

Influence of Iontophoresis vs. Laser on Tempo Mandibular Joint

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ABSTRACT

In an attempt to investigate the influence of iontophoresis vs. laser on tempo mandibular joint, twenty patients were referred to outpatient clinic Elmanial Hospital, Cairo University. Patients were referred from outpatient clinic of the faculty of Dentist. Patients were classified into two equal groups. Group (1) received iontophoresis using lidocaine 4% on the negative electrode over the TMJ area for six sessions. Group (2) received low intensity laser therapy (LILT) over the tender area of the TMJ. Pain was evaluated using VAS and ROM was evaluated using therabite. Pain decreased significantly in both groups where p was <0.001 in group (1) and <0.01 in group (2). ROM increased significantly in both groups where p was <0.01 in group (1) and <0.05 in group (2). Comparing the results of both groups there were no significant differences in pain and ROM where p was >0.05 . It was suggested that both modalities decreased pain and consequently decreased muscle spasm in masticator muscle that leads to increase ROM of the vertical opening of the mouth.

Key words: Iontophoresis, Lidocaine, Laser, and TMJ.

INTRODUCTION

Hypo mobility in tempomandibular joint (TMJ) is a common clinical symptoms associated with masticator muscle disorders. The decreased ability to open the mouth fully is due to the inflammatory process that resulted in a prolonged pain and muscle spasm. Muscle spasm can lead to shortening and a restricted joint capsule. This restriction contributes to the development of trigger points and the joint hypo mobility, compounding the pain process¹.

Whenever, muscle tissue compromised by spasms, any contraction or stretching increases pain. Therefore, to maintain comfort, the patient restricts movement within a range that minimizes pain level. This restriction of the joint range has a distinct reduction in blood

supply to the joint capsule which leads to accumulation of waste products on the surface of the cartilage, causing cartilage surface dystrophy and will initiate an arthritic changes³.

Drug therapy can be applied to relieve pain directly or indirectly. Two methods of direct application of drug for treating pain are iontophoresis on the affected part and direct spraying of medical drug over the spas med muscle. There is no evidence of any side effects of direct drug application if precautions of each drug application are followed⁹.

Iontophoresis is the delivery of medication for therapeutic purposes by means of a direct current. Iontophoresis has been used clinically for more than fifty years. The medications are delivered into deeper tissue via local blood flow and passive diffusion. Animal studies on rhesus monkeys proved that drugs can be penetrated from 1 to 1.5 cm².

However, clinical studies revealed that manipulation, heat therapy, acupuncture, and splinting techniques have significant effects in treating pain, and the superiority of iontophoresis with the selected drugs comes from its localized application, concentration of the medical drugs, and its safety comparison to other methods⁹.

Laser is an acronym for light amplification by stimulated emission of radiation. The first laser was produced in 1960. Laser used for therapeutic applications are described as soft, cold or low power laser, while lasers operating at high power have been used in surgical specialties as well as in military applications¹.

More appropriate term that has been suggested for laser is low level laser therapy (LLLT); this terminology is framed in terms of the reaction between laser and the irradiated biological tissue. Low level intensity laser therapy (LILT) is known as laser acupuncture, some clinicians and authors have recommended the use of LILT as an alternative to metal needles in acupuncture treatments most commonly for the relief of pain¹.

The purpose of this study was to investigate the effect of iontophoresis using a lidocaine on the negative pole to relieve TMJ pain and improve its range of motion in mouth opening, and compare its effectiveness with LILT on TMJ patients. We hypothesized that, there was no significant difference between the application of LILT and iontophoresis to reduce TMJ pain and improve its range in mouth opening.

MATERIAL AND METHODS

Twenty patients complaining from TMJ pain and inability to open their mouths fully were selected randomly from the outpatient

clinic of the faculty of Dentist, Cairo University. The mean age of patients was (47±3.4) years. The study was conducted in out clinic of El Manial University Hospital in June to September 2001.

Patients were divided into two equal groups. Group (1) received iontophoresis using lidocaine on the negative pole electrode. Group (2) received LILT over the TMJ tender area.

Iontophoretic delivery system device (Iomed CO. model # 700, Iomed Inc. UT 84119, USA), was used to deliver dexamethasone.

A Therabite range of motion (ROM) {Therabite Corp.) was used for measuring mouth opening.

Ga As Al infrared laser (Endolaser 476, Enraf Nonius) with a pencil probe (Wavelength 780nm, power 10mw, beam diameter 4mm, was used to deliver LILT over the tender area of the TMJ.

