Electrotherapy

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Electrotherapy

- Means the use of electrical currents for the treatment of
  - Acute and chronic pain
  - Muscle atrophy
- Different currents are used
  - Low-frequency (e.g. TENS)
  - Medium frequency

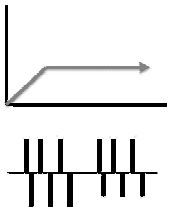
Scribonius Largus (ca. 30 bis 54 n. Chr.)

Terminology

- American Physical Therapy Assoc.
  - NMES – neuromuscular electrical stimulation
    - Stimulation of a target muscle or tissue via an intact nerve
  - TENS – transcutaneous electrical nerval stimulation
    - A form of NMES – pain
  - EMS – Electrical muscle stimulation
    - Direct stimulation of an enervated muscle

Current Types

- Direct current
  - Current flows continuously in one direction
- Alternating current
  - Current reverses its direction of flow at defined intervals
- Pulsed current
  - C. flows in pulses or bursts instead of a continuous flow commonly used in PT



Pulse Parameter

- Frequency
  - Number of pulses/second (Hz)
- Intensity
  - Corresponds to the amplitude of a pulse
- Pulse duration
  - The width or duration of a pulse (ms)

Biological effects 1

Motor response

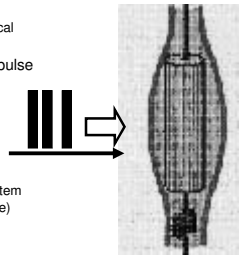
- A normally innervated muscle responses to electrical stimulation according to the frequency

Low Frequency

- Single pulse — single twitch — Anzahl der Impulse
- < 10 Hz — multiple twitches
- > 10 Hz — tetanic contraction (muscle contraction last longer than the duration of the pulse) – increase of muscle strength
- 20 – 80 Hz — increase muscle tone
- > 100 Hz — rapid fatigue of the neuromuscular system Myokymia (decrease muscle tone)

Medium Frequency

- 1 – 100 kHz — Nerves can not be stimulated at these frequencies
- 2.500 Hz — Widely used for muscle strengthening



Important!

- Although 20 – 80 Hz are used do increase muscle tone
- The resulting muscle contraction is not a physiological muscle work
- Use low frequencies together with active exercises
- Russian type provokes a more physiological response

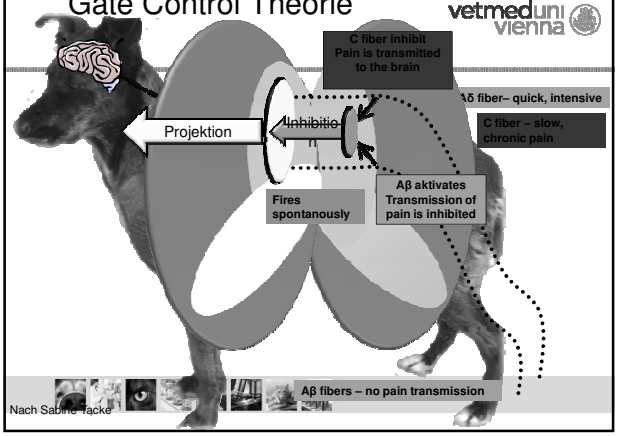
Biological effects 2

- Hyperaemia
  - Is due to
    - Muscle work - functional hyperaemia
    - Release of endogenous vasodilators - dilatation of the arterioles

Biological effects 2

- Analgesia
  - Gate control theory
  - Reduction of muscle tone
  - Stimulation of blood flow
  - Endogenous endorphin release

Gate Control Theorie



Indications

- Pain management
  - Osteoarthritis
  - Spondylosis, spondylarthrosis
  - After orthopedic surgery
- Muscle tension
- Prevention of muscle atrophy

Precautions/Contraindications

- Causal treatment of pain (underlying disease)
- Anesthetized areas of skin
- Acute inflammation
- Tumours
- Infectious diseases

