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Moving Rehabilitation Forward

Rehab/Theta/Physio
User Manual EN

QUICK START GUIDE

Note
- It is strongly advised to carefully read the contraindications and safety measures described in chapter 1 and 2 in this manual before using your device.
- For detailed information on usage also see Chapters 3 to 16 of this manual.

A. Press ON/OFF button

B. Connect the cables
N.B. The Mi-sensor cable (if available with the device) can be connected to any socket on the stimulator.

C. Select language, contrast and volume

D. Choose a type of treatment

E. Choose a programme category

F. Choose a programme

G. Personalise a programme

H. Start a programme

I. End a programme pressing ON/OFF button

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1. HOW TO USE THE MEDICAL EQUIPMENT (INTENDED USE)

Note
- This manual is considered as accessory of the therapy unit and therefore it should accompany it at all times.
- The specific instructions provided given here are conditions for the intended use and correct operation of the equipment as well as the safety of the patient and the operator using it.
- Please read the entire manual carefully and section 2 in particular, since information concerning several chapters is only given once, before using your device!

1.1 Fields of application

The Rehab/Theta/Physio is a stimulator designed for use by health professionals to ensure electric stimulation treatments in pain management (TENS) neuro muscular stimulation (EMS/NMES). The Physio device also allows Direct applications (Iontophoresis/Hyperhidrosis/Oedema) and Denervated muscles stimulation.

The Rehab/Theta/Physio unit is an important supplement to medical and therapeutic treatment for use in hospitals, clinics, general practices and at patient's home by a therapist.

When prescribed by a health care professional, Rehab or Theta devices can be used by patients at home without the presence of the health care professional. Patients shall read carefully this manual and contact their health care professional or DJO in case of any questions.

1.2 Therapy objectives

The Rehab/Theta/Physio is a multifunctional electrotherapy unit for the post surgical and conservative treatment of muscular dysbalance as well as pain management.

The following therapy forms are provided by the unit:
• TENS (transkutane electrical Nervenstimulation) for painmanagement
• NMES (neuromuscular electronical stimulation, also EMS)
• FES (functional electrical stimulation)

The Physio also provides the following functions:
• Direct current (Iontophoresis/Hyperidrosis/Oedema)
• Denervated muscles

1. HOW TO USE THE MEDICAL EQUIPMENT (INTENDED USE)

1.3 Indications

The physiotherapy unit is indicated in the treatment of most musculoskeletal injuries and diseases as well as in postoperative treatment after joint surgeries and in the treatment of several pain indications. Examples:

As an NMES device, indications are for the following conditions:
- Retarding or preventing disuse atrophy
- Maintaining or increasing range of motion
- Re-educating muscles
- Relaxation of muscle spasms
- Increasing local blood circulation

As a TENS device, indications are for the following conditions:
- Symptomatic relief and management of chronic, intractable pain
- Adjunctive treatment for post-surgical and post-trauma acute pain
- Relief of pain associated with arthritis.

As a pulsed current device, indications are for the following conditions:
- Reduction of edema (under negative electrode)
- Reduction of muscle spasm
- Influencing local blood circulation (under negative electrode)
- Retarding or prevention of disuse atrophy
- Facilitation of voluntary motor function
- Maintenance of increase of range of motion

1.4 Contraindications

Do NOT use the Rehab/Theta/Physio on patients with:

- Implanted electronic devices. Do not use the device if you have a cardiac stimulator, implanted defibrillator or other implanted electronic/electrical device.
- Epilepsy
- Pregnancy (do not use on abdominal region)
- Serious arterial circulation problems in lower limbs
- Abdominal or inguinal hernia
- Do not use chest stimulation on patients with cardiac arrhythmia

This could cause an electrical shock, burns, electrical interference or death.

1. HOW TO USE THE MEDICAL EQUIPMENT (INTENDED USE)

Heart disease

If you have suspected or diagnosed cardiopathy you should follow the precautions for use recommended by your doctor.

Note

Fixation metalwork and/or prosthesis equipment
The presence of Fixation metalwork and/or prosthesis equipment (metallic equipment in contact with the bone: pins, screws, plates, prostheses, etc.) is not a contraindication for NMES, TENS and Denervated muscle stimulation. The electrical currents of the Rehab/Theta/Physio are specially designed to have no harmful effect on osteosynthesis equipment.

Never use direct currents (Iontophoresis/Hyperhidrosis/Oedema) provided by Physio device on patients with osteosynthesis devices or other metal implants.

1.5 Secondary effects

Currently, there is no evidence of desired or undesired secondary effects caused by electrotherapy units.

2. SAFETY INFORMATION

Definitions

It is mandatory to read the safety statements before using the physiotherapy unit. The safety statements are classified as follows:

Danger!
This term indicates an imminent hazard. If not avoided, this hazard could result in death or serious injury.

Warning!
This term indicates a hazard. If not avoided, this hazard can result in death or serious injury.

Caution!
This term indicates a potential hazard. If not avoided, this hazard can result in minor personal injury and/or product/property damage.

Safety information

Danger!
Explosion hazard - Rehab/Theta/Physio is not designed for use in areas where an explosion hazard may occur. An explosion hazard may result from the use of flammable anesthetics, oxygen-rich environments, skin cleansing agents and disinfectants.

2. SAFETY INFORMATION

Warning!

- Only authorised individuals are allowed to operate the Rehab/Theta/Physio. Individuals are authorised after receiving training in the operation of the unit and reading this operating on manual.
- Before using the therapy unit, the operator must ascertain that it is in correct working order and operating condition. The cables and connectors, in particular, must be checked for signs of damage. Damaged parts must be replaced immediately, before use.
- Stop therapy immediately if you have doubts about the device settings and/or the therapy protocol.
- Patients must be fully conscious while being instructed in the use of the therapy unit and during therapy.
- The choice of the therapy parameters to program and of the therapy protocols to use is restricted to the responsible physician or therapist. It is the physician's or therapist's decision whether or not to use the unit on a specific patient.
- The patient must be familiar with the functions of the Rehab/Theta/Physio device allowing them to stop therapy, if needed. Patients unable to operate the emergency stop function e.g. paralytic patients, must never be left unattended during therapy.
- Any accessories used with Rehab/Theta/Physio must first be approved by the manufacturer.
- The utmost caution is advised under the following conditions. Depending on the judgement of the responsible physician, the unit may only be applied under supervision and with the parameters defined by the responsible physician. Otherwise the exercise may be too strenuous for the patients with:
  1. hypertension (> stage 2), ischemic heart disease and cerebrovascular diseases
  2. cardiovascular diseases
  3. pregnancy
  4. under 16 years of age
- Never apply the electrodes:
  - Near the head
  - On the front and side of the neck
  - Counter-laterally, i.e. do not use two poles connected to the same channel on opposite sides of the body.
  - On or near skin lesions of any kind (wounds, swelling, burns, irritation, eczema, cancerous lesion, etc.)
- If the person is pregnant or menstruating do not place electrodes directly on the uterus area or connect pairs of electrodes on either side of the abdomen to avoid any risk for the mother and/or the baby.
- Never allow muscular contraction during a stimulation session to result in movement. You should always stimulate isometrically; this means that the extremities of the limb in which a muscle is being stimulated must be firmly fixed, so as to prevent any movement that results from contraction.

2. SAFETY INFORMATION

Warning!

- Extreme caution should be taken when in use around small children and babies! Sufficient distance to the device and its accessories is mandatory for their safety!
- Never leave the device unattended when it is switched on!
- After use, store the device in a safe place to avoid other people not informed to use the device;
- This device is not a toy but a medical device. Misunderstanding its use can cause damage!

Warning!

Shock hazard - Strictly observe the following warnings. Failure to do so could endanger the lives of the patient, the user and other persons involved.

Note

- **Before use** allow the Rehab/Theta/Physio to reach room temperature. If the unit has been transported at temperatures below 0 °C (32°F), leave it to reach at room temperature for about 2 hours, until any condensation has disappeared.
- **Electrosurgical equipment or defibrillators.** Disconnect the electrodes from the device before using electrosurgical equipment, or a defibrillator, to avoid cutaneous burns from the electrodes and destroying the device.
- **Electronic surveillance equipment.** Do not apply stimulation near electronic surveillance equipment (e.g. cardiac monitors, ECG alarms), as there is a risk they may not work properly whilst the electrical stimulation device is being used.
- **Electromagnetic radiation.** Do not use the stimulator in areas in which unprotected devices are used to emit electromagnetic radiation. Portablecommunications equipment can interfere with the device.
- **Cancer.** Do not apply stimulation if you have progressive cancer or near any cancerous tumour. The increased metabolism, caused by certain modes of stimulation, is likely to encourage cancer cells to spread.
- **Muscle shortening.** During the muscular contraction phase it is recommended to hold the extremities of the stimulated limbs to avoid any shortening of the muscle during contraction, which could cause cramps.
- **Contralateral stimulation.** Do not use two terminals connected to the same channel on opposite segments of the body (for example, a positive terminal on the left arm and a negative terminal on the right arm).

2. SAFETY INFORMATION

- **Loss of sensation.** Proceed with caution if stimulation is applied to areas of the skin whose level of sensation is lower than normal. Do not apply stimulation to a person who cannot express themselves.
- **Battery leakage.** If there is leak from a component, take steps to ensure the liquid does not come into contact with skin or eyes. Should this occur, wash the affected area with water and consult a doctor.
- **Strangulation.** Do not wind cables around the neck. Tangled cables can cause strangulation.
- **Post-surgery.** Proceed with caution after recent surgery.
- **Accessibility of the power adaptor.** The plug socket must be close to the power adaptor and be easily accessible.
- **Internal bleeding.** Proceed with caution if you are prone to internal bleeding; for example, after an injury or a fracture.

- The Rehab/Theta/Physio must only be operated in dry rooms.
- **Do not use** the Rehab/Theta/Physio **in water or in a humid atmosphere** (sauna, bath, shower etc.), etc.).
- When connecting the unit to other equipment or when creating a medical system, check that the sum of leakage currents will not cause any hazard. Please contact DJO GLOBAL if you have questionsregarding this matter.
- No modification of this equipment is allowed.
- Do not open the product and its accessories as there is risk of electrocution.
- Before cleaning and service interventions, turn the device off.
- **Liquids and foreign material (such as dust, metal etc.) must not be allowed** to enter the device. If such material has entered into the units, it must be immediately checked by a service technician, before it can be reused.

- **Electricity supply.** Never connect the stimulation cables to an external power supply, as there is a risk of electrocution.

2. SAFETY INFORMATION

- Do not apply stimulation near the area of an implant, such as cochlear implants, pacemakers, skeletal anchorage or electric implants. This could cause an electrical shock, burns, electrical interference or death
- Never use the Rehab/Theta/Physio or the AC adaptor if it is damaged or open. There is a risk of electric shock.
- Disconnect the AC adaptor immediately if there is abnormal heating or smell, or if smoke comes from the AC adaptor or the device.

Warning!

Equipment malfunction - this warnings can cause equipment mailfunctions that result in patient hazards

- Magnetic and electrical fields are capable of interfering with the proper performance of the unit. For this reason make sure that all external devices operated in the vicinity of the unit comply with the relevant EMC requirements. X-ray equipment, MRI devices, -radio systems and cell phones are possible sources of interference as they may emit higher levels of electromagnetic radiation.
  Keep the unit away from such equipment and verify its performance before use.
- Do not use the Rehab/Theta/Physio within one meter of short wave or microwave devices as this could alter the currents generated by the stimulator. If you are in any doubt as to the use of the stimulator in close proximity to another medical device, seek advice from the manufacturer of the latter or from your doctor.
- Exercise caution when using electrotherapy while the patient is connected to monitoring equipment with electrodes attached to the body. Stimulation could disrupt the signals sent to the monitoring equipment.
- Refer repair and maintenance to authorized persons. Persons are authorized after training by a specialist trained and commissioned by the manufacturer.
- Inspect the Rehab/Theta/Physio and it's accessories for damage and loose connections at least once a year. Damaged and worn parts must be immediately replaced with original spare parts by authorized staff.

2. SAFETY INFORMATION

Caution!

Patient hazard - these cautions need to be observed to avoid the risk of electrical shock or other negative effects to the patient.

- Do not apply stimulation close to metal. Remove jewellery, piercings, belt buckles or any other metallic product or device in the area of stimulation.
- Be careful if the patient has sensitivity problems or is not able to communicate that he or she feels discomfort, however light.
- Never begin an initial stimulation session on a person who is standing. The first five minutes of stimulation must always be performed on a person who is sitting or lying down. In rare instances, people of a nervous disposition may experience a vasovagal reaction. This is of psychological origin and is connected with a fear of the muscle stimulation as well as surprise at seeing one of their muscles contract without having intentionally contracted it themselves. A vasovagal reaction causes heart to slow down and blood pressure to drop, which produces a feeling weakness and a tendency towards fainting. If this does occur, all that is required is to stop the stimulation and for the person to lie down with the legs raised until the feeling of weakness disappears (5 to 10 minutes)
- Never allow muscular contraction during a stimulation session to result in movement. You should always stimulate isometrically; this means that the extremities of the limb in which a muscle is being stimulated must be firmly fixed, so as to prevent any movement that results from contraction.
- Do not disconnect any channel during the stimulation session.
- Do not use the stimulator while driving or operating machinery.
- Do not apply stimulation during sleep.
- Do not use the stimulator at altitudes of over 3,000 meters.
- Always turn off the stimulator before moving or removing any electrodes during a session, to avoid electrical shock to the patient.
- Do not try to place electrodes on a body part not directly visible without assistance.
- Attach the electrodes in such a way that their entire surface is in contact with the skin.
- For obvious reasons of hygiene, each patient must have their own set of electrodes. Do not use the same electrodes on different patients.
- Some patients with very sensitive skin may experience redness under the electrodes after a session. Generally, this redness is completely harmless and usually disappears after 10 to 20 minutes. Never start another stimulation session in the same area, however, if the redness is still visible.
- Before each use clean and disinfect the motor point pen tip that is in contact with the skin.
- When using the REHAB/THETA/PHYSIO to customize programs, take special care that the parameters customized and applied by you to the patient are as you wanted them to be.

2. SAFETY INFORMATION

Caution!
Equipment damage -

- Check that the voltage and frequency ratings of your local power line are those indicated on the type plate of the power supply.
- Do not expose the Rehab/Theta/Physio to direct sunlight, because some of the components may reach unacceptably high temperatures.
- The presence of children, pets and vermin does not normally affect the proper functioning. However, make sure that these sources do not contaminate the physiotherapy unit and keep them away from it. Also, keep the unit clean and protect it from dust and lint. The safety rules and regulations set forth apply in any case.
- It is recommended to use the transport bag that comes with the unit, for transport of the device, and to use a proper transport box to ship it.
- Always use the AC adaptor (power supply) provided by the manufacturer to recharge the unit.
- Do not store the device for a long time with empty batteries.
- Only use electrodes and motor point pen supplied by the manufacturer. Other electrodes and motor point pens may have electrical properties that are unsuitable for or may damage the Rehab/Theta/Physio.
- Size of electrodes. Do not use electrodes with an active area of less than 16 cm^2 due to the risk of associated burning. Proceed systematically with caution when the density of the current is over 2 mA/cm^2.
- Do not place the electrodes or pen in water.
- Do not apply solvents of any kind to the electrodes or pen.
- Skin irritation. Some people, with very sensitive skin, may experience redness under the electrodes after a session. Generally, this redness is totally harmless and usually disappears after 10 to 20 minutes. However, never start another stimulation session on the same area if the redness is still visible
- Instructions for electrodes. See the usage and storage instructions displayed on the bag of electrodes

2. SAFETY INFORMATION

Note

- For best results, wash and clean the skin of any oil and dry it before attaching the electrodes.
- Never use a set of adhesive electrodes for more than 15 sessions as the quality of the contact between the electrode and the skin, which is essential for the patient's comfort and the effectiveness of the stimulation, gradually deteriorates.
- For information on use and storage please consult the instructions found on the electrodes packaging.

Note

Biocompatibility

Those parts of the Rehab/Theta/Physio unit that come into contact with the patient when used as intended, are designed to fulfil the biocompatibility requirements of the applicable standards.

3. DESCRIPTION OF THE REHAB/THETA/PHYSIO

3.1 Device components and accessories

Model: Rehab
Part number: 253311x

Your kit contains (included in delivery):

QUANTITY	DESCRIPTION	PART NUMBER
1	Rehab device	201010
1	Fast charger	683010
1	Battery pack	941213
1	Set of 4 pin cables	601132
1	Snap adaptor kit	6111944
1	Protecting cover	690001
2	Bags of small electrodes (5x5 cm 1 snap connection)	42204
2	2 bags of large electrodes (5x10 cm 2 snap connections)	42203
1	User manual and practical guide on CD/USB	45264xx
1	Quick start guide + warning leaflet	885932
1	Electrode placement leaflet	4526645
1	Bottle of gel	602047
1	Motor point pen	980020
1	Transportation pouch	6680033
1	Belt clip	949000

3. DESCRIPTION OF THE REHAB/THETA/PHYSIO

Model: Theta
Part number: 253481x

Your kit contains (included in delivery):

QUANTITY	DESCRIPTION	PART NUMBER
1	Theta device	201011
1	Fast charger	683010
1	Battery pack	941213
1	Set of 4 pin cables	601132
1	Snap adaptor kit	6111944
2	Mi cables	601160
1	Protecting cover	690001
2	Bags of small electrodes (5x5 cm 1 snap connection)	42204
2	2 bags of large electrodes (5x10 cm 2 snap connections)	42203
1	User manual and practical guide on CD/USB	45264xx
1	Quick start guide + warning leaflet	885932
1	Electrode placement leaflet	4526645
1	Bottle of gel	602047
1	Motor point pen	980020
1	Transportation pouch	6680033
1	Belt clip	949000

3. DESCRIPTION OF THE REHAB/THETA/PHYSIO

Model: Physio
Part number: 253511x

Your kit contains (included in delivery):

QUANTITY	DESCRIPTION	PART NUMBER
1	Physio device	201021
1	Fast charger	683010
1	Battery pack	941213
1	Set of 4 pin cables	601132
1	Snap adaptor kit	6111944
4	Mi cables	601160
1	Protecting cover	690001
2	Bags of small electrodes (5x5 cm 1 snap connection)	42204
2	2 bags of large electrodes (5x10 cm 2 snap connections)	42203
1	Set of ultra-flexible electrode for Denervated	602110
1	Set of Iontophoresis electrodes	642110
1	User manual and practical guide on CD/USB	45264xx
1	Quick Start Guide + warning leaflet	885932
1	Electrode placement leaflet	4526645
1	Bottle of gel	602047
1	Motor point pen	980020
1	Transportation case	680031
1	Belt clip	949000

3. DESCRIPTION OF THE REHAB/THETA/PHYSIO

3.2 Explanation of symbols (connections and nameplates)

3.2.1 Symbols on device and AC Power Supply

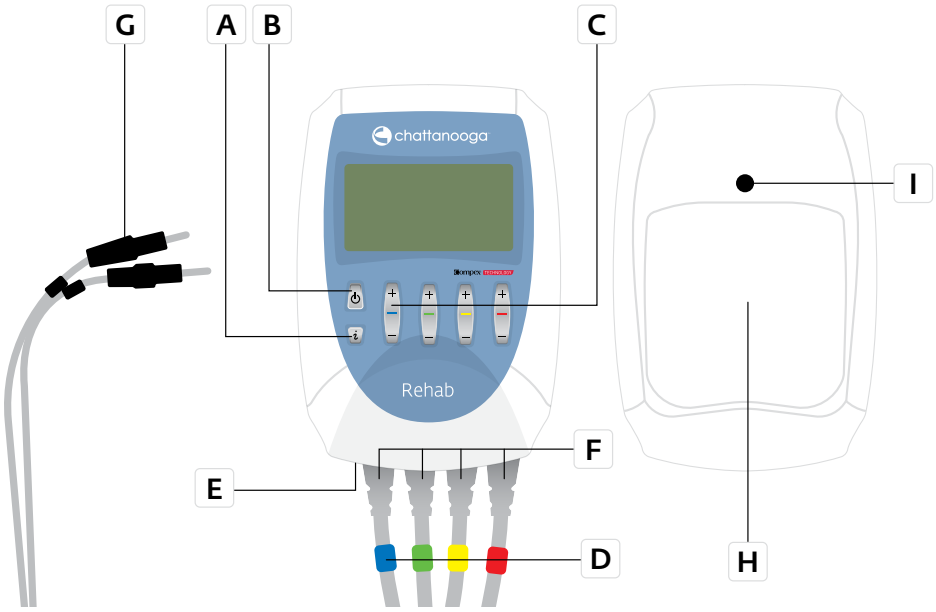
	Read the user manual or operating instructions
	Caution! Observe warnings set forth in operation manual!
	The Rehab/Theta/Physio is a class II device with internal electric power and type BF applied parts.
	The power switch On/OFF button is a multi-function button.
	The name and address next to this factory symbol is the manufacturer. The date is the manufacturing date
	The number next to this symbol is the article reference number
CE- 2797	Device complies with Council Directive 93/42/EEC as amended, concerning medical devices
	The number next to this symbol is the serial number
	WEEE Mark (European Directive 2002/96/EC). Indicates separate treatment from general waste at end of life
	Keep dry
IP20 IP02	IP classification indicates the degree of protection and thus defines its suitability for use under various ambient conditions
	IP 20 on the unit means the protection is effective against ingress of foreign solid objects (diameter greater than 12.5 mm) IP02 on the carrying case means the device is protected against ingress of water (when tilted up tp 15°)

3. DESCRIPTION OF THE REHAB/THETA/PHYSIO

	Non-ionising radiation
	Not made with natural latex rubber
	Keep away from direct sunlight
	Alternating current input on AC power supply
	Direct current output from power supply
	Protection class II equipment. The AC Power Supply device has double insulation
	Indoor use only
	The Geprüfte Sicherheit ("Tested Safety") or GS mark indicates that the equipment meets German and, if available, European safety requirement for electrical devices. Here, approved by TÜV

3. DESCRIPTION OF THE REHAB/THETA/PHYSIO

3.3 Description of the device



A - On/Off button
B - i button. This is used to:
- Increase stimulation energies in several channels simultaneously.
- Access the Top 5 menu (showing 5 most recently used programmes)
- Access parameters info menu for personalised programmes.

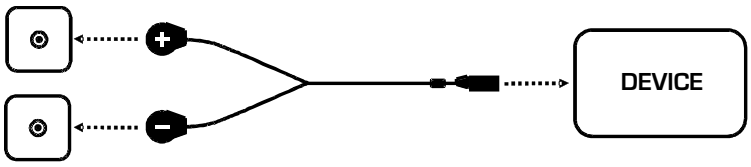
C - +/- buttons for 4 stimulation channels
D - Sockets for 4 stimulation cables
E - Battery charger socket
F - Stimulation cables Channel 1 = blue Channel 2 = green Channel 3 = yellow Channel 4 = red
G - Stimulation cable fitted with pin connector
H - Rechargeable battery compartment
I - Belt clip socket

Note
Emergency stop function: By pressing the On/Off button during stimulation, the device pauses.

4. DEVICE SETUP

4.1 Connecting the cables

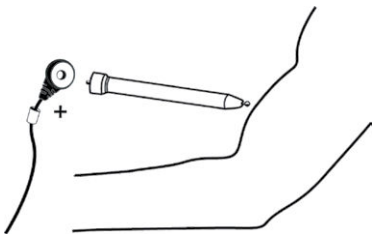
The stimulator cables plug into the 4 sockets on the base of the device. All 4 cables can be connected simultaneously. Both the +/- buttons and the cables are colour-coded to simplify use and facilitate identification of the different channels.



The kit includes four 2,1 mm pin-connector cables and 8 pin to snap converters.

4.2 Connecting the motor point pen

Never use the motor point pen for any purposes other than locating the motor point of the muscle. Follow the instructions in this manual. Clean and disinfect the tip of the motor point pen that comes in contact with the skin before each use. Apply a small amount of gel to the skin when looking for the motor point to enhance patient comfort.



Refer to the picture above to see how to connect the pen.

Connect the tip of the motor point pen (preferably to the red connector). The other connector must be connected to an electrode already on the muscle to be stimulated.

4. DEVICE SETUP

4.3 Charging the unit

The Rehab/Theta/Physio is a portable muscle stimulator powered by a rechargeable battery unit.

Recharging

To recharge the Rehab/Theta/Physio, first disconnect the electrode cables from the device, then plug the charger to a wall socket and finally connect the stimulator to the charger.

The charge menu illustrated below appears automatically.

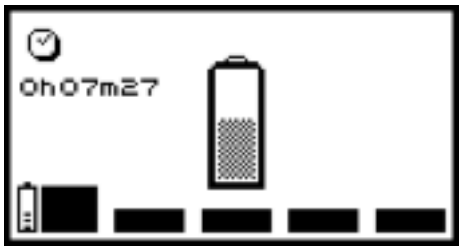


Fig. 1a 1b

Fig. 1a: The stimulator has been charged for 7 minutes and 27 seconds (a full charge may take 2-2,5 hours with the rapid charger delivered with your device).

Fig. 1b: Charging is in progress. When charging is completed, total charge duration flashes and the battery symbol is completely full. The stimulator switches off automatically as soon as you disconnect the charger.

4. DEVICE SETUP

4.4 Preliminary settings

4.4.1 Language, contrast, volume

When you start the stimulator for the first time, you will need to choose the interface language you wish to use from the options screen. See below for instructions on how to proceed. There are a range of settings that you can adjust to suit your needs (interface language, display contrast, backlighting, volume). To change any of these settings, bring up the options screen by holding the On/Off button on the front of the stimulator for a few seconds.

Fig. 2a 2b 2c 2d 2e

Fig. 2b: Use the channel 1 +/- button to choose the language you wish to use.
Fig. 2c: Use the channel 2 +/- button to adjust the contrast of the screen.
Fig. 2d: Use the channel 3 +/- button to adjust the volume.
Fig. 2e: Use the channel 4 +/- button to adjust the backlighting.
On: Backlighting always on.
Off: Backlighting always off.
Auto: Backlighting activated whenever a button is pressed.
2a: Use the On/Off button to confirm and save your choices. The settings will be applied immediately.

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

You are strongly advised to read the countra-indications and safety measures described at the beginning of this manual (chapter 2 “Safety Information”) prior to using your stimulator.

5.1 Select a neurostimulation program

To start the stimulator, press the On/Off button. To choose a programme, you must first choose a type of treatment and a programme category.

NOTE: There is a table summarising the different programmes and their functions at the end of this manual.

5.2 Choosing a type of treatment

Fig. 3a 3b 3e

Fig. 3a: Press the On/Off button to turn off the unit.
Fig. 3b: Use the channel 1 +/- button to choose another type of treatment (i.e.: Specific Treatment or Conditioning).
Fig. 3e: Press the channel 4 +/- button to confirm your choice and access the programme category selection screen.
Press the i button to access the Top 5 menu.

5.3 Choosing a programme category

Fig. 4a 4b 4e

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

Fig. 4a: Press the On/Off button to return to the previous screen.
Fig. 4b: Use the channel 1 +/- button to choose a category.
Fig. 4e: Press the channel 4 +/- button to confirm your choice and access the programme selection screen.
Press the i button to access the Top 5 menu.

5.4 Choosing a programme

NOTE: Consult our Practical Guide for help in choosing a programme. Once you choose a category, the screen will display a list of available programmes.

Fig. 5a 5b 5e

Fig. 5a: Press the On/Off button to return to the previous screen.
Fig. 5b: Use the channel 1 +/- button to choose the programme you want.
Fig. 5e: Press the channel 4 +/- button to confirm your choice. Certain programmes start right away while others allow you to specify additional options.

TOP 5

To access the Top 5 menu, press the i button before selecting a programme. The menu can be accessed from the type of treatment screen (Fig. 3), the programme category screen (Fig. 4), or the programme list screen (Fig. 5).

Fig. 6a 6b 6d 6e

Fig. 6a: Press the On/Off button to return to the previous screen.
Fig. 6b: Use the channel 1 +/- button to choose the programme you want.
Fig. 6d: Use the channel 3 +/- button to personalize the programme.
Fig. 6e: Press the channel 4 +/- button to start the programme.

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

5.5 Personalising a programme

Not all programmes have an option screen.
In certain programmes, you will need to choose the muscle group you want to stimulate. The target area is shown in black on the figure above channel 1.

Fig. 7a 7b 7c 7d 7e

Fig. 7a: Press the On/Off button to return to the previous screen.
Fig. 7b: Use the channel 1 +/- button to choose the desired treatment area. You can choose from 7 areas.
Fig. 7c: Press the channel 2 + button to delete the warming-up sequence and 2 - to choose if you want to combine with any of the 2+2 programmes on channel 3 and 4 (see explanation hereunder).
Fig. 7d: Use the channel 3 +/- button to choose the programme level.
Fig. 7e: Use the channel 4 +/- button to confirm your choices and start the programme.

5.5.1 Choosing a treatment area

If the mode for the manual selection of the body area is activated (Fig 7b) the user must manually select the area to be treated. An average chronaxy value is used based on the area selected by the user. This choice is made after selecting the desired programme.

Note

If mi-SCAN has been activated (by connecting Mi cable):
- Body area representation will not appear on the unit display
- This function adjusts the electrostimulation session to the physiology of each patient. Just before starting the work session, mi-SCAN tests the muscle group and automatically adjusts the settings of the stimulator to the excitability of this area of the body.
- In order to ensure optimum efficiency and comfort of the session it is recommended to perform the mi-SCAN measurement before each session.
- This function is implemented at the beginning of the programme by a short sequence in which measurements are made.
- Throughout the duration of the test, it is important to stay still and be relaxed.
- When the test is complete, the programme can be started by increasing the intensity levels of the channels.

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

5.5.2 Activate the warm-up session

If the warm-up session is activated (heating radiator Fig. 7c) the program should start during the first 5 minutes with very clear muscle twitches, to increase local blood flow and prepare muscle for stimulation.

5.5.3 Choosing the 2+2 function

You have the possibility to choose the 2+2 function which means that you can choose one programme for channels 1 and 2, then select one programme from the 2+2 programme list for channels 3 and 4. So you can treat two different body parts at the same time or combine two different programmes on the same body part.

NOTE: The timer for channel 1+2 will control the total session time. This means that the total time for channel 3+4 can not exceed the session time for channel 1+2. The programme for channel 3+4 is always in one phase.

If a preset programme uses more than two channels, this will not be available for the 2+2 mode.

5.5.4 Level progression

Generally speaking, it is not advisable to progress through the levels too quickly and to aim to reach the maximum level too quickly.
The different levels correspond to progression in rehabilitation using electrostimulation.
Furthermore and without exception, level 1 is the starting point and should be used until the therapeutic targets have been reached.
One of these targets is for the patient to be able to tolerate a significant amount of stimulation energy.
Stimulation energies should therefore be given priority in order to have a many fibres working as possible before changing the level.

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

5.6 Placement of electrodes

The placement of the electrodes belongs to the indication that is supposed to be treated.

Depending on the characteristics of the current used for each programme, the electrode connected to the positive pole may benefit from a “prime” location that is likely to increase the efficacy of the treatment.

This is the case particularly for muscular electrostimulation programmes requiring strong muscular contractions, for which it is recommended that the electrode with positive polarity is placed on the motor point of the muscle.

These recommended positions are also the optimal positions for the mi- sensor system, and as such should be followed closely. (detailed in Muscle Intelligence™ part Chapter 6)

The choice of electrode size (large or small) and the correct positioning of the electrodes on the muscle group that needs to be stimulated are determining factors and are essential for stimulation to be effective. As a result, always use the size of the electrodes shown on the images. Unless advised otherwise by a doctor, always follow the positions specified on the images.

5.7 Body position

To determine the stimulation position to be used based on the position of the electrodes and the programme chosen, please refer to the images of where the electrodes are positioned.

The position of the person to be stimulated depends on the muscle group that requires stimulation and on the programme chosen.

For programmes requiring muscle contractions (tetanic contractions), working the muscle isometrically is always recommended to prevent cramps and muscle soreness after the session. For example, when the quadriceps are stimulated, the patient will be placed in a seated position with the ankles fixed with straps to prevent the knees extending. For other types of programmes (for example, analgesic programmes), which do not cause muscle contractions, position the patient as comfortably as possible.

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

5.8 Adjusting stimulation energies

Stimulation energy settings (intensity level)

For programmes which cause muscle contractions, it is important to use the maximum stimulation energies, i.e. always at the limit of what the patient is able to tolerate.

This means that, in a stimulated muscle, the number of fibres working depends on the stimulation energies. The maximum stimulation energies must therefore be used in order to engage as many fibres as possible.

Below a significant stimulation energy, the number of fibres engaged in the stimulated muscle is too low to considerably improve the quality of the muscles.

The maximum energy will not be reached during the first session but after at least 3 sessions, during which the energy to produce strong muscle contractions will be increased gradually so that the patient becomes accustomed to electrostimulation.
After the warm-up, which should produce clear muscle twitching, the stimulation energies must be increased progressively contraction by contraction throughout the work sequence.

If your device emits a beeping sound and the + symbols under the active channels begin to flash, the stimulator is suggesting you increase the level of the stimulation energies. If you are working at the patient's maximum tolerance level, simply ignore this message.

The energies used should also be increased session by session.

For TENS treatments, stimulation is only sensory.
The intensity must therefore be increased until the patient has a pins and needles sensation (tingling) that is not considered painful.

For neuromuscular electrostimulation programmes which do not cause tetanic muscle contractions (frequencies < 10Hz), the energies must be increased gradually until muscle twitching is produced that can be clearly seen or felt.

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

5.9 Stimulation mode

When you start a programme, you will be prompted to increase the stimulation energies. This is the key to the success of any treatment.

Fig. 8a 8b 8c 8d 8e

Fig. 8a: Press the On/Off button to interrupt the programme momentarily.
Fig. 8 b c d e: The unit will beep and the symbols for the 4 channels will alternate between + and 000. The energy level for the 4 channels is at 0. To start the programme, you will need to increase the energy levels in the channels you are going to use. To do this, use the corresponding + buttons. The different energies reached during the contraction phase are shown by a series of black bar graphs. Active rest phase energies are shown by hatched bar graphs.

NOTE: If you want to increase the energy levels in all 4 channels simultaneously, press the i button. Press it twice to increase the levels in the first 3 channels, and 3 times to increase the levels in the first 2 channels. Interdependent channels will be highlighted in white against a black background.

NOTE: Active rest phase stimulation energies are automatically set at 50% of contraction intensities but can be modified during the rest phase. Once modified, they will be totally independent of the contraction intensities.

NOTE: If your device emits a beeping sound and the + symbols under the active channels begin to flash, the stimulator is suggesting you increase the level of the stimulation energies. If you are working at the patient's maximum tolerance level, simply ignore this message.

If you start a programme with the 2+2 function the following screen will be displayed.

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

The horizontal bars on top of the display shows the total duration and different phases of the programmes. Left bar for P1 and right bar for P2.

P1 shows the programme chosen for channel 1 and 2.
P2 shows the programme chosen for channel 3 and 4.

5.10 Program progression

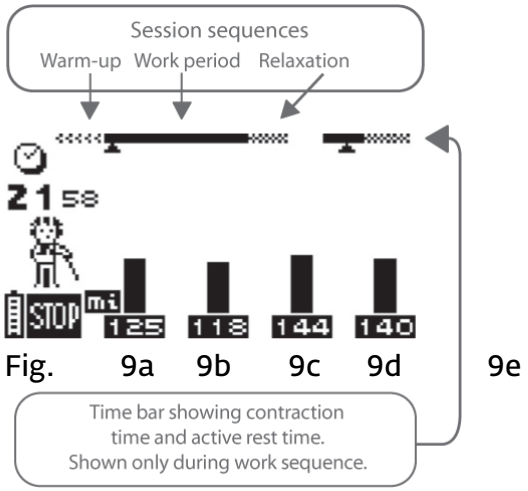


Fig. 9a 9b 9c 9d 9e

Fig. 9 b c d e: The different energies reached during the contraction phase are shown by a series of black bar graphs. Active rest phase energies are shown by hatched bar graphs.
NOTE: Active rest phase stimulation energies are automatically set at 50% of contraction intensities but can be modified during the rest phase. Once modified, they will be totally independent of the contraction intensities.

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

5.11 Pause mode

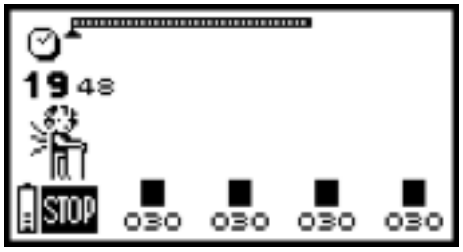


Fig. 10a

Fig 10a: Press the On/Off button to interrupt the programme momentarily. To restart it, simply press the + button of any channel. The session will resume at 80% of the energy levels that were being used prior to the interruption.

5.12 End of program

At the end of each session, a small flag will be displayed on the screen and a short melody will be played.

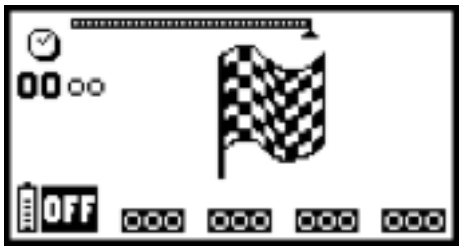


Fig. 11a

Fig 11a: To turn off the stimulator, press the ON/OFF button.

5. HOW TO PERFORM A TREATMENT, NEUROSTIMULATION PROGRAMS

5.13 Performance Check

If the unit can be operated as described above, the therapy unit has passed the performance check successfully.

The device also runs performance checks regularly during operation.

This is what happens if a problem is identified (at start or during operation):
If there is a risk in usage or a malfunction identified:
• the device will ask you to correct it (see also Chapter “Problems and Solutions”)
• or automatically shut down immediately

In this situation, you may attempt to restart the unit by turning it briefly off and on again. With the unit switched off, check that all plugs are correctly connected.
If the error message persists when the unit is switched on again have the unit insprected by an authorised service technician before using it again.

6. TREATMENT OPTIONS

6.1 Muscle Intelligence Technology™

Muscle Intelligence™ (mi) technology provides practitioners with specific information on different muscles and allows them to adapt each stimulation session to the needs of their patients. The corresponding data is transferred automatically from the sensor to the stimulator!

mi-SENSOR
This is a small sensor that links the stimulator to the electrodes. It performs a key function in that it measures certain physiological characteristics of the muscle to be stimulated and transfers this data to the stimulator, which, in turn, analyses the data and adapts its parameters accordingly. This tailoring of each programme to the changing condition of the muscle clearly enhances both patient comfort and therapeutic efficacy.

To access the mi functions, make sure that the stimulation cable fitted with the mi-SENSOR is connected to the stimulator **before** this is turned on.

Do not connect the mi-SENSOR cable if the stimulator is already on.

The mi-SENSOR system may not work properly if restrained or subject to pressure in any way.

The mi-SENSOR must be connected to an adhesive electrode at all times during a stimulation session.

Combination of the 2+2 function and the Mi-Technology:
Please note that when you use the 2+2 function, the Mi-Scan function can still be used on channels 1 and 2, but is only available for the programs Endorphinic, Reinforcement and Disuse atrophy on channels 3 and 4. The functions Mi-Range, Mi-Tens and Mi-Action can not be used in this state.

All Rehab/Theta/Physio devices are able to provide Muscle Intelligence™ Technology with Mi-Action, Mi-Range, Mi-Tens and Mi-Scan functions.

Physio: 4 Mi-sensors are included in the kit.
Theta: 2 Mi-Sensors are included in the kit. By purchasing more cables with Mi-sensors it is possible to take advantage of the Mi-technology on the 4 channels.
Rehab: This device is Mi-ready. By purchasing one or more cables with Mi-sensors it is possible to take advantage of the Mi-technology.

6. TREATMENT OPTIONS

6.1.1 Personalized impulse - mi-SCAN

mi-SCAN:

Just before starting a session of neuro-muscular electrostimulation, mi-SCAN analyses the characteristics of excitability in the muscle subjected to stimulation.

mi-SCAN detects the chronaxy of the muscle in approximately 10 seconds, by detecting when and how strong a mucle contracts while getting different intensitys applied. It allows the stimulator to adjust the width (duration) of the pulse to the measured chronaxy value. Using a width (duration) of the pulse corresponding to the chronaxy of the stimulated muscle allows the use of the minimum power to obtain the same muscle response. As soon as the mi-SCAN function is activated each active channel performs the chronaxy measurement.

As many as 4 different chronaxy measurements – corresponding to 4 different muscle groups – can be taken per session. The number of measurements depends on how many sensors are connected to the stimulator

Each channel that is connected to a standard cable receives the same data as a channel connected to a mi-SENSOR cable (see Fig 13).

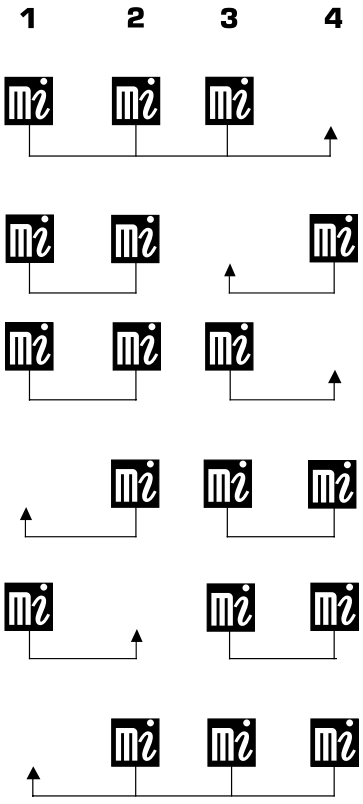


Fig. 13

6. TREATMENT OPTIONS

Before a programme is executed, the sensor scans the muscle briefly. During this time, a horizontal bar will move up and down the figure on the left of the screen.
It is essential that the patient remains completely still and relaxed while these measurements are being taken. The mi-SENSOR system is very sensitive and the slightest contraction or movement could interfere with its results.

Note that certain people might feel an unpleasant tingling sensation during the test.

Once the test is complete, a symbol will appear on the screen indicating that the programme can be started.

6.1.2 Energy management – mi-RANGE & mi-TENS

mi-RANGE: 

This function indicates the minimum energy threshold for programmes whose effectiveness requires obtaining vigorous muscular twitches. The mi-RANGE function is therefore only available for programmes using low stimulation frequencies (below 10 Hz).

For programmes that allow the mi-RANGE function, the stimulator first prompts you to increase the energy level:
- A beep will accompany the flashing "+" symbols.
- When a muscle pumping is first detected, the "+" symbols stop flashing.
- You are at the minimum energy level to provide therapeutic results.
- If you set the stimulation energy below the ideal range of treatment, the stimulator prompts you to raise them again by continuously flashing + signs.

6. TREATMENT OPTIONS

mi-TENS: 

The mi-TENS function can reduce the appearance of unwanted muscular contractions (e.g. at TENS Gate-Control programs), thus providing maximum comfort and efficiency.

