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© Journal of Cosmetic and Laser Therapy, 2007; 9: 253-255

TREATMENT OF TRAUMATIC TATTOO WITH THE Q-SWITCHED Nd:YAG LASER

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Traumatic tattoos are undesirable tattoos caused by different foreign bodies such as fireworks' particles, sand, metals, glass, gunpowder, asphalt, dust, or petroleum products embedded forcefully in the dermis. We report the case of a 54-year-old man who presented with sand and asphalt tattooing on his face following a bomb explosion 15 years ago. Q-switched Nd:YAG laser at a wavelength of 1064 nm with a spot size of 4 mm and a fluence of 7.96 J/cm^2 were [sic] applied to treat the patient. The patient tolerated the treatment very well. Most of the blue dots became whitened immediately after the procedure and remained almost clear after a 6-month follow-up.

© Korean Journal of Dermatology, 2008; 46: 1163-1170 (in Korean, abstract in English)

NEW MELASMA TREATMENT WITH COLLIMATED LOW FLUENCE Q-SWITCHED Nd:YAG LASER

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Background: Laser treatment in melasma has previously failed because of the resulting inflammation and consequent pigmentation and excessive thermal damage caused by the use of high fluences.

Objective: This study is aimed at establishing the concept of the collimated low fluence Q-switched Nd : YAG laser as a treatment for melasma by investigating its therapeutic effects clinically as well as histopathologically.

Methods: 27 patients were treated weekly with Q-switched Nd: AG laser (1,064 nm wavelength, 7 mm spot size, 1.6 ~ 2.5 J/cm² fluence) for 8 weeks. The results were evaluated based on standardized clinical images that used a Robo skin analyzer, spectrophotometer, MASI score and general severity.

Results: 17 (58.8%) patients showed “GOOD” (50-75% improvement). No case of full recurrence was seen and partial recurrence was detected in 12/17 patients. Common adverse effects include pain, erythema, and temporary edema. Rarely, partial hypopigmented macules and diffuse hyperpigmentation appeared. Additional studies, such as immunohistochemical examination and electron microscopic examination, are also currently in progress.

Conclusions: The collimated low fluence Q-switched Nd:YAG Laser is effective in melasma treatment. This treatment method is a new concept that can be described as selective photothermolysis with minimal thermal damage and inflammation reaction to affected tissues by pigmentation. We consider this treatment method should be regarded as Minimized Selective Photothermolysis (MSP) that will provide a new effective treatment for melasma.

© Journal of Investigative Dermatology, 2010; 130: 2333-2335 (Letter to the Editor)

SUBCELLULAR SELECTIVE PHOTOTHERMOLYSIS OF MELANOSOMES IN ADULT ZEBRAFISH SKIN FOLLOWING 1064-nm Q-SWITCHED Nd:YAG LASER IRRADIATION

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Background and Aims: The theory of selective photothermolysis suggests that brief pulses of laser at suitable wavelength and energy settings can cause selective damage to pigmented structures, cells, and organelles while sparing surrounding tissues. We postulated that repetitive treatments with low-fluence Q-switched Nd:YAG laser treatment (laser toning) would achieve selective photothermolysis at a subcellular level, sparing the cell containing the target pigment, and recent reports have suggested this is the case in the treatment of melasma. The present tudy was designed to test our hypothesis in the zebrafish model.

Materials and Methods: Anesthetized zebrafish had approximately half of their body treated with a 5-7 ns Q-switched 1064 nm Nd:YAG laser (7 mm spot, pulse energy 0.3, 0.4, 0.5, 0.7 and 0.9 J/cm² and changes in melanosomes, melanophores, and adjacent cells were examined at this range of laser irradiation fluences. Pigment removal was assessed with gross macrophotography. To assess cellular damage in the target and surrounding cells, TUNEL staining evaluated the degree of apoptotic cell death, and double staining with 40,6-diamidino-2-phenylindole (DAPI) assessed cell survival through the state of the cell nuclei.

Results: At 0.3 J/cm² several pigmented spots remained under x40 magnification, but very few spots were evident for all other settings. DAPI staining showed normal nuclei for all the treatment fluences, confirming that cell necrosis was not caused by laser irradiation. TUNEL staining, however, showed dose-dependent degrees of apoptosis at higher settings with no apoptosis noted at 0.3 or 0.4 J/cm². The ideal setting to eliminate pigment almost completely in the zebrafish model while maintaining healthy cells was therefore 0.4 J/cm². We termed this phenomenon subcellular selective photothermolysis.

Conclusions: Our study confirmed that low-fluence Q-switched Nd:YAG laser energy, laser toning, could selectively photothermolyse melanosomes without killing melanocytes. This might offer a good approach for melasma treatment while preventing postinflammatory hyperpigmentation after melanocyte destruction, which is especially common in Asians.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Dermatologic Surgery, 2010; 36: 909-918

LOW-FLUENCE Q-SWITCHED NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER FOR MELASMA WITH PRE- OR POST-TREATMENT TRIPLE COMBINATION CREAM

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Background: Topical triple combination (TC) treatment is considered the primary approach to melasma. Recently, collimated low-fluence 1,064-nm Q-switched neodymium-doped yttrium aluminum garnet (Nd:YAG) laser treatment has attracted attention as an alternative approach.

Objectives: To compare the clinical efficacy and adverse effects of low-fluence Q-switched Nd:YAG laser when performed before and after treatment with topical TC using a split-face crossover design.

Methods: Thirteen patients with melasma received topical treatment with TC cream or 1,064-nm Qswitched Nd:YAG laser treatment on opposite sides of the face for 8 weeks, and then treatments were reversed for 8 weeks. Responses were evaluated using the Melasma Area and Severity Index (MASI) scoring system, spectrophotometry measurements, and a subjective self-assessment method.

Results: After 16 weeks, better results were seen in subjective assessments when laser treatment was used after 8 weeks of topical TC treatment than before usage of TC. There were no significant adverse effects with the laser treatments.

Conclusions: Laser treatment after topical TC cream was found to be safer and more effective than the post-treatment use of topical agents.

© Aesthetic Dermatology, 2010; 20: 342-347

EFFECT OF LOW FLUENCE Q-SWITCHED 1064 nm Nd:YAG LASER THERAPY ON MELASMA

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Recently, a new approach to treatment of melasma using the low fluence Q-switched (QS) 1064 nm Nd:YAG laser has increasingly been performed successfully and published as “laser toning” in Asian countries. However, we found some confusion with regard to the concept, mechanism and safe parameters in recent papers on laser toning. They use various passes (e.g., 2-10) of different low fluences (e.g., 1.6-5.0 J/cm²) and different intervals in order to achieve the observational clinical effect. Due to these wide variations of parameters, the clinical efficacy and safety of this modality has provoked controversy. Over the past few years, a couple of studies have been conducted on the effects of laser toning, however, little is known about the mode of action based on scientific concepts. In our clinical, ultrastructural and zebra fish studies, we found an effective, reliable and safe approach using the low fluence QS 1064 nm Nd:YAG laser in treatment of melasma.

© Journal of Electron Microscopy, 2011; 60: 11-18

A LOW FLUENCE Q-SWITCHED Nd:YAG LASER MODIFIES THE 3D STRUCTURE OF MELANOCYTE AND ULTRASTRUCTURE OF MELANOSOME BY SUBCELLULAR SELECTIVE PHOTOTHERMOLYSIS

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Background and Aims: Laser treatment using low fluence for melasma was previously introduced to overcome postinflammatory hypermelanosis after Q-switched laser therapy. However, research on the mechanism of this treatment is very limited. In this study, a collimated low fluence 1064 nm Q-switched Nd:YAG laser with a pulse width of <7 ns was applied using top-hat beam mode. The aim of this study was to investigate the mode of action of this laser treatment through electron microscopy.

Methods: The effectiveness of this treatment was confirmed by clinical photos, melasma area and severity index and spectrophotometer. To understand the mode of action, the three-dimensional structure of melanocytes in the epidermis was analyzed using serial images acquired by a 3VIEW surface block face scanning electron microscope.

Results: In the epidermis, after laser treatment, fewer dendrites in the melanocytes were observed compared with pretreatment. In addition, ultrastructural changes in the melanosome were studied using transmission electron microscopy, which showed that laser treatment caused selective photothermolysis on stage IV melanosomes.

Conclusions: This treatment should therefore be regarded as an effective method for treating melasma through subcellular-selective photothermolysis.

© Laser Therapy, 2011; 20: 189-194

THE DUAL TONING TECHNIQUE FOR MELASMA TREATMENT WITH THE 1064 nm Nd:YAG LASER: A PRELIMINARY STUDY

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Background and Aims: Melasma is a treatment-resistant and acquired pigmentary facial skin condition of uncertain etiology particularly prevalent in the older Asian female. Traditional bleaching agents have offered some success. Intense pulsed light (IPL), fractionated nonablative and more recently ablative laser technology have also been used, but were associated with postoperative hyperpigmentation in the Asian skin. The present study examined the consecutive application of 2 modes of the 1064 nm Nd:YAG laser in the 'dual toning' process.

Subjects and Methods: Thirty females, mean age 41.4 ± 11.96 yr, Fitzpatrick skin type IV, participated in the prospective uncontrolled study. All subjects were treated with the 1064 Nd:YAG laser, first with the 5 ns Q-switched mode, 1.2 J/cm², 8 mm collimated handpiece with multiple passes and then immediately after with the micropulsed mode, 300 µs, 7.0 J/cm², 5 mm handpiece, multiple passes. Mild and even erythema was the endpoint. Treatments were given every other week until maximum improvement was obtained. Improvement was rated at a final assessment 6 weeks after the final treatment on a 5 point scale where 1 was little or no improvement and 5 was maximum improvement.

Results: At the final treatment session and at the 6-week assessment, 20 of the 30 patients (67%) saw a fair to excellent degree of improvement, 7 (23%) had visible improvement and little or no improvement was seen in 3 (10%) patients. There were no unexpected side effects in any patients.

Conclusions: The dual toning technique using the 1064 nm Nd:YAG laser was safe and effective, and well-tolerated by all patents without anesthesia. Larger controlled studies are merited with more objective measurement techniques to confirm the results of this preliminary study.

© Dermatologic Surgery, 2011; 37: 551-553 (Letter to the Editor)

ERYTHEMA AB IGNE SUCCESSFULLY TREATED USING 1,064-nm Q-SWITCHED NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER WITH LOW FLUENCE

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Background and Aims: Erythema ab igne, which means "redness from fire," is a reticular, macular dermatosis that develops secondary to prolonged heat exposure. Although spontaneous regression can occur, it is a precancerous lesion that has the potential to develop into squamous cell carcinoma and Merkel cell carcinoma, so early treatment is advised. Up till now, however, there has been no standard treatment for this condition. We report herein on a case of erythema ab igne successfully treated with low fluence Q-switched Nd:YAG laser toning.

Subject and Methods: A 23-year-old woman presented with a 3-month duration of mottled erythematous patches on her legs. She had a history of prolonged and repeated exposure to an electric heater located on her left side while she was working on her desk during the winter season. Erythema ab igne was diagnosed, based on her history of heat exposure, together with the clinical distribution of the reticular, hyperpigmented erythema on the heat-exposed site. She was treated using a 1,064-nm Q-switched Nd:YAG laser with low fluences in what is referred to as the laser toning approach (5 ns pulse width, 1.8-2.5 J/cm², 7 mm diameter collimated beam, 2-3 passes, 20-30% overlap) for 3 sessions, after which the skin lesions had almost completely cleared. The mild post-therapy erythema spontaneously resolved within a few hours.

Conclusions: Laser toning with the low-fluence Q-switched Nd:YAG laser was easily applied, with minimal downtime and without post-therapy bleeding or crust formation. Although further studies are required to compare the cost effectiveness of laser toning with that of awaiting the spontaneous regression of the lesions, which sometimes may be incomplete, we postulate that laser toning can be an effective treatment option for patients with erythema ab igne for whom the reticulated, mottled skin lesions are a psychosomatic problem.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Dermatologic Surgery, 2011; 37: 126-127 (Commentary on Jeong et al, page 3 above)

LOW-FLUENCE Q-SWITCHED NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER FOR MELASMA WITH PRE- OR POST-TREATMENT TRIPLE COMBINATION CREAM

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The above study by Jeong and colleagues (Dermatol Surg 2010; 36: 909-918) answers the important question of how medical skin lightening agents should be used in combination with laser therapy for the treatment of melasma. The 13 subject split-face study evaluated the efficacy of an 8-week application of 4% hydroquinone, 0.05% tretinoin, and 0.01% fluocinolone acetonide combination cream before or after low-fluence 1,064-nm Q-switched neodymium-doped yttrium aluminum garnet (Nd:YAG) laser treatment. This design was employed to determine whether it is better to suppress pigment production in melasma patients before laser injury to the skin or address the postinflammatory hyperpigmentation component only by medical skin lightening therapy after the laser treatment.

The study demonstrated that pretreatment with medical skin lightening was most effective. This may be due to several factors, which will be briefly explored. The triple combination cream used for medical skin lightening in this research contained hydroquinone to inhibit melanin production, tretinoin to enhance hydroquinone penetration and decrease melanosome transfer, and fluocinolone acetonide to minimize irritation. Hydroquinone, a phenolic compound chemically known as dihydroxybenzene, functions by inhibiting the enzymatic oxidation of tyrosine and phenol oxidases. It covalently binds to histidine or interacts with copper at the active site of tyrosinase. It also inhibits ribonucleic acid and deoxyribonucleic acid synthesis and may alter melanosome formation, selectively damaging melanocytes. These activities suppress the melanocyte metabolic processes, inducing a gradual decrease of melanin pigment production, but hydroquinone is a highly unstable compound undergoing rapid oxidation when exposed to air, resulting in the melanocyte-toxic products p-benzoquinone and hydroxybenzoquinone, which can cause depigmentation.

It is the safety concerns arising from oxidized hydroquinone that have led to the recent controversy regarding its use in the United States, Europe, and Asia. Hydroquinone remains the most effective topical pigment-lightening agent currently available, and combining it with a topical retinoid and corticosteroid heightens its efficacy. This research demonstrated that pretreatment with the cream combination was more efficacious probably because it takes time to shut down the melanin-producing machinery. If melanin production is decreased before skin laser injury, postinflammatory hyperpigmentation is reduced and the melasma improved. If the medical cream treatment is used only after laser injury, the melanin-producing machinery is operating at full capacity, increasing chances for postinflammatory hyperpigmentation and slowing the visual improvement of the melasma.

The findings of this research are valuable to the dermatologic surgeon who treats pigmentary disorders. Medical hyperpigmentation therapy of at least 8 weeks should precede laser treatment for melasma to achieve the optimal result.

© Dermatologic Surgery, 2012; 38: 31-37

LOW-FLUENCE Q-SWITCHED 1,064-nm NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER FOR THE TREATMENT OF FACIAL PARTIAL UNILATERAL LENTIGINOSIS IN KOREANS

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Background: Established pigment lasers have been used in the treatment of partial unilateral lentiginosis (PUL) but have shown unsatisfactory results.

Objective: To determine the effectiveness and safety of low-fluence 1,064-nm Q-switched neodymium-doped yttrium aluminum garnet (QS Nd:YAG) laser treatment of PUL in Koreans.

Materials and Methods: Ten Korean patients with facial PUL were treated with 1,064-nm QS Nd:YAG laser, 7-mm spot size, 1.5- to 2.5-J/cm² fluence at 2-week intervals. Standard digital photographs were taken under the same condition at baseline and at each follow-up visit. Independent dermatologists evaluated the photographs. All patients completed a questionnaire to assess their subjective satisfaction with the laser treatment using a 5-point grading system. Degree of pain was assessed using a visual analog scale (0-10). Any complications and side effects were recorded at each visit. Patients were followed up every 4 weeks for 12 weeks after the last laser treatment.

Results: Five of 10 patients (50%) had achieved excellent improvement (76-100%) at the end of treatment, and the remaining 50% had good improvement (51-75%). In patient self-evaluation of the degree of improvement of PUL, 9 (90%) assessed it as very much to much improved (>50% improvement), and 1 (10%) assessed it as moderate (50-75%). Subjects rated the pain associated with laser treatment at a mean score of 3.3 (range: 1-5) on a scale of 1 to 10. Mottled hypopigmentation developed in two patients. At follow-up, 12 weeks after the last laser session, all of the patients had partial recurrence, which was resolved with one to two sessions of laser treatment.

Conclusions: Low-fluence 1,064-nm QS Nd:YAG laser treatment for facial PUL in Koreans showed improvement with no significant side effects. We recommend the low-fluence 1,064-nm QS Nd:YAG laser as a treatment option for facial PUL.

© Journal of Cosmetic and Laser Therapy, 2012; 14: 227-285

RECOVERY OF PIGMENTATION FOLLOWING SELECTIVE PHOTOTHERMOLYSIS IN ADULT ZEBRAFISH SKIN: CLINICAL IMPLICATIONS FOR LASER TONING TREATMENT OF MELASMA

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In recent years, laser toning has gained popularity for the treatment of melasma, and tyrosinase inhibitors are conventionally used to prevent recurrence after this treatment. The effectiveness of this treatment modality, however, is still questionable, and additional *in vivo* studies are needed to validate the method. In this study, we used adult zebrafish skin as an adult melanocyte regenerative system and examined the simulated human skin response to laser toning. Melanosomes regenerated after selective photothermolysis, and these organelles showed a bi-directional translocation pattern in accordance with the changes of intact melanosome patterns. Furthermore, a tyrosinase inhibitor, 1-phenyl-2-thiourea (PTU), completely blocked melanosome regeneration after laser irradiation, but this inhibitor failed to prevent melanosome regeneration after the medication was discontinued. Finally, arbutin and kojic acid, the commercially available tyrosinase inhibitors, slowed down but did not completely block melanosome regeneration. Based on these findings, we describe the limitations of laser toning treatment of melasma and the combined use of tyrosinase inhibitors. We suggest that melanosomes in adult zebrafish skin can be utilized for studying melanosome regeneration response to laser irradiation and for developing a system to assess the comparative efficacy of melanogenic regulatory compounds.

