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Social impact of the treatment of cervical osteoarthritis with ELF-EMF at 60 Hz

Abstract

In recent years, sports injuries (cervical osteoarthritis) have become increasingly common among competitive athletes and people who exercise, with an incidence rate exceeding 60%. Current scientific literature has largely overlooked the psychosocial and environmental impact of this type of condition on athletes and/or patients, which affects not only their physical performance but also their psychological well-being and their ability to quickly return to training and daily life. The objective of this research is to evaluate the social impact of therapy for cervical osteoarthritis in two age groups: G1 (ELF-EMF at 60 Hz) and G2 (conventional treatment), using a nonparametric statistical analysis. It is concluded that this type of therapy is effective because it allows competitive athletes and/or those who engage in physical exercise to return quickly to training and sports facilities, thereby improving their psychosocial, emotional, and environmental well-being.

Keywords: sports medicine, cervical osteoarthritis, magnetic field

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Introducción

In the last decade, more than 100% of athletes participating in various sports competitions (athletics, cycling, football, etc.) and sports movements (rotations) suffer from cervical osteoarthritis; this is due to the high level of training and competitions that affect their physical, psychosocial and environmental lifestyle. Cervical osteoarthritis, also known as cervical spondylosis, is a degenerative condition that affects the joints and discs in the neck. It is a common condition, particularly among older adults, and can cause a range of symptoms including neck pain, stiffness, and limited range of motion; this causes limitations to patients and/or athletes, affecting their quality of life and that of their families due to the presence of pain and the resulting functional disability.[1–3] Sports injuries cause emotional distress in athletes and/or exercisers, with a risk level exceeding 30%, as they trigger psychosocial reactions in high-performance athletes and those around them, leading to physical and psychological deterioration with disorders such as anxiety, depression, sleep difficulties, fatigue, hormonal and mobility problems, overuse, frustration, and helplessness. Athletes with cervical osteoarthritis require specialized medical attention due to the associated pain and inflammation, which constitutes a significant healthcare challenge in health centers and rehabilitation facilities due to increased training loads, physical conditioning, and high levels of competition. The need to identify the deficiencies in the management of chronic pain and the consequences it generates in the different spheres of sport is not yet a priority for the international scientific community, since patients (athletes) complain of the long time required for the diagnosis and treatment of pain and their return to daily life.[4,5] In the current scientific literature there are different theoretical models to explain the impact of pain caused by cervical osteoarthritis, based on the perceptions of athletes and their families, since it has harmful effects on both.[6,7] Esperanza et al. 2023 explain the interrelationship between injuries and the mental health of athletes and their environment, and the influence of psychological risk factors on the performance of high-level competitive athletes, through a search for bibliographic references in various databases (WOS, Pubmed, Scopus, and Punto Q), but without the use of mathematical models.[8] Mogedano CS et al. 2025 conducted a cross-sectional, observational, and analytical study using a computer program that relates the influence of psychological factors and the severity of sports injuries to identify different psychological profiles, with a level of incidence of injury severity with respect to depressive symptoms of ($p < 0.05$); however, this method is not recommended due to the risk of worsening the mental health of athletes.[9] For thousands of years, the use of electromagnetic fields (EMF) in medicine dates back to antiquity, with the first written records dating from 4000 BC, describing its use for therapeutic purposes, through the design and construction of various devices for the treatment of different types of pharmacological and physical therapies; which constitutes a new alternative that improves the psycho-social quality of life of athletes and their families.[10–12,13] In Cuba at 1992, the National Center for Applied Electromagnetism (CNEA) was founded at the University of Oriente, in the province of Santiago de Cuba; in which, various magnetic and electromagnetic equipment was designed and built for application in different socioeconomic sectors, such as industry, agriculture, and medicine. In medicine, this equipment is used for the diagnosis and treatment of diseases and the evaluation of adverse effects in living organisms.[14,15] Martha et al. 2010 reports the effectiveness of (ELF-EMF) therapy combined with conventional therapy in a sample of 40 patients with cervical osteoarthritis, compared to a control group.[16] Mesa et al. 2024 propose the design of a magnetic bed with Halbach-type permanent magnets for the treatment of different somatic diseases; with an effectiveness level of more than 80% compared to conventional treatment, which facilitates a rapid reintegration into sports competitions and therefore an improvement in their psychosocial, emotional and environmental quality of life.[17,18] Esmirna et al. 2023 report the efficiency of extremely low frequency electromagnetic field therapy in patients with post-traumatic knee synovitis of different age groups and sexes as it reduces pain and improves physical examination and ultrasound findings in all patients at the end of the study and therefore shortens rehabilitation time and their return to daily life compared to conventional therapy (cryotherapy + ibuprofen + dipyrone).[18] The aim of this research is to evaluate the psychosocial impact of ELF-EMF therapy at 60 Hz on two age G1 ((15–25) and (26–35)) and G2 ((15–25) and (26–35)) years cervical osteoarthritis at respect to conventional therapy.[19]

