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Low Power Laser Therapy of Shoulder Tendonitis

S. ENGLAND,[1] A. J. FARRELL, J. S. COPPOCK
G. STRUTHERS and P. A. BACON[1]

Department of Rheumatology, Coventry & Warwickshire Hospital, Coventry and Department of Rheumatology, Queen Elizabeth Hospital, Birmingham, England

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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.

Key words: laser, shoulder, tendonitis.

Adrian J. Farrell, Department of Rheumatology, Coventry & Warwickshire Hospital, Coventry, CV1 4FH, UK.

INTRODUCTION

Many forms of treatment are employed by Rheumatologists and Physiotherapists for soft tissue disorders though few have undergone critical evaluation.

Laser light has gained popularity as a new therapy for soft tissue disorders despite a scarcity of studies demonstrating efficacy. We report the first objective controlled evaluation of laser therapy for tendonitis of the shoulder.

PATIENTS AND METHODS

30 patients with either supraspinatus or bicipital tendonitis of at least 4 weeks duration were recruited from rheumatology outpatients attending the Queen Elizabeth and General Hospitals, Birmingham. The diagnostic criteria applied were those suggested by Withrington et al (1) and were as follows:

Supraspinatus tendonitis—a full range of passive glenohumeral movement with pain on resisted abduction of the shoulder.

Bicipital tendonitis—pain on resisted flexion of the elbow and resisted supination of the forearm in the presence of a full range of passive glenohumeral movement.

Patients with inflammatory arthropathies, degenerative changes or calcific periarthritis on shoulder x-ray were excluded.

The mean age of the group was 48 years (range 18–78 years) with equal numbers of males and females. The mean duration of symptoms was 12.5 weeks (range 5–56 weeks) and the group comprised equal numbers of patients with bicipital and supraspinatus tendonitis. Two-thirds of the patients were employed in office or non-manual work the remainder in manual or factory work.

Patients were randomly assigned to three treatment groups:

1. Active laser therapy ($n=10$). 5 mins of 3 mW therapy (the laser used was a gallium-arsenic semiconductor diode operating in the infrared region at 904 nm wavelength, 4,000 Hz frequency with 180 nanosecond pulses, peak power output 10 W) applied to the point of maximum tenderness with the shoulder abducted, slightly extended and medially rotated 90 degrees. This was performed three times a week for 2 weeks.
2. Dummy laser therapy ($n=10$). Patients were treated in the same manner as active treatment, but the laser was not switched on. A cardboard screen was used to blind the patient to light emission

from the laser. Thus the patient and assessor were blind to therapy though the therapists were not for reasons of safety and practicality.

3. Drug therapy ($n=10$) with naproxen sodium 550 mg b.d. for the 2 week treatment period.

All patients were assessed by a single observer using:

i) Shoulder goniometry: maximum active flexion, extension and abduction were measured at 0 and 2 weeks.
ii) Subjective impression of benefit using a 10 cm horizontal visual analogue scale for 'pain'; 'stiffness'; 'restriction' and 'function' at 0 and 2 weeks.

Patients treated with dummy laser were offered the opportunity of having active treatment after the completion of the study. The difference between 0 and 2 weeks was calculated for each of the groups and response to the different therapies compared using the Mann Whitney test.

RESULTS

The three groups were similar in duration and severity of tendonitis. All patients in the active laser treatment group showed improvement in both objective and subjective indices.

1. Active laser therapy v dummy laser therapy:
   Significant improvement was demonstrated for active laser in excess of that seen for dummy laser therapy over the treatment period for all the assessment methods used (see table I).
2. Active laser therapy v drug treatment:
   Active laser therapy produced changes in objective measures of shoulder movement compared with drug treatment. Active shoulder extension (point estimate of treatment effect 10°, 95% confidence levels 0°, 20°; $p<0.02$), flexion (point estimate of treatment effect 14.99°, 95% confidence levels 5°, 30°; $p<0.01$) and abduction (point estimate of treatment effect 20°, 95% confidence levels 10°, 40°; $p<0.005$) all achieved statistical significance. Pain was also significantly better with active laser therapy (point estimate of treatment effect 2 cm, 95% confidence levels 1 cm, 3.5 cm; p 0.005).

   Other subjective indices showed no significant differences.

