

## THE TREATMENT OF LATERAL EPICONDYLITIS WITH IONTOPHORESIS OF IBUPROFEN AND LOW LEVEL LASER

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**ABSTRACT:** The aim of this study was to compare the short-term efficacy of ibuprofen iontophoresis and low energy laser in the treatment of lateral epicondylitis.

Sixty patients with lateral epicondylitis were randomly assigned to ibuprofen iontophoresis or laser groups. Each treatment was applied for ten days. The treatment outcomes were evaluated according to the following methods: a four-point scale was used for the assessment of pain intensity at rest, during function and provoked by resisted wrist extension and palpation; pain free grip strength; lifting test. The clinical assessments were performed before and after the treatment period. A statistically significant pain relief was achieved in the iontophoresis groups at the end of the treatment. In the laser group only pain on pressure decreased in a statistically significant manner. The improvement in pain on pressure was significantly greater in the iontophoresis treated group ( $p=0.029$ ). The improvement in grip strength indicated a significant difference in favor of the iontophoresis group ( $p=0.020$ ). The maximum weight that the patients could lift without pain also increased significantly in only iontophoresis group. Our results suggested that ibuprofen iontophoresis is safe and effective in the treatment of lateral epicondylitis and low-level laser treatment used alone cannot be considered as a very effective treatment in lateral epicondylitis.

Key words: ibuprofen, iontophoresis, lateral epicondylitis, low-level laser

### INTRODUCTION

Lateral epicondylitis is a common lesion of the upper extremity with a prevalence of 1-3% in the general population. It occurs more frequently between 40 and 60 years and usually affects the dominant arm (1). Although overuse or repetitive activities have been proposed as precipitating factors, there is still no agreement about the etiology (2).

The diagnosis of lateral epicondylitis is made clinically and it is based on a history of pain and tenderness localized to lateral epicondyle. Pain frequently radiate down the extensor surface of the forearm and increase with provocation tests (3). Grip strength may be impaired because of pain (1).

Although a great variety of potential therapies have been proposed, there is a lack

of consensus on optimal management (4). The conservative treatment of lateral epicondylitis consist of immobilization and splinting (2), oral or local nonsteroidal anti-inflammatory drugs (NSAIDs) (5), corticosteroid injections (4, 6), different physiotherapies (7, 8), pulse electromagnetic fields (9), iontophoresis (10), acupuncture (11), exercise (12), and manipulation techniques (13). For patients in whom conservative treatment regimens fail, surgery may be required (3).

Low-level lasers also have been proposed as a therapeutic tool for the treatment of lateral epicondylitis (14, 15). However, some clinical studies have contradictory results. In two double blind, placebo laser controlled and randomized studies; low-level laser therapy has been reported to have no beneficial effect on lateral epicondylitis (16, 17).

The purpose of our present study was to investigate the short-term efficacy of low-level laser therapy in comparison to ibuprofen iontophoresis in the treatment of lateral epicondylitis.

## PATIENTS AND METHODS

### *Patients*

Sixty patients diagnosed with lateral epicondylitis, 37 women and 23 men with a mean age of  $44.45 \pm 8.76$  years (ranged 29-62 years) participated in this study. The duration of their symptoms ranged from 1-6 months with an average of  $3.58 \pm 1.96$  months.

The inclusion criteria included pain on the lateral epicondyle for at least one month and pain aggravation during the following tests: palpation of lateral epicondyle, resisted wrist extension with the elbow in full extension and the forearm pronated, and resisted finger extension.

Exclusion criteria were; bilateral epicondylitis, local arthritis or generalize polyarthritis, neurologic abnormality in the affected arm, radial nerve entrapment, dysfunction in the shoulder and neck region, skin diseases on the site of iontophoresis application, a known hypersensitivity to ibuprofen, pregnancy and breast-feeding. Also the patients who had received other treatments for lateral epicondylitis previously were excluded.

### *Study design*

We conducted a clinical, randomized, blind-observer study, comparing the short-term efficacy of ibuprofen iontophoresis and low-level energy laser therapy for lateral epicondylitis. At baseline visit sixty patients with lateral epicondylitis were randomly assigned to receive either ibuprofen iontophoresis (Group 1,  $n=30$ ), or low-level laser therapy (Group 2,  $n=30$ ). The ethics committee of the Osmangazi University Medical School approved this study.

### *Treatment*

*Iontophoresis application:* A topical anti-inflammatory agent containing 5% ibuprofen (Dolgit cream®, Adeka, Turkey) was used for iontophoresis. The electrodes were transversely arranged on both sides of the elbow. Approximately 10 cm (90 mg) ibuprofen cream was applied with the negative electrode on the painful area. Current intensity was between 4-10 mA and it was adjusted according to the patient's tolerance. The duration of each session was 10 minutes.