Short tests are performed regularly throughout the duration of the programme.
A testing phase takes place systematically after each increase in stimulation intensity. In order to allow its smooth progress it is essential to remain perfectly still during this time.

According to the test results recorded by the device, the level of stimulation intensities may be slightly decreased automatically.

6.1.3 Triggering of contraction - mi-ACTION

In default set up, all trigger functions are deactivated, but can be activated where available.

mi-ACTION (voluntary): 

This is a way of working in which voluntary active muscle contraction triggers an electrical stimulation. Contraction by electrostimulation is perfectly controlled by voluntary triggering of muscle contraction.

From the perspective of maximum efficiency, the mi-ACTION working mode requires good muscular qualities. Underperforming muscles may, in some cases, impede the onset of electrically induced contraction.

Programmes used in the mi-ACTION mode have undeniable advantages:
- They require active participation and encourage the patient to engage fully in his or her treatment.
- They give the patient the free choice of triggering a contraction, making the practice of electrostimulation more comfortable.
- They ensure even more effective work as they combine voluntary exercises and electrostimulation that together allow for greater recruitment of muscle fibres.
- They promote the restoration of the body map and motor relearning in patients with impaired neuromuscular control.
- They allow the stimulation of stabilising muscles to be integrated during an overall functional movement.

6. TREATMENT OPTIONS

How it works:

The mi-ACTION mode is active during muscle work sequences (it is not operational during sequences of warm-up and relaxation).

The first muscle contraction of the work sequence starts automatically.
At the end of the first contraction an active rest phase begins, characterised by muscular twitches.

The voluntary triggering of a new contraction is only possible after a minimum rest period, which varies depending on the programme.

As soon as the voluntary triggering of a contraction is possible, the device emits a beep to inform the user.
Once the user hears the first sound signal composed of a beep, the triggering of voluntary contraction is possible.
If no voluntary contraction has occurred after a certain period of time, the unit will automatically pause.

To work properly, the mi-ACTION needs a good muscular twitches during the active rest phase.

If the twitches are not significant enough, the unit beeps and a + sign appears on channels: you must increase the stimulation energy to get good twitching.
Similarly, in order to make these twitches possible, it is imperative that the muscles are properly relaxed during the resting phase.

Care should be taken at the end of each contraction phase to get back into a position allowing the best muscle relaxation.

6. TREATMENT OPTIONS

6.2 SKIP Function – Move on to the next phase

Fig. 14a 14d 14e

In certain programmes, the skip function allows you to end the current programme phase and move on to the next one. For SKIP function to work, the unit must be in Pause mode.

Fig 14a: Press the On/Off button to return to the list of programmes in the category you are working with.
Fig 14d: Use the channel 3 +/- button to skip a particular sequence of a programme. When you do this, the unit will beep and the cursor under the progress bar will move to the beginning of the next sequence.
Fig 14e: Use the channel 4 +/- button to resume the programme at the chosen sequence.

NOTE: The skip function is not available for all programmes. It should also be noted that this function can reduce the effectiveness of a programme if used to shorten the work sequence excessively.

6. TREATMENT OPTIONS

6.3 How to use the Motor Point Pen

The Motor Point Pen supports in locating the optimal electrode position for the mucle stimulation (e.g.: locating the motor point of the vastus medialis of the quadriceps).

Background:
Muscular electrostimulation programmes are programmes which subject the muscles to work. The progress achieved depends on the kind of work to which the muscles are subjected, that is to say the programme chosen. The electrical pulses generated by these programmes are transmitted to the muscles (via the motor nerve) through self-adhesive electrodes. The positioning of the electrodes is one of the determining factors in ensuring a comfortable electrostimulation session.
It is therefore essential to devote special care to this aspect. The correct placement of the electrodes and the use of significant energy allow a large number of muscle fibres to work. The greater the energy, the greater the spatial recruitment, that is to say the number of fibres working, and therefore the greater the number of fibres that make progress.

The motor point:
The motor point is a point where the motor nerve enters the muscle, which is an extremely localised area where the motor nerve is at its most excitable. Although the location of the various motor points is now well known, there may nevertheless be variations of up to several centimetres between different individuals.

The Motor Point Pen, combined with the motor point program, allows determining with greater accuracy the exact location of the motor points for each individual and thus ensuring the greatest effectiveness of the programmes. It is recommended to use this programme and the pen before any initial muscular electrostimulation session. Once located, the motor points can be easily identified by using a skin-marker pencil or in any other way, thus avoiding the need to repeat this process before each session.

Electrode placement:
One stimulation cable has two outputs:
A positive pole (+) = red
A negative pole (-) = black

The positive electrode is the one connected to the positive pole (red). It is supposed to be attached at the motor point of the muscle.

Note
The Motor Point Pen is designated only to be used in combination with the program “Motor Point”.

6. TREATMENT OPTIONS

Locating the motor point with the Rehab/Theta/Physio:
e.g.: locating the motor point of the vastus medialis of the quadriceps

1. Apply a large electrode at the top of the thigh (the muscle belly).
2. Connect the negative pole of the cable (black) to the snap/pin of the large electrode located towards the inner surface of the thigh.
3. Spread a thin but even layer of conductive gel over the inner surface of the thigh in the position indicated for the positive electrode position (the motor point area), spreading the gel a few extra centimetres in all directions.
4. Connect the positive pole (red) of the cable to the snap connection of the motorpoint pen and bring the tip of the pen in contact with the conductive gel.
5. Switch on the device, select the Motor point programme (program category: Rehabilitation and start the programme.
6. Very gradually increase the energy of channel 1, until a value between 5 and 25 is reached, while continuously moving the pen tip over the gel layer, but without ever losing contact with the gel, to avoid triggering an electrode fault message.
7. As soon as you observe a muscle response in form of twitching, you have located the vastus medialis motor point. Visually locate this motor point and apply a small electrode that should be centred over the motor point.
8. Remove the pen from the positive output and connect the positive pole of the cable to the small electrode, which should be correctly centred over the motor point of the vastus medialis.

Warning!
Patient hazard - patient contamination
Before each use of the Motor Point Pen, clean and disincect the pen, expecially the tip that comes into contact with the patients skin.

Note
While using the pen, it might lose contact with the skin coated in gel (even if this is just for a fraction of a second). In this case, the stimulation will be interrupted and the equipment will signal an electrode fault. In such a case, ignore the message, put the tip of the pen back in contact with the skin and gradually increase the energy while moving the pen over the gel layer.

6. TREATMENT OPTIONS

6.4 Statistics

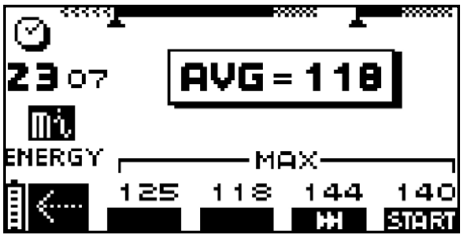


Fig. 16

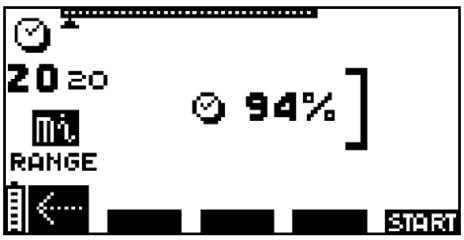


Fig. 17

The stimulator includes a statistics menu containing important programme information that can be consulted in real time. To access the statistics screen, you must place the stimulator in pause mode or wait for the programme to end.

Fig. 16: Neuromuscular electrostimulation programmes MAX indicates the maximum stimulation energy level reached per channel during the contraction phase. AVG indicates the average stimulation energy level used by the different channels during the contraction phase.
Fig. 17: In low frequency programmes, the mi-RANGE function figure enclosed by a single square bracket shows what percentage of stimulation time was spent in the optimal energy range.
Fig 16-17e: Press the channel 4 +/- button to resume the programme at the point where it was interrupted.

6. TREATMENT OPTIONS

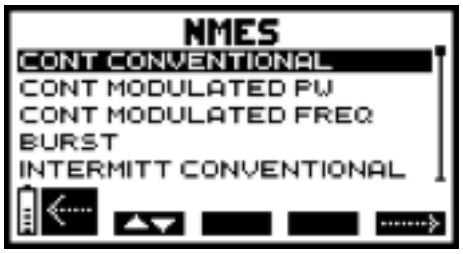
6.5 Programming mode

In the programming mode you could create a custom programme and select your own parameters. Then name your programme and save it in the custom programmes category.

Go to the programming category.

Select NMES or TENS

Select the stimulation form



In order to personalize the parameters:

Fig. 18a 18b 18c 18e

Fig 18a: Press the On/Off button to return to the previous screen.
Fig 18b: Use the channel 1 +/- button to move the cursor between the different settings.
Fig 18c: Use the channel 2 +/- button to increase or decrease the setting values.
Fig 18e: Use the channel 4 +/- button to save the programme.

6. TREATMENT OPTIONS

Saving programme

Fig. 19a 19b 19c 19d

Fig 19a: Press the On/Off button to return to the previous screen.
Fig 19b: Use the channel 1 +/- button to move the cursor in the programme name.
Fig 19c: Use the channel 2 +/- button to write letters and figures.
Fig 19d: Use the channel 3 +/- button to maximize or minimize the space.
Fig 19e: Use the channel 4 +/- button to save the programme.

NOTE: You can save maximum 10 custom programmes.

NOTE: Custom programmes can be combined with a programme from the 2+2 list by adding and selecting the 2+2 option. This programme will consist of one programme on channel 1+2 (P1) and one programme for channel 3+4 (P2) (please see section “Choosing the 2+2 function”).

7. DIRECT CURRENTS (PHYSIO DEVICE ONLY)

Direct currents are provided by Physio device only.

Never use direct currents on patients with osteosynthesis devices or other metal implants.

Iontophoresis, Hyperdrosis and Oedema programmes use Direct currents. Do not use these currents in the chest region.

7.1 Iontophoresis

Read the chapter "Iontophoresis" in the practical guide to become fully familiar with this programme before using it.

NOTE: Use the coloured electrodes (red, green, yellow) supplied with the stimulator whenever you use an Iontophoresis programme.

The Iontophoresis programme is in the direct current category in the specific type of treatment.

Fig.20a 20b 20e

Fig 20a: Press the On/Off button to return to the previous screen.
Fig 20b: Use the channel 1 +/- button to choose the category you want.
Fig 20e: Press the channel 4 +/- button to confirm your choice and access the programme selection screen.

7. DIRECT CURRENTS (PHYSIO DEVICE ONLY)

Fig.21a 21b 21e

Fig 21a: Press the On/Off button to return to the previous screen.
Fig 21b: Use the channel 1 +/- button to choose a programme.
Fig 21e: Press the channel 4 +/- button to confirm your choice.
When working with an Iontophoresis programme, you can choose the number of channels and size of electrodes you want to use. There are 3 electrode sizes (red, green, and yellow). You can also edit the default parameters – Duration, Electrical density – recommended by DJO Global.

Fig.22a 22b 22c 22e

Fig 22a: Press the On/Off button to return to the previous screen.
Fig 22b: Use the channel 1 +/- button to select the parameters you wish to edit: channel to use, density, and duration of session. In the above example, only channel 1 (green electrodes) is active. The electrical density is 0.05 mA and the session duration is 6 minutes.
Fig 22c: Use the channel 2 +/- button to choose the electrode size (colour) you wish to use for each channel and/or to modify the default values (density, duration).
Fig 22e: Press the channel 4 +/- button to confirm your choices and access a confirmation screen.

7. DIRECT CURRENTS (PHYSIO DEVICE ONLY)

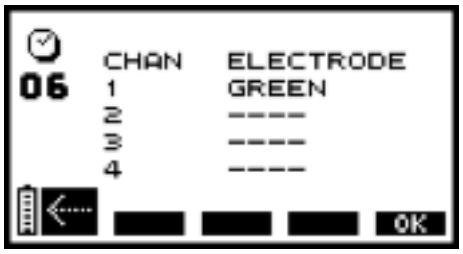


Fig.23a 23e

Fig 23a: Press the On/Off button to return to the previous screen
Fig 23e: Use the channel 4 +/- button to confirm your choices and start the programme.
NOTE: Current intensity is automatically calculated according to the size of electrode used. Electrode size is determined by colour. Make sure you choose the correct colour before running the programme.
Press the i button from the stimulation screen or the end of programme screen to access the programme parameters.

7.2 Hyperhidrosis

Read the chapter "Hyperhidrosis" in the Practical Guide to become fully familiar with this programme before using it.

NOTE: The Hyperhidrosis programme should always be run on channel 1 with the large (red) Iontophoresis electrodes supplied with the stimulator.

The Hyperhidrosis programme is in the Direct Current category of the Specific Treatment type.

Fig.24a 24b 24e

Fig 24a: Press the On/Off button to return to the previous screen.
Fig 24b: Use the channel 1 +/- button to choose a programme.
Fig 24e: Press the channel 4 +/- button to confirm your choice.

7. DIRECT CURRENTS (PHYSIO DEVICE ONLY)

Fig.25a 25c 25e

Fig 25a: Press the On/Off button to return to the previous screen.
Fig 25c: Use the channel 2 +/- button to change the default electrical density value.
Fig 25e: Press the channel 4 +/- button to confirm your choices and access a confirmation screen.
Use the i button to access the electrodes placement pictogram.
The Hyperhidrosis programme lasts for 12 minutes and can only be run on channel 1. Only use the red electrodes with this programme. Other electrodes will cause current intensity calculation errors.

Fig.26a 26e

Fig 26a: Press the On/Off button to return to the previous screen.
Fig 26e: Press the channel 4 +/- button to confirm your choices and start the programme.
Use the i button to access the electrode placement pictogram.
NOTE: Press the i button from the stimulation screen or the end of programme screen to access the programme parameters.

7. DIRECT CURRENTS (PHYSIO DEVICE ONLY)

7.3 Oedema

Read the chapter "Oedema" in the Practical Guide to become fully familiar with this programme before using it.

The Oedema programme is in the Direct Current category of the Specific Treatment type.

Fig.27a 27b

Fig 27a : Press the On/Off button to return to the previous screen.
Fig 27b: Use the channel 1 +/- button to choose a programme.
Fig 27e: Press the channel 4 +/- button to confirm your choice and execute the programme.

The **Oedema** programme begins by looking for the motor evoked potential (MEP) threshold in order to calculate the current intensity that will offer optimal therapeutic efficacy. While this is happening, the MEMO symbol will be displayed over any channels that are connected. To confirm the MEP threshold, press any of the active +/- buttons as soon as you see or feel a motor response.

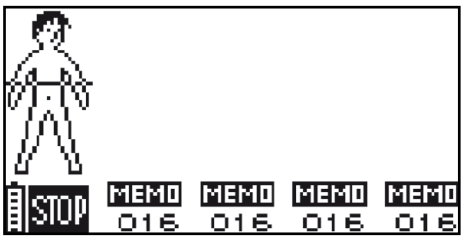


Fig.28a 28b 28c 28d

Fig 28a: Press the On/Off button to stop the programme or return to the previous screen.
Fig 28 b c d e: Press any of the active +/- buttons to confirm the MEP threshold.Once confirmed, the programme will start automatically with the optimal stimulation energy.
NOTE: If no channels are connected, the electrode error symbol will be displayed.

8. DENERVATED PROGRAMS (PHYSIO DEVICE ONLY)

Denervated programs are provided by the Physio device only.

The Denervated programmes are part of the Specific Treatment. Do not use these programmes in the chest region.

Physio Denervated programmes are not contraindicated in patients with osteosynthesis devices or other metal implants.

Denervated programmes should only be run with 2.1 mm pin-connector cables and carbon electrodes (black electrodes supplied with stimulator). For optimal results, apply conductor gel to the electrodes before use. Do not use snap-connector cables or selfadhesive electrodes for Denervated programmes.

There are 4 types of Denervated treatments : TOTAL OR PARTIAL AUTOMATIC AND TOTAL OR PARTIAL MANUAL

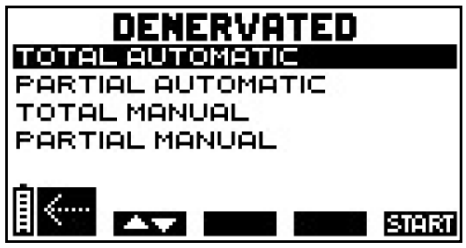


Fig.29a 29b 29e

Fig 29a: Press the On/Off button to return to the previous screen.
Fig 29b: Use the channel 1 +/- button to choose the programme you want.
Fig 29e: Press the channel 4 +/- button to confirm your choice.

8.1 Automatic mode

The stimulator will automatically detect which channels are connected when in automatic mode.

8.1.1 Total automatic

Full denervation with fixed parameters:
Pulse width: 100 ms
Period: 2000 ms
Programme duration: 8 min

NOTE: These are the default values recommended in the **Total manual** mode.

8. DENERVATED PROGRAMS (PHYSIO DEVICE ONLY)

8.1.2 Partial automatic

Partial denervation, with automatic calculation of initial current ramp. The width of the pulse before validation of the ramp is 100 ms.

How it works

When you start the programme, stimulation will automatically begin through the first channel you are using. As soon as you perceive a muscle response, confirm the ramp by pressing the corresponding +/- button (under the MEMO symbol).

The stimulator will display the value for this channel (see Figure 30 below) and automatically begin the search for the next channel.

The Physio can calculate and manage 4 different initial current ramps.

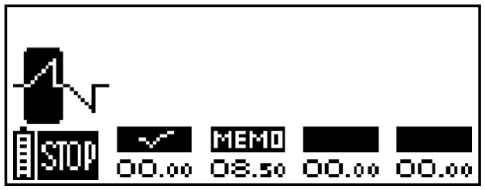


Fig.30a 30b 30c 30d 30e

MEMO displayed above channel where ramp search is being performed.

displayed above inactive channels (channels that are not connected).

displayed once intensity value for corresponding channel has been validated.

Fig 30a: Press the On/Off button to stop the programme and return to the previous screen.
Fig 30b: Press the +/- button under the memo symbol to confirm the current intensity calculated during the ramp search process. The width of the current (pulse length) does not change during this search. In the above example, the search is being performed in channel 1. Once the ramp is validated, the √ symbol will replace the memo symbol and, where applicable, the search will begin in the other channels.
Fig 30 c d e: the +/- buttons for the other channels remain inactive while a search is being performed.

8. DENERVATED PROGRAMS (PHYSIO DEVICE ONLY)

When all the ramps for the active channels have been calculated, the programme will start automatically.

When you increase the stimulation intensity, the pulse width will automatically be modified to maintain the appropriate initial ramp.

8.1.3 Total manual

Full denervation programme. This programme works with rectangular pulses and allows the following parameters to be modified:
- Pulse width
- Period
- Programme duration

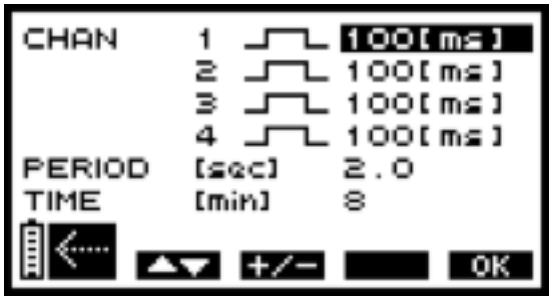


Fig.31a 31b 31c 31e

Fig 31a: Press the On/Off button to return to the previous screen.
Fig 31b: Use the channel 1 +/- button to select the parameter you wish to edit: pulse width for each channel, period, or programme duration.
Fig 31c: Use the channel 2 +/- button to edit the value of the parameter you have selected.
Fig 31e: Press the channel 4 +/- button to confirm your choice and start the treatment.

NOTE: The default values of the **Total manual** programme are the same as the default values of the **Total automatic** programme.

8. DENERVATED PROGRAMS (PHYSIO DEVICE ONLY)

8.1.4 Partial manual

Partial denervation with choice of stimulation parameters to define the desired ramp.

To use a ramp of your choice, first select the pulse width option in the corresponding channel. Confirm your choice and increase the stimulation intensity to the desired level.

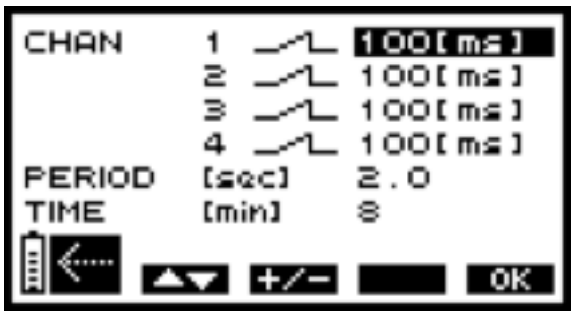


Fig.32a 32b 32c 32e

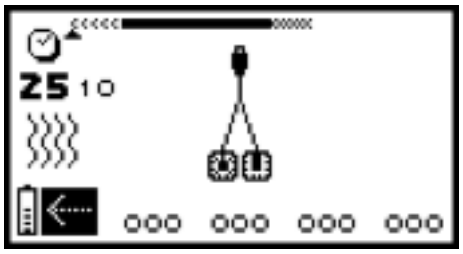
Fig 32a: Press the On/Off button to return to the previous screen.
Fig 32b: Use the channel 1 +/- button to select the parameter you wish to edit: pulse width for each channel, period, or programme duration.
Fig 32c: Use the channel 2 +/- button to edit the value of the parameter you have selected.
Fig 32e: Press the channel 4 +/- button to confirm your choice and start the treatment.

NOTE: Hold down the i button when in the stimulation or end of programme screen to access the parameters for the programme you are using.

9. TROUBLESHOOTING

9.1 Electrode or cable failure

The Rehab/Theta/Physio will beep and alternately display a pair of electrodes and an arrow pointing to the channel where the problem was detected. In the example below, the stimulator has detected an error in channel 2.



The electrode error message can mean that:
- There are no electrodes connected to this channel.
- The electrodes are old, worn, and/or the contact is poor: try using new electrodes.
- The electrode cable is faulty: try connecting it to another channel. If the problem persists, replace the cable.

If for any reason your device seems to present a malfunction other than those presented above, please contact DJO Global customer service.

Problem	Possible cause	Solution
Electrode failure	Poor electrode connection to the cable	Check that the electrodes are properly connected to the cable.
	Poor electrode connection to the skin	Check if the electrodes are outdated, worn and/or the contact is poor: try with new electrodes.

9.2 Battery level

Problem	Possible cause	Solution
Device battery low	During the stimulation the device may turn out to be discharged.	Stop the stimulation and recharge the device.

9. TROUBLESHOOTING

9.3 Others

Problem	Possible cause	Solution
Display does not come on	Low batteries	Load batteries
Weak stimulation with loaded batteries	Electrodes dried out, lost their adhesive power and have no adequate connection to th skin.	Replace electrode
	Electrode placement	Make the electrodes at least 2 inches apart
Stimulation stops with loaded batteries	Poor electrode contact	Reapply electrodes, secure firmly. Electrodes must be a minimum of 2 inches apart.
	Damaged or worn electrodes	Replace.
Stimulation weakens within minutes of starting treatment with loaded batteries	This is a normal body adaptive process	Increase the amplitude (intensity) if required.
Stimulation is uncomfortable	Amplitude (intensity) is too high	Decrease amplitude (intensity).
	Electrodes are too close together	Reposition the electrodes. Electrodes must be a minimum of 2 inches apart.
	Damaged or worn electrodes	Replace
	Ensure proper program is being used	A. Refer to section 6.1 and 7 for a description of the Programs B. Contact clinician if discomfort persists.
Stimulation is ineffective	Improper electrode placement	Reposition electrodes. Electrodes must be a minimum of 2 inches apart.
	Unknown	Contact clinician.

9. TROUBLESHOOTING

Problem	Possible cause	Solution
Stimulation only felt on one electrode	Improper electrode placement	A. Reposition electrodes. Electrodes must be a minimum of 2 inches apart. B. Replace electrodes.
Stimulation on one channel (side) only	Electrodes a. Worn or damaged b. Improper placement	A. Replace. B. Reposition electrode. Electrodes must be a minimum of 2 inches apart.
		Replace.
Intermittent Output	Intermittent program in use	Some programs will seem intermittent. This is expected. Refer to section 6.1 for a description of the Programs.
Stimulation is not producing the usual sensation	Settings and Electrodes positioning	A. Check that all the settings are correct and ensure the electrodes are positioned properly. B. Change the positioning of the electrodes slightly.

10. CARE, MAINTENANCE, TRANSPORT, ENVIROMENTAL STATEMENT

10.1 Care

Warning!
Shock hazard - Remove the power cord of the device from the wall outlet before cleaning.
Shock hazard, equipment damage -

- Liquids must not enter the device and it's components. If liquids have entered into the components, the Rehab/Theta/Physio must be immediately checked by a service technician, before it can be reused.
- Never dismantle the device or the AC adapter as they contain high-voltage parts with a risk of electric shock.

- All parts of the Rehab/Theta/Physio can be disinfected by wiping down with a disinfectant. Thus, it complies with the special hygiene standards for medical technical equipment.

- All components can be cleaned with common disinfectants and mildhousehold detergents.
- Only use a soft cloth and an alcohol-based, solvent-free cleaning product, to wipe the therapy unit down.
- Allow the device to completely dry before use.

Warning!
Patient hazard - patient contamination
- Before using the unit on another patient, clean and disinfect it according to the instructions in this section.

Caution!
Equipment damage -
- The plastic material used is not resistant to mineral acids, formic acid, phenols, cresols, oxidants and strong organic or inorganic acids with a pH value below 4.
- Use only clear disinfectants to prevent discoloration of the device¬.
- Do not expose the therapy unit to strong ultraviolet radiation (sunlight) and fire.
- Do not sterilize the stimulator.
- Do not immerse in liquids.

10. CARE, MAINTENANCE, TRANSPORT, ENVIROMENTAL STATEMENT

10.2 Maintenance

Your Rehab/Theta/Physio does not require calibration or frequently safety testings. Each stimulator is tested prior to distribution. Its characteristics do not vary under normal conditions.
If your stimulator contains parts that seem worn or defective, please stop using it and contact the customer service centre that has been stipulated and authorised by the manufacturer regarding an upgrade.

There are no user serviceable parts inside the device. If the device appears to be non-functional, contact DJO Global or your local dealer.

Warning!
Shock hazard, Equipment damage -
Do not attempt to repair the stimulator or any of its accessories. Never dismantle the device because of risk of electric shock. DJO Global declines all responsibilities for any damages or consequences resulting from unauthorised attempts to open, modify, or repair the stimulator. This may only be done by persons or repair services authorised by the manufacturer

10. CARE, MAINTENANCE, TRANSPORT, ENVIROMENTAL STATEMENT

10.3 Transport

10.3.1 Transport of the Rehab/Theta/Physio

1. Prepare the device and its accessories for shipping within the original Rehab/Theta/Physio shipping box
2. Turn the device and it's accessories off.
3. Disconnect and dismount the device and it's accessories by following the guidelines
4. Place the accessories within the box as shown in the pictures below.
5. Store the user manual in the CD pocket of the transport bag.

Caution!
Equipment damage -
Only use the original transport bag for carrying the device around.

Caution!
Equipment damage -
Only use the original shipping box for shipping the device. DJO cannot be held liable for transport samage if the device is not packed in its original shipping box.

10.4 Enviromental Statement, Expected Life

The Rehab/Theta/Physio device is electronic equipment and may include substances that can damage the environment. It must not be dispose of with unsorted household or municipal waste. It requires separate disposal at a suitable collection point for recycling of electronic equipment. By doing so, you will be contributing to the safeguarding of natural resources and health. Please contact DJO GLOBAL for information about the possible recycling of the product.
When the electrodes no longer stick well to your skin, dispose of them in a receptacle out of reach of children and pets.

The product as well as the parts and accessories supplied with it are designed for a minimum service life of 6 years of normal usage.

11. TECHNICAL DATA, STANDARDS, GUARANTEE, PATENTS

11.1 Technical Data

11.1.1 General information

Model:	Rehab/Theta/Physio
Part number:	253311x/253481x/253511x
MDD:	Class IIa
IP class:	IP22
Applied part:	Type BF
Battery 941213:	Nickel metal hydride (NiMH) rechargeable battery (4.8 V 2000 mA/h).
Battery chargers:	Only battery chargers bearing the part number 68301X can be used to recharge the batteries supplied with Rehab/Theta/Physio stimulators.

11.1.2 Neuro-Stimulation Parameters

All electrical specifications are given for an impedance of 500-1,000 ohms per channel.

Outputs:	Four independent and individually adjustable channels that are electrically isolated from each other.
Pulse shape:	Constant rectangular current with pulse compensation to eliminate any direct current component to prevent residual polarisation at skin level.
Maximum pulse intensity:	120 mA.
Pulse intensity increments:	Manual adjustment of stimulation intensity from 0 to 999 (energy) in minimum increments of 0.25 mA.
Pulse width:	30 to 400 µs.
Maximum electrical charge per pulse:	96 micro coulombs (2 × 48 µC, compensated)
Standard pulse ramp-up time:	3 µs (20 %-80 % of maximum current)
Pulse frequency:	1 to 150 Hz.

11. TECHNICAL DATA, STANDARDS, GUARANTEE, PATENTS

11.1.3 Denervated currents (Physio device only)

Impulse shape:	Compensated, rectangular, or triangular
Maximum pulse intensity:	30 mA
Minimum intensity increment:	0.25 mA
Pulse width:	10 ms – 1000 ms
Pulse frequency:	1/30 Hz – 10 Hz

11.1.4 Direct currents (Physio device only)

Iontophoresis, Hyperhidrosis :	Continuous current
Maximum intensity:	20 mA
Minimum intensity increment:	0.125 mA
Oedema:	Rectangular, non-compensated current
Pulse width:	150 µS
Maximum intensity:	120 mA
Minimum intensity increment:	1 mA
Pulse frequency:	120 Hz

11.1.5 Information on electromagnetic compatibility (EMC)

The Rehab/Theta/Physio is designed to be used in typical environments that have been approved in accordance with the EMC safety standard EN 60601-1-2.

This device complies with the CISPR standard, indicating that radio frequency (RF) emissions are not likely to cause interference with electronic equipment installed nearby (radios, computers, telephones, etc.).

The Rehab/Theta/Physio is designed to withstand foreseeable disturbances from electrostatic discharge, magnetic fields from the mains power supply or RF transmitters.

Nevertheless, it is not possible to ensure that the stimulator will not be affected by powerful RF (radio frequency) fields from other sources.

For more detailed information concerning electromagnetic emissions and immunity, refer to the EMC tables.

11. TECHNICAL DATA, STANDARDS, GUARANTEE, PATENTS

11.1.6 Enviromental conditions

Storage and Transport Conditions
The device must be stored and transported in accordance with the following conditions:

Temperature:	-20° C to 45°C
Maximum relative humidity:	75%
Atmospheric pressure:	700 hPa to 1,060 hPa

Conditions of use

Temperature:	0° C to 40° C
Maximum relative humidity:	30% to 75%
Atmospheric pressure:	700 hPa to 1,060 hPa

11.2 Standards

To guarantee your safety, the Rehab/Theta/Physio has been designed, manufactured, and distributed in compliance with the requirements of European Directive 93/42/EEC, as amended, on medical devices.

The Rehab/Theta/Physio also complies with the IEC 60601-1 standard on general safety requirements for electro-medical devices, the IEC 60601-1-2 standard on electromagnetic compatibility, and the IEC 60601-2-10 standard on particular safety requirements for nerve and muscle stimulators.

Current international standards require that a warning be given concerning the application of electrodes to the thorax (increased risk of cardiac fibrillation).

The Rehab/Theta/Physio also complies with Directive 2012/19/EU on waste electrical and electronic equipment (WEEE).

11. TECHNICAL DATA, STANDARDS, GUARANTEE, PATENTS

11.3 Guarantee

This guarantee is valid only if it is accompanied by proof of purchase.

Your statutory rights are not affected by this guarantee.

Your Rehab/Theta/Physio stimulator is guaranteed for a period of 3 years from the date of purchase. The guarantee covers the device and the AC adaptor (hardware and labour), but not the cables, batteries, electrodes or the motor point pen.

All defects resulting from poor quality material or workmanship are covered.

This guarantee does not cover damage resulting from impact, accidents, misuse, inadequate protection against moisture, immersion in water or repairs made by unauthorized personnel.

11.4 Patents

The Rehab/Theta/Physio incorporates several innovations with patents pending or already issued.

12. EMC TABLES

The Rehab/Theta/Physio needs special EMC precautions and must be installed and started according to the EMC information supplied in this manual.

The use of accessories, sensors and cables other than those recommended by the manufacturer may result in stronger emissions or reduce the immunity of the Rehab/Theta/Physio.

The Rehab/Theta/Physio should not be used beside or stacked on top of any other equipment. If you must use it side by side or on top of another system, you should check that the Rehab/Theta/Physio works properly in the chosen configuration.
The product designation of the Rehab/Theta/Physio used in the text below includes all product variants.

12.1 Electromagnetic emissions

RECOMMENDATIONS AND DECLARATION BY THE MANUFACTURER CONCERNING ELECTROMAGNETIC EMISSIONS		
The device is intended for use in the electromagnetic environment specified below. The customer or user of the device should ensure that it is used in this environment		
Emissions test	**Compliance**	**Electromagnetic environment - Guide**
RF emissions CISPR 11	Group 1	The device uses RF energy only for its internal operation. Consequently, its RF emissions are unlikely to interfere with any adjacent electrical device (radios, computers, telephones etc.).
RF emissions CISPR 11	Class B	The device is suitable for use in any establishment, other than a private dwelling or a place connected directly to the low voltage mains supply which powers residential buildings.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations / emission oscillations IEC 61000-3-3	Not applicable	

12. EMC TABLES

12.2 Electromagnetic immunity

RECOMMENDATIONS AND DECLARATION BY THE MANUFACTURER CONCERNING ELECTROMAGNETIC IMMUNITY			
Device is designed for use in the electromagnetic environment stipulated below. The buyer or user of the device must ensure it is used in this recommended environment.			
Immunity test	**Test level IEC 60601**	**Observance level**	**Electromagnetic environment - Recommendations**
Electrostatic discharge (DES) CEI 61000-4-2	±6 kV at the contact ±8 kV in air	±6 kV at the contact ±8 kV in air	Floors must be wood, concrete or ceramic tile. If floors are covered with synthetic material the relative humidity must be maintained at a minimum of 30%.
Fast transient electrical bursts CEI 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	Not applicable Battery-powered device	The quality of the electrical power supply should be that of a typical commercial or hospital environment.
Shock waves CEI 61000-4-5	±1 kV differential mode ±2 kV joint mode	Not applicable Battery-powered device	The quality of the power supply should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply lines CEI 61000-4-11	<5 % VT (dips >95 % de UT) for 0.5 cycle <40 % VT (dips >60 % de UT) for 5 cycles <70 % VT (dips >30 % de UT) for 25 cycles <5 % VT (dips >95 % de UT) for 5 seconds	Not applicable Battery-powered device	The quality of the power supply should be that of a typical commercial or hospital environment. If the device user requires continuous operation during mains power cuts, it is recommend that the device is powered by a UPS or a battery.
Magnetic field at grid frequency (50/60 Hz) CEI 61000-4-8	3 A/m		Magnetic fields at the mains frequency should be at a level characteristic of a typical location in a typical commercial or hospital environment.
NOTE: VT is the AC supply voltage before application of the test level.			

12. EMC TABLES

RECOMMENDATIONS AND DECLARATION BY THE MANUFACTURER CONCERNING ELECTROMAGNETIC IMMUNITY

Device is designed for use in the electromagnetic environment stipulated below. The buyer or user of the device must ensure it is used in this recommended environment.

Immunity test	Test level IEC 60601	Observance level	Electromagnetic environment - recommendations
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 Vrms 150 kHz to 80 MHz 3 V/m 80 MHz to 2.5 GHz	3 Vrms 3 V/m	Portable and mobile RF communication devices must only be used relative to the device and its wiring at a distance which is not less than the spacing recommended and calculated using the appropriate equation for the transmitter's frequency. Recommended spacing $d = 1.2 \sqrt{P}$ $d = 1.2 \sqrt{P}$ 80 MHz to 800 MHz $d = 2.3 \sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power of the transmitter in watts (W) set by the manufacturer's specifications and where d is the recommended spacing in metres (m). The field intensity of RF fixed transmitters, as determined by an electromagnetic survey a must be less than the observance level to be found in each frequency range. Interference may occur close to any appliance identified by the following symbol: 

NOTE 1 At 80 MHz and at 800 MHz ,the high frequency amplitude is applied
NOTE 2 These guidelines may not be appropriate for some situations. Electromagnetic wave propagation is modified by absorption and reflection due to buildings, objects and persons.

a The field intensity from fixed transmitters, such as radio telephone base stations (cellular/ wireless) and a mobile radio, amateur radios, AM and FM radio transmissions and TV transmissions cannot be predicted with any accuracy. It may therefore be necessary to consider an analysis of the electromagnetic environment of the site to calculate the electromagnetic environment coming from fixed RF transmitters. If the field intensity measured in the environment where the device is located exceeds the appropriate RF observance level above, the device should be monitored to ensure it is operating properly. In the event of abnormal operation, new measures may then be imposed, such as realignment or movement of the device.
b Above the frequency amplitude from 150 kHz to 80 MHz, the field intensity must be < 3 V/m.

12. EMC TABLES

12.3 Recommended separation distances

RECOMMENDED SPACING BETWEEN A PORTABLE AND MOBILE COMMUNICATION DEVICE AND THE DEVICE			
The device is designed for use in an electromagnetic environment in which radiated RF waves are controlled. The buyer or user of the device can contribute to preventing electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication devices (transmitters) and the device according to the table of recommendations below and according to the maximum output power of the telecommunication device.			
Maximum transmitter output power W	Spacing according to the frequency of the transmitter m		
	From 150 kHz to 80 MHz $d = 1.2 \sqrt{P}$	From 80 kHz to 800 MHz $d = 1.2 \sqrt{P}$	From 800 MHz to 2.5 GHz $d = 2.3 \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23
In the case of transmitters whose maximum output power is not shown in the table above, the recommended spacing of d in metres (m) can be calculated using the appropriate equation for the transmitter frequency, where P is the maximum output power of the transmitter in watts (W) as set by the transmitter manufacturer NOTE 1 At 80 MHz and at 800 MHz ,the spacing for high frequency amplitude is applied. NOTE 2 These guidelines may not be appropriate for some situations. Electromagnetic wave propagation is modified by absorption and reflection due to buildings, objects and persons.			

13. CONTACT

We would be happy to answer any questions you may have about our products and services.
Please contact your local dealer, or your corresponding DJO Global site.
DJO Global sites are listed on the backside of the cover.

For technical service from DJO Global, please contact:

internationalproductsupport@DJOglobal.com

14. ELECTROTHERAPY THEORY

14.1 Introduction

In recent years, significant progress has been made in field of electrotherapy of which many users are still largely unaware. Changes and improvements in electrotherapy are so numerous that this discipline appears to be a new concept that can only be applied correctly and effectively using sophisticated, high-tech equipment.
The aim of these articles is to develop this new concept for potential users and provide anyone already working with this equipment with explanations and data that will allow them, based on current knowledge and scientific work carried out, to optimise the use of their stimulators.

14.1.1 The fundamental law of electrostimulation

Electrostimulation is a technique which involves producing action potentials in the excitable cells (nerve and muscle) using an electric current.
Nerve cell membranes have a resting potential with an average value of -70mV, as the internal face of the membrane has negative polarity compared to the external face.
To excite the membrane of the nervous fibre, i.e. causing an action potential to appear at its surface, the resting potential simply has to be reduced to a certain threshold value, which is -50 mV on average (Fig. 1).
Once this threshold value has been reached the membrane changes from a state of rest to a state of activity. An action potential appears which then moves along the nerve fibre. The nerve impulse either goes towards the muscles to instruct them to contract or returns from the surrounding areas towards the brain to relay information regarding the senses.
Electrostimulating the nerve fibre essentially involves reducing the membrane's resting potential to the threshold value by applying an electric current to the skin.
The first question is, of course, which stimulating current to choose.

Which type of current will we use?
A single current must obviously be used, one which can reduce the resting potential to the threshold value but keep the patient as comfortable as possible. In other words, the electrical parameters of this current must be kept to a minimum, and its stimulation energy and duration must be as low as possible.

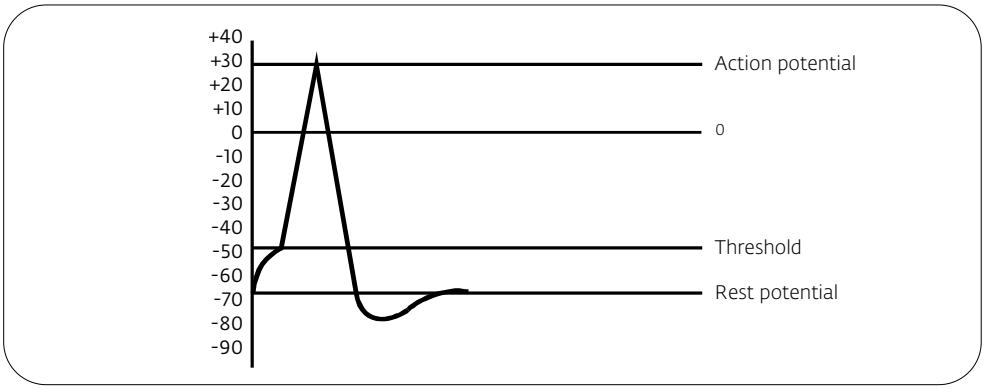


Fig. 1

14. ELECTROTHERAPY THEORY

We will therefore need to understand the fundamental law that it must observe in order to find the optimum qualities of this current.
This first chapter aims to provide a reminder and explanation of this law.
This is followed by a second chapter which, on the basis of this fundamental law and ideas surrounding it, determines the qualities of the optimum current.

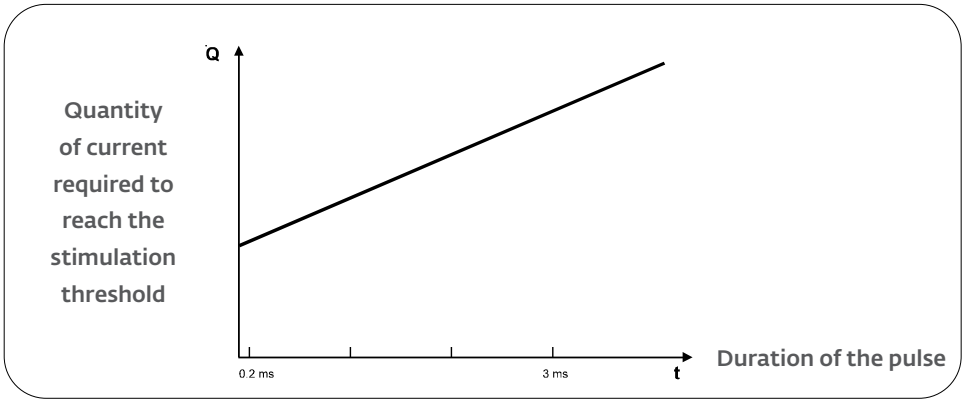
At the turn of the last century, well-known physiologists such as Weiss, Hoorweg, Du Bois Reymond and Lapicque managed to discover the fundamental law of electrostimulation and its mathematical expression.

