

Endolesional ablation of xanthelasma using microfiber optic laser delivery

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ABSTRACT

Xanthelasma palpebrarum is the most common type of cutaneous xanthoma and is often a cause of psychological distress and aesthetic dissatisfaction. The extent, depth, or background skin type, intolerance to downtime, or cost, may restrict the treatment options, or contribute to a recurrence rate of up to 60%. 1470 nm microfiber laser is a recent clinical innovation that allows highly targeted delivery of Laser to deeper tissues through fibers as small as 150 μm in diameter, targeting fat and/or water chromophores. We report a retrospective data series on five patients (10 eyelids) treated with intralesional microfiber laser, where other treatment methods were inappropriate, contraindicated, or declined. Single-use tip firing microfibers (150-300 μm), were introduced into lesions under tactile and visible indicator light guidance (1-2 W; 250-500 Hz, LEED 1-2 Jcm^{-2} , 1470 nm). Results were followed up with before/after photography. The pain was measured using a prevalidated 1-10 Likert scale. Patients were followed up by remote consultation up to one year post-treatment. Xanthelasma size was (7 mm $\pm$ 4 mm, mean $\pm$ SD). The average time to complete resolution was 12 $\pm$ 2.4 weeks (All patients were normolipidemic pre-treatment. Sessions needed were 1.2 $\pm$ 0.4 (mean $\pm$ SD). Maximum discomfort on a 1-10 Likert scale was 3 $\pm$ 1/10 (mean $\pm$ SD), at eight weeks' follow-up. No recurrences were reported up to 1 year's follow-up. No patients had visible scarring. Most importantly, all patients reported minimal downtime and could continue normally with activities of daily life. 1470 nm microfiber laser is a promising method for the management of palpebral xanthelasma: within this case series was safe and effective in experienced hands. Further, larger studies are in hand to assess follow-up long-term outcomes and patient satisfaction.

Key words: xanthelasma; laser; microfiber; adipose; palpebrae; periorbital.

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Introduction

Xanthelasma palpebrarum is the most common type of cutaneous xanthoma, with an incidence of 1.1 % in females and 0.3% in males. Xanthelasmata are often a cause of psychological distress and aesthetic dissatisfaction.^{1,2} Multiple treatments have been described, including surgical resection, trichloroacetic acid peeling, cryotherapy, and a plethora of ablative and non-ablative lasers, including carbon dioxide, erbium-doped yttrium aluminum garnet (YAG) laser pulsed dye, Q-switched neodymium-doped YAG (Nd: YAG), and 1,550-nm erbium-doped laser therapy, all of which have manifest limitations and complications including scarring and complications thereof, burns, hypo, hyperpigmentation, post-inflammatory hyperpigmentation.^{2,3} However downtimes for current treatment modalities can be quite significant ranging from 4.5 days (TCA cross) to 30 days for flatbeamed superpulsed CO₂ laser.^{4,5} Further, considering the thickness of the eyelid skin is only 1088±528 µm, and the complexity of the underlying anterior/posterior lamellar arrangement, the complications of uncontrolled treatment methods such as trichloroacetic acid may have devastating complications. The ideal treatment would produce complete, gradual resorption of the xanthelasma, with minimum downtime, no scars, and allowing a return to everyday life in as little time as possible. We report on the management of xanthelasma palpebrarum with a 1470 nm microfiber laser in challenging scenarios where other treatment modalities were declined, unsuccessful, or contraindicated.

Materials and Methods

Single-use microfibre and 1470 nm laser were from Eufoton (Trieste, It.). A Zimmer Cooler was from Medizinsysteme GMBH (Bavaria GE). Serial photographic documentation and consent to publish were obtained. Standard laser personal and patient protection, including metal shield contact lenses (COX-ii) were used, and the procedure was performed in a laser-controlled environment.

