Dental

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Effect of soft laser and bioactive glass on bone regeneration in the treatment of infra-bony defects (a clinical study).

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This study aimed to investigate the influence of low-power 830 nm gallium-aluminium-arsenide (GaAlAs) laser [continuous wave (CW) 40 mW and fluence 4 J/cm(2), with total energy density of 16 J/cm(2)] on the healing of human infra-bony defects treated with bioactive glass graft material. Twenty patients with chronic periodontitis and bilateral infra-bony defects were included. Using a split mouth design, we treated 20 defects with bioactive glass plus laser irradiation during surgical procedures and on days 3, 5, 7 postoperatively; 20 contra-lateral defects were treated with bioactive glass only. Clinical probing pocket depths, clinical attachment levels and standardized periapical radiographs were recorded at baseline and at 3 months and 6 months postoperatively. At 3 months there was a statistically significant difference between the laser and non-laser sites in the parameters investigated. However, at 6 months, no difference was observed. Our results have confirmed the positive effect of soft laser in accelerating periodontal wound healing.

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Low level laser treatment (LLLT) during & after multiple teeth extirpations- randomised clinical study with control group

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Multiple teeth extraction is a dental surgical procedure, which is sometimes followed by complications like haemorrhage, oedema, pain and inflammation, leading to intake of related drugs, usually analgesics. The current clinical study was conducted in order to observe the efficacy of LLLT applied during and immediately after multiple teeth extractions.

Study Design - Irradiation Parameters: Total number of patients: 40, randomly allocated to two groups (20 p. - irradiated, Energy density applied: 4J/cm 2 HeNe laser & IR Laser; 20 p.- control group, no laser irradiation). The following parameters were observed: haemorrhage, oedema, redness and pain. The presence of each parameter was scored as follows: absent (0 point), mild (5 points), moderate (10 points), severe (15 points), worst (20 points).

The difference was calculated for each evaluated parameter, and demonstrated significance in favour of LLLT ($p<0.05$). The difference in number of patients with pain and those who took of analgesics was significant between both groups at the level of $p<0.00l$.

Advantages of LLLT are: no bleeding or oedema, no inflammation, significantly reduced intake of analgesic drugs - reduced presence of pain, reduced stay in hospital, fewer incidence of postoperative complications, no harmful or side effects observed.

Low level lasers in dentistry

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A wide range of different lasers are used in modern dentistry. The Erbium:YAG laser has a potential of replacing the drill in selected situations; the carbon dioxide laser is a valuable tool in oral surgery; the Argon laser is used in minor surgery and composite curing; the Nd:YAG is used in pocket debridement, tissue retraction and more. This is just to mention a few of the possibilities of the dental laser.

The major drawback so far has been the high cost compared to the conventional therapies and the fast development in the field. The high cost of the investment may not have paid off until the next generation of lasers is on the market. So far the majority of the dentists using lasers are mainly the entrepreneurs and the enthusiasts.

All the above listed lasers are using, or have the possibility of using high powers, ranging from fractions of a watt to 25 watts or more.

Interest from media and patients has been considerable during the last decade, party because of a general interest in "high-tech" and partly because of the eternal dream about an escape from the discomfort experienced in the dental chair.

This article will summarize the physics, science and clinic of a quite different type of dental lasers - the low level laser.

Low level lasers

While the lasers already mentioned can be labeled "High level lasers", there is a less

known type of lasers called "Low level lasers". These lasers are generally smaller, less expensive and operate in the milliwatt range, 1-500 milliwatts. The therapy performed with such lasers is often called "Low Level Laser Therapy" (LLLT) or just “laser therapy” and the lasers are called "therapeutic lasers". Several other names have been given to these lasers, such as "soft laser" and "low intensity level laser" whereas the therapy has been referred to as "biostimulation" and "biomodulation". The latter term is more appropriate, since the therapy can not only stimulate, but also suppress biological processes [1}

Therapeutic lasers generally operate in the visible and the infrared spectrum, 600-900 nm wavelength. However, other wavelengths such as the Nd:YAG at 1064 nm and even the carbon dioxide laser at 10600 nm have been successfully used in laser therapy.

The **energy** used is indicated in Joule (J), which is the number of milliwatts x the number of seconds of irradiation. Thus, 50 mW x 60 seconds produces an energy of 3000 millijoules, equals 3 J. Suitable therapeutic energies range from 1-10 J per point. The **dose** is expressed in J/cm2. To calculate the dose, the irradiated area must be known. 1 J over an area of 1 cm2 = 1 J/cm2. 1 J over an area of 0.1 cm2 = 10 J/cm2. There is generally no heat sensation or tissue heating involved in this therapy.

The history

The first laser was demonstrated in 1960. It was a ruby laser, 694 nm wavelength. Interest in the medical implications of laser light was high and already in 1967 [2] some of the first reports appeared on the effects of very low doses of ruby light on biological tissues. In animal studies it was observed that experimental wounds healed better if irradiated and that even the shaved fur of the experimental animals reappeared faster in the irradiated areas. There appeared to be a biological window for the dose. If too low, there was no effect, if too high there was a suppressive effect. Not much later the Helium-Neon laser was introduced in research and the results were similar. Later on diode lasers were introduced and they provided the same results, although some wavelengths appeared to be better for certain indications. In particular, the introduction of infrared lasers improved the optical penetration of the light, reaching deeper lying tissues.

The first commercially available lasers in the early 80ies were extremely low powered, below 1 mW, in spite of the fact that the first scientific reports used 25 mW. This partly explains the initial controversy about LLLT. With the rapid development of laser diodes, the powers of therapeutic lasers have changed dramatically and diode lasers today are typically in the range of 50-500 mW. Increased power has not only shortened the treatment time but also improved the therapeutic results.

Risks and side effects

The only physical risk in laser therapy is the risk of an eye damage. While never reported to have occurred, the risk of an eye damage must be considered, especially when using an invisible and collimated (parallel) beam. Suitable protective goggles should

be worn by the patient for extra oral therapy in the face.

Since the therapeutic lasers are well above the ionizing spectrum there is no risk of cancerous changes. Suspected malignancies should of course not be treated by anyone but the specialist.

Among the side effects (rarely) observed are:
- temporary increase of pain in chronic pain conditions. It has been suggested that this is a sign of a transfer of the chronic condition into an acute situation.
- tiredness after the treatment. This is probably a result of the pain relief where the pain previously has prevented a normal relaxation pattern
- redness and a feeling of warmness in the area which is irradiated a result of a increases micro circulation

The science

There are more than 2500 scientific studies in the field of laser therapy, among them more than 100 positive double blind studies [3]. In dentistry alone, the number of studies are some 325, from 82 institutions in 37 countries [4]. The quality of these studies vary but it is interesting to note that more than 90% of the studies report on positive effects of laser therapy.