© Clinical and Experimental Dermatology, 2013; 38: 167-171

HISTOPATHOLOGICAL STUDY OF THE TREATMENT OF MELASMA LESIONS USING A LOW-FLUENCEQ-SWITCHED 1064-nm NEODYMIUM:YTTRIUM–ALUMINIUM–GARNET LASER

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The low-fluence 1064-nm Q-switched neodymium:yttrium–aluminium–garnet (QSNY) laser is a widely used treatment for melasma in East Asia, although its mechanism of action is unclear. The aim of this study was to elucidate the mechanism of action of the QSNY laser. We performed a histopathological study on eight Korean women who had considerable improvement in their melasma lesions after a series of low-fluence QSNY laser treatments. Compared with nonlesional skin, samples from melasma lesions showed increased reactivity in melanin (Fontana–Masson staining) and in melanogenesis-associated proteins, including α-melanocyte-stimulating hormone, tyrosinase, tyrosinase-related protein (TRP)-1, TRP–2, nerve growth factor and stem cell factor. After laser treatment, the melasma skin showed a decrease in the number of melanosomes and reduced expression of melanogenesis-associated proteins. Expression levels of the melanogenic proteins were reduced after laser treatment, although the number of melanocytes was unchanged even in hypopigmented areas. Based on these results, we believe that repeated application of low thermal energy via QSNY laser may result in damage to melanocytes and long-lasting hypopigmentation.

© Journal of Cosmetic and Laser Therapy [Epub ahead of print; March 2013]

EXOGENOUS OCHRONOSIS – SUCCESSFUL OUTCOME AFTER TREATMENT WITH Q-SWITCHED Nd:YAG LASER

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Background: Exogenous ochronosis (EO), a disfiguring cutaneous complication of topical hydroquinone use, is difficult to treat. There are few reports of successful outcomes following treatment with different modalities.

Objective: We assessed the results of treatment of EO with the Q-switched Nd:YAG laser.

Material and methods: Patients with histologically-confirmed EO were treated with the Q-switched Nd:YAG laser.

Results and conclusion: Q-switched Nd:YAG laser treatment appears to be effective in reducing the dyschromia of EO.

© Dermatologic Surgery, 2013; 39: 435-442.

ORAL TRANEXAMIC ACID ENHANCES THE EFFICACY OF LOW-FLUENCE 1064-nm QUALITY-SWITCHED NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER TREATMENT FOR MELASMA IN KOREANS: A RANDOMIZED, PROSPECTIVE TRIAL WITH Q-SWITCHED Nd:YAG LASER

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Background: Tranexamic acid (TA) has recently gained in popularity in the treatment of pigmentary disorders.

Objectives: To evaluate the clinical efficacy and safety of oral TA combined with low-fluence 1064-nm quality-switched neodymium-doped yttrium aluminum garnet (QSNY) laser for the treatment of melasma.

Materials and Methods: Forty-eight patients with melasma were enrolled in the study and subsequently divided into two groups: a combination group and a laser treatment group. All patients were treated with two sessions of low-fluence QSNY laser, and patients in the combination group took 8 weeks of oral TA. Two blinded dermatologists evaluated patients using the Modified Melasma Area and Severity Index (mMASI) and a clinical improvement scale.

Results: Mean mMASI score 4 weeks after the second treatment decreased significantly in both groups from base line. Based on overall clinical improvement, a greater number of patients scored as grade 3 and more in the combination group; no patients were scored as grade 4 in the laser-alone group.

Conclusions: Oral TA may prove a safe and efficient treatment option for melasma in combination with low-fluence QSNY laser therapy.

© International Journal of Dermatology [Epub ahead of print; July 2013]

TREATMENT OF NEVUS OF OTA USING LOW FLUENCE Q-SWITCHED Nd:YAG LASER

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Background: Nevus of Ota, caused by dermal melanocytosis, is cosmetically troublesome in Asian patients. The destruction of dermal melanocytosis using Q-switched laser systems carries a high risk of postinflammatory hyperpigmentation/hypopigmentation.

Methods: To determine the usefulness, safety, and adverse problems of low fluence 1064 nm Q-switched Nd:YAG laser in the treatment of nevus of Ota, 19 Korean patients (five male and 14 female; Fitzpatrick skin type IV) who were clinically diagnosed as having nevus of Ota were enrolled in the present study. Low fluence laser treatments were performed with a collimated Q-switched Nd:YAG laser at intervals of two weeks. The fluence of laser treatments was set at 2.5 J/cm^2 and adjusted based on patient response to the previous treatment session and sensitivity to pain. Treatment was applied until the lesions showed mild erythema.

Results: The mean number of total treatment sessions was 17.1 (range 6–32). Among the 19 patients, 18 reached near total improvement, while one patient failed to reach near total improvement after 11 treatment sessions. The mean fluence of treatment was 2.5 J/cm^2 (range 2.0–5.0 J/cm^2). Five patients complained of delayed eyelid response. Post-therapy hyperpigmentation was observed in one patient.

Conclusion: Low fluence 1064 nm Q-switched Nd:YAG laser is an effective modality for the treatment of nevus of Ota with a low incidence of side effects. It is an easy to perform treatment with low downtime.

© Journal of Dermatological Treatment, 2009; 20: 223-228

EFFECTS OF VARIOUS PARAMETERS OF THE 1064 nm Nd:YAG LASER FOR THE TREATMENT OF ENLARGED FACIAL PORES

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Background: A variety of treatment modalities have been used to reduce the size of enlarged facial pores without obvious success. Objectives: To assess and compare the effects of various parameters of a 1064 nm Nd:YAG laser in the treatment of enlarged facial pores.

Methods: This was a prospective intra-individual left-right comparative study. A total of 40 individuals with enlarged facial pores were recruited for this study. Ten individuals were respectively treated on one half of the face with a quasi long-pulsed 1064 nm Nd:YAG laser (method 1), a Q-switched 1064 nm Nd:YAG laser (method 2), both quasi long-pulsed and Q-switched 1064 nm Nd:YAG lasers without carbon-suspended lotion (method 3), and both quasi long-pulsed and Q-switched 1064 nm Nd:YAG lasers with carbon-suspended lotion (method 4). The other half of the face was left untreated as a control. Five laser sessions were performed with a 3-week interval. The pore sizes were measured using an image analysis program and the sebum level was measured with a Sebumeter® before and after the treatments.

Results: The pore size and sebum level decreased in all four methods on the treated side compared to the control ($p<0.05$).

Conclusions: Treatment with a 1064 nm Nd:YAG laser is an effective method for reducing pore size and sebum level.

© Laser Therapy, 2011; 20: 175-180

TREATMENT OF ENLARGED PORES WITH THE QUASI LONG-PULSED VERSUS Q-SWITCHED 1064 nm Nd:YAG LASERS: A SPLIT-FACE, COMPARATIVE, CONTROLLED STUDY

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Background and Aims: A variety of treatment modalities have been used to reduce the size of enlarged pores. The 1064 nm Nd:YAG laser, in addition to its role in removal of tattoos and age-related dyschromia, depilation and skin rejuvenation, may also play a role in reducing the size of enlarged pores. The present split-face controlled study assessed and compared the efficacy between the quasi long-pulsed (micro-pulsed) and the Q-switched modes of the Nd:YAG laser in the treatment of enlarged pores.

Subjects and Methods: Twenty subjects with enlarged pores were recruited for the micropulsed vs Q-switched study, all treated with the same 1064 nm Nd:YAG laser system. Ten subjects were treated with the 300 μs micropulsed mode and the other ten subjects were treated with the 5 ns Q-switched mode. All subjects were treated on the right half of the face, the left half serving as an untreated control. Five laser sessions were performed. The pore sizes were measured using an image analysis program and the sebum level was measured with a Sebumeter® before and after the treatments.

Results: The pore size and sebum level significantly decreased with treatment on the treated side (right cheek and right half of nose) in both the micropulsed and Q-switched modes compared to the control side. ($p<0.05$), but without any statistically significant difference between the modes.

Conclusions: The micropulsed and Q-switched Nd:YAG laser treatments reduced pore size and sebum levels with more or less equal efficacy and with no adverse side effects.

© Laser Therapy, 2011; 20: 181-188

ENLARGED PORES TREATED WITH A COMBINATION OF Q-SWITCHED AND MICROPULSED 1064 nm Nd:YAG LASER WITH AND WITHOUT TOPICAL CARBON SUSPENSION: A SIMULTANEOUS SPLIT-FACE TRIAL

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Background and aims: Enlarged facial pores remain one of the major cosmetic concerns among Asian females. This study attempted to assess and compare the efficacy of a combination of the Q-switched and quasi long-pulsed (micropulsed) Nd:YAG laser to reduce the size of the enlarged pores with and without an exogenous photoenhancer.

Methods: In twenty five female subjects, mean age 34.04 yr and skin type II-IV, a carbon lotion as a photoenhancer was applied on one side of the face (Method 1) and the other side was used as the control (Method 2). The entire face was then treated with a single pass of the 1064 nm Nd:YAG laser in the micropulsed mode, pulse fluence and width of 2.3 J/cm² and 300 µs, respectively. Multiple passes were then delivered in the Q-switched mode (2.5 J/cm² and 5 ns).

Results: Three weeks after the final treatment, 75% of the subjects showed improvement with method 1 whereas 67% showed improvement with method 2. No adverse side effects were reported with either method.

Conclusions: Although histological confirmation was not performed, we were able to prove both subjectively and objectively that the use of the combination of the micropulsed and Q-switched modes of the Nd:YAG laser was useful in reducing pore size, and that the photoenhancer improved the efficacy.

© Journal of Dermatological Treatment [Epub ahead of print; September 2012]

HISTOMETRIC CHANGES AND EPIDERMAL FGF9 EXPRESSION IN CARBON PHOTOENHANCER-ASSISTED Nd:YAG LASER TREATMENT

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Fibroblast growth factor (FGF)-9 plays an important role in wound healing. However, the effects of non-ablative laser treatment on the expression of FGF9 have not been fully investigated. Non-ablative 1,064-nm quasi-long pulsed and Q-switched Nd:YAG laser treatments were delivered to hairless mice with and without a carbon photoenhancer. For histological and immunohistochemical analyses, sections were stained with hematoxylin and eosin as well as FGF9 antibody. Significantly, increased epidermal and dermal thickness was noted in mice treated with carbon photoenhancer-assisted quasi-long pulsed or Q-switched laser treatments compared to those treated without a carbon photoenhancer. Expression of FGF9 was observed in both the epidermis and dermis in all groups of mice during the healing process. Earlier and more pronounced expression of FGF9 was detected in mice treated with carbon photoenhancer-assisted quasi-long pulsed laser therapy. In addition, two peaks of pronounced FGF9 expression were observed, especially in mice that underwent carbon photoenhancer-assisted 1,064-nm quasi-long pulsed Nd:YAG laser treatment. A carbon photoenhancer seems to enhance the effect of quasi-long pulsed and Q-switched Nd:YAG laser treatment. In addition, expression of FGF9 may play an important role in the healing process after laser treatments and could contribute to histometric changes.

© Journal of the American Academy of Dermatology, 2012; 66: 626-633

PROSPECTIVE RANDOMIZED CONTROLLED CLINICAL AND HISTOPATHOLOGICAL STUDY OF ACNE VULGARIS TREATED WITH DUAL MODE OF QUASI-LONG PULSE AND Q-SWITCHED 1064-nm Nd:YAG LASER ASSISTED WITH A TOPICALLY APPLIED CARBON SUSPENSION

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Background: Acne treatments using laser and light devices have been reported to have varying degrees of efficacy. However, there has been no study of treatment of acne using a dual mode (quasi-long pulse and Q-switched mode) 1064-nm Nd:YAG laser assisted with a topically applied carbon suspension.

Objective: To evaluate the clinical efficacy, safety, and histological changes of new laser treatment method for acne vulgaris.

Methods: Twenty-two patients received 3 sessions of quasi-long pulse and Q-switched Nd:YAG laser treatment assisted with a topically applied carbon suspension at 2-week intervals in a randomized split face manner.

Results: At the final visit, the inflammatory acne lesions were reduced on the laser-treated side by 58.6% ($P<.001$), but increased on the untreated side by 5%. The noninflammatory acne lesions were reduced on the laser-treated side by 52.4% ($P<.001$). Sebum output reduction, inflammatory cell and cytokine reductions, a decrease of the thickness of a perifollicular stratum corneum and a full epithelium, and skin rejuvenation effect were found. The histopathologic examination of the acne lesions showed decreased inflammation and immunostaining intensity for interleukin 8, matrix metalloproteinase-9, toll-like receptor-2, and nuclear factor kappa B, and tumor necrosis factor alpha was reduced significantly. No severe adverse reactions were reported. All patients reported mild transient erythema that disappeared in a few hours.

Limitations: The number of subjects studied was small.

Conclusions: This laser treatment was rapid and effective for treating not only the inflammatory but also the noninflammatory acne lesions when compared with the control side. The histopathologic findings correlated well with the clinical acne grade and treatment response. This novel laser treatment appears to be safe and effective for acne treatment.

© Photomedicine and Laser Surgery, 2011; 29: 131-135

CARBON ASSISTED Q-SWITCHED Nd:YAG LASER TREATMENT WITH TWO DIFFERENT SETS OF PULSE WIDTH PARAMETERS OFFERS A USEFUL TREATMENT MODALITY FOR SEVERE INFLAMMATORY ACNE: A CASE REPORT

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Background and Aims: The treatment of inflammatory and noninflammatory acne still presents problems to patients and dermatologists. A new technique using two different sets of 1064nm Nd:YAG laser parameters has been developed in combination with a topical carbon lotion. A preliminary test of the efficacy of this new treatment technique is reported.

Subject and Methods: A 14-year-old girl presented with moderate to severe pustular and cystic acne over the bilateral cheeks and chin. Following topical local anesthesia, a topical carbon lotion was applied to the face, and a Q-switched Nd:YAG laser was used first in a quasi-long pulsed mode (a 300 μs pulse width at 1.1-1.5 J/cm²) followed immediately by a Q-switched mode (5 ns pulse width, 1.5-2.0 J/cm²) using a 7 mm handpiece for both modes. Six treatments were given, 2 weeks apart.

Results: The procedure was well-tolerated. By the fourth treatment significant improvement was observed, and by the sixth treatment, better than 90% clearance of inflammatory lesions was achieved. At the 8-week follow-up after the last treatment, long-lasting improvements in the patient's acne were noted. Improvement was also noted in closed comedones and in the general skin condition, especially pores, sebum reduction, and the red spots seen after inflammatory acne. The patient was satisfied with the result.

Conclusions: This new, minimally invasive technique as a stand-alone treatment gave very good clear ance of inflammatory acne with minimal patient down time. Marked reduction in active acne was observed during treatments and at the 2-month followup visit. Further improvement could probably be achieved with other adjunctive therapeutic modalities.

© Journal of the European Academy of Dermatology and Venereology, 2010; 24: 1070-1074

EFFICACY AND SAFETY OF 1064-nm Q-SWITCHED Nd:YAG LASER WITH LOW FLUENCE FOR KELOIDS AND HYPERTROPHIC SCARS

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Background: Several treatment modalities using laser devices have been used for the treatment of keloids and hypertrophic scars with various therapeutic outcomes.

Objective: The purpose of this study was to describe the efficacy and safety of a 1064-nm Q-switched (QS) Nd:YAG laser with low fluence on keloids and hypertrophic scars.

Methods: Keloids and hypertrophic scars located at 21 anatomic sites in 12 Korean patients (10 men and 2 women; mean age 23.8 years, range 21-33) were treated using a 1064-nm QS Nd:YAG laser with low fluence at 1-2 week intervals. Treatment settings were 1.8-2.2 J/cm², 7-mm spot size and 5-6 passes with appropriate overlapping.

Results: Follow-up data collected 3 months after the final treatment revealed decreases in the mean score for the following lesion characteristics: pigmentation from 1.8 to 1.2; vascularity from 1.4 to 1.0; pliability from 3.0 to 2.0 and height from 2.3 to 1.8. The modified Vancouver General Hospital Burn Scar Assessment score decreased from 8.6 to 5.9 ($P < 0.0001$). Observed side-effects were a mild prickling sensation during treatment, and mild post-treatment erythema, both of which resolved within a few hours.

Conclusions: Our results demonstrate that the QS Nd:YAG laser with low fluence may be used for the treatment of keloids and hypertrophic scars.

© International Journal of Dermatology, 2011; 50: 751-753

SUCCESSFUL TREATMENT OF ARGYRIA USING A LOW-FLUENCE Q-SWITCHED 1064-nm Nd:YAG LASER

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Background: Argyria is a rare skin disease caused by cutaneous deposits of silver granules as a result of exposure to silver substrates or ingestion of silver salt. This pigmentation change causes cosmetic problems, and there was previously no recognized effective treatments for argyria.

Objective: To evaluate the treatment effect of a low-fluence Q-switched 1064-nm Nd:YAG laser on argyria.