Methods

After saline skin preparation, xylocaine (<50 µL, 1% v/v, with adrenalin 1:200,000) was injected for comfort

around the introduction points. Microfiber (single-use, sterile) was introduced into the lesion under tactile guidance and fired at a 1 cms⁻¹ withdrawal speed, with the fiber held parallel to the skin surface, under jet air cooling. Results were followed up with before/after photography. Pain was measured using a prevalidated 1/10 Likert scale. Statistical analysis was performed with GraphPad Prism version 8.0 for Windows, GraphPad Software, San Diego, California, USA. All patients were fitted with Cox-II type corneal shields, following pre-treatment with topical anesthetic eye drops and lubricant.

Dynamic surface cooling using oscillating cold air was maintained throughout and for up to 15 min after. Post-procedure refrigerated (8°C) moisturizing cream was immediately applied. The domiciliary regime was as follows: shower with running water (no exposure to standing water), pat dry with sterile gauze followed by chloramphenicol ophthalmic ointment thrice daily for five days, and aqueous ophthalmic moisturizer thrice daily for a further 14 days. When re-epithelialization was complete, rigorous attention to the application of periorcular moisturizer (SPF 50+ 3 hourly) and sunblock SPF 50+ filtering UVA, B, C and infrared A, B, C) was prescribed. The study conforms to the World Medical Association Declaration of Helsinki (June 1964) and subsequent amendments (<https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/>).

Results

All patients (n=5, 10 xanthelasmata), were normolipidemic pre-treatment. Basic demographic characteristics were as follows: sex 4F:1M, age 55±15 years (mean±SD), Fitzpatrick phototype V (all patients). One patient had a documented history of melasma palpebrarum and post-inflammatory hyperpigmentation. Another patient had a strong history of hypertrophic-keloid spectrum scarring. Otherwise, no relevant past medical surgical medical allergy or dermatologic history was reported. No patient was on photo-sensitizing medication or topical retinoids.

Clinical features of these xanthomata were reported as mean size (7±4 mm, mean ± SD, 6 upper eyelids, 4 lower eyelids). Resolution of the lesion at 17±4 days was reported and this did not affect daily activity. An additional session was offered to tidy up any remaining areas- only taken up by one patient (1.2±0.4 sessions

(mean $\pm$ SD). Maximum discomfort was $3/10 \pm 1/10$ (mean $\pm$ SD, maximum), at eight weeks follow-up on a validated printed Likert scale.⁶ No side effects were reported, including hyper/hypopigmentation, cutaneous, corneal, scleral, or visual field, at 12 months follow up. Figures 1 and 2 report typical outcome in type 5 skin, with a tendency toward hyperpigmentation.

Discussion

Multiple treatment methods include surgical resection, topical application of trichloroacetic acid, electrodesiccation, and laser ablation of various forms and wavelengths.^{2,3,7,8} Whilst surgery is an excellent option, some patients were not eligible, require more extensive reconstruction, or simply elect to decline surgery.⁹ Surgery also is associated with increased recurrence rates and downtime that might be less acceptable to some patients. Rohrich et al. report a relatively high rate of recurrence (40% for primary to 60% for secondary xanthelasmata), associated with the superficial approach of Zarem and

Lorincz.² In contrast, Lee *et al.* report a far lower (3%) recurrence rate,³ but 35% of these patients who presented with grade II lesions extending to the medial canthal area required concomitant medial epicanthoplasty. A further 30% of cases required combined blepharoplasty, with or without graft and flap techniques.³ In addition, xanthelasmata also have a documented recurrence rate, ranging from 13% (laser), 40% (primary excision), and 60% (secondary excision), with the highest recurrence in the first year (26%).¹⁰ Scar formation, contracture, ectropion and hyperpigmentation, and high recurrence rates are significant issues when trichloroacetic acid is used.^{11,12} It is also worthwhile reporting that most of these studies have relatively limited follow-up times, not extending beyond 6 months.⁵

A plethora of lasers has been described, with a variable success rate. In patients with darker skin backgrounds, a thermal insult to the skin may also result in a degree of hyperpigmentation or hypopigmentation and aggravate post-inflammatory hyperpigmentation.¹³ The ideal treatment method would provide a gentle reduction in these lesions, with no scarring and minimal downtime. Xan-