In total, 30 different dental indications have been reported in the literature. The very variety of indications has been used as an argument against the probability of laser therapy. However, it rather shows the input on general biological systems, such as the immune system, SOD activity, ATP production, cell membrane permeability, release of transmitter substances etc.

Laser therapy science is a complicated matter where a combined knowledge about laser physics, medicine, clinical procedures and scientific rules is essential [5]. Many studies, positive and negative, lack relevant reporting parameters and make a proper evaluation difficult. The existing literature is a sufficient foundation for successful clinical therapy but more research is still needed to find out the optimal parameters.

In two recent US meta analyses [6], [7] there was a high overall significance for wound healing, tissue regeneration and pain.

Treatment

Treatment is often carried out through local irradiation of the site of injury/pain, but it can also be performed on distal points such as regional lymph nodes, ganglia and cervical nerve roots corresponding to the dermatome in question. Pain release can often be achieved in one or two sessions (especially if the reason for the pain still is in a acute stage) whereas many conditions have to be treated during several sessions. When calculating the dosage, parameters such as pigmentation of the skin, condition of the tissue, acute/chronic stage, depth beneath skin/mucosa, transparence of overlying tissue must be considered.

New possibilities

The therapeutic lasers offer improved possibilities in the treatment of pain, wound healing, inflammation and oedema. However, they also offer the dentist a possibility to treat indications previously not within the capability of the general dentist. In the following some examples will be given, each with a selected reference

Dentinal hypersensitivity

With the advent of desensitizing agents, the prevalence of treatment-resistant dentinal hypersensitivity has diminished considerably. On the other hand, the placement of composites and inlays has brought a new reason for the very same. Gershman [8] has shown that dentinal hypersensitivity can be successfully treated with LLLT. Mild pulpitis requires higher doses than the common dentinal hypersensitivity, and repeated treatments. Frequently a sensitive tooth neck can be treated with only one treatment

.

Herpes simplex

Oral herpes (HSV1) is a common feature in the dental operatory. Instead of being a contraindication for dental treatment during the acute period, an onset of HSV1 can be a good reason for a visit to the dentist. As with any treatment of HSV1 a treatment in the early prodromal stage is most successful. The pain will be reduced immediately and the blisters will disappear within a few days. Repeated treatment, whenever a blister appears will lower the incidence of recurrence. Unlike Acyclovir tablets, there are no side effects [9]. It has been shown [10] that laser therapy can even be used in the latent period between the attacks to lower the incidence of recurrence.

Mucositis

Patients undergoing radiotherapy [11] and/or chemoradiotherapy [12] suffer gravely from the mucositis induced by the therapy. Nutrition is troublesome and therapy regimen may have to be suboptimal for this reason. LLLT can be used not only to treat the mucositis but even to reduce it by mucosal irradiation prior to radiotherapy /chemotherapy.

Pain

The most frequent complaint among patients is of course pain. LLLT can reduce or eliminate pain of various origins]6]. Postoperative discomfort after surgery can be substantially reduced by irradiating the operated area postoperatively before the anesthesia wears off.

Paresthesia

After oral surgery paresthesias may occur as a result of the surgery, in particular in the mandibular region. LLLT has been used to eliminate or reduce such complications [13].

Sinusitis

While many cases of sinuitis are "dental", a great number of patients arrive in the dental office with sinuitis of a viral or bacterial background. LLLT will in most cases lead to a fast reduction of the symptoms [14], making the scheduled treatment easier.

TMD

Problems in the temporo-mandibular joint region are quite suitable for LLLT. For arthritic cases the treatment is concentrated to the joint area, in myogenic cases the muscular insertions and trigger points are treated. Laser therapy should always be used in combination with conventional treatment but will improve the outcome of the treatment [15].

Tinnitus/vertigo

It has been shown [16] that patients suffering from Ménière's disease (tinnitus/vertigo) have a significantly increased prevalence of problems in the masticatory, neck and trapezius muscles plus problems in the cervical spine, particularly in the transverse processes of the atlas and the axis. Relaxation of the tension in these muscles plus occlusal stabilisation procedures (occlusal adjustment, bite splint) will reduce or eliminate the symptoms of tinnitus and vertigo in this group of patients. Laser therapy can successfully be used to promote muscular relaxation and pain relief in these cases.

Trigeminal neuralgia

Apart from being extremely debilitating, trigeminal neuralgia can sometimes make dental treatment impossible. While no miracle cure, dentists can offer a great deal of comfort to these patients, and with a non-invasive method [17].

Zoster

Zoster in the trigeminal nerve should be treated in its early phase. The zoster attack in itself is bad enough, but not too infrequently a postherpetic neuralgia will persist for years or even lifelasting. Laser therapy is a cost-effective, non-invasive method without side effects [18].

Other indications

29 different dental indications are described in the literature, some of them being aphtae, bone regeneration, dentitio dificilis and decubitus.

Acupuncture

If a dentist is trained in acupuncture, the low level laser will be a very convenient way of replacing the needles in many instances, for corporal or auricular acupuncture. Needles are not too popular with the patients, so the laser will be appreciated. Even for a dentist not practicing acupuncture, there are some well defined acupuncture points which can be used, for instance to reduce nausea [19].

No panacea

The clinical results described above may seem impressive, even to the degree of doubts. However, laser therapy is no panacea and should only be used within the limits of its own merits. Correct diagnosis, proper treatment technique and treatment intervals plus sufficient dosage are all essential to obtain good results.

Non-biomodulating LLLT

A large number of in vitro studies have reported on the enhanced killing of bacteria using various dyes in combination with low level lasers. The most frequently used dye has been toluidine blue (TBO) and some of the microorganisms studied are streptococcus mutans (20) and staphylococcus aureus (21). The bactericidal effect of TBO is enhanced by low level laser light and the clinical implications of this combination in cariology and periodontology are indeed promising. Low level laser has also been shown to enhance the release of fluoride from lacquers (22) and resin cements (23).