Materials and methods

In medicine, magnetic and electromagnetic fields have been used for the diagnosis and treatment of sports injuries, as well as to evaluate the adverse effects they produce in living organisms. This study performed a non-parametric statistical analysis of a sample of 40 patients comparing two age groups: G1 received conventional therapy (cryotherapy + ibuprofen + dipyrone) and the second G2, extremely low frequency electromagnetic field at 60 Hz, with an exposure time (T = 20) min respectively, as measured on a pain scale using a computer program. The equipment used was the Magnetomed 7200(R) from the German company Physiomed Group ®, located in the rehabilitation room of the Joaquin Castillo Duany Military Hospital in the province of Santiago de Cuba, Cuba [19,20]. The calculation and selection of the magnetic induction was performed according to the following equation.

$$B \rightarrow \begin{cases} \equiv \mu_0(1+\chi_m)H \\ \equiv \mu H \\ \equiv \mu_0 \mu_r H \end{cases} \quad (1)$$

where $\mu = \mu_0(H)$ It is the magnetic permeability of the medium μ_0 and the relative μ_r ; $\overrightarrow{H}$, is the intensity of the magnetic field and χ_m , susceptibility of the material. A computer program was used for the calculation and simulation of the induction and homogeneity of the magnetic field since the design of this magnetic device was very complex.[18]

Results

Figure 1 shows the magnetic field induction map with respect to the xz plane (Figures1-3).

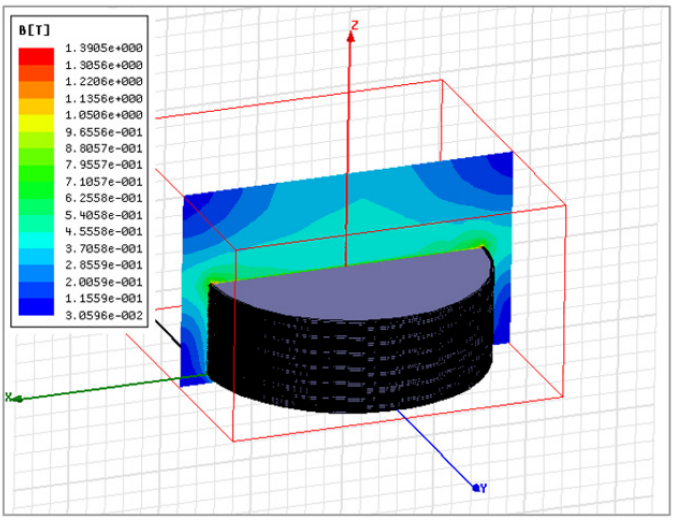

Figure 1 Magnetic field induction map, B = (0.2 to 0.3) mT, number of turns (ne = 1.50), height (h = 0.01) m and diameter (d = 0.03) m [17]. Courtesy of Alejandro Alberto Bordelois Cayamo.

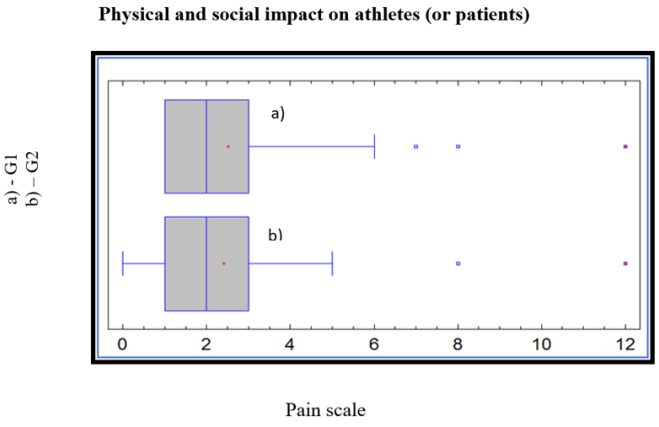

Figure 2 shows the psychosocial impact of the of age G1 ((15–25) at (26–35)) and G2 ((15–25 at (26–35)) of competitive athletes and physical exercise practitioners, with respect to a pain scale.

