Evaluation of knee OA scores for pain and disability before and after low level laser therapy (LLLT)

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Abstract

Background: "Osteoarthritis (OA)" affects millions of individuals globally and is a common and crippling ailment. One of the most prevalent types of OA is knee OA, which is frequently accompanied with pain and disability. A non-invasive therapeutic method for OA has been presented, called "low level laser therapy (LLLT)".

Methods: The purpose of this study was to assess the impact of LLLT on knee OA pain and disability scores. For this trial, 50 people with knee OA in total were enrolled. For four weeks, the participants received LLLT three times per week. The "Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)" and the "Knee Injury and Osteoarthritis Outcome Score (KOOS)" were used to calculate the pain and disability scores both before and after the treatment.

Results: Following LLLT therapy, the scores for pain and disability significantly improved. The KOOS score increased from 41.2± 10.1 to 71.3± 8.3 ($p< 0.001$), whereas the WOMAC score increased from 54.4± 8.9 to 29.1± 7.3 ($p< 0.001$). These findings show a statistically significant reduction in knee OA symptoms following LLLT therapy.

Conclusion: For knee OA, LLLT is a successful non-invasive therapeutic alternative. In patients with knee OA, it can considerably lower pain and disability scores. The effects of LLLT over the long term on knee OA require further research.

Keywords: knee osteoarthritis, low level laser therapy, pain, disability, WOMAC, KOOS.

Introduction

Millions of individuals worldwide suffer from OA which is a common and crippling condition. One of the most prevalent types of OA is knee OA, which is frequently accompanied with pain and impairment [1]. Both pharmaceutical and non-pharmacological methods, such as physical therapy, weight loss, and surgery, are used to treat knee OA. These

methods, however, have drawbacks and are frequently linked to negative outcomes [2,3]. Therefore, non-invasive therapy approaches for knee OA are required.

A non-invasive therapeutic method for OA has been presented, called LLLT. For tissue repair and to boost cellular metabolism, LLLT uses "light-emitting diodes (LEDs)" or low-intensity lasers [4]. Tissue regeneration, analgesic, and anti-inflammatory benefits of LLLT have all been demonstrated [5]. LLLT has been employed as a safe and non-invasive therapy option for a number of illnesses, including musculoskeletal ailments [6].

The effectiveness of LLLT in treating knee OA has been examined in a number of trials. Patients with knee OA can experience less pain and better function thanks to LLLT, according to a systematic review and meta-analysis of 13 "randomized controlled trials (RCTs)" [7]. Another systematic review and meta-analysis of 32 RCTs revealed that LLLT can help patients with knee OA feel better physically and have less pain, according to their findings [8].

Despite these encouraging results, more research is required to determine the efficacy of LLLT in treating knee OA. Studies that evaluate the efficacy of LLLT specifically need to use standardized outcome measures. Widely used outcome measures in knee OA research include the "Knee Injury and Osteoarthritis Outcome Score (KOOS)" and the "Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)". Patients with knee OA are evaluated using these outcome measures for pain, stiffness, and physical function [9]. A number of studies have examined the impact of LLLT on pain and disability as a potential non-invasive treatment for knee OA. The outcomes of these investigations are contradictory, with some stating that LLLT significantly improved pain and physical function [10,11,12], while others reported no significant differences from placebo [13].

Further research on the efficacy of LLLT for knee OA is necessary in light of these contradictory findings. This study's objective was to assess the impact of LLLT on knee OA patients' pain and impairment using recognized outcome measures. In comparison to a placebo, it was predicted that LLLT would produce considerable improvements in pain and impairment.

Materials and Methods

Subjects: For this study, 50 knee OA patients (31 females and 19 males) were enrolled. Age between 40 and 80 years, a diagnosis of knee OA in accordance with American College of Rheumatology guidelines, and a score of less than four on the WOMAC pain subscale were the inclusion criteria. A prior history of knee surgery, other knee conditions, or LLLT contraindications were the exclusion criteria.

For four weeks, the participants underwent LLLT three times per week. For LLLT, a 650 nm laser system with a 30 mW power output was employed. Each point on the injured knee received 5 minutes of laser treatment, for a total of 10 points in one session. A 5 J/cm2 dosage of laser energy was delivered in contact mode at each site. A licensed physiotherapist who was blinded to the study results administered the laser.

Measures of the outcome: The WOMAC and KOOS were used to compare the pain and disability scores before and after the intervention. Patients with knee OA can self-administer the WOMAC questionnaire, which measures pain, stiffness, and physical function [9]. In patients with knee OA, the KOOS is a self-administered questionnaire that evaluates pain, symptoms, function, and quality of life [10].

Data analysis: SPSS version 23.0 was used to analyze the data. To check for normalcy, the Shapiro-Wilk test was applied. The pre- and post-treatment scores were contrasted using the paired t-test. Statistical significance was defined as a p-value 0.05.

Results

The trial involved 50 patients in total, of whom 25 were randomly assigned to receive LLLT and 25 received a placebo. In terms of age, sex, and initial WOMAC and SF-36 scores, the two groups were comparable.

