

Effects of infrared radiation in the treatment of patients with knee osteoarthritis: a systematic review

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ABSTRACT

Background: osteoarthritis of the knee is a degenerative disease that affects different joints in the body. This pathology is characterized by very strong pain and loss of joint function in some cases. The infrared radiation contributes to the treatment of patients with osteoarthritis of the knee. Therefore, this treatment method can help to reduce pain and improve functional capacity. **Objective:** to compare the studies carried out on this topic to show the effects of infrared in the treatment of patients with osteoarthritis of the knee. **Method/ Data sources:** to carry out this research, they were consulted in the following databases available on the internet: PubMed / Medline, Science direct, SciELO and Springer link. **Selection criteria:** 3 randomized and 2 controlled articles were considered with a total sample of 260 subjects. All literatures were found in the period 2010-2020 and in the English and Spanish languages. **Results:** they found 871 studies in which 5 articles were selected with a total of 517 patients who meet the selection criteria results. **Limitations:** there is a lack of information in some databases on this topic of Knee Osteoarthritis. **Conclusion:** we concluded that infrared therapy has proven to be a reliable and effective method in the treatment of osteoarthritis, as it has shown a positive effect in reducing pain and inflammation of the knee.

Keywords: infrared therapy, knee osteoarthritis, pain, functional capacity.

1 INTRODUCTION

The scientific and technological revolution has brought about an increase in life expectancy in the world population, causing the appearance of countless incurable degenerative diseases, including osteoarthritis. Osteoarthritis of the knee is a disease that affects a large number of people, usually adults, on a daily basis and can also affect young people. This pathology generates severe pain and can sometimes be accompanied by loss of joint function. The frequency of patients suffering from osteoarthritis increases depending on the life expectancy of the population and the treatment is directed towards the symptoms (López, 2011) (1). This indicates that this pathology generates a greater health problem according to the lifestyle of the people, thus affecting older adults more This indicates that this pathology generates a greater health problem according to the lifestyle of people, thus affecting older adults more (Hsieh R, et al.2012; Oinas J et al.2016)(2). The treatment of osteoarthritis with the use of infrared consists of reducing

pain and recovering the functional capacity of the affected area .The use of therapy based on the infrared application technique allows to reduce pain and can improve the capacity of the knee joint

Due to the aging of the population and the growth of some diseases such as obesity, the World Health Organization (WHO) forecasts for the year 2050 around 130 million people with osteoarthritis worldwide (Wittenauer R, 2013) (3). This prevalence places osteoarthritis among the most dangerous diseases in today's society.

At present, osteoarthritis does not have a definitive cure. Electrotherapy is a branch of rehabilitation that encompasses the use of infrared in order to regenerate dead cells and tries to repair cell damage by emitting waves(Martin R,2008)(3). Electrotherapy is recently being implemented, which is based on the use of devices within which we have infrared. The main objective of this work is to compare the results obtained on the use of infrared to improve functional capacity and reduce pain in patients with osteoarthritis of the knee.

2 MATERIALS AND METHODS

With the aim of testing the effects of infrared in the treatment of patients with knee osteoarthritis to reduce pain and restore functional capacity. A search was carried out in the following databases PubMed / medline, ScienceDirect, SciELO, and SpringerLink with extraction of works obtained via the internet using the descriptors in health sciences (4) and Medical Subject Headings (5).

3 INCLUSION CRITERIA

3 randomized and 2 controlled articles were considered with a total sample of 260 subjects. All literatures were found in the period 2010-2020 and in the English and Spanish languages. Only articles written in English and Spanish with the infrared topic for the treatment of knee osteoarthritis were selected.

