Efficacy of diode laser and fluoride on dentin hypersensitivity treatment: A clinical trial

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Abstract:

Background: The purpose of this study was to compare the efficacy of diode laser and fluoride in treating dentin hypersensitivity (DH).

Materials and Methods: Fifty-two people were split into three groups, with 25 receiving diode laser therapy, 15 receiving fluoride, and 12 receiving a placebo. The VAS (Visual Analog Scale) was used to measure the level of discomfort. The VRS was used to assess the effectiveness of evaporative and tactile stimuli. A single session of therapy for DH was followed by VAS

application immediately after, 6 hours after, 12 hours after, and 24 hours after treatment, whereas VRS application occurred immediately after, 15 minutes after, and 7 days after treatment. The analysis of variance (ANOVA) and descriptive statistics were utilized. Statistical significance was assumed at the P 0.05 level.

Results: The DH's response to the evaporative stimulation was drastically diminished by the diode laser. The sensitivity of DH to evaporative and tactile stimuli was not affected by fluoride treatment ($P > 0.05$). Individuals whose DH was reduced by diode laser treatment did so more effectively than those whose DH was reduced by fluoride treatment or the placebo group.

Conclusion: Diode laser treatment was more successful in lowering DH levels than fluoride therapy.

Key words: Dentin sensitivity, fluoride, lasers, gingival recession

Introduction: Exposed vital dentine reacts abnormally to stimuli, a condition known as dentine hypersensitivity (DH). One of the most common dental patient complaints is DH, which has been observed to have a rising prevalence. The frequency of DH affects both sexes equally, but it is expected to rise in the future years as people learn more about the need of taking care of their teeth.[1] DH is characterized by sudden, localized discomfort that lasts just a few minutes and is thought to be caused by gingival recession, wasting illnesses, periodontal therapy (scaling, root planing), and even poor tooth brushing techniques [2,3].

Between 5 and 85 percent of the adult population suffers with DH,[3] with those between the ages of 20 and 50 being the most likely to experience it [4]. The primary cause of DH is the erosion of enamel and the subsequent exposing of dentin caused by the removal of root cement. Lack of proper oral hygiene, periodontal therapy, psychological issues, and dietary and environmental acidity may all play a role [5]. Dental caries, pulpitis, and dental fractures should all be checked out during the clinical examination that forms the basis of the diagnosis.

In 1985, diode lasers were initially employed in the treatment of DH.[6] Tissue responses to laser contact are dependent on the wavelength of the laser and the energy with which it is administered to the tissue. Lasers have a photobiomodulation impact on the dental pulp, which leads to an uptick in odontoblast metabolic activity, the formation of tertiary dentin, and the eventual obliteration of dentin tubules [7] Dentistry is another common use for fluoride. The mineral deposits on the open dentin tubules are the result of the chemical ability of fluoride to slow down the fluid motions in the dentin tubules, which is the therapy mechanism for DH [7].

Thus, the purpose of this study was to assess the efficacy of diode laser and fluoride gel in the management of DH.

Method: Fifty-two people with DH from gingival recession were split into three groups: 25 had diode laser treatment, 15 received fluoride treatment, and 12 received a placebo. A sealed envelope with numbers matching to the treatment modalities was used to randomly assign individuals to groups. The procedure was completed in a one sitting. The exposed root area was

targeted with an 808 nm GaAlAs infrared semiconductor laser for 60 seconds. We used cotton rollers for isolation and then a piece of cotton to dry the teeth after applying acidulated fluoride phosphate 1.23%. A little piece of sterile cotton was used to apply the fluoride to the root's exposed surface for 60 seconds. The patient was told to vigorously spit for a full minute after application. For the sham procedure, photons were blocked by an acrylic resin layer. Placebo gel was applied in a manner similar to that of fluoride. However, DH did not receive any medication from the cotton that was used to apply the placebo to his tooth.

No one knew which therapy they would get until after they started. Participation in the study was contingent on meeting the following criteria: being at least 18 years old, having at least one sound tooth with gingival recession, and having a DH diagnosis with a verbal rating scale (VRS) score of greater than or equal to 2. Participants who met the exclusion criteria had either recently undergone periodontal or DH treatment, were pregnant, or had decayed or filled teeth.

A periodontal probe (UNC-15, Hu-Friedy®) was used to quantify gingival recession. Assessment of Pain: Pain was evaluated using the visual analog scale (VAS) and the numeric rating scale (NRS). The VAS is an efficient and reliable method for doing so. [8] On a horizontal scale from 0 to 10 millimeters, the participant rated the intensity of the pain experienced. The participants were given a pain and discomfort scale from 0-10, where 0 indicated no pain and 0 indicated no discomfort. Immediately after (TO), 6 hours after (T1), 12 hours after (T2), and 24 hours after (T3) DH therapy, the patient was instructed to keep a pain diary. It was decided that no pain would be represented by 0, little discomfort by 0.1 to 3.9, moderate pain by 4.0 to 6.9, and severe pain by 7.0 to 10.0.

