



ORIGINAL ARTICLE

Osteoarthritis Therapy: Which is More Effective, Laser Therapy or a Combination of TENS IR

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ABSTRACT

Background: Osteoarthritis (OA) is a progressive joint disorder characterized by cartilage degeneration, commonly affecting older individuals. Knee OA is one of the most frequently encountered forms and often leads to chronic pain and impaired mobility. Non-pharmacological interventions have been increasingly utilized to manage OA symptoms, particularly pain. Among these are Low-Level Laser Therapy (LLLT), Transcutaneous Electrical Nerve Stimulation (TENS), and Infrared (IR) therapy. These modalities aim to decrease pain severity and improve the quality of life. This study was designed to compare the effectiveness of LLLT and the combined application of TENS and IR in alleviating knee pain in OA patients at RSI A. Yani Hospital, Surabaya

Method and Result: A quantitative approach was applied using a two-group post-test-only experimental design to analyze the influence of independent treatments on pain reduction. The study was conducted from February to August 2024. Participants were selected through purposive sampling based on predefined criteria. Data normality was assessed using the Kolmogorov-Smirnov test. Since the data were not normally distributed, the Mann-Whitney U test was used to determine statistical differences between the two treatment groups. The statistical analysis using the Mann-Whitney test yielded a p-value of 0.417 ($p > 0.05$), indicating no significant difference in pain reduction between the LLLT group and the TENS+IR group.

Conclusion: The findings suggest that both LLLT and the combined use of TENS and IR are equally effective in managing knee pain in osteoarthritis patients. As neither treatment showed superior outcomes, both can be considered valid non-pharmacological options in OA pain management protocols. Further studies with larger sample sizes and longitudinal assessment are recommended to confirm and expand upon these findings.

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Introduction

Osteoarthritis (OA) is a degenerative disease of the joints that attacks the joint cartilage and is one of the types of arthritis common in older people [1]. Osteoarthritis genu is a degenerative disease of the joints caused by several factors. This disease is characterized by the occurrence of cartilage damage. The symptoms of genuine osteoarthritis are progressive, with complaints occurring slowly and gradually worsening [2]. Osteoarthritis occurs because the joint repair process is unable to compensate for the damage that occurs. Osteoarthritis can affect both men and women. Under the age of 45 OA attacks more men, and above 55 more women [3].

From a rehabilitation point of view, Osteoarthritis genu can cause various degrees of disorders such as impaired muscle strength, restricted range of joint movement, pain, muscle spasms, and disabilities such as inability to perform certain activities such as standing up from sitting, bowing, kneeling, long-standing. As a result of decreased mobility. Even levels of functional limitation such as disruption of walking, running, and climbing stairs [4].

Low-Level Laser Therapy (LLLT) is a non-invasive light source treatment that produces a single wavelength of light. It doesn't emit heat, noise, or vibration. It's also called photobiology or biostimulation. LLLT is believed to affect the function of connective tissue cells (fibroblasts), accelerate connectivity repair, and act as an anti-inflammatory agent. This light has a good effect on pain, inflammation, and tissue repair [5].

Transcutaneous Electrical Nerve Stimulation (TENS) can reduce pain because the effect of electrical stimulation applied to the nerve fiber will result in antidromic activation, with the presence of this antidromic activation can lead to vasodilatation and suppression of sympathetic activity thus improving blood flow and transportation of material that affects pain is also increased. The administration of Infra Red (IR) intervention with a penetration depth of about 3 mm into skin tissue will cause vasodilation and circulation to become smooth in skin tissues which will lead to reabsorption and relaxation so that the muscles become elastic and flexible which leads to increased muscle flexibility to increase the range of

joint movement and stretch pain disappears so that pain is reduced [6].

Both modalities can reduce pain, in the case of pain Osteoarthritis of the knee, but there is still a minimum of research that proves which modality is better in reducing pain in the case of Osteoarthritis of the knee so the author is interested to know the difference between the influence of LLLT and TENS IR on the reduction of pain in knee Osteoarthritis.

