

Clinical Efficacy of Fluoride Varnish and Low-Level Laser Radiation in Treating Dentin Hypersensitivity

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The objective of this study was to compare the efficacy of fluoride varnish (Fluorniz[®]) and irradiation with a gallium-arsenide-aluminum diode laser in the treatment of cervical dentin hypersensitivity. Cervical dentin hypersensitivity (CDH) is a painful condition that is highly prevalent in the world's adult population, with one in six patients presenting this symptom. Eighty-six teeth were divided into two groups: Group 1, teeth treated with Fluorniz; Group 2, teeth irradiated with a GaAlAs laser at a 4 J/cm² dose. The two treatments were applied to the buccal cervical region in four sessions, at intervals of 72 to 96 h. The response of the patient to tactile and thermal-evaporative stimuli was rated on a visual analog scale. The results showed a reduction of hypersensitivity in response to tactile and thermal-evaporative stimulation at the end of treatment in both groups. In conclusion, short-term treatment with Fluorniz was found to be more effective than low-level laser radiation in reducing cervical dentin hypersensitivity.

Key Words: fluorides, dentin sensitivity, laser, sodium fluoride.

Introduction

Cervical dentin hypersensitivity (CDH) is a painful condition that is highly prevalent in the world's adult population, one out of six patients presents this symptom. CDH is a complex phenomenon that involves both physiological and psychological alterations (1,2). The condition is characterized by acute, rapid and localized pain of variable intensity, which is triggered by a variety of irritants such as thermal (cold and/or hot), mechanical or tactile, chemical (acids and sweets) and bacterial stimuli (3). Several theories have been proposed to explain the etiopathogenesis of CDH; however, the most accepted is the hydraulic conductance of dentin, also known as the hydrodynamic theory. According to this theory, pain results from the movement of fluid inside dentinal tubules, stimulating structures of the dentin/pulp complex in response to changes in intrapulpal pressure at the level of the odontoblast layer (4).

The difficulty in treating CDH is reflected by the large number of techniques and therapeutic alternatives available for the alleviation of this condition (5). On the basis of the hydrodynamic theory, several methods designed to block dentin tubule openings have been proposed, such as the application of fluorides, dentin adhesives, corticosteroids and silver nitrate. Recent studies have obtained satisfactory results with laser radiation therapy. This treatment provides immediate results considering its analgesic and long-lasting action due to its ability to stimulate formation of secondary dentin (6).

In general, the multiple treatment options for CDH available in the literature leave professionals confused, a fact resulting in a lack of confidence to treat it efficiently (6,7). Within this context, the objective of the present clinical study was to compare the use of low-level gallium-arsenide-aluminum (GaAlAs) laser radiation and fluoride varnish (Fluorniz[®]) for the treatment of CDH.

Several of the requirements for the treatment of CDH proposed by Grossman in 1935 are valid until today: treatment should be non-irritant to the pulp, relatively painless during application, easy to apply, rapid action with long-term effects and consistently effective, and should not stain the teeth. However, the results of studies show that therapies have failed on one or more of these criteria. In this respect, laser radiation has now become a reliable and reproducible alternative, with average success rates higher than 90% (8). The lasers used for this purpose can be divided into two groups: low power (HeNe and GaAlAs) and medium power lasers (Nd:YAG and CO₂) (8). The laser energy should be applied perpendicularly to the surface of sensitive dentin in a punctual mode and should be directed at the sensitive cervical region of the tooth. An energy dose of 4 to 6 J/cm² is recommended (2,9).

Sodium fluoride (NaF) is one of the most indicated desensitizing agents for the treatment of CDH, and it is applied in different ways. The use of NaF varnish has been advocated since it extends the action time of the fluoride in contact with exposed dentin, thus increasing the efficacy in reducing CDH. The action of the varnish in occluding or

narrowing the dentinal tubule is relatively short because of its gradual effect and because the varnish may be removed during tooth brushing before exerting its desensitizing effect (4). In addition, the formed precipitate may disappear by the action of saliva or chemical factors such as food, acid beverages and the acid from dental biofilm (10).

