



## Low Level Laser Therapy & TENDINITIS

### clinical research

#### LOW LEVEL LASER THERAPY CAN BE EFFECTIVE FOR TENDINITIS: A META-ANALYSIS

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**Purpose:** To investigate if low level laser therapy (LLLT) with previously defined optimal treatment parameters can be effective for tendinitis. Material : Randomized controlled trials with LLLT for tendinitis. **Method :** Literature search for trials published after 1980 using LLLT on Medline, Embase, Cochrane Library and handsearch of physiotherapy journals in English and Scandinavian languages. Only trials that compared laser exposure of the skin directly over the injured tendon with optimal treatment parameters with identical placebo treatment were included.

**Results:** The literature search identified 77 randomized controlled trials with LLLT, of which 18 included tendinitis. Three trials were excluded for lack of placebo control, of which one trial was comparative, another lacked patients with tendinitis in the treatment group, while the last unwittingly gave the placebo group active treatment. Four trials used too high power density or dose, and three trials did not expose the skin directly overlying the injured tendon. The remaining eight trials were included in a statistical pooling, where the mean effect of LLLT over placebo in tendinitis was calculated to 32% [25.0-39.0, 95% CI].

**Conclusion:** Low level laser therapy with optimal treatment procedure/parameters can be effective in the treatment of tendinitis.

#### Low power laser therapy of shoulder tendonitis.

England S; Farrell AJ; Coppock JS; Struthers G; Bacon PA  
Scandinavian journal of rheumatology; VOL: 18 (6); p. 427-31 /1989/  
Department of Rheumatology, Coventry & Warwickshire Hospital, UK.

30 patients with supraspinatus or bicipital tendonitis were randomly allocated to active infrared **laser therapy** at 904 nm three times weekly for 2 weeks, dummy **laser** or drug treatment for 2 weeks. Objectively maximum active extension, flexion and abduction of the shoulder, and subjectively pain stiffness movement and function were measured at 0 and 2 weeks.

Significant improvement of active over dummy **laser** was noted for all seven assessments. Active **laser therapy** produced significant improvement over drug **therapy** for all three

objective measures and pain. Naproxen sodium significantly improved only movement and function compared to dummy **laser**.

These results demonstrate the effectiveness of **laser therapy** in tendonitis of the shoulder.

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## **Laser Treatment for Tendinitis**

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Tendinitis is a common disorder of the musculoskeletal system. Cardinal symptoms from the tendon are pain from increased tension like muscle contraction or stretching and pain on pressure. In an acute stage inflammation is the most common pathophysiological manifestation, while degeneration of the collagen structure is observed in subacute and chronic cases. However, the episodic nature of chronic tendinitis with increased pain after strenuous use of the affected tendon, may indicate that inflammation also play a part at this stage. A succesful strategy of treatment should include reduction of inflammation and regeneration of collagen. In the laboratory several experiments have shown that laser treatment may have the potential to achieve both these goals. The findings of the laboratory also shows that these effects are highly dependent on dose.

A synthesis of dose from 4 laboratory trials on inflamed collagen producing cell cultures gives the following dose for optimal reduction of tendon tissue inflammation:

Dose : 3 - 8 J/cm<sup>2</sup>

Intensity : 5 - 21 mW/cm<sup>2</sup>

A synthesis from 10 laboratory trials investigating collagen proliferation gives the following optimal dose for stimulation of tendon regeneration :

Dose : 0.2 - 4 J/cm<sup>2</sup>

Intensity : 2 - 10 mW/ cm<sup>2</sup>

For the treatment of tendinitis an optimal suggested dosage at target location will be :

Dose : 0.2 - 4 J/cm<sup>2</sup>

Intensity : 2 - 10 mW/ cm<sup>2</sup>

Treatment should be applied daily for at least five days to reduce inflammation, and for at least 10 days to increase collagen production.

Determination of clinical dose The clinical dose depends on several factors such as laser type, depth to target from skin surface, the type of tissue between skinsurface and target location and the volume of injured tissue.

### *Characteristics for common tendon disorders*

The various tendon locations have different characteristics that affects determination of

dose. Tendon Depth to target tendon (mm)  
Tendon thickness (mm) typical area of tendon defect (cm<sup>2</sup>)

Values for different conditions are as follows:

Plantar fasciitis

10.0 - 12.0

3.0 - 4.0

0.1 - 0.8

Achilles

1.5 - 3.0

4.5 - 6.0

0.5 - 2.0

Patellar

2.5 - 4.0

5.5 - 8.0

1.0 - 4.0

Epicondylitis

1.5 - 2.5

2.0 - 4.0

0.09 - 0.3

Rotatorcuff

5.0 - 10.0

5.5 - 8.0

0.5 - 1.5

Recommendations for optimal laser therapy for common tendon disorders:

Infrared lasers (GaAlAs 820/830 nm) are recommended when :

\* Power density on skin does not exceed 30 mW/cm<sup>2</sup>, when treating superficial disorders

\* Spot size should not be smaller than 0.5 cm<sup>2</sup>

Dose on skin: Number of points: Lateral epicondylitis : 2 J/cm<sup>2</sup> 1 - 2 Rotatorcuff : 2.5 J/cm<sup>2</sup> 2 - 4 Patellar : 8 J/cm<sup>2</sup> : 3 - 5 Achilles : 6 J/cm<sup>2</sup> 2 - 3

It must be added that there are only two clinical trials showing effect on tendinitis (rotatorcuff) with these lasers and that the dose recommendations for other locations are extrapolations and have not yet been tested clinically.

