Influence of acupuncture LASER on Achilles tendonitis

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ABSTRACT

The purpose of this study was to investigate the effect of laser in reducing chronic Achilles tendonitis pain in 12 patients. Gallium Aluminum Arsenide Infra Red laser was used with power out put 10mw and wave length 780nm. Patients were selected randomly from orthopedic out patient clinic Kaser Elaini Hospital, their age ranged from (30-40) with mean age (33.8). Patients were irradiated with laser over acupuncture points (Taixi K.3, Kunlun UB. 60). Pain and ankle range of motion were measured before, six sessions after and after twelve sessions. Statistical results using ANOV showed significant pain decrease on visual analogue scale (VAS) after six sessions, and twelve sessions where (P< 0.001), also ankle dorsiflexion and planterflexion increased significantly after six and twelve sessions where (P<0.05). Statistical results proved that laser was an effective modality in reduction of chronic pain and improving limited range of motion in the ankle due to pain of tendon Achilles.

Key words: *Tendonitis, LASER, Chronic pain.*

INTRODUCTION

Low level laser therapy (LLLT), this terminology is framed in terms of the reaction between laser and the irradiated biological tissue, alternatively the term low intensity laser therapy (LILT) is in equally accurate for a given wave length of laser light, the energy density is the most important factor in determining the tissue reaction. Laser photobiostimlation is another term used to describe therapeutic laser and its effects in tissues, it is sometimes shortened to photobiostimlation or biostimulation this terminology is derived from the early work completed on wound healing to accelerate rates of tissue repair. Irradiation of acupuncture point with low intensity laser therapy (LILT) is commonly known as laser acupuncture. It is used as an alternative to acupuncture needling in treatment of musculoskeletal pain[14].

Laser light's depth of penetration depends on the type of laser energy delivered. He Ne laser absorption occurs rapidly in the superficial structures especially within the first 2 to 5mm of soft tissue, the response that occurs from absorption is termed the direct effect, while response that occurs deeper in the tissues is termed the indirect effect. He Ne laser has an indirect effect up to 8 to 10mm, GaAs which has a longer wavelength has direct effect of absorption 1 to 2cm and an indirect effect up to 5cm. Ga Al As has a penetration of 3.5cm with a 5.5cm lateral spread[17]. It has been suggested that the more deeply penetrating radiation is the IR laser devices and it provides penetration necessary to treat deeper musculoskeletal injuries[10].

Laser acupuncture with power out put of 5mw was used in cases of carpal tunnel syndrome (CTS) in association with TENS. It

was found that both are promoting a positive change in the patient's condition (not observed with the sham devices) including the painful symptoms of CTS, also it was found that there was a significant reduction in pain aspect of the median nerve[5].

Studies showed successful results by using LILT in treating de quervains tenosynovitis and lateral epicondylitis (Tennis elbow) which are similar to plantar fasciitis as these conditions are due to repetitive micro trauma or over use, so it's expected to gain successful results with significant pain relief when treating fasciitis with LILT[1,4].

Achilles Tendonitis is an inflammation of the Achilles tendon. This tendon allows the muscles in the calf of the leg to attach to the back of our heels. The Achilles tendon is a long and thick tendon, which moves foot down, so that the toes point to the ground (plantar flexion). This tendon can become inflamed due to the following causes:

1- Over utilizing it, such as too much running, especially up or down hill.
2- Trauma, such as a kick to the tendon.
3- Shoe or boot pressure, especially at its attachment to the heel, or just above it.

The most common site of Achilles tendonitis is at the heel to 4 inches above the heel. The diagnosis of this problem is made when the following signs are present:

1- Pain in the Achilles tendon with up and down movement of the foot at the ankle.
2- Pain in the Achilles tendon when you squeeze the tendon from side to side[12].

However, reducing pain and inflammation by using modalities such as ice and ultrasonic to assist natural healing process of the involved tissues, other physical agents used as phonophoresis, iontophoresis, deep tissue message, cryotherapy and hydrotherapy all have been described as effective modalities in management of Achilles tendonitis[1,7]. LILT can be used effectively to reduce pain and inflammation as it increases vascular activity by stimulating blood circulation and metabolic activity[15] LILT my have significant effects on release of neurochemicals as serotonin thus promoting pain relief[12].

Furthermore, restore muscle strength and flexibility, gastrocnemius and soleus stretching is most frequently recommended in literature. The efficacy of muscle stretching on reducing symptoms associated with plantar fasciitis was done in 236 individuals, it was found that 72% of the subjects who only stretched for the 8 weeks of treatment showed an improvement in their symptoms[9,18].

