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laser

the international C.E. magazine of laser dentistry

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Diode laser surface decontamination in periodontitis therapy

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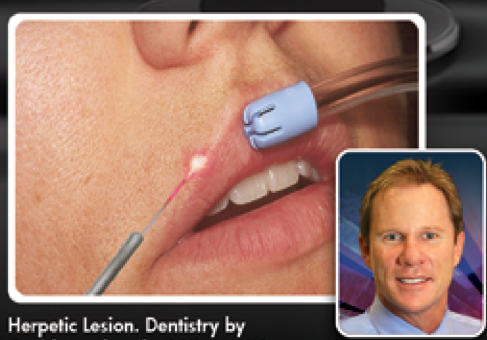

Herpetic Lesion. Dentistry by David Hornbrook, DDS, FAACD.

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Rapidly advancing technology has given dentists the ability to treat patients in new and innovative ways. One of the most exciting advances, of course, is laser technology. And that is what makes the publication you are holding right now so valuable.

For this issue of *laser*, we've assembled a collection of articles from some of the most respected names in laser dentistry. These expert clinicians are sharing their knowledge and expertise with you.

Within these pages, you can read about research on diode laser surface decontamination in periodontitis therapy by Dr. Georg Bach of Germany, and temperature changes in subperiostal bone during laser frenectomies in sheep jaws by Dr. Anastasios Manos and Prof. Nicolaos Parissis of Greece. There are two articles on the use of lasers for periodontal treatment by Dr. Howard Golan of the United States, Dr. Fay Goldstep and Dr. George Freedman of Canada. Dr. Thorsten Kuypers of Germany offers a user report on the use of a minimal-invasive laser technique for surgical crown lengthening. The scientific portion of this issue concludes with a look back at the invention of laser technology by Dr. Ingmar Ingenegeren of Germany.

But there's more.

Every issue of laser magazine also contains a C.E. component. By reading the articles on low-level laser therapy by Drs. Tristan Hunt, Eason Hahm and Praveen Arany of the United States, and implant exposure with Er:YAG laser by Dr. Gerd Volland of Germany, then taking a short online quiz about these articles at *www.DTStudyClub.com*, you will gain one ADA CERP-certified C.E. credit. Keep in mind that because *laser* is a quarterly magazine, you can actually chisel four C.E. credits per year out of your already busy life without any lost revenue or time away from your practice.

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I know that taking time away from your practice to pursue C.E. credits is costly in terms of lost revenue and time, and that is another reason *laser* is such a valuable publication.

I hope you enjoy this issue and that you get the most out of it.

Sincerely,

Torsten Oemus
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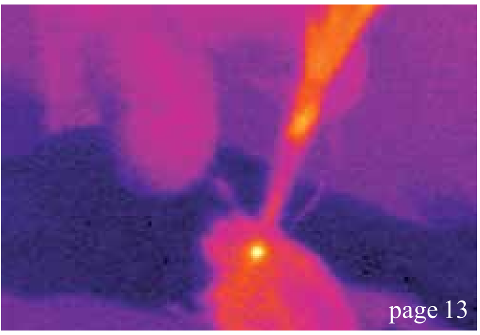
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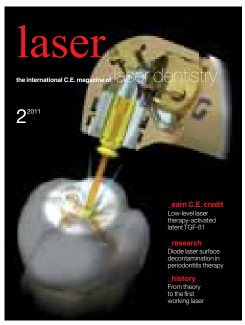

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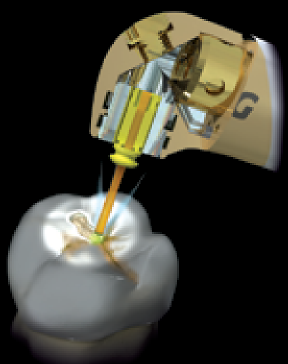

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Low-level laser therapy-activated latent TGF-ß1

Authors_Tristan Hunt, Eason Hahm and Praveen Arany

A potential molecular pathway mediating the nexus between inflammation and wound healing in oral tissues

_c.e. credit part 1

This article qualifies for C.E. credit. To take the C.E. quiz, log on to *www.dtstudyclub.com.*

_Low-level laser therapy in dentistry

For more than 30 years, lasers have been a part of dentistry and oral surgery predominantly as surgical tools. Surgical lasers currently used in dental practice include CO2 lasers, Nd:YAG lasers, Er:YAG lasers and diode lasers.[1] CO2 lasers have been used to precisely remove superficial tissue layers while leaving underlying tissues relatively undamaged and are especially valued for their coagulation effects. Er:YAG lasers have been used for ablation of soft and hard tissues and to sterilize root canals and periodontal pockets while Nd:YAG lasers have been used for debridement of calculus and the reduction of endodontic microbes. The diode lasers have been used for variety of low-level applications from analgesia to stimulating healing.

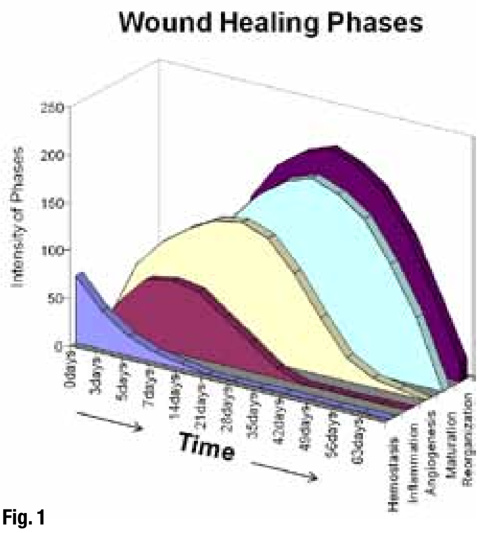

Fig. 1

Low-level laser therapy (LLLT) is considered a non-invasive and painless process that uses photonic energy to provide biological therapeutic advantages, including analgesic capabilities.[2] While these types of lasers are still used surgically, clinicians have been increasingly using LLLT in the past 10 years. Rather than cut or ablate, low-level lasers take advantage of certain photobiological processes, the mechanistic molecular basis of which are yet to be fully characterized. These lasers function in the milliwatt range instead of the higher wattage (0.5 to over 1 W) used by the surgical lasers.