*Infrared pulse lasers (GaAs 904 nm) are recommended when :*

\* Power density on skin does not exceed 20 mW/cm<sup>2</sup>, when treating superficial disorders

\* Spot size should not be smaller than 0.5 cm<sup>2</sup>

Dose on skin: Number of points: Lateral epicondylitis : 0.5 - 2 J/cm<sup>2</sup> 1 - 2 Rotatorcuff : 0.8 - 6 J/cm<sup>2</sup> 2 - 4 Patellar : 0.8 - 6 J/cm<sup>2</sup> : 3 - 5 Achilles : 0.5 - 4 J/cm<sup>2</sup> 2 - 3

Clinical results from seven trials suggests that pulse lasers overcome the skin barrier with less need for variation of dose for the different tendon locations.

*Red HeNe lasers (632 nm)* are only recommended for superficially situated tendon disorders like epicondylitis and paratendonitis of the achilles or patellar tendon. Use of HeNe laser on rotatorcuff, deeply situated patellar tendinitis (jumpers' knee), plantar fasciitis or carpal tunnel is not recommended, due to the poor penetration of visible red light.

Editors note: The master thesis in Physiotherapy Science of Jan Bjordal is called "Low Level Laser therapy in shoulder tendinitis/bursitis, epicondylalgia and ankle sprain. A critical review on clinical effects". Division of Physiotherapy Science, University of Bergen. 1997.

Part of this thesis can be found in Physical Therapy Reviews. 1998; 3: 121-132. "What may alter the conclusions of reviews?".

## **Photomedicine and Laser Surgery**

### **Effects of Low-Level Laser and Plyometric Exercises in the Treatment of Lateral Epicondylitis**

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*Objective:* This study was undertaken to compare the effectiveness of a protocol of combination of laser with plyometric exercises and a protocol of placebo laser with the same program, in the treatment of tennis elbow. *Background Data:* The use of low-level laser has been recommended for the management of tennis elbow with contradictory results. Also, plyometric exercises was recommended for the treatment of the tendinopathy. *Methods:* Fifty patients who had tennis elbow participated in the study and were randomised into two groups. Group A ( $n = 25$ ) was treated with a 904 Ga-As laser CW, frequency 50 Hz, intensity 40 mW and energy density  $2.4 \text{ J/cm}^2$ , plus plyometric exercises and group B ( $n = 25$ ) that received placebo laser plus the same plyometric exercises. During eight weeks of treatment, the patients of the two groups received 12 sessions of laser or placebo, two sessions per week (weeks 1–4) and one session per week (weeks 5–8). Pain at rest, at palpation on the lateral epicondyle, during resisted wrist extension, middle finger test, and strength testing was evaluated using Visual Analogue Scales. Also it was evaluated the grip strength, the range of motion and weight test. Parameters were determined before the treatment, at the end of the eighth week course of treatment (week 8), and eighth (week 8) after the end of treatment.

*Results:* Relative to the group B, the group A had (1) a significant decrease of pain at rest at the end of 8 weeks of the treatment ( $p < 0.005$ ) and at the end of following up period ( $p < 0.05$ ), (2) a significant decrease in pain at palpation and pain on isometric testing at 8 weeks of treatment ( $p < 0.05$ ), and at 8 weeks follow-up ( $p < 0.001$ ), (3) a significant decrease in pain during middle finger test at the end of 8 weeks of treatment ( $p < 0.01$ ), and at the end of the follow-up period ( $p < 0.05$ ), (4) a significant decrease of pain during grip strength testing at 8 weeks of treatment ( $p < 0.05$ ), and at 8 weeks follow-up ( $p < 0.001$ ), (5) a significant increase in the wrist range of motion at 8 weeks follow-up ( $p < 0.01$ ), (6) an increase in grip strength at 8 weeks of treatment ( $p < 0.05$ ) and at 8 weeks follow-up ( $p < 0.01$ ), and (7) a significant increase in weight-test at 8 weeks of treatment ( $p < 0.05$ ) and at 8 weeks follow-up ( $p < 0.005$ ).

*Conclusion:* The results suggested that the combination of laser with plyometric exercises was more effective treatment than placebo laser with the same plyometric exercises at the end of the treatment as well as at the follow-up. Future studies are needed to establish the relative and absolute effectiveness of the above protocol.

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