TENS

Transcutaneous Electrical Nerve Stimulation

Is used in PT for
- orthopedic and neurological disorders
- especially if acute or chronic pain is present
- to treat or prevent muscle atrophy

Indications

- Pain management
  - Osteoarthritis
  - Spondylosis, spondylarthrosis
  - After orthopedic surgery
- Muscle tension
- Prevention of muscle atrophy
  - Always in combination with motion exercises

Precautions/Contraindications

- Causal treatment of pain (underlying disease)
- Anesthetized areas of skin
- Acute inflammation
- Tumours
- Infectious diseases

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Operating Methods

High frequency – low intensity

- Relatively low, sensitive threshold doses
- Relatively high frequencies (50-150 Hz)
- Mechanism: Gate control system

- Intensity is increased until the patient feels a tingling sensation
- No pain or muscle contractions should be induced

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Operating Methods

High intensity – low frequency

- Pulses of approx. 0.2 ms
- 2-4 Hz frequency
- Mostly for acupuncture points
- Intensity: visible muscle contractions
- Mechanism: endogenous endorphins

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Operating Methods

BURST – TENS

- Bursts of pulses: 1-5 times a second
- Frequency: 40-150 Hz
- Higher intensity than that of high frequency/low intensity TENS

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Operating Methods

Modulated TENS

- Automatic variation of pulse duration, frequency and amplitude
- Prevents accommodation

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Technique 1

- Electrode placement

- Local
- Segmental
- Over acupuncture points
- Over trigger points

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Local

- Along the edges of the painful area
- Over the most painful point
- Medial and lateral of joints

- Indications
  - Chronic disorders

- Precautions
  - Implants
  - Acute inflammation
  - Skin diseases

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Local - Joints


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Local - Spine


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Segmental

- Electrodes are placed over the nerve root of the corresponding spinal segment
- Indications
  - Acute conditions
  - Multiple joint involvement
  - Implants

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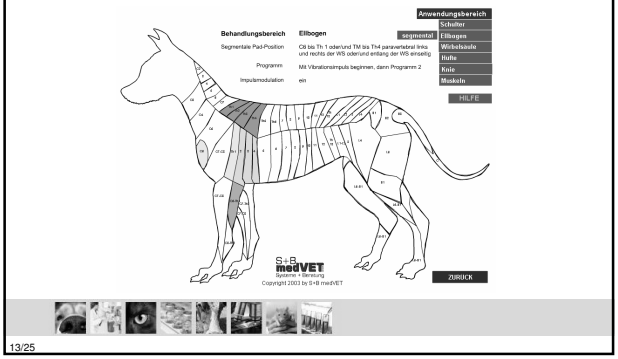
Segmental



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Muscles

Over the motor point and over the muscle insertion

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Patient preparation

- Comfortable position
- Soft and comfortable surface
- Application of heat before electrical stimulation is useful
  - Not in acute conditions!

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Electrode placement

- Rubber electrodes or gel pads
  - Clip hair carefully – avoid skin damage
  - Suitable contact gel – ultrasound gel
  - Spread an even layer of gel on the electrodes
- E-Pads – needle electrodes
  - No necessary of hair clipping
  - Wet the skin with water or alcohol – spray bottle
  - Slide the E-pad into the hair against the direction of hair growth
- Only wet/gel the area were the electrodes are placed!

