USE AND RESPONSE TO TREATMENT USING LOW LEVEL LASER THERAPY

Jane Wigg

Laser therapy for lymphoedema treatment has been used internationally for many years but has been slow to be accepted in the UK. The science behind the technique and its effectiveness in reducing fluid viscosity and encouraging motoricity of the lymphatics has been reported (Lievens, 1987; Eliska and Eliskova, 1997). The evaluation reported in this paper observed the response of 12 patients to laser treatment for lymphoedema. All the patients reported a reduction in tissue thickening and 83% of patients noted improvements in range of movement. In addition, 43% of patients saw an improvement in scar appearance.

Key words

Lymphoedema
Laser therapy
Manual lymphatic drainage (MLD)

Laser has been used for the management of lymphoedema and other conditions for many years. Since attending the Australasian conference in Adelaide in 2002, laser treatment has appealed to the author as an adjunctive therapy. Due to the absence of the UK 'CE' mark, it could not be introduced to practice within an NHS setting. Gaining CE registration in 2008 provided the opportunity for laser therapy to be introduced as an adjuvant treatment within Wolverhampton Lymphoedema Service (WLS).

Guidelines and protocols are essential for the introduction of a new treatment and these were therefore processed and implemented. As laser therapy has been used for many years in Australia and private practice in the UK, ethical approval was not required. In addition, laser has been used in other treatment settings including physiotherapy and wound care (Hopkins et al, 2004). Many lymphoedema services have introduced kinesiotaping as a standard treatment and, despite having little research to support its use, it is widely accepted.

For lymphoedema, laser therapy has been reported to soften hard fibrotic tissues, reduce pain and heaviness, improve the immune system and aid volume reduction (Tadakuma, 1993; Carati et al, 2003).

This paper provides information regarding the first 12 patients to receive laser therapy at WLS (two male, 10 female).

Tilley (2009) has recently summarised the use of laser treatment strategies, previous research studies and the benefits and types of laser. Laser had been reported to change the viscosity of the lymph, allowing it to move more easily through the lymphatics (Eliska and Eliskova, 1997). It is also cited as improving wound healing and changing cell structure to promote healthy regeneration of cells (Karu et al, 2004; Karu and Kolyakov, 2005). Certainly Eliska and Eliskova (1997) showed that a one-off application of laser 'establishes better morphological conditions for the transport of substances from the interstitium to the lymphatic vessels'. As early as 1985, Lievens suggested that laser induces a change in the motoricity of the lymphatic collectors and encourages lymphogenesis. Following his studies on mice and wound healing, he demonstrated that laser therapy reduces the incidence of adhesions and speeds up lymphatic regeneration (Lievens, 1991).

More recently it has been discovered that laser affects cytochrome C oxidase in the mitochondria of every cell to regenerate deoxygenised cells, thus increasing cellular energy, improving blood supply and reducing oxidative stress (Lavi et al, 2003; Tafur, 2008; Chen et al, 2009;).

For lymphoedema, laser therapy has been reported to soften hard fibrotic tissues, reduce pain and heaviness, improve the immune system and aid volume reduction (Carati et al, 2003; Tadakuma, 1993). It also has an effect on macrophages and fibroblasts (Bolton et al, 1995; Young et al, 1989). Thelander and Piller (2000) report improvements in scar tissue and softening as the main

Jane Wigg is Clinical Nurse Manager, Wolverhampton Lymphoedema Service, Wolverhampton; Module Leader of Lymphoedema Degree at Compton Hospice and Trainer and Director of Leduc UK

changes in their initial trial using low level laser scanning on post-surgical oedema. This work showed limb volume reduction to be a significant outcome, along with reduction in tissue hardness, with patients maintaining these effects long term (Carati et al, 2003; Piller, 2006). Tumilty (2009) shows that laser has been reported to be ineffective in as many as 55% of cases when used for tendinopathy, however, meta-analysis of this data show that this was due to treatment not being within a therapeutic range.

Treatment protocol

Wolverhampton Lymphoedema service (WLS) has been using laser therapy since January 2009. Although its use is still in its infancy, subjective results have been positive and provided some unexpected outcomes.

Following the treatment protocol used in the Carati et al (2003) study, and discussing treatment protocols used by a variety of experienced UK private lymphoedema therapists, a treatment plan was devised. Personal communication with Professor Neil Piller from Australia regarding frequency of ongoing treatment has also allowed for continued treatment planning and evaluation of the audit.

