Abstract

Background: Dentinal hypersensitivity is one of the most chronic and painful conditions. A variety of treatment modalities have been developed for the improvement of dentinal hypersensitivity. Laser is one of the latest treatment modality in the field of Periodontics. Hence, the present study was conducted to assess the efficacy of Diode laser in treatment of dentinal hypersensitivity. Aim: The aim of the present study was to compare the efficacy of 810 nm Diode Laser with desensitising mouthwash in the treatment of dentinal hypersensitivity. Materials and methods: The study was conducted on 60 individuals between 25 to 40 years of age with a complaint of dentinal hypersensitivity. Dentinal hypersensitivity was assessed using tactile and air blast stimuli which was rated on a visual analogue scale ranging from zero to 10. Patients were randomly divided into group 1 (30 individuals) treated by desensitising mouthwash containing 3% Potassium Nitrate, Triclosan and Sodium Monofluorophosphate; Group 2 (30 individuals) lased at 1 W with continuous noncontact mode using 400μ fibre of Diode Laser with a wavelength of 810 nm for 60 seconds. Each tooth received one application. The pain assessment was performed at baseline, 2 weeks and 4 weeks of the study period on the same visual analogue scale. Results: The use of Diode Lasers significantly improved hypersensitivity as compared to desensitising mouthwash at the fourth week of the study period. The results were not significant at the baseline and the second week of the study period. Conclusion: The Diode laser was more effective in reducing cervical dentinal hypersensitivity as compared to the desensitizing mouthwash only when used for a longer period of time.

Key words: Dentinal hypersensitivity, Desensitizing mouthwash, Laser

Introduction

Dentinal hypersensitivity may be defined as the response which is produced from exposed dentine due to any chemical, thermal or osmotic stimuli. This pain is not clinically associated with any other defect or pathology. The patients often describe this as sharp, short-lasting tooth pain and this generally occurs when the stimulus reaches the exposed dentine. It has a prevalence rate of 4% to 57% in the general population.

Numerous treatment modalities have been developed for treatment of dentinal hypersensitivity. The key of successful treatment is to reduce dentinal permeability by occluding the dentinal tubules...
or by blocking the neural transmission. The conventional therapy for hypersensitivity includes local application of desensitizing agents like desensitizing toothpastes or mouthwashes which contain potassium salts as active ingredients and block the action potential generated in nerves. The desensitizing agents are recommended to be used twice a day for at least 2 weeks. It has been observed that these conventionally used topical desensitizing agents do not bond to the dentin surface, and their action is transient due to their dissolution in oral fluids. Although these traditional methods have been clinically evaluated and do provide relief to patients, dental professionals are constantly in search of more-effective, faster-acting, and longer-lasting treatments. With increasing advancements in the field of dentistry, newer modalities of treatment like Laser therapy have been the suggested for the treatment of hypersensitivity.

The use of Lasers for the treatment of hypersensitivity in the literature is reported to be as old as 1980. Though preliminary studies with Lasers have given unsatisfactory results, the improvement in technology has led to development of new Lasers with suitable wavelength for therapeutic use. The commonly used Laser for treatment of dentine hypersensitivity includes low output and middle output Lasers. Of the various Lasers available, Diode Laser is the most studied Laser. Several studies have been conducted in the literature to study the efficacy of Diode Lasers in alleviation of hypersensitivity. It is commonly used due to its safety with regard to the pulpal tissue as compared to other lasers like CO₂ laser or Nd: Yag Laser.

Recent studies have shown satisfactory results with Laser irradiation. Most studies have been conducted with different types of Laser, and different parameters i.e wavelength, power and duration of application, and have evaluated the effectiveness of the treatment both immediately upon application and also 6 months after the treatment.

The conventionally used mouthwashes have a short duration of action, and hence studies using Laser as a treatment modality and has a longer duration of action are required. The aim of the present study was thus, to compare the efficacy of the commercially available desensitizing mouthwash (SHY- OR containing 3 percent KNO₃) and Diode LASERs (used at a wavelength of 810 nm, lased at 1 W for 60 seconds) in treatment of dental hypersensitivity.

Materials and methods:
Case selection:
A clinical study was conducted on 60 individuals between 25 to 40 years of age who reported to the Department of Periodontics, AB Shetty Memorial Institute of Dental Sciences, Mangalore with the chief complaint of dental hypersensitivity. The patients who had good oral hygiene and clinically demonstrable teeth with dentinal hypersensitivity, who did not undergo any desensitizing therapy in the last 6 months and those have not used analgesics or anti-inflammatory drugs were included in the study. The patients with systemic or psychological disease, carious lesions/faulty restorations, active periodontal disease, those allergic to desensitizing agents and those who have undergone periodontal surgery in the last 6 months were not included in the study. The patients were divided into two groups, Group 1 (30 patients) treated by desensitising mouthwash and Group 2 (30 patients) treated using Diode LASER. The allocation of patients into these two groups was done by simple randomization. The oral hygiene status and the medical history of all the patients was recorded. All patients included in the study underwent oral prophylaxis and were instructed to use the same non desensitizing toothpastes and soft bristle toothbrushes during the study period. An informed consent was taken from all the participants before initiating the study.

Evaluation of pain:
The sensitivity of each tooth was assessed through the application of air jet (air blast test) and contact with a Williams’s calibrated periodontal probe (tactile stimulation). For the air blast test, a jet of air was used from a three way syringe on the cervical region of the tooth near the cementoenamel junction approximately 0.5 cm from and perpendicular to the tooth for around 2 to 3 seconds.
For tactile stimulation a probe was moved on the cervical region of the tooth in a mesiodistal direction. Both the tests were performed by the same operator.