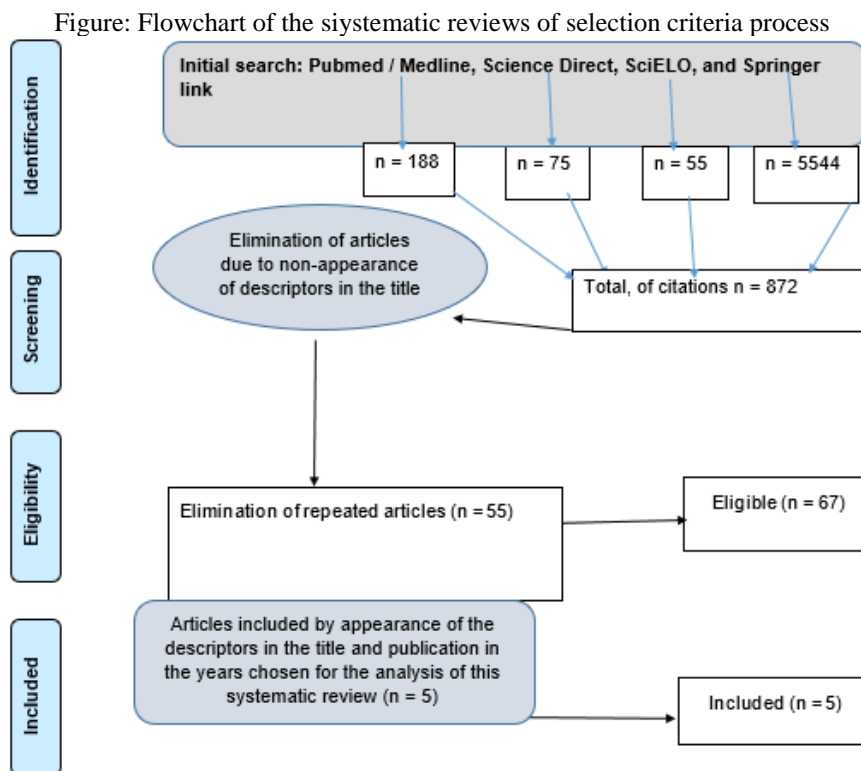
4 EXCLUSION CRITERIA

Non-randomized and uncontrolled articles were not considered. In addition, articles on osteoarthritis in other parts of the human body or articles written in other languages than English and Spanish and those that coincide with other species were not selected.

Final selection of information: the research that was carried out was related to some recent studies carried out on the use of infrared as a means of treatment for patients with osteoarthritis of the knee. 872 articles were found in the initial search, 863 presented exclusion criteria, therefore, a total of 5 studies with 517 participants were considered for this systematic analysis. The selected articles were analyzed in order to compare the effects of infrared in studies carried out on the treatment of patients with

osteoarthritis in the last decade. No article was rejected for methodological reasons. See the diagram below:

