Available online at www.sciencedirect.com
ScienceDirect
journal homepage: http://www.elsevier.com/locate/poamed

Review article

Physical medicine modalities most frequently applied in the lower limbs chronic wounds treatment in Poland

Grzegorz Onik [a,*], *Katarzyna Knapik* [a], *Aleksander Sieroń* [b], *Karolina Sieroń-Stołtny* [a]

[a] *Department of Physical Medicine, Chair of Physiotherapy, School of Health Sciences in Katowice, Medical University of Silesia in Katowice, Poland*
[b] *Department of Internal Medicine, Angiology and Physical Medicine, School of Medicine with the Division of Dentistry in Zabrze, Medical University of Silesia in Katowice, Poland*

ARTICLE INFO

Article history:
Received 20 December 2015
Received in revised form
23 February 2016
Accepted 6 September 2016
Available online xxx

Keywords:
Chronic wounds
Physical medicine
Peripheral arterial disease
Venous leg ulcers
Diabetes mellitus

ABSTRACT

Introduction: Chronic wounds are the ones that present no healing progress for more than three months. The most common reasons for the chronic wound development in the lower limbs include long-lasting diabetes mellitus, venous insufficiency and peripheral arterial disease. However, it is estimated that 15%–20% of the lower limb chronic wounds are of mixed etiology. Standard treatments such as pharmacotherapy, debridement or skin grafting may be supplemented with physical medicine modalities.

Aim: The aim of the paper was to indicate the utility and biological effects of the physical medicine modalities frequently applied in chronic wound treatment.

Discussion: The physical medicine modalities widely used in the lower limbs chronic wounds treatment are variable magnetic fields, low-level laser therapy and hyperbaric oxygen therapy. Those modalities are proved to stimulate various biological reactions which may promote chronic wound healing. Stimulation of angiogenesis and collagen proliferation are factors that promote histological wound maturation and closure. Local circulation improvement mediated by hypocoagulation and vasodilatation is a factor accelerating wounds healing. Modalities-mediated pain reduction is a result of anti-inflammatory activity as well as of endogenous endorphin secretion. Modalities-mediated bacteriostatic and bactericidal effects are also observed. All those effects are mediated by activation of the immune system. An anti-inflammatory effect is due to the inhibition of pro-inflammatory cytokines secretion and the increase in interleukins activity.

Conclusions: Variable magnetic fields, low-level laser therapy and hyperbaric oxygen therapy are modalities revealing various working mechanisms. The significance of their administration in chronic wounds treatment can be attributed to a variety of their biological effects.

* *Correspondence to*: Department of Physical Medicine, Chair of Physiotherapy, School of Health Sciences in Katowice, Medical University of Silesia in Katowice, Medyków 12, 40-752 Katowice, Poland. Tel./fax: +48 32 208 87 12.
E-mail address: grzegorz-onik@o2.pl (G. Onik).

http://dx.doi.org/10.1016/j.poamed.2016.09.001
1230-8013/

1. Introduction

Chronic wounds are defined as remaining unhealed for more than three months. The most common reasons for chronic wound development in the lower limb are long-lasting diabetes mellitus, venous insufficiency and peripheral arterial disease (PAD).[1–3]

PAD is a medical condition arising from defused arthero-sclerotic plaques leading to obstruction or occlusion of arteries with secondary blood flow impairment.[4,5] Routinely this term refers to the arteries of the human body located distally to the aorta bifurcation, except for the coronary and cerebral vessels. However, the diagnosis of PAD correlates with a higher risk of myocardial infraction or stroke.[5–8] PAD is estimated to affect 10%–15% of general population, and the frequency of occurrence rises with age. In Europe and the United States there are about 27 million people diagnosed with PAD.[6] Almost 50% of the patients remain asymptomatic for a long time, which may lead to the diagnosis and treatment delay. What is more, some researchers point to inadequate general practitioners' awareness of PAD.[4–6,8,9] Patients may present diverse symptoms depending on the PAD stage, but the most common one is intermittent claudication.[6] PAD leads to different functional impairments including physical effort and exercises intolerance, gait disturbances, or limitations in activities of daily living. It may also increase the distress level and lower the quality of life (QOL).[3,10] The failure of standard and endovascular treatments may lead to amputation.[9]

