Low level laser therapy for dentine hypersensitivity

Terapia do laser de GaAlAs na hipersensibilidade dentinária

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Abstract

Dentine hypersensitivity is a disease that affects both man and women, and it is an overreaction for a stimulus that normally would not cause pain in a healthy tooth. The etiology is multifactorial, and the pain appears specially when the cervical region dentine is exposed to the oral environment. The purpose of this work was to test the efficiency of application of the gallium-aluminum-arsenide diode laser (GaAlAs) in the treatment of dentine hypersensitivity. Fifty teeth were selected from patients of the São José dos Campos School of Dentistry - UNESP who presented dentine hypersensitivity. The Local Ethics Committee approved this work. The patients were questioned about pain, and after tactile (probe) and evaporative stimuli (air jet), scores were attributed and recorded in an analogous visual scale: score 10 (unbearable pain); 7 to 9 (strong and bearable pain), 4 to 6 (moderate pain), 1 to 3 (light pain) and 0 (no pain). The laser was applied on the surface that presented sensitivity (non contact) for 2 minutes at 15mW. The scores were attributed before and after each application. No more than 3 applications were performed, with an interval of seven days between them. The results were analyzed by the non-parametric Friedman analysis of variance ($p<0.001$) and by Tukey multiple comparison test ($p<0.05$). The percentage of teeth that presented absence of pain to the evaporative test altered from 2% (beginning) to 62% (end of treatment), and to the tactile test from 46% to 86%, significant statistically. It was concluded that the treatment performed was effective for the reduction of dentine hypersensitivity.

Uniterms

Dentine sensitivity; laser therapy

Introduction

Among all the many odontological problems associated with pain, and of difficult solution for the dentist, is the dentine hypersensitivity associated to the neck of the tooth. The hypersensitivity is an exaggerated response to stimuli that would not cause any effect on a healthy tooth (FLYNN et al.[9], 1985; BISSADA[6], 1994). In 1958, Abel[1] characterized the dentine hypersensitivity as a short, sharp pain arising from exposed dentine in response to stimuli typically evaporative, tactile, or chemical and that cannot be described as any other form of dental pathology.

According to Wichgers & Emert[27] (1996), 18% of the adult population suffers from this problem,

and that the higher incidence occurs in the premolars, followed by the canines, incisives and molars, and the vestibular area is the most affected. The origin of the cervical lesions and the pain are various and multifactorial. Among them are the chemical erosion, caused by the ingestion of acid in the diet or frequent vomit, bulimia or gastric disturbs (CHRISTENSEN[7], 1998), the brushing; the use of abrasives and occlusal disbalance, that when associated can explain the loss of dental enamel in the cervical area, and consequently, hypersensitivity.

The erosive agents are probably responsible for starting the sensitivity due to the opening of the tubules.

The treatments are performed to block the hydrodynamic mechanism by transmitting stimuli to the dentin, and closing the dentin tubules, Addy & West[2] (1994). Many treatments with topic products in form of dental cream, mouthwash, and varnishes have been offered to the population in an attempt solve the problem. There are reports in literature of an application of dentin adhesive (IDE et al.[14], 1998), propolis application (MAHMOUD et al.[17], 1999) and the use of silver nitrate solution (TOUYZ & STERN[25], 1999) on cervical dentin, which were considered effective for reducing dentin hypersensitivity. With technological development, the laser therapy has been the proposed for the treatment of cervical hypersensitivity because it is painless for the patient. However, few professional have access to such resource.

The GaAlAs laser has been used for the treatment of dentin hypersensitivity. It acts on the biostimulation because of the increase in production of mitochondrial ATP, increasing the threshold of the free nerve endings, providing an analgesic effect due to the increase of b-endorphine in the cephalorrhachidian liquid (BENEDICENTI[5], 1982). The reduction of pain occurs because of the inhibition of the cycloozygenase enzyme, which suspends the conversion of the arachidonic acid into prostaglandin. The laser also increases the formation of a secondary dentin by the odontoblasts, in process of bioestimulation. The GaAlAs laser is easy to apply and presents good results as described in the literature (MEZAWA et al.[19], 1988; FURUOKA et al.[10], 1988, YAMAGUCHI et al.[28], 1990; GROTH[12], 1993; GERSCHMAN et al.[11], 1994; WALSH[26], 1997; PASSARELI NETO[21], 1998).