Based on Hoorweg's work, Weiss (a Parisian doctor and physiologist) emphasised the importance of the quantity of electrical charges created by the stimulation current. His experiments led to the fundamental observation that to achieve stimulation, it is not the type of current that is significant, but the quantity of current in a specified period of time. In other words, if the stimulation threshold values are given as a quantity of electricity (in electrical charges) that must be created to achieve these, the values are similar even if the electrical pulse with the same overall duration is a different shape.

As a reminder:
the quantity of electrical charges (Q) supplied by an electric current with intensity (I) in a given time (t) is the product of the intensity multiplied by the time.

$$Q = I \, x \, t$$

Since the quantity of electrical charges provided by the stimulation current is the fundamental factor, Weiss studied the way in which the necessary quantity of charges is modified in order to achieve the threshold (i.e. to cause stimulation) based on the duration of the current being applied.
He performed a series of measures to determine the relationship between the quantity of current and the duration of the pulse for durations ranging from 0.23 to 3 ms.
From his experiments, Weiss found that there is a linear relationship between the quantity of charges required to reach the stimulation threshold and the duration of the pulse (Fig. 2).



Linear relationship between the duration of the electrical pulse and the amount of electricity applied to reach the stimulation threshold:

$$Q = q + it$$

Fig. 2

14. ELECTROTHERAPY THEORY

Weiss therefore discovered the mathematical relationship that links the pulse duration with the amount of electricity required to produce the stimulation.
Understandably, he called this relationship the "fundamental formula":

$$Q = q + it$$

Q = the amount of current required to reach the threshold. This is also the quantity of electrical charges provided by the stimulation current, as the Q value is given by the product (I x t) of the stimulation current intensity multiplied by its application time.

t = length of time that the current is applied, which is known as the pulse duration.

i = a coefficient determined by experiment, with the same quantity as an electric current (intensity).

q = a coefficient determined by experiment, with the same dimensions as a quantity of electrical charges; q corresponds to the intersection of the straight line with the y-axis and may be calculated as the Q value when t is equal to zero.

Lapicque, an electrophysiologist who is more widely known than Weiss, did not actually discover a new law of electrostimulation but he performed a number of experiments which confirmed the fundamental formula. He defined it differently to mathematically deduce coefficients called the rheobase and chronaxy, which he gave physiological meaning.

Lapicque developed the "fundamental formula" as follows:

$$Q = q + it$$

or $Q = It$

I : stimulation current intensity

t : pulse duration

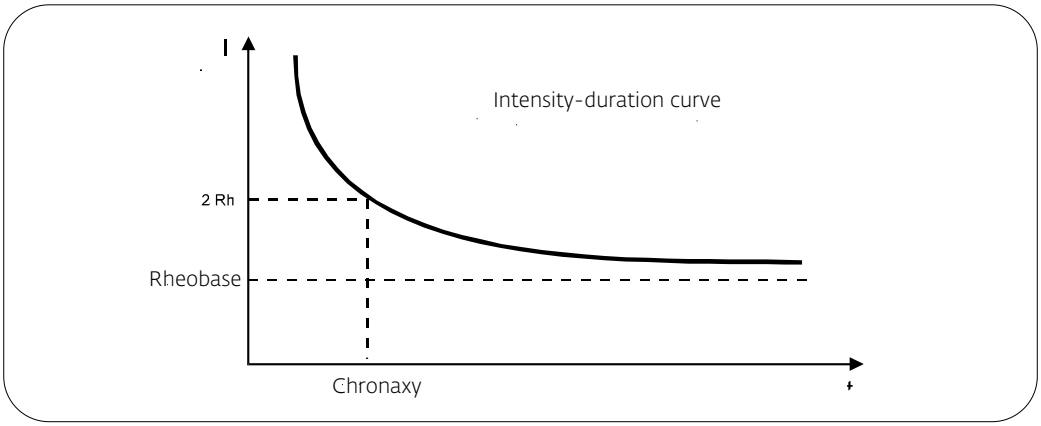
therefore $It = q + it$

by dividing the two by t, Lapicque obtained

$$I = q/t + i$$

which is the relationship between the intensity of the current and the time period in which it must be applied to achieve stimulation (Fig. 3).

14. ELECTROTHERAPY THEORY



Hyperbolic relationship between the current intensity and pulse duration demonstrated by Lapicque and given by the formula $I = q/t + i$, derived from Weiss' fundamental formula.

Fig. 3

Lapicque's development also shows that, even when the length of time that the current is applied is infinite, ($t = \infty$), the current must have a minimum intensity known as the rheobase (Rh) in order to produce stimulation.

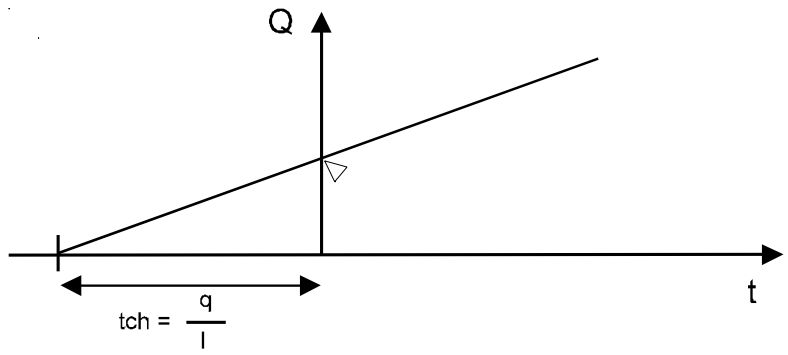
if $t = \infty$ therefore $q/t = 0$
in this case I is the rheobase (Rh)
and $Rh = i$

The rheobase, which is the minimum intensity that must be achieved in order to produce stimulation even if the pulse duration is very long, actually corresponds to the coefficient i of the Weiss formula which has dimensions of electrical intensity.
Lapicque gave the name chronaxy to the minimum length of time in which a current with double the intensity of the rheobase must be applied in order achieve stimulation. In fact, he realised that the chronaxy is a time constant which characterises the excitability of tissue and that its value is the ratio q/i.

This means that:
since $Rh = i$ when $I = 2\,Rh$
therefore $I = 2\,i$
and t is the chronaxy ($t\,ch$)
when $I = 2\,Rh$
therefore from the equation $I = q/t + i$
the result is $2i = q/tch + i$
therefore $i = q/tch \rightarrow tch = q/i$

14. ELECTROTHERAPY THEORY

We can note that the chronaxy can be calculated mathematically from Weiss' fundamental formula as shown in Figure 4.



The chronaxy corresponds to the time value when Q = 0
i.e. $Q = q + it$ if Q = 0 therefore $q + it$ = 0 therefore it = q and $t = q/i$

Fig. 4

14.1.2 Summary

Electrical stimulation, i.e. reducing resting potential to the stimulation threshold using an electric current, is a phenomenon that fulfils a fundamental physiological law.
This shows us that:

1 The factor determining stimulation is the quantity of electrical charges created by the current.
Stimulation must be considered in terms of the amount of current, which is the product (I x t) of the intensity (I) times the duration of the pulse (t).

2 This amount of current fulfils a fundamental formula:

$$Q = q + it$$

where Q is a linear function of time.

Lapicque expresses this formula in another way by the "intensity - pulse duration" ratio: $I = q/t + i$ and he deduced that

a) the rheobase (Rh): minimum intensity that must be reached in order to produce stimulation using an infinite pulse duration

$$Rh = i$$

b) the chronaxy (tch): minimum time in which a current with double the intensity of that of the rheobase must be applied in order to produce stimulation

$$tch = q/i$$

14. ELECTROTHERAPY THEORY

14.1.3 References

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14.2 The Optimum Current

14.2.1 Introduction

The reminders and ideas developed in the previous chapter, "The fundamental law of electrostimulation", must be read before starting this chapter, which describes the qualities of the optimum electrostimulation current.
The optimum current can be defined as being able to reduce the resting potential to the stimulation threshold value under Weiss' law, while also keeping the patient as comfortable as possible. The second requirement is met by minimising the electrical parameters of the stimulation current, i.e. by using a minimum amount of electrical intensity (I), pulse duration (t) and electrical energy (W).
Having set out the conditions, we will now determine the qualities of the current that fulfils these conditions.

14.2.2 Characteristics of the optimal current

14.2.2.1 Electrical stimulation wave produced by the current generator

We can already state that pulses of current, i.e. produced by a current generator, must be used for the following reasons:

- The first point shown by Weiss is the importance of the quantity of electrical charges provided by the stimulation current; however, the quantity of charges can only be controlled by a current generator.
- Only a current generator can ensure stable and reproducible conditions, given the variations in skin resistance.
- If a certain electrical pulse shape is required, only a current generator can maintain a constant current wave shape as it passes through the skin and tissue.

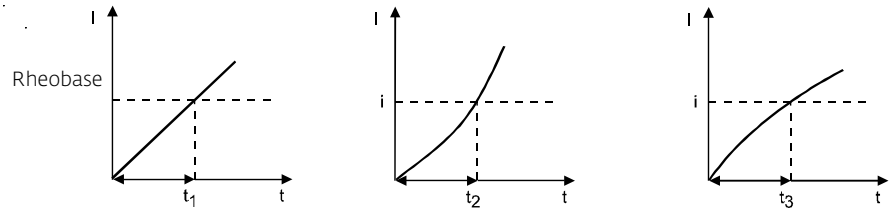
14. ELECTROTHERAPY THEORY

14.2.2.2 Type of establishment of the electrical stimulation wave

According to Weiss' law $Q = it + q$
therefore $I\ t = it + q$
therefore $(I - i)\ t = q$
with i **= rheobase**
i **is a current which resists the stimulation current** I

If the stimulation current I has a value lower than i (i.e. the rheobase), it cannot be used because it cannot change the resting potential by accumulating electrical charges in the excitable membrane (Fig. 1).

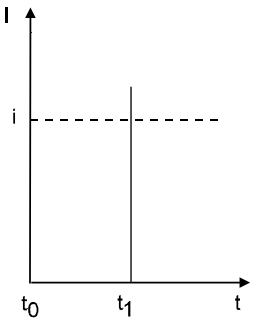
Analysis of the different ways to establish the stimulation current



The pulse times t1, t2 and t3 cannot be used since during these periods $I < i$**.**

Fig. 1

Only one way of establishing the electrical stimulation wave is effective immediately, which is vertical (Fig. 2).
In this case, there is no delay in its efficacy and the duration of the electrical wave is further reduced by it.



The stimulation current established vertically with a value higher than i**, the rheobase, instantaneously produces an accumulation of charges modifying the resting potential.**

Fig. 2

14. ELECTROTHERAPY THEORY

14.2.2.3 Shape of the electrical stimulation wave

When the stimulation current has vertically reached an intensity higher than the rheobase, how should it develop in order to offer maximum comfort?
With minimum intensity, it must provide in time t the quantity of electrical charges
$Q = it + q$ required to trigger the action potential.
Since $Q = I.t.$, it is clear that the rectangle is the wave shape capable of providing the quantity of charges Q with minimum intensity I (Fig. 3).

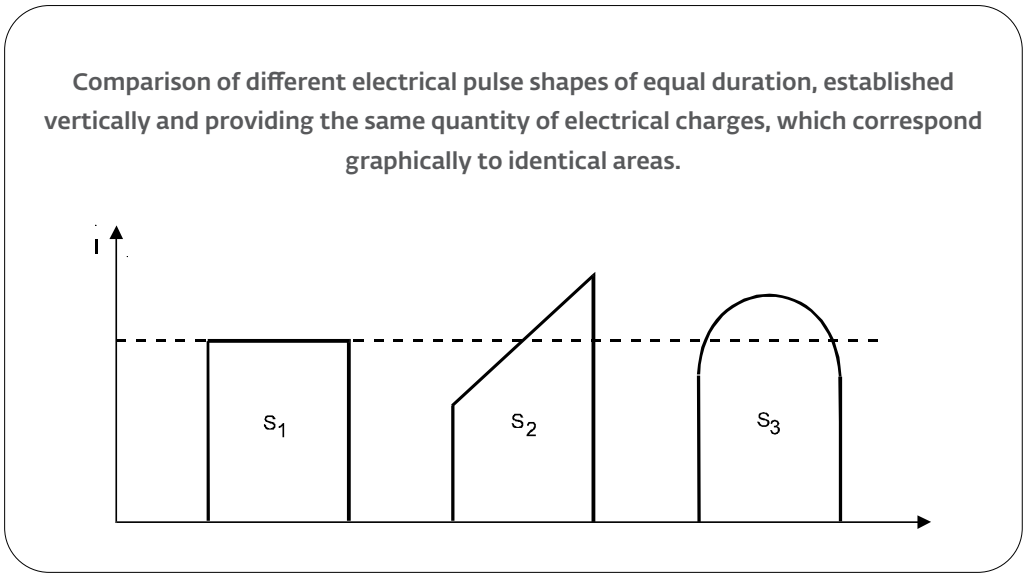


Fig. 3

In order to create the same quantity of charges with pulses with shapes other than rectangular, higher intensities must be used, which are as a result even less comfortable for the patient.

14. ELECTROTHERAPY THEORY

14.2.2.4 Duration of rectangular electrical pulse

First of all, it must be specified that this is in a specific pulse duration phase. Weiss' law is used for stimulation pulse durations close to the excitation constants k.
In the case of motor neurons, this means a time period ranging from 100 to 3,000 microseconds.

$$k = Chronaxy / In^2 = Chronaxy / 0{,}693$$

The third electrical factor, which should be minimised in order to produce the most comfortable possible stimulation, is electrical energy W.

We know that electrical energy is given by the formula $W = I2 \,.\, t \,.\, R$, where:
I : is the current intensity
t : its pulse duration
R : the skin resistance

The Weiss or Lapicque relationship states

$$I = q/t + i$$

and we can replace I by its value in the energy equation.

We get $W = (q/t + i)\ t.R.$

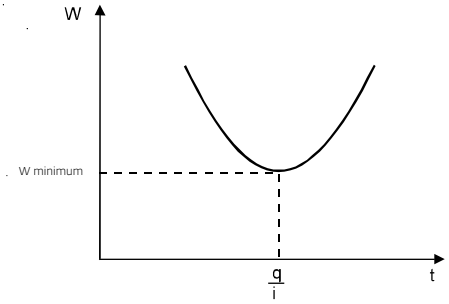
by developing: $W = (q^2/t^2 + 2\ i\ q/t + i^2)\ t.R. = (q^2/t + 2\ q\ i + i^2\ t)\ R.$

When $t \to 0$, $W \to \infty$

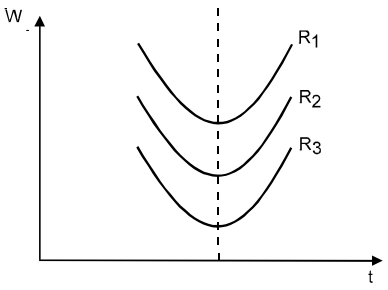
When $t \to \infty$, $W \to \infty$

The shape of this curve is given in Figure 4.

Fig. 4



Relationship between energy and the pulse duration



Variations in electrical energy depending on skin resistance

$$W = (q^2/t + 2\ qi + i^2 t)Rn$$

where $R1 \rangle R2 \rangle R3$

Fig. 5

14. ELECTROTHERAPY THEORY

The electrical energy passing through the skin and tissue is minimal for duration of the stimulation current, i.e. for a pulse duration, which is found by calculating the derivative of the energy curve at the minimum energy point (Fig. 6).

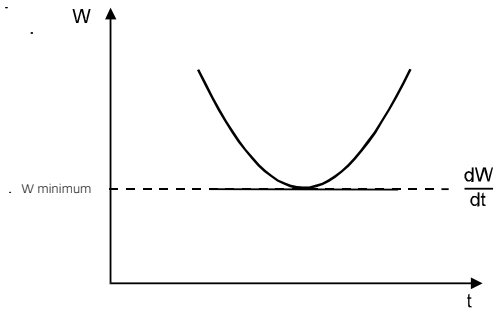


Fig. 6

The derivative of $W = (q^2/t + 2\,q\,i + i^2\,t)\,R$ is $dw/dt = (-q^2\,t^2 + i^2)\,R$
The derivative is the slope of the tangent at any point of a curve.
As at the minimum energy point, this slope is at zero since it is parallel to the abscissa, we can therefore state that:

for W *minimum* $dw/dt = (-q^2\,t^2 + i^2)\,R$= 0 therefore $q^2\,t^2\,R = i^2\,R - t^2 = q^2/i^2 - t = q/i$

As we have seen above, R does not influence the determination of the pulse duration corresponding to the minimum energy.

The electrical energy passing through the skin and tissue is therefore minimum when the rectangular pulse duration is equal to q/i, which is in fact, as we have seen in the article on the fundamental law of electrostimulation, the chronaxy value.

Furthermore, this is why, at the start of the century, pioneers in electrophysiology chose the chronaxy as the value that characterises tissue excitability that is independent from variations in skin resistance.

To reduce electrical energy to its minimum, the rectangular pulse duration will therefore have to equal the chronaxy of the nerve structure that needs to be excited.

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14.2.2.5 Compensation for the rectangular pulse

Every time stimulation needs to be produced, a rectangular pulse current is sent out, which has the same duration as the chronaxy of the nerve structure that needs to be stimulated. Repetition of stimulation is obtained by repeating the electrical impulse.
Whether this is with analgesic or motor stimulation electrotherapy, the stimulations correspond to a series of stimulations set by streams of pulses.
Repeating the pulses if they are not compensated for will result in polarisation, because the electrical mean is not zero (Fig. 7).

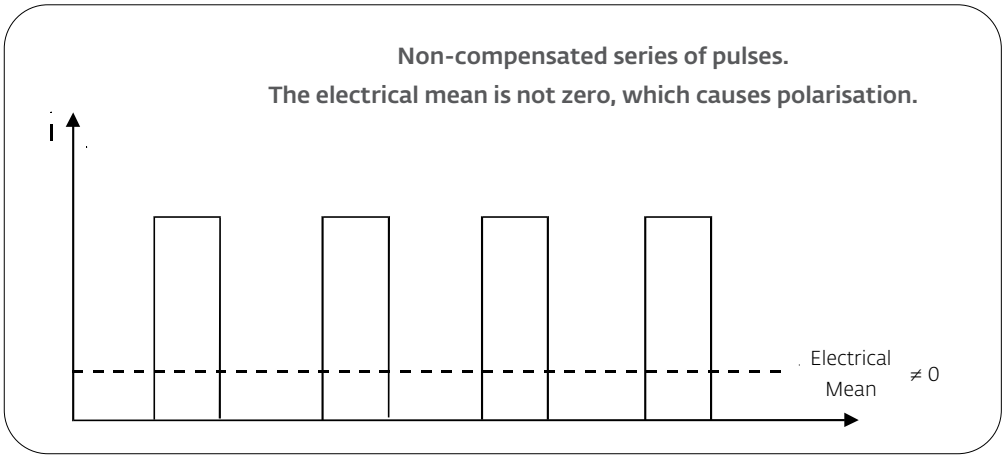


Fig. 7

The polarised current equates to a continuous current with a value equal to the mean intensity. Applying this kind of polarised current to the skin has the same disadvantages as a galvanic current, i.e. risk of skin burns in all cases, and sometimes ionisation if there is metal osteosynthetic material.

To resolve the issue of polarisation, the positive wave must be compensated for by a negative wave with the same quantity of electrical charge, i.e. the same area on the graph (Fig. 8). The electrical mean is therefore zero, the current is completely compensated for and the risks of polarisation are eliminated.

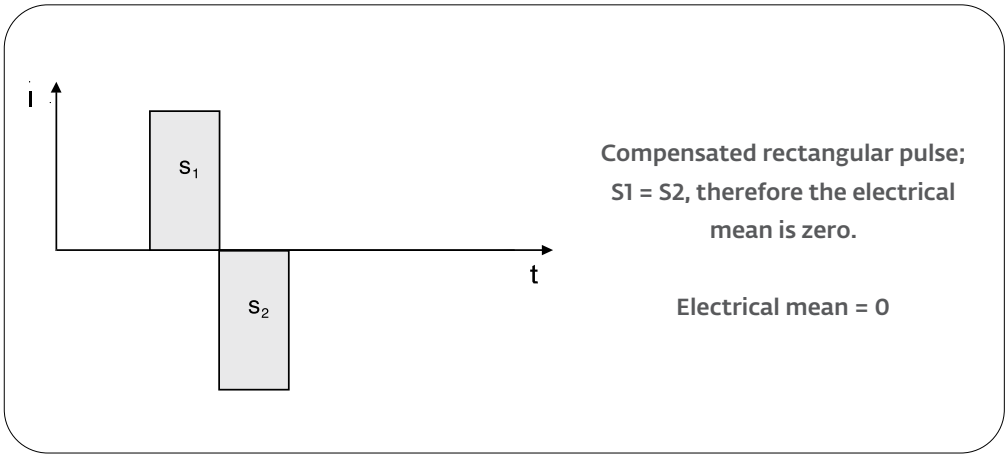


Fig. 8

14. ELECTROTHERAPY THEORY

14.2.3 Summary

The pulse current that is able to produce excitation (action potential) and also offer the patient the maximum amount of comfort can be called the optimum current.
This pulse must have the following characteristics:

1. Constant pulses of current, i.e. produced by a constant current generator.
2. Vertical establishment in order to be effective immediately and to reduce the application time of the current.
3. Rectangular shape in order to apply the lowest possible electrical intensity.
4. Pulse duration that is equal to the chronaxy of the nerve structure requiring stimulation is order to minimise electrical energy.
5. Compensated pulse with an electrical mean of zero in order to prevent side effects linked to polarisation.

14.3 Basic concepts of excitation electrophysiology

14.3.1 Introduction

Passing an electrical current through an excitable living tissue results in a change to the resting potential (Vo).
The changed resting potential is called the local potential (V).
If the variation in the local potential is sufficiently intense and in the right direction, a state of instability is reached and excitation, i.e. the action potential, occurs. The value that the local potential V must reach so that action potential appears is called the excitation threshold (So).
The local potential V, caused by electrical charges provided by the current passing through the excitable tissue (comparable to a neuron) returns to its initial value Vo when the current is stopped. Returning to the resting conditions does not occur instantly but gradually, in the same way as discharging a capacitor.
The mathematical law for the return of V to its initial rest value is:

$$-dV/dt=(V-Vo)/k \quad (1)$$

Where k has time dimensions and is the excitation time constant. The excitation time constant characterises the tendency of the local potential to return to its initial value at a particular speed when the neuron is no longer subjected to the current.
While the current is being passed, the local potential V does not increase instantly but exponentially, in the same way as the charge of a capacitor, with k as the time constant. This constant therefore defines the tendency of the neuron to oppose or resist the variation in potential caused by electrical charges provided by the stimulation current, which is identical to the charge of a capacitor.

14. ELECTROTHERAPY THEORY

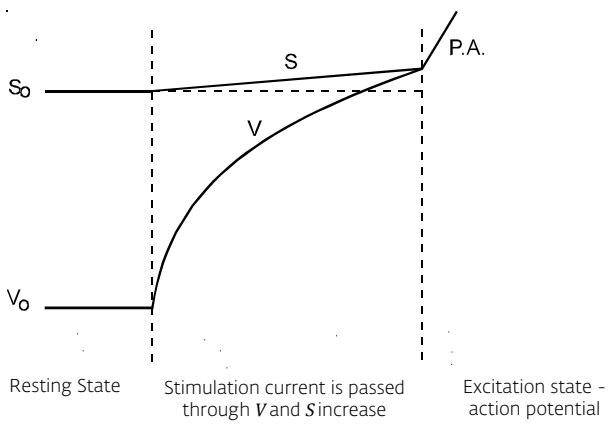
It must be stated that k does not depend on the shape and qualities of the stimulation current; it is a feature of the neuron itself, which expresses the time factor of its tendency to return the membrane potential to the resting value.
The critical value that the local potential V must reach to trigger excitation, i.e. the excitation threshold So, is only a constant value if the pulse duration is extremely short. If, however, the current lasts longer, the threshold increases (S). This phenomenon is demonstrated by the well-known fact that a current which increases slowly must reach a higher value in order to produce stimulation than a current which increases quickly.
The increase in the excitation threshold is known as accommodation. Accommodation is an increase in the threshold (S) which is the result of the change in the local potential caused by the electrical charges provided by the current passing through the neuron.

The increase in the threshold does not occur instantly but gradually and at a particular speed. A second time factor (λ) is therefore involved in the process of electrical excitation, which defines the rate at which the threshold changes (S).
When the local potential V is returned to its resting potential Vo, S returns exponentially to its initial value. So with λ as the time constant according the mathematical law:

$$ds/dt = (S - So)/\lambda \quad (2)$$

This equation is for S what equation (1) is for V, with λ replacing k.

The electrical charges provided by the current passing through the neuron change the membrane potential. They produce a local potential V and this causes the threshold S to increase. Excitation occurs if a sufficient quantity of electrical charges is provided to allow the local potential to catch up with the threshold value, i.e. when $V = S$ (Fig. 1).



$$\emptyset V = V\text{-}Vo = Vm\ ax\ (1\text{-}e^{-t/k})$$

Fig. 1

14. ELECTROTHERAPY THEORY

The excitation process is therefore determined by two time constants:
k the excitation constant
λ the accommodation constant

These are independent from each other. This means that, to a large extent, λ can be modified by experiment separately to k, by changing the ionic concentration of Calcium (Ca). These two constants have values that are very different to each other, but λ is always much larger (100 to 200 times) than k. In the case of human motor neurons, approximate values of 300 µs can be retained for k and 50 ms for λ. This means that k must be lower than λ for the excitation process to occur. The local potential (V) can therefore increase more quickly than the threshold S and catch up with it. If k were greater than λ, the threshold would increase more quickly than the local potential, which would never catch up with the threshold.

14.3.2 Study of the excitation process using a constant current

For the sake of simplicity, at this stage we will only study the excitation process produced by a constant current. The same study can be carried out using exponential, sinusoidal, linear, progressive, or any other type of current, as the results are similar.
For example, let us use the values:
k = 1 ms.
λ = 50 ms.
The issue in the excitation process is whether V will catch up with S or will S have time to escape.
The local potential V starts at Vo and increases exponentially according to the relationship to a final value depending on the intensity of the current.

$$\emptyset V = V\text{-}Vo = V\ max\ (1\text{-}e^{-t/k})$$

The threshold S starts from So and increases according to a more complicated curve, which can only be shown in part, and up to a value depending on the final stable value of V, if excitation has not occurred in the meantime.

In Figure 2a, the intensity of the current is set at a value (we will take as 1), which, without accommodation, would allow V to reach So and to trigger excitation.

In fact V reaches the value So but in the meantime the threshold increased, therefore $V = So < S$ and excitation cannot occur.

To allow V to reach the value S, the current must be 8% more intense.
This is shown in Figure 2b, where the threshold has just been reached in 4 ms (indicated by the arrow), that is the principal useful time.

14. ELECTROTHERAPY THEORY

In Figure 2c, a stronger current with a value of 1.2 is applied and V passes the threshold after 1.85 ms. In Figure 2d, an even stronger current (value = 2) is applied and $V = S$ after 0.7 ms.

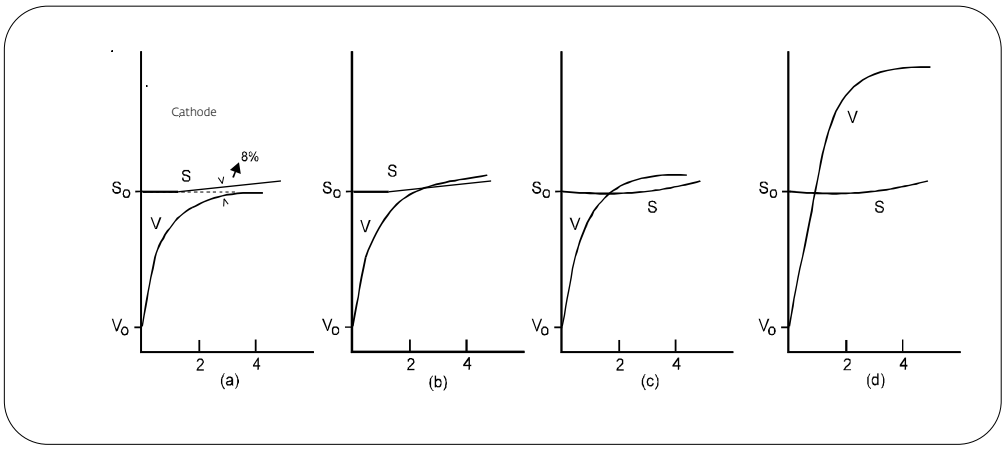
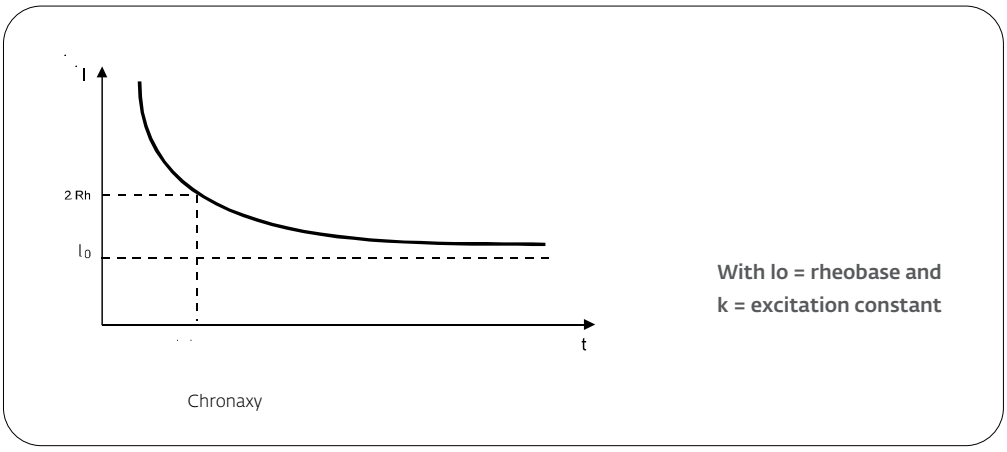


Fig. 2

We can therefore see the intensity-duration relationship appear, which gives the time at which V passes S for different current intensities. The useful times are even shorter when the current is more intense (Fig. 3).



This relationship applies to currents that are very short compared to the accommodation constant. Accommodation can be disregarded and excitation appears when $V = So$. This is why, in the intensity-duration relationship, only the excitation constant k occurs, as the duration of currents used have values close to k (from 0.2 ms to 3 ms).

14. ELECTROTHERAPY THEORY

If the durations of current applied were longer, the threshold would increase and excitation would only occur if V became equal to S. In these cases, the intensity-duration relationship must be reconsidered as the rheobase does not keep the value Io; instead, it increases to a value $I1 > Io$ determined by the excitation and accommodation constants. The actual rheobase Io is linked to the observed rheobase $I1$ by the relationship:

$$\frac{I_1}{I_0} = \left(\frac{\lambda}{k}\right)^{\frac{1}{\lambda}{k-1}}$$

14.3.3 Excitation by a current with any shape

It is possible to determine the equation for the local potential V and to calculate its value at any given point in time with any given shape of current.
An equation can also be determined for the development of the threshold.
These equations required a solid understanding of mathematics and come under the field of specialist electrophysiology. This is why we believe there is no purpose in expanding these equations as part of this work.
However, it can be noted that using these equations, which give the variation of V and , it is possible to study the excitation process with any given shape of current and for any given duration.

14. ELECTROTHERAPY THEORY

14.3.4 Chronaxy - excitation constant relationship

As the chronaxy is a value that characterises tissue excitability, it is worth determining the relationship which links it to the other factor that characterises excitation: k.
The chronaxy is the useful time corresponding to a stimulation current which has an intensity double that of the rheobase, i.e. $2\,Io$. It is therefore very easy to find the relationship between the chronaxy and the excitation constant based on the formula giving the intensity-duration relationship.

	$1 = I0/1\text{-}e^{-t/e}$
is the chronaxy (tch) when	$1 = 2I0$
therefore	$2I0 = I0/1 - e^{tch/k}$
	$2I0 = (1 - e^{tch/k}) = I0$
	$2\,(1 - e^{tch/k}) = 1$
	$2 - 2e^{tch/k} = 1$
	$2e^{tch/k} = 1$
	$e^{tch/k} = 1/2$
	$e^{1/tchk} = 1/2$
	$e^{tch/k} = 2$
	$1n2 = tch/k$
therefore	$t^{ch} = (1n2)k$
This means that the chronaxy = 0.693	

14.3.5 Hydraulic model of excitation

It is possible to set up a hydraulic model that corresponds exactly to excitation. This model allows a better understanding of excitation and may be used to represent the development of the local potential and the threshold under the effect of currents with variable durations and shapes

Water flows from tank A towards tank B by means of pump P, the stimulator (current generator). The flow of water corresponds to the intensity of the stimulation current and the water moved from A to B to the quantity of electrical charges. The water level in tank B reaches a certain level representing the value of the membrane potential
(Vo at rest and V local potential).

The stimulation threshold is given by a point D on float C. Stimulation occurs when level V in the tank B reaches point D by submerging the float.

When pump P injects liquid from A to B therefore increasing level V, part of the liquid goes back to A through tap K representing the excitation constant k. In the tank B, float C is linked to piston E that works by means of the level of liquid in tank F. This is linked to B by tap L representing the accommodation constant λ.

14. ELECTROTHERAPY THEORY

TWO EXAMPLES

A - Currents of long duration and low intensity

In order that level V reaches threshold D, a certain volume of water is necessary (likened to a certain quantity of electrical charges). If this water is supplied slowly by the pump (current of long duration and low intensity), some of the water has time to go through L and raise piston E therefore increasing the threshold level (accommodation). The quantity of liquid (the current) will therefore have to be greater because level V has to reach point D higher up. Moreover, a large amount of liquid returns from B to A through tap K. It is easy to understand that all these extra quantities that P has to transport indicate that we have an unfavourable stimulation current.

B - Currents of short duration and higher intensity

The durations intended here are close to the excitation constant value k.
In this case, as the flow is high, the pump action is short. As almost no liquid has gone through L, the float does not rise and accommodation is therefore negligible. Nevertheless, a certain quantity of water returns through K and has to be compensated for by P.
The Weiss law applies to these kinds of current (please refer to the fundamental law of electrostimulation).

$Q = q + it$ **or** $I\,t = q + it$

Q is the total quantity of liquid provided by P with
I = intensity of the stimulation current
t = pulse duration
q is the volume of liquid separating Vo from So i.e. the quantity of charges that would have to be provided if there were no leak K. In other words, if the membrane potential varied instantaneously and not exponentially in accordance with a time constant K.
it the quantity of liquid that returns from B to A through tap K.

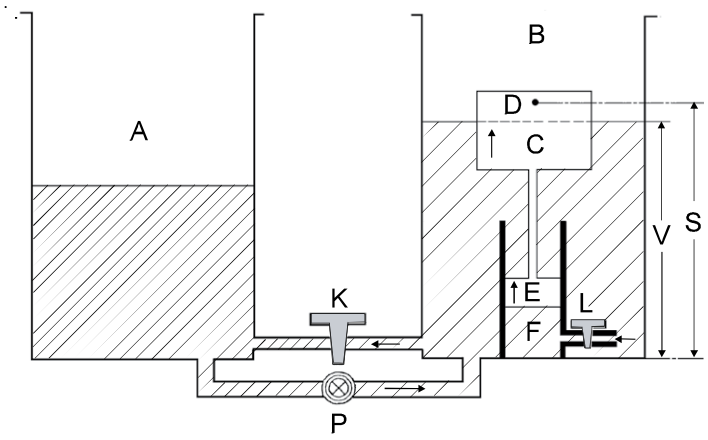


Fig. 4

15. AVAILABLE THERAPY PROGRAMS

15.1 Standard Version Programs and their usage – Rehab/Theta/Physio

Within the Standard version treatment categories and their programs available for Rehab/Theta/Physio device are:

15. AVAILABLE THERAPY PROGRAMS

15.1.1 Program category REHABILITATION I

CATEGORY	REHABILITATION
PROGRAM	TREATMENT OF DISUSE ATROPHY
WHEN?	A muscle that is normally innervated, after a period of immobilisation or diminished movement, rapidly decreases in volume. This decrease depends on the degree and duration of the functional deficit. Slow fibres (type I) in particular are affected by disuse atrophy.
WHY?	To reactivate the trophicity of the muscle fibres altered during disuse atrophy. To reverse muscle wastage.
HOW?	By using frequencies creating a tetanic contraction in type I fibres to impose a significant workload on the atrophied muscle, so that it recovers volume. Recovery therefore takes place far more quickly than by simply using muscle activities.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	Use the maximum stimulation energies. The first and second sessions help the patient become accustomed to the method by gradually increasing the stimulation energy every 3 or 4 contractions. In the following sessions, it is important to support the patient's progress by setting targets which go beyond the energy levels reached in the previous session.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

DISUSE ATROPHY, LEVEL 1 (25 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	35 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	6 s	7 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

DISUSE ATROPHY, LEVEL 2 (25 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	45 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	6 s	5 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION
PROGRAM	REINFORCEMENT
WHEN?	For use either on previously atrophied muscles which have regained their volume as a result of electrostimulation through disuse atrophy treatment programmes, or as a first-line on non- atrophied muscles which have lost their strength and speed of contraction.
WHY?	To restore the strength of the contraction in the case of muscle insufficiency without pronounced disuse atrophy or after restoration of muscle volume.
HOW?	By using frequencies creating a tetanic contraction in the quick fibres (type IIb), which are the strength and speed fibres.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	Use the maximum stimulation energies. The first and second sessions help the patient become accustomed to the method by gradually increasing the stimulation energy every 3 or 4 contractions. In the following sessions, it is important to support the patient's progress by setting targets which go beyond the energy levels reached in the previous session.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

REINFORCEMENT, LEVEL 1 (20 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	75 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	4 s	10 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

REINFORCEMENT, LEVEL 2 (20 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	85 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	4 s	8 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION
PROGRAM	PREVENTION OF DISUSE ATROPHY
WHEN?	After an operation or a bone fracture, a limb or a section of a limb is immobilised, the muscles of this part of the body are affected very quickly by disuse atrophy. This rapid decrease in muscle volume is mainly due to reflex inhibition and a total absence of muscle activity. It is also important to note that disuse atrophy tends to disproportionally affect type I fibres more than type II.
WHY?	To compensate for total or partial inactivity of the muscle following an osteoarticular injury.
HOW?	In order to prevent disuse atrophy, electrostimulation has to compensate for the total inactivity of the muscle by reproducing a series of contractions similar to the different ways in which the muscle functions when it is working normally. The main treatment phases are carried out with conventional operational frequencies for slow fibres to compensate for their tendency towards disuse atrophy.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	Use the maximum stimulation energies. The first and second sessions help the patient become accustomed to the method by gradually increasing the stimulation energy every 3 or 4 contractions. In the following sessions, it is important to support the patient's progress by setting targets which go beyond the energy levels reached in the previous session.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

PREVENTION OF DISUSE ATROPHY, LEVEL 1 (54 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	30 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	3 s	1.5 s	1.5 s
DURATION OF PHASE	2 min	5 s	14 s	3 min
DURATION OF RAMP-DOWN	2 s	1.5 s	1.5 s	3 s

PREVENTION OF DISUSE ATROPHY, LEVEL 2 (47 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	40 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	3 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	6 s	12 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION
PROGRAM	MUSCLE LESION
WHEN?	It is well known that early but well-controlled muscle work has a positive impact on the scarring process of the muscle fibres and the connective supporting tissues. The Muscle Lesion programme can be used as soon as the scar begins to form and is considered satisfactory, but as a general rule not until the 10th day after the initial lesion.
WHY?	To direct and speed up the scarring process and prevent disuse atrophy. To enable the patient to return to sport more quickly.
HOW?	The muscle lesion programme is designed to cause extremely gradual muscle contractions using a rate of tensioning 4 times longer than for standard programmes. This aims to reduce the risk of adverse secondary ruptures.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	Use the maximum stimulation energies. The first and second sessions help the patient become accustomed to the method by gradually increasing the stimulation energy every 3 or 4 contractions. In the following sessions, it is important to support the patient's progress by setting targets which go beyond the energy levels reached in the previous session.
OPTION 2+2	Yes.

MUSCLE LESION (30 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	40 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	6 s	1.5 s	1.5 s
DURATION OF PHASE	2 min	3 s	10 s	3 min
DURATION OF RAMP-DOWN	2 s	1.5 s	1.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION
PROGRAM	MOTOR POINT
WHEN?	It is advisable to use this programme before all initial muscle electrostimulation sessions in order to precisely locate the motor points for each person. Locating the motor points is recommended especially for long muscles, such as those in the lower limbs (quadriceps, etc.).
WHY?	In order to guarantee optimum effectiveness of the programmes.
HOW?	A motor point pen must be used to locate the motor points. See the example on the section on specific indications.
OPTION 2+2	No.

MOTOR POINT (15 MIN)	
	CONTINUOUS STIMULATION
FREQUENCY	3 Hz

15. AVAILABLE THERAPY PROGRAMS

15.1.2 Program category PAIN RELIEF

CATEGORY	PAIN RELIEF
PROGRAM	100 Hz TENS OR FREQUENCY-MODULATED TENS
WHEN?	Gate control, which is activated during TENS stimulation, is particularly effective for the relief of localised pain of non-muscular origin. It is particularly effective for relieving neuropathic pain and inflammatory conditions. The sessions may be repeated at will and without restriction, depending upon the intensity of the pain.
WHY?	Pain relief is now a priority in therapy which must be provided by all healthcare professionals. As TENS treatment is generally palliative, it improves the patient's comfort and helps the therapist to start the process.
HOW?	The principle is to cause a significant influx of tactile sensitivity in order to restrict the entry of pain impulses upon their return to the posterior horn of the spinal cord. We must therefore stimulate the sensitivity fibres on the skin of the painful area. To do this, it is necessary to use a frequency that is the same as the operational frequencies for the tactile sensitivity nerve fibres, i.e. from 50 to 150 Hz.
PULSE WIDTH	Use very short pulse widths corresponding to the chronaxies of the tactile sensitivity fibres, i.e. 30, 50 or 70 µs, depending on whether the patient is very sensitive, normal, or not very sensitive (level 1, 2 or 3 respectively).
ELECTRODES	As a general rule, the electrodes are placed on or near the painful area. The electrodes may also be placed at the nerve trunks depending on the conditions being treated.
INTENSITY	The intensity must be increased gradually until the patient perceives a tingling sensation that is pronounced without being painful. Acclimatisation is normal if a non-modulated TENS programme is used. In this case, it is advisable to slightly increase the stimulation energies on a regular basis so that the patient continues to feel a tingling sensation. The mi-TENS function prevents any kind of muscle contraction. If the sensor detects a muscle response, the stimulator automatically reduces the stimulation energy in order to stop the muscle response.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

TENS			
FREQUENCY	LEVEL	PULSE WIDTH	TREATMENT TIME
100 Hz	1	30 µs	20 min
100 Hz	2	50 µs	20 min
100 Hz	3	70 µs	20 min

FREQUENCY MODULATED TENS				
FREQUENCY	LEVEL	PULSE WIDTH	MODULATION TIME	TREATMENT TIME
50-150 Hz	1	30 µs	2 s	20 min
50-150 Hz	2	50 µs	2 s	20 min
50-150 Hz	3	70 µs	2 s	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF
PROGRAM	PULSE WIDTH MODULATED TENS
WHEN?	Gate control, which is activated during TENS stimulation, is particularly effective for the relief of localised pain of non-muscular origin. It is particularly effective for relieving neuropathic pain and inflammatory conditions. The sessions may be repeated at will and without restriction, depending upon the intensity of the pain.
WHY?	Pain relief is now a priority in therapy which must be provided by all healthcare professionals. As TENS treatment is generally palliative, it improves the patient's comfort and helps the therapist to start the process.
HOW?	The principle is to cause a significant influx of tactile sensitivity in order to restrict the entry of pain impulses upon their return to the posterior horn of the spinal cord. We must therefore stimulate the sensitivity fibres on the skin of the painful area. To do this, it is necessary to use a frequency that is the same as the operational frequencies for the tactile sensitivity nerve fibres, i.e. from 50 to 150 Hz.
PULSE WIDTH	The pulse width varies continuously with this programme. This avoids habituation by using a system of stimulation that is perceived as more pleasant by some patients.
ELECTRODES	As a general rule, the electrodes are placed on or near the painful area. The electrodes may also be placed at the nerve trunks depending on the conditions being treated.
INTENSITY	The intensity must be increased gradually until the patient perceives a tingling sensation that is pronounced without being painful.
OPTION 2+2	Yes.