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LOW LEVEL LASER THERAPY IN DENTISTRY

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In recent years there has been increasing number of dentists using laser technology, either low or high-energy level lasers. There is no laser yet developed that totally replaces the conventional rotary instruments, but some routine work in dental practice can now be done with use of lasers This lecture will give a brief overview of dental disorders, where LLLT proved to be an efficient therapeutic procedure, whether applied as monotherapy or complementary treatment modality LLLT is mainly used for the treatment of soft tissues inside oral cavity, in order to relieve the pain or to induce wound healing, or as a diagnostic device for dental diseases like early detection of caries. Effects of LLLT are based upon biostimulative-regenerative effect, anti-inflammatory and analgesic effect

Here are some of pathological changes, which can successfully be treated with LLLT:
- Wounds after extractions
- Recovery after dental and periodontal surgical procedures
- Open and closed wound healing after minor and major oral surgery
- Lip wounds and combustions
- Abscess
- Scar tissue
- Alveolitis sicca
- Haemathoma
- Herpes labialis
- Aphtae
- Ragadae
- Mucositis
- Dentitio difficilis
- Damages of the mucosa due to the incorrectly sitting prosthesis
- Crown preparation
- Nerve lesions
- Acute and chronic disease of periodontal tissue
- Neuralgia n. trigemini

- Temporo
-mandibular joint disorders
- Trismus
This lecture will bring you exact irradiation techniques and efficient energy densities, which are determined after many years spent in the clinical application of LLLT in dentistry.

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Low Level Laser Therapy in Dentistry - Preventive Performance

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Abstract

The possibility of reducing the patients' pain and anxiety through low level laser applications has been the main objective of my research within laser therapy. This Editorial deals with the low level laser as an indispensable and irreplaceable tool for the dentist nowadays in the dental office, focusing on an innovative operator modality: its preventive performance.
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Clinically, the use of low level laser therapy has demonstrated excellent results. In terms of tissue healing, largely discussed, it shows evidence of the acceleration process in up to three times, mainly for those patients with physiological disturbances,. This may be considered as an indispensable and preventive procedure. Furthermore, the patient's temporary dysfunction, provoked by a wound, being surgically or not, is reduced. This fact causes a comfort that can be achieved only by low level laser.

My double-blinded study compared a group without laser and with systemic analgesic medication with two other groups with laser: one group with laser only after the surgical procedure and the other with laser therapy before and after the surgery. This study clarified that 790 nm laser therapy with a dose of 1,5 J/cm2 was as effective with regards to the analgesic and anti-inflammatory effect as conventional medication, both for the pain and oedema control.

To accomplish the present study, 45 clinical situations were selected during the Graduation Course of in Implant and Prosthesis of 3i Implants Innovations, Inc., in Ribeirão Preto, São Paulo, Brazil. The selection approach was just constituted in writing in the consent on the part of the patient taking the responsibility in coming back for the follow up care, and also in executing the rules imposed by the methodology of the research. To all the patients it was instituted a systemic medication of preventive anti-bioticotherapy was instituted and also continued after the surgical procedure for 6 days to the base of penicillin, and for the allergic ones, to the clindamicin base.

The piece of equipment of low powered laser chosen was a semiconductor diode of GaAlAs (galium, aluminum and arsenium), that emits in the infra-red close with

wavelength of 790 nm and pick power of 30 mW. The emission type is continuous and the application form should be accomplished contacting the gingival tissue; the area of the active point of the crystal of quartz is of 0.13 cm2 (Compact Laser, J. Morita Co., Japan).

The patients were divided in three different groups, constituted of 15 clinical situations each one, as follows:

- Group I: Control, the laser application was simulated, without working the "start", just leaving a "bip" ring. All the patients from that group received that simulation during one minute scanning the operated area. Those patient were well informed with the analgesic and anti-inflammatory systemic medication to the piroxican base (Cicladol 20 mg) twice a day in the postoperative for a period of three days.
- Group II: Lasertherapy sessions in the postoperative immediate, of 24 hs and of 48 hs. It was not instituted the analgesic and anti-inflammatory systemic medication.
- Group III: Lasertherapy sessions in the pre-operative of -48 hs, -24 hs and minutes before the surgical intervention and also in the postoperative in the same way that in the Group II. The patients were equally well educated and have not taken the analgesic and anti-inflammatory systemic medication.

The Group III was elaborated based in NICCOLI FILHO's studies (1995) that used the low power of density laser radiation with prevention.

All the applications were accomplished using the same energy parameters and for the same operator and the way of the application was accomplished sweeping the whole area of the tissue to be irradiated, which should be dry preferentially to allow the minimum reflection of the light for the energy not to be lost and absorbed by the tissue. The point of the equipment that contacted the tissue was involved with plastic by hygiene measure and of infection control (in the same way as it is made clinically) which promotes the loss of 10% of energy, that however is not important.

The time of each application was calculated in agreement with the formula of density power (or intensity). The area of each clinical situation had been calculated associating the clinical exam to the radiographic, determining the same for the probable operative field that would be explored. The chosen energy was based on the studies of Kubasova that says the energy of 0.5 to 5.0 J/cm2 is enough for obtaining of the analgesia effects and of bioestimulation effects. Being like this, the chosen energy density was of 1.5 J/cm2.

The measures, with relationship to the pain and the edema, were accomplished in the immediate postoperative and in the postoperative of 72 hours, always for the same examiner. The examiner asked the patient previously to the laser application what the pain degree was in that moment considering the values of the table 1. with relationship to the edema analysis, the examiner checked the value to each case, according to the table 2. When we irradiated the area to be operated, like suggested by Niccoli Filho (1995), we believed that we were "preparing" the cells, mainly for the chemical mediators liberation, especially for the histamine, which acts by increasing the vascular permeability.

According to Ovsiannikov, this procedure stimulates the immune system. Mikailov and Denisov compared three groups of 112 patients with stages IV of stomach cancer; 32

patients received LLLT before surgery, 38 received it after surgery, and 29 patients did not receive LLLT at all. The laser therapy before the operation was slightly more effective. LLLT increased T-active rosette cells and T-helpers, and decreased T-suppressor cells. The life span of the LLLT patients, as compared to the control group increased by a factor of 2 if surgery was performed and by a factor of 3 if surgery was not performed.

The statistical analysis was just accomplished to check the clearly observed clinical discoveries scientifically. The non-parametric Test of Wilcoxon which compares equal of samples, and with significance degree at level of 5.0% (Tab. 3) was chosen.

With relationship to the painful sensitivity, when we compared GI with GII, and GI with GIII, so much in the immediate postoperative as in the postoperative of 72 hours, we observed there were not significant statistical differences.

Even so, in the immediate postoperative, GIII shows a tendency in being significant, suggesting a superior behavior to GII.

With relationship to the edematous formation, we compared GI with GIII, so much in the immediate postoperative as in the postoperative of 72 hours, we didn't observe significant statistical difference; differently to what we compared, in that situation, GI with GII, where a great tendency to the significance happens.