The Nd:YAG (high-level) and HeNe (low-level) lasers can also be used in cases of dentin hypersensitivity, and had its effectiveness proved by studies of Aun et al.[3], 1989; Lan & Liu[16], 1996; Gutknecht et al.[13], 1997. According to Pereira[22], 1995; Midda & Renton-Harper[20], 1991; and Eduardo et al.[8], 1994, the Nd:YAG laser obliterate the dentin tubules, and is another option for hypersensitivity. However, its high cost restricts its use to laser centers or universities.

Kimura et al.[15], 2000, said that it is necessary to consider the severity of the dentin hypersensitivity before using the laser and that the efficiency of the use of laser for dentin hypersensitivity treatment is higher than other methods but in severe cases, the laser is less effective.

The proposal of a painless treatment has increased the use of the low-level laser therapy. However, the works performed are suggestive and irregular, and justifies more studies about this kind of treatment (BASFORD[4], 1989).

Proposition

The purpose of this study was to test the efficiency of the application of the gallium-aluminum-arsenide diode laser (GaAlAs) for the dentine hypersensitivity treatment.

Material and method

1. Clinical cases selection

Fifty teeth from twelve patients were selected from the odontological clinic of the São José dos Campos School of Dentistry - UNESP. These teeth presented dental sensitivity to tactile (mechanical stimulation performed with a probe #5 – Duflex), and evaporative tests (with air jet from a combination syringe, on the vestibular and lingual cervical region of the tooth, near the amelo-cement junction, approximately 3mm from and perpendicular to the tooth, for 5 seconds, performed by the same operator and equipment).

The patients were questioned about their health in general, their mouth hygiene and alimentation habits.

2. Evaluation of pain

In each section the sensitivity degree of each sample was tested through the application of air jet and contact with the probe. Based on the sub-

jective answer of the patient, scores from 0 to 10 were attributed, these values were registered on a filling card which had the Analogous Visual Scale (Figure 1), suggested by Plagmann et al.[24], 1997.

3. Equipment

The equipment used was: BDP 660 class IIIb Laser – MMOPTICS (Figure 2), set to 15mW (MARSÍLIO[18], 1999) for 2 minutes (non contact), at 660 nm wavelength and 50 J/cm^2 of fluence.

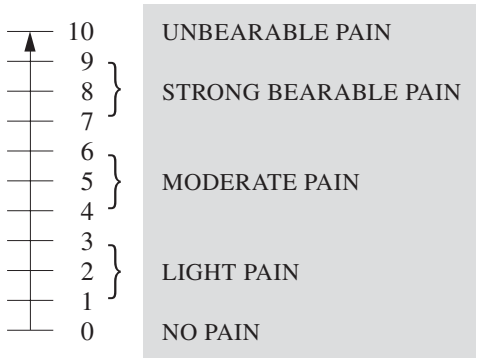

FIGURE 1 - Analogous visual scale.

4. Procedure

The teeth were kept dried and under relative isolation and the laser was applied 3mm away from the tooth and perpendicular to the amelo-cement junction. At this distance the area reached by the laser was the same as the laser's Spot, verified by the Spiricon Laser Beam Analyser Model LBA-100A Equipment (IEAv-CTA- Lasers Division).

Evaluations to the tactile sensitivity and evaporative stimuli were performed, before and after each laser application, and the scores were recorded on the card. No more than three applications were performed on each tooth, with an interval of seven days between them.

Both the patient and applicators used protective goggles.

