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Physical modalities in musculoskeletal disorders: evidence-based?*

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Abstract

A variety of physical modalities are applied in the treatment and rehabilitation of musculoskeletal disorders, but the efficacy of these passive interventions is still controversial. Despite the well-known physiological effects, there are either no clinical data or there is insufficient clinical information on the effectiveness of many techniques used in electrotherapy. As a consequence, we are often unable to make clinical recommendation regarding specific interventions. Because of these often disappointing results based on evidence-based research in electrotherapy, the Belgian government has decided not to reimburse a large number of treatments in this sector. Interventions that have been demonstrated effective through clear evidence in randomised clinical trials and with a good risk-benefit ratio are rather limited as far as musculoskeletal disorders are concerned. Most studies on low-frequency, medium-frequency (including interferential current) and high-frequency currents show the lack of clinical scientific evidence, which is in contrast with the frequent use of electrotherapy all over Europe. The application of these therapies should be further evaluated. The problem in most studies is the lack of practical uniformity (parameters, frequency, duration, etc.). Double-blind studies are not always possible and the diagnosis is not always very clear. Therefore, there is a need for more objective clinical strategies. We should also relativise some of the results because when there is no clear evidence for a specific treatment, it does not mean that this therapy does not work.

Key words: electrotherapy, electrical therapy, musculoskeletal disorders, evidence-based.

Metode fizikalne terapije u mišićnokoštanim stanjima: temeljene na dokazima?

Sažetak

Učinkovitost različitih fizikalnih modaliteta koji se primjenjuju u liječenju i rehabilitaciji mišićnokoštanih poremećaja je još uvijek dvojbena. Unatoč poznatim fiziološkim učincima kliničkih podataka o učinkovitosti mnogih tehnika koje se rabe u okviru elektroterapije nema ili su nedostatni. Zbog toga za specifične intervencije često ne možemo dati kliničke preporuke. Zbog tih razočaravajućih rezultata temeljenih na dokazima istraživanja iz područja elektroterapije belgijska vlada je odlučila ne nadoknađivati većinu terapija iz ovoga područja. Vrlo je malo intervencija za mišićnokoštane poremećaje s dobrim odnosnom rizika i dobrobiti za koje je dokazana jasna učinkovitost u randomiziranim kliničkim istraživanjima. Većina studija o niskofrekventnim, srednjefrekvennim i visokofrekventnim strujama pokazala je nedostatak kliničkih znanstvenih dokaza, što je u suprotnosti s njihovom čestom uporabom u cijeloj Europi. Primjena ovih terapija zahtijeva daljnju evaluaciju. Problem većine studija je nedostatak praktične uniformnosti. Dvostruko slijepe studije nisu uvijek moguće, a niti dijagnoza nije uvijek sasvim jasna. Stoga postoji potreba za objektivnijim kliničkim strategijama. Također treba relativizirati neke od rezultata, jer kada nema jasnih dokaza za specifično liječenje, to ne znači da ono ne djeluje.

Ključne riječi: elektroterapija, električna trerapija, mišićnokoštani poremećaji, temelj na dokazima

Introduction

Electrotherapeutic modalities are used as part of a rehabilitation program in the management of various musculoskeletal conditions. However, the efficacy of these treatments in some musculoskeletal diseases is questionable, e.g., practical uniformity (parameters, frequency, duration, etc.) is lacking, double-blind studies are not always possible, the diagnosis is not always very clear, and there is a need for more objective clinical strategies. All these aspects make it difficult to provide evidence-based effectiveness of electrotherapy. In addition, many areas in physical medicine and rehabilitation have not yet been evaluated and more randomized controlled trails (RCTs) are mandatory.

Material and Methods

A search was conducted for high quality papers on electrotherapy and musculoskeletal disorders published until 2005. Other disorders such as neuropathy, headache, etc. were not included in this study. To identify the articles, the following search engines and key words were used: Medline, PubMed, Cochrane, PEDro, Medline, Embase, Centre for Physiotherapy, Cinahl, Clinical Evidence (BMJ), APC journal club, Philadelphia Panel Evidence-Based

Clinical Practical Guidelines (Cochrane RCTs-observational studies).

The aim of the study was to synthesize literature data to find out whether there is any efficacy of electrotherapy in musculoskeletal disorders using the principles of evidence-based medicine.