Subjects and Methods: Case report of a 49-year-old with a history of ingestion of a colloidal silver solution daily for approximately one year as a traditional remedy.

Results: After seven sessions of treatment, the patient's skin color returned to normal.

Conclusion: A low-fluence Q-switched 1064-nm Nd:YAG laser provided safe and effective treatment for the skin discoloration associated with argyria.

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EFFICACY OF THE FRACTIONAL PHOTOTHERMOLYSIS SYSTEM WITH DYNAMIC OPERATING MODE ON ACNE SCARS AND ENLARGED FACIAL PORES

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Background: Current treatments for acne scars and enlarged facial pores have shown limited efficacy.

Objective: To evaluate the efficacy and safety of the fractional photothermolysis system (FPS) with dynamic operating mode on acne scars and enlarged pores.

Materials and Methods: Twelve patients with mild to moderate atrophic acne scars and enlarged pores were included in this study. Three sessions of FPS treatment were performed for acne scars and facial pores monthly. Two blinded dermatologists who compared before and after photos based on a quartile grading scale conducted objective clinical assessments of acne scar- and facial pore-treated areas. We took a biopsy immediately after one treatment with the laser from one of the authors to assess the histologic effects of the laser on facial pores.

Results: Follow-up results at 4 months after the last treatment revealed that, of the 12 patients, for acne scars, five demonstrated clinical improvements of 51% to 75% and three demonstrated improvements of 76% to 100%, and for facial pores, five demonstrated moderate clinical improvements of 26% to 50% and three demonstrated improvements of 76% to 100%. Side effects, including pain, post-treatment erythema, and edema, were resolved within 1 week.

Conclusion: We suggest that the FPS may provide a new treatment algorithm in some cases with acne scars and enlarged pores. Considering the lack of placebo-controlled, split-face design of our study, optimized, prospective studies should be conducted to fully assess the efficacy of FPS with dynamic operating mode.

© Dermatologic Surgery, 2009; 35: 1199-1205

PREVENTION OF THYROIDECTOMY SCAR USING A NEW 1,550-nm FRACTIONAL ERBIUM-GLASS LASER

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Background: Surgical scars are a common cosmetic problem that occurs in various surgical fields including dermatology. Diverse trials have been made to prevent this annoying scar formation. Recently, 585- and 595-nm pulsed dye laser irradiation presented satisfactory cosmetic outcome for the treatment of surgical scars. Other fractionated lasers or light devices were also applied for scar treatment.

Objective: To determine the effectiveness and safety of a newly developed 1,550-nm fractional erbium-glass laser in the prevention of scar formation after total thyroidectomy.

Materials and Methods: Twenty-seven ethnic South Korean patients with linear surgical suture lines after total thyroidectomy operation were treated with a 1,550-nm fractional erbium-glass laser. The same surgeon performed all of the operations using the same surgical techniques. Each patient was treated four times at 1-month intervals using the same parameters (5-10 mm spot size, 10 mJ, 1,500 spot/cm^2, static mode). Initiation of the first irradiation was made approximately 2 to 3 weeks after the thyroidectomy. The scar prevention effects were evaluated each month for 6 months after thyroidectomy. Two kinds of assessment methods were applied in this evaluation. First, the Vancouver Scar Scale (VSS) was used. Second, three independent physicians gave a global assessment valuation to the final cosmetic results: poor (1), fair (2), good (3), or excellent (4). These results were compared with the surgical scars of a control group (patients who denied laser treatments and had no other treatments during the 6 months after total thyroidectomy by the same surgeon).

Results: The average VSS score was lower in the laser treatment group. The global assessment also presented better cosmetic outcomes in the treatment group than in the controls.

Conclusions: A new 1,550-nm fractional erbium-glass laser may efficiently repress the formation and hypertrophy of thyroidectomy scars on the neck, and it can be safely applied in relatively dark Asian skin without noticeable adverse effects.

© Lasers in Surgery and Medicine, 2009; 41: 545-549

COMPARISON OF A 1,550 nm ERBIUM:GLASS FRACTIONAL LASER AND A CHEMICAL RECONSTRUCTION OF SKIN SCARS (CROSS) METHOD IN THE TREATMENT OF ACNE SCARS: A SIMULTANEOUS SPLIT-FACE TRIAL

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Background and Objective: Acne scarring is a common complication of acne but no effective single treatment modality has been developed. The study was designed to compare the efficacy of a 1,550 nm Er:Glass fractional laser and chemical reconstruction of skin scar (CROSS) method in the treatment of acne scars.

Study Design/Materials and Methods: A split-face trial was conducted in 20 patients (10 rolling, 10 ice-pick types) with acne scars. One side was treated with the 1,550 nm Er:Glass fractional laser three times with a 6-week interval, and the other side was treated with the CROSS method two times every 12 weeks.

Results: Significant improvement was observed in both sides of the face. In the rolling type scar, the objective and subjective improvement rates were significantly higher in the sides treated with laser than the CROSS method. However, in the icepick type, there were no statistically significant differences between the two treatment sides. In the laser sides, grades of pain were significantly higher than in those treated with the CROSS method. However, downtimes and lasting days of erythema were significantly longer in the sides treated with the CROSS method.

Conclusions: The 1,550 nm Er:Glass fractional laser and the CROSS method were both well-tolerated and effective treatment options for acne scars. However, there was a relatively small difference between the two treatment modalities. Therefore, dermatologists should consider the acne scar type to select the treatment options.

© Journal of Cosmetic and Laser Therapy, 2009; 11: 212-215

ATROPHIC ACNE SCAR TREATMENT USING TRIPLE COMBINATION THERAPY: DOT PEELING, SUBCISION AND FRACTIONAL LASER

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Background and Objective: Atrophic scars are a common complication of acne. Many modalities are proposed but each does not yield satisfactory clinical outcomes. Thus, a new combination therapy is suggested that incorporates (i) dot peeling, the focal application and tattooing of higher trichloroacetic acid concentrations; (ii) subcision, the process by which there is separation of the acne scar from the underlying skin; and (iii) fractional laser irradiation. In this pilot study, the efficacy and safety of this method was investigated for the treatment of acne scars.

Subjects and Methods: Ten patients received this therapy for a year. Dot peeling and subcision were performed twice, 2-3 months apart and fractional laser irradiation was performed every 3-4 weeks. Outcomes were assessed using scar severity scores and patients' subjective ratings.

Results: Acne scarring improved in all of the patients completing this study. Acne scar severity scores decreased by a mean of 55.3%. Eighty percent of the patients felt significant or marked improvement. There were no significant complications at the treatment sites.

Conclusions: It would appear that triple combination therapy is a safe and very effective combination treatment modality for a variety of atrophic acne scars.

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COMPARISON OF THE EFFECTIVENESS OF NONABLATIVE FRACTIONAL LASER VERSUS ABLATIVE FRACTIONAL LASER IN THYROIDECTOMY SCAR PREVENTION: A PILOT STUDY

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Background and Aims: Open thyroidectomy in the anterior neck can result in postoperative scarring and the cosmetic outcome of the scar after thyroidectomy is of particular importance to women. Recently, focus has been made on 'laser scar prevention'. The purpose of this split-scar study was to examine and compare laser intervention in the wound healing process in thyroidectomy scars with two different lasers.

Subjects and Methods: Seven patients (5 female, 2 male, Fitzpatrick skin type III-IV) with fresh thyroidectomy scars 2-3 weeks after surgery were enrolled in the study. The average age was 45.1 years (range 28-64 years). Scars were divided into 2 equal portions. Patients were randomized for treatment of one-half of the scar with a non-ablative 1550 nm fractional Er:glass laser (5-10 mm tip, 10 mJ pulse, 2 passes) and the other half with an ablative 2940 nm fractional Er:YAG laser (50 µm depth, 11% coverage, spot size 1). Three sessions were given at 4-week intervals with a post-treatment follow-up of 6 months. Clinical photography was taken at baseline and at the 6-month assessment. Scars were comparatively evaluated for widening, visibility of the incision line, height (scar elevation or depression) erythema and pigmentation.

Results: All patients completed the study, and there were no adverse events. The portion treated with the fractional Er:YAG laser scored significantly better in the clinical assessment (6 out of 7 patients) than that treated with the fractional Er:glass system, and 5 out of 7 patients also felt that the Er:YAG treated side was superior. In addition, the clinicians felt that the visibility of the excision line was significantly lower in the ablative fractional laser treated side.

Conclusions: Although the results of the present study suggested that the fractional ablative Er:YAG laser was superior in scar prevention efficacy to the fractional nonablative Er:glass laser, the patient population was very small. Further controlled studies with larger patient populations are warranted to confirm the superiority between ablative and non-ablative fractional lasers, optimize laser parameters for scar prevention and to understand the cellular mechanisms that underlie laser-induced wound healing.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Journal of the European Academy of Dermatology and Venereology, 2011; 25: 811-818

TREATMENT OF PERIORBITAL WRINKLES WITH 1550- AND 1565-nm Er:GLASS FRACTIONAL PHOTOTHERMOLYSIS LASERS: A SIMULTANEOUS SPLIT-FACE TRIAL

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Objective: This study aimed to compare the clinical efficacies of 1550- and 1565-nm Er:glass lasers in the treatment of periorbital wrinkles and to evaluate histological changes after treatment.

Methods: Twenty patients received five treatments each at 3-week intervals. The right periorbital area was exposed to the 1550-nm Er:glass laser and the left periorbital area was exposed to the 1565-nm Er:glass laser. Clinical improvement was evaluated by two blinded physicians who assessed comparative photographs using a four-point scale at baseline and 3 months after the final treatments. Skin biopsies were performed in five volunteers before treatment and at 3 months after the final treatment.

Results: The mean improvement scores 3 months after treatment with the 1550- and 1565-nm Er:glass lasers were 2.25 ± 0.62 and 2.28 ± 0.59 respectively. Histological examination revealed increased epidermal thickening and decreased solar elastosis 3 months after the final laser treatments.

Conclusions: Both 1550- and 1565-nm Er:glass lasers are safe and effective modalities in the treatment of periorbital wrinkles with no significant differences between the two lasers.

© Dermatologic Surgery, 2012; 38: 623-630

PLATELET-RICH PLASMA COMBINED WITH FRACTIONAL LASER THERAPY FOR SKIN REJUVENATION

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Background and Objectives: Platelet-rich plasma (PRP) is an autologous concentration of human platelets contained in a small volume of plasma and has recently been shown to accelerate wound healing and rejuvenate aging skin. The current study was conducted to determine whether there are additional effects of PRP combined with fractional laser therapy.

Materials and Methods: Twenty-two Korean women underwent three sessions of fractional laser; 11 were treated with topical application of PRP combined with fractional laser. Evaluations were done at baseline and 1 month after the final treatment. The outcome assessments included subjective satisfaction scale; blinded clinical assessment; and the biophysical parameters of roughness, elasticity, skin hydration, and the erythema and melanin index. Biopsies were analyzed using hematoxylin and eosin, Masson-trichrome, and immunohistochemistry for matrix metalloproteinase-1.

Results: PRP combined with fractional laser increased subject satisfaction and skin elasticity and decreased the erythema index. PRP increased the length of the dermoepidermal junction, the amount of collagen, and the number of fibroblasts.

Conclusions: PRP with fractional laser treatment is a good combination therapy for skin rejuvenation. Keratinocyte and fibroblast proliferation and collagen production can explain the capacity of PRP to increase dermal elasticity.

© Korean Journal of Dermatology, 2010; 48: 657-664 (in Korean, abstract in English)

1,550-nm NON-ABLATIVE FRACTIONAL ERBIUM-GLASS LASER IN THE TREATMENT OF FACIAL INFLAMMATORY ACNE: A PRELIMINARY STUDY

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Background: Topical and systemic drugs have been successfully used in the treatment of acne. However, many people are concerned about the side effects of these medicines, especially the childbearing women. Recent reports demonstrated that sequential treatment with laser- and light-based devices led to a clinical improvement in acne. Recently, we witnessed and experienced an example of improvement of inflammatory acne lesions during the treatment of acne scars using a 1,550-nm non-ablative fractional erbium-glass laser.

Objective: This study was designed to investigate the efficacy and safety of 1,550-nm non-ablative fractional erbium-glass laser in the treatment of facial inflammatory acne vulgaris.

Methods: Eleven patients with facial inflammatory acne vulgaris were recruited. These patients received three treatment sessions at a 3-week interval. Inflammatory lesions were counted before and after treatment. The sebum production was quantified using a Sebumeter©. We graded the patients' self-assessment and the investigator's global assessment using a five-point scale also used by the dermatologist. We additionally investigated the histological changes after the treatment sessions, and the adverse effects during the study.

Results: Treatment with 1,550-nm non-ablative fractional erbium-glass laser was well tolerated, resulting in the reduction of inflammatory lesions by 61% ($p < 0.05$). However, the reduction in sebum production from the baseline was not statistically significant. Histopathologic examination of the inflammatory lesions showed a marked decrease in the dermal inflammatory cell infiltration around the perivascular and periappendageal area and the sebaceous glands became smaller after laser treatments. Side-effects were minimal, and were resolved within a few days.

Conclusions: 1,550-nm non-ablative fractional erbium-glass laser was safe and effective for the treatment of facial inflammatory acne lesions.

© International Journal of Dermatology, 2010; 49: 845-847 (Letter to the Editor)

TREATMENT OF ALOPECIA AREATA WITH FRACTIONAL PHOTOTHERMOLYSIS LASER

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Background and Aims: Many studies have documented an abnormal cell-mediated immune reaction in alopecia areata (AA) resulting in premature catagen and telogen phases. Even if cells re-enter anagen, the abnormal imune reaction truncates the anagen phase giving miniaturized hair follicles. The treatment of AA depends on the severity and extent of the disease and the more aggressive treatments frequently show side effects and a relatively high relapse rate. Recently, laser treatment with different wavelengths has been used to manage this problem, including, even more recently, fractional photothermolysis. We report herein on the results of a preliminary subject with AA treated using a fractional laser.

Subject and Methods: A 35-year-old male presented to our hospital with a 2-year history of multiple large lesions of alopecia areata on the frontal region of the scalp. Two years of treatment with many different modalities failed to induce hair regrowth. He was treated weekly with a fractional laser (10-15 mJ/pulse, density 300 spots/cm²), for 24 weeks. Two passes per session were performed.

Results: The treatment was well tolerated with no reported side effects. Hair growth was already observed after 1 month. After 3 months, lesions were covered with 30 to 40% of mostly pigmented terminal hair. After 6 months of fractional laser therapy, there was complete regrowth in all lesions. No relapse was observed during the follow-up period of 6 months. For this reason, the patient was satisfied with the treatment outcome.

Conclusions: The mechanism of the fractional laser in inducing hair regrowth in AA lesions is thought to be the induction of T-cell apoptosis and enhancement of hair growth, with de novo hair follicular neogenesis shown to originate from both follicular and from non-hair follicle stem cells. Factional laser could also also induce minor trauma and the wound healing process which might facilitate hair growth. Until now, we have no idea which cytokines are key inducers of these interesting phenomena. We hope this puzzle will be solved in the near future by physicians and scientists who major in hair biology.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Journal of the European Academy of Dermatology and Venereology, 2011; 25: 1450-1454

THE EFFECT OF A 1550 nm FRACTIONAL ERBIUM-GLASS LASER IN FEMALE PATTERN HAIR LOSS

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Background: Female pattern hair loss (FPHL) is the most common cause of hair loss in women, and its prevalence increases with advancing age. Affected women may experience psychological distress and social withdrawal. A variety of laser and light sources have been tried for treatment of hair loss, and some success has been reported.

Objective: The purpose of this study was to determine the efficacy and safety of a 1550 nm fractional erbium-glass laser in treatment of female pattern hair loss.

Patients and Methods: Twenty eight ethnic South Korean patients with varying degrees of FPHL were enrolled in the study. Patients received ten treatments with a 1550 nm fractional Er:Glass Laser (Mosaic, Lutronic Co., Ltd, Seoul, South Korea) at 2-weeks intervals using the same parameters (5-10 mm tip, 6 mJ pulse energy, 800 spot /cm² density, static mode). Phototrichogram and global photographs were taken at baseline and at the end of laser treatment, and analysed for changes in hair density and hair shaft diameter. Global photographs underwent blinded review by three independent dermatologists using a 7-point scale. Patients also answered questionnaires assessing hair growth throughout the study. All adverse effects were reported during the study.

Results: Twenty seven patients completed a 5-month schedule of laser treatment. One patient was excluded during treatment due to occurrence of alopecia areata. At the initial visit, mean hair density was 100 ± 14 cm², and mean hair thickness was 58 ±12 m. After 5 months of laser treatment, hair density showed a marked increase to 157 ± 28 cm² ($P < 0.001$), and hair thickness also increased to 75 ± 13 m ($P < 0.001$). Global photographs showed improvement in 24 (87.5%) of the 27 patients. Two patients (7.4%) reported mild pruritus after laser treatment; however, these resolved within 2 h.

Conclusions: A 1550 nm fractional erbium-glass laser irradiation may be an effective and safe treatment option for women with female pattern hair loss.

© Dermatologic Surgery, 2011; 37: 41-51

FRACTIONAL PHOTOTHERMOLYSIS LASER TREATMENT OF MALE PATTERN HAIR LOSS

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Background: Various trials have been conducted on the management of male pattern hair loss (MPHL). A variety of laser and light sources have been used for the treatment of MPHL.

Objective: To understand the effects of a 1,550-nm fractional erbium-glass laser on the hair cycle in an alopecia mouse model and to study the clinical effects of the same laser used as treatment for MPHL.