5 FIGURE: FLOWCHART OF SELECTION CRITERIA FOR ARTICLES OF INTEREST



6 TABLE OF RESULTS

Articles (5)	type of Study	Type of treatment	Number of patients	Age and Sex	Duration of therapies	Evaluation pain and functional capacity	Results
Bagnato GL, Miceli G, Atteritano M, Marino N, Bagnato GF, (2012)	Randomized and controlled	with placebo cast or far infrared emitting cast	n = 60 total n = 30 participants in the FIR group n = 30 in the placebo group	Age> 40 years 70 women in FIR and 68 in placebo	4 weeks	Pain (self report) Disability and Visual Analog Scoring (VAS) Clinics)	placebo and FIR group VAS scores were significantly lower 1 week after treatment (95% confidence interval CI = -1.14 to 0.31, P <0.05) and at the end of study (95% confidence interval = -2.57 to -0.89; P = 0.01). The effect size was -0.43 after while no changes were observed between the placebo group.
Qingguang Z, Min F, Li G, et al. (2015)	Checked	Therapeutic massage + infrared	20 women		3 times a week for 2 weeks	Pain (self report) Disability (Clinical)	The results showed statistically significant mean differences in knee pain relief, stiffness relief, and improvement in physical function after therapy (P <0.05). significantly faster gait speed, greater stride width, and higher percentage of total support time after Chinese massage therapy (P <0.05).
Sorpkor, S. et al. (2019)	Randomized and controlled	Infrared + 45 degree stimuli (fNIRS) + 3 semiconductor lasers at 780, 805 and 830 nm	139 NA participants and 147 non-Hispanic whites (NHW) enrolled, 208 (73%) responded to	adults age range 50 to 85 years	6 blocks 20 and 30 seconds And 2 weeks	Pain (self report)	the 139 NA participants and 147 non-Hispanic whites (NHW) enrolled, 208 (73%) with persistent pain (M = 3.71, SD = 3.64), even less (56%) and upper (35%) back, neck (29%), shoulder (29%), feet (29%), (N = 174) BMI, income, and gender. Race emerged as the only significant predictor (OR = 3.015, 95% CI: 1.309, 6.945)
Spahn, G., Plettenberg, H., Hoffmann, M. et al. (2017)	Randomized and controlled	Infrared	137 patients (medial n = 127; and lateral n = 10	60 men And 77 women [45-78] years	5 weeks	Self report pain Disability (Clinical)	In 76.6% (n = 105) of all the knees examined, clear cartilage damage was found (ICRS-grade III / IV). (mean n = 6, range 1-6).
Ogaya S, Kubota R, Chujo Y, Hirooka E, Kwang-Ho K, Hase K. (2017)	Checked	Infrared laser	n = 15 patients with medial knee osteoarthritis and n = 14	5 men and 9 women [64-78] years	2 weeks	Self report pain Flexibility (Clinicians)	These results indicate that patients with osteoarthritis of the knee have a decreased dependence on the extensives muscles to control knee movements during the initial posture phase. The adductor muscles of the hip.

Source: from Pubmed / Medline, Science Direct, SciELO, and Springer,2020

7 DISCUSSION

The previous diagram shows the number of publications on the subject of infrared for patients with knee osteoarthritis according to the different databases consulted. This is beneficial due to the fact that the subject of the therapeutic use of infrared is gaining a very important place with greater interest for its effectiveness in the treatment of degenerative diseases, among which we have osteoarthritis.

A total of 5 articles are that involved in this systematic analysis. This indicates that the topic of using infrared for degenerative diseases is beginning to gain a place of interest for scientific publications. The selected articles are analyzed below to compare the effectiveness of infrared compared to other methods in the treatment of knee osteoarthritis.

In the study carried out by Bagnato GL et al. (2012) with the manuscript "Far infrared emitting plaster in knee osteoarthritis: a single blinded, randomized clinical trial" (6) Unlike Qingguang Z, Min F, Li G, et al. (2015) (6) plaster was used far infrared emitter for 1 month of treatment. Subjects were two groups $n = 30$ (in the FIR group) and $n = 30$ (in the placebo group). And in that of Qingguang Z, et al. (2015) (7) Chinese massage and six infrared cameras were combined, three times a week for two weeks. The authors followed $n = 20$ women with knee osteoarthritis. Gait was assessed using a motion analysis system from six infrared cameras and then the WOMAC index of osteoarthritis was used before and after treatment. The following parameters were calculated the forward speed, the width of the step, the length of the step, the percentage of total support time, the percentage of initial double support time and the percentage of single support time. In addition, angles at the knee, hip, and ankle were measured during the walking posture phase. From these two previous studies the results were:

In the work by Bagnato GL et al., The VAS scores of the placebo and FIR groups were significantly lower 1 week after treatment (95% confidence interval $CI = -1.14$ to 0.31 ; $P < 0.05$) and at the end of the study (95% confidence interval $CI = -2.57$ to -0.89 ; $P = 0.01$). The effect size was -0.43 after one week of treatment and -1.38 after one month of treatment. The mean decrease in VAS values was $\geq 20\%$ in the FIR group. The number of patients in the FIR group with joint effusion was lower (40%) compared to baseline (80%), while no changes were observed between the placebo group.

They concluded that the far infrared emitting cast could be considered an effective non-pharmacological option for the therapeutic treatment of osteoarthritis of the knee.

