

REVIEW ARTICLE

MAGNETIC FIELD THERAPY AND MAGNETOSTIMULATION AS METHODS OF SUPPORTING TREATMENT IN ORTHOPAEDICS, DENTISTRY AND NEUROLOGY – REVIEW OF THE LITERATURE

MAGNETOTERAPIA I MAGNETOSTYMULACJA JAKO METODY WSPOMAGAJĄCE LECZENIE W ORTOPEDII, STOMATOLOGII ORAZ NEUROLOGII – PRZEGLĄD LITERATURY

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ABSTRACT

Introduction

The magnetic field is a method that has been used in physical therapy for over 20 years. Thanks to its biological effects on tissues, this therapy is used for pain relief, as well as regeneration, anti-inflammation, improving peripheral blood circulation, decreasing muscle tensions and decreasing oxygen depletion and oxygen debt.

Aim

The subject of this work is the presentation of the usage of the magnetic field as a method supporting treatment in orthopaedics, dentistry and neurology.

Methods

The authors conducted an analysis of scientific reports regarding the usage of the magnetic field in treating patients with different disease entities. These included treatment of patients with spinal pain syndromes, degenerative changes in patients after strokes and patients suffering from multiple sclerosis. The authors noted the analgesic usage of the magnetic field in dentistry.

Results

The magnetic field is successfully utilized in the treatment of patients with orthopedic ailments, such as degenerative changes or impeded bone fusion. It improves the ability to move, decreases symptoms of fatigue and regulates muscle tensions in patients suffering from neurological diseases. The beneficial effects of the magnetic field are also utilized in dentistry in the treatment of post-procedure inflammation or pain reduction.

Keywords: magnetic field therapy, magnetostimulation, orthopaedics, dentistry, neurology

Wstęp

Pole magnetyczne jest metodą fizykoterapii wykorzystywaną od ponad 20 lat. Dzięki efektom biologicznym w tkankach, terapie te są stosowane w działaniu przeciwbólowym, regeneracyjnym, przeciwzapalnym, poprawiającym krążenie obwodowe, zmniejszającym napięcie mięśniowe oraz zmniejszającym deficyt i dług tlenowy.

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Cel

Przedmiotem pracy jest przedstawienie zastosowania pola magnetycznego jako metody wspomagającej leczenie w ortopedii, stomatologii i neurologii.

Metody

Autorzy dokonali analizy doniesień naukowych, dotyczących wykorzystania pola magnetycznego w terapii pacjentów. Między innymi poddano analizie terapię osób z zespołami bólowymi kręgosłupa, zmianami zwyrodnieniowymi, pacjentów po udarze mózgu czy chorujących na stwardnienie rozsiane. Zwrócono uwagę na wykorzystanie przeciwbólowego działania pola magnetycznego w stomatologii.

Wyniki

Pole magnetyczne z powodzeniem znajduje zastosowanie w terapii pacjentów z dolegliwościami ortopedycznymi – takimi jak zmiany zwyrodnieniowe i utrudniony wzrost kostny. Zmniejsza objawy zmęczenia oraz reguluje napięcie mięśniowe u pacjentów z chorobami neurologicznymi. Korzystne efekty pola magnetycznego wykorzystywane są także w stomatologii w leczeniu pozabiegowych obrzęków czy redukcji bólu.

Podsumowanie

Przegląd literatury potwierdza szerokie spektrum terapeutyczne pola magnetycznego. Pole magnetyczne wykorzystywane jest z pozytywnym efektem w leczeniu dolegliwości obecnych w przebiegu chorób ortopedycznych, neurologicznych czy w stomatologii. Magnetoterapia z powodzeniem może być stosowana jako metoda pomocnicza dla farmakologicznego leczenia przeciwbólowego.

Słowa kluczowe: magnetoterapia, magnetostymulacja, ortopedia, stomatologia, neurologia

Introduction

Magnet therapy is a field that has been used in physical therapy for over 20 years. It is based on the interaction of the alternating magnetic field with the organism. It utilises impulses in the following shapes: sinusoidal, semi-sinusoidal, rectangular, triangle, semi-rectangular and semi-triangle. The frequencies used during treatment usually vary from 2 Hz to 60 Hz. Especially characteristic is the large magnetic flux density of 10 mT. Special flat or tube shaped applicators are used for procedures involving the impulse magnetic field. A relatively newer, but just as effective method is magnetostimulation. The induction used in it doesn't exceed 0.1mT. The equipment is divided into different levels of intensity which have varying degrees of stimulation. It is advised to do a series of treatments during which the dosages gradually increase and then fall (Opara *et al.* 2013). Thanks to the

biological effects in tissues these therapies are used for pain relief, as well as regeneration, anti-inflammation, improving peripheral blood circulation, decreasing muscle tensions and decreasing oxygen depletion and oxygen debt (Dudek *et al.* 2015). Considering the broad spectrum of activity, therapies involving the magnetic field are being used in orthopaedics, dentistry and neurology.