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[17]. 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 process[11].

This study will examine if LILT over most painful tender point or points and on acupuncture points (laser acupuncture), as a non invasive therapy has an effect on chronic plantar Achilles tendonitis.

MATERIAL AND METHODS

This pre and post design study with repeated measures was conducted in out clinic of El Manial University Hospital the purpose of this study was to compare the effect of LILT irradiation over acupuncture points with LILT irradiation over most painful tender point on pain level in Achilles tendonitis patients.

Selection of subjects

Twelve patients (8 females and 4 males) complaining of chronic heel pain due to Achilles tendonitis for more than 6 weeks as literature considered chronic that lasting six weeks or more were included in this study. Their age ranged from 30 to 50 years old. The mean age was (41 ± 2). They were treated with LILT over acupuncture points.

All patients were instructed not to take any analgesics or any physical therapy session during the study period of time.

Exclusion criteria

History of inflammatory or traumatic arthritis

Design of the study

Pre and post design study, where pain and range of motion of ankle joint were assessed before LILT and after six and twelve sessions.

Preparation of the patient

The surface of the skin treated should be cleaned with alcohol wipe in order to remove any material on the surface that might absorb or scatter the radiation. The treated part should be supported in a comfortable way for the patient.

Preparation of the Apparatus

The laser applicator is applied to the surface before switching on apparatus, it is important to maintain the laser applicator in contact with the tissues, so that the beam is applied at right angle to achieve maximum penetration. The device is switched off before removing the applicator from skin contact.

Instrumentation

Gallium aluminum arsenide (Ga Al As) infrared laser (Endolaser 476, Enraf Nonius) with a pencil probe (Wavelength 780nm, power 10mw, beam diameter 4mm), was used in this study.

The maximum output is determined by the probe connected and the power can be set in four steps (20%, 50%, 75% and 100%).

In this study 10mw probe was used and connected selection was 100% following the protocol of Sharma et al., (2002)[21].

Acupuncture points were irradiated with Ga Al As with 2 J per session for each point for 100 seconds:

1- Kunlun (U.B. 60): It's an acupuncture point, it is used in treatment of ankle pain.

Location: Midway between the prominence of the lateral malleolus and the lateral border of the tendon Achilles.

Indications: Painful disorders of the ankle region (arthritis, Achilles tendonitis), sciatica, lumbago, and paralysis of the lower limb[1].

2- Taixi (K.3): It's an acupuncture point, it is used in treatment of ankle disorder.

Location: Midway between the prominence or tip of the medial malleolus (lower most borders) and the medial border of the tendon Achilles.

Indications: Genital and urinary disorders, impotence, low back ache, and disorders of the ankle[1].

Instrument calibration

The apparatus was calibrated at the beginning before first session, at mid session (6 session) and at the end of the treatment (12 session), with an external power meter.

Measurements

1- Ankle joint range of motion was measured for both dorsiflexion and planterflexion before the first session, after six sessions and after twelve sessions.
2- Pain level was measured before the first session, after six sessions and after twelve sessions by VAS. (VAS it's a 10cm line anchored at each end with words such as no pain and the worst pain possible).

Patients were asked to place a mark at the point on the line which represents their experience of pain[24] the reliability of VAS is the highest and its validity is the highest among other scales.

Procedures

Acupuncture points for ankle pain were determined through the location landmarks determined for each point:

1- Kunlun (U.B. 60): Midway between the prominence of the lateral malleolus and the lateral border of the tendon Achilles.
2- Taixi (K.3.): Midway between the prominence or tip of the medial malleolus (lower most borders) and the medial border of the tendon Achilles.

In this study 10mw probe was used and connected selection was 100% following the protocol of Sharma et al., (2002)[21].

Acupuncture points were irradiated with Ga Al As with 2 J per session for each point for 100 seconds.

Range of motion

Ankle dorsiflexion and planter flexion were measured using the goniometry:
Fulcrum: base of lateral malleolus.
Stationary arm: parallel to lateral aspect of the leg pointed to head of fibula.
Movable arm: parallel to lateral border of the foot, pointed to the base of little toe.

RESULTS

In this study, it was found that application of laser puncture over acupuncture points{Kunlun (U.B. 60) Taixi (K.3.)} reduced pain after six sessions from 9.00 ± 1.29 to 5.71 ± 0.95' and after 12 sessions to 2.43 ± 0.53 as shown in table (1) and fig. (1). ANOVA was applied to test the significant differences between the treatment sessions, F value was 4.53 and P value was < 0.001. Post Hoc test showed that after 12 sessions was highly significant.