Inclusive criteria

- 1- TMJ disorders (capsulitis, retrodiscitis, reduced anterior disc displacement, and myofascial disorders).
- 2- No history of allergy to lidocaine.
- 3- No open wound at the site of iontophoresis application area.
- 4- No use of pain medications during the study.

Exclusive criteria

- 1- Cardiovascular disorders (hypertension, peripheral vascular disease).
- 2- Trigeminal neuralgia.
- 3- Inability to overcome usage of pain medications.
- 4- Hyperthyroidism.

Procedure

Pain was evaluated for both groups using visual analogue scale (VAS) before and after six sessions of the treatment.

Mouth vertical opening ROM was measured using a disposable Therabite ROM, before and after six sessions of treatment.

Group (1): 5 mm of lidocaine hydrochloride (4 %) was put on the negative electrode over the affected TMJ, the positive electrode was placed over the upper fibers of trapezius muscle. The intensity of the direct current was 5 milliamps, for 20 min. for six sessions⁶.

Group (2): LILT was used over the tender area of the TMJ, Wavelength 780nm, power 10mw, and beam diameter 4mm, was used and connected selection was 100% following the protocol of Sharma et al., (2002)¹³.

RESULTS

Twenty patients (11 males and 9 females) complained from TMJ disorders participated in this study, the mean age was 47 ± 3.4 years. According to the causes of TMJ disorders, there were 3 patients with capsulitis, 4 patients with retrodiscitis, 2 patients with

myofascial disorders, and 11 patients with reduction of anterior disc displacement as shown in table (1).

Table (1) demographic data.

Male patients	11
Female patients	09
Age	47 ± 3.4
Capsulitis	03
Retrodiscitis	04
Myofascial disorders	02
Reduction of anterior disc displacement	11

The influence of iontophoresis with lidocaine hydrochloride (4 %) applied on the negative electrode over the tender area of TMJ has shown a significant difference after six sessions of treatment, where the mean value of VAS before treatment was 7.3 ± 1.9 and reduced to 1.9 ± 0.7 and P value was < 0.001 . While LILT over the tender area of TMJ has shown a significant difference after six sessions of treatment, where the mean value of VAS before treatment was 7.8 ± 2.0 and reduced to 1.7 ± 0.81 and P value was < 0.01 , as shown in table (2).

Table (2): The effect of iontophoresis vs. LILT on visual analogue scale.

Group	Pre treatment	After six sessions	t value	P value
G (1)	7.3 ± 1.9	1.9 ± 0.7	4.3892	0.001
G (2)	7.8 ± 2.0	1.7 ± 0.81	3.4732	0.01

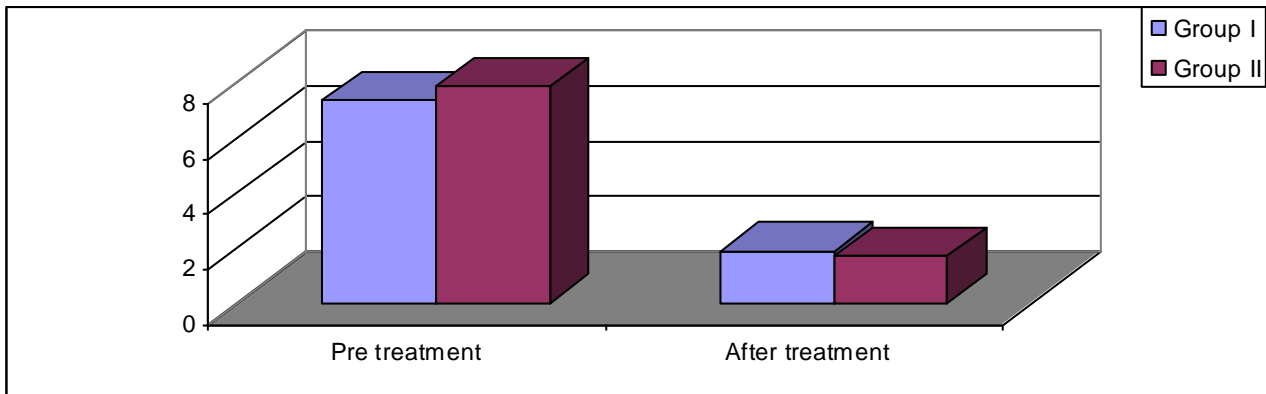


Fig. (1): Influence of iontophoresis and LILT on VAS.