Methods

As laser therapy was being introduced for the first time in the author's clinic, therapists were unsure of the outcomes, and thus, a general feedback form was collated. This consisted of three subjective key discussion areas and an objective assessment of limb volume where appropriate. Feedback was received from the patient and therapist after every session of laser treatment and evaluated subjectively before the next treatment.

Collated data consisted of:

- Immediate effect of laser
- Patient report after application
- General comments
- Circumferential limb volume measurements.

Criteria for inclusion in the study required patients to have:

- Non-active cancer (disease progression)
- Oedema failing to respond to routine treatment, or
- Stubborn thickening of the tissue.

Selected patients were those who had areas of thickened tissues and fibrosis which had responded poorly to other treatments, or patients who had already booked in for a course of manual lymphatic drainage (MLD) where laser was to be used as an additional treatment.

Initially nine patients were selected for laser treatment. Three further patients who were receiving MLD were subsequently enrolled to the study due an increase in thickening (fibrosis). Patients were treated three times for the first two weeks, weekly for four weeks, then fortnightly for two sessions, and subsequently monthly for two sessions, ongoing as necessary.

Alternative suggested frequency is three times a week for three weeks, weekly for four weeks, fortnightly for two sessions and monthly thereafter, until no further improvements can be achieved.

A RianCorp class 1 laser using a 904nm wavelength was used on the 'hi' frequency setting for 60 seconds at each position. The points to be treated were distributed 2cm apart and covered a range of 7–17 positions, providing 1.5j/cm^2 per position over the 60-second period. Positions were not marked using a grid or semi-permanent marker and therefore altered slightly between treatment sessions, but were all within the same treatment area. Treatment areas were marked on a body diagram.

The treatment protocol started with treatment to the scar area first, followed proximally to distal on the oedematous area. For head and neck oedema, treatment started in the clavicular regions extending proximally to the oedema (upwards on the neck).

If combining laser with MLD, laser was used initially followed by MLD

Figure 1. Patient receiving laser therapy.

to fill and clear the collecting vessels. Applying the Eliska and Eliskova theory (1997) that laser changes the viscosity of the fluid, the 'Leduc' reabsorbtion technique was used for all MLD patients after laser therapy. The reabsorbtion manoeuvre will take the interstitial fluid from the tissues and direct it into the initial lymphatics (Leduc et al, 1990). The Leduc method of MLD was used for approximately 20 minutes for upper limb oedema and approximately 15 minutes for breast or head and neck oedema. In the author's opinion, the RianCorp laser is easy to use and with training and within a lymphoedema team, could be administered by healthcare assistants. In this evaluation, however, only medically trained therapists administered treatment.

Measurements

All reports of reduced thickening or mobility changes were those interpreted by the patient as a change or improvement. Those reported by the therapist are anecdotal or were derived using a scale of mild/moderate/severe.

Possible side-effects of treatment

There are no reported side-effects of using laser therapy. However, this observational evaluation documented effects which could either be related to laser therapy or general psychosomatic influences, namely:

- One patient reported headache at day 1 (head and neck oedema)
- One patient reported that the

tissues felt hot on three occasions immediately following treatment
- One patient reported tingling on two occasions
- One patient reported a 'horrible sensation' four hours after the second treatment, which did not occur after subsequent treatments. She said it was not pain but made her feel 'peculiar'.

All of these sensations and changes were reported within the first five treatments.

Outcomes

Subjective outcomes were taken with responses documented from the therapist and patients immediately after treatment.

Treatments were administered by five lymphoedema specialist staff with only four individual treatments being provided by the author to four separate patients. This reduced bias in the study.

Seven patients were treated only with laser, of which three patients had oedema secondary to breast cancer treatment, one male patient had arm oedema which had occurred following treatment for non-Hodgkins lymphoma and three had oedema due to head and neck cancer surgery or treatment.

Five patients had combined treatment with laser and MLD. Four patients had breast oedema and one patient had arm oedema (*Table 1*).

Results

The results for the patients that only received laser (i.e. seven patients, three with head and neck oedema and four with arm oedema) were:
- Five of seven patients (71%) had an improvement in movement (subjective)
- All patients reported reduced thickening and softer tissues
- One patient's oedema dispersed completely at the second monthly treatment and mobility remained improved. The patient had head and neck oedema and only received laser therapy
- Three patients reported fading of redness from radiotherapy scar
- Five patients reported a 'definite'/'visible'/'vast' improvement.