Table I. *Comparison of the differences over the treatment period for both objective (degrees active movement) and subjective assessments (mm 10 cm Horizontal visual analogue scale) in the active laser and dummy laser groups*

Values shown are the point estimate of the difference between medians, 95% confidence limits and p values (Mann Whitney)

	Point estimate of difference between medians	95% confidence limits	p value
Objective			
Extension	6°	0°, 20°	0.05
Flexion	15°	5°, 29°	0.005
Abduction	20°	10°, 40°	0.005
Subjective			
Movement	2 cm	1 cm, 4 cm	0.005
Pain	2.5 cm	2.01 cm, 3 cm	0.001
Stiffness	1 cm	0 cm, 3 cm	0.05
Function	1.5 cm	−0.01 cm, 3.99 cm	0.05

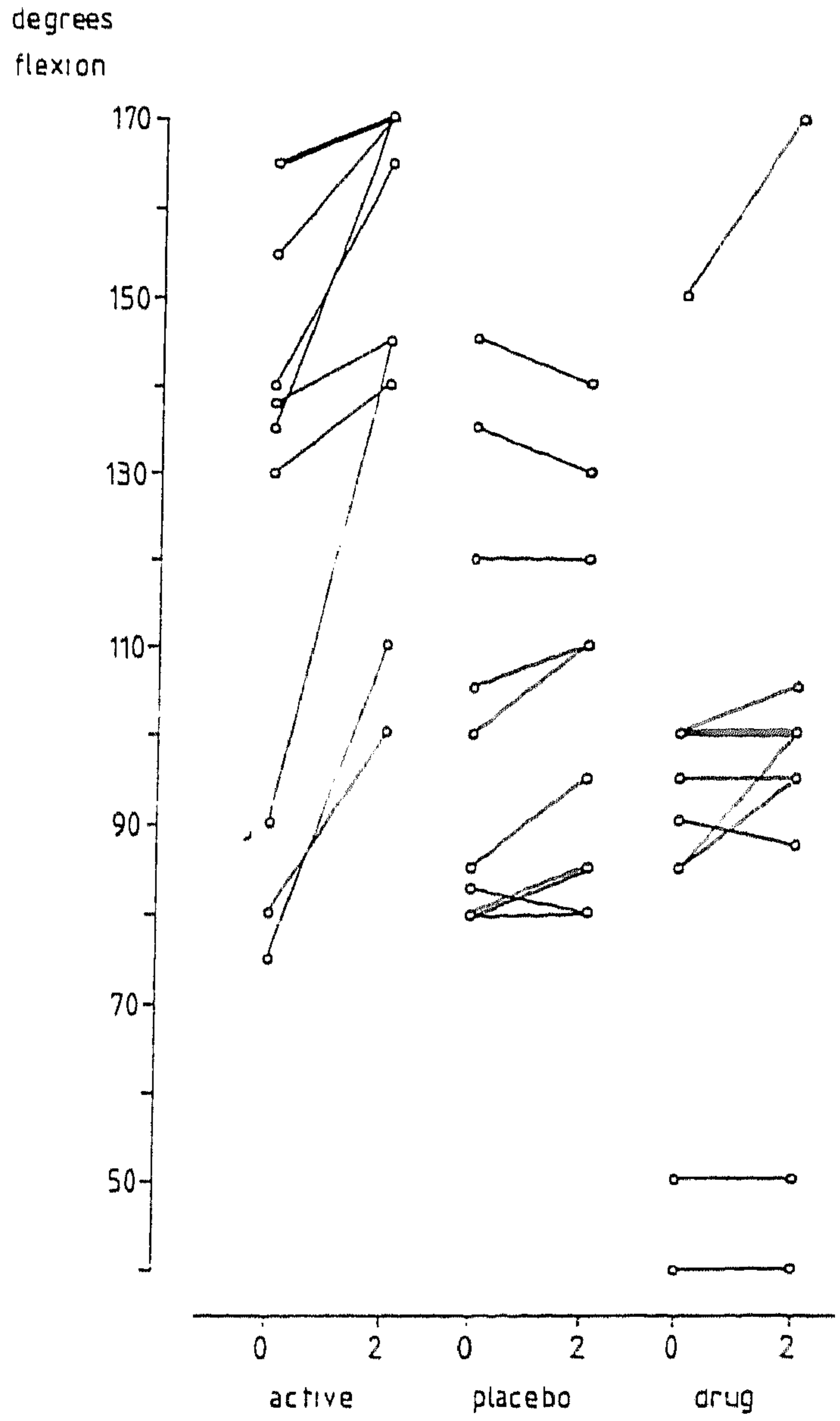

Fig. 1. Changes in shoulder flexion (degrees) over the treatment period for active laser, dummy laser and drug treatment for individual patients.