Methods

This type of research uses pre-experimental with one-group pretest-posttest methods, that is, experimental research that is carried out on only one group without a control group. The research was conducted at RSI Ayani Surabaya in February-July 2024. Sampling is done purposive sampling. The inclusion criteria are Osteoarthritis patients who come to Poli Medical Rehabilitation criteria, while the exclusion is post foot surgery, post knee injection. The total sample in this study was 45 patients with osteoarthritis. The measured variable is the VAS score, before and after therapy of LLLT and TENS IR. The therapy doses of LLLT is 9 joules / cm² applied to the patient's 5 pain points (1.8 J/cm² per point), therapeutic treatment 2 times a week, Transcutaneous Electrical Nerve Stimulation (TENS) is duration of use 10 minutes with a power of 80-120 Hz, and Infra Red (IR) is 10-15 minutes with the distance 30-45 cm [7,8]. The type of data collected is primary data and secondary data obtained from medical records. Data processing and analysis using test analysis paired with T-test and Mann-Whitney's SPSS program. This study was approved by KEP Rumah Sakit Islam Surabaya, No. 106.EC.KEP.RSIAY.06.23.

Results

There were 45 samples that met the inclusion criteria. The characteristics of the samples are provided in Table 1. It can be seen that the distribution of samples in terms of age is evenly distributed between the ages of 30-89 years with the age group 60-69 years dominating (37.8%). The average age is 64.68 years (Table 1). Furthermore, the number of female samples (80%) is higher than the male (20%).

Table 1. Sample Characteristic

Sample Characteristic		Frequency (n=45)	Percentage (%)
Age	30-39	1	2,1
	50-59	14	31,1
	60-69	17	37,8
	70-79	10	22,3
	80-89	3	6,7
Gender	Men	9	20
	Women	36	80

From the SPSS statistical test results (Table 2. The VAS Average in Laser Therapy is 4,62, while the VAS Average in TENS IR Therapy is 4,8. Based on Mann Whitney's analysis results showed that the p-value is 0.417 ($p > 0.05$), which means that

there is no significant difference between the effectiveness of laser therapy and the combination of Transcutaneous Electrical Nerve Stimulation Infra-Red for pain reduction in osteoarthritis.

Table 2. Analysis of Therapy

Therapy	N	VAS Average	Asym. Sig. (2-tailed)
Laser	45	4,62	0.147
TENS IR	45	4,8	

Discussion

The Effects of Laser Therapy

Effects of low-intensity laser therapy in pain reduction in knee joint osteoarthritis. Lasers are rays that are amplified by the emission of radiation from the stimulation of special substances. The laser used is a low-level laser therapy that has a power output of 1 mW to 75 mW, this type of laser interaction with tissues has biological effects that can be used to treat cases of osteoarthritis. The laser also reduces pain and affects peripheral nerve activity. The effect of HeNe injection on peripheral sensory nerve latency in humans suggests that low-dose laser administration to the periphery nerve results in a significant decrease in the velocity of sensory nerve conduction. It shows the pain reduction mechanism of the laser. The mechanism of low-intensity laser pain reduction is by reducing the speed of sensory nerve transmission [6]. The results of this study demonstrate a significant reduction in pain levels among knee osteoarthritis (OA) patients following low-intensity laser therapy, as evidenced by the statistically significant decrease in VAS scores ($p = 0.000$). This finding aligns with previous research indicating that Low-Level Laser Therapy (LLLT) exerts analgesic effects through several mechanisms, including modulation of inflammatory mediators, increased microcirculation, and stimulation of endorphin release. A meta-analysis by Stausholm et al. confirmed that LLLT significantly improves pain

and functional outcomes in knee OA when appropriate parameters are applied [7-9]. Moreover, LLLT has been shown to promote tissue repair and reduce oxidative stress, contributing to long-term pain relief [10]. The use of LLLT as a non-invasive modality offers a valuable alternative or adjunct to pharmacologic interventions, particularly for patients who are contraindicated for NSAIDs or other systemic therapies. These results suggest that integrating LLLT into standard rehabilitation protocols may enhance patient outcomes and reduce reliance on long-term medication use in OA management [7-8].