*Laser application:* For the source of low-level laser, a Gal- Al-As diode laser device (Endolaser 476, Enraf Nonius, Netherlands) was used with a continuous wave with an output of 10 mW and a wavelength of 780 nm. For the irradiation, 5 tender points were chosen and a two-minute irradiation at each point (a total of 10 minutes) was considered as one irradiation dose. When applied for ten minutes, this laser gave a dose on the skin surface of  $1.5 \text{ J/cm}^2$ . The laser probe was held perpendicularly 1 mm from the patient's skin and the laser was calibrated regularly.

Both treatment methods were carried out once a day, five days a week, and a total duration of ten days.

The patients were not allowed to take any other drug or treatment for their lateral epicondylitis throughout the study and they were advised to avoid activities that could provoke pain.

### *Clinical assessment*

The efficacy of ibuprofen iontophoresis and low level laser therapy was evaluated according to the following methods.

(1) A four points scale was used to evaluate the pain intensity at rest, by pressure, during function, and during resisted wrist extension (0= none, 1= mild pain, 2= moderate pain, 3= severe pain).

(2) Pain free grip strength was measured with a hand dynamometer with the elbow full extended and the forearm pronated. Patients were told to squeeze the dynamometer handle until they experienced pain. The test was

repeated three times and the mean value of three consecutive estimations was calculated.

(3) Lifting test: The maximum weight that the patient could lift (1, 2, 3, and 4 kilograms) without pain with the elbow fully extended and the forearm pronated was evaluated on the affected side.

A blinded physician unaware of the treatment allocation performed the clinical assessments.

#### ***Laboratory assessment***

Laboratory assessment (according to standard methods) was performed only at baseline and included the routine hematological and blood biochemistry tests.

#### ***Statistical analysis***

Baseline homogeneity was evaluated by t test for parametric data and by  $\chi^2$  or Fishers exact tests where appropriate for non-parametric data.

For changes in various symptoms after the treatment within each group the Wilcoxon and paired t tests were used. The Mann-Whitney and independent samples t test were used to compare the therapeutic results between the groups. Differences were considered significant if the p values were less or equal to a level of 5% and all results are expressed with 95% confidence interval.

### **RESULTS**

Fifty-three patients completed the study. Three patients in the iontophoresis group, and four patients in the laser group withdrew because of the lack of efficacy. The baseline characteristics of the patients who completed the study are shown in Table 1. There was no significant difference between groups with regard to age, sex, duration of symptoms, and affected arm.

#### ***Subjective outcome***

At the end of the treatment, a statistically significant improvement in the scores of pain at rest ( $p<0.01$ ), on pressure ( $p<0.001$ ), on

resisted wrist extension ( $p<0.01$ ), and during activation ( $p<0.01$ ) was observed in the group treated with ibuprofen iontophoresis. In the laser group only pain on pressure decreased in a statistically significant manner ( $p<0.05$ ). Comparison of the post-treatment scores for pain on pressure between the groups, showed significant improvement in favor of the iontophoresis group ( $p<0.05$ ). Although the changes in other pain parameters showed a trend toward greater improvement in iontophoresis group, there were no significant differences between the groups (Table 2).

#### ***Objective outcome***

There was a significant improvement in grip strength in the iontophoresis group ( $p<0.01$ ), but no significant improvement was seen in the laser group. Comparison between the groups showed significant improvement in grip strength in the iontophoresis group over the laser group ( $p=0.02$ ) (Table 3).

The lifting test showed a significant improvement in the iontophoresis group ( $p<0.01$ ) and no significant difference was observed in the laser group. There was also no significant difference between the groups (Table 4).

No systemic or local side effects of either treatment were seen during the study.

### **DISCUSSION**

Lateral epicondylitis is one of the common lesions of the upper extremity causing pain and tenderness in the lateral elbow region. Treatment is generally conservative and NSAIDs, physical therapy and corticosteroid injections are the most frequently applied therapies (4). Although a great variety of potential therapies have been suggested, there is still no agreement on the optimal conservative treatment.

In this study we investigated the effect of ibuprofen and low-level laser in the treatment of lateral epicondylitis. Our results showed that after two weeks of treatment there was a significant improvement in both

**Table 1:** Baseline characteristics of the patients who completed the study

	Iontophoresis group (N = 27)	Low level laser group (N =26)	p value
Age (years)	44.25±7.72	44.07±8.95	NS
Duration of disease (months)	3.96±1.53 17/10	3.43±1.36 15/11	NS
Sex (Female/Male)	22/27	21/26	NS
Dominant extremity			

**Table 2:** Pain scores of the patients

Pain at rest	Pre-treatment				Post-treatment				p value
	0	1	2	3	0	1	2	3	
Iontophoresis (N= 27)	2	6	13	6	6	7	9	5	<0.01
Low level laser (N= 26)	2	8	10	6	4	7	11	4	>0.05
p value	NS				NS				
Pain on pressure	Pre-treatment				Post-treatment				p value
	0	1	2	3	0	1	2	3	
Iontophoresis (N=27)	0	4	15	8	1	11	11	4	<0.001
Low level laser (N= 26)	0	2	15	9	1	3	14	8	<0.05
p value	NS				<b>0.029</b>				
Pain during activation	Pre-treatment				Post-treatment				p value
	0	1	2	3	0	1	2	3	
Iontophoresis (N= 27)	0	0	12	15	0	4	12	11	<0.01
Low level laser (N= 26)	0	0	10	16	0	1	10	15	>0.05
p value	NS				NS				
Pain on resisted wrist extension	Pre-treatment				Post-treatment				p value
	0	1	2	3	0	1	2	3	
Iontophoresis (N= 27)	0	0	12	15	0	3	14	10	<0.01
Low level laser (N= 26)	0	0	12	14	0	3	11	12	>0.05
p value	NS				NS				