Materials and Methods: Irradiation was applied to the shaved skin of C3H/HeN mice using various energy and density settings and varied irradiation intervals. In a clinical pilot study involving human subjects, 20 participants were treated over five sessions at 2-week intervals. A fractional photothermolysis laser was used at the energy of 5 mJ and a total density of 300 spots/cm².

Results: In the animal study, the hair stimulation effects were dependent upon the energy level, density, and irradiation interval. The anagen conversion of hair and the increase in Wnt 5a, b-catenin signals were observed. In the human pilot study, incremental improvements in hair density and growth rate were observed.

Conclusions: This pilot study showed that a 1,550-nm fractional erbium-glass laser might induce hair growth, but more intensive studies are required to clarify the clinical applications of this treatment.

© Journal of Cosmetic and Laser Therapy, 2013; 15: 74-79

CLINICAL EFFECTS OF NON-ABLATIVE AND ABLATIVE FRACTIONAL LASERS ON VARIOUS HAIR DISORDERS: A CASE SERIES OF 17 PATIENTS

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Background and Objectives: Both ablative and non-ablative fractional lasers have been applied to various uncommon hair disorders. The purpose of this study was to demonstrate the clinical effects of fractional laser therapy on the course of primary follicular and perifollicular pathologies and subsequent hair regrowth.

Materials and Methods: A retrospective review of 17 patients with uncommon hair disorders – including ophiasis, autosomal recessive woolly hair/hypotrichosis, various secondary cicatricial alopecias, pubic hypotrichosis, frontal fibrosing alopecia, and perifolliculitis abscedens et suffodiens – was conducted. All patients had been treated with non-ablative and/or ablative fractional laser therapies.

Results: The mean clinical improvement score in these 17 patients was 2.2, while the mean patient satisfaction score was 2.5. Of the 17 subjects, 12 (70.6%) demonstrated a clinical response to non-ablative and/or ablative fractional laser treatments, including individuals with ophiasis, autosomal recessive woolly hair/hypotrichosis, secondary cicatricial alopecia (scleroderma and pressure-induced alopecia), frontal fibrosing alopecia, and perifolliculitis abscedens et suffodiens. Conversely, patients with long-standing ophiasis, surgical scar-induced secondary cicatricial alopecia, and pubic hypotrichosis did not respond to fractional laser therapy.

Conclusions: Our findings demonstrate that the use of non-ablative and/or ablative fractional lasers promoted hair growth in certain cases of uncommon hair disorders without any remarkable side effects.

© Dermatologic Surgery, 2012; 38: 1744-1746

SILICONE-INDUCED FOREIGN BODY REACTION OF THE FACE SUCCESSFULLY TREATED USING NONABLATIVE 1,550-nm ERBIUM-GLASS AND ABLATIVE 10,600-nm CARBON DIOXIDE FRACTIONAL LASERS

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Background and Aims: The recent increase in the use of fillers for cosmetic purposes has led to a concomitant increase in side effects, including the induction of granulomatous foreign body reactions. Various treatment options, especially systemic corticosteroids, have been tried, including surgical excision, but results have been inconsistent. Although controversial, the CO_2 laser has been reported in effective vaporization of silicone particles. The recent application of fractional nonablative and ablative lasers has attracted interest because of the accelerated wound healing. The present case report assessed the result of both nonablative and ablative laser treatment of silicone-induced granulomas.

Subject and Methods: A 57-year-old Korean female had infraorbital nodules which occurred post-fillers some 4 years previously, and which were histologically diagnosed as foreign body granulomas. Five sessions of combination nonablative fractional 1550 nm Er:Glass laser (FPS) (MOSAIC™, Lutronic, Goyang, South Korea) followed by ablative fractional CO_2 laser (CO_2 FS) (eCO2, Lutronic) were given, preceded by topical anaesthetic cream.

Results: Good clinical improvement was achieved after the 5 treatments with a significant decrease in the size and softening of the lesions. Side effects were minimal and transitory. The patient was very satisfied.

Conclusions: A combination treatment approach using FPS and CO_2 FS together in a patient with silicone-induced foreign body granulomas could be effective by first delivering heat energy, inducing dermal remodeling with FPS, and then evaporating and eliminating the material using CO_2 FS. It is possible that the combination of these approaches offers a synergy giving results not achievable with CO_2 FS on its own. Further study is required to confirm these results.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Lasers in Surgery and Medicine, 2009; 41: 550-554

EFFECTS OF ABLATIVE 10,600-nm CARBON DIOXIDE FRACTIONAL LASER THERAPY ON SUPPURATIVE DISEASES OF THE SKIN: A CASE SERIES OF 12 PATIENTS

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Background and Objectives: We have used an ablative 10,600 nm carbon dioxide fractional laser system (CO_2 FS) for suppurative diseases in order to attempt improvement. The purpose of our study was to demonstrate the effect of CO_2 FS on the course of inflammatory reactions in suppurative diseases.

Materials and Methods: We reviewed a total of 12 Korean patients with suppurative diseases of the skin who had a history of treatment failure with several therapeutic modalities as well as active and multiple inflammatory lesions at the time of CO_2 FS treatment.

Results: Improvement scores considering the number of suppurative lesions revealed that 3 of the 12 patients demonstrated clinical improvement of grade 4. Seven had clinical improvement of grade 3 and two showed improvement of grade 2. Improvement scores in severity were also evaluated; 2 of the 12 patients showed clinical improvement of grade 4. Six demonstrated clinical improvement of grade 3 and four had clinical improvement of grade 2. No patient showed a worsening of suppurative lesions.

Conclusions: Our observations demonstrated that the use of CO_2 FS did not make active suppurative lesions worse, and might have a therapeutic effect on suppurative diseases and their related scars.

© Dermatologic Surgery, 2010; 36: 2022-2029

LOWER-FLUENCE, HIGHER-DENSITY VERSUS HIGHER-FLUENCE, LOWER-DENSITY TREATMENT WITH A 10,600-nm CARBON DIOXIDE FRACTIONAL LASER SYSTEM: A SPLIT-FACE, EVALUATOR-BLINDED STUDY

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Background: Adequate laser settings in the treatment of scars using a carbon dioxide fractional laser system (CO_2 FS) have not been established.

Objective: To compare the efficacy and safety of low-fluence, high-density with high-fluence, low density treatment with CO_2 FS on acne scars and enlarged pores.

Methods: Ten patients with mild to severe atrophic acne scars and enlarged pores were enrolled. Half of each subject face was treated with a single session of CO_2 FS with a fluence of 7 0mJ and a density of 150 spots/cm²; the other half was treated with a fluence of 30 mJ and a density of 250 spots/cm².

Results: Follow-up results 3 months after a single low-fluence, high-density treatment with CO_2 FS showed that four of 10 participants had clinical improvement of 51% to 75% from baseline. After the high-fluence, low-density CO_2 FS treatment, five of 10 patients demonstrated marked clinical improvements of more than 76%.

Conclusions: Higher-energy, lower-density laser settings seem to be more effective than lower energy, higher-density settings for acne scars and enlarged pores, although our results do not constitute a conclusive comparison of the two different modes of CO_2 FS.

© Journal of the European Academy of Dermatology and Venereology, 2012; 26: 125-126

THE COMBINATION OF THE COPPER BROMIDE LASER, A 10,600 nm ABLATIVE CARBON DIOXIDE LASER AND INTRALESIONAL TRIAMCINOLONE FOR THE TREATMENT OF HYPERTROPHIC THYROIDECTOMY SCARS

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Background and Aims: Hypertrophic scars are a common cosmetic problem caused by benign hyperproliferative growths of dermal collagen. Intralesional injections with triamcinolone (TA) have been a standard treatment for keloids and hypertrophic scars. The 10,600 nm ablative carbon dioxide laser (AFL) is an effective treatment option for skin rejuvenation and scarring. The copper bromide laser (578 nm, CBL) improves scar remodeling and re-epithelialization of striae. The purpose of our study was to investigate the efficacy and safety of the combined modalities of CBL, AFL and TA for the treatment of hypertrophic thyroidectomy scars.

Patients and Methods: Thirty patients (4 male, 26 female, ages ranging from 21 to 55 years, Fitzpatrick skin types III or IV) with hypertrophic scarring post thyroidectomy participated in the study. A combination of three different treatment modalities was used: AFL, CBL and intralesional TA solution. Four possible treatment options were set up: AFL, AFL + TA, CBL and CBL + TA. All patients underwent two treatment sessions separated by a 4-week interval. The primary outcomes of interest were improvements in vascularity, thickness, pliability, pigmentation and global assessment. We used a 4-point scoring system: grade 1 (<25% improvement), 2 (26-50% improvement), 3 (51-75% improvement) and 4 (76-100% improvement).

Results: Significant improvements were observed in all categories except in vascularity, for which the CBL appeared superior, which suggested that the CBL could deal with the erythema associated with TA. On the other hand, overall improvement in thickness and pliability was significantly superior in the AFL and AFL + TA groups, but TA is associated with side effects like telangiectasia and residual erythema.

Conclusions: Our results demonstrate that a combination of CBL, AFL and intralesional TA may provide a new treatment option for hypertrophic thyroidectomy scars. AFL on its own had good efficacy, but long-term follow-up and larger patient populations are needed for re-evaluation of scar changes, including the incidence of recurrence.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Dermatologic Surgery 2011; 37: 217-223

EARLY POSTOPERATIVE TREATMENT OF THYROIDECTOMY SCARS USING A FRACTIONAL CARBON DIOXIDE LASER

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Background: Ablative carbon dioxide fractional laser systems (CO_2 FS) have been effectively used to improve the appearance of scarring after surgical procedures, but an optimal treatment time has not been established.

Objective: To evaluate the efficacy and safety of CO_2 FS in early postoperative thyroidectomy scars.

Methods: Twenty-three Korean women with thyroidectomy scars were enrolled in this study. All patients underwent a single session of two passes of a CO_2 FS with a pulse energy setting of 50 mJ and a density of 100 spots/cm² 2 to 3 weeks after surgery.

Results: Mean Vancouver Scar Scale (VSS) scores were statistically significantly lower after laser treatment. Three months after CO_2 FS treatment of thyroidectomy scarring, 12 of 23 participants showed clinical improvement of more than 51% from 2 to 3 weeks after surgery. The mean grade of clinical improvement based on independent clinical assessment was 2.6 ± 0.9.

Conclusion: Early postoperative CO_2 FS treatment of thyroidectomy scars is effective and safe.

© Annals of Dermatology, 2011; 23: 481-489

TREATMENT OF STRIAE DISTENSAE WITH NONABLATIVE FRACTIONAL LASER VERSUS ABLATIVE CO_2 FRACTIONAL LASER: A RANDOMIZED CONTROLLED TRIAL

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Background: Striae distensae are atrophic dermal scars with overlying epidermal atrophy causing significant cosmetic concern. Although a variety of laser and light sources have been used for the treatment of striae distensae, to date no definite old standard treatment modality has been determined.

Objective: To assess and compare the efficacy and safety of nonablative fractional photothermolysis and ablative CO_2 fractional laser resurfacing in the treatment of striae distensae.

Methods: Twenty-four ethnic South Korean patients with varying degrees of atrophic striae alba in the abdomen were enrolled in a randomized blind split study. The patients were treated with 1,550 nm fractional Er:Glass laser and ablative fractional CO_2 laser resurfacing. Each half of the abdominal lesion was randomly selected and treated three times at intervals of 4-weeks using the same parameters. Digital photography was conducted and skin elasticity and the width of the widest striae in each subject were measured at the baseline and 4 weeks after the final treatment. Clinical improvement was assessed by comparing pre- and post-treatment clinical photographs by two blinded physicians and participant satisfaction rates were evaluated. Skin biopsies were taken from three participants. All adverse effects were reported during the study.

Results: Although they do not statistically differ, both treatments with nonablative fractional laser and ablative CO_2 fractional laser showed a significant clinical and histopathologic improvement of striae distensae over pretreatment sites.

Conclusions: These results support the use of nonablative fractional laser and ablative CO_2 fractional laser as effective and safe treatment modalities for striae distensae of Asian skin. However, neither treatment showed any greater clinical improvement than the other treatment.

© Journal of Dermatological Treatment, 2011; 22: 113-121

THE EFFECT OF SUCCINYLATED ATELOCOLLAGEN AND ABLATIVE FRACTIONAL RESURFACING LASER ON STRIAE DISTENSAE

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Background and Aims: Striae distensae are dermal atrophic scars with epidermal thinning and decreased collagen and elastic fiber. There is no old standard treatment modality in the treatment of striae distensae. Collagen is a major extracellular matrix component and is important in wound healing. The ablative CO_2 fractional laser is effective in various cutaneous scars and this study attempted to evaluate the effect of succinylated atelocollagen and ablative CO_2 fractional laser in the treatment of striae distensae.

Subjects and Methods: Participants were divided into two groups and received three laser treatments at a 4-week interval. Clinical improvement was evaluated by participants and two blinded physicians by observing the comparative photographs. Skin biopsies were randomly taken from six participants.

Results: The ablative fractional resurfacing laser was effective in the clinical improvement of striae distensae. Statistically significant differences were partly observed between the collagen and placebo groups. Clinical improvement scored by doctors showed more improvement in the collagen group. However, scoring by participants did not show significant differences between the collagen and placebo groups.

Conclusions: In conclusion, the ablative fractional resurfacing laser is effective in the treatment of striae distensae and succinylated atelocollagen may also be effective for striae distensae treatment. However, to prove the effect of succinylated atelocollagen, further research with a larger group of participants is needed.

© Aesthetic Plastic Surgery, 2011; 35: 1143-1150

MULTIMODAL MANAGEMENT OF ATROPHIC ACNE SCARRING IN THE AGING FACE

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Atrophic facial acne scarring is a widely prevalent condition that can have a negative impact on patients quality of life. The appearance of these scars is often worsened by the normal effects of aging. A number of options are available for the treatment of acne scarring, including chemical peeling, dermabrasion, ablative or nonablative laser resurfacing, dermal fillers, and surgical techniques such as subcision or punch excision. Depending on the type and extent of scarring, a multimodal approach is generally necessary to provide satisfactory results. Resurfacing techniques such as fractionated CO_2 lasers correct surface irregularities, long-lasting dermal fillers address the volume loss resulting from acne, and sub-superficial musculoaponeurotic system (SMAS) face-lift procedures counter the soft tissue laxity and ptosis associated with aging. This article briefly reviews the evolution of individual approaches to treating atrophic acne scarring, followed by case examples illustrating results that can be achieved using a multimodal approach. Representative cases from patients in their 30s, 40s, and 50s are presented. In the author clinical practice, multimodal approaches incorporating fractionated laser, injectable poly-L-lactic acid, and sub-SMAS face-lift procedures have achieved optimal aesthetic outcomes, high patient satisfaction, and durability of aesthetic effect over time.

© Dermatology, 2011; 223: 321-324

FRACTIONAL TRANSEPIDERMAL DELIVERY: A HISTOLOGICAL ANALYSIS

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Background: In autologous cell therapy, e.g. in melanocyte transplantation for vitiligo, a minimally invasive mode of transepidermal delivery of the isolated cells is of crucial importance to reduce potential side effects such as infections and scarring as well as to minimize the duration of sick leave.

Objectives: To compare the characteristics of the microscopic treatment zones induced by ablative fractional CO_2 laser and by microneedle treatment in ex *vivo* human breast skin.

Results: Ablative fractional CO_2 laser treatment resulted in superficial, mainly epidermal defects reaching at most the upper papillary dermis (0.1-0.3 mm), covered by a thin eschar and coated by a small zone of collagen denaturation. Tissue injury characteristics depended on spot size as well as the energy delivered. Microneedle treatment led to thin vertical skin fissures, reaching the mid-dermis (up to 0.5 mm) and injuring dermal blood vessels, but without surrounding tissue necrosis.

Conclusions: Both technologies are able to create small epidermal defects which allow to deliver isolated cells such as melanocytes to an epidermodermal site, with microneedle treatment having the advantage of lacking devitalized tissue and eventually enabling vascular access for the transplanted cells.

© Journal of Cosmetic and Laser Therapy, 2012; 14: 87-88 (Letter to the Editor)

TARGETED LASER RECONSTRUCTION OF SKIN SCARS USING 10,600 nm CARBON DIOXIDE FRACTIONAL LASER

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Background and Aims: Atrophic scars, especially acne scars, have been treated with several modalities, including surgical procedures, resurfacing procedures and injection of dermal fillers or autologous fat tissues. The chemical reconstruction of skin scars (CROSS) method uses a sharpened wooden applicator or syringes to deliver trichloroacetic acid in higher concentration deeply into the atrophic scars. We briefly introduce herein our simple method of a modified CROSS technique, termed targeted laser reconstruction of skin scars, using a10,600 nm carbon dioxide fractional laser system (CO_2 FS) with higher pulse energy for atrophic scars.

Patients and Methods: All patients were treated with three to five sessions of CO_2 FS, in which only the atrophic scar tissues are targeted, unlike full-face resurfacing. Following topical local anaesthesia, high-energy, low-density fractional CO_2 laser energy was applied (100 mJ pulse energy, 100 spots/cm² giving coverage of 8.6%, maximum ablation depth of around 1,236.3 m). A moisturizer was applied several times daily for a few days after each treatment session to promote wound healing and prevent dryness, together with a UVA/B sunscreen.

Results: Post-therapy crusting spontaneously improved in 5 days, and pronounced posttherapy erythema usually lasted less than 1 week. Rather than treating the entire face, lesions could be conveniently treated with CO_2 FS by targeted laser reconstruction of skin scars method, which shortens procedure time, post-treatment bleeding, oozing and recovery time. Patients expressed high satisfaction with the results.

