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Laser treatment applied to acupuncture points in lateral humeral epicondylalgia. A double-blind study

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Summary Forty-nine patients suffering from lateral humeral epicondylalgia were enrolled in a double-blind study to observe the effects of Ga-As laser applied to acupuncture points. The Mid 1500 IRRADIA laser machine was used, wavelength: 904 nm, mean power output: 12 mW, peak value: 8.3 W; frequency: 70 Hz (pulse train). Localization of points: LI 10, 11, 12, Lu 5 and SJ 5. Each point was treated for 30 sec resulting in a dose of treatment of 0.36 J/point. The patients were treated 2–3 times weekly with 10 treatments in all. Follow-ups were done after 3 months and 1 year.

No significant differences were observed between the laser and the placebo group in relation to the subjective or objective outcome after 10 treatments or at the follow-ups.

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Key words: Ga-As laser; Epicondylalgia; Tennis elbow; Pain; Placebo

Introduction

During the past decade, low power laser treatment has frequently been used by physicians and physiotherapists for the alleviation of pain. At the beginning, He-Ne laser was the method used, and the pain relieving effect of helium-neon (He-Ne) laser has been studied by several authors with contradictory results [2,5,8,14,15].

During the last few years gallium-arsenide (Ga-As) lasers have grown in popularity compared to the He-Ne laser used in the treatment of musculoskeletal pain syndromes. However, very few controlled clinical studies of Ga-As laser applied to acupuncture points have been reported. England et al. [3] reported favourable results when using the Ga-As laser in the treatment of bicipital and supraspinatus tendinitis [3]. In 1988, Lundeberg et al. [9] carried out a comparative study of Ga-As, He-Ne and placebo laser by radiating acupuncture points related to the elbow in patients suffering from epicondylalgia (tennis elbow). The dose of laser used was, for Ga-As, 0.004 J/point and, for He-Ne, 0.093 J/point. No significant differences between the groups could be found [9]. However, the dose of Ga-As laser used was very low. Hitherto there is no agreement about how, where and when Ga-As is to be used. The purpose of this double-blind study was to see whether an increased dose of Ga-As laser, 0.36 J/p, applied to acupuncture points related to the elbow, affected the pain in patients suffering from lateral humeral epicondylalgia.

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Patients and methods

Patients

Forty-nine patients, 28 men and 21 women, suffering from lateral epicondylalgia were enrolled in the study. The patients were aged 24–70 (mean 46.7), and they had suffered pain for periods between 1 and 36 months (median 6).

Details were recorded of profession, work load and involvement in monotonous and repetitive movements.

All 49 patients were right-handed, and 42 were affected in the right elbow. Nineteen patients attributed their symptoms to sport, 14 to work, 10 to other activities and 6 patients did not know the cause of their ailment. Onset of pain was sudden in 26 cases and insidious in 23.

Eleven patients had not tried any prior treatment; 18 had been given steroid injections, 15 ultrasound and 12 other treatments including medication, TENS, etc.

The patients were either self-referred or referred by their physician or physiotherapist.

The 49 patients were randomly allocated into 2 groups: group A – the laser group, 23 patients, 12 men and 11 women with a mean age of 45 years (33–70) and a median duration of pain of 8 months (1–35); group B – the placebo group, 26 patients, 16 men and 10 women with a mean age of 48.3 years (24–64), and a median duration of pain of 6 months (1–36).

Both groups had a similar general condition regarding the affected arm, cause of the pain and previous treatment.

TABLE I

TEST SCHEDULE: PRE-TREATMENT VALUES

The number of patients denotes how many of them are positive at the different tests.

	No. of patients (49)
1. Pain at epicondyle	48
2. Resisted wrist ext.	43
3. Stretching of the extensor muscle	21
4. Middle finger test	43
5–6. Resisted pronation/supination	34/36
7. Vigorimeter test	47
8. Lifting test 1–4 kg	33/43/45/46

Method of examination

A pain duration of 1 month and a record of pain over the lateral epicondyle during 2 or more of the following clinical tests were criteria for inclusion in the study: (1) palpation of the lateral epicondyle; (2) resisted wrist extension with the elbow extended and the forearm pronated; (3) passive stretching of the extensor muscle group with the elbow extended and the forearm pronated; (4) resisted finger extension with the elbow extended and the forearm pronated. Resisted extension applied to dig. III = middle finger test (Table I).

