

on tissue, time-integrated spectral exposure and the retinal thermal hazard weighting function as described in by IEC TR 60825-9. All measurements were taken with traceability to national standards.

Results: The results are presented as a 9-stage flow diagram. The home-use IPL hair removal device used in this worked example under worst-case conditions shows that any exposure to the human eye will not permanently damage retinal tissue and that safety eyewear is not a necessity.

Conclusion: By a worked example, following a simple flowchart, it is shown that the ocular hazard calculation of any intense light equipment can be worked through easily and the protective density of eyewear determined. Prior to publication of the draft revised IEC 60601-2-57 international standard for Optical radiation safety and laser equipment, all suppliers of professional and home-use intense light equipment should refer to BS 8497-2 to evidence ocular safety.

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MEASUREMENT OF WAVELENGTH DEPENDANT PULSE DURATIONS AND FLUENCE VARIATION WITHIN A DISCHARGE OF BROADBAND INTENSE PULSED LIGHT USING TIME-RESOLVED SPECTROSCOPY

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Background: High quality IPLs can offer simple, safe and effective treatments for long-term hair reduction and removal of benign vascular and pigmented lesions. Significant differences in clinical outcomes have been recorded amongst different IPL systems despite comparable display settings. This study illustrates the variation in pulse structures used by several popular intense pulsed light (IPL) systems available to clinics and estheticians. Using five well-known wavelengths, Dye (585 nm), Ruby (694 nm), Alexandrite (755 nm), Diode (810 nm), and Nd:YAG (1064 nm), the study investigates whether the exposure pulse duration within a broadband spectral discharge, is wavelength dependant.

Study: Using a fast spectrometer, generating 1,000 full spectral scans per second, time resolved spectral data of IPL outputs was captured with a resolution of 0.035 nm. IPL spectral outputs were graphically illustrated as an excel spreadsheet.

Results: The pulse durations measured, were found to be different for the five wavelengths, but this difference is probably biologically negligible. The rate of change of fluence during the pulse is the same for different wavelengths within the same pulse. The relationship between the fluence distribution during the pulse and chromophore heating is explored and modeled for hair follicles using computer simulation for optimum results.

Conclusion: Fluence differences during the pulse, especially peak fluence at the start of a free discharge IPL pulse has a greater likelihood of causing adverse skin reactions. Constant delivery of energy across the pulse duration is shown to generate efficient specific heating of the target chromophore.

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THE ACTION OF ANTIOXIDANTS, FULLERENE ON LASER THERAPY OF PIGMENT SPOTS

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Background: Our studies had disclosed that treated area with 1440 nm fractional LASER were induced to generate ROS (Reactive oxygen species) which contain hydrogen- and super oxide radicals in the guinea pig skin in ASLMS 2008. Those are highly reactive molecules and are cause damage to cell. ROS were significantly reduced by antioxidants. The C₆₀-Fullerene is expected novel and potent anti-oxidants, more effectively protect skin cells from oxidative stress, and more stable than ascorbate in ultraviolet rays and heat. ROS is one of the induction factors for inflammation so we measured COX-2 mRNA expression level in the skin. Furthermore we examined whether fullerene as radical scavenger repress hyperpigmentation after LASER treatment in human skin.

Study: Measurements of COX-2 mRNA: 0.5%-water-soluble fullerene (C60: 10 ppm) was applied to 5 guinea pigs back two days before laser irradiation with AFFIRM (Cynosure: Nd-YAG: 1440 nm: 3 J/cm² 1times each area). 1.5 hr after irradiation LASER, RNA samples were extracted from each skin, which is normal, LASER irradiation and LASER with fullerene treated area. COX-2 mRNA was quantified by SYBR Green method with ABI 7500. GAPDH3 was measured to be an internal control. Evaluation of hyperpigmentation: 0.5%-Fullerene/2%-HQ (Hydroquinone) or 2%-HQ creams were applied to two pigment spots of human skin, respectively. After 1 week, these were treated by LASER (SYNOSURE Accolade: 4.6 J/cm²) and followed up by photos.