Table 1

Details of treatments given

	Arm	Breast MLD and laser	Head and neck Laser only
Cause			
Secondary to breast cancer	Three laser only one MLD and laser	Five	
Non-Hodgkins lymphoma	One laser only		
Head and neck cancer			Three

The results for the patients who received combined treatments (five patients) were:
- All patients reported a softening of the tissues
- All patients reported an improvement in range of movement
- Two patients reported an improvement of the scar
- Two patients reported fading of redness of radiotherapy scar
- Two patients felt that MLD responded better following laser therapy
- There was no reduction of affected limb volume in breast cancer-related lymphoedema (BCRL).

The overall results included:
- 100% of patients reported a softening of the tissues
- 83% of patients reported an improvement in movement
- 42% of patients reported an improvement in scar tissue or appearance
- There was no measurable change in limb volume (n=4).

Patients with head and neck-related oedema or breast-only related oedema were not measured or were unable to be measured for this trial.

Long-term results

All the patients included in this study are now receiving monthly laser sessions (15–30 minutes). Two patients reported an increase of thickening to the tissue between monthly laser sessions, which softened immediately after the application of laser. Consequently, the patients were returned to fortnightly laser treatment for an extra session and all other patients had the treatment protocol altered to provide four fortnightly sessions.

Implications for practice

There was a 100% positive patient response from using laser therapy. These outcomes are quite different to the Carati (2003) trial where one-third of the patients saw a limb volume reduction of 200mls at 2–3-month follow-up. At present, the author's clinic have not seen any limb volume reduction in these patients, only changes in tissue, but the sample is small. It had been expected that some patients would have no response to treatment, but this has not been the case.

The perceived outcome measures were reduction of fibrosis and thickening, which was seen in all patients. Other outcomes, such as improvements in scar tightness, appearance and improved mobility have led the clinic's therapists to want to use laser for symptoms other than oedema, as an improvement in the scar increases mobility and, therefore, reduces oedema through increased exercise. At present, WLS is continuing to evaluate laser therapy until all the patients

involved in the observational study have received six months' treatment.

The results of this initial evaluation have been both successful and interesting. However, long-term resource implications need to be considered. For example, some patients will require monthly ongoing sessions (Piller, 2006). It is worth remembering that if the effects of laser can be maintained long term with top-up sessions of less than 30 minutes, patients' quality of life and oedema can be improved (Karu et al, 2004; Karu and Kolyakov, 2005).

There is a need to recognise flexibility in the treatment regimen. However, this is not always easy to provide in a regimented and busy clinic and gives rise to treatment being driven by economics as much as by need (Tilley, 2009). To evaluate laser therapy effectively, it is essential that the optimal treatment can be administered and that resources are not the leading force. If not, this new technique will be shown to be ineffective when, in reality, it is reduced application that is to blame and not the treatment itself.

Specialist lymphoedema services need to consider the increased workload and embrace the need for prevention and early intervention. Laser therapy assists in the regeneration of healthy cells, therefore, if it is introduced before the increased production of fibroblasts, thickening and fibrosis will be kept to a minimum, thus reducing the costs from the time-consuming and physically demanding work of decongestive lymphatic therapy.

Specialist lymphoedema treatment is evolving. At WLS, through education and training, the 'gross' lymphoedemas of a decade ago are rarely seen. This is a changing world which allows for the specialist to become proactive in the prevention and early intervention of lymphoedema. Although not particularly scientific, this small evaluation has ensured that the laser has a place in the therapeutic range of the author's clinic, and with the use of other specialist treatments such as MLD, the Flowtron Hydroven 12 on the LymphAssist mode (Arjo Huntleigh) and kinesiotaping, the future of lymphoedema management is looking exciting. JL

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Key points

- Laser therapy has been used internationally for many years but has been slow to be accepted in the UK.
- For lymphoedema, laser therapy has been reported to soften hard fibrotic tissues, reduce pain and heaviness, improve the immune system and aid volume reduction (Tadakuma, 1993; Carati et al, 2003).
- An improvement in scar tissue and range of movement had a positive effect on the lymphoedema.
- Treatment is simple and easy to apply and as part of a care plan, could be administered by healthcare assistants.
- To evaluate laser therapy effectively, it is essential that the optimal treatment can be administered and that resources are not the leading force.

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