Effects of Ga-Al-As Laser Therapy in Pain Reduction: A Clinical Study of 51 Patients

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Abstract

This study was conducted to examine the effects of Gallium Aluminium Arsenide (Ga-Al-As) laser therapy in pain reduction from 1995 to 1996, fifty-one patients with Tendinitis and Musculoskeletal trigger points, aged between 22-67 years old, received 4 Joules/cm^2, contact application continuous beam of a Ga-Al-As laser (30 mw, 780 nm, 300 Hz). Pain measurement was taken via visual analogue scale. The results of pain reduction following laser treatment after one day between age groups of 22-40 and 41-67 and also between the two diagnoses Tendinitis and Musculoskeletal trigger points showed a statistically significant reduction in pain ($p< 0.05$). The results of unpaired t-test revealed a significant difference in the treatment of both groups of diagnosis for pain reduction after one day. ($p<0.05$)

Key words : Laser, Pain, Tendinitis, Trigger point.

1.Introduction

Laser light is energy which is obtained by means of stimulated emission of radiation. It differs from other forms of radiant energy in that the rays are coherent, monochromatic and collimated. The laser light is visible with a wavelength between 630 and 1300 nm [1]. The absorption of light energy from laser supplies provides internal energy to body cells thus stimulating the cell functions. This effect is called biostimulation [2].

The laser light biostimulation of structural tissue can be lifted to an energy level which leads to chemical reactions. It stimulates protein synthesis, phagocytic activities and the aerobic energy to induce antiinflammatory, analgesic and tissue repair effect [3].

The laser type is determined by the wavelength of the light based on the state of aggregation of the energized material. Many types of lasers have been used e.g. Helium – Neon (He-Ne), Gallium Aluminium Arsenide (Ga-Al-As), Neodimium – YAG, Carbon dioxide [1]. He-Ne lasers have been used in Canada and Europe in the treatment of a large range of pathological conditions. Ga-Al-As is a type of laser with a wavelength of 780 nm. The clinical use of Ga-Al-As laser therapy is by no means a new phenomenon. In fact, therapy using Ga-Al-As laser has existed for many years. The effect of Ga-Al-As laser revealed several positive effects [4-6] including acceleration of wound healing and pain reduction [7,8], despite a large number of studies with negative change [9,10].

Tendinitis is a syndrome which results from performing a repetitive activity that places excessive forces on the tendon. Musculoskeletal trigger point is a syndrome which has pain in muscles resulting in decreased mobility with prolonged shortening of muscles following abnormal mechanical stress on muscles. Pain in muscle can be referred from other structures such as joints [11].

Usually, pain treatments by laser therapy are studied throughout all treatment periods. Some studies found laser therapeutic results after a few days [12,13]. Some revealed that laser therapy could have immediate effect [13]

especially the effect from laser blood irradiation [14,15]. As a result, the study for the pain treatment change could be determined after one day. The purpose of this study was to examine the effects of Ga-Al-As laser therapy in pain reduction after one day. It is hypothesized that the change before and after treatment would be greater which would have the effect of decreasing pain.

2. Materials and methods

2.1 Instrumention

The laser instrument used in this study was the Endolaser 476 (Ga-Al-As) point application type Rontgenweg 600 AL Delft Netherlands which emits laser radiation wavelength of 780 nm, output 30 mw 300 Hz and a 4 mm. diameter probe. It is classified as a class 3 B medical device.

2.2 Subjects

Subjects were patients with a diagnosis of Tendinitis (Tennis elbow, Golfer's elbow) and Musculoskeletal trigger points (Deltoid muscle and Supraspinatus muscle) during year 1995-1996. All patients were in the subacute stage and divided into two categories of age range and diagnosis. They were treated with laser therapy and agreed to participate in the study.