Aim

The objective of this paper is to present the use of magnetic field therapy and magnetostimulation as a method supporting treatment in orthopaedics, dentistry and neurology.

Materials and methods

Authors reviewed over 100 reports published in PUBMED about using of magnetic field therapy and magnetostimulation in various

field of therapy. The used keywords were: magnetic field therapy, magnetostimulation in combination with orthopaedics, dentistry and neurology. Selected articles present high efficiency of this methods.

Results

Orthopaedics

Electromagnetic fields have been used in the treatments of several disease entities which can be generally categorized as orthopaedic. A frequent ailment observed in a lot of people is pain in the lower spine. The reasons for this occurrence are degenerative lesions and repeated strain. Another cause of such pain can be the so called „postural stress” which means excessive strain of certain segments of the spine, connected with the necessity of keeping a regular position. It occurs mostly among people nurses and office workers (Rok *et al.* 2005). Nayback – Beebee *et al.* (2017) determined the influence of therapies using the impulse electromagnetic field on chronic pain in the lower spine. 75 people suffering from low back pain lasting minimum 3 weeks took part in the research. Therapy involving the impulse magnetic field was conducted 3 times a week in 30 minute sessions. As a result, the patients' pain intensity sensation dropped by 0.5 points on the NRS (Numerical Rating Scale) (Nayback – Beebe *et al.* 2017). Similar evidence for positive analgesic effects of the magnetic field was demonstrated by Zdrodowska *et al.* (2015). Researchers analyzed the influence of magnet therapy on pain typical for degenerative changes of the intervertebral disk. Respondents assessed the pain intensity before and after finishing treatment using the VAS scale. The final analysis presented unambiguous results – all 60 respondents noted an improvement (Zdrodowska *et al.* 2015).

Magnet therapy is also an efficient method used for help patients recover after surgery. This is proven by the researched done by Kulikov *et al.* (2018), the aim of which was to determine the efficiency of rehabilitation using the magnetic field in patients who

had undergone lumbar discectomy. Survey subjects who started rehabilitation during a period no longer than one month after the procedure were asked to determine the level of pain in the operated area using the VAS scale. The results clearly show that a decrease in pain (measured by the VAS scale) was noted after 10 treatments using the magnetic field with a low frequency (1–3 mT) (Kulikov *et al.* 2018). People with lumbar discopathy and ailments caused by this dysfunction, such as lower spine pain constituted the group of respondents in the research carried out by Taradaj *et al.* (2018) It is noteworthy that the authors subjected all respondents to therapy using the magnetic field, however the treatments had different parameters. The 106 people taking part in the research were divided into 5 subgroups. The first group – A (magnet therapy 10 mT, 50Hz), group B (magnet therapy 5 mT, 50Hz), group C (placebo magnet therapy), group D (magnetostimulation 49 mT, 195Hz) and group E (placebo magnetostimulation). Group A turned out to be the most efficient in reducing pain, improving the functional ability of the spine, and expanding the range of movement. Positive changes like improvement of health and pain reduction were also observed in all other groups, however they were short-term and gradually returned as the months passed (Taradaj *et al.* 2018). The clinical efficiency of such therapies was proven not only by stimulation patients with spinal dysfunctions recover. According to research carried out by Bagnato *et al.* (2016), magnet therapy also gives positive effects in the treatments of knee osteoarthritis (Bagnato *et al.* 2016). Koczy *et al.* (2019) examined 30 male with advanced knee osteoarthritis within hip joints who had undergone treatment. The patients were divided into two groups. The first one was subjected to magnet therapy and the latter to magnetostimulation. The treatments using the magnetic field turned out to be effective. All the surveyed people, no matter which therapeutic subgroup they belonged to, reported a decrease in pain after magnetic field therapy. However a rapid effect

was observed in the group which underwent therapy using magnetostimulation. An improvement was also noted in the other part of respondents, but the speed of changes was slower and took place after 2/3 of the time since the start of the treatments. The opposite effect was observed when it came to taking analgesics. Those subjected to magnetic therapy displayed a clear tendency to decrease the dosages of analgesics, whilst no such change was observed in the second group (Koczy *et al.* 2019). All presented results prove the analgesic effect of therapy using the magnetic field.

Moreover, stimulation with the static magnetic field and electromagnetic field can significantly increase bone recovery. Several studies show that the static magnetic field has a positive influence on the bone tissue, as well as bone formation. These studies mostly concern the assessment of the effectiveness of the magnetic field on the function of bone cells (especially osteoblasts) and studying the mechanism which is key to understanding the positive influence of the magnetic field on bone recovery after fractures (Gujjalapudi *et al.* 2016; Xia *et al.* 2018; Yang *et al.* 2018; Elsis *et al.* 2015). Treatments using the magnetic field accelerate the fusion of bones after fractures (Adie *et al.* 2011; Assiotis *et al.* 2012). In his studies Markov (2017) notes that the positive effects of the repair processes of bones are connected with the strengthening of the actions of osteoblasts (Markov, 2017). From this perspective it is possible to use the static magnetic field as a non-invasive therapeutic method to maintain health and treat osteoblast disorders (Kim 2015; Cunha 2012). It was proven that magnet field therapy and physical activity are beneficial in the prevention and treatment of osteoporosis. Such results are presented by the research carried out by Elsis *et al.* (2015) The researchers compared the mineral density of bones in elderly women. The respondents were divided into two groups. The first was subjected to pulse magnet therapy (with a low frequency and low intensity), while the second was