Table 3 - Statistical results with significance degree at level of 5.0%, when Tc = 138

Event	Samples Pairs	Immediate PO	PO of 72 hours
Pain	GI - GII GI - GIII	| 45.5 | | 107.5 |	| 67.5 | | 22.5 |
Edema	GI - GII GI - GIII	| 133.5 | | 42.0 |	| 135.0 | | 90.0 |

In agreement with the applied methodology and with the obtained results, the use of low power density laser in implanted patients suggested:

1 - A similar behavior to the analgesic and anti-inflammatory systemic medication, suggesting the possibility of replacement;
2 - for pain control, lasertherapy sessions in the pre-operative were more effective than the postoperative lasertherapy sessions, as executed in GIII;
3 - for tumor formation control, lasertherapy sessions in the postoperative were enough, as executed in GII. Cells with acid pH are more susceptible to light. Furthermore, the possible mechanism at a cellular level probably is depending on the monochromatic carachter of the light, which the organisms are not adapted to evolutionwise. Thus, laser light is one of the environment factors (external agents) capable of modifying the cellular proliferation. The stimulus or inhibition caused by the light may be regarded as a sensorial answer to accommodate to the environmental conditions.

So the question is: why don't we prepare the target tissue through low level laser irradiation as a preventive procedure prior to the trauma?

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Inflammation in periodontal tissues in response to mechanical forces.

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Orthodontic forces are known to produce mechanical damage and inflammatory reactions in the periodontium and dental pulp, as well as inflammatory mediators, e.g. prostaglandins, interleukin (IL)-1, IL-6, tumor necrosis factor alpha, and receptor activator of nuclear factor kappaB ligand, in the periodontal ligament (PDL) and dental pulp. We have studied the effects of aging on the production of inflammatory mediators in the PDL using in vitro and in vitro</I >methods and found that aging of PDL tissues may be an important factor in the severity of periodontal disease through a higher production of inflammatory mediators in response to mechanical forces. Further, the levels of inflammatory mediators in gingival crevicular fluid, an osmotically mediated inflammatory exudates found in the gingival sulcus, have been shown to be significantly elevated during orthodontic treatment. In order to reduce inflammation, low-level laser therapy has been recently studied in vitro</I and in vitro by many investigators as a substitute for anti-inflammatory drugs. Clinical and experimental studies have shown that low-level laser irradiation reduces orthodontic post-adjustment inflammation. We believe that orthodontic forces (mechanical forces) may play an important role in periodontal inflammation and that low-level laser therapy may be useful for its inhibition

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Comparison of the effectiveness of the conservative treatment of the periodontal pockets with or without the use of laser biostimulation.

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The use of laser therapy as the agent reinforcing conventional treatment of the periodontal diseases becomes more and more common. In the physiotherapy of the periodontal diseases the biostimulating, laser is eagerly used because of its action which accelerates the healing of wounds and also because of its antioedematous, anti-inflammatory and analgesic action. The aim of work was the evaluation of the influence of laser biostimulation on the change of the periodontological pockets depth after the routine conservative periodontological treatment with additional use of laser biostimulation and without it for two groups of pockets: above and below 5 mm. In six patients having periodontitis 613 sites were submitted to the statistic analysis (290 treated conservatively only, including 251 with the depth 2-5 mm and 39 above 5 mm as well as 323 with the use of laser therapy including 297 shallow pockets and 26 deep ones). The initial values of API, SBI, PPD and their changes in the course of the treatment were registered. During each control appointment the patients subjectively estimated periodontal pain occurrence. In both studied groups statistically essential decrease of the evaluated parameters was obtained. Reinforcing the conventional treatment with laser biostimulation shortens its duration and leads to the elimination of pain faster than with the use of conservative treatment only. The changes of the PPD index among the successive examinations were statistically essentially higher in the therapy with the use of laser, especially in relation to deep pockets.

J Oral Rehabil. 2003 Dec;30(12):1183-9.

Clinical evaluation of low-level laser therapy and fluoride varnish for treating cervical dentinal hypersensitivity.

Corona SA, Nascimento TN, Catirse AB, Lizarelli RF, Dinelli W, Palma-Dibb RG.

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The aim of this study was to evaluate in vivo the use of low-level galium-aluminium-arsenide (GaAlAs) (BDP 600) laser and sodium fluoride varnish (Duraphat) in the treatment of cervical dentine hypersensitivity. Twelve patients, with at least two sensitive teeth were selected. A total of 60 teeth were included in the trial. Prior to desensitizing treatment, dentine hypersensitivity was assessed by a thermal stimulus and patients' response to the examination was considered to be a control. The GaAlAs laser (15 mW, 4 J/cm2) was irradiated on contact mode and fluoride varnish was applied at cervical region. The

efficiency of the treatments was assessed at three examination periods: immediately after first application, 15 and 30 days after the first application. The degree of sensitivity was determined following predefined criteria. Data were submitted to analysis and no statistically significant difference was observed between fluoride varnish and laser. Considering the treatments separately, there was no significant difference for the fluoride varnish at the three examination periods, and for laser therapy, significant difference ($P < 0.05$) was found solely between the values obtained before the treatment and 30 days after the first application. It may be concluded that both treatments may be effective in decreasing cervical dentinal hypersensitivity. Moreover, the low-level GaAlAs laser showed improved results for treating teeth with higher degree of sensitivity.

Stomatologiia (Mosk). 2000;79(6):16-9.

[Use of transcutaneous laser biostimulation of blood and a running alternating magnetic field in preparing periodontitis patients for surgery]

[Article in Russian]

Lepilin AV, **Bulkina NV**, **Bogomolova NV**, **Raigorodskii IuM**.

A total of 103 patients with exacerbation of chronic generalized periodontitis of moderate and high severity were treated using running alternating magnetic field generated by ATOS device and transcutaneous laser biostimulation of the blood. These treatment modalities accelerated preoperative treatment and allowed performing the operations on the periodontal tissues in the optimal status under conditions of improved defense forces of the organism.

Stomatologiia (Mosk). 1998;77(3):12-4.

[A comparative analysis of the use of Uzor and Optodan laser apparatus for the prevention and combined treatment of pulpitis and periodontitis]

[Article in Russian]

Milokhova EP, **Semenova LL**, **Balynskii IV**, **Nazyrov IuS**.

Clinical research 242 patients for comparison purposes of efficiently of employment of semiconductor laser apparatus "Uzor" and "Optodan" as physiotherapeutic of the factor for preventive maintenance and treatment of complications, arising the ambassador endodontic of treatment is spent. Results of application of semi-conductor laser apparatus are resulted at the various forms pulpitis and periodontitis. Significant reduction of a pain directly after a procedure LSL is marked. The highest efficiency is established by use of the apparatus "Optodan", connected with distinction configurations of a impulse.