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Treatment procedure

- Use of modulation is recommended
- Start with sinusoidal current – well tolerated
- Increase intensity slowly

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Technique 2

- Dosage – generally
  - Acute conditions
    - Low intensity
    - Short treatment duration
    - Short series of treatment
    - Short interval between treatments
  - Chronic conditions
    - Higher intensity
    - Longer treatment duration
    - Longer series of treatments
    - Longer intervals between treatment

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Technique 3

- Dosage according to the animals subjective criteria
  - Low dose: just below the sensory response
  - Medium dose: dog will notice a prickling sensation (relaxed, eyes closed)
  - High dose: normally not tolerated

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Technique 4

- Dosage according to motor criteria
  - Below motor threshold: no visible twitch contraction
  - At motor threshold: Visible twitch contraction
  - Above motor threshold: Wavelike muscle movements and contractions

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Treatment mode - Indication

- Acute
  - Segmentally
- Chronic
  - Joints: locally
    - Distal joints: Electrodes medial & lateral
    - Proximal joints: above & below
  - Spinal muscles
    - Transverse: left & right of the spine
    - Longitudinal: cranial & caudal
- Single joint:
  - Affected joint & areas of referred pain
- Multiple joints:
  - Initially most affected joint

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Can we treat cats?

- Yes (mostly)

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Home treatment

- Some TENS units are suitable for home treatment
- Instruct the owner carefully
- Perform the first treatments in your clinic
- Explain the owner how to use the unit
- Last session is performed by the owner under supervision
- Monitor regularly

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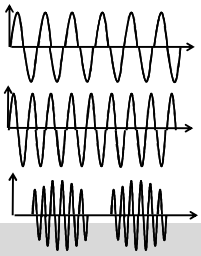
Middle Frequency

- 1.000 to 100.000 Hz
- To currents with different frequncies are combined
- Mostly used: Russian
- No nerve stimulation
- Physiological muscle contraction



Iontophoresis

The use of continuous direct current to enhance the transdermal administration of a drug.

The drug will either be positive or negative in charge. If negative, it is placed under the cathode or negative electrode to repel the charges and "push" the drug in.

Iontophoresis

- There are only a few studies which show an increase of the drug concentration in the tissue or the blood
  - American Journal of Sports Medicine by A. Burke Gurney, PT and Daniel C. Wascher (Dexamethason)
- Some"randomized, double-blind, placebo-controlled" Studies, showing a pain reduction /improved function
  - Nirschl RP, et al: Iontophoretic Administration of Dexamethasone for Acute Epicondylitis. Am J Sports Med 31:189-195;2003
- The FDA confirms the iontophorese as useful, to applicate Lidocain Fentanyl

*

Iontophoresis

Positive	**Negative**
➢Novocain	➢Mobilat
➢Procain	➢Diclofenac

Iontophorese

Electrode placement

- Active Elektrode directly on the targed area
- Second electrode can be placed on each suitable position

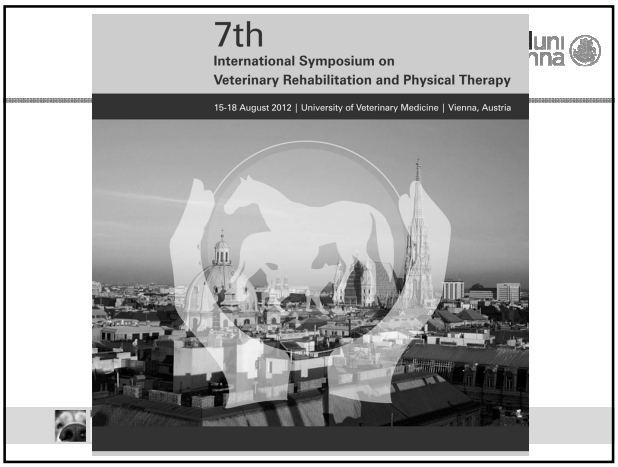
Dosage

Dosage is given for an individual drug
(eg, 40/mA= min for dexamethasone)
Amplitude times time = current dosage

- At 1 mA the treatment time would be 40 minutes (40/1mA = 40 min)
- At 4 mA the treatment time would be 10 m inutes (40/4mA = 10 min)
- Some evidence that more medication is delivered with a higher amplitude, lower treatment time

Dosage

- But as higher the dosage as higher is the risk of skin damage and destruction of the drug
- Use maximal (0.1) 0.2 mA/cm² electrode
- 5cm² electrode = 5 x 0.2 = 1 mA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