According to Porto et al. (5), fluoride varnish is indicated for the treatment of CDH because of its immediate effect and easy application. In contrast, low-level laser radiation has been used successfully since it is able to induce changes in the neural transmission network inside the dental pulp, rather than causing alterations on the exposed dentin surface, as observed in most treatments. Furthermore, a biostimulating effect consists of the production of secondary dentin, allowing physiological occlusion of the dentinal tubules and stimulation of endorphin release from the synapses of nerve terminals located in the dentinal tubules (7).

Yui et al. (11) evaluated the efficacy of GaAlAs laser application in teeth with CDH and found that the percentage of teeth without pain increased from 2% at baseline to 62% at the end of treatment in the evaporative test, and from 46% to 86% in the tactile test, demonstrating that GaAlAs laser therapy was effective in reducing CDH. In another clinical study (8), teeth diagnosed with CDH were either submitted to GaAlAs laser applications or exposed to photocuring light for 30 s (sham treatment). GaAlAs laser therapy reduced pain significantly after each application and at the end of treatment. However, after 6 weeks, no significant difference was observed between groups at the end of treatment or after immediate evaluation of the results. Corona et al. (12) compared GaAlAs laser radiation and NaF varnish (Duraphat®) for the treatment of CDH and concluded that both treatments are effective in reducing CDH, although laser provided better results in treating more sensitive teeth. Another study (5) compared the efficacy of 4% NaF and low-level laser (GaAlAs) therapy in the treatment of CDH and found no significant difference between the therapies when CDH was evaluated immediately and 1 month (5).

The objective of this study was to compare the efficacy of fluoride varnish (Fluorniz®) and irradiation with a GaAlAs diode laser in the treatment of cervical dentin hypersensitivity.

Material and Methods

After approval by the local Ethics Board (Process no. 210/10-P), all volunteers signed an informed consent form.

After confirmation of the inclusion and exclusion criteria, sensitive teeth were identified in the first session and randomly allocated to Group 1 and Group 2 in an alternating fashion according to location in the hemiarch.

The sample consisted of 86 teeth, 40 in Group 1 and 46 in Group 2.

First, each selected tooth was subjected to two stimuli: a tactile stimulus consisting of passing the tip of the exploratory probe along the cervical region until the patient felt the pain that made him seek treatment. After 3 min, a second stimulus (thermal-evaporative) consisting of the air jet of a triple syringe was applied to the cervical region, 1 cm from the tooth, for one second. After each stimulus, sensitivity was rated on a visual analog scale (VAS).

The VAS consists of a 10-cm long line, graded into 1-cm intervals, where the left end corresponds to no pain and the right end corresponds to intense, almost unbearable pain in response to the stimulus (13). After application of the stimuli, the patients marked the number that corresponded to the degree of sensitivity they felt. The patient received a chart with a graph of the VAS for each recording. The number marked by the patients on the scale was transferred to a registration form in the medical record during each assessment.

After the first recording, the teeth were treated according to the group to which they belonged. In Group 1, treatment consisted of removal of the dental biofilm with a cotton pellet, isolation of the tooth with cotton rolls and application of Fluorniz® (5% NaF varnish, S.S. White, Rio de Janeiro, RJ, Brazil) to the buccal cervical region for 4 min, in four sessions at intervals of 72 to 96 h. In Group 2, the dental biofilm was removed with cotton pellet and the tooth was isolated with cotton rolls. Next, low-level laser radiation (Clean Line, Taubaté, SP, Brazil) at a 4 J/cm² dose was applied punctually to the cervical region on the buccal face, in four sessions at 72–96-h intervals.

On the next visit after each Fluorniz or laser application, the response of the patient to tactile and thermal-evaporative stimuli marked on the NVS was recorded. Another recording was obtained 72 h after the end of treatment.