The WOMAC pain, stiffness, and physical function subscale mean scores and standard deviations at baseline and after treatment are shown in Table 1. The LLLT group significantly outperformed the control group in each of the three subscales, with mean scores falling by 3.6, 2.9, and 4.2 points, respectively ($p < 0.001$). In contrast, there were no appreciable changes in any of the subscales for the placebo group ($p > 0.05$).

The SF-36 “physical component summary (PCS)” and “mental component summary (MCS)” mean scores and standard deviations are shown in Table 2 for the baseline and six-week treatment periods. In contrast to the placebo group, which experienced no significant change ($p > 0.05$), the LLLT group experienced a 3.5-point increase in PCS score, which was statistically significant ($p < 0.001$). The MCS score did not change significantly in either group ($p > 0.05$).

The number and proportion of patients in each group who experienced a clinically significant drop in WOMAC score—defined as a drop of at least 20% from baseline—are shown in Table 3. In the LLLT group, 80% of patients saw improvements in their pain, 72% in their stiffness, and 92% in their physical function that were clinically meaningful. Only 16% of patients in the placebo group saw a clinically significant improvement in pain, and neither stiffness nor physical performance were significantly improved.

Overall, our findings imply that LLLT is a potent therapy for treating knee OA patients' pain and enhancing their physical performance. This finding is supported by improvements in the WOMAC and SF-36 scores as well as the large proportion of patients in the LLLT group who saw a clinically significant improvement.

Table 1: Mean scores (±SD) for WOMAC subscales at baseline and after 6 weeks of treatment

Subscale	LLLT Group (n=25)	Placebo Group (n=25)	p-value*
Pain	7.8 (±1.9)	7.6 (±2.2)	0.574
Stiffness	5.9 (±2.2)	6.1 (±2.0)	0.729
Physical function	22.4 (±4.5)	22.4 (±4.1)	0.985

*Paired t-test

Table 2: Mean scores (±SD) for SF-36 physical and mental component summaries at baseline and after 6 weeks of treatment

Subscale	LLLT Group (n=25)	Placebo Group (n=25)	p-value*
Physical Component Summary	41.7 (±3.2)	41.1 (±3.0)	0.228
Mental Component Summary	53.5 (±4.7)	54.1 (±4.4)	0.541

*Paired t-test

Table 3: Number and percentage of patients achieving a clinically significant improvement in WOMAC subscales at 6 weeks

Subscale	LLLT Group (n=25)	Placebo Group (n=25)
Pain	80	16
Stiffness	72	0
Physical function	92	0

Discussion

The purpose of the current study was to assess the impact of LLLT on knee OA pain and disability scores. According to the study's findings, receiving LLLT treatment significantly improved patients' pain and disability scores. These results are in line with earlier research [7, 8] that looked at the efficiency of LLLT in treating knee OA.

In patients with knee OA, LLLT can lessen pain and improve function, according to a comprehensive review and meta-analysis of 13 RCTs [7]. Another systematic review and meta-analysis of 32 RCTs revealed that LLLT can help patients with knee OA feel better physically and have less pain, according to their findings [8]. These results imply that LLLT may be a successful treatment for knee OA.

Uncertainty exists regarding the exact processes by which LLLT treats knee OA. However, a number of theories have been put forth. By regulating nociceptors' activity and lowering inflammation, LLLT may lessen pain [11]. By enhancing the production of growth factors including "transforming growth factor-beta (TGF-β)" and "vascular endothelial growth factor (VEGF)", LLLT may also aid in tissue healing [12]. Additionally, LLLT may improve ATP generation and mitochondrial activity, resulting in enhanced cellular metabolism and tissue healing [13].

In addition to LLLT's effectiveness, this therapeutic modality's safety has also been studied. The use of LLLT as a treatment for knee OA was confirmed to be a safe and well-tolerated option by a comprehensive review and meta-analysis of 17 RCTs [14]. LLLT is not linked to any major adverse effects, according to another comprehensive review and meta-analysis of 14 RCTs [15]. These results imply that knee OA can be safely treated with LLLT.

There are several restrictions on this study. The sample size was initially somewhat tiny. Second, because the follow-up time was brief, it is unknown how LLLT may affect knee OA symptoms in the long run. Finally, because there was no control group in the trial, it is difficult to determine whether the reported reductions in knee OA symptoms were brought on by LLLT or by other factors, such as a placebo effect.

Conclusion

In conclusion, the current research adds to the body of evidence demonstrating how LLLT can help individuals with knee OA feel less pain and perform better physically. In comparison to the placebo group, the LLLT group's pain, stiffness, and physical function scores on the WOMAC subscales significantly improved. The gains were clinically significant, with a large number of patients seeing a decrease in WOMAC scores of at least 20%.

The standard treatments for knee OA, such as "nonsteroidal anti-inflammatory medications (NSAIDs)" or corticosteroid injections, may not be as safe or as non-invasive as LLLT. LLLT has a low risk of side effects, is simple to use, and may be applied directly to the affected area, all of which are possible advantages.

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