**Table 3:** The mean grip strength values of the patients (bar)\*

	Pre-treatment	Post -treatment	p value
Iontophoresis (n=27)	0.29±0.03	0.31±0.04	<0.01
Low level laser (n=26)	0.28±0.04	0.29±0.02	NS
p value	NS	<b>0.020</b>	

\* Data were expressed as the mean±standard deviation

**Table 4:** The results of the weight test (kg)\*

	Pre-treatment	Post-treatment	P value
Iontophoresis (n= 27)	1.59±0.57	1.96±0.70	<0.01
Low level laser (n= 26)	1.54±0.58	1.65±0.62	NS
p value	NS	NS	

\* Data were expressed as the mean±standard deviation

groups but that ibuprofen iontophoresis was better than low- level laser therapy. Low-level laser therapy is widely used for the treatment of acute and chronic musculoskeletal pain syndromes but its efficacy still remains controversial. In some studies a significant pain relief was reported with low- level laser (14,15), but there are also reports suggesting a significant placebo action (16,17,18). The differences in the results may be due to the specifications of the laser. There are many different lasers and they may have different effectiveness on same condition. The mechanisms of action of low-level laser irradiation for analgesia are also not completely understood. In an experimental study by Honmura, it has been suggested that low power irradiation on the inflamed regions of carrageenin-treated rats seemed to interfere with the initial inflammatory reactions and the subsequent progress of the inflammation and exerted anti-inflammatory and analgesic effects (19). In another study, the authors had suggested that a neuronal activity inhibition might be responsible for the therapeutic effect and the laser irradiation selectively inhibited nociceptive signals at peripheral nerves (20).

The efficacy of Ga-Al-As laser in lateral epicondylitis has been investigated only in a few studies. In a study by Simunovic, Ga-Al-As laser (830 nm continuous wave) treatment

was compared to placebo in a double-blind and placebo controlled study and a significant improvement in pain scores and grip strength was reported in patients treated with Ga-Al-As laser (15). However, Krasheninnikoff failed to demonstrate any beneficial effect of low-level laser over placebo in lateral epicondylitis in his placebo controlled study. In this study, the active laser was a Ga-AL-AS 30 mW 830 nm low level laser with a output power 3.6 J/point. The treatment session consisted of eight treatments, two per week and as in our study, the tender points on the lateral epicondyle were irradiated. The results of the study showed that there were no differences between laser and placebo (16).

In our study, patient treated with low level laser demonstrated improvement in only subjective pain scores and any significant improvement was observed in objective parameters. As no correlation between the subjective and objective parameters was found, it may be suggested that the observed improvement for pain in the laser group may reflect a placebo effect.

NSAIDs have been used topically to treat various rheumatic diseases (21,22). The topically administration of NSAIDs in painful soft tissues and around joints results in high local concentration of the drug without high systemic circulating levels, thus permitting an

anti-inflammatory effect while avoiding the risk of general disturbances (23). Iontophoresis is a technique that facilitates the penetration of the drug through the skin and it is based on the characteristics of ions in a solution to migrate towards a pole of opposite charge by means of the electromotive force supplied by a low intensity direct current (10).

Certain NSAIDs have been used by topical iontophoresis for the treatment of lateral epicondylitis and successful results have been obtained (24,25). In a randomized study, Demirtaş compared the therapeutic efficacy of sodium salicylate and sodium diclofenac in a group of patients with lateral epicondylitis (24). The results of this study showed that both treatments are effective but there was a significantly greater improvement in the patients treated with sodium diclofenac. In this study we used a 5% ibuprofen cream for iontophoresis. Topical administration of this cream results in higher concentrations in the muscle, fascia, joint capsule and subcutis (26). In various clinical studies, its clinical efficacy has been shown (21,22).

In this study, patients treated with ibuprofen iontophoresis demonstrated significant improvements with regard to pain and functional impairment and our results were in consisted with other studies, which have demonstrated similar effects.

In conclusion, this study confirmed the efficacy and safety of topical ibuprofen application and showed that there were greater improvements in this group than in the laser group. The absence of both local and general side effects, demonstrated the good tolerability of this way of administration. Even though we have shown that low-level laser treatment have some effect on subjective pain, there was no significant improvement on grip strength and weight test, which are objective evaluation criteria. On the basis of these findings, we suggest that low-level laser treatment used alone cannot be considered as a very effective treatment in lateral epicondylitis and placebo-controlled further studies are needed to determine the true effectiveness of low level lasers.

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