Histometrical Evaluation of the Healing of the Dental Alveolus in Rats After Irradiation with a Low-Powered GaAlAs Laser

Rosane F. Z. Lizarelli*; Tereza L. Lamano-Carvalho**; Luis G. Brentegani** *Physics Institute of São Carlos, University of São Paulo, São Carlos, SP, Brazil. 13560-970

**College of Dentistry of Ribeirao Preto, University of São Paulo, Ribeirao Preto, SP, Brazil. 14.040-000 LIZARELLI, R. F. Z.; LAMANO-CARVALHO, T. L.; BRENTEGANI, L. G.

Histometrical evaluation of the healing of the dental alveolus in rats after irradiation with a low-powered GaAlAs laser. in Lasers in Dentistry V, John D. B. Featherstone, Peter Rechmann, D.D.S., Daniel Fried, Editors, Proceedingsof SPIE Vol. 3593, p. 49-56, 1999. ABSTRACT The aim of the present work was to evaluate histometrically the effect of the irradiation with semiconductor diode GaAlAs 790 nm low-powered laser in the chronology of alveolar repair of rats.
Lasers of low intensity possesses an eminently analgesic, anti-inflammatory and bioestimulant effect, producing an increase of the local micro-circulation and in the speed of healing. Groups of five animals had their upper right incisors extracted under anesthesia and the mucous sutured; three groups received 1.5 J/cm2 of irradiation immediately after the extraction with laser for sweeping on the operated area. After that, the animals were sacrificed in the periods of 7, 14 and 21 days after the dental extraction. The material was decalcified and processed for inclusion in paraffin. Longitudinal sections of 7 micrometers in the alveolus were made and stained with HE.
The histometric analysis was performed with the Merz grid, and 2000 points were counted in each cervical, middle and apical thirds of the alveolus, assessing the percentage of the bone tissue. The results shows that low-powered intensity laser produced acceleration in osseous formation (10%) in some periods. The influence of low-powered laser on the healing process is more significant when we can apply the laser light just after the tissue trauma. Cells with a lower than normal pH, where the redox state is shifted in the reduced direction, are considered to be more sensitive to the stimulate action of light than those with the respective parameters being optimal or near optimal. The proposed redox-regulation mechanism may be a fundamental explanation for some clinical effects of irradiation, a consequence of this was the difference between the groups of 7 days is more significant than between the other groups.

Int J Oral Maxillofac Surg. 2004 Jan;33(1):38-41.

Efficacy of low level laser therapy in reducing postoperative pain after endodontic surgery-- a randomized double blind clinical study.

Kreisler MB, Haj HA, Noroozi N, Willershausen B.

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The aim of the study was to evaluate the effect of low level laser application on postoperative pain after endodontic surgery in a double blind, randomized clinical study. Fifty-two healthy adults undergoing endodontic surgery were included into the study. Subsequently to suturing, 26 patients had the operation site treated with an 809 nm-GaAlAs-laser (oralaser voxx, Oralia GmbH, Konstanz, Germany) at a power output of 50 mW and an irradiation time of 150 s. Laser treatment was simulated in further 26 patients. Patients were instructed to evaluate their postoperative pain on 7 days after surgery by means of a visual analogue scale (VAS). The results revealed that the pain level in the laser group was lower than in the placebo group throughout the 7 day follow-up period. The differences, however, were significant only on the first postoperative day (Mann-Whitney U-test, $p<0.05$). Low level laser therapy can be beneficial for the reduction of postoperative pain. Its clinical efficiency and applicability with regard to

endodontic surgery, however require further investigation. This is in particular true for the optimal energy dosage and the number of laser treatments needed after surgery.

Stomatologiia (Mosk). 2002;81(4):48-53.

[Preparation of bone tissue of the jaw to implantation of abutment elements of dentures]

[Article in Russian]

Kulakov AA, **Prokhonchukov AA**, **Soboleva SE**, **Vakhtin VI**.

A complex multi-staged method for stimulation of bone tissue regeneration in the jaws after removal of teeth and preparation of bone tissue for subsequent implantation, stimulation of bone tissue regeneration after implantation, and adaptation of bone tissue of the jaws to masticatory pressure is developed. The method is based on utilization of magnetic laser exposure with a universal Optodan laser device. In case of pronounced inflammation and pyodestructive processes after implantation, these processes are liquidated due to detoxifying effect of the blood, which is stimulated by irradiation of the carotid sinuses on both sides. Granulation tissue round the heads of implants is removed by laser coagulation with surgical lasers Lancet or Stokos.

Clinical results evaluation of dentinary hypersensitivity patients treated with laser therapy.

Brugnera A, Cruz FM, Zanin FA & Pecora JD.

Proc. SPIE Vol. 3593, 1999, p. 66-68.

300 human teeth were treated for hypersensitivity during the period 1995-1997. Pulpal vitality was verified using thermal tests, and only reversible processes were treated. HeNe and GaAlAs lasers were used. All teeth received 4 J/session, up to 5 sessions. 79% of the patients were treated in 3 sessions with success; 8.6% were cured in 4 sessions; and 4.3% were successfully treated in 5 sessions, obtaining 92% success in total.

Aust Dent J. 1994 Dec;39(6):353-7.

Low level laser therapy for dentinal tooth hypersensitivity.

Gerschman JA, Ruben J, Gebart-Eaglemont J.

Oro-Facial Pain Clinic, Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne.

A comparative double blind study testing low level laser therapy (Gallium/Aluminium/Arsenide laser [GaAlAs]) against placebo was carried out in the management of dentinal tooth hypersensitivity. Subjects demonstrating dentinal hypersensitivity and complying with strict selection criteria were randomly assigned to an active and placebo group. Low level laser therapy was applied for one minute to both the apex and cervical area of the tooth; and reapplied at one week, two-week and eight-week intervals. Dentinal

hypersensitivity was rated at each visit. There were 28 subjects in the placebo group and 22 and 21 subjects, respectively, in the tactile sensitivity and thermal sensitivity groups. Comparisons between the groups were conducted using independent groups t-test. In both the tactile and thermal sensitivity groups differences between the active and placebo groups were significant from the first week and increased further in the second and eighth weeks. The mean value of thermal sensitivity decreased 67 per cent ($p < 0.001$) compared with placebo (17 per cent) and tactile sensitivity decreased 65 per cent ($p = .002$) compared with placebo (21 per cent) at eight weeks. Results demonstrate that the GaAlAs laser is an effective method for the treatment of both thermal and tactile dentinal hypersensitivity. There were no reported adverse reactions or instances of oral irritation.