Table (1): The effect of laser on VAS.

# Of subjects	VAS pre treatment X ± SD	VAS after 6sessions X±SD	VAS after 12sessions X±SD
12	9.00 ± 1.29	5.71 ± 0.95	2.43 ± 0.53

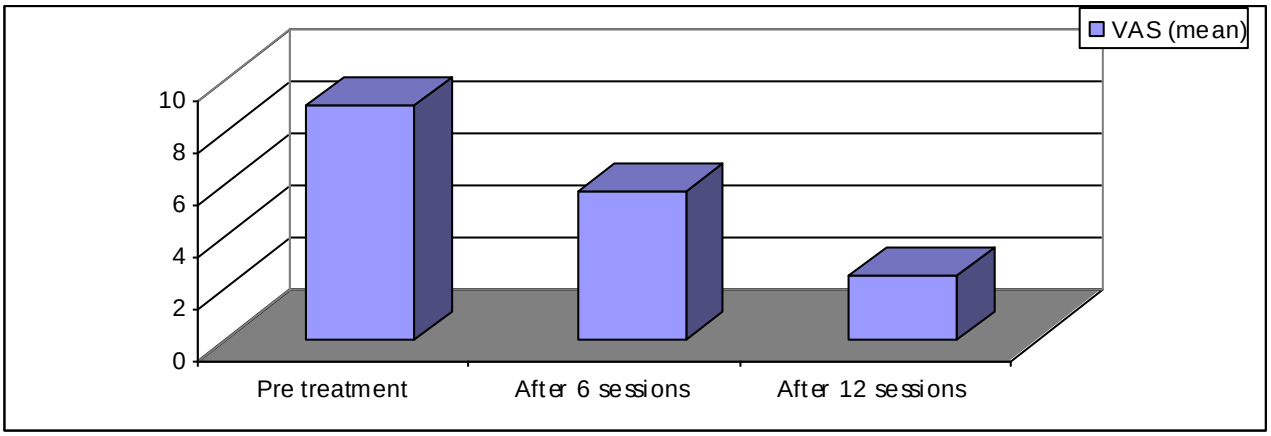

Fig. (1): Influence of LILT on VAS.

It was found that application of laser puncture over acupuncture points {Kunlun (U.B. 60) Taixi (K.3.)} improves ROM of ankle dorsiflexion after six sessions from 25.00 ± 3.20 to 30.31 ± 2.12 and after 12 sessions to 35.03 ± 0.59 as shown in table (2) and fig. (2). ANOVA was applied to test the significant differences between the treatment sessions, F value was 2.69 and P value was < 0.05. Post Hoc test showed that after 12 sessions was highly significant.

Table (2): The effect of laser on ankle dorsiflexion.

# Of subjects	ROM pre treatment X + SD	ROM after 6 sessions X+SD	ROM after 12sessions X+SD
12	25.00± 3.20	30.31 ± 2.12	35.03 ± 0.59

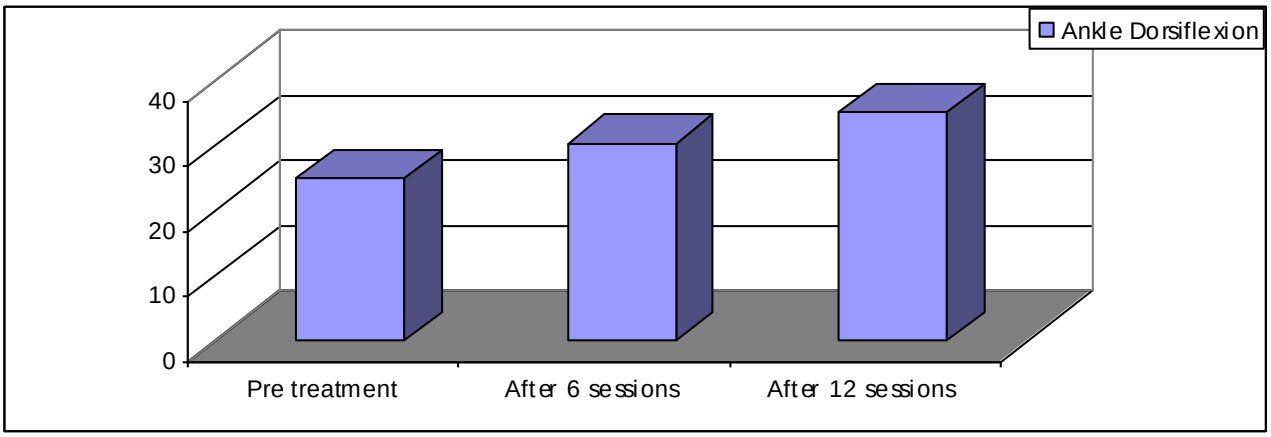

Fig. (2): Influence of LILT on dorsiflexion.