5. The Tukey Test and Friedman Two Way Non parametric Analysis of Variance were applied.

RESULTS

The tactile and evaporative assessments were analyzed using Friedman Non parametric Analysis of Variance. The groups showed statistically significant differences among them (p<0,001).

Tactile: Chi-square= 54,887 with 5 degrees of freedom (p <0,001).

Evaporative: Chi-square= 124,550 with 5 degrees of freedom (p<0,001).

FIGURE 2 - BDP 660 class IIIb Laser – MMOPTICS.

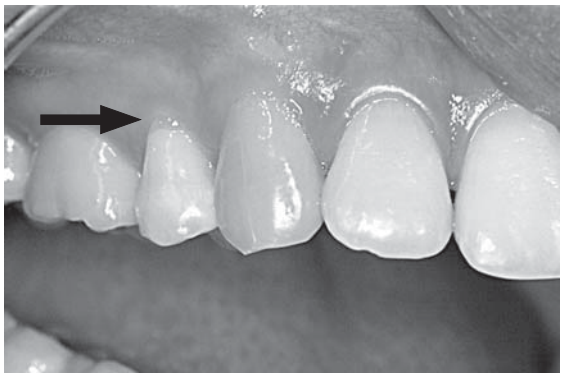

FIGURE 3- Vestibular cervical sensitivity dentine.

The Figure 4 shows mean values according to period and method of evaluation of pain.

Figures 5 and 6 present frequency of scores attributed and recorded on a visual analog scale at the beginning and end of treatment.

The percentage of teeth that presented absence of pain to the evaporative test altered from 2% (beginning) to 62% (end of treatment), and to tactile test from 46% to 86%, significant statistically. The teeth that presented unbearable pain to the evaporative test altered from 14% to 8%, and to tactile test the 4% continued till the end of treatment.

To isolate the group or groups that differ from the others we used a multiple comparison procedure (Tukey Test).

Tukey Test showed values in decrescent order indicating reduction in tooth sensitivity at the end of treatment (Table 1 and 2).

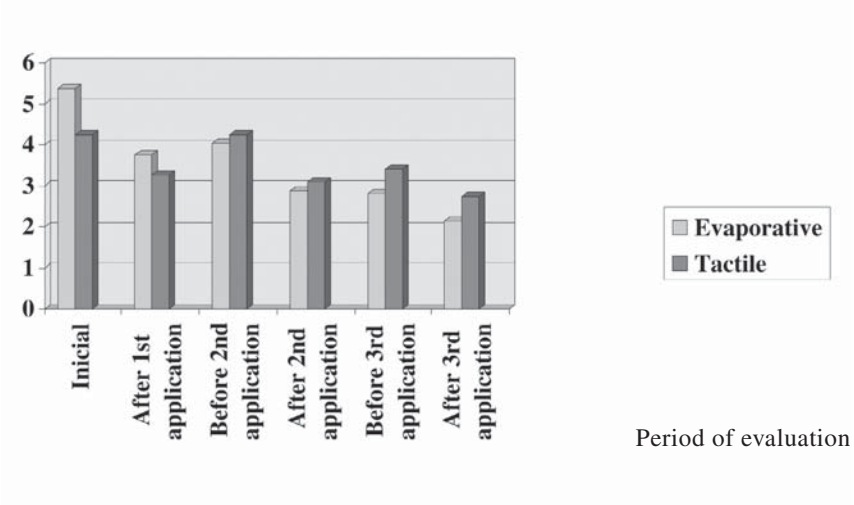

FIGURE 4 - Mean values (Friedman's test) according to period and method of evaluation of pain.

