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Diode laser assisted management of dentinal hypersensitivity: A case report

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Abstract
Dentin hypersensitivity (DH) is a fairly common and painful dental condition. It is described as pain that results from exposed dentine, usually in response to thermal, chemical, tactile, or osmotic stimuli. Reports suggest that between 4 and 74% of people have this issue, suggesting that it is a prevalent issue.
Dentinal hypersensitivity associated pain is one of the important factor which elicit oral discomfort and restricts the patients to perform oral hygiene and or interfere with dietary intake; thereby may cause periodontal diseases, nutritional deficiency etc. There are many different therapy options available (medicated dentifrices, oral rinse, restoration etc,) which required continuous usage as none is capable of constant delivery of the agent to the site, but are associated with certain limitations e.g. lack of patients compliance, poor taste, time consuming etc.
Consequently, an effective substitute method for treating dental hypersensitivity right away is laser desensitization. Dentin hypersensitivity was initially treated with lasers in 1985. According to research, when a laser interacts with dental pulp, it has a photo bio modulating effect that increases odontoblasts' metabolic activity and plugs the dentinal tubules by encouraging the production of tertiary dentine, which eventually lessens hypersensitivity.
This case report shows the successful management of hypersensitivity of dentin in patient's teeth affected by erosion by using a diode laser (980 nm wavelength, 1W power) in multiple appointments followed by restorative rehabilitation.

Keywords: Dentin hypersensitivity, laser desensitisation, diode laser, 980 nm

Introduction
When a stimulus-thermal, drying, tactile, osmotic, or chemical-is encountered, dentin hypersensitivity (DH) is characterized by brief, acute pain that lasts for a few seconds to several minutes [1]. Depending on the population samples examined, the prevalence of DH has been shown to vary from 4% to 57% in numerous studies. The prevalence of DH is even higher in patients with periodontitis, ranging from 60% to 98% [2]. But as more persons continue to have their teeth into old age, the number of DH cases is probably going to rise. Patients of any age and gender may be equally affected by this illness [3, 4]. Mandibular incisors were shown to be the most commonly impacted teeth in another investigation, and the majority of hypersensitive areas were found on the facial surface of teeth [5].
It is generally known that dentin hypersensitivity (DH) and dentin tubule openness *in vivo* are related, and tubule occlusion appears to lessen sensitivity [6]. There are several causes of dentin sensitivity, but the loss of enamel and the cementum's removal from the root, which exposes the dentin, are the main culprits [7]. Enamel loss is usually caused by a combination of two or more of the following: periodontal therapy, bleaching, gingival recession, abrasion, erosion, abfraction, and physiological causes.
Dentin hypersensitivity (DH) has been extensively studied, yet many dental experts are still unsure regarding the diagnosis, etiology, and causes of DH. To make a conclusive diagnosis of DH, a comprehensive clinical history, clinical and radiographic exams, and appropriate questioning are essential. The type of pain (sharp, dull, or throbbing), the number and location of impacted teeth, the precise tooth portion that causes the pain, and the intensity of the discomfort are important variables to consider. Diagnosis is DH if symptoms are associated with exposed dentin.

Teeth with living pulps, however, may exhibit symptoms similar to DH when a particular cause, such as caries, fractures, leaking restorations, or recent dental work, is present. It is more difficult to reach a final diagnosis when exposed dentin and reversible pulpitis coincide. Sensitivity to heat, cold, and air are common signs of both inflamed pulps and hypersensitive teeth [8, 9]. Nonetheless, pulpal pain usually lasts longer than the stimulus that initially triggered it and is duller, painful, and poorly localized [7].

According to Grossman, the perfect dentin hypersensitivity (DH) treatment should be painless, prevent damaging the pulp of the teeth, be simple to administer, offer quick relief, last a long time, and not discolor the teeth [8]. The two main methods used to treat dentin hypersensitivity are nerve activity inhibition and dentin tubule occlusion. To treat dental hygiene (DH), clinicians employ a range of techniques, such as periodontal membranes, antimicrobial agents, resin suspensions, fluoride treatments, specialty toothpastes, and, more recently, laser therapy [10].