J Clin Laser Med Surg. 2003 Oct;21(5):291-6.

Effect of the clinical application of the GaAlAs laser in the treatment of dentine hypersensitivity.

Marsilio AL, Rodrigues JR, Borges AB.

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OBJECTIVE: The aim of this study was to evaluate the effectiveness of the clinical use of the gallium-aluminum-arsenium (GaAlAs) laser at the maximum and minimum energies recommended by the manufacturer for the treatment of dentine hypersensitivity. BACKGROUND DATA: Dentine hypersensitivity (DH) is a response to a stimulus that would not usually cause pain in a healthy tooth. It is characterized by sharp pain of short duration from the denuded dentin. Its etiology is unknown. The dentin only begins to show sensitivity when exposed to the buccal environment. This exposure can result after removal of the enamel and/or dental cement, or after root denudation. Different treatments are proposed for this disorder. MATERIALS AND METHODS: In this study, 25 patients, with a total number of 106 cases of DH, were treated with GaAlAs low-level laser therapy (LLLT). 65% of the teeth were premolars; 14% were incisors and molars; 6.6% were canines. The teeth were irradiated with 3 and 5 J/cm2 for up to six sessions, with an interval of 72 h between each application, and they were evaluated initially, after each application, and at 15 and 60 days follow-up post-treatment. RESULTS: The treatment was effective in 86.53% and 88.88% of the irradiated teeth, respectively, with the minimum and maximum energy recommended by the manufacturer. There was a statistically significant difference between DH and after a follow-up of 60 days for both groups. The difference among the energy maximum and minimum was not significant. CONCLUSION: The GaAlAs low-level laser was effective in reducing initial DH. A significant difference was found between initial values of hypersensitivity and after 60 days follow-up post-treatment. No significant difference was found between minimum (3 J/cm2) and maximum (5 J/cm2) applied energy.

J Clinical Pediatric Dentistry. 1995; 19: 232.

The effect of laser irradiation on the activation of inflammatory cells and the vital pulpotomy. A study of the application of Ga-As semiconductor laser to endodontics.

Kurumada F.

The effects of GaAs on the activation of machrophages and fibroblasts were examined be determinating the rate of glucose utilization into the cell and the activity of lactate dehydrogenase in culture supernatant. The irradiated macrophages that had been prepared from the perioneal exudate cells, did not show any enhancement of activity, whereas the fibroblast cell line was activated by laser irradiation.
These findings suggest that GaAs irradiation was effective for the growth of fibroblasts and induced

suppressive effects for macrophages. Further, the effects of laser on the vital pulpotomy were investigated. It was observed that irradiation induced enhancement of calcification in the wound surface and stimulated formation of calcified tissue. These observations indicate that laser irradiation is a useful method for the vital pulpotomy.

Human gingival fibroblast proliferation enhanced by LLLT

Almeida-Lopes L. [Analysis in vitro of the cellular proliferation of human gingival fibroblasts with low level laser.] 1999. Dissertation at Universidade do Vale do Paraíba, São Paulo, Brazil.

Human gingival fibroblast were cultured in Petri dishes with different Fetal Bovine Serum concentration, 5% or 10%. Four irradiations of 2 J/cm2 were given with 12 hours intervals. Lasers with 670, 692, 780 and 786 nm were used. Cells in 5% FBS profilerated better than in all control groups whereas the cells in the 10% FBS did not proliferate better than controls. The 670 and 692 visible lasers caused a higher improvment in cell proliferation that the infrared lasers. This study confirms the fact that cells in a less-than-optimal stage react better to LLLT than cells in an optimal nutritional stage. It also confirms that visible red is the best wavelength for superficial wound healing.

Aust Dent J. 1997 Aug;42(4):247-54.

The current status of low level laser therapy in dentistry. Part 1. Soft tissue applications.

Walsh LJ.
Department of Dentistry, University of Queensland.

Despite more than 30 years of experience with low level laser therapy (LLLT) or 'biostimulation' in dentistry, concerns remain as to its effectiveness as a treatment modality. Controlled clinical studies have demonstrated that while LLLT is effective for some specific applications, it is not a panacea. This paper provides an outline of the biological basis of LLLT and summarizes the findings of controlled clinical studies of the use of LLLT for specific soft tissue applications in dentistry. Areas of controversy where there is a pressing need for further research are identified.

Aust Dent J. 1997 Oct;42(5):302-6.

The current status of low level laser therapy in dentistry. Part 2. Hard tissue applications.

Walsh LJ.
Department of Dentistry, University of Queensland.

While most applications of low level laser therapy (LLLT) in dentistry are directed toward soft tissues, in recent years there has been increasing interest in tooth-related or hard tissue applications of LLLT. This report provides an overview of applications of LLLT in the treatment of dentine hypersensitivity and pain arising from the periodontal ligament, and describes the phenomenon of lethal laser photosensitization and its applications in the treatment of dental caries. Technical aspects of LLLT equipment and safety concerns are also discussed.

Am J Orthod Dentofacial Orthop. 1995 Dec;108(6):614-22.

A clinical investigation of the efficacy of low level laser therapy in reducing orthodontic postadjustment pain.

Lim HM, Lew KK, Tay DK.
Faculty of Dentistry, National University of Singapore.

Low level laser therapy (LLLT) has been shown to produce analgesic effects in many clinical applications. The aim of this clinical study was to test the efficacy of LLLT in controlling orthodontic postadjustment pain. Thirty-nine volunteers were selected for this study that used a double-blind design with placebo control. Elastomeric separators were placed at the proximal contacts of one premolar in each quadrant of the dentition to induce orthodontic pain. The tip of a 30 mW gallium-arsenide-aluminium (830 nm) diode laser probe was then placed at the buccal gingiva and directed at the middle third of the root. Three different treatment durations of 15, 30, and 60 seconds and one placebo treatment of 30 seconds were tested within each subject. The study was conducted over 5 days, and the visual analogue scale (VAS) was used to quantify the pain experienced by the subjects before and after laser applications for each day. Analysis of the VAS median scores showed that teeth exposed to laser treatment had lower levels of pain as compared with those with the placebo treatment. However, nonparametric statistical analysis of the data showed that the differences between treatments and placebo within each subject were not statistically significant.

Br J Oral Maxillofac Surg. 1993 Jun;31(3):170-2.

A randomised double blind comparative study of low level laser therapy following surgical extraction of lower third molar teeth.