The influence of iontophoresis with lidocaine hydrochloride (4 %) applied on the negative electrode over the tender area of TMJ has shown a significant difference after six sessions of treatment, where the mean value of ROM of the vertical opening of the mouth before treatment was 28 ± 3.4 mm and increased to 37 ± 2.7 mm and P value was < 0.01 . While

LILT over the tender area of TMJ has shown a significant difference after six sessions of treatment, where the mean value of ROM of the vertical opening of the mouth before treatment was 30 ± 4.0 mm and reduced to 35 ± 2.5 mm and P value was < 0.05 , as shown in table (3).

Table (3): The effect of iontophoresis vs. LILT on vertical mouth opening ROM.

Group	Pre treatment (ROM = mm)	After six sessions ROM	t value	P value
G (1)	28 ± 3.4	37 ± 2.7	3.9892	0.01
G (2)	30 ± 4.0	35 ± 2.5	2.4732	0.05

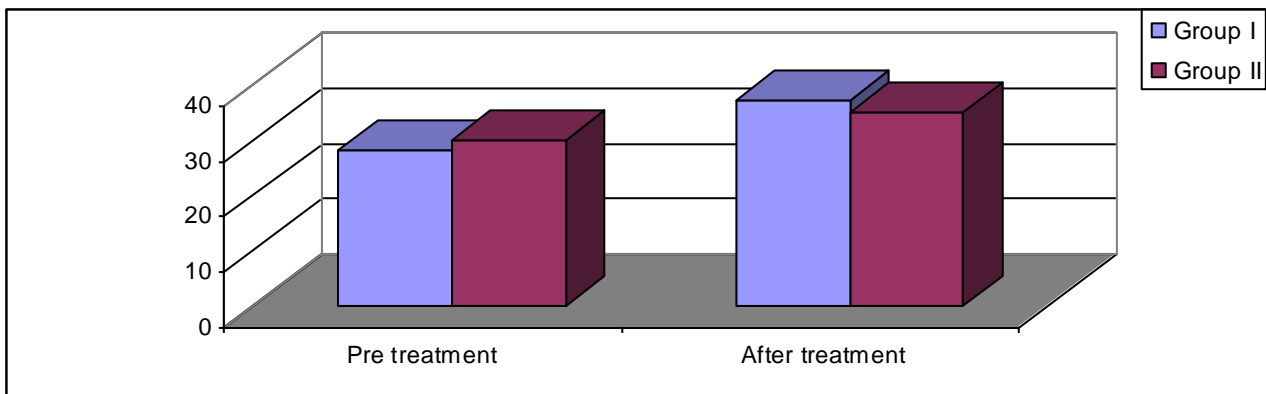


Fig. (2): Influence of iontophoresis and LILT on ROM.

Comparing the influence of iontophoresis with lidocaine hydrochloride (4 %) applied on the negative electrode over the tender area of TMJ to LILT over the tender area of TMJ in both groups, has shown no significant differences in both VAS before treatment and after six sessions of treatment

where P value was > 0.05 as shown in table (4), and in ROM of the vertical opening of the mouth, there were no significant differences in ROM of before treatment and after six sessions of treatment where P value was > 0.05 . as shown in table (4).

Table (4): Iontophoresis vs. LILT on VAS and Vertical mouth opening ROM.

	G1	G2	t value	P value
VAS pre tr.	7.3 ± 1.9	7.8 ± 2.0	0.2364	NS
VAS after 6 tr.	1.9 ± 0.7	1.7 ± 0.81	0.1346	NS
ROM pre tr.	28 ± 3.4	30 ± 4.0	0.4673	NS
ROM after 6 tr.	37 ± 2.7	35 ± 2.5	0.7342	NS

DISCUSSION

Iontophoresis is infiltration of medication into the body via electric current. As a non invasive alternative to hypodermic injections which may further damage traumatized tissue, iontophoresis offers a unique advantage over traditional methods of drug delivery.

lidocaine hydrochloride (4 %) is used for infiltration anesthesia, nerve block techniques. In this study, application of lidocaine over the negative electrode over the TMJ had significantly decreased the pain where ($P \leq 0.001$). Similarly, Harris (1982) conducted a study, where he directly applied the medication iontophoretically to the trigger area resulting in a more rapid resolution of the muscle problem¹⁰.

In this study, ROM of the vertical opening of the mouth had increased significantly in group (1). It was suggested that, the increase of ROM was attributed to the relieve of pain due to the local effects of the delivered medication.