It was found that application of laser puncture over acupuncture points {Kunlun (U.B. 60) Taixi (K.3.)} improves ROM of ankle planterflexion after six sessions from

60.00 ± 5.30 to 62.95 ± 2.03 and after 12 sessions to 70.43 ± 5.53 as shown in table (3) and figure (3). AOVA was applied to test the significant differences between the treatment sessions, F value was 2.73 and P value was < 0.05. Post Hoc test showed that after 12 sessions was highly significant.

Table (3): The effect of laser on ankle planterflexion.

# Of subjects	ROM pre treatment X + SD	ROM after 6sessions X+SD	ROM after 12sessions X+SD
12	60.00 ± 5.30	62.95 ± 2.03	70.43 ± 5.53

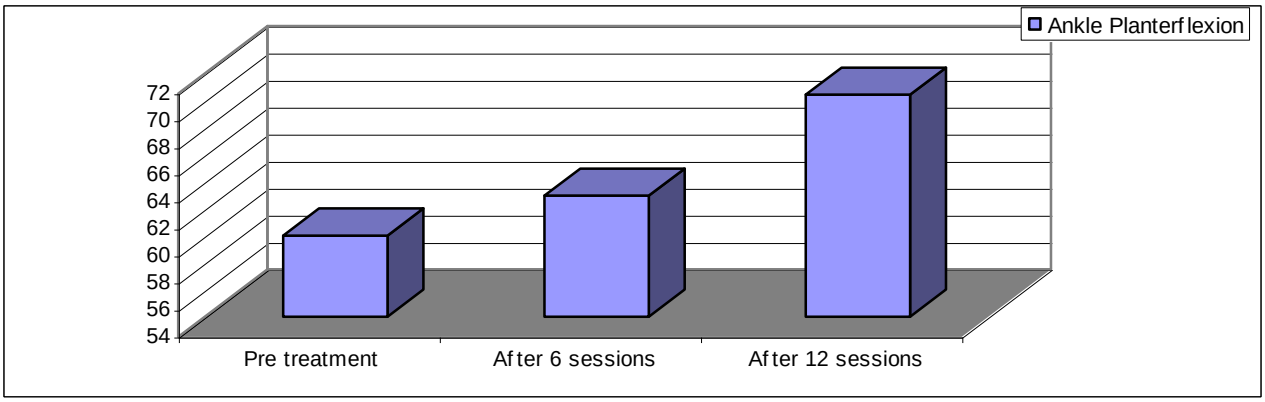

Fig. (3): Influence of LILT on ankle planterflexion.

DISCUSSION

The irradiation of acupuncture points with low intensity laser is commonly known as laser acupuncture[14]. Infrared laser penetrates deeper than red light[22]. Gas lasers as He Ne is not so popular in this therapy (acupuncture), He Ne works quite well but has many disadvantages when compared to the modern semi: conductor Ga Al As diode systems[16]. The wavelengths of He Ne or Ga As laser systems are fixed at 632.8nm and 904mm while in Ga Al As the wavelength of the radiation emitted by the device is dependent upon the amount of aluminum used in the manufacture of the laser diode[14].

In this study, application of laser puncture over acupuncture points {Kunlun (U.B. 60) Taixi (K.3.)} reduced pain after six sessions from 9.00 ± 1.29 to 5.71 ± 0.95' and after 12 sessions to 2.43 ± 0.53. ANOVA was applied to test the significant differences between the treatment sessions, F value was 4.53 and P value was 0.001. Post Hoc test showed that after 12 sessions was highly significant.

LILT can be used effectively to reduce pain and inflammation as it increases vascular activity by stimulating blood circulation and metabolic activity[15] LILT my have significant effects on release of neurochemicals as serotonin thus promoting pain relief[19].

The effect of laser stimulation on inflammatory process and oedema 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 oedema is diminished[13]. 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 process[11].