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by an elevated glucose level in blood serum resulting from impaired insulin secretion or/and insulin resistance.[2,11,12] The number of people with DM is presumed to rise, particularly in developing countries. The World Health Organization estimates that about 347 million people worldwide are diabetic, where 90% suffer from type 2 diabetes.[2,13] DM may be complicated by cerebral, vascular, renal, ocular or muscular insults; skin pathologies are equally threatening.[14,15] Diabetic foot ulcers (DFUs) are the main reason for hospitalization in the diabetic population.[16] Peripheral autonomic, motor and sensory neuropathies are common factors predisposing to DFUs. Gait abnormalities in diabetic patients are consequences of the lower extremity muscles hypotrophy, range of motion limitations and foot deformations.[2,17,18] PAD correlates with DFUs. DM worsens the prognosis in patients with PAD, and DFUs may be escalated by PAD.[19] DFUs decrease the QOL and increase costs associated with long-lasting treatment. DFUs are the major cause of non-traumatic lower limb amputations.[18,20]

Venous leg ulcers (VLUs) are skin lesions resulting from venous insufficiency occurring mainly in the lower leg region.[21] They are found to be the most common chronic wounds with recurrence tendency.[21,22] It is estimated that VLUs affect 1% of adults and 3% of the elderly. VLUs develop more frequently in people with vascular and metabolic diseases.[21,23–27] Superficial and perforator vein valve impairments result in venous hypertension and blood stasis. In VLUs pathophysiology two theories have been considered: the fibrin cuff hypothesis and leukocyte trapping. Actually, the most probable mechanism assumes chronic inflammation leading to tissue destruction.[21,28,29] In patients with VLUs the decrease in QOL is correlated with functional limitations. However, it is important to indicate psychological consequences of VLUs, which may include feelings of isolation and resentment, or symptoms of depression.[23,26,27,30]

About 15%–20% of lower extremity ulcers are of mixed etiology (venoarterial). If the arterial component overweighs, compression therapy may be contraindicated. However, according to some researchers supervised compression with reduced pressure may be helpful in arterial disorders.[29,31–33]

DFUs treatment requires multidisciplinary approach, which may lead to reducing both the amputation rate and expenditure, and to improving the QOL. The most important aspect of DFUs therapy is glycaemia control, which should be supported by the patients' education.[18,34] Common local therapeutic procedures include dressings, debridement, decompression, vascular or non-vascular surgeries or skin grafting.[18,20,34,35] DFUs infections may complicate the treatment. Physicians may deal with osteomyelitis, deep tissue infections or even gangrene. Frequently DFUs infection treatment requires combined drug therapy. Sometimes pharmacotherapy must be associated with surgical interventions. Ultimately, amputations must be performed.[35,36]

VLUs treatment strategy is based on compression bandaging and this seems to be the most effective conservative method.[37,38] However, to increase the effectiveness of compression bandaging pharmacotherapy is introduced. Pentoxifylline, aspirin and antibiotics are frequently administered drugs.[39] The aims of VLUs debridement are bacteria and necrotic tissue removal and wound healing enhancement. Additionally, wound healing is promoted by dressings pre-moistened in antiseptics, chlorhexidine or silver sulfadiazine.[40]

Circulation assessment is a crucial aspect of arterial lower extremity ulcer therapy. Standard treatment is based on the foot offloading, debridement or skin grafting. Multidrug therapy is aimed at the local circulation improvement and bacteriostatic effect if the wound is infected.[41]

Physical medicine is an integral branch of medicine applying physical factors in prophylaxis and therapy. Frequently enumerated advantages of physical medicine modalities are minimal or absent side effects, low costs of treatment and patients' acceptance. This militates for physical medicine modalities application in chronic wound treatment.[42–44]

2. Aim

The aim of the paper was to indicate the utility and biological effects of physical medicine modalities frequently applied in chronic wound treatment.

3. Discussion

3.1. *Variable magnetic fields*

Variable magnetic fields may be applied as magnetotherapy or magnetostimulation, depending on the parameters used. Magnetotherapy is characterized by high values of magnetic

Please cite this article in press as: Onik G, et al. Physical medicine modalities most frequently applied in the lower limbs chronic wounds treatment in Poland, *Pol Ann Med.* (2017), http://dx.doi.org/10.1016/j.poamed.2016.09.001