Fernando S, Hill CM, Walker R.
Department of Oral and Maxillofacial Surgery, Dental Hospital, Cardiff, South Glamorgan.

A randomised, double blind comparative study was undertaken to assess the efficacy of low level laser therapy in the reduction of postoperative pain and swelling in patients undergoing the extraction of bilaterally impacted mandibular third molar teeth. Healing of the sockets was also compared after 1 week. A group of 64 patients had one randomly-selected operation side treated with a semi-conductor laser and the other side with an apparently identical but non-operating model. Complete data were obtained from 52 of the 64 patients. The results showed that there was no evidence of a difference in pain and swelling on the third day after operation between laser and placebo sides. There was no difference between the two sides when they were assessed for healing 7 days after surgery.

Nor Tannlaegeforen Tid. 1991 Feb;101(3):78-80.

[Laser therapy in dental practice. What is laser?]

[Article in Norwegian]

Arctander KH, Bjornland T, Haanaes HR.
Klinikk for Oral Kirurgi og Oral Medisin, Universitetet i Oslo.

This article briefly discusses laser theory and medical use of different types of laser, laserphysics and laser properties. The indications for lasertherapy as claimed from laser-producers, are numerous. However, we recommend that the effect of treatment with low level laser therapy has to be more documented before general use in a dental practice.

Effect of 830-nm laser light on the repair of bone defects grafted with inorganic bovine bone and decalcified cortical osseous membrane.

Barbos Pinheiro AL, Limeira Junior Fde A, Marquez Gerbi ME, Pedreira Ramalho LM, Marzola C, Carneiro Ponzi EA, Oliveira Soares A, Bandeira De Carvalho LC, Vieira Lima HC, Oliveira Goncalves T.
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OBJECTIVE: The aim of this study was to assess histologically the effect of LLLT (lambda830 nm) on the repair of standardized bone defects on the femur of Wistar albinus rats grafted with inorganic bovine bone and associated or not to decalcified bovine cortical bone membrane. BACKGROUND DATA: Bone loss may be a result of several pathologies, trauma or a consequence of surgical procedures. This led to extensive studies on the process of bone repair and development of techniques for the correction of bone defects, including the use of several types of grafts, membranes and the association of both techniques. There is evidence in the literature of the positive effect of LLLT on the healing of soft tissue wounds. However, its effect on bone is not completely understood. MATERIALS AND METHODS: Five randomized groups were studied: Group I (Control); Group IIA (Gen-ox); Group IIB (Gen-ox + LLLT); Group IIIA (Gen-ox + Gen-derm) and Group IIIB (Gen-ox + Gen-derm + LLLT). Bone defects were created at the femur of the animals and were treated according to the group. The animals of the irradiated groups were irradiated every 48 h during 15 days; the first irradiation was performed immediately after the surgical procedure. The animals were irradiated transcutaneously in four points around the defect. At each point a dose of 4 J/cm2 was given (phi approximately 0.6 mm, 40 mW) and the total dose per session was 16 J/cm2. The animals were humanely killed 15, 21, and 30 days after surgery. The specimens were routinely processed to wax, serially cut, and stained with H&E and Picrosirius stains and analyzed under light microscopy. RESULTS: The results showed evidence of a more advanced repair on the irradiated groups when compared to non-irradiated ones. The repair of irradiated groups was characterized by both increased bone formation and amount of collagen fibers around the graft within the cavity since the 15th day after surgery, through analysis of the osteoconductive capacity of the Gen-ox and the increment of the cortical repair in specimens with Gen-derm membrane. CONCLUSION: It is concluded that LLLT had a positive effect on the repair of bone defect submitted the implantation of graft.

Stomatologiia (Mosk). 2003;82(4):20-4.

[Magnetic laser therapy in the treatment of apical periodontitis]

[Article in Russian]

Giliazetdinova IuA, Vinnichenko AV, Vinnichenko IuA.

A new method for the treatment of apical periodontitis, making use of Optodan laser, differs from the known method by more rapid periapical tissue regeneration, which is paralleled by high antiinflammatory effect of magnetic laser therapy at early stages of treatment.

Lasers Surg Med. 1991;11(5):462-70.

Effect of low level laser therapy on wound healing after palatal surgery in beagle dogs.

In de Braekt MM, van Alphen FA, Kuijpers-Jagtman AM, Maltha JC.
Department of Orthodontics and Oral Histology, University of Nijmegen, The Netherlands.

The effect of low level laser therapy on wound healing and wound contraction after palatal surgery in Beagle dogs of 12 weeks of age was investigated. A total of 30 Beagle dogs was used and assigned to a control group (Group C; n = 6) and two experimental groups (Group L; n = 12 and group LL; n = 12). In both experimental groups, Von Langenbeck's palatal repair was simulated. Then in the LL group the denuded bony areas were treated with low level laser therapy using a continuous Ga-As-A1 laser beam (830 nm) and energy output set at 30 mW. Per treatment a dosage of 1 J/cm2 wound surface area was used. Therapy was carried out three times a week with a total of ten treatments. Wound healing was observed clinically until wound healing was completed at 4 weeks p.o. and wound areas were measured at regular intervals on standardized intra-oral photographs. Wound contraction was measured as the increments of the distances between tattoo points on the opposite wound margins. No significant differences were found in the quality and rate of wound healing between the two experimental groups. The same held true for the increments of the distances between opposite tattoo points. It was concluded that macroscopically low level laser therapy under conditions used in this study did not have an influence on wound closure or wound contraction.

Ned Tijdschr Tandheelkd. 1994 Mar;101(3):100-3.

[Treatment with soft laser. The effect on complaints after the removal of wisdom teeth in the mandible]

[Article in Dutch]

Braams JW, Stegenga B, Raghoebar GM, Roodenburg JL, van der Weele LT.
Kliniek voor Mondziekten, Kaakchirurgie en Bijzondere Tandheelkunde, Academisch Ziekenhuis Groningen.

In a placebo controlled double-blind randomized study the effect of low level laser therapy on postoperative complaints after removal of lower third molars was examined. Several parameters were investigated in two groups of patients; in one group low level laser was applied during and following third molar removal, in the other no active additional laser treatment was given. The results of this study show that therapeutic low level laser treatment could not statistically reduce the postoperative pain, swelling, trismus and function impairment after extraction of lower third molars.

Low-intensity laser coupled with photosensitizer to reduce bacteria in root canals compared to chemical control. 2002. 91f.