3. Drug v dummy laser therapy:
   Drug therapy failed to show any significant improvement over dummy for any of the objective assessments used in this study. Subjective benefit was evident for drug treatment for movement (point estimate of drug effect −1.25 cm, 95% confidence levels −2 cm, 0 cm; p 0.05), and function (point estimate of drug effect −1 cm, 95% confidence levels −2 cm, 0 Cm; p 0.05).
4. Cross over from dummy to active laser therapy:
   All patients treated with dummy laser therapy were offered the opportunity to cross over to active laser treatment following the completion of the formal study. All improved. 6 patients receiving active therapy were followed up two months after treatment and all had maintained the improvement in objective shoulder movements.

Our results indicate that treatment with laser has a significant effect on supraspinatus and bicipital tendonitis in excess of that seen with dummy laser or drug therapy.

DISCUSSION

The first laser was a ruby device produced in 1962 by Maiman. The 25 years since has seen a rapid application of the laser not only as a scientific tool but as a therapeutic option in a number of medical disciplines.

The essence of the laser (light amplification by stimulated emission of radiation) is to use an external energy source to raise the atoms of the laser media to 'higher energy levels'. The inevitable fall of atoms to lower energy levels releases photons (spontaneous emission). These photons collide with atoms at higher levels causing them to fall to lower levels, each atom releasing an identical photon in the process. This sequence results in two identical or coherent photons (stimulated emission). When propagated through the media and further amplified by repeated passage by reflectance, it results in a highly amplified beam of coherent light, of a single frequency with little divergence and enormous intensity. The thermal effects conferred by these properties are utilized in many surgical fields particularly ophthalmology. Lasers used in rheumatology are low power devices with minimal thermal effects.

The Eastern European literature refers to extensive experience of laser in sporting injuries and soft tissue disorders (2) though controlled data is not evident.

In inflammatory arthritis, Yakovenko (3) describes improvement of clinico-immunological parameters in 45 patients with rheumatoid arthritis (RA) treated with laser. Similarly Goldman (4) demonstrated a significant effect on erythema, pain, grip strength and pinch grip in the treated hands of 30 patients with RA. This was an observer blind study and analysis was directed towards the difference between one hand receiving active treatment with a 1060 nm neodymium laser compared with sham treatment to the other hand. The moderate effects noted in Bliddal's study may be explained by the different wavelength used (633 nm) and that only one joint, the index MCP was treated (5).

Studies using a lower power Helium Neon Laser (6) in a group of patients with other conditions such as neuralgia, sciatica and osteoarthrosis demonstrated pain relief in 19 out of 26 patients though none of the 10 controls. Pain relief was associated with an increased 24 hour urinary excretion of 5-hydroxyindoleacetic acid.

The treatment of shoulder disorders is a controversial area hampered by inconsistencies in description and terminology. We have used Withrington's (1) definitions of tendonitis which are in keeping with Cyriax's principles of distinguishing capsular from rotator cuff lesions (7). Studies of adhesive capsulitis, it's natural history (8–11) and response to treatment (12–15) have highlighted the slow functional recovery of this disorder.

A variety of treatments have been studied for tendonitis of the shoulder. A controlled study of electromagnetic field therapy in persistent rotator cuff tendonitis (16) demonstrated a significant improvement for pain, painful arc, pain on resisted movement and range of active movement. Local steroid injection (17) has gained wide application, whilst ultrasound which is effective in lateral epicondylitis (18) and is also commonly used for tendonitis of the shoulder, demonstrated no advantage over placebo in one large scale study (19).

Though we have demonstrated a beneficial effect for low power laser in shoulder tendonitis, the mechanism by which laser may act is unclear. Vague 'biostimulative' effects are often invoked in explanation (20). There is however evidence that laser irradiation both increases collagen production by fibroblasts in vitro and accelerates wound healing in Vivo (21). It is suggested that these effects are achieved by enhancing collagen gene expression at the transcriptional level.

Low power lasers are already in widespread use for the treatment of rheumatic disorders despite little published evidence demonstrating their efficacy. Ours is the first controlled study to assess the effects of laser therapy on shoulder tendonitis. The patient group was selected using precise and widely accepted criteria (1). Statistically significant improvement was noted for active v dummy laser for all assessment methods and for active v drug therapy, for range of movement and pain.

Though encouraging, we advocate caution in extrapolating our results to justify the use of laser in other clinical situations. Further studies are required not only to demonstrate laser's efficacy, but also to establish optimum frequency and treatment regimens. Of the many physical therapies in routine use few have been scrutinized in a controlled manner. The opportunity to do so to a new therapy should not be lost. The charm accompanying 'technological' therapies may have helped obscure their objective benefits. Further controlled studies of physical therapies including laser are imperative.

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