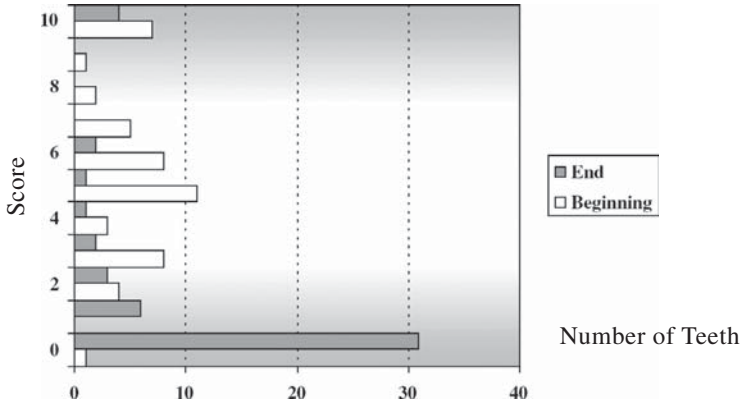

FIGURE 5 - Teeth distribution: dentine hypersensitivity to evaporative stimuli in the beginning and end of treatment.

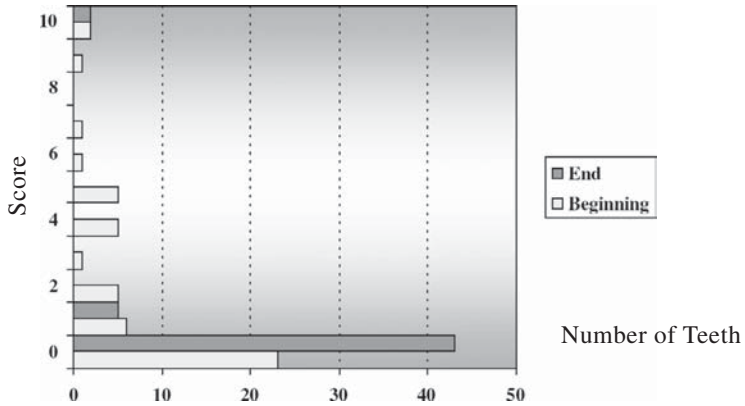

FIGURE 6 - Teeth distribution: dentine hypersensitivity to tactile stimuli in the beginning and end of treatment.

Table 1 - All Pairwise Multiple Comparison Procedures (Tukey Test) – evaporative stimuli

Comparison	q	p < 0,05
Initial x After 1st irradiation	6,12	YES
Before 2nd irradiation x After 2nd irradiation	4,46	YES
Before 3rd irradiation x After 3rd irradiation	2,49	NO

Table 2 - All Pairwise Multiple Comparison Procedures (Tukey Test) – tactile stimuli

Comparison	q	p < 0,05
Initial x After 1st irradiation	3,74	NO
Before 2nd irradiation x After 2nd irradiation	4,38	YES
Before 3rd irradiation x After 3rd irradiation	2,45	NO

Discussion

Pain is a phenomenon that, in dental parameters, completely discourages the patient to keeping his/her oral hygiene. The touch of the toothbrush during the hygiene, the air inhaled or even the ingestion of liquids at different temperatures, which is normally a pleasure, become displeasing and induce future periodontal problems due to plaque accumulation on the regions not touched by hygiene procedures.

Therefore, the dentin hypersensitivity is a largely explored topic in dentistry, with many researches for efficient new methods for its treatment. However, the definite results of applied therapies are dissenting, especially according to the etiology and longevity of treatment.

The low-level lasers have analgesic, bio-stimulant and anti-inflammatory effects, regulate the cellular metabolism (BENEDICENTI[5], 1982; EDUARDO et al.[8], 1994), and are indicated to be used in the treatment of dentin hypersensitivity, herpes, aphthas, for endodontic intervention and after surgeries (EDUARDO et al.[8], 1994). Pinheiro et al.[23], 1998 approve the use of low-level lasers for disorders in the maxilo-facial region. According to Kimura et al.[15], 2000, the severity of the hypersensitivity should be taken into consideration before the use of laser, since in severe cases the laser will be less effective.

Flynn et al.[9], 1985, sustain that there is no prevalence between males and females, comparing the results of these work in which 83.3% of the patients were women. This fact may be explained by the fact that women are more open to treatments in general. In this work the most frequent surface was also the vestibular cervical surface of premolars, agreeing with Flynn et al.[9], 1985.

