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ABSTRACT

Picosecond lasers are a novel laser with the ability to create a pulse of less than one nanosecond. They have been available in the clinical context since 2012. Dermatologists are now using picosecond lasers regularly for the treatment of blue and green pigment tattoo removal. This article reviews the use of picosecond lasers beyond tattoo removal. The overall consensus for the use of picosecond lasers beyond tattoo treatment is positive. With examples of this in the treatment of: nevus of Ota, minocycline induced pigmentation, acne scarring and rhytides.

REVIEW

The use of picosecond lasers beyond tattoos

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ABSTRACT

Picosecond lasers are a novel laser with the ability to create a pulse of less than one nanosecond. They have been available in the clinical context since 2012. Dermatologists are now using picosecond lasers regularly for the treatment of blue and green pigment tattoo removal. This article reviews the use of picosecond lasers beyond tattoo removal. The overall consensus for the use of picosecond lasers beyond tattoo treatment is positive. With examples of this in the treatment of: nevus of Ota, minocycline induced pigmentation, acne scarring and rhytides.

Introduction

Picosecond lasers are a relatively novel laser technology with the ability to create a pulse of less than one nanosecond(1).They have been available in the clinical context since 2012 and are being increasingly used worldwide. Dermatologists are now using picosecond lasers regularly for the treatment of blue and green pigment tattoos, traditionally colours that were difficult with the nanosecond lasers(2). It is hypothesised that this class of laser is superior to alternatives in tattoo removal including: ablative, non ablative lasers and fractional photothermolysis(3). This is attributable to their ability to create greater mechanical stress on the target with less thermal effects in comparison to nanosecond lasers(4). Furthermore, the high specificity of the picosecond laser to the target, with less reverberating diffusion of heat creates fewer potential side-effects(1). This review analyses the current reported literature on the use of picosecond lasers beyond tattoo removal.

Methods

A literature search was performed in December 2015, to review the current use and evidence on Picosecond lasers in dermatology beyond tattoo removal. A PubMed, Embase and Google scholar search was carried out, with the search criteria “Picosecond laser”, “cosmetic”, “pigmentation”, and “Dermatology”. Articles were selected and reviewed looking at their use beyond tattoo treatment. Only articles published in English were included.

Results

Our search identified only eight articles, with all studies being of small sample size. There was one study on the use of picosecond laser in minocycline-induced cutaneous pigmentation, one on the treatment of Nevus of Ota, two on acne scarring, two on photo-damage and rhytides, and one on hyperpigmentation. In total 126 patients were treated. Side-effects included minimal erythema and oedema which was of minimal duration; there was no report of post-inflammatory hyperpigmentation in the literature. The average number of treatment sessions was 3-5, and the average follow up was three months.

Discussion

From the literature search it is evident that there is currently a wide scope for the use of picosecond lasers beyond their traditional use in tattoo removal. The overall conclusion for the use of picosecond lasers beyond tattoo treatment is certainly encouraging. Current examples of this in the literature include the treatment of: nevus of Ota, minocycline-induced

pigmentation, acne scarring and photodamage/rhytides. As demonstrated table 1, the studies show promising results with positive outcomes. All of the studies demonstrated that there were no significant side-effects with the use of picosecond lasers: with the most common adverse effects including mild transient erythema and oedema. Furthermore, improvement was found in all of the studies post treatment with picosecond lasers. This study highlights that research is missing to demonstrate the potential of picosecond lasers beyond tattoo removal, and that there is a potential wider scope for the use of picosecond lasers beyond tattoos. Further research with larger sample size and split-face studies comparing it to nanosecond lasers are required to ascertain the probable benefit of picosecond laser as either an equivocal or possibly a superior method to the current lasers in use today.

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Table Legend

Table 1. Summary of all studies using the picosecond lasers beyond tattoo removal.

Study	Dermatological condition	Aim	No. of Patients	Outcome
Chestnut et al (2015)	Treatment of Nevus of Ota	• Improve cosmetic outcome of Nevus of Ota, and reduce hyperpigmentation • Age 24-32 years • Skin type not specified • Treated with Picosecond 755-nm alexandrite laser in Nevus recalcitrant to QS laser treatment • Follow up: 7 months	N=3	• SE of mild oedema and erythema in all patients • No repigmentation within the follow up window of 27 months • 'significant lightening and cosmetic improvement'
Rodrigues and Bekhor (2015)	Treatment of Minocycline-induced cutaneous Pigmentation	• Treatment with Picosure • Age 59-75 years • Caucasian cohort • Split face study: Picosure vs QS Nd: YAG • Follow up: 12 weeks	N=3	• Pigmentation completely resolved/almost completely in 2/3 of patient after only sessions and significantly reduced after one session in 1/3
Tanghetti and Shin (2015)	Treatment of skin with picosecond laser to improve pigmentation, tone, texture and pore size	• Treatment with 755nm picosecond toning • 5000-6000 pulses (3-4 passes) • 3-5 treatments • maintenance treatment 2-3 months • Follow up: 6 months	N=20	• Pigmentation, superficial skin texture and pore size improved over 3-5 treatments • Minimal downtime • SE of mild erythema and oedeoma lasting 5 hours post treatment • Blinded grading of photographs • 90-95% improvement in hypopigmentation • 70-75% improvement in texture • 50-60% improvement in pore size • 2 cases of transient hypopigmentation
Wu et al (2015)	Treatment of photo aging décolletage	• Treatment with 755nm picosecond pulsed alexandrite laser • 4 treatments at 3 week intervals • Fitzpatrick I-IV • Follow up at 1 and 3 months	N=20	• Blinded evaluator • Statistically significant improvement in dyspigmentation, keratosis and skin texture ($P < 0.05$) but not at 3 months ($P=0.08$) • One patient extremely satisfied and six extremely dissatisfied • Pain minimal
Brauer et al (2015)	Treatment of Facial Acne scarring	• Single centre prospective study	N=20	• Blinded assessor • Minimal pain

		• 6 treatments • follow up 3 months Age 27-61 years • Fitzpatrick I-V		• Patients satisfied to extremely satisfied • 24.3% average improvement in scar volume • Histology showed elongation and increased density of elastic fibers and increase dermal collagen and mucin
Geronemus et al (2014)	Treatment of Facial Acne scarring with Picosecond	• 15 women, 5 men • Fitzpatrick skin type I-V • Treated with PicoSure 755nm laser with focus lens array • Biopsies performed (does not state on how many patients) • Follow up: 1,4,6 months	N=20	• Blinded assessment (not stated by whom) demonstrated a 26-74% overall clearance at Follow up 1 and 3 months • 24.3% average improvement demonstrated with scar volume 3D analysis • Histology from biopsies demonstrated elongation and increased density of elastic fibres, increased dermal collagen and mucin
Weiss et al (2014)	Treatment of wrinkles with Picosecond laser	• Treated with 750 picosecond at 1 month intervals	N=20	• Assessed using blinded photographs • Does not state who the assessor is • Found an average of a 2-point improvement by assessor • On average, subjective 50-75% improvement • Side effects of mild oedema and erythema, of less than 24 -hour duration • Minimal downtime

References for table:(5–10).