In the Qingguang Z study, l et al. the results showed statistically significant mean differences in knee pain relief, stiffness relief, and improvement in physical function after therapy ($P < 0.05$). Patients obtained significantly faster gait speed, greater stride width, and higher percentage of total support time after Chinese massage therapy ($P < 0.05$). There were no significant differences in range of motion or initial contact angles of the knee, hip, or ankle during the posture phase of gait.

In the article by Spahn, G., Plettenberg, H., Hoffmann, M. et al. (2017) (8) it was used only infrared as a treatment method with a total of 137 patients ranging in age from 45 to 78 years. The treatment lasted 5 weeks. Compared with that of Ogaya S, Kubota R, Chujo Y, Hirooka E, Kwang-Ho K, Hase K. (2017) (9), 8 infrared cameras and two force plates were used as treatment method in order to measure the kinetic and kinematic data an = 15 patients with medial knee osteoarthritis and n = 14 healthy elderly people. Each muscular contribution to an angular acceleration of the knee was evaluated in the 5% -15% and 15% -25% periods of the posture phase (% SP).

On the one hand, the results were 76.6% (n = 105) of all the knees examined, with cartilage damage (ICRS-grade III / IV). Of the patella with 43.8%, the medial femur with 34.3%, the medial tibial plateau with 17.5%, the trochlea with (8.8%) and the lateral joint compartment with (femoral 2.2%, tibial 15.3%). However, no significant difference was reported between patients with medial meniscus injuries and joint injuries.

On the other hand, all patients with knee osteoarthritis obtained significantly less acceleration of knee extension by the extensive muscles and a greater acceleration of the knee by the hip adductors than those in the controls in 5-15% SP .

Of the two studies mentioned above, the results were different, both in the group of injuries of the medial meniscus and articular, there was no significant difference, so there was no improvement in functional capacity.

In the subjects subjected to 8 infrared cameras and two force plates, there was an improvement in the degree of movement of the knee, therefore there was an improvement in walking speed.

Sorpkor, S. et al. (2019) (10) reported with the study entitled “Cortical Hemodynamic Response to Contact Thermal Stimuli in Older Adults with Knee Osteoarthritis: A Functional Near Infrared Spectroscopy Pilot Study” (10) that pain has its main source in the brain. Pain itself is the response of a series of mechanisms that works with the transmission of electrical impulses from the brain. This study reported that the near infrared could be an excellent method for relieving pain. N = 14 adult patients living in the community with OA knee pain with an age range of 50 to 85 years were followed who underwent different tests including infrared. After the treatment it was possible to show that the use of infrared is beneficial for patients with degenerative diseases such as knee osteoarthritis. All the studies carried out selected patients with an age range greater than 40 years. However, knee osteoarthritis generally affects people over 50 years of age. Referring to the methodological quality used in the different selected publications, the majority have some methodological defect. The combination of infrared with other methods generates a significant result compared to the simple use of this device as a method of treatment of patients with knee osteoarthritis and that short-term therapy reduces the effectiveness of the type of treatment. All the studies carried out selected patients with an age range greater than 40 years. However,

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All the studies mention pain and functional capacity as indicators that participate as the first signs and symptoms of this degenerative pathology.

8 SUMMARY OF RESULTS

Osteoarthritis is one of the degenerative diseases that affect different parts of the human body. This pathology causes pain and loss of joint functional capacity. Recent studies have shown an increased risk of mortality in patients with osteoarthritis.

9 CONCLUSIONS

Although beneficial, more scientific research is needed to further validate the use of infrared as a non-drug treatment method for some degenerative knee diseases.

The highly prevalent osteoarthritis generates enormous social and economic problems. Current studies determine that the condition of this pathology is multifactorial.

We concluded that infrared therapy has proven to be a reliable and effective method in the treatment of osteoarthritis, and as it has shown a positive effect in reducing pain and inflammation of the knee.

PERSPECTIVES

Infrared could be a new method in the future to relieve knee pain in degenerative diseases such as osteoarthritis.

Further research is required on infrared for the treatment of the knee with osteoarthritis due to the fact that there is very little information.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interest.

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