Conclusions: Optimized, prospective studies should be conducted in the future to confirm the effectiveness of our method, however based on our results we believe that the targeted laser reconstruction of skin scars using high-energy, low-density CO_2 FS can be easily and widely used for various types of atrophic scar.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Journal of Lasers in Medical Sciences, 2012; 3: 56-60

EVALUATION OF FRACTIONAL CO_2 LASER EFFICACY IN ACNE SCAR

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Introduction: Acne scars form after severe episodes of active acne in the teen and early adult years. Several treatment options have been used for depressed acne scars such as punch grafting, punch excision, carbon dioxide (CO_2) laser and so on, but results have been inconsistent. More recent studies have shown that laser skin resurfacing, such as with the ablative fractional CO_2 laser, can effectively treat depressed acne scars. In the present study, we investigated the efficacy of the fractional ablative CO_2 laser in acne scar.

Methods: In this clinical trial we used an ablative fractional CO_2 laser (eCO2 Lutronic Corp., Goyang, South Korea; FDA approved) in 15 female cases with an age range of 20-40 years. All patients underwent 3 sessions of laser resurfacing at one-month intervals. In the first session we used the laser with the 120 tip at a density of 150 spots/cm², and pulse energy of 70 J/cm² with a 4 mm diameter spot in static mode on the depressed acne scars. In the second and third sessions, the same 120 tip was applied over the areas treated in the previous session with a density of 100 spots/cm² pulse energy of 70 J/cm² using the 12 mm square spot size in the static mode. Photographs were taken at baseline, before every treatment session and at 3 months after the final session. The patients completed questionnaires concerning the percentage of improvement, in consultation with an independent dermatologist. Finally, the clinical photography was compared by an independent panel of clinicians who objectively evaluated the efficacy of ablative fractional CO_2 laser treatment of acne scars.

Results: Objective and subjective improvement after the 3rd session was estimated about 20-70% and 30-70%, respectively, without any erythema, permanent hyperpigmentation or other adverse effects. In the long-term follow-up, these results continued to improve but one limitation of the study was that this long-term improvement was not recorded formally. The most important point for the patients was that they were able to resume their social and work commitments and all aspects of activities of daily living (ADL) from 4 to 7 days after treatment.

Conclusions: Ablative fractional CO_2 laser resurfacing can be used as a safe and efficacious method to treat depressed acne scars, but further studies will help define the optimal treatment parameters and other potential indications for this device.

© Journal of Lasers in Medical Sciences, 2012; 3: 132-134

ABLATIVE FRACTIONAL CO_2 LASER MAY BE A NOVEL TREATMENT FOR TATTOO ALLERGIC REACTION: A CASE REPORT

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Background and Aims: Cosmetic tattooing has become a popular method to enhance the appearance of eyebrows, for example. However, an allergic reaction between the tattoo pigments and other substances, for example botulinum toxin (BTA), can occasionally occur for unknown reasons, and allergic reactions have been reported on attempted removal of these and other tattoos with laser. The present case report investigated the treatment with an ablative fractional CO_2 laser of the allergic reaction between tattoo pigment and a BTA injection.

Case and Methods: A 47-year-old female, who, some years previously, had her eyebrows tattooed, suddenly and unexpectedly developed a severe facial allergic reaction to a BTA injection, even though she had been receiving these almost twice per year for 5 years. As part of the allergic reaction, the areas of tattoo pigment became very swollen, pruritic and painful, and did not respond to corticosteroid treatment. Further intralesional triamcinolone injections over 8 months failed to improve the problem. When she came to our clinic, we noted red eczematous and indurated papules and plaques confined to her eyebrows, almost resembling a keloid scar, with the rest of her skin appearing normal. We applied an ablative fractional CO_2 laser once a week for 7 sessions, three weeks between sessions, with no concurrent therapy other than mineral water spray and zinc oxide ointment.

Results: One possible limitation in this report which must be stated first is that the etiology of the allergic reaction was not histopathologically identified. The patient had no problems with the treatment, pain was not an issue and side effects were mild and transient. Gradual flattening of the allergic papules and plaques in the treated areas appeared as treatment progressed, together with lightening of the tattoo itself. One month after the final treatment, near total flattening of the tattoo allergic reaction and depigmentation of the ink was observed which was maintained without further treatment over a further three-month period. The patient was highly satisfied.

Conclusions: Ablative fractional CO_2 treatment could offer an alternative treatment for allergic-reaction associated raised papules and areas of plaque in tattooed areas which have failed to respond to corticosteroid intervention. Further studies are necessary to confirm our results and ascertain the ideal parameters.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Acta Dermato-Venereologica [Epub ahead of print; March 2013]

DECREASED TISSUE AND SERUM EXPRESSION OF GALECTIN-7 IN PATIENTS WITH HYPERTROPHIC SCARS

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Hypertrophic scars (HS) result from an imbalance between collagen biosynthesis and matrix degradation during wound healing. In this study a proteomics approach was used to compare the protein profiles of skin tissue obtained from patients with HS and healthy controls. One of the epidermal proteins, galectin-7 was markedly down-regulated in HS. Serum levels of galectin-7 in 27 patients with HS were less than 1/3 of those in 15 healthy controls. Tissue protein expression was subsequently evaluated using immunohistochemical staining on HS tissue and on serially-obtained control tissue during wound healing. Weaker galectin-7 immunoreactivity was detected along the cytoplasmic membrane of basal and suprabasal cells in samples from HS. In addition, galectin-7 was stained in the extracellular space of the upper papillary dermis in HS tissue. Ablative laser treatment, used to induce wound healing of healthy control tissue, demonstrated marked galectin-7 expression at the cytoplasmic membrane on days 3, 5, 14 and 21. Pronounced galectin-7 staining at the upper papillary dermis was detected on days 1, 3 and 10. These results suggest that the differences in galectin-7 expression and subcellular and extracellular distribution may be crucially involved in the pathogenic process of HS.

© Dermatologic Surgery [Epub ahead of print; April 2013]

EARLY POSTOPERATIVE TREATMENT OF SURGICAL SCARS USING A FRACTIONAL CARBON DIOXIDE LASER: A SPLIT-SCAR, EVALUATOR-BLINDED STUDY

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Background: Although focus has recently been directed toward the early treatment of surgical scars, the optimal time at which to initiate treatment with fractional laser and its effect on scar remodeling remains controversial.

Objectives: To assess the safety and efficacy of treating surgical scars using an ablative carbon dioxide (CO_2) fractional laser during the early postoperative period.

Materials and Methods: We performed a prospective, split-scar, evaluator-blinded study on 16 postoperative scars of 15 patients. Patients began treatment 3 weeks after surgery and were treated in two sessions of CO_2 fractional laser therapy on half of the scar at 2-week intervals. All patients were followed for 3 months after the final treatment session.

Results: Three months after the last treatment, a greater decrease in Vancouver Scar Scale score was noted in the treated half of the scars, especially in terms of texture and thickness. Patients also expressed a significantly greater degree of satisfaction with the treated side as assessed using a subjective 4-point scale. Only one patient experienced any adverse effect, which was the development of hypertrophy, on the treated and untreated side of the scar.

Conclusion: CO_2 fractional laser is an effective treatment modality for surgical scars in the early postoperative period.

© Journal of Dermatological Treatment [Epub ahead of print; May 2013]

ABLATIVE FRACTIONAL LASER TREATMENT FOR HYPERTROPHIC SCARS: COMPARISON BETWEEN Er:YAG AND CO_2 FRACTIONAL LASERS

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Background: Nonablative fractional photothermolysis has been reported to show early promise in the treatment of hypertrophic scars, but there are few reports on ablative fractional photothermolysis for the treatment of hypertrophic scars.

Aim: To evaluate and compare the efficacy and safety of Er:YAG fractional laser (EYFL) and CO_2 fractional laser (CO_2FL) for treatment of hypertrophic scars.

Methods: Thirteen patients with hypertrophic scars were treated with 2,940 nm EYFL, and ten were treated with 10,600 nm CO_2FL. An independent physician evaluator assessed the treatment outcomes using Vancouver scar scale (VSS) and 5-point grading scale (grade 0, no improvement; grade 1, 1–25%; grade 2, 26–50%; grade 3, 51–75%; grade 4, 76–100% improvement). Patients are queried about their subjective satisfaction with the treatment outcomes.

Results: After the final treatment, average percentage changes of VSS were 28.2% for EYFL and 49.8% for CO_2FL. Improvement was evident in terms of pliability, while insignificant in terms of vascularity and pigmentation. Based on physician's global assessment, mean grade of 1.8 for EYFL and 2.7 for CO_2FL was achieved. Patient's subjective satisfaction scores paralleled the physician's objective evaluation.

Conclusion: CO_2FL is a potentially effective and safe modality for the treatment of hypertrophic scars, particularly in terms of pliability.

© The American Journal of Cosmetic Surgery, 2011: 28: 273-275

ABLATIVE FRACTIONATED CO_2 LASER RESURFACING FOR THE FACE AND NECK

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Introduction: There has been little information reported on the use of fractionated CO_2 laser resurfacing of the neck. We describe our initial experience with conservative treatment on the neck with concurrent treatment to the face.

Materials and Methods: We retrospectively reviewed all cases of full-face and neck ablative fractionated CO_2 laser resurfacing at our institution performed for the treatment of photodamage.

Results: Eighteen consecutive patients were included with at least 3 months of follow-up. All neck settings were lower than the face settings. Eleven patients were treated with a 120 µm spot size and 7 patients with a 300 µm spot size. Average time of reepithelialization was 5 to 7 days for the full face and 7 to 14 days for the neck. Similarly for erythema resolution, patients reported an average of 4 weeks for improvement versus 6 weeks for the neck area. Two patients reported being dissatisfied with the procedure, and all others were happy with neck results. Complications included 1 case of herpes simplex virus reactivation with perioral lesions, 3 cases of postinflammatory hyperpigmentation of the face, and 1 case of postinflammatory hyperpigmentation with persistent erythema of the neck.

Conclusions: Fractionated CO_2 laser treatment to the neck involved delayed healing times despite the use of lower laser settings.

© The American Journal of Cosmetic Surgery, 2011; 28: 71-74

DEPTH OF eCO2 FRACTIONAL RESURFACING WITH 3 DIFFERENT SPOT SIZES ON FACIAL SKIN *IN VIVO*

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Introduction: To estimate the depth of laser vaporization of microthermal zones and surrounding thermo-coagulation with the eCO2 laser.

Materials and Methods: Pretragal skin was lased with 3 spot sizes (120, 300, and 1000 µm), and each spot size was lased at 5 different fluences. The 15 different lased areas were then biopsied.

Results: For the 120 µm tip, as the power increased from 80 to 160 mJ, the depth of laser penetration increased from 520 to 900 µm. Total coagulative effect increased from 720 to 1000 µm. For the 300 µm tip, as the power increased from 100 to 180 mJ, the depth of laser penetration increased from 200 to 550 µm. Total coagulative effect increased from 320 to 720 µm. For the 1 mm tip, as power increased from 60 to 220 mJ, the depth of laser penetration hovered around 125 to 150 µm. Total coagulative effect increased from 150 to 350 µm.

Conclusion: The 120 µm tip allows for the deepest penetration into facial skin with the least amount of surface area ablated. The 300 µm tip allows for an intermediate level of penetration into the dermis and an intermediate amount of surface ablation. The 1000 µm tip can be used to fully ablate epidermis as in traditional laser resurfacing. Traditional CO_2 lasers ablate the entire epidermis, which provides excellent results at the price of prolonged healing times and erythema. These lasers worked with larger spot sizes, often as much as 2.25 mm, and at fluences of about 7-8 J/cm² . Fractional CO_2 lasers focus the same amount of energy into the skin in microscopic thermal zones as small as 120 µm, which create fluences of nearly 100 times those of traditional lasers. This results in tissue ablation past the epidermis and through the papillary dermis into the reticular dermis in these narrow zones while leaving the surrounding epidermis intact. These areas of undisturbed tissue allow for more rapid healing. The theory is that the deep penetration into the reticular dermis allows for deep collagen neogenesis, which is good for rhytid improvement while maintaining a rapid healing time.

© Journal of Plastic, Reconstructive & Aesthetic Surgery, 2012; 65: 1305-1311

SKIN-TIGHTENING EFFECT OF FRACTIONAL LASERS: COMPARISON OF NONABLATIVE AND ABLATIVE FRACTIONAL LASERS IN ANIMAL MODELS

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This experimental study was performed to demonstrate the effects of non-ablative fractional laser (NAFL) and ablative fractional laser (AFL). Twenty male Sprague-Dawley rats were used for the study. Three 2x2-cm-sized squares were tattooed on the abdomen of the animals. Each tattooed square was used for NAFL, AFL and control experiments. The NAFL and AFL treatment were performed with the same total energy of 12,000 mJ/cm^2. The laser treatments consisted of four sessions, with an interval of 3 weeks between sessions. The areas of tattooed skin were serially measured, and skin samples were obtained for histologic examination after 4 months of treatment.

NAFL did not cause immediate skin shrinkage, but the size of the NAFL-treated skin was reduced by 4.3% after 4 months. In contrast, AFL caused immediate skin shrinkage (11.5% reduction), and the size was maintained at 9% reduction after 4 months. In histologic examination, the dermal collagen was arranged flat and parallel to the skin surface in the upper dermis, and regenerated collagen fibres were clearly noticed in both NAFL-and AFL-treated skin samples. Immunohistochemical stains showed well-regenerated type I and III collagen fibres. Western blot analysis of skin samples showed that type I/III collagen ratio was not significantly changed after fractional laser treatment. Electron microscopic studies aimed to evaluate the long-term micro-architecture of the collagen fibrils. AFL treatment reduced D-band periodicity by 5.2% and fibril diameter by 14.8%, although there was no statistically significant difference ($p > 0.05$).

Fractional laser treatment shrinks the skin surface area and regenerates collagen. The AFL treatment showed more profound skin changes than NAFL

© Journal of Cosmetic Dermatology, 2013; 12: 49-56

SHORT FLAP RHYTIDECTOMY AND FRACTIONAL CO_2 LASER REJUVENATION OF THE AGING FACE

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Background: There is currently a high demand for a concurrent system of skin rejuvenation accompanying rhtidectomy. CO_2 laser treatment prior to surgical ablative reduction has produced promising results, but the adjunct service of laser treatment at the time of surgery has never been reviewed.

Objectives: Determine the effects of concurrent treatment of rhytides and evidence of aging in the skin with surgical correction followed by fractional CO_2 laser application.

Methods: During study time from September 2008 to February 2009, patients who underwent short flap rhytidectomy were treated with the Lutronic eCO2™ fractional laser using the patented "Controlled Chaos Technology."

Results: Complications included 2.3% herpes simplex outbreak, 4% persistent erythema past 2 weeks, four cases of prolonged edema to 5 days, one case of impetigo, and no evidence of dyspigmentation. Patient satisfaction data demonstrated no refunds at 12 months.

Conclusion: Combination fractional laser resurfacing with short flap, high-superficial muscular aponeurotic system rhytidectomy is a safe procedure with excellent patient satisfaction and clinical outcomes.

© Dermatologic Surgery, 2011; 37: 433-438

TREATMENT OF SYRINGOMA USING AN ABLATIVE 10,600-nm CARBON DIOXIDE FRACTIONAL LASER: A PROSPECTIVE ANALYSIS OF 35 PATIENTS

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Background: Treatment of syringoma aims to destroy the dermal tumor using methods that can include surgical excision, electrodessication, cryosurgery, chemical peeling, and laser ablation, but complete removal of syringomas is often unsuccessful, and recurrence occurs frequently.

Objective: To investigate the therapeutic efficacy of an ablative 10,600-nm carbon dioxide fractional laser system (CO_2 FS) for the treatment of periorbital syringomas.

Methods: Thirty-five patients with periorbital syringomas were treated with two sessions of CO_2 FS at 1-month intervals. Laser fluences were delivered in two or three passes over the lower eyelids, using a pulse energy of 100 mJ and a density of 100 spots/cm². Clinical improvement was assessed by comparing preand post-treatment clinical photographs and patient satisfaction rates. We examined the histological features of human periorbital syringomas treated with CO_2 FS.

Results: Evaluation of clinical results 2 months after treatment showed that 15 of the 35 patients (42.9%) demonstrated marked (51-75%) clinical improvement, 12 (34.3%) had moderate (26-50%) clinical improvement, five (14.3%) showed minimal (0-25%) improvement, and three (8.6%) showed near total (>75%) improvement. Clinical improvement scores were less at 4 months after the second CO_2 FS treatment (not statistically significant). The mean maximal depth of the necrotic column was 1,236.3 µm. A specimen obtained from the infraorbital area immediately after treatment showed formation of necrotic columns on the interfollicular skin.

Conclusion: The use of CO_2 FS can have a positive therapeutic effect on periorbital syringomas.

© Korean Journal of Dermatology, 2010; 48: 510-512 (in Korean, abstract in English)

A CASE OF CONGENITAL MELANOCYTIC NEVUS CLINICALLY IMPROVED BY FRACTIONAL CARBON DIOXIDE LASER TREATMENT

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Congenital melanocytic nevi are cosmetically disfiguring, pigmented skin lesions that are present at birth. A 61-year-old man presented with an asymptomatic 3×2 cm sized black-colored patch involving the helix, antihelix and triangular fossa of the left auricle, and the lesion had been there since birth. The patient refused surgical removal and so we tried fractional carbon dioxide laser treatment for cosmetic improvement only. Clinical improvement was observed after 18 treatment sessions. We report herein on a case of congenital melanocytic nevus within the auricle, and this was treated with fractional carbon dioxide laser.