Similar results were reported by Branco, (1999) who found that laser acupuncture was an effective method in the treatment of pain due to carpal tunnel syndrome[4], Wong et al., (1999) found that, the same effective results in treating painful carpal tunnel syndrome with laser acupuncture[23], Saunders (2003) found that, there was, significant pain relief in treating supra spinatus tendonitis with infrared laser[19], Vasseljen, (1992) found that, laser was an effective modality in the treatment of pain in tennis elbow[22], Basford et al., (1999) found that laser irradiation is an effective method in treating musculoskeletal back pain[3], and Slattery et al., (2002) found that, laser is an effective procedure in treating chronic mach and shoulder pain[20].

In contrast, Basford, (1998) found that laser is not beneficial in treating chronic planter fasciitis pain[2]. However, in a survey study Green field, (2002) reported that the efficacy of laser in treating chronic tennis elbow was not beneficial and questionable[15].

It was found that application of laser puncture over acupuncture points {Kunlun (U.B. 60) Taixi (K.3.)} improves ROM of ankle dorsiflexion after six sessions from 25.00 ± 3.20 to 30.31 ± 2.12 and after 12 sessions to 35.03 ± 0.59. ANOVA was applied to test the significant differences between the treatment sessions, F value was 2.69 and P value was 0.05. Post Hoc test showed that after 12 sessions was highly significant. ROM of ankle planterflexion after six sessions improved from 60.00 ± 5.30 to 62.95 ± 2.03 and after 12 sessions to 70.43 ± 5.53. ANOVA was applied to test the significant differences between the treatment sessions, F value was 2.73 and P value was 0.05. Post Hoc test showed that after 12 sessions was highly significant.

Alexander (2000)[1] found that, laser acupuncture is an effective modality in treating Rhaumatoid arthritis pain in hands. Beckerman (1992)[6] found that, laser therapy is an effective treatment for musculoskeletal and skin disorders, Irnish et al., (2002)[13] found that, significant pain decrease and improvement of range of motion of cervical spine, and Eckerdal, (1996)[8] found that, laser is an effective method in the treatment of neurogeinc facial pain.

LILT irradiation on peripheral sensory nerve latency was investigated and it was found that there is a significant decrease in sensory nerve conduction velocity which may prove the information about pain relief mechanism of lasers, also in a double blind study of pain relief bu using He.Ne irradiation it was found that it may affect serotonin metabolism by increasing its level therefore leading to pain relief.

Conclusion

Application of LILT on acupuncture points {Kunlun (U.B. 60) Taixi (K.3.)} reduced pain of tendon achilis, and improved ankle range of motion of both dorsiflexion and planterflexion. Further studies are needed to compare transcutaneous nerve stimulation and laser acupuncture.