Results

Average pain elicited by tactile and evaporative stimuli differed in the five assessments of NaF and laser therapy, as demonstrated by the Wilcoxon test. Figures 1 and 2 illustrate the differences in mean pain scores obtained after tactile and thermal-evaporative stimulation, respectively, with the observation of a gradual reduction in subsequent assessments.

For Fluorniz treatment, a significant decrease in mean pain scores after tactile stimulation was observed from the first to the fifth assessments ($p < 0.001$), except between the first and second assessments ($p = 0.38$) and between the fourth and fifth assessments ($p = 0.18$). Fluorniz treatment also significantly reduced mean pain scores after

thermal-evaporative stimulation from the first to the fifth assessments ($p<0.001$), except between the fourth and fifth assessments ($p=0.12$).

A significant reduction in mean pain scores elicited by tactile stimulation was observed after laser therapy from the first to the fifth assessments ($p<0.001$), except between the third and fourth assessments ($p=0.33$), between the third and fifth assessments ($p=0.08$), and between the fourth and fifth assessments ($p=0.12$). Laser therapy also significantly reduced mean pain scores after thermal-evaporative stimulation from the first to the fifth assessments ($p<0.001$), except between the fourth and fifth assessments ($p=0.38$). Figure 3 shows the percent reduction of CDH between the first and last assessments.

Hypersensitivity in response to tactile stimulation was reduced by 83.1% at the end of treatment in the Fluorniz group and by 63.4% in the laser group. The reduction of hypersensitivity in response to thermal-evaporative stimulation at the end of treatment was 81% in the Fluorniz group and 67.1% in the laser group. These results show that Fluorniz varnish was a more effective treatment of CDH than laser radiation.

Discussion

Dentin hypersensitivity is one of the most common painful conditions affecting the oral cavity, with a prevalence ranging from 4 to 57% (14).

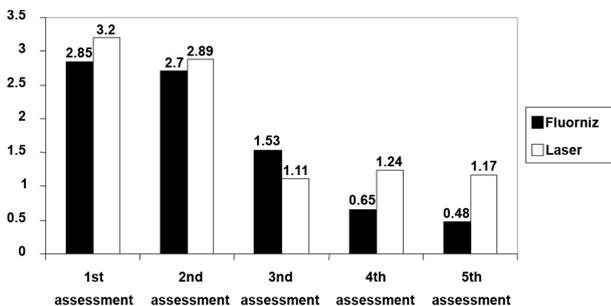


Figure 1. Mean pain score elicited by tactile stimulation in five assessments of teeth subjected to Fluorniz and laser treatment.

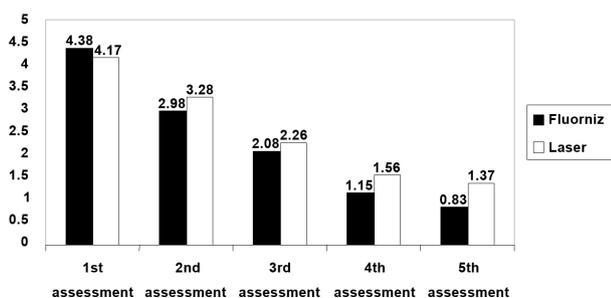


Figure 2. Mean pain score elicited by thermal-evaporative stimulation in five assessments of teeth subjected to Fluorniz and laser treatment.

In the present study, the stimulation tests proposed by Walter (15) and Madhavan et al. (16) were used to evaluate the level of hypersensitivity. According to these authors, these methods provide accurate data for the evaluation of hypersensitivity levels by attempting to translate subjective into objective data.