PULSE WIDTH MODULATED TENS			
FREQUENCY	PULSE WIDTH	MODULATION TIME	TREATMENT TIME
80 Hz	70-180 µs	2 s	30 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF
PROGRAM	ENDORPHINIC
WHEN?	An increase in the tension of the contractured muscle fibres and the crushing of the capillary network resulting from this causes a decrease in the blood flow and a gradual accumulation of acid metabolites and free radicals. Without treatment, there is a risk that the contracture will become chronic and genuine atrophy of the capillary network may gradually occur.
WHY?	To relieve chronic muscle pain.
HOW?	Studying publications about reducing pain by increasing endorphin production shows that the pulses have to be large enough to excite type Aδ nerve fibres as well as type Aα, which is shown by the production of muscle twitches. The effects of endorphinic stimulation are described for frequencies between 2 and 8 Hz. In addition to the general effect of increasing endorphin production in the hypothalamus, which elevates the pain perception threshold, there is a very significant localised effect. The 5 muscle twitches induced every second by stimulation produce very significant hyperaemia, which drains the acid metabolites and free radicals that had accumulated in the chronically contractured muscle areas.
PULSE WIDTH	Endorphinic stimulation is primarily aimed at the sensitive Aδ nerve fibres which are best stimulated with pulse width of 200µs. However the vascular effect is secondary to the co- activation of the motor units, which have a slightly higher chronaxy that is measured at the start of the session using the mi-SCAN function.
ELECTRODES	Electrodes must be placed after a thorough palpatory examination to locate the most painful point, where a small electrode preferably connected to the positive pole of the cable will be placed. The other electrode is placed at the end of muscle or muscle group being stimulated.
INTENSITY	An essential factor in the therapeutic efficacy is to cause visible muscle twitching, which may, in certain cases, require higher stimulation energies to be used. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

ENDORPHINIC		
FREQUENCY	PULSE WIDTH	TREATMENT TIME
5 Hz	200 µs	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF
PROGRAM	BURST
WHEN?	The Burst programme is an type of endorphinic programme, which has a less pronounced vascular effect than endorphinic. It may be used in the same way to relieve pain following a chronic contracture.
WHY?	To relieve chronic muscle pain.
HOW?	The Burst mode involves replacing the emission of an isolated electric pulse by an emission of a very short burst of 8 pulses. In this way, the Burst programme emits 2 burst per second, which can produce the same endorphinic results as for a standard frequency of 2 Hz.
PULSE WIDTH	The pulse width for the programme is 180 µs.
ELECTRODES	Electrodes must be placed after a thorough palpatory examination to locate the most painful point, where a small electrode preferably connected to the positive pole of the cable will be placed. The other electrode is placed at the end of muscle or muscle group being stimulated.
INTENSITY	An essential factor in the therapeutic efficacy is to cause visible muscle twitching, which may, in certain cases, require higher stimulation energies to be used.
OPTION 2+2	Yes.

BURST TENS		
FREQUENCY	PULSE WIDTH	TREATMENT TIME
2 Hz (2 pulse trains per second with an internal frequency of 80 Hz)	180 µs	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF
PROGRAM	MIXED BURST / TENS ALTERNATED
WHEN?	Described by Han, modulated stimulation Burst TENS successively activates (every 3 seconds) the Gate control mechanism and releases endogenous opioid substances. This is a therapeutic option, which may be worth considering for poorly classified pain with multiple causes.
WHY?	To improve the patient's comfort and to enable the therapist to start the process more easily.
HOW?	Burst-modulated TENS is based on the Gate control theory (TENS effect) and on the release of morphine-like substances produced by the body, endorphins (Endorphinic effect). The stimulation frequencies vary every 3 seconds, producing a combined stimulation of 80 Hz and 2 Hz.
PULSE WIDTH	The pulse width for the programme is 180 µs.
ELECTRODES	As a general rule, the electrodes are placed on or near the painful area.
INTENSITY	The stimulation should produce a sharp but pleasant tingling sensation and visible muscle twitches. Please note: This programme has two distinct energy levels. First adjust the intensity level for 80 Hz (TENS) until a tingling sensation is felt, then repeat the procedure for 2 Hz (endorphinic) in order to produce visible muscle twitches.
OPTION 2+2	Yes.

MIXED TENS		
FREQUENCY	PULSE WIDTH	TREATMENT TIME
80 Hz 3 s / 2 Hz 3 s	180 µs	30 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF
PROGRAM	DECONTRACTURING
WHEN?	This type of treatment is indicated to relieve pain following acute muscle contractures (torticollis, lumbago, etc.). It will also reduce muscle tension in the contracted muscles to facilitate manual handling techniques.
WHY?	To decrease muscle tension.
HOW?	Current experiments show that muscles twitches caused by a very low frequency of 1 Hz can effectively remove contractures or decrease resting muscle tension of the stimulated muscle.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes must be placed after a thorough palpatory examination to locate the most painful point, where a small electrode preferably connected to the positive pole of the cable will be placed. The other electrode is placed at the end of muscle or muscle group being stimulated. If a contracture affects all the muscle fibres, the electrodes suitable for neuromuscular stimulation can also be applied (please refer to the positions recommended for the muscle being stimulated).
INTENSITY	An essential factor in the therapeutic efficacy is to cause visible muscle twitching, which may, in certain cases, require higher stimulation energies to be used. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

DECONTRACTION	
FREQUENCY	TREATMENT TIME
1 Hz	20 min

15. AVAILABLE THERAPY PROGRAMS

15.1.3 Program category VASCULAR

CATEGORY	VASCULAR
PROGRAM	HEAVY LEGS
WHEN?	The problem of "heavy legs" occurs when venous blood return sometimes does not take place, but does not cause any damage to the body. Heat, certain stages of the menstrual cycle, prolonged standing and long continuous periods sitting down may cause swelling (stasis oedema) with a considerable feeling of heaviness in the lower limbs. A certain degree of muscle tension is often associated with this, and female patients can experience cramps in their calves.
WHY?	To accelerate venous blood return, re-oxygenate the tissues and produce a relaxing effect.
HOW?	During the treatment session, we move progressively and automatically through a series of clearly defined frequencies, requiring a large increase in the flow to allow acceleration of the venous blood return (7 Hz), produce an analgesic effect by increasing the production of endorphins (5 Hz) and end by relaxing the muscles (3 Hz), while keeping the blood flow noticeably high.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the calf muscles.The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	A large electrode is placed transversely under the popliteal fossa and two small electrodes are positioned on the contour of the gastrocnemius muscles.
INTENSITY	An essential factor in the effectiveness of electrotherapy is the ability to cause visible muscle twitches. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	No.

TENS			
	1ST SEQUENCE	2ND SEQUENCE	3RD SEQUENCE
FREQUENCY	7 Hz	5 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1 s	1 s
DURATION OF PHASE	7 min	7 min	7 min
DURATION OF RAMP-DOWN	0.5 s	0.5 s	6 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	VASCULAR
PROGRAM	VENOUS INSUFFICIENCY 1
WHEN?	In the event of venous insufficiency without oedema.
WHY?	To increase the general blood flow so as to improve the circulation of the interstitial fluid and increase oxygenation of the tissues and the intima of the veins. To drain the veins as much as possible in order to combat stasis.
HOW?	Send pulses so as to cause short tetanic contractions (to drain the deep veins), separated by long periods to increase the flow.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned according to the specific indication.
INTENSITY	Adjust the stimulation energy so as to produce appropriate muscle responses both in the tetanic contraction phase and in the phase to increase blood flow.
OPTION 2+2	No.

VENOUS INSUFFICIENCY 1 (21 MIN)		
	CONTRACTION	ACTIVE REST
FREQUENCY	50 Hz	8 Hz
DURATION OF RAMP-UP	1.5 s	1 s
DURATION OF PHASE	4 S	21 S
DURATION OF RAMP-DOWN	1.5 s	1 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	VASCULAR
PROGRAM	VENOUS INSUFFICIENCY 2
WHEN?	In the event of venous insufficiency without oedema.
WHY?	To encourage drainage of the deep veins and of the oedema.
HOW?	Encourage venous blood return using a sequenced stimulation starting in the leg muscles and continuing to the thigh muscles, supporting the distal tetanic contraction to prevent regurgitation.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned according to the specific indication.
INTENSITY	Adjust the stimulation energy in order to produce pronounced but comfortable muscle contractions. The stimulation energies must be greater on channels 1 and 2 than on channels 3 and 4.
OPTION 2+2	No.

VENOUS INSUFFICIENCY 2 (21 MIN)			
	1ST CONTRACTION (CH 1+2)	2ND CONTRACTION (CH 1+2+3+4)	REST
FREQUENCY	50 Hz	50 Hz	0 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0 s
DURATION OF PHASE	3 s	3 s	19 s
DURATION OF RAMP-DOWN	0 s	1.5 s	0 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	VASCULAR
PROGRAM	ARTERIAL INSUFFICIENCY 1
WHEN?	Arterial insufficiency in the lower limbs is conventionally divided into four clinical stages. These four stages (I, II, III, IV) depend on the approximate severity of the loss of blood flow and the tissue-related consequences. The arterial insufficiency 1 programme is to be used to treat Stage II. In Stage II, arterial occlusion is responsible for pain that occurs on exertion and is relieved by resting: this is known as intermittent claudication.
WHY?	To improve the absorption of oxygen by the muscles, increase tolerance on exertion and walking distance.
HOW?	To avoid further reducing the supply of oxygen to the muscle fibres, the contractions remain infra-tetanising (9 Hz) and are separated by long periods of active rest (3 Hz) in order to avoid muscular fatigue.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned according to the specific indication.
INTENSITY	Stimulation energies must be increased as high as possible whilst still remaining comfortable for the patient.
OPTION 2+2	No.

ARTERIAL INSUFFICIENCY 1 (14 MIN)		
	CONTRACTION	ACTIVE REST
FREQUENCY	9 Hz	3 Hz
DURATION OF RAMP-UP	1 s	1 s
DURATION OF PHASE	15 s	15 s
DURATION OF RAMP-DOWN	1 s	1 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	VASCULAR
PROGRAM	ARTERIAL INSUFFICIENCY 2
WHEN?	Arterial insufficiency in the lower limbs is conventionally divided into four clinical stages. These four stages (I, II, III, IV) depend on the approximate severity of the loss of blood flow and the tissue- related consequences. The Arterial insufficiency 2 programme is used to treat Stage III. At Stage III the severity of the arterial occlusion causes constant pain which occurs even at rest.
WHY?	To improve oxygen uptake by the muscles, to reduce muscular pain at rest and partially restore muscular tolerance to exertion.
HOW?	To avoid further reducing the supply of oxygen to the muscle fibres, the contractions remain infra-tetanising (7 Hz) and are separated by long periods of active rest (2 Hz) in order to avoid muscular fatigue.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned according to the specific indication.
INTENSITY	Stimulation energies must be increased as high as possible whilst still remaining comfortable for the patient.
OPTION 2+2	No.

ARTERIAL INSUFFICIENCY 2 (14 MIN)		
	CONTRACTION	ACTIVE REST
FREQUENCY	7 Hz	2 Hz
DURATION OF RAMP-UP	1 s	1 s
DURATION OF PHASE	15 s	15 s
DURATION OF RAMP-DOWN	1 s	1 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	VASCULAR
PROGRAM	CRAMP PREVENTION
WHEN?	For people suffering from cramps which may appear spontaneously at rest during the night or following prolonged muscular effort. These cramps can be partially due to an imbalance in the flow of blood through the muscles.
WHY?	To improve the circulatory system to prevent the occurrence of cramps.
HOW?	This programme consists of two different phases: an 8 Hz sequence to improve blood flow and develop blood capillaries. A 3 Hz sequence to relax muscular tonus and increase the well-being of the patient.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	An essential factor in the effectiveness of electrotherapy is the ability to cause visible muscle twitches. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

CRAMP PREVENTION (*40 MIN)		
	1ST SEQUENCE	2ND SEQUENCE
FREQUENCY	8 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s
DURATION OF PHASE	8 min	2 min
DURATION OF RAMP-DOWN	1.5 s	1.5 s

* 1st and 2nd sequence loop 4 times

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	VASCULAR
PROGRAM	CAPILLARISATION
WHEN?	The 8 Hz frequency produces the greatest increase in blood flow in young patients who are in a good state of physical health. Use of the Capillarisation programme must therefore be restricted to sport rehabilitation and will be proposed in situations where a hyperaemia is desired e.g. to accelerate the scarring process. The Capillarisation programme can also be used for non-injured athletes as part of their physical preparation to achieve a variety of ends: • To supplement endurance training • To optimise the overcompensation phase prior to an endurance or resistance competition. • Supplementary use of the Hypertrophy programme
WHY?	To induce the greatest circulatory activation in patients who are athletes. To increase the capillary network and make the muscle fibres more resistant to fatigue.
HOW?	When using low stimulation frequencies of 8 Hz, the increase in blood flow is greatest in young people who are in good physical condition. However a frequency of 8 Hz may cause early muscle fatigue and a depletion in the muscular response in patients with underperforming muscles.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	An essential factor in the effectiveness of electrotherapy is the ability to cause visible muscle twitches. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

CAPILLARISATION	
	CONTINUOUS STIMULATION
FREQUENCY	8 Hz
DURATION OF RAMP-UP	1.5 s
DURATION OF PHASE	25 min
DURATION OF RAMP-DOWN	1.5 s

15. AVAILABLE THERAPY PROGRAMS

15.1.4 CONDITIONING I

CATEGORY	CONDITIONING I
PROGRAM	RESISTANCE
WHEN?	For athletes wishing to increase their ability to sustain intense and prolonged exertion, or to develop their ability to maintain or repeat a muscular activity carried out at a high percentage of the maximum strength.
WHY?	Increased anaerobic (lactic) capacity in the muscles. Increased strength endurance.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

RESISTANCE, LEVEL 1 (27 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	50 Hz	5 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	7 s	7 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

RESISTANCE, LEVEL 2 (28 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	55 Hz	6 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	8 s	7 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

RESISTANCE, LEVEL 3 (28 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	60 Hz	7 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	8 s	6 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING I
PROGRAM	STRENGTH
WHEN?	For athletes practising a discipline which requires strength and speed.
WHY?	An increase in maximum strength and muscle contraction speed.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

STRENGTH, LEVEL 1 (33 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	75 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	4 s	19 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

STRENGTH, LEVEL 2 (35 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	83 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	4 s	23 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

STRENGTH, LEVEL 3 (38 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	90 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	4 s	27 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING I
PROGRAM	ACTIVE RECOVERY
WHEN?	To facilitate and accelerate muscle recuperation after intense exertion. Use this programme during the three hours which follow a period of intense training or a competition.
WHY?	Strong increase in blood flow, accelerated elimination of waste products from muscle contraction and a relaxing endorphinic effect.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Precision in positioning the electrodes is less significant than for programmes aiming to develop muscle quality. The electrodes can be placed in an alternative way, reducing the number of electrodes needed and stimulating more muscles during a session.
INTENSITY	An essential factor in the effectiveness of electrotherapy is the ability to cause visible muscle twitches. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

ACTIVE RECOVERY (24 MIN)				
	1ST SEQUENCE	2ND SEQUENCE	3RD SEQUENCE	4TH SEQUENCE
FREQUENCY	9 Hz	8 Hz	7 Hz	6 Hz
TIME	2 min	2 min	2 min	3 min
	5TH SEQUENCE	6TH SEQUENCE	7TH SEQUENCE	8TH SEQUENCE
FREQUENCY	5 Hz	4 Hz	3 Hz	2 Hz
TIME	3 min	3 min	3 min	3 min

15. AVAILABLE THERAPY PROGRAMS

15.2 Full Version Programs and their usage – Theta/Physio devices only

Note

- The Full Version offers additional programs to the Standard Version.
- Additional programs to already at Standard version existing program categories are automatically included within the corresponding program category.
- Full Versions programs are only included in Theta and Physio devices

15. AVAILABLE THERAPY PROGRAMS

15. AVAILABLE THERAPY PROGRAMS

15.2.1 REHABILITATION II

CATEGORY	REHABILITATION II
PROGRAM	HIP PROSTHESIS
WHEN?	Except where there are complications, as soon as possible following the surgical implantation of a total hip replacement.
WHY?	To restore the muscular qualities of the gluteus medius and gluteus maximus muscles, to recover stability when standing on one foot and to prevent limping.
HOW?	The three levels of the programme correspond to the Disuse atrophy (level 1 and 2) and Reinforcement (level 1) programmes for which the low frequencies have been removed so as not to cause vibration in the prosthesis.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the gluteal muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned on the gluteal muscles must correspond to the specific indication.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Progressively increase the level of energy during the course of a treatment session.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

HIP PROSTHESIS, LEVEL 1 (30 MIN)				
	WARM UP	CONTRACTION	REST	FINAL RECOVERY PHASE
FREQUENCY	-	35 Hz	-	-
DURATION OF RAMP-UP	-	1.5 s	-	-
DURATION OF PHASE	-	6 s	6 s	-
DURATION OF RAMP-DOWN	-	0.75 s	-	-

HIP PROSTHESIS, LEVEL 2 (30 MIN)				
	WARM UP	CONTRACTION	REST	FINAL RECOVERY PHASE
FREQUENCY	-	45 Hz	-	-
DURATION OF RAMP-UP	-	1.5 s	-	-
DURATION OF PHASE	-	6 s	6 s	-
DURATION OF RAMP-DOWN	-	0.75 s	-	-

HIP PROSTHESIS, LEVEL 3 (15 MIN)				
	WARM UP	CONTRACTION	REST	FINAL RECOVERY PHASE
FREQUENCY	-	75 Hz	-	-
DURATION OF RAMP-UP	-	1.5 s	-	-
DURATION OF PHASE	-	4 s	11 s	-
DURATION OF RAMP-DOWN	-	0.75 s	-	-

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION II
PROGRAM	PATELLOFEMORAL SYNDROME
WHEN?	In conjunction with the rehabilitation of centred (post-traumatic chondropathy) or decentred (external subluxation of the patella) patellofemoral syndromes.
WHY?	To restore the trophicity of muscle fibres altered during the muscle disuse atrophy process and to develop the active stability of the knee.
HOW?	Depending upon the diagnosis, stimulation will either involve all of the heads of the quadriceps muscle or it will be limited solely to the vastus medialis. The three levels of the programme correspond to the Disuse atrophy (level 1 and 2) programmes and the Reinforcement (level 1) programmes respectively, for which the low frequencies have been removed so as not to cause micro-trauma in the patella.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the gluteal muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned on the quadriceps or only on the vastus medialis in accordance with the specific indication.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Progressively increase the level of energy during the course of a treatment session.
OPTION 2+2	Yes as 3+1 as ch 1+ch 2+ch 3 are used for patellar syndrome program.

15. AVAILABLE THERAPY PROGRAMS

PATELLOFEMORAL SYNDROME LEVEL 1 = DISUSE ATROPHY, LEVEL 1 (30 MIN)				
	WARM UP	CONTRACTION	REST	FINAL RECOVERY PHASE
FREQUENCY	-	35 Hz	-	-
DURATION OF RAMP-UP	-	1.5 s	-	-
DURATION OF PHASE	-	6 s	6 s	-
DURATION OF RAMP-DOWN	-	0.75 s	-	-

PATELLOFEMORAL SYNDROME LEVEL 2 = DISUSE ATROPHY, LEVEL 2 (30 MIN)				
	WARM UP	CONTRACTION	REST	FINAL RECOVERY PHASE
FREQUENCY	-	45 Hz	-	-
DURATION OF RAMP-UP	-	1.5 s	-	-
DURATION OF PHASE	-	6 s	6 s	-
DURATION OF RAMP-DOWN	-	0.75 s	-	-

PATELLOFEMORAL SYNDROME LEVEL 3 = DISUSE ATROPHY, LEVEL 1 (15 MIN)				
	WARM UP	CONTRACTION	REST	FINAL RECOVERY PHASE
FREQUENCY	-	75 Hz	-	-
DURATION OF RAMP-UP	-	1.5 s	-	-
DURATION OF PHASE	-	4 s	11 s	-
DURATION OF RAMP-DOWN	-	0.75 s	-	-

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION II
PROGRAM	ACL
WHEN?	As a supplement to rehabilitation of a ligamentoplasty of the anterior cruciate ligament of the knee. The programme can be used early as it does not put any stress on the tendon graft.
WHY?	To restore the muscular qualities of the quadriceps and the hamstrings and recover a stable knee to allow the safe resumption of active sport.
HOW?	The ACL programme is specifically designed for the rehabilitation of ligamentoplasties. It allows intensive use of the quadriceps while protecting the tendon graft during the first few post- operative weeks due to co-activation of the hamstring muscles. Stimulation starts with the hamstrings (channels 1 and 2). While they are contracted, stimulation continues on the quadriceps (channels 3 and 4), thus preventing any risk of anterior draw movement.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the quadriceps and hamstring muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned on the gluteal muscles must correspond to the specific indication.
INTENSITY	The maximum tolerable stimulation energy on the 4 channels, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Progressively increase the level of energy during the course of a treatment session.
OPTION 2+2	No. The 2+2 function is not available on this program since all four channels are in use.
NOTE	Take care to properly observe the correct position of the stimulation channels.

15. AVAILABLE THERAPY PROGRAMS

ACL (30 MIN)			
	1ST CONTRACTION (CH 1+2) HAMSTRINGS	2ND CONTRACTION (CH 1+2+3+4) HAMSTRINGS + QUADRICEPS	ACTIVE REST
FREQUENCY	40 Hz	40 Hz	4 Hz
DURATION OF RAMP-UP	1.5 s	3 s	0.5 s
DURATION OF PHASE	3 s	6 s	8 s
DURATION OF RAMP-DOWN	0 s	0.75 s	0.5 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION II
PROGRAM	ROTATOR CUFF
WHEN?	In addition to the rehabilitation of rotator cuff tendinopathies, after sedation of acute pain and manual correction of joint misalignment.
WHY?	To develop the active stability of the shoulder by restoring the functional attributes of the muscles supporting the glenohumeral joint.
HOW?	Selective stimulation of the infraspinatus and supraspinatus muscles using parameters adapted to their postural function (type I fibres). Combination with a TENS programme for a combined analgesic effect.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the infraspinatus and supraspinatus muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned according to the specific indication.
INTENSITY	The maximum tolerable stimulation energy on the 4 channels, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Progressively increase the level of energy during the course of a treatment session.
OPTION 2+2	Yes

15. AVAILABLE THERAPY PROGRAMS

ROTATOR CUFF, LEVEL 1 (25 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	35 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	6 s	7 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

ROTATOR CUFF, LEVEL 2 (25 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	45 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	6 s	5 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

ROTATOR CUFF, LEVEL 3 (20 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	75 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	4 s	10 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION II
PROGRAM	BACK/TRUNK STABILISATION
WHEN?	After an episode of low back pain, once the pain has been relieved. Muscular work by electrostimulation has the advantage of being carried out isometrically with very little stress on the vertebral structures and discs.
WHY?	To develop the support qualities of the abdominal and lumbar muscles and to restore awareness of postural control.
HOW?	By simultaneously stimulating the abdominal and lumbar muscle groups, using parameters adapted to restoring the qualities of type I muscle fibres used in postural control.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned jointly on the abdominal and lumbar muscles in accordance with the specific indication.
INTENSITY	The maximum tolerable stimulation energy on the 4 channels, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Progressively increase the level of energy during the course of a treatment session.
OPTION 2+2	No.

BACK/TRUNK STABILISATION (30 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	40 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	2 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	6 s	12 s	3 min
DURATION OF RAMP-DOWN	2 s	1 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION II
PROGRAM	CARDIAC REHABILITATION
WHEN?	In addition to the aerobic exercises suggested during cardiac rehabilitation.
WHY?	Heart failure limits the capacity for exertion linked, in part, to changes in the peripheral muscles. Electrostimulation allows muscle qualities to be improved, in particular aerobic capacity, which contributes to improving tolerance of exertion and the quality of life in patients suffering from severe cardiac failure.
HOW?	The work regime imposed by the cardiac rehabilitation programme uses the oxidative metabolism through contractions which are of low power but very long and repeated over a long period (1 hour).
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	The quadriceps muscles are a priority because of their volume and their functional importance. Electrodes must be positioned according to the specific indication.
INTENSITY	The maximum tolerable stimulation energy on the 4 channels, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Progressively increase the level of energy during the course of a treatment session.
OPTION 2+2	No.

CARDIO TRAINING (60 MIN)				
	WARM UP	CONTRACTION	REST	FINAL RECOVERY PHASE
FREQUENCY	-	10 Hz	-	-
DURATION OF RAMP-UP	-	2 s	-	-
DURATION OF PHASE	-	20 s	20 s	-
DURATION OF RAMP-DOWN	-	1 s	-	-

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION II
PROGRAM	ATROPHY (MODULATED FREQUENCY)
WHEN?	Use on weakened muscles following immobilisation or restricted activity.
WHY?	The programme imposes a work regime adapted to the physiology of the type I fibres where the qualities have been altered during muscle disuse atrophy.
HOW?	Progressive incrementation of the frequency (25-40Hz) at the beginning of each contraction may improve the comfort of the stimulation in hypersensitive patients.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy on the 4 channels, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Progressively increase the level of energy during the course of a treatment session.
OPTION 2+2	Yes.

ATROPHY, MODULATED FREQUENCY (30 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	25-40 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	2 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	4 s	8 s	3 min
DURATION OF RAMP-DOWN	2 s	1 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	REHABILITATION II
PROGRAM	REINFORCEMENT (MODULATED FREQUENCY)
WHEN?	For use either on previously atrophied muscles which have regained their volume as a result of electrostimulation with disuse atrophy treatment programmes, or as a first-line treatment on non-atrophied muscles which have lost their strength and speed of contraction.
WHY?	The programme imposes a work regime adapted to the physiology of the type II fibres to restore contraction strength in the case of muscular insufficiency without marked disuse atrophy or following recovery of muscle volume.
HOW?	Progressive incrementation of the frequency (35-60 Hz) at the beginning of each contraction may improve the comfort of the stimulation in hypersensitive patients.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy on the 4 channels, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Progressively increase the level of energy during the course of a treatment session.
OPTION 2+2	Yes.

FORCE, MOD. FREQUENCY (30 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	35-60 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	3 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	8 s	15 s	3 min
DURATION OF RAMP-DOWN	2 s	1 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

15.2.2 AGONIST / ANTAGONIST

CATEGORY	AGONIST / ANTAGONIST
PROGRAM	ATROPHY / REINFORCEMENT
WHEN?	The alternate stimulation of the two antagonistic muscle groups has the advantage of allowing the active mobilisation of a joint while inducing muscle work which is beneficial to functional recuperation.
WHY?	To combine muscle work aimed at successively restoring the two types of muscle fibres (disuse atrophy, then reinforcement) to give mobility across the full range of movement of the joint. This type of use is particularly interesting for combating adhesion.
HOW?	There are four different programmes: - Atrophy 1/1 and Reinforcement 1/1. These programmes produce identical length contractions for the agonist and the antagonist. - Atrophy 2/1 and Reinforcement 2/1. These programmes produce contractions for the agonist which are twice as long as for the antagonist.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The stimulation energies must be adjusted successively for each muscle group to obtain joint mobility in the desired range.
OPTION 2+2	No. The 2+2 function is not available in this program since all four channels are in use.
NOTE	For 2-channel configuration, channels 1 and 2 alternate. Take care to properly position channel 1 on the agonist and channel 2 on the antagonist. For 4-channel configuration, channels 1+2 alternate with channels 3+4. Take care to properly position channels 1 and 2 on the agonist and channels 3 and 4 on the antagonist.

15. AVAILABLE THERAPY PROGRAMS

ATROPHY 1 (21 MIN)				
	SEQUENCE 1 AGONIST	SEQUENCE 1 ANTAGONIST	SEQUENCE 2 AGONIST	SEQUENCE 2 ANTAGONIST
FREQUENCY	35 Hz	0 Hz	0 Hz	35 Hz
DURATION OF RAMP-UP	1.5 s	0 s	0 s	1.5 s
DURATION OF PHASE	6 s	6 s	6 s	6 s
DURATION OF RAMP-DOWN	0.75 s	0 s	0 s	0.75 s

ATROPHY 2 (21 MIN)				
	SEQUENCE 1 AGONIST	SEQUENCE 1 ANTAGONIST	SEQUENCE 2 AGONIST	SEQUENCE 2 ANTAGONIST
FREQUENCY	35 Hz	0 Hz	0 Hz	35 Hz
DURATION OF RAMP-UP	1.5 s	0 s	0 s	1.5 s
DURATION OF PHASE	8 s	8 s	4 s	8 s
DURATION OF RAMP-DOWN	0.75 s	0 s	0 s	0.75 s

15. AVAILABLE THERAPY PROGRAMS

REINFORCEMENT 1 (16 MIN)				
	SEQUENCE 1 AGONIST	SEQUENCE 1 ANTAGONIST	SEQUENCE 2 AGONIST	SEQUENCE 2 ANTAGONIST
FREQUENCY	70 Hz	4 Hz	4 Hz	70 Hz
DURATION OF RAMP-UP	1.5 s	0.5 s	0.5 s	1.5 s
DURATION OF PHASE	4 s	3 s	3 s	4 s
DURATION OF RAMP-DOWN	0.75 s	0.5 s	0.5 s	0.75 s

REINFORCEMENT 2 (17 MIN)				
	SEQUENCE 1 AGONIST	SEQUENCE 1 ANTAGONIST	SEQUENCE 2 AGONIST	SEQUENCE 2 ANTAGONIST
FREQUENCY	70 Hz	4 Hz	70 Hz	4 Hz
DURATION OF RAMP-UP	1.5 s	0.5 s	1.5 s	0.5 s
DURATION OF PHASE	6 s	4 s	3 s	3 s
DURATION OF RAMP-DOWN	0.75 s	0.5 s	0.75 s	0.5 s

15. AVAILABLE THERAPY PROGRAMS

15.2.3 PROGRAMMES FOR HAEMOPHILIACS

CATEGORY	PROGRAMMES FOR HAEMOPHILIACS
PROGRAM	ATROPHY / REINFORCEMENT
WHEN?	To prevent disuse atrophy or restore muscular qualities in haemophilia patients suffering from arthropathy.
WHY?	Repeated episodes of haemarthrosis (intra-articular bleeding) may lead to actual cases of arthropathy which cripple haemophiliacs especially as they are usually accompanied by a loss of joint stability. Specific programmes for haemophiliacs aim to improve the active joint stability by restoring the qualities specific to each type of muscle fibre.
HOW?	The characteristic of the programmes for haemophiliacs is to induce muscular contractions very gradually to avoid any risk of causing microlesions in the muscle fibres and/or supporting connective tissue and secondary bleeds.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Very gradually increase the level of energy during the course of a treatment session.
OPTION 2+2	No.

HAEMOPHILIA, DISUSE ATROPHY, LEVEL 1 (25 MIN)		
	CONTRACTION	REST
FREQUENCY	40 Hz	0 Hz
DURATION OF RAMP-UP	6 s	0 s
DURATION OF PHASE	3 s	10 s
DURATION OF RAMP-DOWN	1.5 s	0 s

15. AVAILABLE THERAPY PROGRAMS

HAEMOPHILIA, DISUSE ATROPHY, LEVEL 2 (32 MIN)		
	CONTRACTION	REST
FREQUENCY	45 Hz	0 Hz
DURATION OF RAMP-UP	6 s	0 s
DURATION OF PHASE	5 s	9 s
DURATION OF RAMP-DOWN	1.5 s	0 s

HAEMOPHILIA, REINFORCEMENT, LEVEL 1 (15 MIN)		
	CONTRACTION	REST
FREQUENCY	70 Hz	0 Hz
DURATION OF RAMP-UP	6 s	0 s
DURATION OF PHASE	3 s	10 s
DURATION OF RAMP-DOWN	1.5 s	0 s

HAEMOPHILIA, REINFORCEMENT, LEVEL 2 (20 MIN)		
	CONTRACTION	REST
FREQUENCY	80 Hz	0 Hz
DURATION OF RAMP-UP	6 s	0 s
DURATION OF PHASE	3 s	15 s
DURATION OF RAMP-DOWN	1.5 s	0 s

15. AVAILABLE THERAPY PROGRAMS

15.2.4 NEUROLOGICAL

CATEGORY	NEUROLOGICAL
PROGRAM	HEMIPLEGIC FOOT
WHEN?	One of the problems faced by hemiplegics is the greater or lesser degree of difficulty in raising the toe of the foot. Consequently, this produces steppage during the swing phase of the gait. This programme is not recommended if: a) the stimulation of the levator muscles in the foot causes a spasm in the muscles of the lower limb to reflex. b) the spasticity of the triceps surae is high. In such cases use a preparation programme which inhibits the tone.
WHY?	To prevent foot drop during the swing phase of the gait.
HOW?	By manually triggering an electrically induced tetanic contraction in the levator muscles of the foot that is synchronised with the gait phase where the foot is lifted off the ground.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	In this case, use an intensity that is sufficient to provide a degree of contraction that can cause dorsiflexion of the ankle during the swing phase of the gait.
OPTION 2+2	No.

HEMIPLEGIC FOOT (13 MIN, TRIGGERED)	
	CONTRACTION
FREQUENCY	50 Hz
DURATION OF RAMP-UP	0.5 s
DURATION OF PHASE	1.5 s
DURATION OF RAMP-DOWN	0.25 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	NEUROLOGICAL
PROGRAM	SPASTICITY
WHEN?	Spastic hypertonia develops in the different types of lesions of the central nervous system pathways. Since it is no longer under the control of the higher nervous centres, the myotatic reflex becomes hyperactive and hypertension develops predominantly in the anti-gravity muscles. Over time, spasticity may lead to muscle contractures and a decreased range of movement.
WHY?	To reduce spasticity by inhibiting the motor neurons of the spastic muscle through reciprocal inhibition reflex.
HOW?	Stimulating the antagonistic muscle to the spastic muscle by reciprocal inhibitory reflex. This programme has a very gradual rate of tensioning and does not use low frequencies in order to avoid triggering the myotatic reflex (monosynaptic stretch reflex) of the spastic muscle.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	Use the necessary energy to produce a contraction that is capable of causing movement across the whole of its range. Care must always be taken to ensure that the stimulation does not spread as far as the spastic muscle.
OPTION 2+2	No.

SPASTICITY (21 MIN, TRIGGERED)		
	CONTRACTION	REST
FREQUENCY	35 Hz	0 Hz
DURATION OF RAMP-UP	4.5 s	0 s
DURATION OF PHASE	5 s	5 s
DURATION OF RAMP-DOWN	3 s	0 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	NEUROLOGICAL
PROGRAM	HEMIPLEGIC SHOULDER
WHEN?	The shortage of suspensory muscles in the humeral head combined with spasticity of the pectoralis major can often be a cause of a lower subluxation of the shoulder in hemiplegic patients. This is always painful and often develops into a complex regional pain syndrome.
WHY?	To reduce shoulder pain and to treat or prevent subluxations of the shoulder.
HOW?	Stimulating the deltoid and the supraspinatus facilitates a reduction of spasticity in the pectoralis major by reciprocal inhibition reflex. This programme has a very gradual rate of tensioning and does not use low frequencies in order to avoid myotatic reflex stretching (monosynaptic stretch reflex) of the spastic muscle.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned according to the specific indication.
INTENSITY	Use the necessary energy to effect strong contractions of the deltoid and the supraspinatus to elevate the shoulder stump whilst ensuring that this electrically induced activation does not spread to the adductor and depressor muscles of the shoulder.
OPTION 2+2	No.

SHOULDER SUBLUXATION (25 MIN)		
	CONTRACTION	REST
FREQUENCY	40 Hz	0 Hz
DURATION OF RAMP-UP	3 s	0 s
DURATION OF PHASE	8 s	8 s
DURATION OF RAMP-DOWN	1.5 s	0 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	NEUROLOGICAL
PROGRAM	SLOW START NEURO REHABILITATION
WHEN?	Electrostimulation is an excellent complement to traditional kinesiotherapy for many central neurological diseases such as hemiplegia. Treatment must be used in conjunction with passive mobilisation but should also preferably be combined with active movement as soon as the patient's recovery permits.
WHY?	To help facilitate motor control and motor relearning.
HOW?	The programme has a very gradual rate of tensioning followed by a long period of rest. Mobilisation must be synchronised with the contraction induced by the stimulation.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the abdominal and lumbar muscles. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used. Progressively increase the level of energy during the course of a treatment session.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

NEURO REHAB (SLOW START), LEVEL 1 (20 MIN)				
	WARM UP	CONTRACTION	REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	35 Hz	-	3 Hz
DURATION OF RAMP-UP	1.5 s	4 s	-	1.5 s
DURATION OF PHASE	2 min	5 s	15 s	3 min
DURATION OF RAMP-DOWN	2 s	2 s	-	3 s

NEURO REHAB (SLOW START), LEVEL 2 (20 MIN)				
	WARM UP	CONTRACTION	REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	45 Hz	-	3 Hz
DURATION OF RAMP-UP	1.5 s	4 s	-	1.5 s
DURATION OF PHASE	2 min	5 s	15 s	3 min
DURATION OF RAMP-DOWN	2 s	2 s	-	3 s

15. AVAILABLE THERAPY PROGRAMS

15.2.5 PAIN RELIEF II

CATEGORY	PAIN RELIEF II
PROGRAM	TENS 80Hz
WHEN?	Gate control, which is activated during TENS stimulation, is particularly effective for the relief of localised pain of non-muscular origin. It is particularly effective for relieving neuropathic pain and inflammatory conditions. The sessions may be repeated at will and without restriction, depending upon the intensity of the pain.
WHY?	Without side effects, TENS Gate control effectively relieves pain and improves the patient's level of comfort. The sedation period that results from the stimulation allows the vicious, self-perpetuating cycle of pain to be broken.
HOW?	The principle involves causing high levels of sensitivity impulses in order to limit the input of pain impulses when they return to the posterior horn of the spinal cord. Apart from the 80 Hz frequency, this programme specifically tries to stimulate other sensory fibres (pressure, vibration) in addition to stimulation of the Aβ fibres (tactile sensitivity).
PULSE WIDTH	The pulse width for the programme is 180 µs.
ELECTRODES	The electrodes are usually placed in such a way as to cover or surround the painful area.
INTENSITY	The intensity must be increased gradually until the patient feels a tingling sensation that is pronounced without being painful.
OPTION 2+2	Yes.

TENS			
FREQUENCY	PULSE WIDTH	MODULATION TIME	TREATMENT TIME
80 Hz	180 µs	-	30 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	KNEE PAIN
WHEN?	To relieve knee-joint pain, irrespective of its cause (gonarthrosis, rheumatoid polyarthritis, chondromalacia, etc.)
WHY?	For the relief of pain.
HOW?	Using the Gate control principle. This involves causing high levels of sensitivity impulses in order to limit the input of pain impulses when they return to the posterior horn of the spinal cord.
PULSE WIDTH	The pulse width varies continuously with this programme. This avoids habituation by using a system of stimulation that is perceived as more pleasant by some patients.
ELECTRODES	Depending upon the pain, four large electrodes placed around the patella produce a significant analgesic effect on all knee pain.
INTENSITY	The intensity must be increased gradually until the patient feels a tingling sensation that is pronounced without being painful.
OPTION 2+2	Yes

KNEE PAIN			
FREQUENCY	PULSE WIDTH	MODULATION TIME	TREATMENT TIME
80 Hz	75-180 µs	2 s	30 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	TRAPEZIUS MUSCLE PAIN
WHEN?	As with all muscular pains, pain in the trapezius muscles can best be relieved by endorphin stimulation. However, TENS stimulation may be preferable for the first sessions if there is acute pain in an area of inflammation.
WHY?	For the relief of pain.
HOW?	Using the Gate control principle. This involves causing high levels of sensitivity impulses in order to limit the input of pain impulses when they return to the posterior horn of the spinal cord.
PULSE WIDTH	The pulse width varies continuously with this programme. This avoids habituation by using a system of stimulation that is perceived as more pleasant by some patients.
ELECTRODES	The electrodes must be placed on the painful area, preferably on the points of sensitivity.
INTENSITY	The intensity must be increased gradually until the patient feels a tingling sensation that is pronounced without being painful.
OPTION 2+2	Yes.

TRAPEZIUS PAIN			
FREQUENCY	PULSE WIDTH	MODULATION TIME	TREATMENT TIME
60 Hz	80-200 µs	3 s	30 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	SHOULDER PAIN
WHEN?	To relieve shoulder pain following a mechanical conflict, an inflammatory disorder, shoulder surgery, or inflammatory tendinopathy.
WHY?	For the relief of pain.
HOW?	Using the Gate control principle. This involves causing high levels of sensitivity impulses in order to limit the input of pain impulses when they return to the posterior horn of the spinal cord.
PULSE WIDTH	The pulse width varies continuously with this programme. This avoids habituation by using a system of stimulation that is perceived as more pleasant by some patients.
ELECTRODES	The electrodes must be positioned where the pain is located. Four large electrodes surrounding the joint produce a significant analgesic effect on all shoulder pain.
INTENSITY	The intensity must be increased gradually until the patient feels a tingling sensation that is pronounced without being painful.
OPTION 2+2	Yes.