SEGUNDO, A. S. G.
Dissertation (Professional Master's Degree "Lasers in Dentistry") - Nuclear and Energy Research Institute / School of Dentistry, University of São Paulo, São Paulo. Advisor: Martha Simões Ribeiro, DDS, PhD, José Luiz Lage-Marques. DDS, PhD

The photodynamic therapy is a process in which a dye is associated with an appropriate wavelength of light and this dye goes to an excited state. The excited photosensitizer reacts with oxygen to form the highly reactive compound singlet oxygen, and this compound can kill bacteria and tumor cells. The purpose of this study was to evaluate the bacterial reduction in root canal contaminated with Enterococcus Faecalis. Thirty teeth with their root canals prepared were contaminated with E. faecalis. Ten teeth have received the chemical substance sodium hypochlorite for 30 minutes; ten teeth have received the azulene dye paste for 5 minutes and have been irradiated with a diode laser, output power 10mW and ?= 685nm for 3 minutes. Ten teeth have not received treatment (control group). The bacterial reduction was significantly higher for laser group when compared to chemical and control groups. These results indicate that photodynamic therapy was an effective method to kill bacteria.

Stomatologiia (Mosk). 2002;81(5):29-35.

[Alternative methods for prevention and treatment of dental caries using laser and magnetic laser exposure]

[Article in Russian]

Prokhonchukov AA, Zhizhina NA, Kolesnik AG, Morozova NV, Vasmanova EV, Mozgovaia LA, Kunin AA, Milokhova EP, Saprykina VA, Nazyrov IuS, Kulazhenko TV, Semenova LL, Ermolov VV, Chuprakova EV.

Alternative methods for prevention and treatment of dental caries are presented, based on the use of laser and magnetic laser exposure (patent No. 2053818, in Russia) with a new generation laser device with Optodan microprocessor monitoring (patent No. 2014107, Russia). The methods are intended for wide clinical application in children and adolescents in pedodontic departments and outpatient centers and particularly for group and individual use in dental rooms at school.

Int J Oral Maxillofac Surg. 2004 Jan;33(1):38-41.

Efficacy of low level laser therapy in reducing postoperative pain after endodontic surgery-- a randomized double blind clinical study.

Kreisler MB, Haj HA, Noroozi N, Willershausen B.
Department of Oral Surgery, Johannes Gutenberg University Mainz, Mainz, Germany. matthiaskreisler@web.de

The aim of the study was to evaluate the effect of low level laser application on postoperative pain after endodontic surgery in a double blind, randomized clinical study. Fifty-two healthy adults undergoing endodontic surgery were included into the study. Subsequently to suturing, 26 patients had the operation site treated with an 809 nm-GaAlAs-laser (oralaser voxx, Oralia GmbH, Konstanz, Germany) at a power output of 50 mW and an irradiation time of 150 s. Laser treatment was simulated in further 26 patients. Patients were instructed to evaluate their postoperative pain on 7 days after surgery by means of a visual analogue scale (VAS). The results revealed that the pain level in the laser group was lower than in the placebo group throughout the 7 day follow-up period. The differences, however, were significant only on the first postoperative day (Mann-Whitney U-test, $p<0.05$). Low level laser therapy can be beneficial for the reduction of postoperative pain. Its clinical efficiency and applicability with regard to endodontic surgery, however require further investigation. This is in particular true for the optimal energy dosage and the number of laser treatments needed after surgery.

J Mass Dent Soc. 1999 Spring;48(1):8-13, 40.

Rapid healing of gingival incisions by the helium-neon diode laser.

Neiburger EJ.

Fifty-eight extraction patients had one of two gingival flap incisions lased with a 1.4 mw helium-neon (670 nm) diode laser for 30 seconds (fluence = 0.34 J/cm2). Healing rates were evaluated clinically and photographically. Sixty-nine percent of the irradiated incisions healed faster than the control incisions. No significant difference in healing was

noted when patients were compared by age, gender, race, and anatomic location of the incision. This study concludes that helium-neon diode lasers, at the previously mentioned energy level, increase the rate of gingival wound healing in 69 percent of patients, without any side effects. For the last 30 years, low-power lasers in dentistry have appeared to stimulate healing rates and increase the rate of repair of injured tissue. Helium-neon and similar lasers emit light in the red (600-700 nm) spectrums and produce energy densities (fluences) below 20 Joules/cm2. They have been studied in a variety of animal tissue culture and human evaluations to determine their ability to increase the rates of wound healing by biostimulation. Over the last three decades, researchers have found that ruby and gas helium-neon (low-power laser radiation) have a biostimulatory effect on living tissue. Studies show that under specific conditions, red spectrum laser light speeds the healing of wounds. Photons from the red light lasers, which include ruby lasers (694 nm), helium-neon gas lasers (632 nm), and helium-neon diode lasers (650-670 nm), appear to stimulate rapid epithelialization and fibroblast (collagen) proliferation in animal and human tissue cultures. Low-power lasers have been reported to reduce post-extraction pain and swelling and to increase rates of wound healing (including scar formation, phagocytosis) in cell culture, animal, and human clinical studies. The new, compact, and inexpensive (under $50) helium-neon diode lasers have produced similar effects. These FDA Class IIIa lasers have no hazards associated with them, although one should avoid direct exposure to the eye for a prolonged period of time. In the past, many biostimulation studies using red spectrum lasers produced confusing data and conflicting results. Some studies reported that the biostimulation effect did not occur in all cases of laser irradiation, while other research reported that it did. Results seem to depend on the delivery of appropriate energy fluence levels (between 1 and 20 J/cm2) and the type of laser (wavelength) used. Several of these studies never described the levels of laser energy used to promote the described biostimulatory results. This caused controversy when determining whether or not helium-neon lasers influence wound healing. Studies suggest that low-power laser exposure can significantly increase the healing rate during the first few days of the healing process; however, studies do not show appreciable net benefit as compared to controls toward the end of a two-week wound repair cycle. The increased healing effect appears to be centered around the early, most sensitive stages of the healing process. Several studies showed optimum tissue healing rates at helium-neon laser exposure levels between 1 J/cm2 and 20 J/cm2. Laser-enhanced biostimulation has been reported to produce metabolic changes within the cells. This results in faster cell division, rapid matrix production (increased collagen, myofibroblasts, etc.), and cell movement. There have been few controlled studies using adequate numbers of human subjects in identifying the beneficial effects of helium-neon laser biostimulation. Ethical concerns, bulky equipment, and problems with biased study designs have frustrated a practical evaluation of laser biostimulation for general dental practice. A recently published "preliminary" study involving 52 patients was designed to reduce these issues. The purpose of this study is to complement the above research and to evaluate whether helium-neon diode laser radiation at average fluences of 0.34 J/c