Patients with symptoms in the neck or thorax were only included if it was ascertained that these symptoms did not affect the elbow. This judgement was made by an outsider RPT trained in orthopaedic medicine.

Those excluded were patients with local arthritis, generalized polyarthritis or neurological abnormality in the affected arm and those with clear signs of entrapment of the radial nerve [7,10]. No other treatment or drugs were used during the month before the trials began.

Before the treatments, the patients were also tested as to whether pain could be produced at the lateral aspect of the epicondyle by isometric pronation and supination of the forearm.

Grip strength can be measured by a vigorimeter. Thorngren and Werner [13] used the Martin vigorimeter to determine the ratio dominant hand/non-dominant hand to 1.07 ± 0.11. According to this result, the value of the non-affected arm can serve as a parameter for evaluating the pain-free grip strength. Consequently, we used the Martin vigorimeter to measure the grip strength in the non-affected arm, and the pain threshold when gripping in the affected arm (Fig. 1). The vigorimeter is a dynamometer with a rubber balloon to be compressed in the hand. The air-pressure within the balloon is registered in kilopounds/cm^2 (1 kp/cm^2, 98.1 kP_a) on a manometer through a rubber tube connection. In our study a balloon of medium size was used. Patients were seated comfortably, shoulder at rest, elbow extended, forearm pronated with 20° dorsiflexion of the wrist, holding the balloon with the connection tube protruding between thumb and index finger. They were

instructed to press the balloon, and to stop when any kind of pain was experienced over the lateral epicondyle (pain threshold). If the mere position of the arm caused such pain, this was noted, and no pressure was exerted. Otherwise, the mean value of 3 consecutive estimations was calculated.

Sitting in the position described above, the patient was also required to lift 4 different weights, viz., 1, 2, 3 and 4 kg, and pain was recorded as present or absent (Table I).

All tests were performed bilaterally.

Method of treatment

The Mid 1500 IRRADIA laser was used. This is a Ga-As laser; wavelength 904 nm; measured mean power output 12 mW; peak value 8.3 W, frequency 70 Hz (pulse train).

The laser wand was held perpendicularly 1 mm from the patient's skin, and the distance between skin and laser wand was maintained by means of a piece of 5 × 3 mm plastic fixed to the wand. The laser machine was standardized initially and then every month. An on/off key introduced into the transducer circuit of the laser allowed a red light to be shown on the placebo group without affecting the normal output of the laser when the key was turned on. The position of the key was controlled by a third party and was unknown to patient or therapist. Localization of points: LI 10, 11, 12, Lu 5 and SJ 5 [4]. These points are anatomically the motor points of the extensor group of muscles. Each point was treated for 30 sec, 2–3 times weekly, 10 treatments in all.

One of the authors (E.H.) was responsible for the clinical examination before the 1st and after the 10th treatment, and at the follow-up 3 months later; the treatments were performed by a physician. A subjective assessment completed the clinical examination at the 10th treatment and at the follow-up. A scale of 1–5 was used: 1 = excellent, 2 = good, 3 = improved, 4 = slightly improved, and 5 = unchanged or worse. The 1 year follow-up was carried out by means of a questionnaire including the subjective assessment.

All the patients were informed that 2 modes of laser treatment were to be tried out and that no fee was to be charged. The patients were treated singly to avoid influencing one another, and they were all treated under the same conditions.

The laser/placebo code was only broken after the follow-ups. Correlation analysis and the Mann–Whitney U test of 2 independent samples were used for the statistical analysis.