© British Journal of Dermatology, 2012; 166: 658-661

COMBINATION TREATMENT OF 10,600 nm ABLATIVE CARBON DIOXIDE FRACTIONAL LASER AND NARROW BAND UVB IN REFRACTORY NON-SEGMENTAL VITILIGO: A PROSPECTIVE, RANDOMIZED HALF-BODY COMPARATIVE STUDY

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Background: Vitiligo is a common acquired depigmentation disorder caused by the loss of melanocytes. Despite the numerous treatment modalities that are available for vitiligo, responses to treatment are still unsatisfactory. For this reason, new treatment modalities and approaches are needed.

Objectives: The effects of fractional CO_2 laser therapy followed by systemic NB-UVB phototherapy on non-segmental vitiligo (NSV) were investigated as a prospective and randomized left-right comparative study.

Methods: A total of 10 patients with NSV who presented with symmetrical vitiligo lesions showing no further improvement despite more than one year of conventional treatment were enrolled. Two sessions of half-body CO_2 fractional laser therapy were performed at a two-month interval. NB-UVB phototherapy was then administered to the entire body 5 days after each fractional laser treatment twice a week, increasing the dosage incrementally by 15% at each session. Objective clinical assessments were made by two blinded dermatologists using a quartile grading scale, and the patients overall satisfaction was evaluated using a 10-point visual analogue scale.

Results: Two months after the last treatment, mean improvement scores, assessed by physicians, were significantly higher for those treated with half-body fractional CO_2 laser therapy followed by NB-UVB, compared to those treated with NB-UVB alone (p=0.034). In addition, according to subjective assessment, the half-body laser treatment combined NB-UVB phototherapy showed significantly higher improvements, compared to NB-UVB treatment alone (p=0.023). Noticeable adverse events, such as infection, scarring, and Koebner phenomenon, were not found in any patient.

Conclusions: This study suggests that fractional CO_2 laser therapy followed by NB-UVB could be used effectively and safely as an alternative modality for the treatment of refractory vitiligo.

© Journal of the European Academy of Dermatology and Venereology [Epub ahead of print; May 2012]

THE EFFECT OF FRACTIONAL CARBON DIOXIDE LASERS ON IDIOPATHIC GUTTATE HYPOMELANOSIS: A PRELIMINARY STUDY

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Background: Idiopathic guttate hypomelanosis (IGH) is a commonly acquired leukoderma that is characterized by discrete, round or oval porcelain-white macules around 2 mm in diameter that increase in number with age. A variety of therapies with variable success rates, including cryotherapy, superficial abrasion and topical retinoids are currently being used.

Objectives: The effects of fractional CO_2 laser therapy on IGH were investigated in this pilot study. Patients and Methods: A total of 40 patients with IGH were enrolled. The hypopigmented lesions were treated using a 10,600 nm carbon dioxide fractional laser (CO_2 FL). Two months after a single treatment, physicians clinical assessments were performed and the patients overall satisfaction was evaluated.

Results: The mean age of enrolled patients was 57.5 ± 10.9 years and the gender ratio was 7:33. The face was the most commonly treated area, although the extremities are epidemiologically the most frequently affected areas. Two months after treatment, objective assessments performed by two independent dermatologists indicated more than 50% improvement in 36 patients (90%), compared with baseline. In addition, 33 patients (82.5%) were very satisfied or satisfied with just one session of CO_2 FL treatment. Although a few patients complained of long-standing erythema and postinflammatory hyperpigmentation, these problems spontaneously resolved within 2 months after the assessments. No other noticeable side effects were observed.

Conclusions: CO_2 FL might be a very convenient and effective modality for treating IGH without significant side effects.

© Dermatologic Surgery, 2013; 39: 477-479 (Communications and Brief Reports)

REFRACTORY PYODERMA GANGRENOSUM EFFECTIVELY TREATED USING A 10,600-nm CARBON DIOXIDEFRACTIONAL LASER

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Background and Aims: Pyoderma gangrenosum (PG) is a chronic neutrophilic skin disease that appears as enlarging painful skin ulcers with an undermined border. No consistently effective treatment has as yet been identified, although immunosuppressive and immunomodulatory agents are currently used in conjunction with corticosteroids. The present case report suggests the potential efficacy of a fractional CO_2 laser (CO_2 FS) in a patient with refractory PG

Subject and Methods: The subject was a 71-year-old Korean female with a painful and enlarging ulcerative lesion on the right shin that had remained resistant to oral, topical and injected drugs for over a year. Based on a series of laboratory tests a diagnosis of PG was reached. All systemic and topical medications were halted. Four sessions of CO_2 FS were then planned (eCO2™, Lutronic, Goyang, South Korea). Following local injection anesthesia around the lesion, the laser was applied (2 passes, 80 mJ, 150 spots/cm², 120 µm microbeams, static mode, 12.5% coverage /pass). Antibiotic ointment and a foam dressing were applied, and concomitant injection therapy with triamcinolone acetonide was performed.

Results: Marked improvement of the lesion was seen after the 2nd treatment session. By the 4th session, the lesion had almost completely healed with acceptable cosmesis. The patient, who was very satisfied with the result, was followed for 5 months without any further CO_2 FS or injections with no sign of recurrence.

Conclusions: Some previously published studies have reported that fractional technology had beneficial effects on cutaneous inflammatory disorders. The authors' own experience showed the efficacy of CO_2 FS in in treatment of axillary hidradenitis suppurativa. As in the current case, the severity of the lesions was reduced with improved control of inflammation and granulation tissue formation. CO_2 FS may induce the recruitment of wound healing cells into recalcitrant wounds but without worsening the existing wound, thereby triggering the return of the regular wound healing cycle. Our results in the present case suggest that CO_2 FS may have benefits in treatment of recalcitrant PG, but further studies are required to confirm this and elicit the underlying mechanisms.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Journal of the Optical Society of Korea, 2008; 12: 98-102

EVALUATION OF MORPHOLOGICAL CHANGES IN DEGENERATIVE CARTILAGE USING 3-D OPTICAL COHERENCE TOMOGRAPHY

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Background: Optical Coherence Tomography (OCT) is an important noninvasive medical imaging technique that can reveal subsurface structures of biological tissue. OCT has demonstrated a good correlation with histology in sufficient resolution to identify morphological changes in articular cartilage to differentiate normal through progressive stages of degenerative joint disease.

Current systems: Current OCT systems provide individual cross-sectional images that are representative of the tissue directly under the scanning beam, but they may not fully demonstrate the degree of degeneration occurring within a region of a joint surface. For a full understanding of the nature and degree of cartilage degeneration within a joint, multiple OCT images must be obtained and an overall assessment of the joint surmised from multiple individual images.

3-D OCT: This study presents frequency domain three-dimensional (3-D) OCT imaging of degenerative joint cartilage extracted from bovine knees. The 3-D OCT imaging of articular cartilage enables the assembly of 126 individual, adjacent, rapid scanned OCT images into a full 3-D image representation of the tissue scanned, or these may be viewed in a progression of successive individual two-dimensional (2-D) OCT images arranged in 3-D orientation. A fiber-based frequency domain OCT system that provides cross-sectional images was used to acquire 126 successive adjacent images for a sample volume of 6×3.2×2.5 mm. The axial resolution was 8 μm in air. The 3-D OCT was able to demonstrate surface topography and subsurface disruption of articular cartilage consistent with the gross image as well as with histological cross-sections of the specimen.

Conclusions: The 3-D OCT volumetric imaging of articular cartilage provides an enhanced appreciation and better understanding of regional degenerative joint disease than may be realized by individual 2-D OCT sectional images.

© Lasers in Surgery and Medicine, 2009; 41: 721-727

SUPERIOR LIPOLYTIC EFFECT OF THE 1,444 nm Nd:YAG LASER: COMPARISON WITH THE 1,064 nm Nd:YAG LASER

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Background and Objectives: Recently developed laser lipolysis systems have been disappointing because they require more time to remove the same amount of fat than other liposuction methods. A new Nd:YAG laser has been introduced that uses the 1,444 nm wavelength, better absorbed by fat.

Study Design/Materials and Methods: This study consisted of two protocols. The first protocol was an *in vivo* minipig model. Four 10 x10 cm areas were treated on the back of the first minipig. Using the same total energy and power settings (5,000 J, 8 W), both the 1,064 nm and 1,444 nm lasers were used to irradiate the two cephalic areas. The two caudal areas were irradiated with both lasers, using the maximum power settings (12 W with the 1,064 nm laser, 8 W with the 1,444 nm laser). Another minipig was administered a preoperative injection of tumescent solution and treated with the same condition. Measurements of fat volume with computed tomography and histological exams were conducted. The second experiment involved *in vitro* human fat. Equal amounts of human fat, harvested by liposuction, were put into test tubes and irradiated with 1,064 nm and 1,444 nm lasers. Oil production was measured from each test tube.

Results: A marked reduction in fat volume and more oil vacuoles and giant cells in histology were identified with the 1,444 nm wavelength compared to the 1,064 nm wavelength. Human fat in the *in vitro* experiments also revealed more oil production following the use of the 1,444 nm laser.

Conclusions: The 1,444 nm Nd:YAG laser showed a greater lipolytic effect compared to the 1,064 nm Nd:YAG laser in *in vivo* minipig and *in vitro* human fat experiments. To achieve a full understanding of the effects of 1,444 nm Nd:YAG laser lipolysis on the human body, *in vivo* experimentation will be necessary.

© Lasers in Medical Science, 2013; 28: 519-527

ABLATION EFFICIENCY AND RELATIVE THERMAL CONFINEMENT MEASUREMENTS USING WAVELENGTHS 1,064, 1,320, AND 1,444 nm FOR LASER-ASSISTED LIPOLYSIS

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Background and Aims: Laser-assisted lipolysis is routinely used for contouring the body and the neck while modifications of the technique have recently been advocated for facial contouring. In this study, wavelength-dependence measurements of laser lipolysis effect were performed using different lasers at 1,064, 1,320, and 1,444 nm wavelengths that are currently used clinically.

Materials and Methods: Fresh porcine skin with fatty tissue was used for the experiments with radiant exposure of 5-8Wwith the same parameters (beam diameter 600 ìm, peak power 200 mJ, and pulse rate 40 Hz) for 1,064, 1,320 and 1,444 nm laser wavelengths. After laser irradiation, ablation crater depth and width and tissue mass loss were measured using spectral optical coherence tomography and a micro-analytical balance, respectively. In addition, thermal temporal monitoring was performed with a thermal imaging camera placed over ex vivo porcine fat tissue; temperature changes were recorded for each wavelength.

Results: This study demonstrated greatest ablation crater depth and width and mass removal in fatty tissue at the 1,444 nm wavelength followed by, in order, 1,320 and 1,064 nm. In the evaluation of heat distribution at different wavelengths, reduced heat diffusion was observed at 1,444 nm.

Conclusions: The ablation efficiency was found to be dependent upon wavelength, and the 1,444 nm wavelength was found to provide both the highest efficiency for fatty tissue ablation and the greatest thermal confinement.

© Facial Plastic Surgery Clinics of North America, 2009; 17: 505-514

FACELIFT ADJUNCTIVE TECHNIQUES: SKIN RESURFACING AND VOLUMETRIC CONTOURING

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Background: The efficacy of even the best surgical facelifting techniques for the jowls and mandibular contouring is variable, and may provide only limited and temporary improvement of the midface contour. Commonly applied techniques for posterior cervicofacial rhytidectomy such as the superficial muscular aponeurotic system (SMAS) approach may have only minimal effect on the melolabial fold or may even accentuate it. The same approaches might also result in an unbalanced appearance unless the changes evoked by intrinsic and extrinsic aging are not taken into consideration.

Effects of Time: Time does not stand still, and improvements delivered by the surgical lifting techniques alone generally diminish over time as tissues undergo natural postoperative changes which are typically greater in older patients, those with severely photoaged skin or who tend to be heavier built , in smokers or those who have undergone significant weight loss.

Rationale for Adjunctive Surgery: The optimum approach would therefore appear to be ensure first of all absolute precision in performing the selected surgical techniques, and then to employ adjunctive nonsurgical or minimally invasive approaches which might offer a more natural appearance overall and which may be longer lasting. An interesting addition to the laser armamentarium has been the 1444 nm wavelength for interstitial laser-assisted lipolysis, and laser-assisted facial contouring (LAFC) with this system has attracted a lot of attention.

Benefits of LAFC: With LAFC, the descended fat masses associated with the nasolabial and melomental folds and jowling can be precisely removed, impossible with a surgical facelift which can only achieve an overall tightening effect. The same system can then be employed to achieve deep dermal heating for eventual skin tightening through collagen remodeling. The optical fiber-delivered 1444 nm energy also provides an ideal undermining technique to enhance the usual lifting approaches. Appropriate injectable fillers can be concomitantly used for any depressed areas, and fractional ablative resurfacing with the CO_2 or Er:YAG lasers can be used to rejuvenate photoaged skin so that the patient's face is comprehensively treated from the deeper tissues to the surface.

Conclusions: The plastic surgeon must therefore be familiar with and take these new minimally-invasive adjunctive procedures into careful consideration in order to maximize and prolong the aesthetic effect of an excellently-performed facelift.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Facial Plastic Surgery, 2011; 27: 315-330

LASER-ASSISTED FACIAL CONTOURING USING A THERMALLY CONFINED 1444-nm Nd:YAG LASER: A NEW PARADIGM FOR FACIAL SCULPTING AND REJUVENATION

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Background and Aims: The micropulsed 1444-nm neodymium-doped lipolysis laser exhibits favorable characteristics for novel application in facial contouring. The study described herein is the first clinical report of laser-assisted facial contouring (LAFC).

Subjects and Methods: We retrospectively reviewed records of 478 LAFC patients (mean age 52) who underwent contouring of 1278 individual mid- and lower facial treatment sites over 18 months. Along with clinical assessment, study parameters evaluated among “original” and “modified” (where protocol updates included deep dermal soft tissue coagulation as an optional step) protocol groups included laser power, pulse energy, and total energy delivery as well as lipoaspirate volume at each treatment site.

Results: Mean power and pulse energy were similar (within 5%) and total -5 energy use was greater (70% higher for mid- and lower face) in the original protocol group. Lipoaspirate volume was similar for both groups for the midface (within 10%) but elevated w in the modified protocol group for the lower face (40% higher). Treatment complications were observed in 47 of 363 treatment sites (13%) in the original and in 12 of 915 treatment sites (1%) in the modified protocol group with the majority (63%) of the complications comprising over- versus undercorrections of desired tissue contour. Clinical efficacy varied with improvements of mid- and/or lower facial contour ranging from marginal to subtle to very apparent.

Conclusions: LAFC as detailed herein is a novel treatment modality that enables selective soft tissue removal for greater precision in three-dimensional contouring of the face. Protocol modifications based on laboratory and observed tissue photothermodynamics have improved LAFC safety.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Histology and Histopathology, 2011; 26: 1375-1382

COMPREHENSIVE HISTOLOGIC ANALYSIS OF INTERSTITIAL LIPOLYSIS WITH THE 1444 nm WAVELENGTH DURING A 3-MONTH FOLLOW-UP

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A number of near-infrared wavelengths have been proposed and studied for laser lipolysis, but the histologic evaluation of tissue response to laser lipolysis during long-term follow-up has been lacking. A 1444 nm Nd:YAG laser with better absorption in both fat and water has recently attracted attention. The present study was designed to investigate the comprehensive histopathology of 1444 nm Nd:YAG laser-assisted lipolysis at different energy levels during a 3-month follow-up. Laser lipolysis was performed on porcine fat tissue *in vivo* using a 1444 nm Nd:YAG laser (AccuSculpt®, Lutronic Corporation, Ilsan, Republic of Korea) and the total energies delivered interstitially to 10x10 cm areas were 750 J, 1500 J, 2250 J, 3000 J, 3750 J, 4500 J, and 5250 J. Biopsy samples were taken and histologically analyzed immediately after biopsy and at 1, 2, 4, and 12 weeks postoperatively. With a fluence setting above 3000 J/100 cm², inflammation was severe and remained by the 3-month follow-up, resulting in severe scarring of the fat tissue. Below this energy level, mild lobular inflammation in the early phase biopsy had resolved with no scarring by the 3-month follow-up. No histologic changes in the epidermis or dermal connective tissue were present. This study suggested that controlling the energy level is important for clinical applications of laser lipolysis with no significant complications.

© Laser Therapy, 2011; 20: 39-46

PRELIMINARY EXPERIENCE IN FACIAL AND BODY CONTOURING WITH 1444 nm MICROPULSED Nd:YAG LASER-ASSISTED LIPOLYSIS: A REVIEW OF 24 CASES

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Background and Aims: Near-infrared laser-assisted lipolysis has claimed attention recently as a fast, safe and effective way to remove unwanted fat from various areas of the body. Removal of fat from the face has however proved more difficult. A novel 1444 nm line of the micropulsed Nd:YAG has recently been developed, offering superior duality of absorption in both fat and water. The present preliminary study was designed to assess the efficacy of the 1444 nm wavelength in facial and body contouring.

Subjects and Methods: Twenty-four informed and consenting female patients (ages ranging from 23 yr to 59 yr, mean age 32.38 ± 7.26 yrs) were recruited into the study. The laser used was a micropulsed 1444 nm Nd:YAG system. Following tumescent anesthesia, the tip of the optical fiber was placed in the subcutaneous fat via a cannula inserted through a small puncture wound, and lasing was commenced while the tissue over the end of the optical fiber was continuously palpated to check for excessive heat formation. Cold compresses were applied post-lasing. Patients were followed for at least 2 months with clinical photography at baseline, immediately post-treatment and at subsequent assessment points.