SHOULDER PAIN			
FREQUENCY	PULSE WIDTH	MODULATION TIME	TREATMENT TIME
80 Hz	75-180 µs	3 s	30 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	FRACTURE PAIN
WHEN?	In addition to other analgesic treatments during the first few days after a simple immobilisation or osteosynthetic surgery on a fracture. Extended use for rib fractures where strict immobilisation is not possible, resulting in severe pain over several weeks.
WHY?	For the relief of pain.
HOW?	Using the Gate control principle. This involves causing high levels of sensitivity impulses in order to limit the input of pain impulses when they return to the posterior horn of the spinal cord.
PULSE WIDTH	The pulse width for the programme is 170 µs.
ELECTRODES	Depending on the means of restraint and/or the size of the dressing used, access to the painful area may be awkward. It is important to surround the painful area as much as possible. Another possible strategy is to directly stimulate the large nerve trunks superior to the point of pain.
INTENSITY	The intensity must be increased gradually until the patient feels a tingling sensation that is pronounced without being painful. If the nerve trunks are stimulated, the stimulation should cause the tingling to radiate into the painful area.
OPTION 2+2	Yes.

FRACTURE PAIN			
FREQUENCY	PULSE WIDTH	MODULATION TIME	TREATMENT TIME
70 Hz	170 µs	2 s	30 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	CERVICAL PAIN
WHEN?	Neck pain most often results from chronic contractures of the levator scapulae muscle and/or the upper trapezius and is due, for example, to non-ergonomic work posture.
WHY?	For pain relief and relaxation of muscle contractures.
HOW?	Endorphin stimulation aids pain relief by increasing production of endogenous opioids. The associated vascular effect results in effective drainage of acidic metabolites and enables the elimination of muscular acidosis.
PULSE WIDTH	Endorphin stimulation first targets the sensitive Aδ nerve fibres, which are best stimulated with a larger pulse of 200µs. However the vascular effect is secondary to the co-activation of the motor units, which have a slightly higher chronaxy that is measured at the start of the session using the mi-SCAN function.
ELECTRODES	Electrodes positioned according to the specific indication.
INTENSITY	An essential factor in the effectiveness of electrotherapy is the ability to cause visible muscle twitches. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

CERVICAL PAIN LO		
FREQUENCY	PULSE WIDTH	TREATMENT TIME
5 Hz	250 µs	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	THORACIC BACK PAIN
WHEN?	Thoracic back pain is most commonly a result of chronic contractures of the paravertebral back muscles (erector spinae) and is, for example, due to spinal osteoarthritis or postures where the spinal muscles remain tense for long periods of time.
WHY?	For pain relief and relaxation of muscle contractures.
HOW?	Endorphin stimulation aids pain relief by increasing production of endogenous opioids. The associated vascular effect results in effective drainage of acidic metabolites and enables the elimination of muscular acidosis.
PULSE WIDTH	Endorphin stimulation first targets the sensitive Aδ nerve fibres, which are best stimulated with a larger pulse of 200µs. However the vascular effect is secondary to the co-activation of the motor units, which have a slightly higher chronaxy that is measured at the start of the session using the mi-SCAN function.
ELECTRODES	Electrodes positioned according to the specific indication.
INTENSITY	An essential factor in the effectiveness of electrotherapy is the ability to cause visible muscle twitches. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

THORACIC BACK PAIN		
FREQUENCY	PULSE WIDTH	TREATMENT TIME
5 Hz	250 µs	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	LOW BACK PAIN
WHEN?	Low back pain most frequently results from chronic contractures of the paravertebral lumber muscles. It may be caused by a mechanical conflict, vertebral osteoarthritis, disc space narrowing, etc.
WHY?	For pain relief and relaxation of muscle contractures.
HOW?	Endorphin stimulation aids pain relief by increasing production of endogenous opioids. The associated vascular effect results in effective drainage of acidic metabolites and enables the elimination of muscular acidosis. TENS Gate control, applied using the third channel, improves comfort during endorphin stimulation.
PULSE WIDTH	Endorphinic stimulation is primarily aimed at the sensitive Aδ nerve fibres which are best stimulated with pulse width of 200µs. However the vascular effect is secondary to the co- activation of the motor units which have a slightly higher chronaxy and which is measured at the start of the session using the mi-SCAN function . Channels 3 and 4 provide Gate control stimulation and use a larger pulse adapted to the chronaxy of the Aβ fibres.
ELECTRODES	Electrodes positioned according to the specific indication. Combining 2 stimulation currents.
INTENSITY	The intensity must first be set on channels 3 and 4, which deliver the TENS programme according to the usual TENS rules (tingling). It will be gradually increased on channels 1 or 2 until visible or palpable muscle twitches are produced. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes, forced. - a minimum of 2 channels with muscular work imposed by the Low back pain programme. - 2 channels with the TENS programme. • Electrodes positioned on the painful area. • Sufficient stimulation energy to produce a clear tingling sensation. Take care to properly observe the correct order of the channels.

LOWER BACK PAIN		
FREQUENCY	PULSE WIDTH	TREATMENT TIME
5 Hz	250 µs	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	LUMBOSCIATICA
WHEN?	Patients with lumbosciatica have lumbar pain which is most commonly caused by chronic contractures of the paravertebral lumbar muscles. In addition, involvement of the spinal nerve root leads to irradiation of pain over a shorter or longer distance along the sciatic nerve and in some cases, along one or the other of its branches (common peroneal or tibial).
WHY?	For pain relief and relaxation of muscle contractures in the lumbar area and to relieve neurogenic sciatic pain.
HOW?	The release of endorphins and the elimination of acidic toxins allow lumbar pain to be treated effectively. The TENS Gate control effect works more specifically on sciatic nerve neuralgia.
PULSE WIDTH	Endorphinic stimulation is primarily aimed at the sensitive Aδ nerve fibres which are best stimulated with pulse width of 200µs. However the vascular effect is secondary to the co- activation of the motor units, which have a slightly higher chronaxy that is measured at the start of the session using the mi-SCAN function . Channels 2, 3 and 4 provide Gate control stimulation and use a larger pulse adapted to the chronaxy of the Aβ fibres.
ELECTRODES	Electrodes positioned according to the specific indication. Combining 2 stimulation currents.
INTENSITY	The intensity must first be set on channels 2, 3 and 4, which deliver the TENS programme according to the usual TENS rules (tingling). It will be gradually increased on channel 1 until visible or palpable muscle twitches are produced. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes, forced. - a minimum of 2 channels with muscular work imposed by the Low back pain programme. - 2 channels with the TENS programme. • Electrodes positioned on the painful area. • Sufficient stimulation energy to produce a clear tingling sensation. Take care to properly observe the correct order of the channels.

LUMBOSCIATICA		
FREQUENCY	PULSE WIDTH	TREATMENT TIME
5 Hz	250 µs	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	LUMBAGO
WHEN?	This type of treatment is indicated to relieve pain following acute muscle contractures in the low back region. It will also reduce tension in the contracted muscles to facilitate manual handling techniques.
WHY?	To reduce muscular tension and to provide a relaxing effect.
HOW?	Highly individualised muscular twitching that is induced by a very low frequency (1 Hz) has a relaxing effect.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles in the lumbar region. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	A small electrode, preferably connected to the positive pole is placed on the most painful area of the paravertebral muscles which can be detected by palpation. The other electrode is placed on the same muscles 2 or 3 finger widths away from the first one.
INTENSITY	An essential factor in the therapeutic efficacy is to cause visible muscle twitching, which may, in certain cases, require higher stimulation energies to be used. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

LUMBAGO		
FREQUENCY	PULSE WIDTH	TREATMENT TIME
1 Hz	250 µs	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	EPICONDYLITIS
WHEN?	Epicondylitis is manifested by acute pain located at the point of insertion of the extensor muscles for the wrist and fingers onto the lateral epicondyle. The Epicondylitis programme is used during the acute and inflammatory phase of the complaint. It can also be used for localised pain at the medial epicondyle which results from functional overwork of the flexor muscles (epicondylitis or medial epicondylitis)
WHY?	To relieve pain during the acute and inflammatory phase of the complaint.
HOW?	Using the Gate control principle. This involves causing high levels of tactile sensitivity impulses in order to limit the input of pain impulses when they return to the posterior horn of the spinal cord. For this programme, the frequency is modulated (50-150 Hz) to avoid habituation.
PULSE WIDTH	This programme uses very short duration impulses (50 µs) suitable for the higher level of excitability of the sensitive Aβ fibres.
ELECTRODES	Due to the small extent of the painful area, 2 small electrodes are usually sufficient to cover the whole of the desired area.
INTENSITY	The intensity must be increased gradually until the patient feels a tingling sensation that is pronounced without being painful. The mi-TENS function prevents any kind of muscle contraction. If the sensor detects a muscle response, the stimulator automatically reduces the stimulation energy in order to stop the muscle response.
OPTION 2+2	Yes.

EPICONDYLITIS			
FREQUENCY	PULSE WIDTH	MODULATION TIME	TREATMENT TIME
50-150 Hz	50 µs	2 s	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	TORTICOLLIS
WHEN?	This type of treatment is indicated to relieve pain following acute muscle contractures in the neck region. It will also reduce tension in the contracted muscles to facilitate manual handling techniques.
WHY?	To reduce muscular tension and to provide a relaxing effect.
HOW?	Highly individualised muscular twitching that is induced by a very low frequency (1 Hz) has a relaxing effect.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles in the lumbar region. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	A small electrode, preferably connected to the positive pole is placed on the most painful area which can be detected by palpation. A second electrode is placed on the paravertebral neck muscles.
INTENSITY	An essential factor in the therapeutic efficacy is to cause visible muscle twitching, which may, in certain cases, require higher stimulation energies to be used. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

TORTICOLLIS		
FREQUENCY	PULSE WIDTH	TREATMENT TIME
1 Hz	250 µs	20 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	PAIN RELIEF II
PROGRAM	ARTHRALGIA
WHEN?	Various factors such as obesity, age, trauma, poor posture, etc. are detrimental to the joints. These detrimental factors may cause the joints to deteriorate and to become inflamed and painful.
WHY?	To relieve acute and chronic joint pain.
HOW?	The principle is to cause a significant influx of tactile sensitivity in order to restrict the entry of pain impulses upon their return to the posterior horn of the spinal cord. For this programme, the frequency is modulated (50-150 Hz) to avoid habituation.
PULSE WIDTH	This programme uses very short duration impulses (50 µs) suitable for the higher level of excitability of the sensitive Aβ fibres.
ELECTRODES	The electrodes are usually placed in such a way as to cover or surround the painful area.
INTENSITY	The intensity must be increased gradually until the patient feels a tingling sensation that is pronounced without being painful. The mi-TENS function prevents any kind of muscle contraction. If the sensor detects a muscle response, the stimulator automatically reduces the stimulation energy in order to stop the muscle response.
OPTION 2+2	Yes.

ARTHRALGIA			
FREQUENCY	PULSE WIDTH	MODULATION TIME	TREATMENT TIME
50-150 Hz	50 µs	2 s	20 min

15. AVAILABLE THERAPY PROGRAMS

15.2.6 CONDITIONING II

CATEGORY	CONDITIONING II
PROGRAM	POTENTIATION
WHEN?	For optimal muscle preparation immediately before a competition. The session should be carried out 10 minutes prior to the start.
WHY?	To increase the speed of contraction and increase power. Reduces nervous control to attain or maintain a specified level of exertion.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

POTENTIATION (3 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	1 Hz	7 peaks*	1 Hz	1 Hz
DURATION OF RAMP-UP	1.5 s	0 s	0 s	1.5 s
DURATION OF PHASE	30 s	7 s	10 s	20 s
DURATION OF RAMP-DOWN	2 s	0 s	0 s	3 s

* Contraction peak Hz: 1) 2-10 2) 2-15 3) 2-20 4) 2-25 5) 2-35 6) 2-45 7) 2-55 8) 2-65 9) 2-75

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	ENDURANCE
WHEN?	For athletes who wish to improve their performance during long sporting trials/ disciplines.
WHY?	To improve the oxidative capacity of the stimulated muscles and to aid in developing the athlete's aerobic performance.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

ENDURANCE, LEVEL 1 (55 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	10 Hz	3 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	0.5 s	0 s	1.5 s
DURATION OF PHASE	5 min	8 s	2 s	10 min
DURATION OF RAMP-DOWN	2 s	0.5 s	0 s	3 s

ENDURANCE, LEVEL 2 (55 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	12 Hz	3 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	0.5 s	0 s	1.5 s
DURATION OF PHASE	5 min	8 s	2 s	10 min
DURATION OF RAMP-DOWN	2 s	0.5 s	0 s	3 s

ENDURANCE, LEVEL 3 (55 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	14 Hz	3 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	0.5 s	0 s	1.5 s
DURATION OF PHASE	5 min	8 s	2 s	10 min
DURATION OF RAMP-DOWN	2 s	0.5 s	0 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	EXPLOSIVE STRENGTH
WHEN?	For athletes who practise a discipline where explosive strength is a significant performance factor. To increase the maximum capacity for instantaneous power.
WHY?	To increase the speed at which the maximum power is attained and to improve the effectiveness of explosive actions such as jumping, sprinting etc.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

EXPLOSIVE STRENGTH, LEVEL 1 (32 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	104 Hz	1 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	0.75 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	3 s	28 s	10 min
DURATION OF RAMP-DOWN	2 s	0.5 s	0.5 s	3 s

EXPLOSIVE STRENGTH, LEVEL 2 (32 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	108 Hz	1 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	0.75 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	3 s	29 s	10 min
DURATION OF RAMP-DOWN	2 s	0.5 s	0.5 s	3 s

EXPLOSIVE STRENGTH, LEVEL 3 (34 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	111 Hz	1 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	0.75 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	3 s	32 s	10 min
DURATION OF RAMP-DOWN	2 s	0.5 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	PLYOMETRY
WHEN?	To develop muscular explosive power by imposing a stress similar to that induced by voluntary plyometry exercises while reducing stress on joints and tendons.
WHY?	Increase the speed of contraction and the capacity to perform actions at maximum strength (jump, bound, shoot, etc.).
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	HYPERTROPHY
WHEN?	For body-building enthusiasts and athletes wishing to increase their muscle mass. Possibility of combining this programme with voluntary training.
WHY?	Increase the volume of stimulated muscles and improve muscular resistance.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

HYPERTROPHY, LEVEL 1 (31 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	45 Hz	8 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0 s	1.5 s
DURATION OF PHASE	5 min	4 s	8 s	10 min
DURATION OF RAMP-DOWN	2 s	1 s	0 s	3 s

HYPERTROPHY, LEVEL 2 (32 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	50 Hz	9 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0 s	1.5 s
DURATION OF PHASE	5 min	5 s	7 s	10 min
DURATION OF RAMP-DOWN	2 s	1 s	0 s	3 s

HYPERTROPHY, LEVEL 3 (33 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	55 Hz	10 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0 s	1.5 s
DURATION OF PHASE	5 min	6 s	6 s	10 min
DURATION OF RAMP-DOWN	2 s	1 s	0 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	MUSCLE BUILDING
WHEN?	For those who wish to improve overall muscle quality in balance with a discrete effect on increasing muscular volume.
WHY?	To improve muscular trophicity, and increase the tone and volume of the muscles in a balanced way.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

MUSCLE BUILDING, LEVEL 1 (23 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	40 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	5 s	10 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

MUSCLE BUILDING, LEVEL 2 (25 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	45 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	6 s	9 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

MUSCLE BUILDING, LEVEL 3 (26 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	6 Hz	50 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	2 min	7 s	8 s	3 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	LOW BACK REINFORCEMENT
WHEN?	The low back muscles play an important role in protecting the lumbar region. Some sporting activities, such as rowing, require specific work from the low back muscles.
WHY?	Improve the active stability and contraction qualities of the lumbar region. This programme enables these muscles to be worked in an intense and isolated manner in order to maintain and improve the strength of the low back muscles.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Place the electrodes on the paravertebral muscles of the low back area.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

LOWER BACK REINFORCEMENT, LEVEL 1 (33 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	40 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	5 s	10 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

LOWER BACK REINFORCEMENT, LEVEL 2 (35 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	45 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	6 s	9 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

LOWER BACK REINFORCEMENT, LEVEL 3 (36 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	50 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	7 s	8 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	CORE STABILISATION
WHEN?	The abdominal muscles and the muscles in the low back area are very important for all sporting activities. Good neuromuscular control and stabilisation of the trunk are essential for the optimal positioning of the lumbar spine and to ensure the effective transmission of strength in any complex movement.
WHY?	Increase postural control of the trunk muscles. May be combined with or supplement active dynamic exercises.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Place the electrodes on the paravertebral muscles of the low back region and on the abdominal muscles.
INTENSITY	The maximum tolerable stimulation energy, which is one of the key factors determining the effectiveness of the treatment. The higher the stimulation energy, the higher the number of muscle fibres (motor units) being used.
OPTION 2+2	Yes.

15. AVAILABLE THERAPY PROGRAMS

CORE STABILISATION, LEVEL 1 (33 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	40 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	5 s	10 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

CORE STABILISATION, LEVEL 2 (35 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	45 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	6 s	9 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

CORE STABILISATION, LEVEL 3 (36 MIN)				
	WARM UP	CONTRACTION	ACTIVE REST	FINAL RECOVERY PHASE
FREQUENCY	5 Hz	50 Hz	4 Hz	3 Hz
DURATION OF RAMP-UP	1.5 s	1.5 s	0.5 s	1.5 s
DURATION OF PHASE	5 min	7 s	8 s	10 min
DURATION OF RAMP-DOWN	2 s	0.75 s	0.5 s	3 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	RECOVERY PLUS
WHEN?	To promote muscle recuperation following an exhausting exertion that caused cramps or is likely to induce them when the activity is stopped.
WHY?	To increase blood flow to drain away toxins that have accumulated in the muscles. To relieve and/ or prevent aching pains. To promote muscle relaxation. To accelerate restoration of the muscular qualities following a workout or competition.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Precision in positioning the electrodes is less significant than for programmes aiming to develop muscle quality. The electrodes can be placed in an alternative way, reducing the number of electrodes needed and stimulating more muscles during a session.
INTENSITY	An essential factor in the effectiveness of electrotherapy is the ability to cause visible muscle twitches. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

RECOVERY PLUS (25 MIN)				
	1ST SEQUENCE	2ND SEQUENCE	3RD SEQUENCE	4TH SEQUENCE
FREQUENCY	2 Hz	4 Hz	6 Hz	5 Hz
TIME	2 min	2 min	4 min	4 min
	5TH SEQUENCE	6TH SEQUENCE	7TH SEQUENCE	8TH SEQUENCE
FREQUENCY	4 Hz	3 Hz	2 Hz	1 Hz
TIME	4 min	3 min	3 min	3 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	TONING MASSAGE
WHEN?	Specific massage programme that includes some short muscle contractions. This programme can supplement traditional heating or even replace it if traditional heating is difficult to use.
WHY?	Activates circulation and revives of the contractile properties of the muscles.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Electrodes positioned depending on the muscle to be stimulated, in accordance with the instructions.
INTENSITY	Gradually increase the stimulation energy until there is clear visible muscle twitching. During the tetanic contraction phases, ensure that the energy stimulation is sufficient to impose significant muscle contractions.
OPTION 2+2	Yes.

TONING MASSAGE (29 MIN)				
	1ST SEQUENCE	2ND SEQUENCE	3RD SEQUENCE	4TH SEQUENCE
VIBRATIONS WITH FREQ. MODULATION 1-8 HZ	➔	-	➔	-
CONTRACTION / RELAXTION	-	10 reps ➔	-	8 reps ➔
	5TH SEQUENCE	6TH SEQUENCE	7TH SEQUENCE	8TH SEQUENCE
VIBRATIONS WITH FREQ. MODULATION 1-8 HZ	-	➔	-	➔
CONTRACTION / RELAXTION	7 reps ➔	-	6 reps ➔	-

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	RELAXING MASSAGE
WHEN?	To eliminate uncomfortable or painful sensations resulting from an exaggerated increase in muscle tone.
WHY?	To allow a decrease in muscle tension. To drain away the toxins responsible for the increase in muscle tone. The programme produces a sense of well being and relaxation.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Precision in positioning the electrodes is less significant than for programmes aiming to develop muscle quality. The electrodes can be placed in an alternative way, reducing the number of electrodes needed and stimulating more muscles during a session.
INTENSITY	An essential factor in the effectiveness of electrotherapy is the ability to cause visible muscle twitches. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

RELAXING MASSAGE (21 MIN)			
	1ST SEQUENCE	2ND SEQUENCE	3RD SEQUENCE
FREQUENCY	7 Hz	5 Hz	3 Hz
TIME	7 min	7 min	7 min

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	CONDITIONING II
PROGRAM	ANTI-STRESS MASSAGE
WHEN?	This programme can be used for relaxation and well-being after physical activity or a stressful situation. It provides very effective muscle relaxation through comfortable stimulation of the muscles, which aids circulation and helps the muscles relax.
WHY?	Increases vascularisation of the tissues, reduces muscle tension.
PULSE WIDTH	To make it as comfortable as possible for the patient, use pulse widths equivalent to the chronaxies of the motor nerves of the muscles being stimulated. The mi-SCAN function can be used to determine the pulse widths suitable for the patient's muscles.
ELECTRODES	Precision in positioning the electrodes is less significant than for programmes aiming to develop muscle quality. The electrodes can be placed in an alternative way, reducing the number of electrodes needed and stimulating more muscles during a session.
INTENSITY	An essential factor in the effectiveness of electrotherapy is the ability to cause visible muscle twitches. The mi-RANGE function can be used to determine the minimum level of energy required to produce an appropriate muscle response.
OPTION 2+2	Yes.

ANTI-STRESS MASSAGE (21 MIN)				
	1ST SEQUENCE	2ND SEQUENCE	3RD SEQUENCE	4TH SEQUENCE
FREQUENCY	3 Hz	2 Hz	1 Hz	Freq. mod. 1-6 Hz
TIME	2 min	1 min	30 s	40 s
	5TH SEQUENCE	6TH SEQUENCE	7TH SEQUENCE	8TH SEQUENCE
FREQUENCY	Freq. mod. 1-3 Hz	1 Hz	Freq. mod. 1-6 Hz	1 Hz
TIME	30 s	30 s	90 s	30 s
	9TH SEQUENCE	10TH SEQUENCE	11TH SEQUENCE	12TH SEQUENCE
FREQUENCY	Freq. mod. 1-3 Hz	1 Hz	1 Hz	1 Hz intensity decrease
TIME	90 s	30 s	30 s	-

These 3 sequences loop 5 times

These 4 sequences loop 2 times

15. AVAILABLE THERAPY PROGRAMS

15.3 Optimum Version Programs and their usage – Physio device only

15.3.1Incontinence

CATEGORY	INCONTINENCE
PROGRAM	STRESS INCONTINENCE
WHEN?	The sphincter urethra is deficient and cannot remain closed in the event of a sudden and significant increase in abdominal pressure (exertion, coughing, etc)
WHY?	The aim of this programme is to strengthen the sphincter muscle of the bladder. The objective is therefore to produce tetanic contractions of the paraurethral components of the striated muscle of the pelvic floor, using the optimum tetanization frequencies of the fast fibres.
ELECTRODES	Use of an intravaginal probe.
INTENSITY	Use of the maximum energy tolerated by the patient in order to obtain the greatest possible spatial recruitment. The current intensity is increased regularly every 3 or 4 contractions throughout the session. The therapist plays a decisive role in reassuring the patient and obliging her to work with the most powerful possible contractions.
OPTION 2+2	No.

STRESS INCONTINENCE (20 MIN)		
	CONTRACTION	ACTIVE REST
FREQUENCY	75 Hz	0 Hz
DURATION OF RAMP-UP	1.5 s	0 s
DURATION OF PHASE	4 s	12 s
DURATION OF RAMP-DOWN	1.5 s	0 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	INCONTINENCE
PROGRAM	URGE INCONTINENCE
WHEN?	The bladder contracts abnormally (detrusor overactivity) and presses on the urine, increasing the pressure within the bladder.
WHY?	This treatment relies on the reduction of detrusor activity by stimulation of an inhibitory reflex from sensory nerve endings in the perineal region. The electrical parameters must therefore be created so as to excite these myelinated afferent nerve fibres at the frequency that produces optimum activation of the inhibitory reflex.
ELECTRODES	Use of an intravaginal probe.
INTENSITY	Gradually increase the energies until the patient feels the stimulation. Then increase the energies again to a value equal to three times that of the perception threshold.
OPTION 2+2	No.

URGE INCONTINENCE (30 MIN)	
FREQUENCY	PULSE WIDTH
5 Hz continuous stimulation	150 µs

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	INCONTINENCE
PROGRAM	MIXED INCONTINENCE
WHEN?	Combination of urge and stress incontinence in greater or lesser proportions.
WHY?	This programme treats both aspects of this form of incontinence at the same time. Firstly, using tetanic contractions at the frequency of fast fibres (75 Hz), it strengthens the paraurethral components of the striated muscle of the pelvic floor, so increasing the pressure of urethral closure. Secondly, during the resting phases between contractions, it inhibits the activity of the smooth muscle of the bladder using very low frequencies (5 Hz).
ELECTRODES	Use of an intravaginal probe.
INTENSITY	Use of the maximum energy level tolerated during the tetanic contraction phases to obtain the maximum possible space recruitment and therefore maximum possible efficacy. The intensity will be increased regularly during the session, every 3 or 4 contractions. During the rest phase, the low-frequency intensity should be adjusted to at least three times the intensity of the perception threshold.
OPTION 2+2	No.

MIXED INCONTINENCE (30 MIN)		
	CONTRACTION	ACTIVE REST
FREQUENCY	75 Hz	5 Hz
DURATION OF RAMP-UP	1.5 s	0.5 s
DURATION OF PHASE	4 s	23 s
DURATION OF RAMP-DOWN	0.75 s	0.5 s

15. AVAILABLE THERAPY PROGRAMS

CATEGORY	INCONTINENCE
PROGRAM	POST PARTUM PREVENTION
WHEN?	Labour causes considerable trauma to the pelvic region. The consequences of this trauma are various: strained muscle, torn muscle, partial denervation, loss of body image, loss of strength and control of the striated muscles of the pelvic floor, etc.
WHY?	Incontinence is a relatively common result of this situation, which is why prophylactic pelvic re-training treatment by neuromuscular electrostimulation is indicated.
ELECTRODES	Use of an intravaginal probe.
INTENSITY	Use of the maximum electrical intensity tolerated by the patient in order to achieve the greatest possible space recruitment. The electrical intensity is increased regularly every 3 or 4 contractions throughout the session.
OPTION 2+2	No.

POST PARTUM PREVENTION (20 MIN)		
	CONTRACTION	ACTIVE REST
FREQUENCY	50 Hz	0 Hz
DURATION OF RAMP-UP	1.5 s	0 s
DURATION OF PHASE	5 s	10 s
DURATION OF RAMP-DOWN	0.75 s	0 s

15. AVAILABLE THERAPY PROGRAMS

15.3.2 Direct Current

15.3.2.1 Iontophoresis

A. Introduction

A source of electric current applied to any part of a patient's body sets up an electric field between the electrodes and through the tissues. In this electric field, the positive particles are attracted to the negative pole while the negative particles are attracted to the positive pole. This means that migration of charged particles (electrophoresis) is produced in the tissues crossed by an electric field. This migration is significant, provided the electric current is kept stable at an adequate intensity and for a sufficiently long time.

Direct current (also referred to as galvanic current) at a constant intensity over time enables charged particles to be mobilized through tissues. If the charged particles are medicines, the direct current acts as a vector allowing for the introduction and penetration of medicinal substances. This technique is internationally known as "iontophoresis". Direct current, applied via surface electrodes on part of the body, sets up an electric field through the tissues that is responsible for mobilizing ionized medicines.

B. Electrolysis

Passing a direct current through an aqueous solution containing dissolved mineral salts leads to a number of reactions and changes that are referred to as electrolysis. This phenomenon of electrolysis involves the chemical decomposition of certain substances in solution owing to the passing of an electric current. Studying electrolysis helps to explain the reactions that occur under electrodes placed on the skin, given that the skin is always in contact with an aqueous saline solution, namely the product of perspiration.

When the two terminals of a source of electric current are immersed in a vessel containing absolutely pure water, i.e. without any dissolved substances (distilled water), the current does not flow. Pure water does not allow the current to flow, acting as an insulator. If a substance such as sugar is added to the water, the current still does not flow. However, if salt (sodium chloride - NaCl) is added, the current does flow. Some substances, such as salt, can turn the medium into a conductor when dissolved in water. These substances (known as electrolytes) allow the current to flow because they dissociate into ions in the water. This dissociation is known as ionization. The dissolved ions are attracted to the opposite pole, resulting in ionic migration. Ionic migration explains why the electric current flows through the solution.

Positive ions attracted to the negative pole (the cathode) are called cations. Negative ions attracted to the positive pole (the anode) are called anions. Cations are involved in chemical changes when placed in contact with the cathode. The same occurs when anions come into contact with the anode.
NaCl dissolved in water is ionized into Na^+ and Cl^-. Na^+ is attracted by the cathode and Cl^- by the anode.

15. AVAILABLE THERAPY PROGRAMS

• At the cathode

Na+ captures an electron and becomes Na

$Na+ + 1\ electron \rightarrow Na$

and Na reacts with the water to give NaOH and a release of hydrogen

$Na + H2O\ NaHO + 1/2\ H2$

• At the anode

Cl- gives up an electron and becomes Cl

$Cl- = 1\ electron \rightarrow Cl$

and Cl reacts with the water to give HCl and a release of oxygen

$2Cl + H2O \rightarrow 2\ HCl + 1/2\ O2$

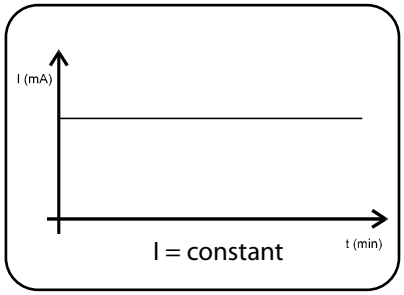
In total, the cathode has given up one electron and the anode has captured one electron, in other words, the electric current has circulated. An alkaline reaction (production of sodium hydroxide NaOH) is produced at the cathode with release of hydrogen. At the anode an acidic reaction (production of hydrochloric acid HCl) is produced with release of oxygen.

Therapists should concern themselves with the alkaline reaction at the cathode because an accumulation of sodium hydroxide on the negative electrode may cause a chemical burn to the skin in contact with the electrode.

Thus the burn that may be caused during iontophoresis treatment is primarily a chemical burn due to sodium hydroxide accumulating on the cathode. The quantity of accumulated sodium hydroxide depends on current density (intensity divided by the surface area of the electrode) and application time

C. Direct Current

Direct current (DC) or galvanic current has a constant intensity over time. The graph of this consists of a straight line parallel to the time axis (x-axis). It is the intensity of the current (I) that is constant over time, not necessarily the tension or voltage (U).



15. AVAILABLE THERAPY PROGRAMS

The current of choice for iontophoresis treatment is direct current because it ensures maximum ionic transfer. All studies evaluating penetration and chemical research demonstrating efficacy have been performed with direct current. Other forms of electric current have never demonstrated any efficacy for iontophoresis and their use in this application is insubstantial.

Direct current, applied via surface electrodes on part of the body, sets up an electric field through the tissues that is responsible for mobilizing ionized medicines. In addition to this, however, the galvanic current has several effects. It produces:

• slight heating of the tissues

• vasodilation in the skin which is evident as erythema under the two electrodes and disappears spontaneously 20 to 60 minutes after treatment

• a slight pricking sensation or irritation under the electrodes

• at the cathode:
- alkaline reaction (NaOH)
- increased excitability of the nerves
- reduced protein density (sclerolytic)

• at the anode:
- acidic reaction (HCl)
- reduced excitability of the nerves
- increased protein density (sclerotic)

D. Density of the current

With regard to the efficacy or the safety of the treatment, electric density must be discussed. The degree of ionic transfer depends on the intensity of the current, as well as on the size of the skin-electrode contact area, i.e. it depends on density. How well the skin tolerates the galvanic current, for the same intensity, depends on dispersion of the current over a surface area that can vary in size. Likewise, the accumulation of sodium hydroxide at the cathode and its concentration on the skin depends on the intensity, as well as on the size of the skin-electrode contact area.

Electric density D (mA/cm2)
=
Intensity (mA) / Surface area (cm2)

$$D = \frac{I}{S}$$

15. AVAILABLE THERAPY PROGRAMS

To monitor efficacy and safety properly, we need to work with strict checks on electric density. The equipment must, therefore, control the intensity of the current in relation to the size of the electrodes being used. Furthermore, this equipment must be a perfect generator of constant current. In this way, the intensity, and hence the density, will not change during treatment when skin resistance decreases as a result of heating and vasodilation of the skin.

E. Penetration

Penetration by the ionized medicinal substance depends on several factors:
1. Solubility of the medicinal substance
2. Concentration of the medicinal solution
3. Absence of ions competing with the medicine in the solution
4. pH of the solution
5. The solution being placed on the correct electrode
6. Absence of grease on the skin's surface
7. Quantity of sweat gland ducts in the skin
8. Density of the electric current
9. Duration of treatment

The size or molecular weight of the medicine: it is often said, mistakenly, that molecular weight is a factor that affects penetration. Although it is true at the cellular level for cell membrane penetration, it has nothing to do with penetration of the skin during iontophoresis treatment. The medicine penetrates the skin via the sweat gland ducts which are approximately 10 microns (10 thousandths of a millimeter) in diameter. Proportionately, this is gigantic when compared to the diameter of the largest molecules.

1 - SOLUBILITY

The medicine being used to penetrate by ionic migration obviously has to be an electrolyte, in other words it must be soluble in water and ionizable. The recommended substances and how to use them are given in the practical section.

2 - CONCENTRATION OF THE SOLUTION

The concentration of the medicine in the solution affects the quantity of ions transferred; the concentrations usually recommended are 1% to 2% (or 1 to 2 g/100 ml). However, some substances with very strong biological activity (i.e. potent at very weak concentrations) can be used in solutions diluted to as little as 0.01% (0.1 mg/ml).

15. AVAILABLE THERAPY PROGRAMS

3 - COMPETING IONS

Ionic migration indiscriminately affects all ions present in the solution, anions being attracted by the anode and cations by the cathode. If ions other than the medicinal substance are present in the solution, they will compete for migration. Therefore, the greater the quantity of competing ions in relation to the quantity of medicinal ions, the lower the penetration by the medicine. This is why it is desirable for the medicine to be in solution in distilled water and for the active electrode to be impregnated with that solution only.

4 - THE PH

The pH plays a part because it can influence not only the polarity of the ionized medicinal substance, but also the charge of the pores of the skin. Some medicinal substances are called amphoteric because their molecules have both an acidic and a basic function and consequently their ionization varies according to the pH of the medium. In an acidic medium (pH < 7) the basic function fixes an H+ and the medicine has positive polarity, whereas in a basic medium (pH > 7) the acidic function releases an H+ and the medicine has negative polarity. The charge of the pores of the skin is also influenced by the pH: when the pH is less than 3 the charge of the pores is positive and when it is greater than 4 the charge becomes negative. As most solutions have a pH > 4, the pores are negatively charged and a positively charged medicine interacts with the pores in the form of attraction, whereas a negatively charged medicine is repelled by the pores.

5 - THE SOLUTION BEING PLACED ON THE CORRECT ELECTRODE

The solution must be placed on the cathode or anode, depending on the polarity of the ionized medicine. Positively charged medicines must be placed on the positive electrode (anode) and negatively charged medicines on the negative electrode (cathode). The ionized medicine is therefore placed on the electrode of the same polarity so that it is repelled by that electrode and attracted towards the other. A table in the practical section gives the charges of various medicines.

6 - ABSENCE OF GREASE ON THE SKIN

A layer of grease between the medicinal solution and the skin will prevent penetration of the ionized medicine. This is why proper preparation of the skin that is going to be covered by the electrodes is so important. A description of the preparation method is given in the practical section.

7 - QUANTITY OF SWEAT GLAND DUCTS

The skin, with its top layer of keratin, is impermeable to water and substances dissolved in it, so penetration can only take place through the pores of the skin and, the more abundant the sweat gland ducts in the skin, the greater the penetration. The skin beneath the active electrode can be seen as being pierced by a number of micro-pipettes from which the ionized medicine will penetrate into the tissues.

8 - DENSITY OF THE ELECTRIC CURRENT

The greater the current density, the greater the penetration. However, if the density is too high, there is a risk of burning. The most appropriate density appears to be 0.05 mA/cm2.

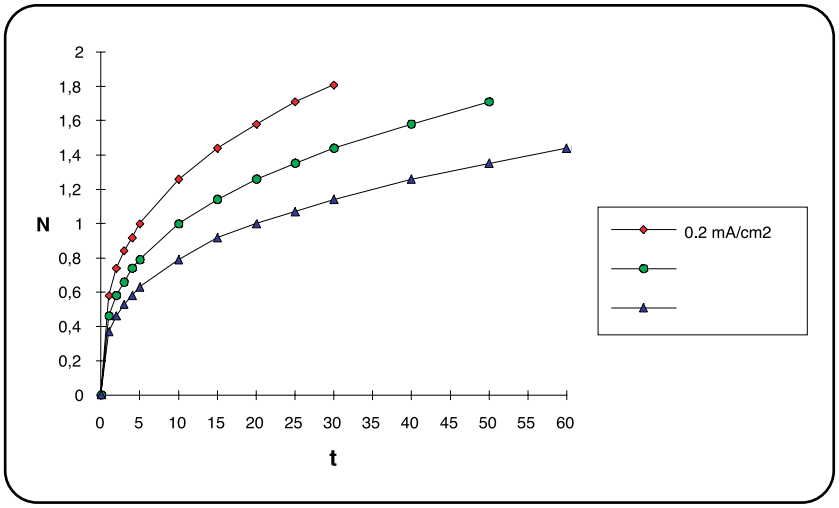
15. AVAILABLE THERAPY PROGRAMS

9 - DURATION OF TREATMENT

Owing to the inertia inherent in any dynamic phenomenon, effective mobilization of ionized medicines requires a certain amount of time. The first 15 seconds are necessary for effective activation of the migration process. Thereafter, as more time elapses more medicine will penetrate the tissues. However, the increase in the quantity penetrating over time is obviously not infinite since the substance disappears from the active electrode as it penetrates the tissue.

The quantity (N) of ionized medicine penetrating the tissues depends on all the factors described above. Once the treatment conditions are established, however, penetration only depends on the current density and the duration of treatment. The quantity (N) of ionized medicine penetrating the tissues is a function of density and duration; N is proportional to the cube root of density (D) multiplied by time (t).

$$N \propto \sqrt[3]{D.t}$$



Practice

a. Precautions prior to Iontophoresis treatment

ATTENTION: Do not perform the treatment if the patient is suffering or has suffered from asthma, hay fever, food allergy, eczema, allergy to penicillin or aspirin. Do not carry out the treatment on allergic patients, whatever form their allergy may take: hay fever, eczema, or food allergy. The more likely the medicinal product is to cause strong reactions in an allergic subject (e.g. aspirin), the more vigilant one should be.

ATTENTION: Make sure that the medicine is not contraindicated. Iontophoresis treatment must not be performed if the patient has a disease or is taking other treatments that are listed among the contraindications for the ionized medicine.

15. AVAILABLE THERAPY PROGRAMS

ATTENTION: Stop the treatment immediately and do not repeat it with the same medicine if a local allergic reaction is identified. Do not repeat Iontophoresis treatment if any local allergic reaction, however mild, was observed during the last treatment.

ATTENTION: No Iontophoresis treatment near a metal implant. Electrodes for Iontophoresis treatment must not be placed close to metallic bone or joint implants (prosthesis or bone fixing).

b. Preparing the patient and the area to be treated by iontophoresis

1. Thoroughly clean the area of skin to be treated, then rinse and dry.
2. Correct cleaning of the skin is not enough. It must also be degreased with a fat solvent (such as ether) applied to swabs.

ATTENTION: Do not shave the area of skin onto which the electrodes are placed. Hair does not interfere with Iontophoresis treatment. If treatment is done in an area where hair is shaved, there is a risk of causing small skin wounds. These wounds form points of low electrical resistance where the current will flow preferentially.

3. Place the patient in a relaxed position so that he moves as little as possible during treatment.

c. Preparing the electrodes and solution of ionized medicine

1. Apply the solution of ionized medicine to a dry electrode previously rinsed with distilled water.
2. Apply the ionized medicinal solution to the electrode of the same polarity. In this way, the medicinal ions are repelled from that electrode and attracted to the other with the opposite polarity.
3. In order to make the circuit conductive, the active electrode has been impregnated with the solution of ionized medicine and the inactive electrode has to be soaked with a conductive substance of the therapist's choice: a conducting gel, physiological liquid, or simply tap water.

d. Attaching the electrodes

1. Place the active electrode on the area to be treated. If the area to be treated is painful, find the chosen pain point by palpation and centre the active electrode on that point.

ATTENTION: Avoid placing the active electrode over scarred areas. Unless the Iontophoresis treatment is intended to soften a scar or improve a keloid, avoid placing the active electrode on an area of skin with scarring.

15. AVAILABLE THERAPY PROGRAMS

ATTENTION: Do not place electrodes over skin wounds, however slight. Apart from special forms of Iontophoresis treatment, such as antibiotic therapy for instance, only place the electrodes over healthy, intact skin with no lesions, however slight.

2. When attaching the electrodes it is important to make sure that their entire surface area is applied to the skin. Just applying a strap passing through the centre of the electrode and leaving the outer edges unattached is inadmissible. Use the widest possible strap, use several straps or several turns of the same strap or even use adhesive tape to fix the sides of the electrodes properly.

ATTENTION: Make sure there is never any contact between a metal component and the skin. If the connector of an electrode comes into contact with the skin, the current will flow preferentially through that point of low impedance. As this contact has a very small surface area, the density of the electricity will be very high, resulting in an electric burn.

3. If possible, place the inactive electrode at right angles to the active electrode. There has been no study on how the positioning of the two electrodes in relation to each other influences the efficacy of Iontophoresis treatment. However, the depth of penetration should logically be greater if the direction of the electric field is perpendicular to the surface of the skin rather than oblique or longitudinal.

e. During treatment

ATTENTION: Do not move or remove the electrodes without stopping the treatment first. Physio is programmed so that the current increases gradually at the start of the treatment and decreases gradually at the end or when the treatment is stopped. This means that there can be no excitation phenomenon and the patient will never be surprised by a shock or a painful electrical discharge. If, by contrast, the electrodes are disconnected the sudden break in the circuit may give rise to an excitation phenomenon.