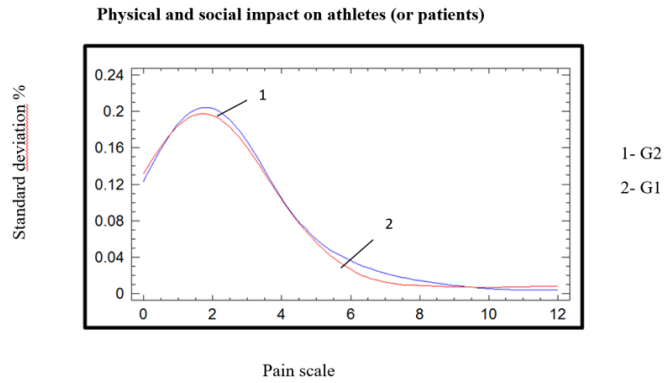

Figure 3 Psychosocial impact vs standard deviation of the of age groups 1 and 2, with respect to the pain scale.

Discussion

Figure 1 shows the magnetic induction distribution lines with respect to the center of the magnetic system configuration, which can be used for the desired purposes since it is sufficient to treat this and/or any type of pathology and allows the therapist, using software, to select the magnetic induction and the homogeneity of the magnetic field, according to the type of pathology to be treated, with high effectiveness.[16–18] In the figure 2 was observed G1 and G2 years of competitive athletes and physical exercise practitioners with conventional therapy (G1) it has a higher standard deviation (2.36 to 2.06) and a higher coefficient of variation (98.0% to 81.8%) and its range is slightly higher (12.0 vs 11.0) and its minimum is 0.0, while those of extremely low frequency electromagnetic field therapy of 60 Hz (G2), part of 1.0. These differences in dispersion and at the lower end could explain why the global distributions are not equivalent, even though their central values coincide. The total absence of normality in both samples indicates strongly skewed and heavy-tailed distributions, suggesting that there is insufficient evidence to claim that one of the samples tends to produce systematically higher values than the other; due to a higher frequency of very low scores. However, the difference in the overall distributions indicates that the variability and shape of the pain response do depend on this condition. This demonstrated that the presence or absence of extremely low-frequency magnetic field induction does not modify the median of the pain scale, but it does alter the overall distribution of scores. This highlights the importance of not only comparing measures of central tendency, but also when

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the data do not follow a normal distribution, no existe una diferencia estadísticamente significativa entre las medianas con un nivel de confianza del 95%.[14,15]

Figure 3 shows that both age groups presented the same typical level of pain (median = 2), but the distribution of scores differs significantly. Group I shows greater dispersion (higher standard deviation) and includes lower values (minimum = 0) compared to G2 within a given VAS range; this demonstrates that there are no significant differences between the two therapies for a treatment time of 0 to 10 days, the psychosocial impact on athletes in Group II is higher than that of G1 because there is less incidence of pain, with a confidence level greater than 95%. The results of this study demonstrated the high level of incidence of the degree of correlation between variables in the psychosocial behavior of high-performance athletes and practitioners of physical exercise, with cervical osteoarthritis: number of age and sex groups, range of pain (EVA) and the values of the extremely low frequency magnetic field induction (ELF-EMF) at 60Hz with respect to the number of treatment days, since it is an indicator that lays the basis for the prognosis of patients (or athletes) with this type of pathology and introduces a new technology in the field of medical sciences; however, it is recommended that future research projects increase the sample size (age and sex groups, electrical current, frequency, and magnetic field induction) with respect to: days of treatment and pain intensity. These differences in distribution are due to factors such as stimulus intensity, pain perception threshold, and/or unmeasured characteristics; this will allow for the implementation of different treatment protocols and, therefore, the rapid reintegration of athletes into training, sports competitions, and social life and reduce the negative impact on high-performance athletes with complex regional pain syndrome and the undesirable repercussions on their environment.[19,20]

Conclusion

In this type of therapy (G2) it is feasible because it increases the psychosocial impact on 60% of athletes, due to the incidence of injuries associated with this sport and therefore allows their rapid reintegration into sports competitions and social life.

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