Result

All 49 patients completed the treatment. After the treatment period 1 patient in each group withdrew and after the 3 month follow-up another

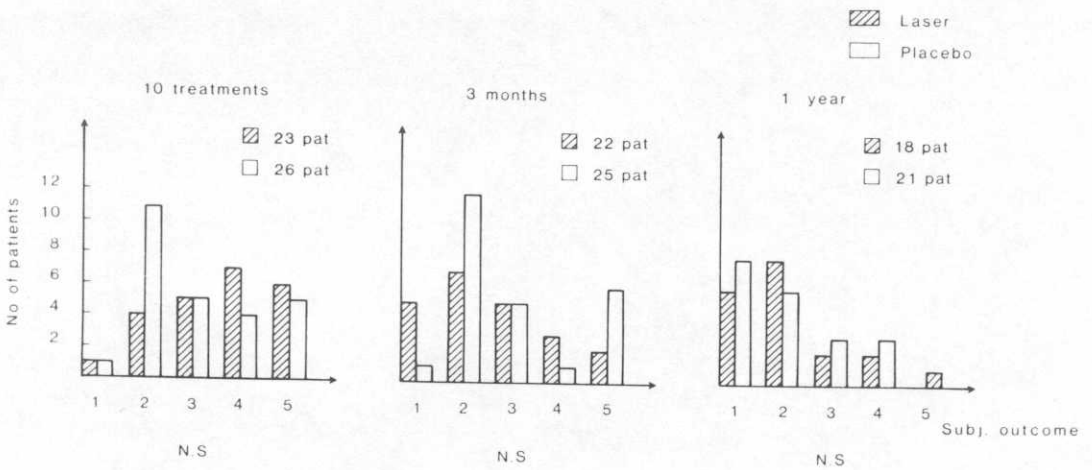

Fig. 1. Subjective outcome after the 10th treatment and at follow-up. 1 = excellent, 2 = good, 3 = better, 4 = slightly improved, and 5 = unchanged/worse. N.S. = non-significant.

7 patients withdrew, 4 in the laser group and 3 in the placebo group. Because of continuing elbow pain, they wished to try a different treatment.

Subjective outcome

After 10 treatments, 5 patients of 23 in the laser group and 12 patients of 26 in the placebo group reported an excellent or good result (1–2 on the verbal scale). Five patients in each group reported improved (3 on the scale), 13 in the laser group and 9 in the placebo group reported slightly improved, unchanged or worse (4–5 on the scale). A comparison between the groups showed no significant difference after 10 treatments or at the follow-ups (Fig. 1).

Evaluation of the vigorimeter test

The median values of the 2 groups after the 10th treatment and at the 3 month follow-up were compared with those obtained before the 1st treatment.

After 10 treatments the pain threshold on gripping the balloon was raised in the placebo group to a higher degree than in the laser group. However, the difference was not significant. Even at the 3 month follow-up there was still a slight difference (Table II). No significant differences were observed in any of the clinical variables either after the treatments or at the follow-ups. The correlation (r) between the subjective outcome and the vigorimeter test in the laser group was 0.78 after 10 treatments and 0.82 at the 3 month follow-up. The corresponding correlations in the placebo group were 0.56 and 0.62.

No correlation between the subjective outcome and the pre-duration of pain could be detected and no side-effects were reported during or after the treatment period.

TABLE II

EVALUATION OF THE VIGORIMETER TEST (kP_a)

Pre-tr = the pain-free grip strength (vig. test) of the 2 groups was calculated before the 1st treatment (median). N. aff. arm = non-affected arm, aff. arm = affected arm. Post-tr = the differences between the post-treatment and the pre-treatment values of the affected arm were calculated after 10 treatments and 3 months. The median differences obtained were compared between the 2 groups.