REFERENCES

1- Alexander, R. and White, A.: Acupuncture in a Rheumatology clinic, 18(2), 2000.
2- Basford, J.R., Malanga, G.A., Krause, D.A. and Harmsen, W.S.: A randomized controlled evaluation of LILT: Plantar fasciitis: Arch. Phys. Med. Rehabili., 97(3): 249-254, 1998.
3- Basford, J.R., Sheffield, C.G. and Harmsen, W.S.: Laser therapy: a randomized controlled trial of the effects of low intensity Nd: XAG laser irradiation musculo skeletal back pain: Archives of physical medicine and rehabilitation, 80(6): 647-652, 1999.
4- Branco, K. and Naeser, M.A.: Carpal tunnel syndrome: Clinical outcome after low level laser acupuncture, microamps transcutaneous electrical nerve stimulation, and other alternative therapies, an open protocol study in journal of altern – complement- Med., 5(1): 5-26, 1999.
5- Baxter, G.D., Diamontopoulos, C., O'Kane, S., Shields, T.D. and Allen, J.: Introduction in therapeutic laser, theory and practice, Churchill Livingstone, 6-40 and 180-196, 1994.
6- Beckerman, H., De Bie, R.A. and Bouter, L.M.: The efficacy of laser therapy for Musenaloskeletal and skin Disorders: A Criteria Based Meta-Analysis of Randomized clinical trials: physical therapy, 72(7): 783-791, 1992.
7- Cornwall, M.W. and MC Poil, T.G.: Common clinical signs and symptoms, plantar fasciitis: Etiology and treatment, journal of orthopaedic and sports physical therapy, 29(2): 756-760, 1999.
8- Eckerdal, A. and Bastian, L.: Can low reactive-level laser therapy be used in the treatment of neurogenic facial pain? ADouble blind, placebo controlled investigation of patients with trigeminal neuralgia in laser therapy, 8: 247-252, 1996.
9- Enwemeka, C.S.: Laser Biostimulation of Healing wounds: specific effects and Mechanisms of Action: The Journal of orthopedic and sports physical therapy, 9(10): 333-338, 1988.
10- Gill, H. and Kiebzak, G.M.: Out come of non surgical treatment for plantar fasciitis; Foot and Ankle Int, 17: 527-532, 1996.
11- Green Field, C. and Webster, V.: Chronic lateral epicondyhitis, survey of current practice in the out patient departments in Scotland, Physiotherapy, 88(10): 578-594, 2002.
12- http://altmedd-cjb.net.
13- Irnich, D., Behrens, N., Gleditsch, J.M., Stor, W., Schreiber, M.A., Schops, P., Vichers, A.J. and Beyer, A.: Immediate effects of dry needling and acupuncture at distant points in chronic neck pain in pain, 99(1-2): 83-89, 2002.
14- Jerosch, J.: Endoscopic release of plantar fasciitis-a Benign procedure: Foot and Ankle Int., 21(6): 511-513, 2000.
15- Kibler, W.B., Gold Berg, F.C. and Chandler, T.J.: Functional biomechanical deficits in running athletes with plantar fasciitis: the American Journal of sports Medicine, 19(1): 66-71, 1991.
16- Lynch, D.M., Goforth, W.P. and Martin, J.E.: Conservative treatment of plantar fasciitis. A prospective study in Journal of the American podiatric medical association, 88(8): 375-80, 1998.
17- Peilin, S.: Introduction in the treatment of pain with chinese Herbs and acupuncture, 5-7, 2000.
18- Ryan, J.: Use of posterior night splints in the treatment of plantar fasciitis in American family physician, 52(3): 891-898, 901-902, 1995.
19- Saunders, L.: Laser versus ultrasound in the treatment of supra spinatus tendinosis: Randomised controlled trial: physiotherapy, 89(6): 365-373, 2003.
20- Slattery, K., Amy, R., Pinto, J., Conzalez, G. and Shanks, S.: Treatment of chronic neck and shoulder pain 635nm low level

laser therapy Arandomized Double blind clinical' study on 100 patients, Laser in Medicine, Published by North American Association Laser Therapy NAALT, 2002.
21- Sharma, R., Thukral, A., Kumar, S. and Bhargava, S.K.: Effect of Low level lasers in de quervains tenosynovitis prospective study with ultrasoncographic assessment, physiotherapy, 88(12): 730-734, 2002.
22- Vasseljen, O.: Low level laser versus traditional physiotherapy in the treatment of tennis elbow: physiotherapy, 78(5): 329-334, 1992.
23- Wong, E., Lee, G., Cherman, J.Z. and Mason, D.P.: Successful management of female office workers with repetitive stress injury or carpal tunnel syndrome by a new treatment modality-application of low level laser: Laser therapy, 9: 131-136, 1997.

الملخص العربي

تأثير الوخز بالليزر على التهاب وتر أخيل

تهدف هذه الدراسة إلى فحص تأثير الليزر على ألتهاب وتر أخيل (العرقوب) من حيث الألم ومدى الحركة ، استخدم جهاز جاليوم أرزينيد ليزر ذو الأشعة الحمراء بقوة 10 مللي وات وطول 780 نانوميتر ، تم اختيار المرضى عشوائياً من العيادة الخارجية للعظام بمستشفى القصر العيني ، حيث اشترك في هذه التجربة أثنى عشر مريضاً (8 من الذكور ، 4 من الإناث) يتراوح أعمارهم ما بين الثلاثين والأربعين ومتوسط أعمار العينة 33.8 سنة ، تم تحديد نقاط الوخز بالليزر على النحو التالي : 1- تاكساي (كلية 3) . 2- كونلون (مثانة 60) ، كما تم قياس معدل الألم بالوتر وكذلك مدى حركة مفصل القدم قبل بداية العلاج وبعد ستة جلسات وأثنى عشر جلسة ، استخدم قياس تحليل متغيرات (أنوفا) حيث تبين أن معدل الألم انخفض بدلالة إحصائية أقل من 0.001 وتحسن معدل حركة القدم (الثني الظهري والثني الأخمصي) بدلالة إحصائية أقل من 0.05 ، برهنت النتائج الإحصائية على أن الليزر وسيلة فعالة في انخفاض الألم الذي أدى بدوره إلى تحسن مدى حركة القدم في التهاب وتر أخيل .

الكلمات الدالة : ليزر – التهاب الأوتار – الآلام المزمنة .