Results of the articles are presented starting from galvanic current to low-, medium- and high-frequency currents. Musculoskeletal disorders are used as subtitles under the title of therapy itself. Tables summarizing the outcomes of these papers will be helpful in understanding the topic.

Galvanic current

Continuous: no randomized clinical trials were identified.

Iontophoresis: (Table 1).

Plantar pain and fasciitis: In 19 RCTs, 1626 participants received topical corticosteroids in combination with galvanic current. Limited evidence for the effectiveness of this treatment has been provided. Immediate symptom reduction was only achieved in combination with traditional modalities. Long-term effects are doubtful (1).

Calcifying tendinitis of the shoulder: we found two RCTs investigating the efficacy of acetic acid iontophoresis for calcifying tendinitis of the shoulder. Acetic acid iontophoresis and physiotherapy had no better clinical and radiological effect than physiotherapy alone (2,3).

Patellar tendonitis syndromes: in a poor quality study, physiotherapeutic treatment in combination with iontophoresis was found to be more promising than physiotherapy alone. In order to confirm its effectiveness, RCTs are required.

Achilles tendon pain: positive effects of iontophoresis with dexamethasone were demonstrated at short- and long-term follow-up in only one RCT with a small sample size (1).

Elbow epicondylitis: in an RCT, 199 patients were treated with iontophoretic administration of dexamethasone sodium phosphate. Symptoms were reduced at short-term follow-up (at 2 days and 1 month), whereas long-term effect was not studied.

Galvanic current – general conclusion: well-designed and properly conducted randomized studies are required to determine the efficacy of continuous galvanic currents and iontophoresis.

Not continuous: no beneficial effect of low-frequency electrical stimulation on denervation atrophy was demonstrated (5,6).

Table 1 Examples of iontophoresis usage

Disorder	**Treatment**	**Evidence**
Plantar heel pain	Corticosteroids	Limited evidence
Plantar fasciitis	0.4% Dexamethasone	+ Effect of immediate symptom reduction Long-term?
Achilles tendon pain	Dexamethasone	+ Effect at short-term; long-term follow-up limited evidence
Elbow epicondylitis	Dexamethasone	+ Effect at short-term; follow-up Long-term?
Shoulder tendonitis – calcifications	Acetic acid	+ Effect but natural process rather than treatment

Low-frequency current

Diadynamic current: there are no randomized clinical trials reported in the literature.

Transcutaneous electrical nerve stimulation (TENS) (analgesic):
Chronic low back pain: only two RCTs (175 patients) were found. There is inconsistent evidence to support the use of TENS as a single treatment in chronic low back pain and large multicentre RCTs are needed. However, the limited data available provide evidence that TENS and acupuncture-like (AL)-TENS reduce pain and improve the range of motion in chronic back pain patients, at least at short term (7-9).

Knee osteoarthritis: TENS and AL-TENS were shown to be superior to placebo with regard to pain control (10,11).

Rheumatoid arthritis (RA) of the hand: in three RCTs, 78 patients with RA were treated with AL-TENS and classical (C)-TENS. The results showed AL-TENS to be beneficial for pain and muscle power. C-TENS had no clinical effect on pain. However, in patient assessment of change in disease, C-TENS scored better than AL-TENS. There are conflicting effects of TENS on pain outcomes in RA (12).

Mechanical neck disorders: evidence for the treatment of acute or chronic mechanical neck disorders with different forms of electrotherapy is either lacking, limited, or conflicting (12).

Chronic pain: published trials do not provide information on the stimulation parameters which are most likely to provide optimum pain relief, nor do they answer questions about long-term effectiveness of TENS. Large multicentre randomized controlled trials are needed. Moreover, no positive conclusion could be drawn for acupuncture, AL- TENS or laser therapy (13-15).

Post-stroke shoulder pain: the evidence from randomized clinical trials so far does not confirm or refute that electrical stimulation (ES), i.e. TENS or functional electrical stimulation (FES), or some other applied around the shoulder after stroke influences pain. However, there are some benefits concerning passive humeral lateral rotation. Reduction of glenohumeral subluxation could be a possible mechanism (16).

TENS general conclusion: TENS is used clinically by a variety of health care professionals for reduction of pain. In most trials, data are lacking on how TENS efficacy is affected by important factors such as the mode of application, site of application, duration of TENS treatment, optimal frequencies and intensities, and compliance. Moreover, clinical effectiveness will remain arbitrary until the publication of high-quality controlled clinical trials (17,18).