Figure 1. Patient treated with intralesional microfiber laser (right) on recurrent xanthelasma over a background of type V southeast Asian skin with a documented history of post-inflammatory hyperpigmentation (a) pretreatment; (b) final result.

thelasmata are fat-laden, with membrane-bound lipid vacuoles, cholesterol crystals, lysosomes, and residual bodies, producing a typical histologic picture of foamy histiocytes. Surrounding fibrosis and inflammation are common findings. They may extend down to the orbicularis oculi.¹⁴ The thermally mediated destruction of perivascular foam cells, is thought to be responsible for the treatment efficacy of laser. Additionally, coagulation of hyperpermeable vessels within the dermis may result in the obstruction of further lipid leakage into the tissue, thereby potentially preventing recurrence.¹⁵ Various types of lasers, such as carbon dioxide (CO₂), yttrium aluminum garnet (YAG), argon, and pulsed dye (PDL),

have been utilized to treat xanthelasma palpebrarum. The use of flat-beamed traditional lasers in the 1450 and 1470 nm range is not new and is already documented to lead to acceptable outcomes and relatively lower downtimes.¹⁶ Heat-induced destruction of sebaceous glands is likely accountable for the efficacy of 1450 nm lasers, apocrine hydro cystoma, and possibly appendigeal tumors.^{17,18} As an extension of this idea we explored the use of 1470 nm microfiber optic delivery in an attempt to reduce downtimes and potential for side effects in situations where there was no viable alternative, in an attempt to deliver thermal energy directly intralesionally, reduce the port of entry, associated complications and downtime associated with epithelial loss. Crucially, transdermal delivery of energy requires higher fluences, whereas such a device would reduce the required fluences and hence risk for adverse effects.

Microfiber laser presents an exciting step-change in this therapeutic limitation of this technology, allowing highly selective targeting of deeper tissues in the subcutaneous and even deeper layers, and has been successfully used in keloids, and hypertrophic scarring, facelifting and scarring amongst others.^{14,19,20} Several studies have demonstrated the safety and efficacy of Laser in the 1450-1500 nm range, including for the management of sebaceous hyperplasia, scarring, rejuvenation, apocrine, hydrocystoma, lupus miliaris disseminatus, scarring.¹⁵ Use of a narrow diameter fiber is certainly more technically demanding than open surgery or traditional laser, however, we contend that its two significant advantages are an entry point of 150 μ m, which in our patients healed without significant marks, and secondly, obviating the requirement to de-epithelialize, reducing substantially the post procedural downtime.^{4,5}

Limitations

This study is to our knowledge the first to explore intralesional microfiberoptic delivery of a 1470 nm laser, for the treatment of xanthelasmata, but this study was limited by the small number of cases and the retrospective data collection. Despite this, our early data suggests that the minimal downtime and substantially reduced side effect profile deserve further investigation, in situations where other forms of treatment are declined, contraindicated, or inappropriate.



Figure 2. The patient was treated with intralesional microfiber laser (right) on recurrent xanthelasma over a background of type V southeast Asian skin, with complete resolution and no evidence of hyperpigmentation, despite a strong tendency to hyperpigmentation. Pretreatment (a) pretreatment; (b) 4 weeks post-treatment (c) final result.

Conclusions

1470 nm microfiber Laser is a promising method for the management of palpebral xanthelasma. This case series illustrated the potential for a safe and effective technique in experienced hands. Further, larger studies are in hand to assess follow-up long-term outcomes and patient satisfaction

Conflict of interest: the authors declare no potential conflict of interest, and all authors confirm accuracy. None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript.

Ethics approval: the Ethics Committee approved this study (code ELMS291). The study conforms with the Helsinki Declaration of 1964, as revised in 2013, concerning human and animal rights.

Informed consent: all patients participating in this study signed a written informed consent form for participating in this study.

Patient consent for publication: written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

Availability of data and materials: all data generated or analyzed during this study are included in this published article.

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