Laser Therapy in Dentin Hypersensitivity

In 1985, laser therapy was originally presented as a possible treatment for dentinal hypersensitivity [11]. A new therapeutic approach for the treatment of DH has been made possible by advancements in laser technology over the past few decades and its extensive use in dentistry. Various kinds of middle output (Nd: YAG, CO2) and low output (Diode, He-Ne) lasers have been employed to reduce hypersensitivity. Low-power lasers have demonstrated anti-inflammatory properties as well.

Diode lasers are the lasers that are most frequently used to treat DH. Even in the most severe cases of DH, different wavelengths have been employed in numerous investigations and have produced the best benefits in multiple clinical trials. Through a process known as photo bio modulation, the laser's interaction with the dental pulp raises the odontoblasts' cellular metabolic activity and speeds up the development of tertiary dentine, which obliterates the dentinal tubules [12].

In this case report, a diode laser of 980 nm was used to treat the patient with severe hypersensitivity.

Case Report

A 32 yr old female patient presented to the Department of Conservative Dentistry and Endodontics with a chief complaint of severe sensitivity in the upper front and left back tooth region, triggered by cold and hot drinks, acidic foods, and even a slight breeze. Her medical history was non-contributory and she had no significant past dental history. On asking about her habits, she reported of Excessive consumption of acidic and aerated beverages The patient had been prescribed desensitizing potassium toothpaste twice daily which she had been following for 10 days without any significant pain reduction.

Clinical examination revealed erosion on the labial surface of teeth #11, #21(Fig.1) and cervical abrasion on tooth #25 (Fig.2). Severe hypersensitivity was experienced by the gentle passage of a probe on the exposed dentin and on using a slight burst of air from the 3-way syringe. The treatment plan decided was to perform a laser desensitisation with diode laser followed by composite restoration to fill the non carious defect as and when her symptoms were relieved. Patient was explained the treatment plan and was given oral hygiene instructions. Patient consented to the treatment plan.

Fig 1: Erosion seen on the labial surface of #11,21

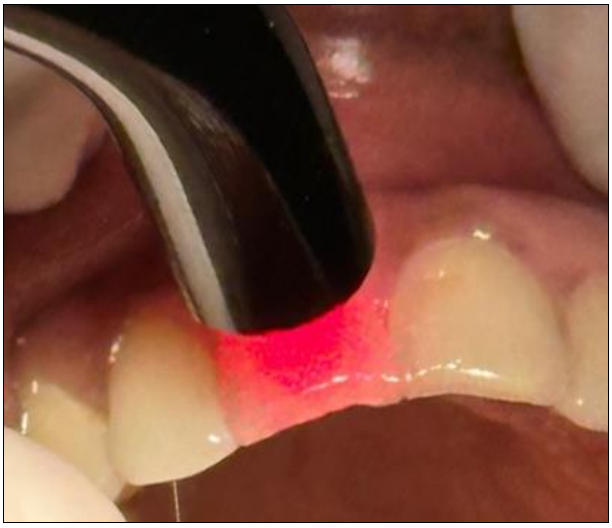

Fig 2: Erosion seen on tooth #24

The teeth were isolated using cotton rolls and dried with a cotton pellet. A burst of air for 3 seconds was applied on the erosion defects with a 3-way syringe and the patient's pain was evaluated using a visual analogical scale (VAS; 0 no pain to 10 extreme pain) to which the patient gave a rating for 10 for #11 and #21 and 8 to #25.

A diode laser of red light, 980 nm wavelength and 1W power was used with a photobiomodulation tip for desensitisation. The laser was placed for 30 seconds on the defect area of #11, 2 cm away from the tooth surface in non-contact mode. The same was repeated for tooth #21 an #25 for 30 seconds each. (Fig 3, 4).

Fig 3: Laser desensitization on tooth #11

Fig 4: Laser desensitization on tooth #24

Immediately after the LD, the VAS score was reduced to 8 on #11, #21 and 5 for #25. Patient was still dissatisfied. The patient was recalled after a week for the second sitting of laser desensitisation and post op instructions were given to avoid consumption of acidic beverages and food. Patient reported back after one week with no relief in her symptoms. Laser desensitisation was performed for 2 more sittings every week with the same procedure followed previously and VAS score decreased by 1-2 counts each progressive week. In the 4th week when the patient was recalled for a check-up, she was completely relieved of her symptoms and she rated 0-1 on VAS.