Results: Expression of COX-2 mRNA at LASAR irradiation skin area remarkably increased than non irradiation area. At fullerene treated area, COX-2 mRNA was decreased than LASAR irradiation area. Result of observing skin of laser irradiation area after two weeks, 0.5%-Fullerene/2%-HQ area was slightly brighter than 2%-HQ area.

Conclusion: These data suggests that fullerene might have drug action antiphlogistic for inflammation which is induced by ROS.

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CHARACTERIZATION OF IRRADIATED BONE BY FTIR

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Background: The bone cut is very common in medical and dental surgeries. In some cases, the use of laser can be more advantageous than drill, due to less mechanical damage and more defined cut. However, it is necessary to know the effects of laser irradiation on bone tissues, regarding its possible undesirable chemical changes. In this study, FTIR (Fourier-Transformed Infrared) spectroscopy was used to compare ablated and non-ablated bones, and to verify the chemical changes promoted by irradiation.

Study: Rabbit bones were cut in blocks, and samples were polished down to 0.1 mm. Firstly, samples were analyzed by FTIR; after this initial analysis, all samples were irradiated using a pulsed Er,Cr:YSGG laser, with 2780 nm wavelength, at energy density of 6.06 J/cm². During irradiation, samples were positioned at a motorized translation stage and were moved at speed of 13 mm/s to avoid pulse overlapping. After irradiation, samples were submitted to a new FTIR analysis. In order to verify any changes due to irradiation, the area under phosphate (1030–1150 cm⁻¹),

amides ($1680\text{--}1200\text{ cm}^{-1}$), OH^- ($3600\text{--}2400\text{ cm}^{-1}$), and carbonate (around 875 cm^{-1} and between $1560\text{--}1410\text{ cm}^{-1}$) bands were calculated, and normalized by phosphate band area. All data were subjected to ANOVA/Tukey analysis at 5% significance level.

Results: It was observed that Er,Cr:YSGG irradiation promoted a significant decrease on the contents of amides I, II and III, evidencing that laser treatment caused an evaporation of the organic content of bone and changed the collagen structure. It was also observed a significant reduction of carbonate (875 cm^{-1}), suggesting an increase of cristallinity on irradiated bones.

Conclusion: According to the results of this study, Er,Cr:YSGG laser irradiation promoted chemical changes on bones. These changes could be the responsible for the faster initial stages of healing processes reported in literature studies for laser cuts.

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IN VIVO MULTIPHOTON MICROSCOPY OF TOLUIDINE BLUE STAINING IN HEALTHY AND NEOPLASTIC ORAL TISSUE

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Background: A positive Toluidine blue (TBO) stain has been used clinically as an indicator of oral neoplasia for many decades. Clinical visualization of the stain is used as a subjective evaluator of lesion presence and delineation. Preliminary studies have demonstrated that a positive TBO stain can be mapped accurately and quantified in 3-D at tissue surface and subsurface using in vivo multiphoton microscopy (MPM). Subsequent selective photodestruction of the stained tissues using Photodynamic Therapy (PDT) may also be possible. However, the precise localization and potential binding sites of TBO within the tissues remain unknown. This information is foundational if TBO is to be used for high-resolution diagnosis and selective PDT. The objective is to identify at a cellular level, localization and potential binding sites of TBO in healthy and neoplastic oral tissues.

Study: Using the standard hamster cheek pouch model for oral carcinogenesis over 0–16 weeks, and non-invasive in vivo multiphoton microscopy (MPM), the distribution, localization and concentration of TBO in healthy and neoplastic oral mucosa was mapped and quantified.

Results: A positive TBO stain identifies and delineates surface and subsurface neoplasia. TBO penetrated to a depth of up to 100 μm within the tissues. It showed a strong presence in malignant tissues, and in areas of high vascularity.