Table 2 Transcutaneous electrical nerve stimulation (TENS) in physical and rehabilitation medicine

Disorder	**Treatment**	**Evidence**
Chronic low back pain	TENS	-
Chronic low back pain		+ Effect during treatment period
Neck pain	TENS	-
Rheumatoid arthritis of hand	TENS	?
Chronic LBP		+ Effect short term
Knee osteoarthritis	TENS	+ Effect on pain control
Knee osteoarthritis	Dexamethasone	?
Chronic pain	TENS	?
Chronic pain	TENS – acupuncture – laser	-
Chronic pain	TENS – long-term use	+

TENS (normal muscle stimulation):

Normal muscle: active exercises are more effective than neuromuscular electrical stimulation (TENS). TENS may only be preferred to active training for within-cast muscle training and perhaps in specific situations where patient compliance with active training is insufficient (12).

Mid-frequency current

There are no RCTs evaluating mid-frequency current reported in the literature.

Interferential currents

Soft-tissue shoulder disorders: in one RCT, it was stated that interferential electrotherapy was not effective as adjuvant to exercise therapy for soft-tissue shoulder disorders (19).

Low back and neck pain: there are two RCTs showing no beneficial effects of interferential therapy for low back and neck pain (20).

Knee osteoarthritis (OA): in two RCTs, two different results were found. In one RCT, interferential therapy was not significantly more effective than any other therapy in treating knee OA. The only patients that improved during therapy were those in the exercise group (21). In the other RCT, interferential current was very effective for chronic OA knee pain.

Jaw pain: no significant differences between interferential currents and placebo were detected (22,23).

Bone healing: interferential current does not reduce the healing time in tibial fractures (24).

Stress incontinence: interferential therapy has its place in the conservative management of mild and moderate stress incontinence but is statistically not more effective than vaginal cones (25).

Swelling: interferential therapy does not reduce swelling following ankle reduction and internal fixation of malleolar fractures (26).

Conclusion on interferential currents: trials are of poor quality. There is no evidence that interferential therapy is effective in the treatment of soft tissue shoulder disorders, low back pain, recurrent jaw pain, swelling, bone healing, knee OA and delayed-onset muscle soreness (DOMS). However, there is some evidence to conclude that interferential therapy is effective in the treatment of stress incontinence.

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Table 3 Evidence of efficacy of interferential currents

Disorder	**Evidence**
Soft tissue disorders	-
Low back pain	-
Knee osteoarthritis	- ?
Recurrent jaw pain	-
Bone healing	-
Stress incontinence	+
Ankle swelling (distortion)	-
Delayed-onset muscle soreness	-

High-frequency current

Diathermy (pulsed electromagnetic therapy)

Mechanical neck disorders: limited evidence of pain relief has been found. Only in chronic mechanical neck disorders, immediate post-treatment pain relief has been found.

Whiplash-associated disorders: in only one RCT there was improvement in pain and range of motion with the use of pulsed electromagnetic fields (PEMFs) treatment reported in patients with whiplash-associated disorders of undefined duration (27). Further studies are needed.

Articular hyaline cartilage: physiological effects of PEMFs on cells and tissues are well documented. Data strongly support the clinical use of PEMFs in OA patients.

Knee osteoarthritis: the beneficial symptomatic effect of PEMFs in the treatment of knee OA is controversial (28,29).

Delayed union of fractures: a significant influence on healing of tibial fractures with delayed union was demonstrated in a RCT (30).
Bone regeneration in bone lengthening procedures: PEMFs may shorten the duration of external fixation after bone lengthening procedures.

Fibroblast proliferation: pulsed short-wave diathermy is associated with increased rates of fibroblast and chrondrocyte proliferation in vitro (31).

Soft tissue injuries of the ankle: there is insufficient evidence to conclude that diathermy is of benefit.

Pressure sores: there is no evidence of benefit in the treatment of pressure sores. However, the possibility of a beneficial or harmful effect cannot be ruled out because there are only two trials with methodological limitations and a small number of patients.

Leg ulcers: there is no reliable evidence of benefit in the healing of venous leg ulcers (32).