**Visual analogue scale (VAS):**
Based on the subjective answer of the patients, scores were recorded using a visual analogue scale. A visual analogue scale is 10 cm in length, where 0 is equal to no pain and 10 is the worst pain imaginable. The patients with dentinal hypersensitivity in all four quadrants were selected. The most sensitive tooth was selected for recording the visual analogue score (Figure 1).

In both the groups, evaluation of the air blast test and tactile stimuli was done at baseline, 2 weeks and 4 weeks after intervention on a visual analogue scale.

**Group 1:** The patients were kept on a desensitizing mouthwash containing 3% potassium nitrate (active ingredient), triclosan and sodium monofluorophosphate (Brand name-SHY OR, Group Pharmaceuticals). The patients were asked to rinse their mouth twice a day with 15 ml of the mouthwash for 30-60 seconds.

**Group 2:** The teeth were isolated and kept dried and the Laser was applied 2mm away and perpendicular to the CEJ. The diode laser (Picasso plus, AMD lasers) was used at 1 W in a continuous non-contact mode using 400μ fibre of Diode Laser with a wavelength of 810 nm for 60 seconds. Only one application was used on each tooth.

The evaluation of pain and visual analogue scale for both the groups, were done at baseline, after 2 weeks and at the end of 4 weeks of use of the desensitizing agent.

The selected patients were randomly allocated into the two treatment groups:

Figure 1: The visual analogue scale used for the study

Statistical analysis
The data collected was entered into a Microsoft excel spreadsheet and analyzed using IBM SPSS Statistics, Version 22 (Armonk, NY: IBM Corp). The descriptive data were presented in the form of mean, median, standard deviation and quartiles for continuous variables. The data collected followed a normal distribution. For an intragroup comparison, Wilcoxon sign rank was used to compare VAS score at different time intervals. For an intergroup comparison, Mann-Whitney U test was used for comparison of VAS scores at baseline, 2 weeks and 4 weeks. The A P value <0.05 was considered to be statistically significant.

Results
Intragroup comparison (graph 1)
Using tactile stimulation and air blast test, the mouthwash as well as the Laser group showed a significant improvement in hypersensitivity at 2 weeks and 4 weeks when compared to baseline, with maximum reduction being observed at the fourth week.

Inter group comparison (graph 1)
When both the groups were compared, the Laser group appeared to be more effective in reducing hypersensitivity when tested using air blast and tactile stimulation, with significant results noted only at the fourth week of the study. The second week did not show any significant difference in the Laser or the mouthwash group.

Discussion
Dentine is a permeable tissue and has fluid-filled dentinal tubules. The nerve fibres are found in the deeper areas of the tubules and in the superficial surface of pulp tissue. When any kind of stimuli activate the nerve fibres, pain may be experienced. The teeth can become more sensitive to even normal stimuli like temperature changes, air currents, probing with a sharp instrument etc. when the dentine is exposed. The most common reasons of this hypersensitivity may be due to attrition, abrasion, erosion, abfraction, developmental anomalies where the enamel and cementum fail to meet each other, gingival recession or periodontal therapy.

Currently, the most accepted theory of dentinal hypersensitivity supports the hydrodynamic theory was developed by Brannstrom. This theory explains that dentine hypersensitivity may be caused by movement of the dentinal fluid in the tubules.

Graph 1: Comparison of VAS scores of mouthwash and laser group at baseline, 2 weeks and 4 weeks by tactile and air blast stimulation

VAS Score
leading to distortion of the nerve fibres and thereby causing hypersensitivity. According to this theory, the action of desensitizing agents is due to their ability to cause blockage of the dentinal tubules.26

The present study was a clinical study comparing 3% potassium nitrate mouthwash with Diode Laser at 810nm for treatment of dentinal hypersensitivity. The demonstration of 3% potassium nitrate as an effective desensitizing agent in the form of a mouthwash in this study correlates with a previous study done by Pereira et al.27 There are not many published studies evaluating this formulation but several authors have reported the high efficacy of potassium nitrate containing toothpaste in alleviating hypersensitivity. The possible mechanism of action of potassium salts is by diffusion along the dentinal tubules and decreasing the excitability of the nerve fibres. These potassium ions may also block the synapse between nerve cells.9

Recently, the introduction of Lasers in dentistry has opened further vistas for treatment of dentinal hypersensitivity. This action of Lasers can be attributed to the formation of tertiary dentine that leads to physiological obliteration of tubules as reported by Villa et al.28 Another possible mechanism could be by acting directly on nerve transmission, with a depolarization process that prevents the diffusion of pain.29 These probable mechanisms could be the reason for excellent efficacy of Laser in reducing hypersensitivity in the present study.

A previous study by Liu et al conducted using Diode Lasers at 980 nm have also been successful for treating hypersensitivity.30

Although more expensive, Laser therapy leads to rapid results with less application time. This could be due to the fact that Laser therapy in contrast to the other treatment modalities leads to a decrease in nerve conduction rather than modifying the dentine surface.24 In addition, Laser therapy stimulates the normal physiological cellular functions.

The limitations of the study include the lack of a longer follow up period to evaluate the permanence of this treatment. Moreover, the effect of Laser irradiation on vitality of pulp could not be assessed in this study. Since the VAS scale is subjective, use of more objective tests will help in validating the results of the study. Further studies can be performed to evaluate whether the synergistic action of mouthwash and Laser is more effective than Laser alone.

Conclusion
Within the limits of the study it can be concluded that Diode Laser (810 nm) and desensitizing mouthwash provided similar results in reduction of cervical hypersensitivity when used for two weeks. However, desensitizing mouthwash could not equalize the performance of Lasers when used for four weeks. These results have to be confirmed by greater samples of patients and by longer follow-up periods (six months) to confirm the long-lasting action of Lasers.

References