Conclusion: TBO penetrates effectively into the oral mucosa, permitting accurate visualization and quantification of surface and subsurface presence.

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OZONE THERAPY vs PHOTOBIO-MODULATION IN HEALING OF DRY SOCKET

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Background: Alveolar osteitis is an inflammation of alveolar socket after tooth extraction. It mostly occurs after lower wisdom tooth extraction. Wound healing may be delayed due to the lack of oxygen supply, excessive secretion or low pH. Starting factors

include surgical trauma, local ischemia, smoking, systemic bone diseases, immunodeficiency, oral microbial flora (state of oral hygiene), signs of inflammation inside oral cavity and general health state of the patient. Wound healing is slowed by necrotic tissues, exsudation and metabolic debris. Without proper cleaning process is slowed and infectious complications may appear.

Conventional treatment of alveolar osteitis contains regular in-office wound cleaning with subsequent alveolar dressing (mostly local antibiotic and anesthetic, sometimes corticosteroid).

Antibiotics are generally administered in case of purulent osteitis. Prescription of painkillers is necessity. This strategy offers slow improvement in days, needs regular check-up, with significant risk of medical side-effects (antibiotics). Many patients are disabled for one week or more. They are many strategies how to improve results with physical therapy. Most common and recommended alternatives today: ozonotherapy, intraoral laser photobiomodulation and extraoral LED photobiomodulation.

Ozone treatment is based on antimicrobial, antihypoxic and immunomodulatory effects of ozone. This method is cheap but highly controversial. They are many countries which promote this method like low-cost, low risk alternative. But they are many others (incl. USA) which see ozone like toxic substance without better effect than alternatives. Laser photobiomodulation is based on stabilization of cell membranes by a non-thermal photochemical process, increase of cellular metabolism and minor thermal changes, and possibly induced endorphin release.

Extraoral LED photobiomodulation uses cheaper and more ergonomical alternative to laser. LED is so cheap that offers enough output to make general photobiomodulation so direct illumination of wound is not mandatory. Aim of this study is to compare conventional treatment of alveolar osteitis with those three alternative methods to find best choice and starting point for future treatment improvements.

Study: A group of 80 patients with diagnosis alveolar osteitis after surgical extraction of third lower molars was formed. It included men and women aged from 18 to 50 years old. The teeth were extracted because of their complicated eruption. All patients were divided in 4 groups of 20 – A, B, C and D. Treatment in every group was conducted according to special protocol. Patients from group A were treated with conventional therapy – alveolar dressing with antibiotics (Framykoin, Zentiva, Czech republic) were replaced every day. There was no general administration of antibiotics. Patients from group B received ozone therapy.

Ozonated water with ozone concentration of 4 mg/l produced by the chair-side ozone generator TAO 80 was used for extraction wound irrigation. This procedure was conducted every day until the minimization of subjective symptoms took place. Group C patients were treated with laser. Laser biophotomodulation (670 nm, 35 mW, 5 minutes) was directly applied on extraction wound. Indirect LED photobiomodulation was applied in patients from group D. They were enlightened with OmniLux Clar-U LED lamp (670 nm, 4 W, 10 minutes) everyday during the treatment. After this session a medicinal alveolar pack was replaced in the extraction wound. Subjective symptoms (pain, “bad breath”) and objective examination (local inflammation signs) were assessed. Objective classification was provided by independent evaluator who not performed treatments, methods were blinded. Regular pictures were made. Subjective classification of pain, was evaluated daily by patients using a numerical rating scale 0–10. Groups of patients were statistically compared.

Results: A—Conventional treatment of patients lasted approximately for $8,4 \pm 0,6$ days. After this time period they didn't observe any subjective symptoms (pain, “bad breath”, troubles with mouth opening). No local inflammation signs were notices during objective examination. B—Irrigation of ozonated water