1. Ask the patient to move as little as possible during the treatment and not to remove the electrodes. For the same reasons as in the previous point.
2. Warn the patient that a pricking sensation from the electrodes is normal and harmless. This is a normal effect of the galvanic current which has nothing to do with burning.
3. If there is an electrode fault during treatment. The Physio measures the impedance of the circuit and, when this is too high, the equipment stops and indicates “ELECTRODE FAULT” as well as the number of the channel on which there is a problem. There are a number of possible reasons for this safety and efficacy check system coming into operation:

- electrode disconnected
- poor connection
- channel reversal
- defective cable
- defective electrode
- solution not conducting (non-ionizable medicine or concentration too low)

15. AVAILABLE THERAPY PROGRAMS

f. After treatment

1. Thoroughly clean the skin over the treated area using tap water. During Iontophoresis treatment, acids and bases form on the electrodes and hence come into contact with the skin. If the concentration of these substances is too high and they stay on the skin for too long, chemical burns may result. It is advisable to clean the patient's skin immediately after the treatment to remove these chemical substances.
2. Clean the electrodes thoroughly with tap water, then rinse with distilled water before leaving them to dry.

15.3.2.2 Hyperhidrosis

Sweating is a physiological phenomenon intended to contribute to heat regulation in order to maintain a constant body temperature at 37°C. Hyperhidrosis [Hyper + hidros (sweat)] occurs when sweating is excessive. Indeed the amount of sweat produced considerably exceeds the volume required for thermoregulation. The neurological control responsible for sweating is provided by the hypothalamus and the sympathetic system. In some cases, hyperhidrosis, in particular in its general form, constitutes only a symptom the cause of which must be found. Treatment with iontophoresis involves localized palmar or plantar (or mixed) forms, which are usually idiopathic, although a psychological cause is sometimes suspected. The problems caused are significant: difficulty in performing manual tasks, cutaneous symptoms, etc., and have social and professional repercussions. It is estimated that around 1% of the population is affected by localized hyperhidrosis.

Treatment with iontophoresis (Hyperhidrosis programme) makes it possible to obtain lasting remission of hyperhidrosis after around ten sessions. The remission period can last up to six months, and the treatment can be started again when the signs reappear.

METHOD

USE CHANNEL 1 (other channels inactive for this programme)

A. Protocol

Hyperhidrosis: The first session will be conducted with the electrical density automatically provided (by default) of 0.05 mA/cm2. You must then increase this electrical density by 0.01 in each of the subsequent sessions.

- First session: D = 0.05 mA/cm2
- Second session: D = 0.06 mA/cm2
- Third session: D = 0.07 mA/cm2

etc.

15. AVAILABLE THERAPY PROGRAMS

B. Treatment Frequency

Three sessions per week until remission of the symptoms, generally between 5 and 10 sessions.

C. Electrode position

Use channel 1, connecting the "+" and "–" outputs to the large red iontophoresis electrodes, then place the electrodes in the bottom of a nonmetal basin two-thirds full of tap water.

D. Patient position

The patient is seated with the feet or hands immersed in the basin, with the palms or soles resting on the electrodes.

E. Stimulation intensities

For these programmes, the intensity increases automatically after validation ("+" or "–" key on the fourth channel) of the the desired electrical density selection.

15. AVAILABLE THERAPY PROGRAMS

15.3.2.3 Oedema

A. Introduction

This chapter addresses the electrotherapeutic treatment of traumatic oedema. The practical method presented has been developed on the basis of the following publications:

Bettany JA, Fish DR, Mendel FC High-Voltage pulsed direct current: effect on oedema formation after hyperflexion injury. Arch Phys Med Rehabil 71 (9): 677 – 81; 1990

Karnes JL, Mendel FC, Fish DR, Burton HW High-voltage pulsed direct current: its influence on diameters of histamine-dilated arterioles in hamster cheek pouches. Arch Phys Med Rehabil 76 (4): 381 – 6; 1995

Fish DR, Mendel FC, Schultz AM, Gottstein- Yerke LM Effect of anodal high-voltage pulsed current on oedema formation in frog hind limbs. Phys Ther 71 (10): 677 – 81; 1991132

Taylor K, Fish DR, Mendel FC, Burton HW Effect of a single 30-minute treatment of high voltage pulsed current on edema formation in frog hind limbs. Phys Ther. 72 (1): 63 – 8; 1992

The use of interrupted direct current can reduce post-traumatic oedema in 3 to 4 days. Although Taylor has shown that a single 30-minute session can successfully reduce oedema, the effects are short-lived (lasting only about 6 hours). To achieve long-lasting results, the current must be applied 3 times daily. For optimum results, other methods designed to reduce oedema formation (cold therapy, compression bandaging, elevation, etc.) should be used between sessions.

The mechanisms by which interrupted direct currents act (consisting of monophasic pulses) are still unclear. Karnes has ruled out a vasoconstrictor mechanism and the most plausible hypothesis is that the currents reduce local protein substrate density by reducing vascular membrane permeability, also preventing the arrangement of protein molecules, or by combining both mechanisms.

B. Parameters

Consequently, it is important to
A - Work with monophasic rectangular pulses delivered at a continuous frequency of 120 Hz.
B - Place one or more negative electrodes (cathodes) on the swelling and positive electrodes above the swelling.
C - Set pulse duration to 150 µs (optimum level determined in tests).
D - Set current intensity to 90% of the motor evoked potential (MEP) threshold. I session = 0.9 MEP threshold.
E - Ensure that each treatment lasts at least 30 minutes.

15. AVAILABLE THERAPY PROGRAMS

C. Protocol

a. Treatment frequency

3 per day, or even up to one session every four hours.

b. Position of the electrodes

The negative pole is the active pole. It is necessary to try to cover the oedematous region with negative electrodes.

For example, for oedema caused by an ankle sprain, two stimulation channels will be used: two large negative electrodes will be placed on the malleolar and perimalleolar region, and one of the two outputs of each electrode is not used.

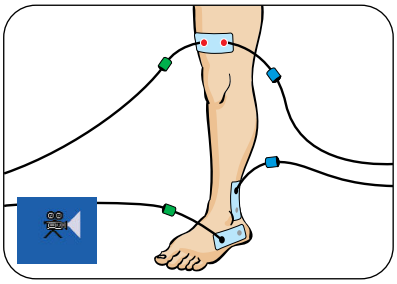
A large electrode is positioned above the patella, at the level of the quadricipital tendon, and will be connected to the positive poles of the two stimulation channels.

c. Patient position

The patient will be placed in the most comfortable position for him or her, with the treated limb elevated. For example, for oedema of the ankle, the patient will be in the supine position, with the lower limbs elevated by about thirty centimetres relative to the plane of the table.

d. Stimulation intensities

The Oedema programme begins automatically with a short test in which the stimulation intensity increases automatically. The rehabilitation therapist, visually or by palpation, attempts to detect the start of muscular activity. As soon as the motor threshold is reached, the therapist presses one of the “+” or “-“ keys on one of the channels used (MEMO symbol), and the Oedema programme then beings with an intensity equal to 90% of that of the motor threshold.



15. AVAILABLE THERAPY PROGRAMS

15.3.3 Denervated

A. Introduction

In the current state of knowledge there is nothing to indicate that electrostimulation is capable of influencing the re-innervation process of a partly or fully denervated muscle.

Electrostimulation of denervated muscle fibres, however, is essential insofar as it is the only really effective means of retaining a certain trophicity and limiting the sclerosis phenomenon of these fibres throughout the duration of their possible re-innervation period. Indeed, after many months of being patient, nothing is more frustrating than to find functional trouble caused by muscles that are certainly re-innervated but with a sclerosis condition that prevents them from being used satisfactorily.

If stimulation enables the amyotrophy to be limited and sclerosis of the denervated muscle to be avoided during its re-innervation period, it then becomes pointless if there is any hope of re-innervation for the denervated fibres.

The choice of form and parameters of the electrical current depend on state of denervation of the muscle: is it completely or partly denervated? Therefore, before undertaking any electrostimulation treatment on a denervated muscle, the following two questions should be answered:
1 - Is there any hope of re-innervation? In other words, have the re-innervation times elapsed or not?
2 - Is the muscle completely or partly denervated?

B. Factors guiding the therapeutic approach

1. Are we within the re-innervation times?

To be able to answer this question, it is essential to have the following three pieces of information:
A The date of the injury,
B The degree of the injury,
C The rate of nerve fibre regeneration.
- Interviewing the patient usually establishes how old the injury is and where it is located.
- The rate of regeneration of an injured nerve is approximately 1 millimetre per day, i.e. 3 centimetres a month.
- The following elementary calculation gives the re-innervation times:

$$\frac{\text{Distance in cm between nerve fibre injury and the motor point of the denervated muscle}}{\text{Rate of nerve fibre regeneration (= 3 cm per month)}} = \text{Re-innervation time}$$

15. AVAILABLE THERAPY PROGRAMS

2. Total or partial denervation?

How can we find out if the muscle is partly or totally denervated?

- An electromyogram examination is of course preferable but it must be recent and the results must be passed on to the physiotherapist, which does not always happen in day to day practice.

- Muscular testing is often worthwhile. However, with certain muscles, especially if there are only very few innervated fibres left, the really analytical contraction of the muscle is difficult to obtain because of the inevitable activity of the agonist muscles.

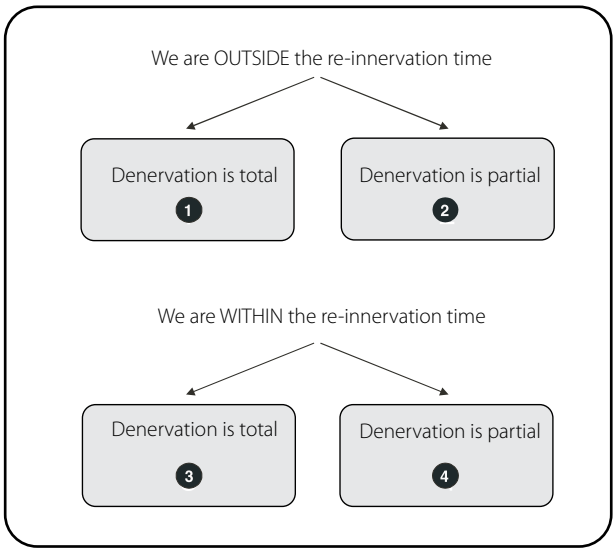
- Nevertheless, there is a simple and easily reproducible way to find out the state of denervation of a muscle. Biphase rectangular micro-pulses (lasting between 0.15 and 0.35 ms) are only capable of exciting the nerves but not of directly exciting the denervated muscle fibres. It is sufficient, therefore, to test by means of a disuse atrophy treatment. If no response is observed in spite of significant current strengths, the muscle can then be considered as completely denervated; if, on the other hand, a contraction, even of low intensity, is achieved, then the muscle is partly denervated.

C. Practical therapeutic approach

It is therefore actually easy to find out the two fundamental factors that will guide our therapeutic approach:

- There is hope of re-innervation or, on the contrary, denervation is final.
- The muscle is partly or totally denervated.

Four situations can thus arise:



15. AVAILABLE THERAPY PROGRAMS

The practical therapeutic approach must be adapted to each situation:

Situation 1: Total denervation outside the time
Electrostimulation by means of the Denervated programmes is pointless, since a muscle definitively without any innervation will always end up atrophying and sclerosing.

Situation 2: Partial denervation outside the time
It is not possible to avoid atrophy and sclerosis of muscle fibres that are definitively denervated. Stimulation of these fibres by means of the Denervated programmes is therefore not indicated here. It is possible, however, to work on the innervated part of the muscle, by means of neurostimulation rectangular biphasic micropulses in order to achieve compensatory hypertrophy of the innervated fibres.

Situation 3: Total denervation within the time
Pending possible re-innervation, it is important to prevent atrophy as much as possible and limit the sclerosis phenomenon. Stimulation of muscles deprived of innervation, by means of wide rectangular pulses in the Denervated programmes is the preferred technique here.

➔ **Physio device proposes manual or automatic total denervation programs**

Situation 4: Partial denervation within the time
It is important to try and prevent atrophy and to limit the phenomenon of sclerosis of the denervated fibres; to do this it is necessary to use the triangular gradient pulses in the Denervated programmes.

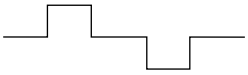
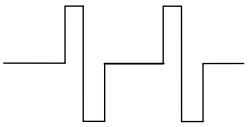
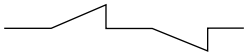
The ramp to be used to excite specifically the denervated fibres and not the innervated fibres or the motor neurons must be determined. Ramp detection is therefore essential; this will be carried out by the device's automatic system with a pulse of 100 ms or, better still, after establishing the accommodation curve that will make it possible to choose possibly a shorter pulse duration. Once the ramp has been established, the device will automatically adjust the width of the pulse to the intensity used so as to keep the ramp constant (see graph below). These ramped pulses must be balanced in order to have a zero electrical mean so as to avoid chemical burns.

➔ **Physio device proposes manual or automatic partial denervation programs**

Depending on the circumstances it may also be worthwhile working on the innervated part of the muscle using the rectangular biphasic micro-pulses in the neurostimulation programmes.

15. AVAILABLE THERAPY PROGRAMS

D. Summary

	outside the re-innervation time	within the re-innervation time
TOTAL DENERVATION	0 Stimulation is pointless	 Long rectangular pulses (100 ms with automatic mode)
PARTIAL DENERVATION	 Rectangular biphasic pulses of short duration (200 to 400 µs)	 Long triangular pulses Possibly on  innervated fibres

More information is detailed in Specific indications chapter.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.1 Overview

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.2 Disuse atrophy rehabilitation (standard protocol)

Example: disuse atrophy of the quadriceps
Traumas of the locomotive system can be extremely diverse (fractures, sprains, dislocations, etc.) and have varied functional repercussions.

Despite immense progress in orthopaedic medicine, it is still common practice to have a period of immobilisation of the area concerned, which can be total or partial.
The result is always a significant reduction, in the normal activity of the muscles in the traumatised region.
The rapid disuse atrophy which occurs (reduction in the muscle volume and the muscle tissue's ability to contract) can sometimes compromise the functional future of the patient.
The physiological mechanisms involved in the alteration of the different muscle fibres under such circumstances are well-known, and therefore extremely specific treatments can be proposed, which can produce optimum benefits on their own.

This standard protocol is recommended for the majority of cases of functional disuse atrophy. However, this protocol can be adapted depending on the pathology, the treatment objectives and the speed of the patient's recovery.

16.2.1 Protocol

Weeks 1 – 2: Disuse atrophy Level 1
During the first two weeks of treatment, the following 3 objectives must be worked towards and achieved:
- Eliminate muscle wastage.
- Familiarise the patient with the NMES technique so that the patient can work with high levels of stimulation energy.
- Obtain the first signs of regain of trophicity (slight increase in volume, improvement in tone).

Weeks 3 – 6: Disuse atrophy Level 2
The objective is the restoration of near-normal muscle volume.

Weeks 7 – 8: Reinforcement Level 1
The objective is to develop the maximum strength the muscle or muscle group can produce.

16.2.2 Treatment frequency

One to two sessions every day (if two sessions are carried out every day, enough time must be given to rest between the two sessions).
Minimum: three sessions per week.

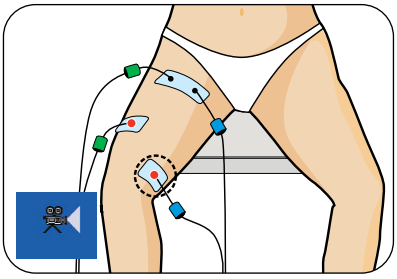
16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.2.3 Electrode position

During neurostimulation for motor stimulation purposes, the general rule is to position a small electrode on the motor point of the muscle and the other electrode at one end of the same muscle.

For optimum effectiveness, the positive electrode should preferably be positioned on the motor point.

The precise location of the motor point(s) is easy to ascertain by following the instructions for the indication “Locating a motor point” in this manual.
This step ensures that the electrodes will be positioned to provide optimum comfort to the patient and optimum effectiveness of the therapy.



16.2.4 Patient position

The stimulation of a muscle when it is at its maximum inner range is uncomfortable and quickly becomes painful due to the sensation of cramp that results from this position. Consequently, this position must be avoided and the patient should be placed in a position in which the stimulated muscle is in a mid-range position. The end of the stimulated limb must be securely tied down so that the electrically induced contraction does not cause any movement.
The stimulation will therefore be carried out using isometric contractions.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.2.5 Stimulation energy

In NMES, the stimulation energy is directly responsible for spatial recruitment: the higher the stimulation energy, the higher the percentage of motor units recruited and the greater the impact of the progress.
The general rule is to always try to increase the energy to the maximum level tolerated by the patient.
The therapist plays a fundamental role by encouraging and reassuring the patient, who can then tolerate levels of energy that produce powerful contractions. The levels of energy reached must increase throughout the session, and also from session to session, because the patients quickly get used to the technique.
When the patient has difficulty in reaching satisfactory levels of stimulation energy, it can be useful to ask the patient to add voluntary co-contractions, which improves mediocre spatial recruitment and also makes the stimulation more comfortable.
The levels of energy can then be gradually increased over time.
For this, the mi-ACTION is a useful tool, because it requires the patient to contract his/her muscle voluntarily to initiate and/or accompany the electrically induced contraction depending on the given set-point.

16.3 Rehabilitation of the peroneus muscles following an ankle sprain

The purpose of the peroneus muscles is to maintain the stability of the talocrural joint and prevent the ankle from rotating inwards.
Following a sprain, due to the functional disability, reflex inhibition phenomena and immobilisation, these muscles can undergo partial disuse atrophy, a loss of proprioceptive reflexes and a considerable loss of strength.
Rehabilitation following such an accident must therefore focus essentially on the peroneus muscles in order to prevent recurrences.
To fulfil their function optimally, the peroneus muscles must effectively put up resistance to brief and powerful stresses. They must therefore be capable of responding with a powerful, short contraction at that very moment when the stress being applied to the foot risks making the ankle tilt inwards.

There are therefore two main aspects of the rehabilitation of these muscles:
1. The proprioceptive reflex:
Allows the peroneus muscles to sense the lower limb position relative to neighbouring parts and to contract at the right moment with an appropriate strength effort.
This aspect of rehabilitation consists of properly performing exercises on classic “balance boards”, such as Freeman boards, a sufficient number of times (number of sessions).

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

2. Muscle reinforcement:
Allows the peroneus muscles to contract with enough strength to oppose the stress applied to the ankle joint.
This aspect of rehabilitation consists of producing peroneus muscle contractions using electro-stimulation and using programmes designed for developing explosive force. Only this method is really capable of developing the strength of these muscles effectively, given the impossibility of feasibly being able to carry out active methods with this level of load!

16.3.1 Protocol

Treatment at an early stage:
- Weeks 1 – 2: Reinforcement Level 1
- Weeks 3 – 4: Reinforcement Level 2

Treatment at a late stage:
- Weeks 1 – 2: Disuse atrophy Level 2
- Weeks 3 – 4: Reinforcement Level 1
- Weeks 5 – 6: Reinforcement Level 2

If the patient is experiencing associated pain symptoms, TENS stimulation can be performed in addition on the other channels.
In this case, the specific practical rules for TENS (electrode placement, regulation of intensity) should be followed for each channel used for this purpose.

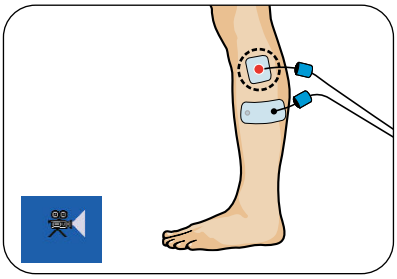
16.3.2 Treatment frequency

Three sessions per week, right after the proprioceptive session, or alternating one day on, one day off.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.3.3 Electrode position

A single channel is enough for the stimulation of the peroneus muscles.
A small electrode is placed under the head of the fibula, at the passage of the Common Peroneal nerve.
The large electrode is placed mid-way up the external lateral side of the leg.
For optimum effectiveness, the positive electrode should preferably be positioned on the motor point.



16.3.4 Patient position

First of all, the patient is seated on the rehabilitation table, barefoot and without touching the floor.
In this position, the therapist gradually increases the stimulation energy until a motor response is manifested by an eversion of the foot.
As soon as this response is obtained (most often after 2 or 3 contractions), the barefoot patient is put into standing position.
This position is particularly useful because it requires an associated proprioceptive effort, which can be of increasing difficulty (two feet, one foot, balance board, etc.)

16.3.5 Stimulation energy

In NMES, the stimulation energy is directly responsible for spatial recruitment: the higher then stimulation energy, the higher the percentage of motor units recruited and the greater the impact of the progress.
The general rule is to always try to increase the energy to the maximum level tolerated by the patient.
The therapist plays a fundamental role by encouraging and reassuring the patient, who can then tolerate levels of energy that produce powerful contractions.
The levels of energy reached must increase throughout the session, and also from session to session, because the patients quickly get used to the technique.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.4 Rehabilitation of low back muscles

Muscular insufficiency of the muscles that provide stability of the lumbar region is often the cause of common low back pain or identified as a contributing factor, which increases the risk of recurrence.

The particular benefit of electrostimulation is three-fold:

- It enables treatment to be started at an early stage because, unlike voluntary exercises, the stress applied to the stabilising muscles in the lumbar region through electrostimulation is initially carried out in isometric mode, which considerably reduces the mechanical stresses exerted on the vertebral and periarticular structures.
- It enables an appropriate work regime to be created to restore the quality of the postural muscles, i.e. the muscles that are essentially made up of type I, high-endurance fibres.
- It promotes motor re-learning and postural control by combining synchronised, electrically induced contractions of the abdominal and lumbar muscles with voluntary proprioception exercises.

16.4.1 Protocol

Weeks 1 – 2: Lumbar stabilisation Level 1
Weeks 3 – 4: Lumbar stabilisation Level 2

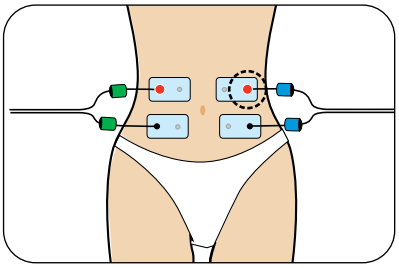
16.4.2 Treatment frequency

Three to five sessions a week for four weeks.

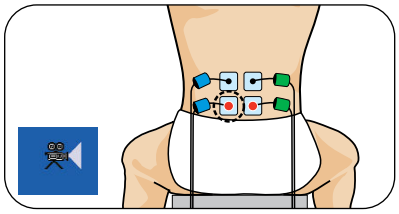
16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.4.3 Electrode position

Two channels are needed for the stimulation of the abdominal muscles:
Four large electrodes are positioned on the abdomen, one above, one below and one either side of the belly button.
For optimum effectiveness, the positive pole should preferably be positioned on the upper electrode.



Two further channels are needed for the simultaneous stimulation of the lumbar muscles, one for the right side and the other for the left side.
Two small electrodes are placed on the muscle body at the level of the lowest lumbar vertebrae at one finger's breadth distance from the spinous processes on both sides. Two small electrodes are placed 2 finger's breadths above the body of the paravertebral muscles.
For optimum effectiveness, the positive pole should preferably be positioned on the lower electrodes.



16.4.4 Patient position

For the first two weeks:
The patient is seated on a firm seat, with the forearms resting on armrests and a straight back, without leaning against the back of the chair.

For the following two weeks:
The patient is seated on a balance ball, feet resting on the ground, pelvis width apart.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.4.5 Associated exercises

For the first two weeks:
On each contraction induced by the stimulation, the patient must:
• Breathe out slowly
• Pull in the stomach
• Elongate the body along its axis
The patient then returns to the starting position during the rest phase and slowly breathes in.

For the following two weeks:
The basis of the exercises stays the same: combine an electrically-induced contraction with breathing out, pulling in the stomach and elongating the body.
Depending on the patient's progress, the following can gradually be added to the exercises:
• Additional movement of an upper limb: lifting up an arm
• Additional movement of a lower limb: taking one foot off the floor
• Quick movements of two upper limbs: throwing and catching a ball
• etc.

16.4.6 Stimulation energy

In NMES, the stimulation energy is directly responsible for spatial recruitment: the higher the stimulation energy, the higher the percentage of motor units recruited and the greater the impact of the progress.
The general rule is to always try to increase the energy to the maximum level tolerated by the patient.
The therapist plays a fundamental role by encouraging and reassuring the patient, who can then tolerate levels of energy that produce powerful contractions.
The levels of energy reached must increase throughout the session, and also from session to session, because the patients quickly get used to the technique.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.5 Treatment of patellofemoral syndrome

A distinction must be made between two types of patellofemoral syndrome:
1. With patellar mal tracking, which means the patella is not running centrally in the trochlear groove, commonly being pulled laterally.
2. Without patellar mal tracking, i.e. with a centred patellofemoral syndrome, as in post-traumatic chondropathy.

The proposed protocols are based mostly on the studies carried out by Dr. Gobelet (University Hospital of Lausanne, Switzerland, Physical Medicine Department) and by Dr. Drhezen (College of Physiotherapy, Liège, Belgium).

16.5.1 Lateral tracking

An essential cause of the mal tracking, of the patella is determined by an imbalance between the different heads of the quadriceps muscle.
A particularly significant weakness of the vastus medialis in comparison with the vastus lateralis creates a lateral displacement of the patella with hyperpressure between the lateral condyle and the adjacent retropatella surface.
Specific reinforcement of the vastus medialis is the ideal way to treat this pathology.
It can be enhanced effectively with electrostimulation.

16.5.1.1 Protocol

Weeks 1 – 2: Patellofemoral syndrome Level 2
Weeks 3 – 4: Patellofemoral syndrome Level 3

If the patient is experiencing associated pain symptoms, TENS stimulation can be performed in addition on the other channels.
In this case, the specific practical rules for TENS (electrode placement, regulation of intensity) should be followed for each channel used for this purpose.

16.5.1.2 Treatment frequency

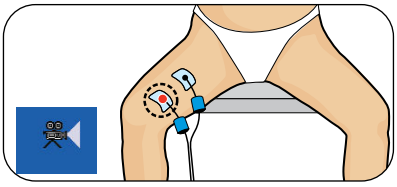
Three sessions per week.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.5.1.3 Electrode position

Only one channel is used.
- Place a small electrode on the distal motor point of the vastus medialis, which innervates the oblique fibres.
- A second electrode is placed at the upper end of the vastus medialis at around mid-thigh level.

For optimum effectiveness, the positive pole should preferably be positioned on the lower electrode corresponding to the distal motor point of the vastus medialis.
This placement of electrodes makes it possible to focus contraction of the vastus medialis, which cannot be achieved during voluntary exercises.



16.5.1.4 Patient position

The focused contraction of the vastus medialis moves the patella upward and inward, thus re-centring the kneecap and reducing the joint stresses in the lateral compartment of the knee.
This makes it possible to place the patient in a sitting position with the knee bent at 60 – 90° in order to apply high stimulation energies to the vastus medialis.
During stimulation, the patient's ankle will be tied firmly to the chair or the medical table on which he/she is seated.
In case the patient finds this position painful, the first sessions will be carried out with the knee in full extension.
After this, we will try to gradually put the knee in a flexed position.

16.5.1.5 Stimulation energy

In NMES, the stimulation energy is directly responsible for spatial recruitment: the higher the stimulation energy, the higher the percentage of motor units recruited and the greater the impact of the progress.
The general rule is to always try to increase the energy to the maximum level tolerated by the patient.
The therapist plays a fundamental role by encouraging and reassuring the patient, who can then tolerate levels of energy that produce powerful contractions.
The levels of energy reached must increase throughout the session, and also from session to session, because the patients quickly get used to the technique.
With this programme, the stimulation starts directly with a tetanic contraction, because the warm-up phase has been eliminated so as not to produce muscle twitches that are likely to cause unwanted microtraumas to the kneecap.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.5.2 Post-traumatic condition

Repeated traumas to the knee joint, like those caused by the practice of certain sports, may entail cartilaginous lesions of the kneecap.
These lesions can lead to pain of varying intensity and the occurrence of reflex inhibition, which in turn can result in disuse atrophy of the entire quadriceps. The resulting insufficiency of the quadriceps negatively affects the active stability of the joint and increases pain.

This vicious circle can be interrupted through electrostimulation of the quadriceps using the Patellofemoral syndrome programme, the parameters of which are specially adapted to avoid any unwanted effects on the kneecap.

However, for irreversible cartilaginous lesions, it is always recommended that the benefits obtained should be maintained through maintenance treatments.
The protocol detailed below is also suitable for the rehabilitation of patello femoral athroposies.

16.5.2.1 Protocol

- Week 1: Patellofemoral syndrome Level 1
- Weeks 2 – 3: Patellofemoral syndrome Level 2
- Week 4 then maintenance: Patellofemoral syndrome Level 3

If the patient is experiencing associated pain symptoms, TENS stimulation can be performed in addition on the fourth channel.
In this case, the specific practical rules for TENS (electrode placement, regulation of intensity) should be followed for this channel.

16.5.2.2 Treatment frequency

Five sessions per week during the first four weeks.
Then one session per week to maintain the results after week four.

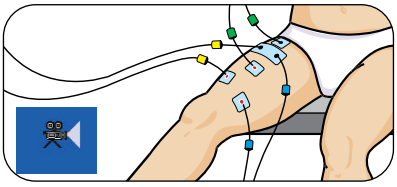
16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.5.2.3 Electrode position

In this programme, 3 stimulation channels are used for the quadriceps.
This is because of the need to work with the knee extended in order not to cause excessive pressure on the posterior side of the patella.
Indeed, this position places the quadriceps in inner range, which is not generally favourable to electrostimulation techniques, since, in this position, the patient very often feels the contraction as being uncomfortable and even painful (cramp sensation).
The use of high stimulation energies that ensure significant spatial recruitment can be difficult to achieve in some patients.
The third stimulation channel overcomes this disadvantage by optimising spatial recruitment and therefore the effectiveness of the treatment.

- Three small electrodes are placed respectively on the motor points of the vastus medialis, the vastus lateralis and the rectus femoris.
- A large, two-way electrode is placed at the top of the thigh and a further small electrode is positioned just above.

For optimum effectiveness, the positive pole should preferably be positioned on the motor point.



16.5.2.4 Patient position

For this indication, it is recommended to carry out the session with the patient's knee extended.

16.5.2.5 Stimulation energy

In NMES, the stimulation energy is directly responsible for spatial recruitment: the higher the stimulation energy, the higher the percentage of motor units recruited and the greater the impact of the progress.
The general rule is to always try to increase the energy to the maximum level tolerated by the patient. The therapist plays a fundamental role by encouraging and reassuring the patient, who can then tolerate levels of energy that produce powerful contractions. The levels of energy reached must increase throughout the session, and also from session to session, because the patients quickly get used to the technique.
With this programme, the stimulation starts directly with a tetanic contraction, because the warm-up phase has been eliminated so as not to produce muscle twitches that are likely to cause unwanted microtraumas to the kneecap.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.6 ACL ligamentoplasty

Ruptures of the Anterior Cruciate Ligament (ACL) of the knee are among the most common accidents in sports trauma.
Reconstructive surgery of the ACL has been subject to continuous developments in recent decades, with considerable progress, in particular owing to the use of arthroscopic techniques.

Associated with the improvement in the rehabilitation treatment of injured athletes, the return time to athletic activity continues to decrease significantly, and today is practically half what it was around ten years ago.
The return to athletic activity requires both satisfactory solidity of the tendon graft, which must be capable of supporting significant mechanical stresses, and, more importantly, good active joint stability.

This active joint stability requires muscles capable of opposing sometimes phenomenal stresses in the shortest time periods possible, by activating the proprioceptive reflex.
One of the potential consequences of the operative procedure is significant disuse atrophy of the quadriceps muscles, the treatment of which is one of the primary objectives of the rehabilitation therapist. However, during the first 3 - 4 months of quadriceps rehabilitation, there must be no open kinetic chain exercises due to the anterior drawer component of the tibia, which can endanger the tendon graft during the avascularisation phase.

The method described in this chapter is intended to describe an NMES protocol suitable for this particular problem of ACL ligamentoplasty, avoiding any risk of a secondary lesion to tissue.
This safety is ensured by using specific ACL programmes that consist of appropriate sequential stimulation of the quadriceps and hamstrings.

Note
This particular stimulation mode does not allow for work with mi-ACTION.

For ligamentoplasty using the patellar tendon as the graft, the NMES can be started promptly. When using doubled semitendinosus and gracilis tendons for ligamentoplasty, NMES must not be used before the standard healing period of these tendons.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.6.1 Protocol

Weeks 1 – 16: ACL
During the **first two weeks** of treatment, the following 3 objectives must be worked towards and achieved:
- Eliminate muscle wastage.
- Familiarise the patient with the NMES technique so that the patient can work with high levels of stimulation energy.
- Obtain the first signs of regaining trophicity (slight increase in volume, improvement in tone, etc.).

During **the following weeks**, the objective is the restoration of near-normal muscle volume.

When open kinetic chain exercises are permitted, which is normally **at the end of the fourth month** after the operation, NMES of the quadriceps can be continued using the Reinforcement programmes Level 1 then 2.

16.6.2 Treatment frequency

One to two sessions every day (if two sessions are carried out every day, enough time must be given to rest between the two sessions).
Minimum: three sessions per week.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.6.3 Electrode position

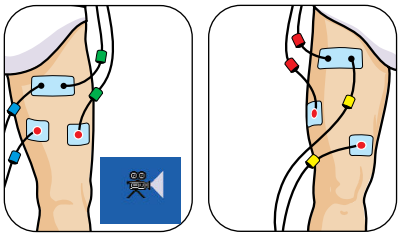
The stimulation sequence means that the order of channel numbers must be complied with, as the stimulation of the hamstrings must start before that of the quadriceps.

Channels 1 and 2 are used to stimulate the hamstrings, and channels 3 and 4 are used to stimulate the quadriceps.

For this program, it is therefore particularly important to follow the order of channel.

For each muscle group, it is recommended that the small electrodes be placed precisely on the motor points, as shown in the illustration, or better yet, that the motor points be found using the instructions for the indication “Locating a motor point” in this manual.

For optimum effectiveness, the positive pole should preferably be positioned on the motor point.



16.6.4 Patient position

The very first sessions, the primary objective of which is to eliminate muscle wastage, can be performed with the lower limb extended, with a small cushion placed under the popliteal fossa.
For the subsequent sessions, the patient will be placed in a sitting position with the knee bent at a comfortable angle. After satisfactory recovery of joint mobility, the knee is ideally bent between 60 and 90°.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.6.5 Stimulation energy

As always in NMES, the objective of the rehabilitation therapist is to motivate the patient to tolerate the highest possible stimulation energy level.
With the ACL programmes, and taking into account the particular sequential stimulation mode, it is not possible to adjust the energy levels of channels 3 and 4 without having previously increased levels on channels 1 and 2.
This is an additional safety feature that prevents contraction of the quadriceps if it is not preceded by contraction of the hamstrings.
As usual, a patient who tries to work with the maximum energies he/she is capable of tolerating will reach higher energy levels for channels 3 and 4 (quadriceps) than for channels 1 and 2 (hamstrings).

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.7 Rehabilitation of the gluteal muscles following total hip replacement

Orthopaedic surgery to the hip and, in particular, the fitting of a prosthesis, results in disuse atrophy of the gluteus muscles with loss of strength in the active stability of the hip when standing on one foot and walking.

In addition to active physiotherapy exercises, neuromuscular electrical stimulation of the gluteus maximus and medius is a technique particularly indicated for the effective treatment of weakness in these muscles.

It is recommended to start treatment as soon as possible after the operation.
The very low frequency sequences such as the warm-up, active rest between tetanic contractions and final recovery phase at the end of the treatment sequences generate individualized muscle twitches producing vibration in the prosthetic material.

The three levels of the Hip prosthesis programme correspond respectively to the programmes:
• Disuse atrophy, Level 1
• Disuse atrophy, Level 2 and
• Reinforcement, Level 1,
from which the very low frequencies are removed.

The three levels of the Hip prosthesis programme therefore induce only tetanic contraction phases separated by complete rest phases.

16.7.1 Protocol

• Week 1: Hip prosthesis Level 1
• Weeks 2 – 3:Hip prosthesis Level 2
• Week 4: Hip prosthesis Level 3

If the patient is experiencing associated pain symptoms, TENS stimulation can be performed in addition on the other channels.
In this case, the specific practical rules for TENS (electrode placement, regulation of intensity) should be followed for each channel used for this purpose.

16.7.2 Treatment frequency

Once daily, 5 days per week, for 4 weeks.

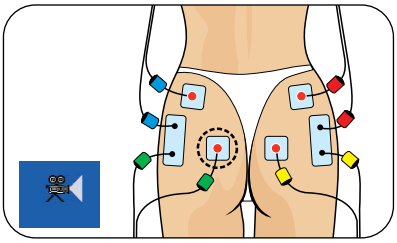
16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.7.3 Electrode position

Two channels are used, one for stimulation of the gluteus maximus and the other for the gluteus medius.
- A small electrode is placed at the intersection of the orthogonal axes dividing the buttock into four quadrants with the same area (motor point of the gluteus maximus).
- A second small electrode is placed above and outside of the upper external quadrant of the buttock on the gluteus medius at the point where it passes over the gluteus maximus.

For optimum effectiveness, the positive pole should preferably be positioned on the motor point.

The other negative poles are connected to the two outputs of one large electrode positioned diagonally in the lower-lateral quadrant of the buttock, taking care to avoid placing this electrode on a scarred/ wounded area.



16.7.4 Patient position

If the patient's condition allows, the patient is placed in a standing position, which requires him/ her to exert additional effort that is beneficial for proprioceptive control.
If this is not possible, all or part of the session can be conducted in a side lying or prone position.

16.7.5 Stimulation energy

In NMES, the stimulation energy is directly responsible for spatial recruitment: the higher the stimulation energy, the higher the percentage of motor units recruited and the greater the impact of the progress. The general rule is to always try to increase the energy to the maximum level tolerated by the patient. The therapist plays a fundamental role by encouraging and reassuring the patient, who can then tolerate levels of energy that produce powerful contractions. The levels of energy reached must increase throughout the session, and also from session to session, because the patients quickly get used to the technique.
With this programme, the stimulation starts directly with a tetanic contraction, because the warm-up phase has been eliminated so as not to produce muscle twitches that are likely to cause unwanted vibrations on the prosthesis.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8 Rehabilitation of the shoulder

The "specific properties" of the shoulder joint are complex and particularly demanding at a functional level. The shoulder must be capable of providing significant mobility of the upper limb whilst providing a stable base.
The limited congruence of the joint surfaces (the humeral head within the glenoid cavity), although partially compensated by the labrum, exposes the joint to misalignment that the passive capsular/ligament elements cannot control.
Neuromuscular control must constantly compensate for the deficiencies in passive stability by maintaining coordinated forces capable of opposing the unstable component resulting from intrinsic forces (contraction of muscles generating translational forces: pectoralis major, biceps brachii, coracobrachialis, triceps brachii (caput longum), or extrinsic forces (fall, contact, etc.).

Owing to the numerous advances in the fields of biomechanics, physiology and physiopathology, the therapeutic approach to shoulder pathologies has evolved considerably in recent years.
In this chapter, we will discuss three pathological conditions of the shoulder, for which neuromuscular electrostimulation is a preferred treatment among the established rehabilitation techniques.

These three conditions are:
1. Rotator cuff tendinopathy
2. Shoulder instability
3. Adhesive capsulitis

The protocols proposed have been developed on the basis of the following publications:

- Flatow EL, Soslowsky LJ, Ateshian GA, Pawluk RJ, Bigliani LU, Mow VC: Shoulder joint anatomy and the effect of subluxations and size mismatch on patterns of glenohumeral contact.; Orthop Trans 15: 803; 1991

- Harryman DT, Sidles JA, Clark JM, McQuade KJ, Gibbs TD, Matsen FA: Translation of the humeral head on the glenoid with passive glenohumeral motion; J Bone Joint Surg 72A: 1334; 1990

- Matsen F, Lippit S, Iserin A; Mécanismes patho-anatomiques de l'instabilité gléno-humérale ['Pathoanatomical mechanisms of glenohumeral instability'] 'Expansion scientifique française', Paris, Cahier d'enseignement de la SOFCOT [Teaching book of the French Society of Orthopaedic Surgery], pp 7 – 13

- Gibb TD, Sidles JA, Harryman DT,McQuade KJ, Matsen FA; The effect of capsular venting on glenohumeral laxity; Clin Orthop 268: 120 – 6; 1991

- Howell SM, Galinat BJ; The glenoid-labral socket. A constrained articular surface. Clin Orthop 243: 122; 1989

- Itoi E, Motzkin NE, Morrey BF, An KN; Bulk effect of rotator cuff on inferior glenohumeral stability as

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function of scapular inclination angle: a cadaver study; Tohoku J Exp Med 171 (4): 267 – 76; 1993

16.8.1 Rotator cuff tendinopathy

The anatomical location of the rotator cuff exposes it in particular to significant stress and rotator cuff tendinopathy therefore constitutes a real public health problem. A study conducted in the United Kingdom in 1986 showed that 20% of the population has consulted a doctor for shoulder problems.
The pathogenesis of these cases of tendinopathy is associated with multiple factors: intrinsic factors (vascularisation deficiency, structural abnormality of collagen fibres, etc.) or extrinsic factors (excessive mechanical stress, kinematic defects, etc.), sometimes combined, these can be considered as causes of tendon dysfunctions.
Kinematic defects appear to play an important role, and most often involve limitations in range of motion, pain phenomena and functional constraint. The limitations in range of motion observed in specific tests involve flexion (elevation) and/or abduction.
A limitation in flexion shows anterosuperior misalignment, while a limitation in abduction shows misalignment in medial rotation spin. Recovery of range of motion is obtained after correction of the joint misalignment, which must be performed using appropriate techniques. Neuromuscular control work must be focused on the coordination muscles, the muscles depressing the humeral head and the lateral rotators. The priority given for many years to the latissimus dorsi and pectoralis major muscles is strongly disputed today due to the medial rotation component of these muscles.
In fact, the only muscles enabling these mechanical requirements to be satisfied are the supraspinous and infraspinous muscles, which neuromotor rehabilitation, including electrostimulation, will focus on as a primary objective.

16.8.1.1 Protocol

Phase 1: TENS (and Decontracture if required)
Phase 2: Rotator cuff Level 1 + TENS (in case of persistent pain)
Phase 3: Rotator cuff Level 2 + (mi-ACTION mode)

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8.1.2 Treatment frequency

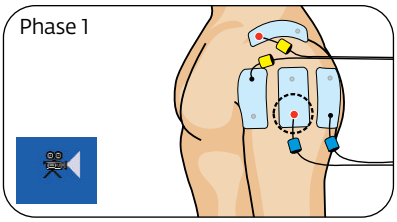
Phase 1:
One to several consecutive TENS sessions for the first to third initial treatments, before performing the manual joint realignment techniques.
In case of hypertonicity of the pectoralis major muscle, a session can be carried out using the Decontracture programme on the pectoralis major muscle to reduce excessive muscular tension that could impede the medial spin correction techniques.

Phase 2:
Three to five sessions per week until the pain disappears

Phase 3:
Three to five sessions per week until the end of treatment
When the patient has recovered good motor control of the stabilizing muscles, it is beneficial to perform the last sessions of the treatment in mi-ACTION mode. When this function is active, the initiation of the electrically induced contraction requires voluntary contraction on the part of the patient. For this exercise, it is recommended that the mi-sensor be positioned on the electrode placed on the infraspinous muscle and to ask the patient to perform a voluntary isometric contraction of his/her lateral rotators.