The laser therapy is a painless, safe, fast, conservative treatment, and it is well accepted by the patients (MARSÍLIO[18], 1999). However, the lasers, especially high-level ones, are very expensive and the professional has to be qualified to its use. The low-level ones, on the other hand, are more accessible to most professionals, but we can't forget the need of high knowledge of their use and the rules of security.

The results of this study, in these parameters, agree with those of Furuoka et al.[10], 1989; Basford[4], 1989; Yamaguchi et al.[28], 1990; Groth[12], 1993; and Gershman et al.[11], 1994, proving the effectiveness of the use of the GaAlAs laser for the treatment of dentin hypersensitivity. It should be noted that the study was purposely performed in a short period of evaluation to fulfill predetermined deadlines. Probably, if the application sessions continued the results would be even better.

As alternatives with more accessible cost and simpler techniques of hypersensitivity treatment which aim at producing an occlusive effect on the dentin tubules, blocking the hydrodynamic flux, there are the application of fluoridated varnish, restorative or adhesive systems, silver nitrate, formalin, zinc chloride, calcium hydroxide, strontium chloride, potassium oxalate (PEREIRA[22], 1995), propolis (MAHMOUD et al.[17], 1999) and potassium nitrate (TOUYZ & STERN[25], 1999).

Besides cost-benefit characteristic, the longevity of the performed treatment should also be taken into account. Long-term studies are necessary to confirm the durability of the therapeutic effect of the treatment with low-level lasers compared to conventional forms of treatment, bearing in mind that the search for the cause of the problem is extremely important, such as: diet regularization, occlusal adjustment, strength control and hygiene habits, among others.

Conclusion

After analyzing the results presented but the Tukey Multiple Comparison Test, with 95% reliance, it could be concluded that the treatment with GaAlAs laser was effective for reducing dentin hypersensitivity, and the percentage of teeth that presented no pain to the evaporative test was two in the beginning of the treatment and 62% in the end of treatment, and to the tactile test raised from 46 to 86%.

Resumo

A hipersensibilidade dentinária é uma patologia que afeta indivíduos de ambos os sexos, caracterizando-se por uma resposta exagerada a um estímulo que normalmente não causaria dor em um dente sadio. A etiologia é multifatorial, sendo que a dor se instala principalmente quando a dentina localizada na região cervical do dente fica exposta ao meio bucal. Este trabalho teve como objetivo testar a eficácia da aplicação do laser diodo de arseneto de gálio alumínio (GaAlAs) no tratamento da hipersensibilidade dentinária. Foram selecionados cinqüenta dentes de pacientes da Faculdade de Odontologia de São José dos Campos – UNESP que apresentavam hipersensibilidade dentinária. Este trabalho foi aprovado pelo Comitê de Ética local. Os pacientes foram questionados sobre a dor e, após estímulo táctil (sonda exploradora) e estímulo evaporativo (jato de ar), atribuíam escores, que eram anotados em uma escala visual análoga: escore10 (dor intolerável), 7 a 9 (dor forte e tolerável), 4 a 6 (dor moderada), 1 a 3 (dor leve) e 0 (ausência de dor). A aplicação do laser foi realizada na superfície

que apresentava sensibilidade (não-contato) durante 2 minutos a 15 mW de potência. Os escores foram atribuídos antes e após cada aplicação. Foram realizadas no máximo 3 aplicações, com intervalo de 7 dias. Os resultados foram analisados pela Análise de Variância Não Paramétrica de Friedman ($p<0,001$) e Comparação Múltipla de Tukey ($p<0,05$). A porcentagem de dentes que apresentou ausência de dor ao teste evaporativo passou de 2 % (início) para 62 % (final do tratamento) e, ao teste táctil, de 46 % para 86 %, estatisticamente significante. Concluiu-se que o tratamento realizado foi efetivo na redução da hipersensibilidade dentinária.

UNITERMOS

Sensibilidade da dentina, laser, laserterapia

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