Results: All patients successfully completed the study. Patient subjective satisfaction was high, and an objective clinician assessment from the clinical photography showed good efficacy. There were no major adverse side effects. Minor side effects were transitory, all resolved spontaneously and good results were maintained during a 2-3 month follow-up.

Conclusions: The present study showed high efficacy for the micropulsed Nd:YAG laser at 1444 nm for laser-assisted lipolysis of both body and facial areas, with no adverse side effects and virtually no downtime. The high absorption rate of 1444 nm in both fat and water, coupled with the 100 μs pulse, was believed to contribute highly to the success of the study and the satisfaction of the patients. Further larger studies are warranted.

© Journal of Dermatology, 2013; 40: 1-5

HISTOLOGICAL EVALUATION OF DERMAL TISSUEREMODELING WITH THE 1444-nm NEODYMIUM:YTTRIUM–ALUMINUM–GARNET LASER IN *IN VIVO* MODEL

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The 1444-nm neodymium:yttrium–aluminum–garnet (Nd:YAG) laser has been expected to be more effective and safe for laser lipolysis, due to higher affinity to fat and water, than 1064-nm and 1320-nm wavelengths. The purpose of this study was to evaluate the skin tightening effect of the 1444-nm Nd:YAG laser through *in vivo* guinea pig models. The 1444-nm Nd:YAG laser was used to irradiate shaved dorsal skin of the guinea pigs and compared with controls (no power, only tunneling). Immediately, 1 week, 1 month and 3 months after laser administration, full-thickness skins were harvested and to evaluate dermal thickness, collagen organization, fibroblast proliferation, and intensity of elastic fibers and mucopolysaccharides, using hematoxylin–eosin, Masson-trichrome, Verhoeff's stain and Alcian blue stain. Dermal thickness showed an increase with time in all groups. In collagen organization, fibroblast proliferation, and intensity of elastic fibers and mucopolysaccharides, the treatment groups were higher than those of the control group, overall. Our study showed that the 1444-nm Nd:YAG laser appeared to be effective for the skin tightening effect in *in vivo* guinea pig models. The 1444-nm Nd:YAG laser can be used for skin tightening, as well as reduction of fat tissues

© Dermatologic Surgery, 2011; 37: 1375-1376 (Letter to the Editor)

TREATMENT OF LIPOMAS USING A SUBDERMAL 1,444-nm MICROPULSED NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER

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Background: Lipomas are often removed because of aesthetic concerns or discomfort secondary to local structure compression, but scars and the potential for prolonged recovery times are known complications of most surgical modalities. We report herein on an effective, simple, safe method for the treatment of lipomas using a micropulsed 1,444-nm Nd:YAG laser applied interstitially through an optical fiber.

Subjects and Methods: Three female patients of Korean descent (aged 19, 38, and 48 were diagnosed with ultrasound as having lipomas on their backs. Following tumescent anesthesia, Subjects were treated in a single session of micropulsed subdermal 1,444-nm Nd:YAG laser energy (pulse rate 30 Hz, pulse energy 200 mJ, pulse width 100 µs, power 6 W) via a 600 m optical fiber through a microcannula. The total accumulated energy used in each case ranged from 1,100 to 4,200 J/cm² determined by the lipoma size. After treatment, aspiration of lipid was performed.

Results: All 3 patients were satisfied with the small scars from the cannula entry point, which were no longer visible a few months after the laser treatment. Patients returned for follow-up examination and ultrasonography periodically for 2 to 6 months after the laser surgery. In all cases, reduction or complete disappearance of the lipoma was observed at the 6-month follow-up, and no infections, episodes of severe bleeding, or any other serious adverse effects were reported.

Conclusions: Our findings in these three patients showed that a single treatment using the 1,444-nm Nd:YAG laser resulted in complete or near-complete lipoma resolution, and enabled the uses of a finer cannula for the liposuction. We anticipate that the 1,444-nm wavelength laser may achieve more-effective lipolysis, given its high fat and water affinity.

© Journal of the Korean Society for Surgery of the Hand, 2011; 16: 29-34 (in Korean)

TREATMENT OF WRIST GANGLION USING Nd:YAG LASER

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Purpose: We evaluated the results of treatment for a ganglion with catheterized Nd: YAG laser assisted arthrotomy.

Materials and Methods: Twenty-five patients with a ganglion underwent laser assisted arthrotomy. The first procedure was the puncturing and aspiration of the ganglion using an 18 G needle under local anesthesia. The joint capsule and ligament near the origin of the ganglion were cauterized using a catheterized laser instrument (ACCUSCULPT™, Lutronic Inc.). The patients was observed clinically and evaluated by ultrasonography.

Results: The average period of follow-up was 12.3 months. Among the 25 patients presented during follow-up period, 22 patients (88%) had no recurrence. Two patients had partial recurrence and 1 patient had complete recurrence.

Conclusions: Catheterized Nd:YAG laser assisted arthrotomy is considered to be an effective non-invasive method with a relatively low recurrence rate for the treatment of wrist ganglions.

© Dermatologic Surgery, 2011; 37: 1528-1530 (Brief Communication)

SUCCESSFUL TREATMENT OF RECURRENT DIGITAL MUCOID CYSTS USING A 1,444-nm NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER

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Background and Aims: Digital mucoid cysts (DMCs), also known as ganglions or synovial cysts, are common tumors of the distal interphalangeal (DIP) joints. DMCs can cause pain, cosmetic disfigurement, and nail deformities. Recently, the 1444 nm Nd:YAG laser has attracted attention in laser-assisted lipolysis, with high efficacy due to the high duality of absorption in both water and fat. We report herein on two cases of relapsing DMCs successfully treated using the 1444 nm laser, without recurrence.

Case Reports and Methods: Two patients, a 65-year-old man and a 48-year-old woman, had pathologically-confirmed periungual DMCs. Previous treatments with cryotherapy in combination with CO_2 laser or on its own, had been unsuccessful. Treatment was performed interstitially with a 600 moptical fiber, delivering 100 s pulses of 1444 nm laser energy (6 W and 4 W, total energy 72 J/cm² and 44 J/cm² for the male and female, respectively).

Results: Following compress dressings for 1 week, no recurrence was seen in either patient 6 months post-treatment, and at 9 months disappearance of the nail deformity caused by the DMC was observed.

Conclusions: Our cases suggest that the micropulsed interstitial 1444 nm laser could serve an effective and easy treatment option for DMCs and offers clear advantages over other modalities with regard to recurrence, but further large studies are necessary to prove the effectiveness of this novel laser on DMCs.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Journal of Dermatological Treatment [Epub ahead of print; July 2012]

ANTIFUNGAL EFFECTS OF A 1,444-nm NEODYMIUM:YTTRIUM-ALUMINIUM-GARNET LASER ON ONYCHOMYCOSIS: A PILOT STUDY

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Background and Aims: Investigations of laser- or light-assisted antibacterial and antifungal treatments have been introduced. In the present study, we investigated the antifungal activities of 1,444-nm Nd:YAG lasers against onychomycosis by microbiologic analysis and scanning electron microscopy.

Materials and Methods: Scraped toenails from 20 participants with mycologically-confirmed onychomycosis were prepared on polystyrene weighing dishes and treated with a 1,444-nm Nd:YAG laser. The samples were analyzed for the presence of colony-forming units (CFUs) and scanning electron microscopy was performed using a toenail treated with the 1,444-nm Nd:YAG laser.

Results: The mean reduction rate achieved by treatment with a total energy of 300 J was 75.9% (range: 33.3-100%), and by treatment with 450 J was 85.5% (range: 66.7-100%). However, the difference in CFU reduction rates between the laser settings of 300 J and 450 J was not significant. Analysis by scanning electron microscope revealed numerous disintegrated spores on the lower portions of the nail plate treated with the 1,444-nm laser, while the upper portion of the nail plate presented only a few small and greatly disintegrated fungal spores.

Conclusions: Our results suggest that a Nd:YAG laser with a wavelength of 1,444-nm has antifungal effects on onychomycosis. However, further investigations should be performed to determine the long-term clinical and microbiological effects of this treatment.

© Dermatologic Surgery 2012; 38: 960-963 (Brief Communication)

SUCCESSFUL TREATMENT OF MULTIPLE CUTANEOUS NEUROFIBROMAS USING A COMBINATION OF SHAVE EXCISION AND LASER PHOTOTHERMOCOAGULATION WITH A 1,444-nm NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER

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Background: Neurofibromatosis type 1 (NF-1) is an autosomal-dominant disorder of chromosome 17q11.2. Multiple cutaneous neurofibromas, one of the most characteristic clinical features of NF-1, are mainly a cosmetic problem, but are a major source of morbidity and psychological concern. Surgical excision is time consuming and painful. The present study preliminarily evaluated a novel interstitial 1444 nm fiber-based laser in the treatment of neurofibromas.

Case Report and Methods: A 35-year-old Asian male with a 20-year history of literally hundreds of neurofibromas presented to have removal of as many neurofibromas as possible without inconvenience or scarring. Because of the profusion of lesions he suffered from psychological problems, and was unable to wear short-sleeved shirts or shorts. He underwent treatment with the 1444 nm laser, (150 mJ/pulse, 20 Hz, 3W, 100 μs) delivered interstitially via a 600 μm optical fiber following shave excision of the protruding mass. Fifteen lesions were treated much more rapidly with this modality compared with surgical excision.

Results: The patient was happy with the results both intraprocedural and 7 months post-operatively. He rated the 1444 nm system against conventional surgery with an total preference score of 9 versus 6, respectively, out of 10. At 7 months after treatment, histology revealed the previous spindle neural cells had been replaced with normal collagen fibers, and the areas treated with the 1444 nm laser showed flattened skin with no visible recurrence or scarring.

Conclusions: The interstitial 1444 nm laser offers a new, speedy and less-invasive approach to the treatment of multiple neurofibromas. The good result achieved in this patient is believed to be due to the excellent absorption at this wavelength in water and the controlled heating effect due to the high peak power and short pulse widths. Further controlled studies with much larger patient populations are definitely warranted.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Dermatologic Surgery [Epub ahead of print; February 2012]

A CASE REPORT OF MULTIPLE ECCRINE HYDROCYSTOMAS SUCCESSFULLY TREATED WITH SUBDERMAL 1444-nm MICROPULSED NEODYMIUM-DOPED YTTRIUM ALUMINUM GARNET LASER

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Background and aims: Eccrine hydrocystomas (EHs) are rare, benign cystic tumors of the eccrine sweat glands. There have been previous reports of EHs treated with laser, namely the long-pulsed dye and carbon dioxide lasers A new 1444 nm 100 µs Nd:YAG laser was recently developed and has attracted a great deal of interest in laser assisted lipolysis, including facial contouring. We report herein on a case of multiple EHs (MEHs) that responded well to micropulsed interstitial 1444 nm laser treatment.

Subject and Methods: A 66-year-old Korean female presented with a 12-year history of multiple asymptomatic lesions on her face which appeared especially in the summer. The were histopathologically diagnosed as EHs. The patient was treated with a single session of the micropulsed 1444 nm laser (100 µs pulse width. 200 mJ pulse energy, repetition rate 30 Hz, 6 W of power) delivered interstitially to the lesions with a 600 µm optical fiber. The bilateral total fluence was 240 J/cm².

Results: At one week post-treatment, the entry point scars were invisible, and the patient was very happy with the result. Four weeks post-treatment, even though it was during the summer, gross observation reveled almost total clearance with no side effects. No recurrence was noted in a six-month follow-up period.

Conclusions: A single session of the micropulsed 1444 nm laser could possibly achieve a more effective clearance of MEHs than conventional treatment options. Scarring was nonexistent and recurrence was not seen for 6 months. The good effect was probably due to the high absorption rate of this wavelength in water, coupled with the containment of photothermal damage at the very tip of the fiber, achieved with high peak powers and short micropulses. Further long-term evaluation including large population studies will be needed to determine whether the favorable clinical outcome observed in the present case will apply to the general population with EHs, and if it is permanent.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Journal of Cosmetic and Laser Therapy [Epub ahead of print; July 2013]

SUCCESSFUL REMOVAL OF POLYACRYLAMIDE HYDROGEL BY PULSED FIBEROPTIC 1444-nm Nd:YAG LASER

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Background: Tissue augmentation by polyacrylamide gel (PAAG) may lead to displacement or complications several years later and necessitate its removal.

Objective: To use a fiberoptic 1444-nm Nd-YAG laser for removing polyacrylamide hydrogel augmentations.

Methods: Five patients with frontal and cheek augmentations were referred for gel removal. After nerve block anesthesia, a 600-µm optical fiber tip with a metallic cannula was inserted into a hole created by a 16-gauge needle, and the laser was triggered. The cannula was moved in a fan pattern in the augmented area and then was removed. The tissue was squeezed from its outermost region toward the hole to extrude the gel. The laser system used was a 1444-nm fiberoptic Nd:YAG, Lutronic lasers, South Korea. The parameters used were: pulse rate = 30, pulse energy = 150 J, power = 4.5 W, and total energy= 400–1200 J.

Results: The heat of the laser tip liquefies the gel and by coagulating the surrounding tissues, produces multiple patent canals. These two factors facilitate gel removal by squeezing the tissues. No temporary or permanent complication, such as hematoma, burning, or fibrosis was detected.

Conclusion: The 1444-nm Nd-YAG laser is a safe and efficient method for removing subcutaneous polyacrylamide hydrogel.

© Korean Journal of Dermatology, 2011; 49: 125-130 (in Korean, abstract in English)

THE MEASUREMENT OF OPTIMAL POWER DISTANCE IN LEDs

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Background: The use of light technology in dermatology has grown rapidly over the last decade, with many developments in its use for the treatment of a wide variety of skin conditions from non-melanoma skin cancers to facial resurfacing for photodamaged skin. Light-emitting diodes (LEDs) have attracted much attention in medical fields.

Objective: (1) To assess the optimal distance of 630 nm LEDs [OmniLux®, (Photo Therapeutics Ltd,Tamworth, UK)] and 830 nm LEDs [HEALITE®) (Lutronic, Korea)] for maximum power as determined by a power meter and (2) to apply the theory to practical use.

Methods: Two separate hinged planar light emitting diode arrays were studied: 1) the Omnilux Revive™ which delivers non-coherent red light at a wavelength of 633±3 nm and 2) the Lutronic HEALITE®, which delivers non-coherent light at a wavelength of 830±5 nm. An X93 power meter (Gigahertz-Optik, Germany) was placed against a black background in order to reduce the amount of reflected light. We measured the LED powers over a range of 3-25 cm in 1 cm increments.

Results: On the irradiation side of the LED, power increases according to the mass effect of the radiation angle. However, at a certain distance, the power decline effect predominated over the amassment effect. In this respect, the LED light was estimated to be emitted in a reverse V shape. The proper irradiation distance for use in medical fields can thus be determined.

Conclusion: The proper irradiation distance of LED will be useful and the proper use of LED depending on the shape of the target will be performed in many medical fields

© Laser Therapy, 2011; 20: 205-215

IS LIGHT-EMITTING DIODE PHOTOTHERAPY (LED-LLLT) REALLY EFFECTIVE?

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Background: Low level light therapy (LLLT) has attracted attention in many clinical fields with a new generation of light-emitting diodes (LEDs) which can irradiate large targets. To pain control, the first main application of LLLT, have been added LED-LLLT in the accelerated healing of wounds, both traumatic and iatrogenic, inflammatory acne and the patient-driven application of skin rejuvenation.

Rationale and Applications: The rationale behind LED-LLLT is underpinned by the reported efficacy of LED-LLLT at a cellular and subcellular level, particularly for the 633 nm and 830 nm wavelengths, and evidence for this is presented. Improved blood flow and neovascularization are associated with 830 nm. A large variety of cytokines, chemokines and macromolecules can be induced by LED phototherapy. Among the clinical applications, non-healing wounds can be healed through restoring the collagenesis/collagenase imbalance in such examples, and 'normal' wounds heal faster and better. Pain, including postoperative pain, postoperative edema and many types of inflammation can be significantly reduced.

Experimental and Clinical Evidence: Some personal examples of evidence are offered by the first author, including controlled animal models demonstrating the systemic effect of 830 nm LED-LLLT on wound healing and on induced inflammation. Human patients are presented to illustrate the efficacy of LED phototherapy on treatment-resistant inflammatory disorders.

Conclusions: Provided an LED phototherapy system has the correct wavelength for the target cells, delivers an appropriate power density and an adequate energy density, then it will be at least partly, if not significantly, effective. The use of LED-LLLT as an adjunct to conventional surgical or nonsurgical indications is an even more exciting prospect. LED-LLLT is here to stay.

© Journal of Cosmetic and Laser Therapy; 2012; 14: 107-110

THE SYSTEMIC EFFECT OF 830-nm LED PHOTOTHERAPY ON THE WOUND HEALING OF BURN INJURIES: A CONTROLLED STUDY IN MOUSE AND RAT MODELS

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Background: The present controlled study assessed the systemic effect of 830-nm LED phototherapy in rodent models.

Materials and Methods: Two HR-1 hairless mice and 3 HWY/Slc hairless rats were divided into two groups: the treatment group (Tx Group, one mouse, two rats) and the control group (Con Group, one mouse, one rat). All animals received an identical 12 mm × 12 mm control burn over three sites on the dorsum with a fractional ablative CO_2 laser. Wounds were protected with a film-type dressing. The abdomen of the Tx Group subjects was irradiated with an 830-nm LED array immediately post CO_2 treatment and then at 1, 5 and 6 days post laser irradiation. Wound healing was assessed macroscopically from the clinical photography.