Table 4 Evidence of efficacy of diathermy (pulsed electromagnetic therapy)

Disorder	**Evidence**
Mechanical neck disorders	-
Knee osteoarthritis	-
Whiplash injury	- ?
Delayed union of tibial fractures	-
(Fibroblast proliferation)	-
Bone regeneration in lengthening procedures	+
Soft tissue injuries of ankle	-
Knee osteoarthritis	-
Pressure sores	-
Venous leg ulcers	-

Ultrasonography

Shoulder pain: ultrasound (US) only has a therapeutic effect on calcified tendinitis of the shoulder. However, there is no evidence of its effectiveness in shoulder pain (mixed diagnosis), adhesive capsulitis, rotator cuff tendonitis and impingement syndrome. When compared to exercises alone, US is of no additional benefit (33,34).

Knee osteoarthritis: US therapy appears to be more beneficial than placebo in patients with knee OA. The studies are limited by poor description of the characteristics of the device, the population, the OA, and low methodological quality. US treatment could increase the effectiveness of isokinetic exercise for functional improvement of knee OA. Pulsed US has greater effect than continuous US (35,36).

Patellofemoral pain syndrome: clinically important effects of US on pain relief in patients with patellofemoral pain syndrome were not detected. Again, the methodological quality of the trials is low. Another limitation is poor description of the therapeutic application of US. No conclusions can be drawn concerning the use or non-use of US. More studies are needed (37).

Plantar heel pain: there is no evidence supporting the benefit of US in plantar heel pain management (38).

Acute ankle sprain: there is no proven effectiveness of treating ankle sprains with US (39,40).

Table 5 Evidence of efficacy of therapeutic ultrasound

	Disorder	**Evidence**
Shoulder	Mechanical neck disorders	-
Shoulder	Knee osteoarthritis	+
Knee	Whiplash injury	-
Knee	Delayed union of tibial fractures	-
Heel	(Fibroblast proliferation)	-
Ankle	Bone regeneration in lengthening procedures	-
Pain	Soft tissue injuries of ankle	+ ?
Pain	Knee osteoarthritis	+
Fracture/stress fracture	Pressure sores	+

Pain and musculoskeletal injuries: there is little evidence that active therapeutic US is more effective than placebo for treating people with pain or a range of musculoskeletal injuries (41).

Lateral epicondylitis: there is limited evidence supporting the benefit of US in the treatment of lateral epicondylitis (41).

Fracture healing: US therapy may have a beneficial effect on fracture (including stress fracture) healing. Treatment with a low-intensity pulsed ultrasound signal may reduce healing time (41).

Phonophoresis: limited and poor-quality studies have been published on phonophoresis.

Low-level laser therapy (LLLT)

Supraspinatus tendinitis, shoulder impingement syndrome: laser therapy appears to be of benefit only when used alone, not in combination with therapeutic exercise (42).

Tennis elbow: poor results were found as to the effectiveness of LLLT for tennis elbow (43). However, LLLT need not be ruled out for tennis elbow treatment. The optimal treatment dose has not been discovered yet. Further research with well-designed RCTs is needed to establish the absolute and relative effectiveness of this intervention for tennis elbow treatment.

Ankle sprains: LLLT has no effect in the treatment of lateral ankle sprains (44).

Low back pain: conflicting results were obtained in the studies depending on the method of application and other features of LLLT application (45). Also, there is a lack of data on how LLLT effectiveness is affected by wavelength, treatment duration, dosage and site of application, e.g., over nerves instead of joints.

Rheumatoid arthritis: although short-term relief (follow-up of 3 months) of pain and morning stiffness has been demonstrated, LLLT has no effect on functional assessment, range of motion and local swelling in RA (46). The lack of proper description of the characteristics of the LLLT device and application techniques makes it difficult to compare the results of trials.

Musculoskeletal pain: there is no clinically relevant effect on pain in musculoskeletal syndromes (47,48).

Table 6 Evidence of efficacy of low-level laser therapy (LLLT)

	Disorder	**Evidence**
Shoulder	Supraspinatus tendonitis	-
Shoulder	Rotator cuff tendinitis	+
Elbow	Lateral epicondylitis	-
Ankle	Ankle sprain	-
Osteoarthritis	Osteoarthritis	-
Rheumatoid arthritis	Rheumatoid arthritis	-
Pain	Musculoskeletal pain	+ ?

Conclusion

Evidence-based effectiveness of the different treatments is not always provided because many areas of PMR have not yet been evaluated. Hence, more RCTs on electrotherapy for musculoskeletal disorders are required.

One should keep in mind that "saying there is no good evidence that a treatment works is not the same as saying the treatment does not work!"

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