Different ways of fluoride administration for the treatment of CDH have been reported (6). In this respect, varnishes containing a high concentration of fluorine are the most widely used products that provide highly satisfactory results. The short-term efficacy of fluoride varnish has been demonstrated in the literature (4,6,17,18), but long-term results have been questioned because saliva may dissolve calcium fluoride crystals and pain from sensitive teeth will reappear (6). In the present study, fluoride varnish resulted in a satisfactory reduction of CDH to both tactile (83.1%) and thermal-evaporative stimuli (81%) (Fig. 3). These results agree with other studies using the same type of therapy (18). In addition, a significant decrease of dentin sensitivity was observed in each assessment. However, this decrease was not significant from the first to the second assessments after tactile stimulation and from the fourth to the fifth assessments after tactile and thermal-evaporative stimulation. These findings indicate that Fluorniz application exerts a therapeutic effect on dentin sensitivity after the second and third application and that a fourth application is not required.

The results of low-level laser therapy in reducing dentin hypersensitivity are highly satisfactory (4,5,7,8,14). In the present investigation, a significant reduction in the level of CDH to tactile (63.4%) and thermal-evaporative (67.1%) stimuli was observed in the group submitted to laser radiation, in agreement with most studies. For tactile stimulation, a significant decrease in mean pain scores was observed from the first to the third assessments, whereas sensitivity no longer declined significantly thereafter. In contrast, mean pain scores elicited by thermal-evaporative stimulation decreased until the fourth assessment, with no significant decrease thereafter, suggesting that three

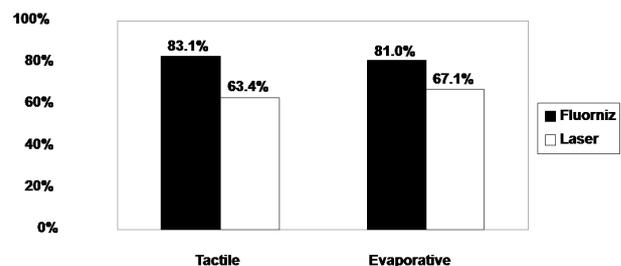


Figure 3. Percent reduction of mean pain elicited by tactile and evaporative stimulation between the first and last assessments of teeth subjected to Fluorniz and laser treatment.

sessions of laser application are sufficient to obtain therapeutic results.

The present results agree with other clinical studies in which the application of concentrated fluoride to exposed buccal dentin surfaces was effective in reducing hypersensitivity, as demonstrated by the increased resistance of dentin to decalcification and by the precipitation of calcium fluoride crystals in exposed dentinal tubules (14,16). However, Umberto et al. (14) observed a greater efficacy of GaAlAs laser radiation when compared to NaF gel. In addition, the combination of laser radiation and NaF gel provided the best short-term results.

Analysis of the percent reduction in dentin sensitivity at the end of treatment showed that Fluorniz application was significantly more effective than laser radiation, at least in the short-term reduction of CDH. In contrast, Umberto et al. (14) obtained the best results when laser application was combined with 1.25% NaF, followed by laser application alone. Treatment with 1.25% NaF alone was the least effective. Long-term studies are required, since the proposal of laser therapy is a long-lasting action as a result of stimulating the formation of secondary and tertiary dentin.

Fluorniz treatment was more effective than low-level laser radiation in the short-term reduction of CDH.

Resumo

Este trabalho teve o objetivo de comparar a efetividade das terapias com verniz fluoretado (Fluorniz) e com laser diodo de arseneto de gálio e alumínio (AsGaAl) no tratamento da hipersensibilidade dentinária cervical (HSDC). Foram selecionados 86 dentes divididos em dois grupos. No Grupo I foi aplicado Fluorniz e no Grupo II realizou-se irradiação com laser AsGaAl com dosimetria de 4 J/cm², ambos na região cervical da face vestibular, em quatro sessões com intervalos de 72 a 96 horas. O registro da resposta do paciente quanto aos estímulos tácteis e termo-evaporativos foi realizado através da escala visual numérica. Os resultados demonstraram que houve uma redução da hipersensibilidade ao final do tratamento tanto para estímulo táctil quanto para o estímulo termo-evaporativo, para ambos os grupos. Concluiu-se que, em curto prazo, a terapia com Fluorniz demonstrou-se mais efetiva que o laser de baixa potência para diminuição da HSDC.

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