2.3 Dosage

The laser was set to deliver a continuous beam at a maximum intensity of 4 Joules for each 1 cm^2 of tissue irradiation [16]. In this study, the patients received laser therapy once in the first day and had not received physical therapy or medication prior to inclusion in this study. The techniques were point and contact application for the pain. After one day all patients received laser therapy once a day 5 times a week during the treatment period.

2.4 Pain assessment

A visual analogue scale (VAS) was used to assess the level of pain [17]. The scale is a 100 mm. horizontal line. The left end corresponds to no pain indicating least pain and the right end indicates severe pain. The post test of pain assessment was identical to the pre test and was performed one day after treatment with the laser.

2.5 Data analysis

Data analysis was performed for the differences of pain on pre treatment and post treatment after one day. The paired t-test was used to compare pain before and after treatment in terms of all patients, age range and diagnosis. An unpaired t-test was used to analyse the mean differences in pain between the two diagnoses after one day.

3. Results and discussion

Subjects were 51 patients with Tendinitis or Musculoskeletal trigger points. Patients characteristics are outlined in Table 1

Table 1. Characteristics of patients in pain reduction.

n	51
Male	17
Female	34
Age (yr.)	22-67
Age $\bar{X} \pm$ SD.	40±9.38
Tendinitis (n)	24
Musculoskeletal trigger points (n)	27

The pain is evaluated on the pain rating scale (visual analogue scale). Pre treatment and post treatment means for pain using laser treatment for all patients were significant for difference as shown in Table 2 and Fig. 1

Table 2. The average pain reduction for all patients between pre treatment and post treatment

Age (yrs)	VAS $\bar{X} \pm$ SE. (mm.)		t-value	p-value
	Pre treatment	Post treatment		
22-67 (n=51)	46.47± 1.99	23.13± 2.00	17.70	$p<0.05$

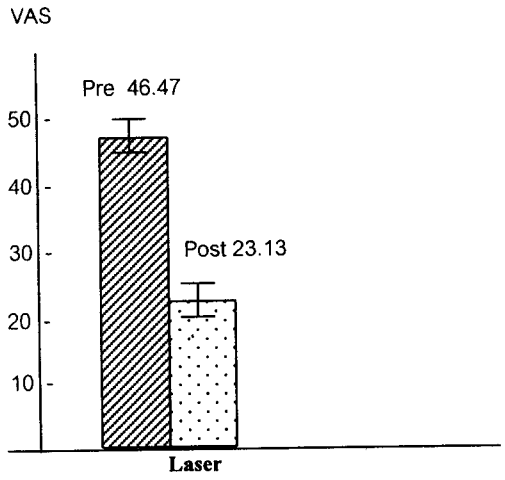

Fig.1 The results of mean pre treatment and mean post treatment for all patients from visual analogue scale (VAS).

The age may influence the result, therefore the patients were divided into two age- range groups of 22-40 and 41-67 years. The results of both age ranges showed a statistically significant reduction in pain score between pre treatment and post treatment. However there was no difference between the age ranges as shown in Table 3 and Fig 2.

Table 3. The average pain reduction between pre treatment and post treatment for each age range.

Age (yrs)	VAS $\bar{X}$+SE (mm.)		t-value	p-value
	Pre-treatment	post treatment		
22-40(n=25)	46±3.00	23.00±3.08	15.13	p<0.05
41-67 (n=26)	46.92±2.67	23.06±2.66	13.75	p<0.05

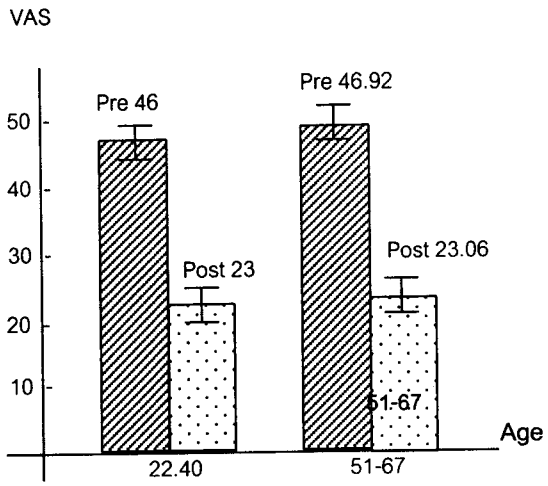

Fig 2 The results of mean pre treatment and mean post treatment from visual analogue scale