Rocabado (1999) concluded that, ROM was increased due to relaxation of the masticatory muscles due to the reduction of

pain. Therefore, it appears that, this treatment might reduce the masticatory muscle spasm through its indirect effect on pain perception¹².

Therefore, iontophoresis of lidocaine and dexamethasone may provide an avenue to the introduction of other treatment such as therapeutic exercise to maximize the therapeutic effects¹².

In this study LILT over the tender area of TMJ decreased pain significantly in the second group, where $P \leq 0.01$. It was suggested that LILT can be used effectively to reduce pain and inflammation as it increases vascular activity by stimulating blood circulation and metabolic activity¹³ LILT may have significant effects on release of neurochemicals as serotonin thus promoting pain relief⁵.

However, human tissue cultures showed significant increasing in fibroblastic proliferation which acts as the precursor cells to connective tissue structures as collagen and epithelial cell as well as increasing the intracellular material and swollen mitochondria of cells. Thus, as laser increases procollagen production will enhance wound healing⁴.

Furthermore, analysis of the cellular metabolism with attention to the activity of DNA and RNA has been made, it was suggested that laser stimulation enhances the synthesis of nucleic acids and cell division⁷.

In this study, ROM of the vertical opening of the mouth had increased significantly where the P value was ≤ 0.05 . It was suggested that the increased ROM was due to relieving of pain, the decrease of edema, and the decrease of masticatory muscle spasm.

Studies showed that laser irradiation caused increased phagocytosis by leukocytes leading to the possibility of a bactericidal effect therefore, enhancing immunologic responses⁴.

The effect of laser stimulation on inflammatory process and edema is through the interruption of the formation of intermediate substrates necessary for the production of inflammatory chemical mediators as kinins, histamines and prostaglandins without these mediators the disruption of the body's homeostatic state is minimized and the extent of pain and edema is diminished. Biopsies of experimental wounds examination showed decreasing in prostaglandins by laser as during inflammation prostaglandins cause vasodilatation which contributes to the flow of plasma into the interstitial tissue prostaglandins type PGE₂, is decreased and PGF₂ is increased thus accelerating resolution of the acute inflammatory process⁴.

Conclusions

It appears that application of lidocaine solution by iontophoresis on the negative pole over TMJ and LILT over the tender area of TMJ decreases pain of TMJ and increases ROM of the vertical opening of the mouth when applied for six sessions. Further studies

are needed to investigate a mixture of lidocaine and dexamethasone by iontophoresis, and LILT over the acupuncture points of the TMJ.

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الملخص العربي

أثر العلاج بانتقال الأيونات مقابل الليزر في علاج مفصل الفك

في محاولة لدراسة أثر العلاج بانتقال الأيونات مقابل الليزر لعلاج مفصل الفك تم اختيار عشرون مريضاً من العيادة الخارجية لكلية طب الأسنان – جامعة القاهرة لعلاجهم بالعيادة الخارجية بمستشفى المنيل الجامعي ، تم تقسيم المرضى إلى مجموعتين متساويتين ، المجموعة الأولى تلقت العلاج بالأيونات باستخدام ليدوكاين 4% على القطب السالب الذي تم وضعه فوق مفصل الفك ، المجموعة الثانية تلقت العلاج بالليزر مستخدمة جاليوم أريزنيدي ليزر ذو الأشعة الحمراء بطول 780 نانومتر وقوة 10 مللي وات فوق نقطة الألم لمفصل الفك ، استخدم مقياس الألم المرئي ومدى حركة الفك باستخدام ثيرابايت لبيان أثر العلاج ، أثبتت النتائج الإحصائية انخفاض معدل الألم في المجموعة الأولى أقل من 0.001 وفي المجموعة الثانية أقل من 0.01 وتحسن معدل الحركة داخل مفصل الفك بدلالة إحصائية أقل من 0.01 في المجموعة الأولى وأقل من 0.05 في المجموعة الثانية وبمقارنة النتائج في المجموعتين أثبتت النتائج عدم وجود فروق ذو دلالة إحصائية بين المجموعتين ، كما أن كلا الوسيلاين لهما تأثير في انخفاض معدل الألم الذي كان له تأثيراً إيجابياً نحو انخفاض التقلص العضلي لعضلات الفك مما أدى إلى تحسن معدل الحركة بالفك .

الكلمات الدالة : العلاج بانتقال الأيونات – ليدوكاين – ليزر – مفصل الفك .