Results: At the 2-day post-laser assessment, the healing process in the wounds in the Tx Group was already apparent compared with the Con Group. At the final evaluation (post-burn day 7), no site on the Con Group (six wounds) showed 100% healing, recovery was over 70% in four and lower than 50% in two sites. Of the nine Tx Group sites, 100% recovery was seen in three sites, over 70% in five sites and one wound was exacerbated through trauma.

Conclusions: LED phototherapy on the abdomen produced faster wound healing of the uniform burn wounds than in animals with the same burn wounds that did not receive LED phototherapy, strongly suggesting the systemic effect of LED phototherapy.

© Laser Therapy, 2013; 22: 43-49

830 nm LIGHT-EMITTING DIODE LOW LEVEL LIGHT THERAPY (LED-LLLT) ENHANCES WOUND HEALING: A PRELIMINARY STUDY

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Background and Aims: The application of light-emitting diodes in a number of clinical fields is expanding rapidly since the development in the late 1990s of the NASA LED. Wound healing is one field where low level light therapy with LEDs (LED-LLLT) has attracted attention for both accelerating wound healing and controlling sequelae. The present study evaluated LED-LLLT in 5 wounds of various etiologies.

Subjects and Methods: There were 5 patients with ages ranging from 7 to 54 years, comprising 2 males and 3 females. The study followed 5 wounds, namely 2 acute excoriation wounds; 1 acute/subacute dog bite with infection; 1 subacute post-filler ulcerated wound with necrotic ischemic tissue and secondary infection; and 1 subacute case of edema and infection of the lips with herpes simplex involvement after an illegal cosmetic tattoo operation. All patients were in varying degrees of pain. All wounds were treated with multiple sessions (daily, every other day or twice weekly) using an LED-LLLT system (830 nm, CW, irradiance of 100 mW/cm² and fluence of 60 J/cm²) till improvement was achieved.

Results: Full wound healing and control of infection and discomfort were achieved in all patients, with wound condition-mediated treatment periods ranging from 1 to 8 weeks. No recurrence of the herpes simplex case was seen in a 4-month follow-up.

Conclusions: 830 nm LED-LLLT successfully brought about accelerated healing in wounds of different etiologies and at different stages, and successfully controlled secondary infection. LED-LLLT was easy and pain-free to apply, and was well-tolerated by all patients. The good results warrant the design of controlled studies with a larger patient population.

© The Journal of Dermatology. 2012; 39: 493-496 (Letter to the Editor)

PRURIGO PIGMENTOSA TREATED WITH JESSNER'S PEEL AND IRRADIATION WITH AN 830-nm LIGHT-EMITTING DIODE

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Background and Aims: Although prurigo pigmentosa (PP) is a rare inflammatory dermatitis of unknown etiology, it is comparatively common in Korean and Japanese women aged approximately 20-40 years. It is characterized by periods of exacerbation and remission, with recurrent eruptions of extremely pruritic erythematous macules and papules that resolve leaving reticulate hyperpigmentation. We describe herein two young women with PP who were successfully treated with Jessner's peel and 830-nm light-emitting diode (LED) phototherapy.

Patients and Methods: Patient 1 was a 17-year-old girl with an intractable and severe itchy rash of 4 weeks' duration with lesions on her chest and back, and patient 2 was a 22-year-old Korean female with a 4-week history of similar intensely pruritic lesions on her upper back, posterior neck and chest. Both patients were on a weight-control diet. Both patients were treated with oral minocycline, antihistamine and topical corticosteroids, and the pruritis and erythema improved. After 2 weeks in patient 1 the scaly patches became more severe with hyperpigmentation, and after 1 week in patient 2, reticular hyperpigmentation appeared. Both patients was started on weekly treatments with a superficial chemical peel (Jessner's solution) followed immediately with LED phototherapy (HEALITE™, Lutronic Corp, Ilsan, Korea), 830 nm, continuous wave, 60 J/cm² over 20 min.

Results: In patient 1, after 1 month of weekly treatments her reticular pigmentation had cleared, and the pigmentation did not recur during a subsequent 10-month follow-up, although the lesions did recur. In the case of patient 2, after 6 weekly sessions, her pigmentation had cleared (Fig. 1d). No recurrence was observed within the following 10 months.

Conclusions: Most current treatments of PP are focused on the early stage, with no previous reports of the treatment of hyperpigmented lesions. We found that treatment with Jessner's peel and 830 nm LED phototherapy effectively reduced the PIH sequelae and should therefore be considered a good noninvasive treatment option.

(Abstracted by Dr. R Glen Calderhead, MSc, PhD, DrMedSci, FRSM)

© Annals of Dermatology. 2013; 25: 163-167

THE EFFECTS OF 830 nm LIGHT-EMITTING DIODE THERAPY ON ACUTE HERPES ZOSTER OPHTHALMICUS: A PILOT STUDY

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Background: Skin lesions and pain are the most distinctive features of herpes zoster. Light-emitting diode (LED) therapy is an effective treatment known for its wound-healing effects.

Objective: To determine whether the LED treatment affects wound healing and acute pain in acute herpes zoster ophthalmicus.

Methods: We recruited 28 consecutive Korean patients with acute herpes zoster ophthalmicus for the study. In the control group (group A), 14 subjects received oral famcyclovir. In the experimental group (group B), 14 subjects received oral famcyclovir and 830 nm LED phototherapy on days 0, 4, 7, and 10. In order to estimate the time for wound healing, we measured the duration from the vesicle formation to when the lesion crust fell off. The visual analogue scale (VAS) was used for the estimation of pain on days 4, 7, 10, and 14.

Results: The mean time required for wound healing was 13.14±2.34 days in group B and 15.92±2.55 days in group A (p=0.006). From day 4, the mean VAS score showed a greater improvement in group B, compared with group A. A marginal but not statistically significant difference in the VAS scores was observed between the two groups (p=0.095).

Conclusions: LED treatment for acute herpes zoster ophthalmicus leads to faster wound healing and a lower pain score.

© Laser Therapy, 2012; 21: 105-111

INFLAMMATORY ACNE IN THE ASIAN SKIN TYPE III TREATED WITH A SQUARE PULSE, TIME RESOLVED SPECTRAL DISTRIBUTION IPL SYSTEM: A PRELIMINARY STUDY

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Background and Aims: Acne remains a severe problem for both patients and clinicians. Various approaches using photosurgery and phototherapy have been reported with varying degrees of success and robustness of results. An improved intense pulsed light (IPL) system has become available with interesting beam characteristic which might improve IPL treatment of inflammatory acne in the Asian skin, Fitzpatrick type III/IV.

Subjects and Methods: The 18 study subjects comprised 15 females and 3 males with active mild to moderately severe inflammatory acne (mean age 25.3 ± 7.70 yr, range 17-47 yr, Burton scale 1-4, all Fitzpatrick type III Asian skin). They were treated once (8 subjects) or twice (10 subjects) with an IPL system offering both square pulse and time resolved spectral distribution technologies (420 nm cut-off filter, 30 ms pulse, 8-12 J/cm², 2-3 passes). Clinical photography was taken at baseline and at 4 weeks after the final treatment. Percentage of acne clearance was assessed by an independent dermatological panel and graded from zero to 5, 5 being total clearance.

Results: All subjects completed the study. Post-treatment side effects were mild and transient, with virtually no downtime or postinflammatory hyperpigmentation (PIH) experienced by any subject. All subjects had some improvement and no exacerbation was seen in any subject. Clearance was evaluated by the panel as grade 4 in 5 subjects, grade 3 in 8, grade 2 in 4 and grade 1 in 1, so that 14 of 18 subjects (78%) had clearance of at least 60%. Patient evaluation was in general slightly better than that of the panel.

Conclusions: The special beam characteristics of the IPL system used in the present preliminary study achieved good to very good results in the treatment of acne in the Fitzpatrick type III Asian skin without PIH induction. The results suggested that acne treatment in the Asian skin using this system is both safe and effective, and merits larger population studies to further optimize parameters and standardize top-up treatments.

© Journal of Cosmetic and Laser Therapy [Epub ahead of print; October 2012]

A FRACTIONAL 2,940 nm SHORT-PULSED, ERBIUM-DOPED YTTRIUM ALUMINIUM GARNET LASER IS EFFECTIVE AND MINIMALLY INVASIVE FOR THE TREATMENT OF PHOTODAMAGED SKIN IN ASIANS

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Background: Although ablative fractional laser for the facial photodamaged skin was effective and safe, there have been only limited reports regarding the efficacy and safety of fractional Er:YAG laser treatments for photodamaged facial skin in Asians.

Objective: Our objective was to assess the efficacy and safety of the Er:YAG laser (2,940 nm) using the ‘‘ablative’’ fractional resurfacing mode to treat photodamaged facial skin.

Methods: A total of 29 Korean patients were treated for photodamaged facial skin using a fractional Er:YAG laser. The number of treatment was mean 2.3 sessions at two-week intervals. Independent investigators assessed the efficacy using standardized photographs. The patients’ satisfaction rate was also evaluated.

Results: For dyspigmentation, 62.5% of the treated patients showed improvement greater than 26%. Regarding wrinkles, 50% of the treated patients showed improvement greater than 26%. All patients showed various degrees of improvement in skin laxity. Assessing the overall features, 62.5% of the study subjects showed improvement greater than 26%, and most of them (91.7%) reported that their subjective satisfaction rate was above “slight satisfaction”. Downtime accounted for approximately one week in most patients.

Conclusions: A fractional Er:YAG laser can deliver an effective and minimally invasive treatment for photodamaged facial skin in Asians.

© Medical Lasers, 2012; 1: 11-15

LONG-PULSED ALEXANDRITE LASER VS. INTENSE PULSED LIGHT FOR AXILLARY HAIR REMOVAL IN KOREAN WOMEN

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Background and Objectives: Although several lasers are available for treatment of unwanted hair, treatment of darker skin types is especially challenging because of increased concentrations of epidermal melanin. The laser energy absorbed by targeted hair follicles is reduced, and the risk of side effects in the epidermis is increased. While many studies have documented the safety and efficacy of different laser systems, few studies investigating laser hair removal in Korea have been reported. This study was conducted in order to compare effectiveness, satisfaction level, and safety of a long-pulsed alexandrite laser and intense pulsed light (IPL) in axillary hair removal in Korean women.

Materials and Methods: In this within-patient, right-left, assessor-blinded comparative study, 13 female patients with Fitzpatrick skin type III to IV were randomized for treatments with the long-pulsed (755 nm) alexandrite laser and IPL (600-950 nm filter) on their right or left side of the axilla. Three sessions of treatment at four week intervals were performed; follow-ups were conducted eight weeks after the last treatment. Hair counts and photographic evaluation of treated sites were performed at baseline and at the last follow-up. The patients scored satisfaction rates and degree of pain for both devices.

Results: Thirteen patients completed the study. At eight weeks after the final treatment, the decrease in hair counts on the alexandrite laser side (96%) was greater than that on the IPL side (86% vs. pretreatment). The score for patient-evaluated overall satisfaction was higher with the alexandrite laser, although higher pain scores were reported with the alexandrite laser. A burn was observed on one patient on the alexandrite laser side, but was transient and recovered without sequelae.

Conclusions: Both systems demonstrated satisfactory hair removal results, as reported by both patients and clinician. The long pulsed alexandrite laser can be used effectively and safely for hair removal in darker skin types.

© Journal of the Korean Academy of Periodontology, 2008; 38: 657-668 (in Korean, abstract in English)

EFFECTS OF RESOLUTION OF INFLAMMATION FOR LOW-POWER CO_2 LASER TREATMENT IN GINGIVITIS PATIENTS

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Purpose: In this study, we compared low-power CO_2 laser treatment to ultrasonic scaling, which is generally approved as a power-driven mechanical instrumentation, and evaluated both of these treatments regarding their clinical effectiveness and change in the volume of in GCF.

Materials and methods: Twenty patients who had gingivitis were selected to participate in the study. None of the patients has any systemic problems. Randomly selected, one quartile received ultrasonic scaling only, another quartile received ultrasonic scaling and CO_2 laser irradiation, the other quartile received CO_2 laser irradiation only. The final quartile served as the control group. Clinical parameters were measured at baseline, 1 week, 2 weeks, 4 weeks and 8 weeks

Results: Pocket probing depth and clinical attachment level were not changed during the study period. Gingival index of all groups improved after treatment. At 1 week after treatment, the gingival index of the ultrasonic scaling group was significantly different compared to the control group. At 2 weeks after treatment, the gingival index of all experimental groups were significantly different compared to the control group. At 4 and 8 weeks after treatment, the gingival index of all group had increased, but the experimental group was lower than the control group. Sulcus bleeding index was similar to the results of the gingival index. At 1 week after treatment, all experimental groups were significantly different compared to control group and this was maintained throughout the study. At 2 weeks after treatment, sulcus bleeding index of all group was lowest during the study. Gingival crevicular fluid was measured with a Periotron 8000 (Oraflow, Inc. USA). At baseline, all groups showed a moderately severe condition. At 1 week after treatment, the laser treatment group demonstrated the greatest reduction in the quantity of gingival crevicular fluid, although gingival crevicular fluid was somewhat reduced in the other groups. At 2 weeks after treatment, all groups were in a healthy state. At 4 and 8 weeks after treatment, all groups showed recurrence of inflammation, and the control group was the most significantly increased.

Conclusions: This study showed that the effects of CO_2 laser treatment were similar to conventional ultrasonic scaling but with a longer latency period than plaque control only.These results suggest the potential application of CO_2 laser treatment for altered periodontal therapy.

© Lasers in Surgery and Medicine, 2010; 42: 257-263

IN VITRO STUDY OF THE SOFT TISSUE EFFECTS OF MICROSECOND-PULSED CO_2 LASER PARAMETERS DURING SOFT TISSUE INCISION AND SULCULAR DEBRIDEMENT

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Background and Objectives: Carbon dioxide (CO_2) lasers are an important part of dental treatment. Advances in laser technology have produced microsecond pulse durations and small beam sizes. The histological effects on porcine intraoral soft tissue with a range of microsecond-pulsed CO_2 laser parameters used for incision and sulcular debridement were evaluated *in vitro* and compared with historical histologic data.

Study Design/Materials and Methods: Fresh pig mandibles were used as the targets for incision and sulcular debridement using a microsecond-pulsed CO_2 laser, wavelength at 10,600 nm, articulated arm delivered, non-contact with spot size 200 µm, 500 µm, and 1 mm, and focal distance of 1 mm. For sulcular debridement, epithelium within a periodontal pocket (6 mm x 6 mm) was removed. Laser parameters for incision were from 30 Hz, 350 microseconds, 28 mJ and energy density of 143 J/cm² to 90 Hz, 1,000 microseconds, 60 mJ, and 1,911 J/cm². Width and depth of tissue removed, as well as coagulation effects of the tissue treated were measured. These were compared to a historical histologic database. Laser-treated surfaces were observed qualitatively using scanning electron microscopy (SEM).

Results: All laser parameters studied were able to reach the defined simulation objectives in reasonable amounts of time, less than a minute for incision and <20 seconds for sulcular debridement. The depth of the cut was significantly greater than the historical 95% confidence interval, but equivalent for width, lateral, and deep coagulation to the historical database. Sulcular debridement was achieved with minimal coagulation, <100 mm. SEM analysis did not identify any alteration to enamel, dentin, or bone during sulcular debridement.

Conclusion: The treatment objectives of incision and sulcular debridement were achieved with minimal lateral and deep coagulation in reasonable amount of time. Microsecond-pulsed CO_2 lasers can be safely and effectively used for incision and sulcular debridement.

© Photomedicine and Laser Surgery, 2012; 30: 331-338

SCREENING OF CO_2 LASER (10.6 µm) PARAMETERS FOR PREVENTION OF ENAMEL EROSION

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Background data: A new clinical CO_2 laser providing pulses of hundreds of microseconds, a range known to increase tooth acid-resistance, has been introduced in the market.

Objective: The aim of this study was to screen CO_2 laser (10.6 µm) parameters to increase enamel resistance to a continuous-flow erosive challenge.

Methods: Different laser parameters were tested in 12 groups (n=20) with varying fluences from 0.1 to 0.9 J/cm², pulse durations from 80 to 400 µs and repetition rates from 180 to 700 Hz. Non-lased samples (n=30) served as controls. All samples were eroded by exposure to hydrochloric acid (pH 2.6) under continuous acid flow (60 µL/min). Calcium and phosphate release into acid was monitored colorimetrically at 30 sec intervals up to 5 min and at 1 min intervals up to a total erosion time of 15 min. Scanning electron microscopic (SEM) analysis was performed in lased samples (n=3). Data were statistically analyzed with a one-way ANOVA ($p<0.05$) and Dunnett‘ s post-hoc tests.

Results: Calcium and phosphate release were significantly reduced by a maximum of 20% over time in samples irradiated with 0.4 J/cm² (200 µs) at 450 Hz. Short-time reduction of calcium loss (equal to or less than 1.5 min) could be also achieved by irradiation with 0.7 J/cm² (300 µs) at 200 and 300 Hz. Both parameters revealed surface modification.

Conclusions: A set of CO_2 laser parameters was found that could significantly reduce enamel mineral loss (20%) under *in vitro* erosive conditions. However, as all parameters also caused surface cracking, they are not recommended for clinical use.

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