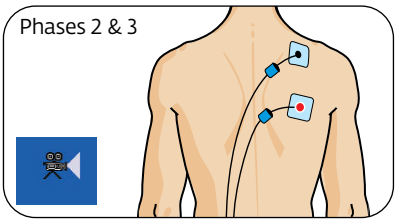
16.8.1.3 Electrode position

Phase 1
Four large electrodes are placed in such a way as to cover the whole shoulder as well as possible.

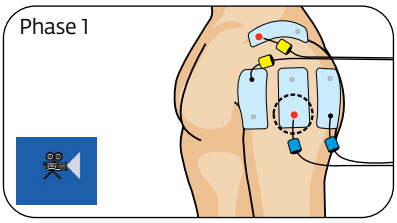


Phase 2
A small electrode is placed on the fleshiest part of the infraspinous fossa and the other small electrode is positioned on the external part of the supraspinous fossa but not over rear deltoid as this result in unwanted shoulder extension. For optimum effectiveness, the positive pole should preferably be positioned on the infraspinous muscle.
If the patient is still experiencing pain, TENS can be combined using the other channels. The specific placement of electrodes for TENS used for phase 1 will be applied to channels 2 and 3.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS



And, in case of persistent pain:



Phase 3
Continuation of the stimulation of the supraspinous and infraspinous muscles.
The electrodes are positioned in the same way as for phase 2.

16.8.1.4 Patient position

The patient is seated with the arm against his/her body, the forearm and the hand resting on an armrest, the upper limb is placed in the reference position with neutral rotation.
In phases 2 and 3, and on the condition that the position remains painless, the arm can gradually be placed in slight abduction, not exceeding 30°.

16.8.1.5 Stimulation energy

Phase 1:
The stimulation energy must be gradually increased to obtain a clear tingling sensation.

Phase 2 and 3:
The stimulation energy must be gradually increased to the patient's maximum sub-painful threshold for the stimulation of the infraspinous and supraspinatus muscles (channel 1) and until they experience a tingling sensation for the channels using TENS (phase 2 in case of associated pain).

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8.2 Shoulder instabilities

Shoulder instabilities are one of the most common pathologies, and their treatment remains a difficult challenge.
Trauma, repeated microtraumas or a constitutional laxity can compromise the stability of the shoulder either by injuring the passive structures (distension or tear of the inferior glenohumeral ligament, detachment of the labrum, progressive stretching of the capsule, etc.) or by disturbing the motor systems, causing a reduction in the coordination component resulting from the action of the scapular and scapulohumeral muscles.
The supra- and infraspinous muscles are the main coordination muscles of the glenohumeral joint; however, their efficacy is reinforced by the tone and muscle mass of the deltoid.
Unlike in the rehabilitation of rotator cuff tendinopathy, in which the work of the deltoid must be prescribed due to the subacromial interference, combined muscular electrostimulation of the deltoid and the supra- and infraspinous muscles is beneficial in this case because it allows for the stabilising musculature of the shoulder to be optimised.

16.8.2.1 Protocol

Phase 1: Disuse atrophy Level 1 until full, painless mobility is obtained
Phase 2: Disuse atrophy Level 2 until there is no pain during physical examination
Phase 3: Disuse atrophy Level 2 (+ mi-ACTION mode). Stimulation of of the infra- and supraspinous muscles combined with voluntary proprioception exercises until the recovery of strength and endurance corresponding to functional requirements.

16.8.2.2 Treatment frequency

Three to five sessions per week.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

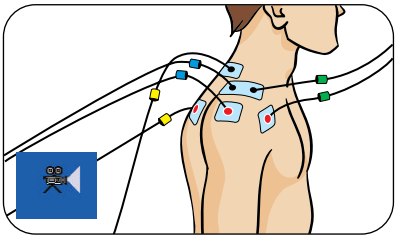
16.8.2.3 Electrode position

Phases 1 and 2:
Three channels for stimulation of the deltoid and the spinal muscles.
For the deltoid:
- one small electrode is placed on the anterior bundle of the deltoid and another small electrode is placed on the middle bundle.
- a large two-way electrode is placed on the shoulder above the acromion.

For optimum effectiveness, the positive poles should preferably be positioned on the small electrodes.

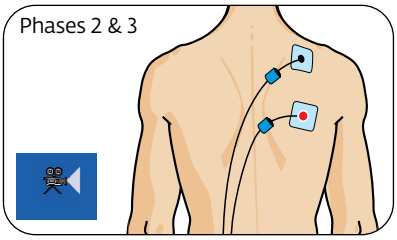
For the spinal muscles:
- a small electrode is placed on the fleshiest part of the infraspinous fossa connected to the positive pole.
- a small electrode is positioned at the external part of the supraspinous fossa connected to the negative pole but not over the rear deltoid.

For optimum effectiveness, the positive pole should preferably be positioned on the infraspinous muscle.



Phase 3:
- A small electrode is placed on the fleshiest part of the infraspinous fossa and
- The other small electrode is positioned on the external part of the supraspinous fossa.

For optimum effectiveness, the positive pole should preferably be positioned on the infraspinous muscle.



16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8.2.4 Patient position

Phases 1 and 2:
The first stimulation sessions are conducted on a patient seated, with the upper limb in the reference position, the forearm resting on an armrest.
In subsequent sessions, the arm will gradually be placed in increasing abduction to 60°. The patient's position during stimulation should prevent any stress on the scar tissue and should always remain painless.

Phase 3:
The stimulation of the infra- and supraspinous muscles can be performed simultaneously with active work, such as, for example, proprioception exercises.
The patient can be placed in the push-up position, with the hands resting on a trampoline. In this position, he/she is asked to bounce in time with the phase of electrically induced contraction of the spinal muscles. This exercise is always performed after warm-up and will first be performed with two-handed support, then one-handed support.
The mi-ACTION function can be used to greatly facilitate the combination of voluntary exercises with the stimulation.

16.8.2.5 Stimulation energy

The stimulation energy must be gradually increased to the maximum of the patient's sub-painful threshold.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8.3 Adhesive capsulitis

The SECEC (European Society for Surgery of the Shoulder and the Elbow) gives the following clinical definition for retractile capsulitis: limited active and passive mobility, by a minimum of 30%, in the 3 planes, for more than 3 months.
This limitation results from the thickening (inspissation) and fibrosis of the joint capsule with recess disappearance, which translates into a loss of active and passive shoulder mobility.
This affliction is idiopathic in a third of cases, but in the other two thirds there is a prior shoulder pathology that can be of a highly variable nature (shoulder trauma, shoulder surgery, hemiplegia, subacromioncoracoid impingement, etc.). The diabetic population is particularly at risk, with 20% of this population presenting capsulitis at some stage. Note that the initial development is a reflex sympathetic dystrophy (even if this does not exactly conform with a strict definition of the term, since it essentially affects the limb extremities); this reflex sympathetic dystrophy then regresses as the capsule fibrosis and the joint ankylosis develops.
Clinically, we see the development of a first entirely painful acute phase, then the shoulder gradually loses mobility as the pain recedes; then, the shoulder is just stiff and painless. At this point there is a loss of active and passive mobility affecting especially the abduction and external rotation of the shoulder (external rotation is reduced to at least 50% compared to the healthy side).
There is spontaneous evolution towards recovery for a period of time that varies from 3 months to 2 years, depending essentially on the quality of the rehabilitation treatment used.
The objectives of rehabilitation are first to relieve pain in the acute phase, and then to restore the biomechanical and neuromuscular qualities of the shoulder.

16.8.3.1 Protocol

Phase 1 (Acute phase): TENS
The criterion for moving from phase 1 to phase 2 is achieving a shoulder that is not painful at rest. Clinical examination often exposes a set of symptoms similar to those of rotator cuff tendinopathy, for which the same therapeutic approach can be used. This clinical presentation is the result of the compensatory mechanisms established during the acute phase.

Phase 2: Disuse atrophy Level 1, then Disuse atrophy Level 2.

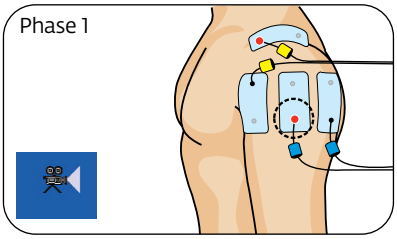
16.8.3.2 Treatment frequency

Three to five sessions per week.

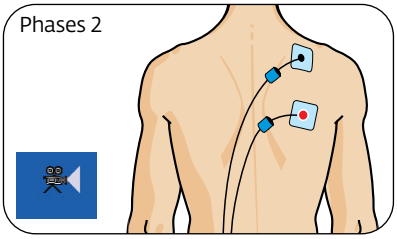
16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8.3.3 Electrode position

Phase 1:
Four large electrodes are placed in such a way as to cover the whole shoulder as well as possible.



Phase 2:
One stimulation channel for the infraspinous and supraspinous muscles.
• One small electrode is placed on the fleshiest part of the infraspinous fossa.
• The other small electrode is positioned on the external part of the supraspinous fossa.
For optimum effectiveness, the positive pole should preferably be positioned on the infraspinous muscle.



16.8.3.4 Patient position

Phase 1:
The patient is placed in the most comfortable position for him or her.

Phase 2:
The patient is seated with the arm against his/her body, the forearm and the hand resting on an armrest, the upper limb is placed in the reference position with neutral rotation. In phase 2, and on the condition that the position remains painless, the arm can gradually be placed in slight abduction, not exceeding 30°.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8.3.5 Stimulation energy

Phase 1:
The stimulation energy must be gradually increased to obtain a clear tingling sensation.

Phase 2:
The stimulation energy must be gradually increased to the maximum threshold the patient can tolerate.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8.4 Cardiac Rehabilitation

Chronic heart failure causes functional impairment associated with the intricate physiopathological mechanisms involved between the cardiac dysfunction and the peripheral changes associated with a deconditioning syndrome.

The skeletal muscle abnormalities are morphological and functional. They include a reduction in muscle mass, a reduction in slow-twitch type 1 fibres and a reduction in capillary density.
Metabolically, the muscle changes are characterised by a reduction in the density of the mitochondria and a reduction in the mitochondrial oxidative capacity.
Appropriate physical exercise, which improves one's capacity for exertion, is known to be one of the essential components in the treatment of chronic heart failure.
However, some patients are excluded from the cardiac rehabilitation programmes due to the severity of their cardiac condition or due to co-morbidities limiting the practice of physical exercise. It is because of this that neuromuscular electrostimulation has been proposed as an alternative or complementary treatment to physical exercise for heart failure, as it enables muscular performance and capacity for exertion to be improved.

The protocols proposed have been developed on the basis of the following publications:

1. Karavidas A, Arapi SM, Pyrgakis V, Adamopoulos S.
Functional electrical stimulation of lower limbs in patients with chronic heart failure.
Heart Fail Rev. 2010 Nov;15(6):563-79. Review

2. Banerjee P, Clark A, Witte K, Crowe L, Caulfield B.
Electrical stimulation of unloaded muscles causes cardiovascular exercise by increasing oxygen demand.
Eur J Cardiovasc Prev
Rehabil 2005 ; 12: 503-508

3. Quittan M, Wiesinger G, Sturm B, et al.
Improvement of thigh muscles by neuromuscular electrical stimulation in patients with refractory heart failure.
Am J Phys Med Rehabil 2001;80(3): 206-214

4. Maillefert JF, Eicher JC, Walker P et al.
Effects of low-frequency electrical stimulation of quadriceps and calf muscles in patients with chronic heart failure.
J Cardiopulm Rehabil 1998;18(4): 277-282

5. Deley G, Kervio G, Verges B et al.
Comparison of low-frequency electrical myostimulation and conventional aerobic exercise training in patients with chronic heart failure.
Eur J Cardiovasc Prev Rehabil 2005 ;12(3): 226-233

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8.4.1 Protocol

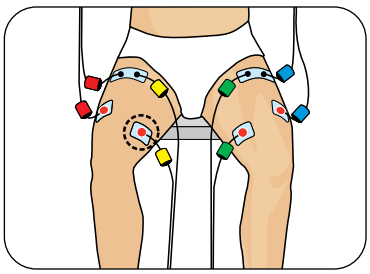
Cardiac rehabilitation.

16.8.4.2 Treatment frequency

Three to six sessions a week for four to eight weeks.

16.8.4.3 Electrode position

The quadriceps are the priority muscles due to their functional importance and their high volume of muscle mass.
Two channels are needed per thigh for quadriceps stimulation.
• Two small electrodes are placed on the motor points of the vastus medialis and the vastus lateralis.
• Two large electrodes are positioned at the top of the thigh.
For optimum effectiveness, the positive pole should preferably be positioned on the motor point.



16.8.4.4 Patient position

The patient should preferably be placed in a sitting position with his/her knees bent at approximately 90°, the ankles must be restrained to avoid the knees from being extended, which can induce contractions. If the patient is not able to stay seated, the session can be carried out in a lying position, taking care to place a large cushion under the popliteal fossae so that the knees are flexed.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.8.4.5 Stimulation energy

In NMES, the stimulation energy is directly responsible for spatial recruitment: the higher the stimulation energy, the higher the percentage of motor units recruited and the greater the impact of the progress. The general rule is to always try to increase the energy to the maximum level tolerated by the patient. The therapist plays a fundamental role by encouraging and reassuring the patient, who can then tolerate levels of energy that produce powerful contractions. The levels of energy reached must increase throughout the session, and also from session to session, because the patients quickly get used to the technique.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.9 Reflex sympathetic dystrophy (or Complex regional pain syndrome)

Reflex sympathetic dystrophy (RSD) is a disease that physiotherapists frequently see and which they must be able to diagnose and treat at an early stage.

The protocols proposed have been developed on the basis of the following publications:

1. Abram S, Asiddao C, Reynolds A,
Increased Skin Temperature during Transcutaneous Electrical Stimulation. Anesthesia and Analgesia 59: 22 - 25, 1980

2. Owens S, Atkinson R, Lees DE,
Thermographic Evidence of Reduced Sympathetic Tone with Transcutaneous Nerve Stimulation. Anesthesiology 50: 62 - 65, 1979

3. Owens S, Atkinson R, Lees DE,
Thermographic Evidence of Reduced Sympathetic Tone with Transcutaneous Nerve Stimulation. Anesthesiology 50: 62 - 65, 1979

4. Abram S,
Increased Sympathetic Tone Associated with Transcutaneous Electrical Stimulation. Anesthesiology 45: 575 - 577, 1976

5. Meyer GA, Fields HL,
Causalgia treated by selective large fibre stimulation of peripheral nerve. Brain 9: 163 - 168, 1972

Diagnostic / definition

RSD is a complication which most often occurs following a trauma. In most cases, this trauma is to the bone or joints of the limbs. The type of trauma is generally a fracture or operation, but may also involve dislocations, wounds, burns, phlebitis, infections, etc.

RSD does not start immediately after the trauma or the operation, but appears some time later. In general, it starts when physiotherapy begins.
This is why the role of the physiotherapist is vital.

The main sign of RSD is pain. The pain is most often located at the end of the traumatised limb. It is described by the patient as a burning pain. The intensity of the pain is high and often disproportionate to the initial trauma. It increases with stress and activity and decreases when the patient is calm and resting. Mobilisation and massage accentuate it; simply touching the skin may be very painful.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

Depending on the stage of development, other signs may appear:
- The skin becomes cold with sweating, oedema and cyanosis developing in the more advanced stages.
- The muscles in the affected area become atrophied.
- The underlying bone develops osteoporosis (Sudeck's atrophy).

The precise mechanism of development of RSD is not yet exactly known. However, it is well established that the sympathetic nervous system plays a major role.
Indeed, vasomotor disorders associated with hyperactivity of the orthosympathetic system innervating the region concerned have been observed.

Treatment
There are two aspects to the treatment of RSD: the relief of pain and the reduction in the activity of the orthosympathetic system.
However, mobilisations, massages and all techniques likely to cause or accentuate the pain must be ruled out, as they could potentially aggravate the RSD.

Few therapeutic methods meet these criteria, which makes transcutaneous electrical nerve stimulation (TENS) the first treatment of choice available to physiotherapists for treating RSD.
However, it is essential here to limit the stimulation to the myelinated nerve fibres of the tactile sensory system only, the type Aß fibres, as these are the only fibres which have an inhibiting affect on the orthosympathetic system. This is not the case for the other nerve fibres (Aδ, B, C), as these activate this orthosympathetic nervous system.
This selective targeting of the Aβ fibres, which are the most excitable nerve fibres (tactile sensory system), is possible if very short pulse widths (≤ 50 µs) are used, i.e. the TENS programme.

16.9.1 Protocol

TENS 1: for very sensitive or hyperalgesic patients
TENS 2: for all other patients

16.9.2 Treatment frequency

A minimum of 20 to 40 minutes of treatment every day.

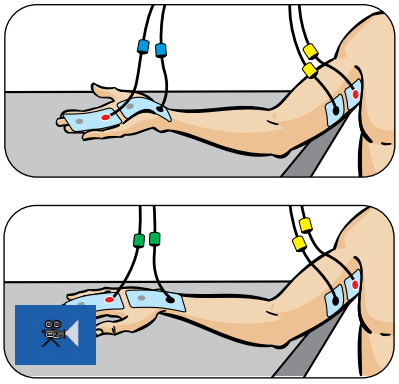
16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.9.3 Electrode position

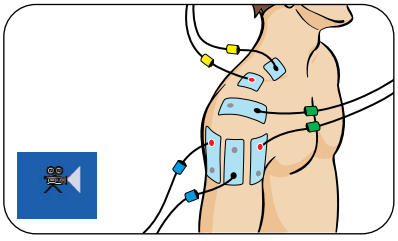
Use three channels
- Two channels are used with four large electrodes to cover the painful area.
- The third channel uses small electrodes to excite the nerve path(s) supplying the extremity of the limb concerned.

Upper limb:

Distal RSD of the upper limb:
- Four large electrodes are used to cover the palms and backs of the hand and fingers.
- Two small electrodes a finger's width apart are placed as high as possible on the inner side of the arm; the upper electrode is thus positioned at the level of the brachial wall of the axilla.



RSD of the shoulder:
- Four large electrodes are used to cover the whole shoulder.
- A small electrode is placed at the level of the supraclavicular cavity, and another small electrode is positioned on the bony protrusion of the acromion.

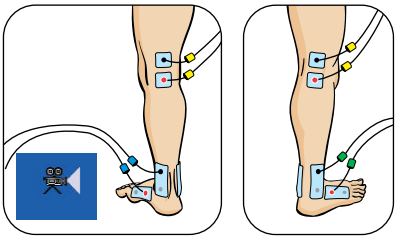


16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

Lower limb:

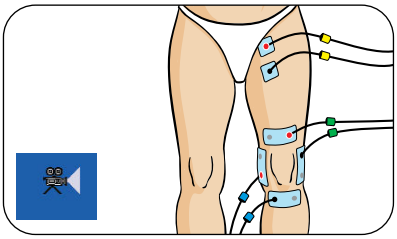
Distal RSD of the lower limb:

- Four large electrodes are used to surround the ankle and foot.
- A small electrode is placed in the middle of the popliteal fossa; another small electrode is placed similarly one finger's breadth above.



RSD of the knee:

- Four large electrodes are used to cover the knee and surround the kneecap.
- A small electrode is placed at the level of the inguinal fossa just beside the femoral artery, and another small electrode is placed similarly one finger's breadth above it.



16.9.4 Patient position

The most comfortable position for the patient.
To improve the irradiation of the tingling sensation caused by neural stimulation, it is recommended to exert a slight pressure on the small electrodes placed on the nerve being targeted (bag of sand weighing 1 or 2 kg, cushion placed between the chest and arm, etc.)

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.9.5 Stimulation energy

The stimulation energy must first be adjusted on the third channel, which stimulates the target nerve at the axilla, supraclavicular, popliteal or inguinal regions. The energy level is gradually increased until the patient feels paresthesia (tingling) at the end of the limb being treated.
Then, the energy level is adjusted on the other two channels so that the patient feels an increase in the tingling sensation.
During the session, because of the habituation phenomenon, the sensation of paresthesia will gradually be reduced and even disappear. It is then recommended that the energy be increased slightly to maintain the sensation, but without causing muscle contractions.
The mi-TENS function eliminates this possibility by automatically reducing the stimulation energy to below the motor excitation threshold.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10 Endorphinic treatment of Rachialgia and Radiculalgia

This chapter deals with the analgesic treatment of spinal pain (Rachialgia) and nerve root pain (Radiculalgia).

The practical methods of treatment described in this chapter are based on the following reference publications:

1. Hollt V., Przewlocki R., Herz A.
Radioimmunoassay of beta-endorphin basal and stimulated levels in extracted rat plasma.
Naunyn Schmiedebergs Arch Pharmacol 1978; 303 (2): 171 - 174

2. Viru A., Tendzegolskis Z.
Plasma endorphin species during dynamic exercise in humans. Clin Physiol 1995; 15 (1): 73 - 79

3. Pierce E.F., Eastman N.W., Tripathi H.T., Olson K.G., Dewey W.L.
Plasma beta-endorphin immunoreactivity: response to resistance exercise. J Sports Sci 1993; 11 (6): 499 - 452

4. Dzampaeva E.T.
Hearing loss correction by endogenous opioid stimulation. Vestn Otorinolaringol 1998; (3): 13 - 16

5. Ulett G.A., Han S., Han J.S.
Electroacupuncture: mechanisms and clinical application. Biol Psychiatry 1998; 44 (2): 129 - 138

6. Wang H.H., Chang Y.H., Liu D.M., Ho Y.J.
A clinical study on physiological response in electroacupuncture analgesia and meperidine analgesia for colonoscopy. Am J Chin Med 1997; 25 (1): 13 - 20

7. Chen B.Y., Yu J.
Relationship between blood radioimmunoreactive beta-endorphin and hand skin temperature during the electroacupuncture induction of ovulation. Acupunct Electrother Res 199: 16 (1 - 2): 1 - 5

8. Boureau F., Luu M. , Willer J.C.
Electroacupuncture in the treatment of pain using peripheral electrostimulation. J Belge Med Phys Rehabil 1980; 3 (3): 220 - 230

9. Wu G.C., Zhu J., Cao X.
Involvement of opioid peptides of the preoptic area during electroacupuncture analgesia.
Acupunct Electrother Res 1995; 20 (1): 1 - 6

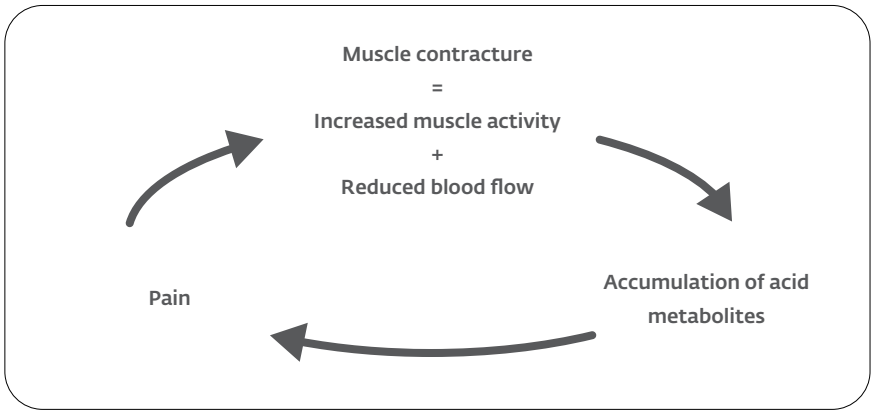
Spinal pain is an extremely common painful state that can result from a wide variety of anatomical lesions

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

and various physiopathological mechanisms.

Whatever the triggering factors, the quasi-systematic occurrence of contracture of the paravertebral muscles is often directly responsible for spinal pain.

The increase in the tension of the contractured muscle fibres and the crushing of the capillary network resulting from this causes a decrease in the blood flow and a gradual accumulation of acid metabolites and free radicals. This muscular "acidosis" is directly responsible for the pain, which in turn sustain and reinforce the degree of contracture. If left untreated, there is a risk that the contracture will become chronic and real atrophy of the capillary network will gradually develop; the aerobic metabolism of the muscle fibres deteriorates, giving way to glycolytic metabolism, which gradually becomes predominant. This mechanism of chronic contracture is summarised in the following diagram:



In addition to the general effect of increasing endorphin production (which raises the pain perception threshold), stimulation with an endorphinic programme produces marked local hyperaemia and allows drainage of acid metabolites and free radicals.
The major analgesic effect obtained in this way during each session should not, however, lead to premature termination of treatment. Indeed, in order to restore the atrophic capillary network, the treatment must be continued for a minimum of ten sessions or so.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10.1 Endorphinic treatment of cervical pain

Chronic contractures of the levator scapulae and/or superior trapezius are often responsible for the painful symptoms in patients with neck pain. The use of endorphinic treatment on these contractured muscles is thus the treatment of choice for this condition.
However, it must be ensured that the stimulation energy levels are sufficient to obtain clearly visible muscle twitches (leading to a marked hyperaemic effect) so that the acid metabolites swamping the capillary bed of the contractured muscle can be drained away.
This treatment should be continued for at least ten sessions in order to restore the capillary network, which is usually atrophic in chronically contractured muscles.

16.10.1.1 Protocol

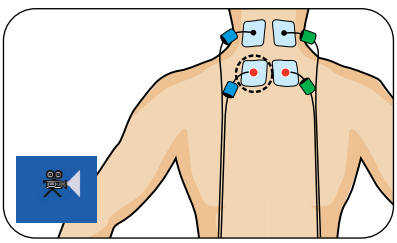
Cervical pain: 10 to 12 weeks

16.10.1.2 Treatment frequency

Three to five sessions per week for two to three weeks (10 to 12 sessions in total).
Each session should last at least 20 minutes. Ideally, it may be beneficial to carry out two successive stimulation sessions with the Neck pain programme, ensuring a ten-minute rest period is taken between the two sessions to allow the stimulated muscles to recover.

16.10.1.3 Electrode position

Depending on the location of the pain (unilateral or bilateral), one or two stimulation channels are used:
- A small electrode is placed on the most painful point that can be found by palpation. In most cases this point of maximum contracture is found in the levator scapulae or superior trapezius.
- In the case of bilateral pain, another small electrode is likewise placed on the most painful point. For optimum effectiveness, the positive pole of each channel should preferably be positioned on the painful area.
  One or two small electrodes are placed on the cervical paravertebral muscles at C3 - C4 level.



16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10.1.4 Patient position

The patient is placed in the position most comfortable for him/her: prone position or seated facing a medical table with a chest support.

16.10.1.5 Stimulation energy

The energy must be increased gradually until it causes clearly visible muscle twitches, which are required to induce hyperaemia.
The mi-RANGE function makes it possible to work with certainty within a therapeutically effective range.
The stimulator prompts you to firstly increase the level of energy:

- a beep sound accompanies the flashing "+" symbols.
- When it detects that the muscles have started to pump, the "+" symbols will stop flashing. You are at the minimum level of energy that provides therapeutic results.

If the stimulation is well tolerated by the patient, it is advised to increase the energy level slightly.
At the end of the treatment or during a break, a statistic showing the percentage of time spent in the effective range will appear on the screen.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10.2 Endorphinic treatment of thoracic back pain

Whatever the trigger, chronic contractures of the dorsal paravertebral muscles (erector spinae) are responsible for the pain that incapacitates patients suffering from thoracic back pain.
Provided that sufficient stimulation energy is used to obtain clear muscle twitches, the dorsalgia treatment - thanks to the remarkable hyperaemia it causes - will be particularly effective for draining the metabolic acids that have built up in the contractured muscle.
A significant analgesic effect will therefore usually be observed in the first treatment sessions.
This treatment should however be continued for at least ten sessions in order to restore the capillary network, which is usually atrophied in chronically contractured muscles.

16.10.2.1 Protocol

Thoracic back pain: 10 to 12 sessions.

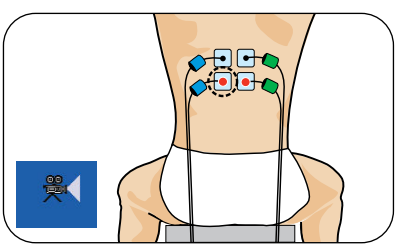
16.10.2.2 Treatment frequency

Three to five sessions per week for two to three weeks (10 to 12 sessions in total).
A session should last at least 20 minutes. Ideally, it may be beneficial to carry out two successive stimulation sessions within the Thoracic back pain programme, ensuring however a ten-minute rest period between the two sessions to allow the stimulated muscles to recover.

16.10.2.3 Electrode position

The points of maximum contraction are usually bilateral but not always symmetrical; therefore, two stimulation channels are used.

- Two small electrodes are placed on the most painful points, which can be easily located by palpatory examination of the painful area.
  For optimum effectiveness, the positive pole should preferably be positioned on the painful area.
- Two other electrodes, also small ones, are placed on the top of the erector spinae muscles, a few centimetres above or below the electrodes placed on the painful points, depending on whether the pain radiates towards the neck or the lumbar region.



16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10.2.4 Patient position

The patient is placed in a position he/she finds the most comfortable: in the prone or side lying position, or seated.

16.10.2.5 Stimulation energy

The energy must be increased gradually until it causes clearly visible muscle twitches, which are required to induce hyperaemia.

The mi-RANGE function makes it possible to work with certainty within a therapeutically effective range. The stimulator prompts you to firstly increase the level of energy:

- a beep sound accompanies the flashing "+" symbols.
- When it detects that the muscles have started to pump, the "+" symbols will stop flashing. You are at the minimum level of energy that provides therapeutic results.

If the stimulation is well tolerated by the patient, it is advised to increase the energy level slightly.
At the end of the treatment or during a break, a statistic showing the percentage of time spent in the effective range will appear on the screen.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10.3 Endorphinic treatment of low back pain

Chronically contractured lumbar paravertebral muscles are often the source of pain felt by patients with lumbago. Although a physiotherapist must naturally find the cause of the pain and treat it accordingly, treatment of these chronic contractions using the Low back pain programme brings about fast, significant pain relief. In the lumbar region, the stimulation currents required to obtain visible (or at least palpable) muscle twitches are generally high and can be difficult to tolerate by some patients. This is why it is generally recommended to combine TENS treatment with the Low back pain programme to make treatment more comfortable for the patient.
This treatment should be continued for at least ten sessions in order to restore the capillary network, which is usually atrophic in chronically contractured muscles.

16.10.3.1 Protocol

Low back pain + TENS : 10 to 12 sessions
The Low back pain programme is designed to provide endorphinic stimulation on the first two channels and TENS stimulation on the other two channels.

16.10.3.2 Treatment frequency

Three to five sessions per week for two to three weeks (10 to 12 sessions in total), a session should last at least 20 minutes.
Ideally, it may be beneficial to carry out two successive stimulation sessions within the Low back pain programme, ensuring a ten-minute rest period is taken between the two sessions to allow the stimulated muscles to recover.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10.3.3 Electrode position

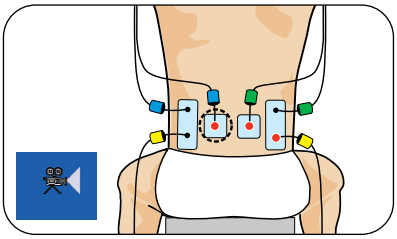
Three stimulation channels are used.
In the Low back pain programme, endorphinic stimulation is always used on channels 1 and 2, while the TENS stimulation is provided on channels 3 and 4.

For endorphinic treatment:

- Two small electrodes are placed on the most painful points, which can be easily located by palpitating the lumbar paravertebral muscles.
  For optimum effectiveness, the positive pole should preferably be positioned on the painful area.
- Two large electrodes with two outputs are placed a finger-width outside the small electrodes and are attached to the negative poles of the two previous channels.

For the TENS treatment:

The free outputs of the two large electrodes are used to connect the third channel.



16.10.3.4 Patient position

The patient is placed in the position he/she finds the most comfortable: in the side lying or prone position, taking care to use a cushion or a specially designed table to prevent lordosis.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10.3.5 Stimulation energy

The energy must firstly be adjusted on the third channel (TENS). The energy is gradually increased until the patient feels a strong tingling sensation in the lumbar region.
The energy is then adjusted on channels 1 and 2 (endorphinic).
The energy is gradually increased in order to cause muscle twitches, visible if possibly (or at least palpable).
If the patient finds it hard to tolerate the energy increase, due to the discomfort it can cause, it is recommended to temporarily stop increasing the energy on the first two channels. The energy is then increased again on the third channel (TENS) in order to increase the feeling of paresthesia in the lumbar region.
After a minute or two, the energy can be increased again on the first two stimulation channels so that the muscle twitches can be seen.
It is essential to increase the energy on channels 1 and 2 sufficiently to cause visible (or at least palpable) muscle twitches. In fact, these muscle twitches are directly responsible for the significant hyperaemia effect and therefore guarantee the effectiveness of the treatment.

Note
When TENS is used in combination with an endorphinic programme (such as the Low back pain programme in this case) the mi-TENS function is inactive.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10.4 Treatment of lumbosciatic pain

Patients suffering from lumbosciatic pain most often present lumbar pain that commonly originates from chronic contractures of the lumbar paravertebral muscles.
In addition, involvement of the spinal nerve root leads to irradiation of pain over a shorter or longer distance along the sciatic nerve and in some cases, along one or the other of its branches (common peroneal or tibial).
The combination of the Lumbosciatica programme and the TENS programme is the preferred treatment, as it produces - through its endorphinic effect (Lumbosciatic programme) – a significant analgesic effect on chronic contractures of the lumbar region and – through the TENS programme – reduces the medullar input of the nociceptive impulse (Gate control) due to painful irradiation of the sciatic nerve.

Combining endorphinic stimulation with TENS stimulation is entirely appropriate here as on one hand, it treats low back pain caused by chronic contractures of the muscles in that area, and on the other hand, relieves neurogenic pain of the sciatic nerve, for which TENS is the treatment of choice.

16.10.4.1 Protocol

Lumbosciatica: 10 to 12 sessions.
The Lumbosciatica programme is designed to provide endorphinic stimulation on the first channel and TENS stimulation on the other three channels.

16.10.4.2 Treatment frequency

Three to five sessions per week for two to three weeks (10 to 12 sessions in total), a session should last at least 20 minutes.
Ideally, it may be beneficial to carry out two successive stimulation sessions within the Lumbosciatica programme, ensuring a ten-minute rest period is taken between the two sessions to allow the stimulated muscles to recover.

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16.10.4.3 Electrode position

Two stimulation channels are used, ensuring they are switched on in the correct order, as this determines the order in which the channels deliver stimulation. With the Lumbosciatica programme, the endorphinic stimulation is always provided on channel 1, whereas the TENS stimulation is delivered by channels 2, 3 and 4.

For endorphinic treatment:

- A small electrode is placed on the top of the root of the sciatic nerve, which is painful to palpate. For optimum effectiveness, the positive pole should preferably be positioned on this painful area.
- Another small electrode is placed two finger-widths above the previous electrode and is attached to the negative pole of the same channel

For TENS treatment:

Two large electrodes are placed on the path of the sciatic nerve:

- one on the lower part of the buttock and
- the other on the posterior thigh.
- The second channel is connected to these large, single-output electrodes.

Note

The 3rd and/or 4th channel (TENS) can be used in two situations:

- In the event of more extensive irradiation in the common peroneal or tibial nerves. Two large electrodes are therefore placed longitudinally on the calf (tibial) or laterally (common peroneal) on the lower leg and are connected by a channel.
- If the patient does not like endorphinic stimulation in the lumbar region two large electrodes are placed to the lumbar region and are connected by a channel.

16.10.4.4 Patient position

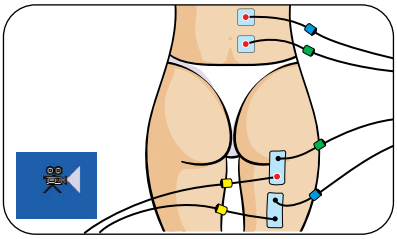
The patient is placed in the position he/she finds the most comfortable: in the prone position (with a cushion or on a specially designed table to prevent lordosis) or in the side lying position.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.10.4.5 Stimulation energy

The energy is gradually increased on the second channel (TENS), in order to cause a distinctive tingling sensation along the painful irradiation of the sciatic nerve.
The gradual energy increase on the first channel must be sufficient to obtain visible (or at least palpable) muscle twitches of the muscles of the lumbar region, which cause hyperaemia.

Note
When TENS is used in combination with an endorphinic programme (such as the Low back pain programme in this case) the mi-TENS function is inactive.



16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.11 Hemiplegia - Spasticity

This chapter examines the treatment of problems specific to the hemiplegic patient, including spasticity, which is found not only in hemiplegic patients but also in most disorders of the central nervous system (tetraplegia, paraplegia, multiple sclerosis, etc.).

The practical methods of treatment described in this chapter are based on the following reference publications:

1. Wal J.B.
Modulation of Spasticity: Prolonged Suppression of a Spinal Reflex by Electrical Stimulation. Science 216: 203 - 204, 1982

2. Baker L.L., Yeh C., Wilson D., Waters R.L.
Electrical Stimulation of Wrist and Fingers for Hemiplegic Patients. Physical Therapy 59: 1495 - 1499, 1979

3. Alfieri V.
Electrical Treatment of Spasticity. Scand. J Rehab Med 14: 177 - 182,

4. Carnstan B., Larsson L., Prevec T.
Improvement of Gait Following Electrical Stimulation. Scand J Rehab Med 9: 7 - 13, 1977

5. Waters R., McNeal D., Perry J. Experimental Correction of Foot Drop by Electrical Stimulation of the Peroneal Nerve. J Bone Joint Surg (Am) 57: 1047 - 54, 1975

6. Liberson WT, Holmquest HJ, Scot D
Functional Electrotherapy: Stimulation of the Peroneal Nerve Synchronized with the Swing Phase of the Gait Hemiplegic Patient. Arch Phys Med Rehabil 42: 101 - 105, 1961

7. Levin MG, Knott M, Kabat H
Relaxation of Spasticity by Electrical Stimulation of Antagonist Muscles. Arch Phys Med 33: 668 - 673, 1952

The treatments discussed in this chapter are applicable through the programmes in the Neurological Rehabilitation category and some of these programmes require each contraction to be manually triggered.
All programmes used reduce spasticity as long as they are applied correctly to the muscles antagonistic to the spastic muscles. Some of these programmes are intended solely for the treatment of spasticity, while others are intended to treat situations or complications specific to the hemiplegic patient, namely: functional neuromuscular electrical stimulation of the foot and subluxation of the shoulder.

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16.11.1 Dorsiflexion of the hemiplegic foot

One of the problems in hemiplegic patients is the greater or lesser degree of difficulty that they encounter when raising the foot voluntarily, or even the total inability to do so.
For this reason, the foot drops when walking during heel strike.
Neuromuscular electrical stimulation (NMES) in the area of the flexor muscles of the foot (tibialis anterior, extensors of the toe) allows for dorsiflexion to be achieved.
This NMES is functional (FES) if the dorsiflexion achieved is synchronised with the gait so as to stop the foot from dropping when lifted from the ground.

The aim of FES is to teach the hemiplegic patient to walk again by creating a functional gait pattern that the patient is then able to reproduce more easily.
However, this method of gait rehabilitation using FES is not suitable for all hemiplegic patients. Two types of case must be considered:

1. If the stimulation of the muscles lifting the foot produces a spasm reflex in the muscles of the lower limb, this technique should no longer be used (this phenomenon is rare in hemiplegics but more common in paraplegics).
2. If the spasticity of the soleus muscle is considerable, to the point where satisfactory dorsiflexion cannot be achieved, programmes for the treatment of spasticity in the lower limb must be used initially, before resuming work on the gait with FES when spasticity of the triceps surae has been sufficiently reduced.

16.11.1.1 Protocol

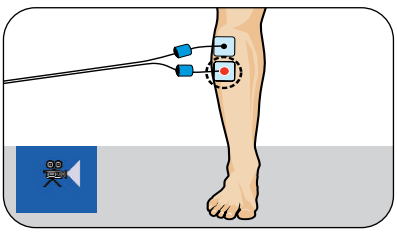
The hemiplegic foot. USE CHANNEL 1 (other channels are inactive for this programme)

16.11.1.2 Treatment frequency

Minimum of three sessions per week, the length of treatment varies greatly depending on progress.

16.11.1.3 Electrode position

A single channel is sufficient to stimulate the levator muscles of the foot.
A small electrode is placed on the motor point of the tibialis anterior.
For optimum effectiveness, the positive pole should preferably be positioned on the lower electrode, which corresponds to the motor point of the tibialis anterior.



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16.11.1.4 Stimulation energy

Use the energy necessary to achieve slight dorsiflexion that is enough to prevent the foot from dropping while walking. In this application, there is nothing to be gained from producing a more powerful contraction that might diffuse into the antagonists.

Activate the contraction by pressing any key on any channel. As this contraction phase is very short, rapidly increase the energy of channel 1 until satisfactory dorsiflexion is achieved.

16.11.2 Spasticity

Reminder
Spasticity or spastic hypertonia is a term which describes the condition of paretic or paralysed muscles showing different symptoms to varying degrees, including in particular, an increase in muscle tonus mainly in the antigravity muscles, hyperreflexia, and clonus.

During passive stretching of a spastic muscle, there is resistance at the beginning of the movement, which then diminishes in the course of extension.
The more rapid the passive stretching movement, the stronger this resistance.
If passive stretching is very rapid and is maintained, clonus may occur, i.e. a contractile oscillation of 5 to 7 Hz, which persists for 40 to 60 cycles for as long as the stretching is maintained.

Spasticity is caused by a lesion in the central nervous system which affects the tractus pyramidalis (cerebral-spinal tract).
This interruption in central control releases the activity of the myotatic stretch reflex, which becomes hyperactive. As this stretch reflex is responsible for muscular tonus, hypertonia develops affecting mainly the antigravity muscles (extensions of the lower limbs and flexors of the upper limbs), since these contain more neuromuscular spindles than their antagonist muscles.

In time, spasticity leads to the shortening of muscle-tendon structures and a reduction in the range of articular movement, which can lead to stiffening and misalignment of the joints.

Use of neuromuscular electrical stimulation (NMES)
Starting in the neuromuscular bundles are afferent proprioceptive nerve fibres, which are directly associated with the α motor neurons of the same muscle and which are indirectly associated (via interneurons) with the α motor neurons of the antagonist muscle.
Stretching a muscle therefore stimulates the afferent proprioceptive nerve fibres of the neuromuscular bundles and they monosynaptically activate the α motor neurons of the muscle being stretched (myotatic stretch reflex) and inhibit, via an interneuron, the α motor neurons of the antagonist muscle (reciprocal inhibition reflex).

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

NMES of a muscle excites not only the α motor neurons of that muscle but also, and even more readily, the afferent proprioceptive nerve fibres which are contained in the neuromuscular bundle of the muscle and which have a lower stimulation threshold.
Stimulating these activates the α motor neurons of this muscle and also inhibits the α motor neurons of the antagonist muscle (reciprocal inhibition reflex). It is this last action that NMES uses in the treatment of spasticity: NMES of a muscle antagonist to a spastic muscle makes it possible to reduce the spasticity by inhibiting the α motor neurons of the spastic muscle via the reciprocal inhibition reflex.