Effects of Combination Therapy TENS IR

Transcutaneous Electrical Nerve Stimulation (TENS) is an alternative therapy to reduce chronic pain in osteoarthritis. The electric current is generated through this device for nerve stimulation through the skin. TENS antidromic stimulation can block the transmission of stimuli from the nociceptor to the spinal cord. TENS also activates the autonomous nervous system which will trigger a vasomotor stimulus response that will subsequently modify tissue chemistry to reduce pain. Infra-Red has also been widely used to deal with various musculoskeletal problems, including osteoarthritis. Infrared raises the temperature of the underlying tissue. Increased tissue temperature can lead to vasodilatation, increased cellular activity, an increased pain

threshold, as well as reduced muscle spasms.⁷ In this study, there was an effect of pain reduction before and after TENS IR therapy on knee osteoarthritis. Based on analysis of VAS data score on OA patients before and after TENS IR therapy for 6 months with statistical test paired sample T-test obtained results with a value of $p = 0,000$ ($p < 0.05$), which means there is a significant effect of TENSIR therapy on the reduction of pain in OA patient. TENS functions by stimulating large-diameter afferent fibers, which inhibit nociceptive transmission at the spinal cord level, thereby reducing pain perception.⁹ The addition of infrared therapy enhances therapeutic outcomes by improving local blood flow, reducing inflammation, and promoting tissue repair [10]. A randomized controlled trial by Taspinar et al. also demonstrated that TENS combined with physical modalities significantly improved pain and physical function in OA patients [11]. Furthermore, a recent study by Hsieh et al. (2023) highlighted that multimodal physical therapy, including TENS and IR, resulted in sustained pain relief and better adherence among elderly OA patients [12]. These findings suggest that the TENS-IR combination offers a synergistic effect and may serve as an effective, safe, and accessible adjunct in long-term OA management, particularly for patients seeking to minimize reliance on pharmacologic agents.

Comparison of The Effects of Laser Therapy and TENS IR Therapy on Osteoarthritis of the Knee Joint.

In this study, based on Mann Whitney's analysis results showed that the p value is 0.417 ($p > 0.05$), which means that there is no significant difference between the effectiveness of laser therapy and the combination of Transcutaneous Electrical Nerve Stimulation Infra Red for pain reduction in osteoarthritis patients at RSI Surabaya A Yani Medical Rehabilitation Clinic. Results show that both low-intensity laser therapy and TENS IR, are equally effective in relieving pain in knee osteoarthritis.

These findings are consistent with previous studies indicating that both Low-Level Laser Therapy (LLLT) and the combination of Transcutaneous Electrical Nerve Stimulation and Infrared therapy (TENS+IR) can provide effective analgesia in patients with knee osteoarthritis, although neither appears to be superior [13]. A systematic review by Stausholm et al. (2019) concluded that LLLT significantly

reduces pain and improves function in knee OA when appropriate doses are used [14]. Similarly, TENS has been shown to reduce pain intensity and improve quality of life in OA patients, especially when combined with other modalities such as infrared therapy [15]. The lack of statistically significant difference in this study may be due to comparable mechanisms of action shared by both interventions, such as enhanced local circulation, anti-inflammatory effects, and neuromodulation of pain pathways. Furthermore, variations in individual pain perception, disease severity, and treatment duration might also influence outcomes. These results suggest that clinicians can flexibly choose either modality based on patient preferences, availability, or contraindications, as both offer similar benefits in pain management for knee osteoarthritis.

In addition to pharmacological and non-pharmacological therapy, osteoarthritis patients receive education to practice fasting and physical exercise to reduce obesity. Obesity is one of the controllable risk factors for osteoarthritis. Therefore, physical exercise is necessary not only to maintain general fitness but also to reduce body weight, which is one of the risk factors for the occurrence and worsening of osteoarthritis, and of course, it should be chosen in a way that does not directly burden the knee joints. In addition, physical exercise also helps reduce complaints, particularly joint pain [16].

Conclusion

Low Level Laser Therapy and Transcutaneous Electrical Nerve Stimulation (TENS) Infra Red (IR) are both effective in reducing pain in osteoarthritis.

Conflict of Interest

No conflict of interest in this study

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