	Pre-tr		Post-tr	
	N. aff. arm	Aff. arm	10 tr	3 months
A Laser	100	20	10	29
B Placebo	100	22	17	28

Discussion

In this study no statistical difference was observed between the laser group and the placebo group in relation to the subjective and objective outcome after 10 treatments or at the follow-up. The depth of penetration of laser is defined as the distance the laser light has penetrated the skin until its intensity has been reduced to 37% of the incident intensity. The He-Ne laser has a depth of penetration of 0.62 mm and the Ga-As laser 1.4 mm [11]. Consequently, it seems reasonable to use Ga-As laser at epicondylalgia as this condition is supposed to be caused by an inflammatory condition in the tissue surrounding the tendon of extensor carpi radialis. It also seems reasonable that various tissues with dissimilar absorption spectra could respond differently to diverse stimulating frequencies [1]. In an attempt to explore the 'biostimulative' effects of laser, its effect on peripheral nerve has been studied by Snyder-Mackler et al. [12], who in a controlled study of He-Ne laser observed a notable increase in nerve conduction in the superficial radial nerve. This has been refuted by Greathouse et al. [6] and Lundeberg et al. [9], who did not find the corresponding increase in nerve conduction. Furthermore, no changes in subcutaneous temperature were observed after treatment [6,9].

In our study, 6 of 23 patients in the laser group and 5 of 26 in the placebo group reported the result 'unchanged' or 'worse.' The rest of the patients had improved to some extent, and remarkably enough, the improvement in the placebo group was even somewhat better than in the laser group.

Before entering the study, the general condition of the two groups was similar. As no correlation did exist between the subjective or objective out-

come after 10 treatments and the pre-duration of pain, we suggest that the observed improvement in both groups reflects the spontaneous recovery known to occur and the expectations of recovery.

Our results do not support the use of laser treatment with the chosen parameters.

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References

1 Basford, J.R., Low-energy laser treatment of pain and wounds: hype, hope or hokum?, Mayo Clin. Proc., 61 (1986) 671–675.
2 Bischko, J.J., Use of the laser in acupuncture, Acupunct. Electro-ther. Res. Int. J., 5 (1980) 29–40.
3 England, S., Farrell, J.S., Coppock, J.S., Struthers, G.R. and Bacon, P.A., Low power laser therapy of shoulder tendinitis, Scand. J. Rheum., 18 (1989) 427–431.
4 Essentials of Chinese Acupuncture, Foreign Languages Press, Beijing, 1980.
5 Gallachi, G., Müller, W., Plattner, G.R. and Schnorrenberger, C.C., Akupunktur- und Laserstrahl-Behandlung beim Zervikal- und Lumbalsyndrom, Schweiz. Med. Wschr., 111 (1981) 1360–1366.
6 Greathouse, D.G., Currier, D.P. and Gilmore, R.L., Effects of clinical infrared laser on superficial radial nerve conduction, Phys. Ther., 65 (1985) 1184–1187.
7 Hagert, C.-G., Lundborg, G. and Hansen, T., Entrapment of the posterior interosseous nerve, Scand. J. Plast. Reconstr. Surg., 11 (1977) 205–212.
8 Kroetlinger, M., On the use of the laser in acupuncture, Acupunct. Electro-ther. Res. Int. J., 5 (1980) 297–311.
9 Lundeberg, T., Haker, E. and Thomas, M., Effect of laser versus placebo in tennis elbow, Scand. J. Rehab. Med., 19 (1987) 135–138.
10 Morrison, D.L., Tennis elbow and radial tunnel syndrome. Differential diagnosis and treatment, J. Am. Osteopath. Ass., 80 (1981) 823–826.
11 Norin, B., Laserfysik och Hudens Optik, Norart Education, Sweden, 1987, pp. 1–34.
12 Snyder-Mackler, L., Bork, C. and Fernandez, J., The effect of helium-neon laser on latency of sensory nerve, Phys. Ther., 65 (1985) 737.
13 Thorngren, K.G. and Werner, C.O., Normal grip strength, Acta Orthop. Scand., 50 (1979) 255–259.
14 Waylonis, G.W., Wilke, S., O'Toole, D., David, A., Waylonis, D.A. and Waylonis, D.B., Chronic myofascial pain: management by low-output helium-neon laser therapy, Arch. Phys. Med. Rehab., 69 (1988) 1017–1020.
15 Weissman, R., Laser-Akupunktur – keine Alternative zur klassischen Akupunktur, Münch. Med. Wschr., 121 (1979) 243–244.