The clinical applications of a low-power laser for patient care in dentistry have been used to reduce inflammation, relieve pain and discomfort – including hypersensitive dentine – and promote wound healing.[3] There are some clinical studies but few rigorously controlled trials to demonstrate the efficacy of LLLT definitively, as well as a paucity of basic science research to probe its mechanistic underpinnings in its various dental applications. This short review does not attempt to comprehensively overview the state of the field, but highlights some of the recent human clinical studies that have attempted to directly explore the efficacy of LLLT on inflammation and healing in oral tissues.

_Inflammation

Inflammation is a complex reaction to injurious agents, such as microbes and damaged, usually necrotic, cells that consist of vascular response, migration and activation of leukocytes and systemic reaction.[4] Inflammation is usually a protective pathophysiological response of the body to help prevent noxious damage and return to a homeostatic physiological state. But in scenarios of persistent stimuli or uncontrolled inflammatory reactions, this mechanism can turn pathological and harm the host instead.

_Wound healing and regeneration

Wound healing, on the other hand, is the resolution of inflammation that succeeds the inflammatory reaction. The ultimate goal of healing is to remove all traces of the inflammatory reaction, along with the noxious stimuli, and return tissues to their original structural and functional homeostatic state. The ideal outcome of wound healing is a complete restoration of the damaged tissue and is termed "regeneration." There are two possible modes of regeneration, although these two processes are not sharply delineated and may coexist in certain scenarios. Firstly, the mode of regeneration involving proliferation of material preceding development of the new part is termed "epimorphosis," while the other involves transformation directly into a new organism or part of an organism without proliferation at the cut surfaces, termed "morphallaxis."[5]

_The nexus of inflammation and healing with timing of LLLT

While inflammation is critically important and precedes healing, a persistent inflammatory reaction will interfere with effective healing. The ability to modulate the inflammatory response by changing the initial milieu of factors can potentially direct the eventual healing process. The use of LLLT attempts to do just this by delivering photonic energy in this early inflammatory, post-injury scenario that could activate or inactivate specific molecular pathways, accelerating the resolution and the subsequent healing process. The early or repeated use of LLLT during the persistence of the inflammatory phase is therefore a central aspect in defining its clinical efficacy. The use of LLLT in a chronic inflammatory scenario will probably be inefficacious due to the recurrent, persistent noxious stimuli and the poor healing milieu. We believe LLLT does not create a novel in vivo scenario but aids in the re-establishment of homeostatic mechanisms, often accelerating its natural trajectory.

_LLLT in gingivitis and periodontitis

Gingivitis generally is not associated with significant pain, and thus the LLLT studies have fo-

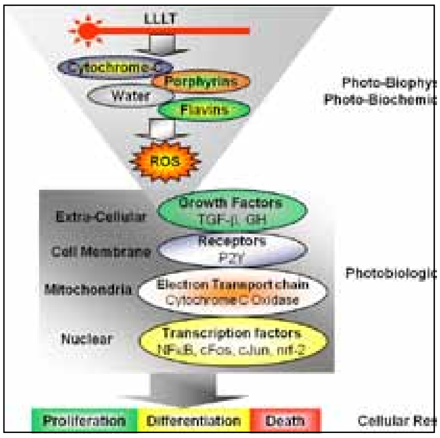

Fig. 2

cused on its anti-inflammatory effects.[1] In one study, 10 female subjects refrained from all oral hygiene for 28 days in an effort to induce gingivitis. On day 21 and day 24, the marginal gingival, buccal to the one of the lateral mandibular incisors, was irradiated for four minutes by LLLT. Results showed no statistical difference between the laser and control sites in regards to the level of plaque formation or gingival bleeding.[6] In a more recent study, patients were subjected to 10 LLLT sessions with a 670 nm laser to treat gingival inflammation. Clinical parameters such as the gingival index, plaque index and probing index at one, three and six months after laser or conventional oral hygiene therapy were assessed. While both methods are successful at reducing gingivitis, the authors concluded that LLLT leads to better therapeutic results.[7]

Periodontitis, due to pathogenic bacterial species, often presents with bleeding and swelling of the gums, halitosis, gingival recession, and if untreated can lead to tooth loss. Qadri et al. showed that treatment with LLLT along with routine oral hygiene measures reduced gingival inflammation.[8]

In a split mouth, double-blind study, patients with moderate chronic periodontitis were treated with a 635 nm InGaAlP diode laser at 4.5J/cm2 and a 820 nm GaAlAs diode laser at 8.75 J/cm2 following basic periodontal treatments of scaling, root planning and oral hygiene instructions. Following treatment, plaque and gingival indices as well as pocket depth were all reduced for the laser-treated side, indicating a reduction in inflammation. Additionally, analyses of gingival crevicular fluid showed decrease matrix metalloproteinase-8 (MMP-8) in the laser-treated side that has been linked directly to the severity of inflammation. Another study by the same group observed that the longer coherence length of an HeNe laser had a more pronounced biological effect than an InGaAlP diode laser on gingival inflammation.[9]

In a study performed to evaluate LLLT as an initial treatment for periodontitis, 30 subjects ranging from ages 20 to 60 who had periodontal pockets