Rubber dam was used to isolate the patient's teeth after her sensitivity complaints subsided and she expressed satisfaction with the therapy. After bonding agent was applied and dried for 15 seconds, acid etching was performed on #11 and #21 (Fig 5,6). A2 shade composite restorations were completed, and then polishing and finishing were applied (Fig 7). The patient was happy with the care she received, her sensitivity was fully addressed, and pictures were taken after the procedure. (Fig 7).

Fig 5: Etching of the teeth and Etched tooth surfaces

Fig 6: Composite restoration done on erosive lesion

Fig 7: Pre and Post treatment photographs of the lesion

Discussion

Dental hypersensitivity is a fairly frequent condition that affects the quality of life and is characterized by a sudden, ntense discomfort in reaction to stimuli like eating, drinking, brushing one's teeth, or breathing [13]. Given that the aetiology of DH may be complex, multiple approaches should be used during treatment to get optimal results, as suggested by the findings from earlier studies [14].

As was previously said, a key contributing reason to DH is the loss of enamel and the removal of cementum from the root, exposing dentin. These processes can be brought on by erosion, recession, abfraction, abrasion, or any combination of these.

The physical outcome of a pathologic, chronic, localized, painless loss of dental hard tissue that is chemically etched away from the tooth surface by acid and/or chelation without bacterial involvement is referred to as dental erosion, or erosiodentium, in clinical terminology [15].

It's important to separate erosive lesions from abrasion and attrition. The latter are frequently flat, with glossy sections that have clear borders and matching characteristics at the teeth that oppose them. Occlusal surfaces are the places where this condition is most frequently observed [16].

Sharp angle rounding, dentine cupping or scooping, and enamel thinning are early indicators of erosion in enamel. In the more advanced stages, additional morphological alterations lead to the development of an enamel concavity, the width of which obviously surpasses the depth [15].

In this case, on clinical examination, a glossy saucer shaped defect was seen on the on the labial surface of tooth 11 and 21 involving and was diagnosed to be dental erosion.

Conventional treatments for dental hypersensitivity (DH) involve the topical administration of desensitizing agents, such as protein precipitates, agents for occlusion of dentinal tubules, and, more recently, lasers, either professionally or at home [17, 18, 19]. The ability of dentine desensitization agents to effectively seal dentinal tubules is directly correlated with their efficacy, as per Brannstrom's hydrodynamic theory.[20,21] Dentinal tubule occlusion is thought to diminish dentine permeability and, in turn, decrease dentinal hyperplasia.

When compared to traditional methods, in-office DH laser treatment has many drawbacks that reduce its therapeutic usefulness, such as high cost, complicated usage, and gradual decline in effectiveness [18]. According to HE *et al.*'s systematic review of the literature, laser therapy and topical desensitizing agents are both effective in treating dentine hypersensitivity. However, there's a chance that laser therapy will be slightly more effective than topical medications in treating dentine hypersensitivity [22].

The specialist literature states that dentine hypersensitivity has been successfully treated with both red and infrared wavelength lasers. Through a process known as photobiomodulation, the laser's interaction with the dental pulp raises the odontoblasts' cellular metabolic activity and speeds up the development of tertiary dentine, which obliterates the dentinal tubules [12].

Pinheiro [23] reports that the active medium, wavelength, power density, emission mode, application technique, and optical characteristics of the target tissue all affect the tissue response [12]. For the treatment of DH, both low level lasers (LLL) and high-level lasers (HLL) were employed. It was discovered that HLL actions result in C-fiber and A-beta afferent fiber blockage as well as dentin tubule occlusion [24].

LLLT (Low Level Laser Therapy) using DLs with wavelengths between 635-910 nm is extensively researched

for treating DH. These lasers stimulate odontoblastic cells, promoting dentinal tubule obliteration and tertiary dentin formation. They also enhance cell circulation, providing anti-inflammatory effects and pain relief. DLs of 660, 810, 940, and 980 nm are commonly used for DH treatment, offering varied tissue interactions relieving DH.