This phenomenon of inhibiting α motor neurons through NMES of the antagonist muscle is clearly demonstrated by electromyography.

In fact, Hoffmann's reflex in a muscle, produced by a stimulus, is reduced in amplitude when the motor nerve of the antagonist muscle is stimulated.

NMES is an effective technique in the treatment of spasticity, not only because it reduces hypertonia, but also because it allows strengthening of the antagonist muscle as well preventive´or curative stretching of the retraction of the spastic muscles; this is much more effective than the conventional passive methods.

However, care must be taken in the treatment of spasticity to ensure that NMES is used correctly toachieve a positive effect. It is particularly necessary to avoid stimulating spastic muscle by diffusion, which can occur when the electrical energy is too high. It is also necessary that the antagonist muscle is tensed extremely gradually to avoid over-stretching the spastic muscle and thereby increasing its spasticity. This is achieved through the gradual rate of contraction specific to the Spasticity programme. Another particularity of this programme is the absence of all low frequencies, which can also increase spasticity by generating repeated micro-stretches of the spastic muscle.

Spasticity mainly affects the antigravity muscles of the lower limbs and the flexor muscles of the upper limbs, but out of these muscles, the ones most affected and the severity of spasticity vary greatly depending on the type of disorder of the cerebro-spinal tract (hemiplegia, tetraplegia, paraplegia or multiple sclerosis). Moreover, for the same type of disorder of the cerebro-spinal tract, the severity of spasticity and the muscles in which it is most apparent varies from one patient to another. For these reasons, each case has to be considered individually. It is therefore the task of the therapist to carry out an accurate clinical evaluation of each patient in order to select the muscles on which the treatment is to be concentrated.

In general, spasticity mainly affects the following muscles:
In the lower limbs:
- triceps surae
- quadriceps
- adductors
- gluteus maximus

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

In the shoulder:
- pectoralis major
- latissimus dorsi

In the upper limbs:
- biceps brachii
- flexors of the fingers and wrist

In the treatment of spasticity, NMES is applied to one or more of the following muscles, depending on the patient: tibialis anterior, extensor of the toes, lateral peroneal, hamstrings, tensor fascia lata, deltoid, supraspinatus, triceps brachii, extensors of the fingers and wrist.

16.11.2.1 Protocol

Spasticity: length of treatment to be adjusted depending on progress.
If the patient is experiencing associated pain symptoms, TENS stimulation can be performed in addition on the other channels.
In this case, the specific practical rules for TENS (electrode placement, regulation of intensity) should be followed for each channel used for this purpose.

16.11.2.2 Treatment frequency

One or two 20 to 30-minute sessions per day.

16.11.2.3 Electrode position

Place the electrodes on the muscle antagonist to the spastic muscle to be treated. The stimulation does not act on the spastic muscle, but on its antagonist.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.11.2.4 Patient position

The patient and body part being treated are positioned in such a way as to achieve the maximum range of motion. In fact, unlike the conventional rules for using NMES, it is worthwhile for these treatments to allow for isotonic contraction of the antagonist muscle, causing movement to the maximum range of motion, thus causing maximum stretching of the spastic muscle.

Lower limb:
leg: patient seated
thigh: prone position

Pelvic girdle:
supine position

Shoulder girdle:
patient seated, arm abducted at 30° to the body, elbow resting on an armrest

Upper limb:
patient seated
triceps: elbow in supination;
Extensors of the fingers and wrist: wrist in pronation

16.11.2.5 Stimulation energy

Always work with an energy that is too low to produce muscle fibre stimulation in the spastic muscles. The stimulation energy must however be adjusted manually so that the isotonic contraction of the antagonist muscle causes movement to the maximum range of motion, thus creating maximum stretch of the spastic muscle.
This action cannot be carried out if the agonist-antagonist imbalance is too great; this occurs when spasticity of a muscle exceeds the contraction strength of its atrophied antagonist. Stimulation then only allows for more or less reduced movement or even no movement at all.
However, the treatment should be carried out even in this situation, because stimulation, even subliminal, has a beneficial effect on the reduction of spasticity.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.11.2.6 Manual activation of stimulation

When the mi-SCAN is activated, the stimulation session starts automatically with a measurement of the chronaxy. This is a short test lasting around ten seconds, which allows the optimum duration of the stimulation pulse to be adjusted, ensuring maximum comfort. The energy should then be gradually increased to cause the first contraction of the antagonist muscle.

Each contraction is followed by a five-second rest period. Once this rest period has finished, press any button on any channel to trigger the next contraction.
By doing so, each contraction is triggered and therefore controlled by a manual action. This technique provides a clear psychological benefit for the patient, who can trigger contractions with his/her good hand, and it also makes it possible to work synchronously with the associated movements.

16.11.2.7 Associated actions

Passive mobilisation:
When the severity of spasticity causes a marked imbalance between the spastic muscle and its antagonist, and there is a risk of joint stiffness, the therapist can complete the movement induced by stimulation using passive mobilisation or gravity assisted posture

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.11.3 The hemiplegic hand

In hemiplegic patients, the hand and wrist show paresis or even paralysis with more or less pronounced spasticity of the flexor muscles and atrophy of the extensors. This highly debilitating situation can develop into retraction, stiffening and misalignment if regular treatment is not initiated.
This specific indication is an example of using the Spasticity programme for the area most commonly affected by debilitating spasticity.

16.11.3.1 Protocol

Spasticity
If the patient is experiencing associated pain symptoms, TENS stimulation can be performed in addition on the other channels.
In this case, the specific practical rules for TENS (electrode placement, regulation of intensity) should be followed for each channel used for this purpose.

16.11.3.2 Treatment frequency

One to two 20-minute sessions per day.

16.11.3.3 Electrode position

A single channel is sufficient to stimulate the extensor muscles of the fingers and the wrist.
- A small electrode is placed on the fleshy part of the epicondylar muscles approximately two finger-widths below the epicondyle.
- The second electrode, also small, is placed on the dorsal aspect of the forearm, where the lower and middle thirds meet.

The position of these electrodes must be adjusted so as to firstly obtain extension of the fingers, and then extension of the wrist.
Extension of the wrist alone with flexion of the proximal and distal interphalangeal joints will not produce optimum results.
Extension of the interphalangeal joints is therefore the first objective.

16.11.3.4 Patient position

The patient is seated beside a table. The elbow and forearm rest on the table, the shoulder is in a functional position, with the elbow bent and the hand in pronation.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.11.3.5 Stimulation energy

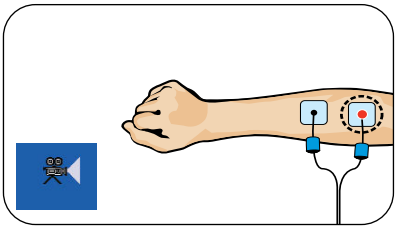
Always work with an energy that is too low to produce diffusion of stimulation to the flexors of the fingers and wrist.
Ideally, the stimulation energy should be adjusted so that the contraction of the extensors extends the fingers and wrist to the maximum range of movement.
The complete movement cannot be carried out if the spasticity of the flexor muscles exceeds the contraction strength of the atrophied extensors. Stimulation will only cause reduced movement, or even no movement at all in extreme cases.
Treatment with NMES should be carried out even in this situation, because even subliminal stimulation has a beneficial effect on the reduction of spasticity.
To complete the extension, passive stretching is also necessary.
Combined treatment of stimulation and passive motion is therefore given.

16.11.3.6 Manual activation of stimulation

When the mi-SCAN is activated, the stimulation session starts automatically with a measurement of the chronaxy. This is a short test lasting around ten seconds, which allows the optimum duration of the stimulation pulse to be adjusted, ensuring maximum comfort. The energy should then be gradually increased to cause the first contraction of the antagonist muscle.
Each contraction is followed by a five-second rest period.
Once this rest period has finished, press any button on any channel to trigger the next contraction.
By doing so, each contraction is triggered and therefore controlled by a manual action. This technique provides a clear psychological benefit for the patient, who can trigger contractions with his/her good hand, and it also makes it possible to work synchronously with the associated movements.

16.11.3.7 Associated actions

Passive mobilisation:
When contraction of the extensors is insufficient to mobilise the fingers and wrist to their maximum range, the movement should be completed by passive extension.
The electrically-induced contraction is allowed to develop until the maximum extension it can produce is achieved.
The movement is then completed by applying gentle and gradual pressure.



16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.11.4 The hemiplegic shoulder

Reminder
One of the specific problems commonly encountered in hemiplegic patients is subluxation of the paretic or paralysed shoulder.
Atrophy with loss of strength which affects the abductor muscles of the arms (deltoid and supraspinatus muscles) results in an inability to provide satisfactory support for the head of the humerus. In addition, more or less pronounced spasticity of the depressor muscles of the shoulder (pectoralis major and latissimus dorsi) causes a downward pull on the head of the humerus, which adds to the pull caused by the weight of the limb.
This situation commonly leads to the displacement of the head of the humerus from the glenoid cavity. Radiologically, it is clear that the axis of the anatomical neck of the humerus no longer passes through the centre of the glenoid cavity.
This is inferior subluxation.

This subluxated shoulder can often cause pain. The pain can remain localised around the shoulder, but can also radiate into the upper limb towards the hand through stretching of branches of the brachial plexus. Vasomotor and trophic disorders of the hand, such as those seen in algoneurodystrophy (complex regional pain syndrome) may be combined, resulting in classic shoulder-hand syndrome.

Use of neuromuscular electrical stimulation (NMES)
NMES of the abductor muscles of the arm (deltoid and supraspinatus) may be used to prevent or treat atrophy and reduce spasticity in the latissimus dorsi and pectoralis major muscles.
This technique is indicated in the prevent or treatment of subluxation of the shoulder in hemiplegic patients. Radiological investigations show evidence of re-centring of the humeral head in relation to the glenoid cavity.
Moreover, pain in the shoulder and upper limb often associated with subluxation is effectively reduced by this type of treatment. However, in the event of pain radiating in the upper limb, the analgesic action can be supported by using TENS (Gate control), which is programmed on the third and fourth channel.
In shoulder-hand syndrome, in addition to shoulder pain, which is itself a secondary problem associated with hemiplegia, complex regional pain syndrome (CRPS) can occur, which affects the hand. In this situation, CRPS should be treated using the programmes and method described in this chapter, which deal with this disorder (algoneurodystrophy).

16.11.4.1 Protocol

The hemiplegic shoulder

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16.11.4.2 Treatment frequency

One 25-minute session per day, five days per week, for 4 weeks.
Regular treatment carried out in one single session per week may then be necessary in the absence of significant recovery or the persistence of considerable spasticity of the pectoralis major muscle.

16.11.4.3 Electrode position

Two channels are used to stimulate the abductor muscles of the arm.
One channel for the deltoid and the other for the supraspinatus.
• A small electrode is placed on the lateral aspect of the shoulder, in the middle of the deltoid muscle;
• another small electrode is placed on the outer part of the supraspinatous fossa.

For optimum effectiveness, the positive pole should preferably be positioned on the small electrodes which correspond to motor points. The negatives poles are connected to the two outputs of a large electrode placed on the acromion like an epaulette.

If there is painful irradiation towards the hand and forearm, TENS stimulation is available on channels 3 and 4.

For TENS, two large electrodes are used for each channel, positioned to cover or follow the painful area or irradiation.

16.11.4.4 Patient position

The patient is seated beside a table, with his/her elbow and forearm resting on a cushion on the table.

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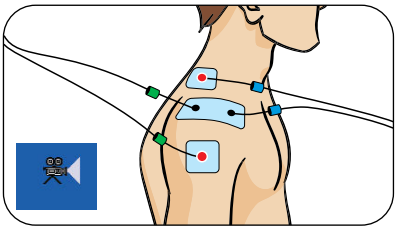
16.11.4.5 Stimulation energy

The energy is gradually increased for each contraction until the maximum tolerable energy level is reached. The therapist plays a fundamental role in encouraging and reassuring the patient, who can then tolerate levels of energy that produce powerful contractions.

If the TENS programme is used on channels 3 and 4, the energy will be adjusted on these channels so that the patient clearly feels moving tingling.
However, care must be taken to ensure that the energy is low enough to avoid any muscle contraction.



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16.12 Treatment of venous insufficiency

Unlike occasionally experiencing heavy legs, venous insufficiency is a result of organic damage to the vein walls which clinically manifests as large or small varicose veins. These are the result of a permanent dilation, secondary to the hyperpressure and stasis of the venous blood, to which is added progressive hypoxia of the intima (inner layer of the wall).
The deficiency of the valves of the deep veins and the perforating veins is behind this process. Their role in preventing the regurgitation of venous blood is no longer guaranteed. Hydrostatic pressure is accentuated and muscle contractions are no longer sufficient to evacuate the venous blood.
The blood stagnates and causes hyperpressure in the superficial veins until varicose distensions are produced.
Stasis oedema is often associated with venous insufficiency, but not always. Moreover, this oedema may be present or absent in the same patient, depending on the time of day and how much time the patient has spent standing up.

We must therefore distinguish between:
e. Venous insufficiency without oedema.
f. Venous insufficiency with oedema.

The implications for the type of the electrostimulation programme are different depending on whether there is or is not an oedema associated with varicose veins.

16.12.1 Venous insufficiency without oedema

On one hand, electrical stimulation must allow for an increase in the general blood flow (arterial as well as venous) so as to improve the circulation of the interstitial fluid and increase oxygenation of the tissues and the intima of the veins. On the other hand, it is necessary to drain the veins as much as possible to combat stasis. The increase in arterial flow (and therefore capillary flow, and therefore venous flow) is achieved by means of the optimum low frequency for increase of flow, i.e. 8 Hz.
The deep veins are drained by being compressed, which is caused by tetanic contractions of the leg muscles. The programme therefore consists of short tetanic contractions of the leg muscles, separated by long active pauses to increase the flow.

16.12.1.1 Protocol

Venous insufficiency 1

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

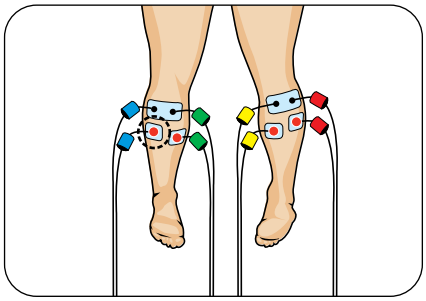
16.12.1.2 Treatment frequency

3 to 6 sessions per week for approximately 6 weeks to treat the acute episode.
It is then recommended to keep up treatment with a few weekly sessions.

16.12.1.3 Electrode position

Two channels are required for each leg.

- A small electrode is placed just under the head of the fibula on the common peroneal nerve, and
- another small electrode in the upper part of the popliteal fossa over the tibial nerve.
  For optimum effectiveness, the positive poles should preferably be positioned on these two small electrodes.
- The two other negative poles are connected to the two outputs of a large electrode placed on the upper part of the calf, just below the popliteal fossa.



16.12.1.4 Patient position

The patient must be in a supine position with his/her legs inclined so that gravity encourages venous return.

16.12.1.5 Stimulation energy

For the draining stage (contraction): the energy must be gradually increased until a significant and balanced contraction is being caused for all stimulated muscles.
For the activation stage of blood circulation: the energy must be increased until clearly visible muscle twitches are obtained.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.12.2 Venous insufficiency with oedema

The presence of oedema, particularly when it does not go upon wakening, completely changes the electrical stimulation programme.
Oedema is caused by blood plasma leaking through the venous membranes, due to hyperpressure in the distal veins. In this case, it is not possible to use the low arterial flow increase frequencies because they reduce peripheral vascular resistance, increase the perfusion pressure of the capillaries and risk aggravating the oedema.
On the other hand, tetanic contractions encourage drainage of the deep veins and drainage of the oedema, provided they are carried out in a certain order and under certain conditions.
The most effective way consists of producing an initial ejection effect in the leg and then in the thigh, without relaxing the compression of the deep veins in the leg.
In this way, the venous blood is pushed in the first stage towards the thigh by a contraction of the leg muscles.
Then, in the second stage, the contraction of the thigh muscles eject the blood upwards, provided however that the leg muscles remain contracted to prevent regurgitation.

16.12.2.1 Protocol

Venous insufficiency 2

16.12.2.2 Treatment frequency

3 to 6 sessions per week for approximately 6 weeks to treat the acute episode.
It is then recommended to keep up treatment with a few weekly sessions.

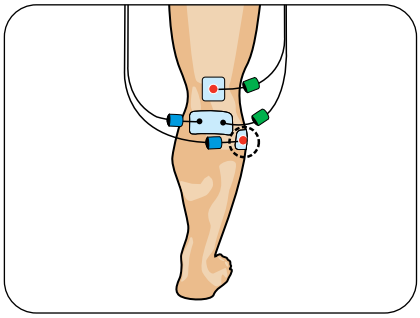
16.12.2.3 Electrode position

It is necessary to work in staggered contractions mode.
This means that only channels 1 and 2 start to produce a tetanic contraction, while channels 3 and 4 are at rest.
After 3 seconds of tetanic contraction via channels 1 and 2, the contraction starts only on channels 3 and 4, while the contraction induced by channels 1 and 2 continues.
After 3 seconds of simultaneous contraction on the four channels, there is a complete rest phase of 20 seconds on the four channels.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

For this program, it is therefore particularly important to follow the order of channel numbers below:

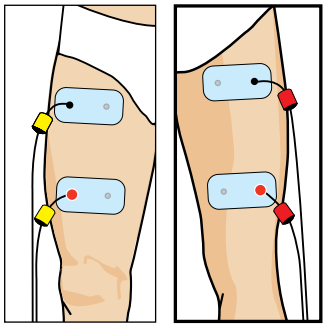
For the calf (channels 1 and 2):
- A small electrode is placed just under the head of the fibula on the common peroneal nerve, and
- another small electrode in the upper part of the popliteal fossa over the tibial nerve.
  For optimum effectiveness, the positive pole should preferably be positioned on these two small electrodes.



For the thigh (channels 3 and 4):
For the quadriceps (channel 3):
- a large electrode is placed diagonally on the lower third of the quadriceps,
- a second large electrode is placed at the top of the thigh.
  For optimum effectiveness, the positive pole should preferably be positioned on the large lower electrode.

For the hamstrings (channel 4):
- a large electrode is placed diagonally on the lower third of the hamstrings,
- a second large electrode is placed diagonally on the upper third of these muscles. For optimum effectiveness, the positive pole should preferably be positioned on the large lower electrode.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS



The two other negative poles are connected to the two outputs of a large electrode placed on the upper part of the calf, just below the popliteal fossa.

16.12.2.4 Patient position

The patient must be in a supine position with his/her legs inclined so that gravity encourages venous return.

16.12.2.5 Stimulation energy

Adjust the stimulation energy to obtain significant contractions for the 4 channels and if possible, at a higher level on channels 1 and 2 than on channels 3 and 4.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.13 Treatment of arterial insufficiency in the lower limbs

We will limit this chapter to insufficiency of the arteries in the lower limbs.
High blood pressure, smoking, cholesterol and diabetes are among the main causes of progressive deterioration of the arterial walls (arteriosclerosis).
This presents as narrowing of the arteries with, consequently, a reduction in the blood flow in the tissues downstream of the narrowed arteries.
The less well irrigated tissues suffer and become hypoxic, all the more so because the width of the arteries has shrunk and more intense activity requires more oxygen.

Arterial insufficiency in the lower limbs is conventionally divided into four clinical stages. These four stages (I, II, III, and IV) depend on the approximate severity of the loss of blood flow and the tissue-related consequences.

Stage I is asymptomatic. In a clinical examination, an arterial murmur can be heard, which is evidence of narrowing, although the patient has no complaint.

In **Stage II**, the reduction in the flow causes pain in the legs when walking. At rest, the flow is sufficient, but it cannot meet tissue requirements during physical activity: the patient suffers from "intermittent claudication" (IC).
This means that pain occurs after walking a certain distance (the shorter the distance, the more severe the condition); in the end, this pain makes the patient stop: then, after a recovery period, the pain lessons and the person can resume walking until the cycle starts again.

Stage III is characterised by constant pain, including when at rest. Blood flow is so reduced that the tissues constantly suffer from hypoxia with a continual presence of acid metabolites.

Stage IV corresponds to suffering that is so advanced that tissue necrosis with gangrene occurs. This is then called critical ischaemia, a condition which often leads to amputation.

Only Stages II and III can benefit from treatment by electrostimulation.
Stage IV is an emergency situation and requires surgical treatment.
Stage I is asymptomatic and the patient has no complaint.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.13.1 Stage II arterial insufficiency

With intermittent claudication (Stage II), the muscle fibres suffer from an oxygen shortage during physical activity.
The narrowed arteries cannot meet the fibres' need for oxygen, which increases with walking.
With a chronic reduction in blood flow and a lack of oxygen, the capillary network degenerates and the fibres lose their oxidative power.
They use the little oxygen that they still receive increasingly badly.
Therefore, the problem becomes twofold: very little oxygen provided and poor use of what oxygen there is. Low frequency stimulation can act on the fibres' capacity to use oxygen.
Considerable studies have shown that low frequency stimulation leads to an improvement in the oxidative capacity of the stimulated muscle (increase in the number and size of mitochondria, increase in oxidative enzymatic activity). Electrostimulation therefore improves the tolerance of muscle fibres to physical activity in the case of arterial insufficiency and thus increases the walking range of patients suffering from intermittent claudication.

16.13.1.1 Protocol

Arterial insufficiency 1

16.13.1.2 Treatment frequency

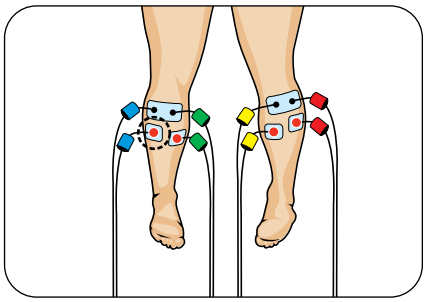
5 sessions per week for 12 weeks to treat the acute episode.
It is then recommended to keep up treatment with a few weekly sessions.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.13.1.3 Electrode position

Two stimulation channels are required for each leg.

- A small electrode is placed just under the head of the fibula on the common peroneal nerve, and
- another small electrode in the upper part of the popliteal fossa at the nerve trunk of the tibial nerve. For optimum effectiveness, the positive pole should preferably be positioned on these two small electrodes.
- The two other negative poles are connected to the two outputs of a large electrode placed on the upper part of the calf, just below the popliteal fossa.



16.13.1.4 Patient position

Place the patient in a comfortable position.

16.13.1.5 Stimulation energy

Adjust the stimulation energy to the maximum level the patient can tolerate, to recruit as many fibres as possible.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.13.2 Stage III arterial insufficiency

The same benefit can be obtained using low frequency electrostimulation in Stage III arterial insufficiency. In this case, because of the more severe obstruction of the arterial width and the more serious deterioration of the muscle qualities, stimulation frequencies lower than those used for intermittent claudication must be used.
To carry out a Stage III arterial insufficiency session, we will proceed in the same way as in stage II, but using a programme adapted to more severe deterioration of the arterial capital.

16.13.2.1 Protocol

Arterial insufficiency 2
The protocol is absolutely identical, apart from the patient position.

16.13.2.2 Patient position

The difficulty with which the arterial blood is transported to the distal extremities makes it preferable to position the patient in such a way that gravity aids the arterial circulation.
The patient is therefore placed on a comfortable seat in such a way that does not compress the posterior arterial trunks.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.14 Urinary incontinence

This section deals with the treatment of female incontinence. It describes the practical method established on the basis of the following publications:

Fall M, Lindström S,
Electrical Stimulation: A Physiologic Approach to the Treatment of Urinary Incontinence. Urologic Clinics of North America 18: 393 - 407, 1991

Plevnik S, Vodusek DB, Vracnik P,
Optimization of pulse duration for electrical stimulation in treatment of urinary incontinence. World J Urol 4: 22 - 23, 1986

Lindström S, Fall M, Carlsson CA,
The neurophysiological basis of bladder inhibition in response to intravaginal electrical stimulation.
J Urol 129: 405 - 410, 1983

Fall M, Erlandson BE, Sundin T,
Intravaginal electrical stimulation: Clinical experiments on bladder inhibition. Scand J Urol Nephrol Suppl 44: 41, 1978

Amaro JL, Gameiro MOO, Padovani CR,
Treatment of urinary stress incontinence by intravaginal electrical stimulation and pelvic floor physiotherapy. Int. Urogynecol. Journal 14: 204 - 208, 2003

Two types of urinary phase are recognized: short voluntary micturition phases separated by long collecting phases during which the bladder gradually fills.

Continence, i.e. the absence of urine loss during the collecting phase, requires firstly a relaxed bladder and secondly a permanent closure of the sphincter urethrae. Impairment of one of these two elements results in urinary incontinence. Clinically, a distinction is made between three types of incontinence.

1 Urge incontinence:
The bladder contracts abnormally (detrusor overactivity) and presses on the urine, increasing the pressure within the bladder.

2 Stress incontinence:
The sphincter urethrae is deficient and cannot remain closed in the event of a sudden and significant increase in abdominal pressure (exertion, coughing, etc.).

3 Mixed incontinence (urge and stress incontinence):
Combination of urge and stress incontinence in greater or lesser proportions.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.14.1 Urge incontinence

Since this type of incontinence is due to detrusor (smooth muscle of the bladder) overactivity, the treatment is concerned with reducing the activity of this muscle.

The detrusor is controlled by the parasympathetic nervous system, which increases its activity, and by the orthosympathetic system, which reduces it.

Various mechanisms act to inhibit detrusor activity. These include an inhibitory reflex originating in the sensitive nerve fibres of the vaginal area. Excitation of these afferent fibres (originating in branches of the internal pudendal nerve) has a dual inhibitory effect on the detrusor:

1 By activating the inhibitory orthosympathetic neurons.

2 By central inhibition of activation of parasympathetic motor neurons.

Electrical excitation of these afferent fibres produces an optimum inhibitory effect with:
- A frequency of 5 Hz by the orthosympathetic route
- A frequency of 5 to 10 Hz by the central route.

16.14.1.1 Protocol

Urge incontinence:
Weeks 1 – 3.

16.14.1.2 Treatment frequency

Three sessions per week.

16.14.1.3 Electrode position

Use of an intravaginal probe.

16.14.1.4 Patient position

The patient reclines on her back on a couch with a cushion under the buttocks and the knees flexed at 90°, feet flat on the couch.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.14.1.5 Stimulation energies

Gradually increase the energies until the patient feels the stimulation, i.e. five pulses per second. Then, increase the energies again to a value equal to three times that of the perception threshold.

16.14.2 Stress incontinence

Three concentric elements operate in the area of the sphincter urethrae:

1 - The smooth muscles of the urethra.
2 - The intramural striated sphincter.
3 - The paraurethral components of the striated pelvic floor musculature.
The intramural striated sphincter is composed exclusively of slow fibres (type I), while the paraurethral components also contains fast fibres (type IIb).

The intramural striated sphincter is therefore resistant to fatigue but not strong. It is able to maintain a prolonged closure of the bladder; but it is unable to withstand a sudden and intense increase in pressure within the bladder, for example during coughing. In this case, it is the fast fibres of the paraurethral muscle that have to maintain continence by contracting strongly during the brief moment when pressure is increased.

Normally, the paraurethral components of the striated muscle of the pelvic floor is capable, by contracting, of generating a urethral closing pressure well above that produced in the bladder during coughing. But when these muscles are unable to develop sufficient strength rapidly enough at the appropriate moment, urine escapes from the bladder. This is stress incontinence.

The objective of any treatment of this type of incontinence is to strengthen the sphincter. In order to do this, it is necessary to use a programme that brings about tetanic contractions of the paraurethral components of the pelvic floor musculature, using fast fibre tetanization frequencies.

16.14.2.1 Protocol

Stress incontinence:
weeks 1 – 3.

16.14.2.2 Treatment frequency

Five sessions per week.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.14.2.3 Electrode position

Use of an intravaginal probe.

16.14.2.4 Patient position

The patient reclines on her back on a couch with a cushion under the buttocks and the knees flexed at 90°, feet flat on the couch.

16.14.2.5 Stimulation energy

It is always necessary to work with the maximum tolerable energy. It is therefore important to regularly increase the energy level during the session every 3 or 4 contractions. The therapist plays a decisive role in reassuring the patient and encouraging her to work with the strongest possible contractions.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.14.3 Mixed incontinence (urge and stress incontinence)

Many patients do not exhibit well defined urge or stress incontinence. Often a mixture of the two forms is present in varying proportions; it is difficult in these situations to establish which is the predominant symptom.

Electrical stimulation treatment is particularly advantageous in this type of incontinence, particularly with Compex equipment. The stimulator is able to provide combined treatment to inhibit the detrusor and strengthen urethral closure in the same session and using the same stimulation programme.

The sphincter urethrae is strengthened by means of tetanic contractions with the optimum fast fibre tetanization frequency. Between the tetanic contractions, during the resting phase, a very low frequency pulse (5 Hz) allows for detrusor inhibition.

16.14.3.1 Protocol

Mixed incontinence:
weeks 1 – 3.

16.14.3.2 Treatment frequency

Five times per week.

16.14.3.3 Electrode position

Use of an intravaginal probe.

16.14.3.4 Patient position

The patient reclines on her back on a couch with a cushion under the buttocks and the knees flexed at 90°, feet flat on the couch.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.14.3.5 Stimulation energy

The energy levels are set separately, starting with the energy level of the very low-frequency inhibition of the detrusor at the beginning of the session. Then between contractions, the energy level of the tetanic reinforcement contractions is adjusted.

1
During the very low frequency inhibition of the detrusor (duration 24" at the beginning of the session and between the contractions): it is necessary to use a energy equal to three times that of the perception threshold. The energy will gradually be increased until the patient feels 5 pulses per second. Once this threshold value has been determined, the energy will gradually be increased until three times the initial energy is reached.

2
During tetanic contractions (duration of contraction 4"): it is necessary to work with the maximum tolerable energy at all times. Therefore, it is important to regularly increase the energy during the session every 3 or 4 contractions. The therapist plays a decisive role in reassuring the patient and encouraging her to work with the strongest possible contractions.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.14.4 Postpartum prevention

Pregnancy, and, to an even greater extent, delivery, cause significant trauma to the pelvic region. The consequences of this trauma are varied: strained muscles, torn muscles, partial denervation, loss of body image, loss of strength and control of the striated muscles of the pelvic floor, etc. Urinary incontinence is a relatively common problem in this situation, which is why prophylactic pelvic re-training treatment by neuromuscular electrostimulation is indicated.

16.14.4.1 Protocol

Postpartum prevention:
weeks 1 – 3.
The treatment can start 6 to 8 weeks after delivery.

16.14.4.2 Treatment frequency

Three times per week.

16.14.4.3 Electrode position

Use of an intravaginal probe.

16.14.4.4 Patient position

The patient reclines on her back on a couch with a cushion under the buttocks and the knees flexed at 90°, feet flat on the couch.

16.14.4.5 Stimulation energy

It is necessary to work with the maximum tolerable energy at all times. It is therefore important to regularly increase the energy level during the session every 3 or 4 contractions. The therapist plays a decisive role in reassuring the patient and encouraging him/her to work with the strongest possible contractions.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.15 Denervated muscle electrostimulation

16.15.1 Situation 1 – Total denervation outside the time

Example: PARALYSIS OF THE AXILLARIS NERVE

Questioning the patient gives us the following information:

- The level of the injury: This is a complication of a complex fracture of the shoulder.
- The date of the injury: The accident occurred 9 months ago.

Question n° 1: Are you outside or within the re-innervation time?

The distance between the injury and the motor point of the deltoid can be assessed at 6/8 cm. The re-innervation time is therefore 3 months, or 6 months at most. As the injury is 9 months old, there is therefore no hope of re-innervation.

Question n° 2: Is the denervation total or partial?

Testing for total or partial denervation of the deltoid

16.15.1.1 Protocol

Disuse atrophy, level 1.

16.15.1.2 Electrode position

Use two channels, one for the anterior fascicle and the other for the centre fascicle of the deltoid. A positive electrode is placed on the motor point of the medial part, a few centimetres below the outer edge of the acromion. Another positive electrode is centred on the fleshy body of the anterior fascicle. The two negative connections are connected to a large electrode positioned on the shoulder.

16.15.1.3 Stimulation energy

The energy will be gradually increased until significant figures are reached (above 40 or 50 mA).

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.15.1.4 Results

No muscular contraction of the deltoid is observed, either visually or by palpation. It can then be concluded that denervation is total

CONCLUSION
Our patient has paralysis of the axillaris nerve with total denervation of the deltoid, with no hope of re-innervation.

PRACTICAL THERAPEUTIC APPROACH
Electrostimulation of the deltoid, using Denervated programmes, is of very little value here. Whatever is done, a denervated muscle without any hope of re-innervation will always end up atrophying and sclerosing. Rehabilitation can then be solely palliative.

16.15.2 Situation 2 - Partial denervation outside the time

Example: PARALYZED SCIATIC

Questioning the patient gives us the following information:

- The level of the injury: Radicular compression L4 - L5 following a discal hernia.
- The date of the injury: The patient has had a steppage gait for at least 3 years.

Question n° 1: Are we outside or within the re-innervation time?

The distance between the injury and the motor points of the muscles of the anteroexternal part of the leg can be estimated at 65 or 70 cm. The re-innervation time is therefore around 24 months here; as our patient's injury goes back more than three years, there is no longer any hope of reinnervation.

Question n° 2: Is the denervation total or partial?

Testing for total or partial denervation of the muscles of the antero-external part of the leg

16.15.2.1 Protocol 1

Disuse atrophy, level 1.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.15.2.2 Electrode position

Use one stimulation channel. The small, positive electrode is placed under the head of peroneous where the lateral popliteal nerve passes through. The negative electrode (large) is placed crosswise at mid-height of the outside of the leg.

16.15.2.3 Results

By increasing the current strength gradually, an incomplete dorsal bending movement of the ankle can be seen as well as a hint of an eversion movement of the foot.

CONCLUSION
Our patient has paresis of the sciatic nerve with partial denervation of the muscles of the antero-external part of the leg; there is no hope of re-innervation for the denervated fibres.

PRACTICAL THERAPEUTIC APPROACH
Electrostimulation of the muscles of the antero-external part of the leg, using Denervated programmes, is of no value. In fact, denervated fibres with no hope of re-innervation will always end up atrophying and sclerosing.

On the other hand, it might be worthwhile to work on the innervated part of the paretic muscles by means of neurostimulation with rectangular biphasic pulses in order to achieve hypertrophy of the innervated fibres to compensate for the denervated ones (compensating hypertrophy).

16.15.2.4 Protocol 2

Disuse atrophy, level 1:
weeks 1 and 2.
Disuse atrophy, level 2:
weeks 3 to 6 - 8.

16.15.2.5 Electrode position

Use one stimulation channel. The live electrode (the smallest one) is placed under the head of peroneous where the lateral popliteal nerve passes through. The negative electrode (large) is placed crosswise at mid-height on the outside of the leg.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.15.2.6 Treatment frequency

Three times a week for six to eight weeks. Then, maintenance of what has been achieved at a rate of one session every two weeks.

16.15.2.7 Patient position

The patient, with bare feet, is placed in a standing position; his weight is on the inside of the foot to combat the movement caused by the electrically induced contraction.

16.15.3 Situation 3 - Total denervation within the time

Example: PARALYSIS OF THE RADIALIS NERVE

Questioning the patient gives us the following information:

- The level of the injury: This paralysis is the result of a fracture of the humerus.
- The date of the injury: The fracture occurred 4 months ago.

Question n° 1: Are we outside or within the reinnervation time?

The distance between the injury and the motor points of the extensor muscles of the wrist and fingers can be estimated at about twenty centimetres; the reinnervation time will therefore be around 7 months (9 months at most); as the trauma only goes back 4 months, we are within the re-innervation time.

Question n° 2: Is the denervation total or partial?

Testing for total or partial denervation of the extensor muscles of the wrist and fingers

16.15.3.1 Protocol 1

Disuse atrophy, level 1.

16.15.3.2 Electrode position

Use one stimulation channel. The small positive electrode is placed on the fleshy part of the epicondylus muscles, a small negative electrode is placed a few centimetres below on the dorsal side of the forearm.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.15.3.3 Stimulation energy

The energy level will be gradually increased until significant values are obtained.

16.15.3.4 Results

No muscular contraction of the extensors of the wrist and fingers is observed, either visually or by palpating. It can be concluded, therefore, that denervation is total.

CONCLUSION
Our patient has paralysis of the radialis nerve with complete denervation of the extensor muscles of wrist and fingers. There is hope of re-innervation.

PRACTICAL THERAPEUTIC APPROACH
In this case the purpose of rehabilitation is going to be to prevent atrophy as much as possible and limit the phenomenon of sclerosis pending possible re-innervation.

Here the preferred technique is going to be stimulation of the extensor muscles of wrist and fingers by means of Denervated programmes. To stimulate a fully denervated muscle wide rectangular pulses will be used (between 50 and 200 ms) as the denervated fibre can only be slightly excited. It therefore needs a large amount of electrical charge to reach its excitation threshold.

16.15.3.5 Protocol 2

Total automatic or Total manual

Unless the exact stimulation parameters are known (for that one would have to have the precise results of a recent electromyograph), it is recommended that the Total automatic programme be used (Physio will work with default figures).

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.15.3.6 Choice and position of the electrodes

Self-adhesive electrodes are not very suitable for stimulating denervated muscles. It is preferable to use soft carbon electrodes, the size of which should be chosen so that the electrodes can cover all the fibres of the muscle you need to stimulate.
In the Denervated programme, we work in bipolar mode, i.e. the positive and negative poles are immaterial.

After being coated with gel, the two electrodes will be positioned crosswise on the fleshy part of the muscle (thus avoiding the tendinous parts); the size of the electrodes will have been previously determined so that they cover the muscle fibres as much as possible; they must therefore cover the full width of the muscle.

16.15.3.7 Stimulation intensities

The maximum tolerable intensity should always be used in order to obtain the greatest spatial recruitment possible. For safety reasons, in the Denervated programme, the maximum intensity strength is limited to 30 mA.

16.15.3.8 Stimulation frequency

In automatic mode, the pulses are 100 ms wide and are repeated every two seconds (frequency 0.5 Hz). The muscle fibres respond to each pulse with a single twitch.

16.15.3.9 Duration and frequency

The treatment lasts for 8 minutes and must be repeated 5 times a week until possible re-innervation is achieved. It will be abandoned as soon as the re-innervation time has elapsed.

During rehabilitation, it is desirable to test the denervated muscles regularly with the Disuse atrophy programme in order to check for the possible start of reinnervation, in which case it is appropriate to choose triangular shaped pulses, i.e. the form suitable for stimulation of partly denervated muscles (see Situation 4 below).

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.15.4 Situation 4 – Partial denervation within the time

Example: PARALYSIS OF THE LATERAL POPLITEAL NERVE

Questioning the patient gives us the following information:

- The level of the injury: This is a complication of a total knee prosthesis.
- The date of the injury: The operation was carried out 45 days ago.

Question n° 1: Are we outside or within the re-innervation time?
The distance between the injury and the motor points of the muscles of the antero-external part can be assessed at about fifteen centimetres; the re-innervation time will therefore be around 5 months. As the injury only goes back a month and a half, we are within the re-innervation time.

Question n° 2: Is the denervation total or partial?

Testing for total or partial denervation of the muscles of the antero-external part of the leg

16.15.4.1 Protocol 1

Disuse atrophy, level 1.

16.15.4.2 Electrode position

Use one stimulation channel. A small, positive electrode is placed under the head of peroneous where the lateral popliteal nerve passes through. The negative electrode (large) is placed crosswise at mid-height on the outside of the leg.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.15.4.3 Results

By gradually increasing the current, an incomplete dorsal flexing movement of the ankle is seen as well as a hint of an eversion movement of the foot.

CONCLUSION
Our patient has paresis of the lateral popliteal nerve with partial denervation of the muscles of the antero-external part of the leg; there is hope of reinnervation for the denervated fibres.

PRACTICAL THERAPEUTIC APPROACH
With a denervated muscle, several therapeutic choices are available to the rehabilitating physiotherapist. See Choice of pulse shape and parameters (Denervated muscles – Theory).

Depending on the clinical circumstances and the school we subscribe to, we can work on the innervated part of the muscle using the short duration rectangular biphasic pulses supplied by the Neurostimulation programmes.
However, it seems necessary to try to prevent atrophy and limit the phenomenon of sclerosis of denervated fibres. To do this, use the sloped pulses of the Partial automatic or Partial manual programmes.

16.15.4.4 Protocol 2

Partial automatic or Partial manual.
Unless the exact stimulation parameters are known (for that one would have to have the precise results of a recent electromyograph), it is recommended that the Partial automatic programme be used (Physio will work with default figures).

16.15.4.5 Choice and position of the electrodes

Self-adhesive electrodes are not very suitable for the stimulation of denervated muscles. It is preferable to use soft carbon electrodes, the sizes of which should be chosen so that the electrodes cover all the fibres of the muscle you need to stimulate.
In the Denervated programme, we work in bipolar mode, i.e. the positive and negative poles are immaterial.

After being coated with gel, the two electrodes will be positioned crosswise on the fleshy part of the muscle (therefore avoiding the tendinous parts); their size will previously have been determined so that they cover the muscle fibres as much as possible. They must therefore cover the full width of the muscle.

16. HOW TO USE THE REHAB/THETA/PHYSIO ON SPECIFIC INDICATIONS

16.15.4.6 Automatic ramp search

Place the electrodes on the muscle to be stimulated and validate the choice of the Partial automatic (or manual) programme by pressing “START”.

The programme begins with an automatic ramp search on each stimulation channel in turn. The automatic ramp search works as follows: every half second (500 ms) the stimulator creates a 100 ms wide pulse, the ramp of which increased progressively. As soon as the start of muscle response is observed, press the “+” or “-” key located under the “MEMO” icon. The stimulator then memorizes the slope. The ramp search then begins on the following channel. It is thus possible to work with 4 channels, and each stimulation channel will have the ramp appropriate to the state of the stimulated muscle.

16.15.4.7 Stimulation intensities

The maximum tolerable intensity should always be used in order to obtain the greatest spatial recruitment possible.

For safety reasons, in the Denervated programme, the maximum intensity is limited to 30 mA.

By increasing the intensity strength, Compex 3 adjusts the pulse width so that the ramp remains constant.

16.15.4.8 Stimulation frequency

The triangular pulses are repeated every two seconds (frequency: 0.5 Hz).
The muscle fibres respond to each pulse with a single twitch.

16.15.4.9 Duration and frequency

The treatment lasts for 8 minutes and must be repeated 5 times a week until re-innervation is achieved. It will be abandoned as soon as the re-innervation time has elapsed.

If re-innervation is only partial, once the time has elapsed, a disuse atrophy treatment on card 1 must be used in order to achieve compensating hypertrophy (see Situation 2).

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