The laser treatment group included patients with Tendinitis and Musculoskeletal trigger points. In their case, the results of pain reduction by Ga-Al-As laser was more significant as compared to the pre treatment as shown in Table 4 and Table 5.

Table 4. Reduction in pain scores measured by visual analogue scale of the Tendinitis group.

n =24	Before treatment $\bar{X}$ ± SE (mm.)	After treatment one day $\bar{X}$ ± SE(mm.)	Difference (mm)	t-Value	p-value
Pain scores	$\bar{X}$ =43.33±1.78 (75-25)	$\bar{X}$ =20.62± 1.78 (50-0)	22.71±3.56	12.64	P<0.05

Table 5. Reduction in pain scores measured by visual analogue scale of Musculoskeletal trigger points group.

n=27	Before treatment $\bar{X}$ ±SE(mm.)	After treatment one day $\bar{X}$ ±SE(mm.)	Difference (mm.)	t-value	p-value
Pain scores	$\bar{X}$=49.07±1.79 (75-20)	$\bar{X}$25.37 ±1.79 (50-5)	23.70± 3.58	13.78	P<0.05

An unpaired t-test was used to determine whether the pain reduction differed one day after the treatment between the Tendinitis and Musculoskeletal trigger points groups (Table 6).

Table 6. The results of pain reduction between the Tendinitis and Musculoskeletal trigger points.

VAS X±SE.(mm)		t-value	p- value
Tendinitis (n=24)	Mus.Trig.pt. (n=27)		
20.62±1.78	25.37±1.79	6.75	p<0.05

The results of the unpaired t-test indicated a significant difference in the treatment between the two groups for pain reduction after one day ($p<0.05$). The mean values of the results between the two groups differed in the post treatment. It, therein, indicated that the Tendinitis had more pain reduction effect than the Musculoskeletal Trigger points group. According to human tissues studies the absorption of the laser energy penetrates the tissues under the skin surface to depths up to 15 mm. [18]. The tendon is usually thinner than muscle, especially in the tennis elbow case, where the muscles are mostly superficial attached proximally to bone [19]. As a result the laser irradiation could penetrate the tendon better, thus producing better results in the Tendinitis group.

The study showed good results. It might be that the Ga-Al-As has an excellent penetration effect because of its scarce absorption by the skin tissues, it is capable of valid energy density and has better reflection and a greater diffusion, thus permitting a greater tissue penetration [20]. The wavelength 780 nm laser was effective in the treatment of both short term and long term model [21]. The effect on increasing microvascularization which stimulates edema resorption had the greater and faster fibroblastic epithelium regenerative activity which enables an accelerated tissue repair [22].

Usually energy density is given in Joules per centimeter squared (J/ cm^2) and the range in therapeutic use is from 0.1 J/ cm^2 to 4 J/ cm^2 [16]. 4 J/ cm^2 laser energy applied at the earliest possible time could increase the rate of collagen synthesis [22]. The laser should be used in the contact method because it can prevent the loss of efficiency associated with the scattering and reflection in the non-contact method. The effects of the additional physical therapy or medicine did not alter the results of the study because the patients received no additional treatment. This fact also serves to strengthen the results.

5. Conclusion

The treatment results by the application of Ga-Al-As laser in the treatment of patients with Tendinitis and Musculoskeletal trigger points has considerably improved. The Ga-Al-As laser therapy is a valuable addition to the treatment modalities currently used for pain treatment.

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