LLLT causes biostimulation using the thermal energy and the light delivered. It works on the regulation of cell physiological functions, on analgesia effect, bioregulation of cell responses, and anti-inflammatory effects. This study has demonstrated the long-term effectiveness of LLL in reducing pain levels. Additionally, research has shown that dentinal tubule blockage causes the release of alpha and ß-endorphins, which bind to nociceptive system receptors and cause analgesia [24].

Different wavelengths have been shown by researchers to be able to occlude dentinal tubules in earlier investigations. Dentinal hypersensitivity was found to be lessened by low-level laser therapy using a diode laser 810 nm at 0.5 W according to Ruchi Pandey *et al*. [25] Using various procedures that combined the laser and desensitizing drugs, Anely Oliveira Lopes *et al*. found that all treatments reduced DH [26].

Recently, diode lasers have become the preferred choice for dentists in their daily practice. There's a substantial body of literature, particularly focused on their effectiveness in treating dentinal hypersensitivity [27, 28]. Based on these evidences, a diode laser with a wavelength of 980nm and 1W power, along with a photo-biomodulation tip in non-contact mode, was utilized in this case.

Suri *et al* [29] examined the effects of diode laser 980 nm alone and in combination with NaF on dentinal hypersensitivity. They discovered that dentinal hypersensitivity was considerably reduced by the combination of diode laser 980 nm and NaF [30]. Hence, we chose to employ a diode laser with a wavelength of 980 nm in this instance in accordance with the research and case reports.

Matsumoto *et al* reported an 85% improvement in indexes in teeth treated with lasers [31]; Aun *et al* reported successful treatment in 98% of cases [32]; Yamaguchi *et al* reported effective improvement in 60% of cases in the laser-treated group and only 22.2% in the control group [33]; Kumazaki *et al* reported an improvement of 69.2% in the laser-treated group compared to 20% in the placebo group [34]; Gerschman *et al* find in a double-blind study significant values in the treated group in relation to the placebo group [35]: sensitivity to thermal stimuli is reduced by 67%, whereas the placebo group has a reduction of 17%; sensitivity to tactile stimuli is reduced by 65%, while the placebo group shows a reduction of 21% [36].

Unlike more powerful and older systems like Er, Cr: YSGG, or Er: YAG lasers, which can cause side effects or damage to the pulp, the DL's particular wavelengths make it extremely safe for the patient [19]. There have been multiple studies that discuss the safety of treating DH using lasers; some writers have explicitly examined the risk of laser-induced pulp damage. According to one such study, there is no visible pulp damage as long as the temperature increase within the pulp stays below 5°C. When the laser's energy and power settings are kept within the specified ranges, this temperature threshold is typically not crossed [8].

Several diode laser wavelengths have been investigated in clinical investigations for this purpose. The power used in this instance was 1W, which is consistent with the findings of Naghsh N *et al*. who showed that applying 810 and 980 nm diode lasers at 1-W power and an exposure duration of 30 s was effective in reducing pain in dentin-affected patients by sealing the dentinal tubules without overly melting the dentin and achieving a good degree of analgesia [37].

Since pain is a subjective experience, it is challenging to quantify. As a result, the VAS score has been widely employed to gauge pain severity. Because it is a continuous scale, easy to understand, and allows us to distinguish between different forms of pain, this scale has numerous benefits [38, 39]. In the current instance, the patient's pain response has been greatly reduced at each subsequent laser therapy appointment. VAS has been used to assess pain perception both before and after the desensitizing agent and laser applications.

This case study showed that the patient's discomfort was successfully reduced by several laser desensitization treatments. Following each therapy session, there were consistently noticeable improvements in pain and suffering.

Conclusion

Within the scope of the conducted case report, linked research and literature reviews, laser desensitisation has produced exceptionally safe and successful outcomes in the treatment of dentinal hypersensitivity. Low-level laser therapy as a strategy for alleviating dentin hypersensitivity indicates good therapeutic success, but needs further ongoing follow-up.

Conflict of Interest

Not available.

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Not available.

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