subjected to kinesiotherapy. The therapies were conducted for a period of 12 weeks. The analysis of their results proved their effectiveness – increase in bone mineralization and improvement of bone density – in both cases (Elsis *et al.* 2015). Higher values were noted, however, in the group subjected to the work of the magnetic field (Adie *et al.* 2011). Magnetostimulation was found to be helpful in the healing of bones and was studied relatively well. The majority of the results demonstrates an improvement in the healing of both bones and ligaments. This data was shown in relation to the spine, femur and tibia (Cook *et al.* 2014).

Dentistry

A positive effect of magnet therapy on patients who were after orthodontic procedures or currently undergoing dental treatment has been noticed. The main beneficial effects of such therapy are: decrease of pain and decrease of post-procedure inflammation. Additionally, among patients who experienced sensory disturbances in the area of the innervation of the inferior alveolar nerve, a much milder course of complication was observed, which increased the chance for a faster return to the proper sensory state. In the studies done by Lietz – Kijak *et al.* (2016), the group of respondents declared an over 50% decrease of pain after undergoing treatment using magnetostimulation twice. Moreover, the author noted that the majority of respondents gave up taking analgesics, only in one case the use of non-steroid analgesics extended to the third day of treatment. It was also noted that the pain subsided completely after 10 days (Lietz – Kijak *et al.* 2016) However, Preiskorn *et al.* (2001) while analysing the use of magnetostimulation in conjunction with standard therapy noticed that the pain decreased already during the first 24h from the treatment. Pain subsided completely after 3–4 treatments (Preiskorn *et al.* 2001). Complications such as peripheral nerve damage might occur as a result of the usage of block anaesthesia and

performing of surgery. Their consequence is lingual nerve palsy. Based on his studies Lesiakowski *et al.* (2004) deduced that the use of magnetostimulation as a method of supportive treatment speeds up the return of feeling of touch and temperature as well as taste (Lesiakowski *et al.* 2004).

Using the computer system Digora Lietz – Kijak *et al.* (2016) assessed the quantitative and qualitative course of healing of the bone structure of the apex area. 30 respondents took part in the studies. The analysis of the density of bone trabeculae in the osteolysis showed a significant increase. This proves the immense influence of the magnetic field on the bone tissue. Additionally, an increase in the optical density of bones in sliding tooth places (Lietz – Kijak *et al.* 2009).

Neurology

In neurology magnetostimulation and magnet therapy are most commonly used in supporting the treatment of multiple sclerosis, Parkinson's, and the results of strokes. Among positive results of such therapy are decreasing the symptoms of fatigue, progress in the area of muscle tension – decrease in spasticity and normalization of deep reflexes (Nielsen *et al.* 1995). Broła *et al.* (2010), while conducting their research noticed the positive effect of the magnetic field on the feeling of fatigue accompanying people suffering from multiple sclerosis. The reduction of this ailment created a wider understanding of the aspect which concerned the significant improvement of the physical and cognitive dimension, and, to a lesser degree, the psychosocial dimension. As for the occurrence of depressive states, a significant mood improvement was noticed after 6 weeks from implementing the therapy (Broła *et al.* 2010). Improvement after using magnetic field therapy is also visible in patients diagnosed with Parkinson's. The patients were subjected to treatment using the magnetic field with a frequency of 40 Hz, an induction of 10 mT and a sinusoidal waveform. Among the benefits were the reduction of dyskinesia and clumsiness. Moreover,

performing motor activities, sleep quality, mood, cognitive functions and the activities of the autonomous system were all significantly improved (Pasek *et al.* 2010). In Poland, the pioneer who first used the magnetic field in the treatment of strokes and their negative effects was Sieroń *et al.* (2010). They describes the beneficial influence of magnetic fields, specifically in the global improvement of the scale of disability in everyday activities and the improvement of the neurological state (Sieroń *et al.* 2010). Furthermore, Cichoń *et al.* (2018) noted a favourable influence of the magnetic field with a low frequency on the parameters of oxidative stress among people who had suffered a stroke. The respondent group of 57 patients was divided into two subgroups. The difference between them was the usage of the magnetic field as a method supporting rehabilitation. The results clearly demonstrated a significant improvement in the aforementioned parameters in the group which used supported therapy. The benefits were primarily in the area of physical activity and mental state (Cichoń *et al.* 2018).

Conclusions

The literature review shows the broad therapeutic spectrum of the magnetic field. The magnetic field is utilized with a positive effect in the treatment of ailments present in the course of orthopaedic and neurological diseases, as well as in dentistry. Magnet therapy can be successfully used as a supporting method in pharmacological analgesic treatment.

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