After applying an evaporative stimulus (air) and a tactile stimulus, we were able to assess the pain using the VRS. Select teeth were isolated using cotton rollers, allowed to dry, and then subjected to evaporative stimulus testing [9]. A periodontal probe was used to scale the root surface of the tooth during the evaluation of the tactile stimuli. Measurements were taken immediately (T0), 15 minutes (T1), and 7 days (T2) following the single treatment session to determine any changes in pain intensity. The Visual Analog Scale (VRS) had a range from 0 (no discomfort) to 3 (extreme pain) where 0 meant no discomfort but the patient still felt stimulation, 1 meant some discomfort but not unpleasant, 2 meant pain during application of stimulus, and 3 meant pain during application and immediately after. Evaluation of Quality of Life in Relation to Oral Health

The Statistical Package for the Social Sciences (SPSS) (version 23.0, IBM Corp., Armonk, NY, USA) was used to analyze the data. The data was analyzed descriptively. The ANOVA test was used to compare how each group responded to an evaporative stimulus, a tactile stimulus, and a pain rating. Statistical significance was assumed at the P 0.05 level.

Result: The average age of the 52 people that took part was 40.1. Participants' ages did not vary significantly across groups. Gender, level of education, income, and receding gums were also comparable across the two sets of participants.

Before and after treatment, DH for the three groups is shown in Table 1 for the evaporative and tactile stimuli, respectively. The DH response to the evaporative stimuli was considerably attenuated by diode laser (p0.001).

Table 1: Assessment of dentin hypersensitivity in the three groups according to evaporative and tactile stimuli

	Fluoride group	Laser group	Placebo group	p value
Evaporation				
T0	2.0	2.2	2.0	0.035
T1	1.6	1.1	1.5	0.416
T2	1.1	1.0	1.3	0.324
p	0.345	0.001	0.175	
Tactile				
T0	1.8	1.7	1.7	0.780
T1	1.4	1.1	1.2	0.756
T2	0.7	0.6	0.6	0.701
p	0.387	0.085	0.461	

No significant changes in DH to evaporative and tactile stimuli were seen after topical fluoride treatment ($P > 0.05$). Table 2 displays the outcomes of the VAS evaluation. There was no discernible difference between the three groups statistically.

Table 2: Assessment of pain with the visual analog scale in the three groups

Time	Fluoride group	Laser group	Placebo group	p value
T0	4.5	4.6	3.3	0.125
T1	3.3	3.4	3.5	0.876
T2	3.4	3.5	3.1	0.707
T3	3.2	3.4	3.2	0.855
p	0.415	0.351	0.406	

Discussion: One of the most frequent medical issues is DH. It's characterized as an abnormal response to a stimuli, independent of where it's presented in the oral cavity (Buccal, lingual, palatal, or occlusal) [7]. The wide variety in DH incidence is attributable to the fact that various demographics and investigational techniques are used. There was little to no difference in mean pain as judged by the Visual Analog Scale (VRS) at baseline across the groups. All three groups showed reductions in pain severity over time. Shortly after treatment, 15 minutes after treatment,

and 7 days after treatment, there was no significant difference between the groups in response to the tactile stimulus. Treatment with diode laser resulted in a higher decrease in DH 15 min after treatment compared to treatment with fluoride and therapy with placebo, as measured by the evaporative stimulus evaluation. Pesevska et al. showed comparable outcomes, with 86.6% of diode laser patients and 26.6% of fluoride patients showing a decrease in DH after treatment. [10]

Based on VAS analysis, we found that DH decreased with time across all three groups in this research. However, no treatment was able to completely eliminate DH within 24 hours. It's possible that fluoride's effectiveness in lowering DH levels may have been enhanced with more treatment sessions [1]. The average age of participants with a DH diagnosis was 48.4 years old. Davari et al. also found that people between the ages of 20 and 50 had a higher prevalence of DH[4]. Exposure of dentin tubules, which increases the risk for and severity of DH, is proportional to the depth of the recession. The gingival recession severity in the current study's evaluative groups was comparable to that seen in the sample as a whole (mean = 3.5 mm).

Since pain is a subjective outcome and difficult to quantify, assessing the efficacy of treatments for DH can be a complex process. Different people react very differently to the same painful stimuli because everyone has a unique pain threshold. The visual analog scale (VAS), however, is a standard method for measuring pain. The current research also used evaporative and tactile cues in order to quantify discomfort. Tactile and evaporative stimuli (physiological and controlled stimuli) were shown to be beneficial in trials examining DH by Holland et al. [11]

However, there are limitations to the study as well, including the small sample size resulting from a low number of participants and dropouts throughout the study period. To more accurately assess the long-term consequences of DH therapy, further research with bigger samples and longer follow-up are required.

Conclusion: DH is an oral ailment that has a major effect on people's daily lives and standard of living. Diode laser treatment proved more successful than fluoride therapy in lowering DH levels. However, more study is needed to verify these findings and refine current DH treatment methods.

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