Low-level laser therapy in cases of dentin hypersensitivity

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Abstract. Dentin hypersensitivity is characterized by short, sharp pain in response to a stimulus – thermal, drying, tactile, osmotic or chemical. These stimuli cause an unpleasant sensation lasting from seconds to minutes after provocation. Many alternative treatment methods have been introduced. One of the options is the use of low-level laser therapy, whose effect is based on the increase of the excitability threshold of the free nerve endings causing an analgesic effect, as well as on the stimulation of pulp mesenchymal cells to differentiate into odontoblasts and produce reparative dentin. To investigate the efficacy of low-level laser therapy in treating dentin hypersensitivity, we selected a group of patients complaining of sensitivity at the cervical area of teeth provoked by stimuli such as air, touch and cold spray. The patients were with good oral hygiene and with intact teeth or small non-carious cervical lesions. They confirmed the absence of serious systematic and psychological diseases; some of them smoked electronic cigarettes, which may aggravate the pain. The patients were submitted to six sessions of treatment of dentin hypersensitivity with intervals from 48 to 72 hours, as indicated by the manufacturer of the low-intensity laser device. The painful sensation was measured before each of the six sessions and immediately after the treatment. The results were evaluated by using a four-point scale. The answers assessment showed good results – there was a decrease of the pain sensation from 3-4 level to 1-2 level. Yet, we have to interpret this carefully, because pain evaluation is subjective and some of the smokers have quit smoking electronic cigarettes during the treatment. As a method of curing dentin hypersensitivity, the low-level laser therapy shows a good treatment efficacy, but needs further continuous follow-up.

1. Introduction
Dentin hypersensitivity (DHS) is characterized by short, sharp pain in response to a stimulus – thermal, drying, tactile, osmotic or chemical, which cause an unpleasant sensation lasting from seconds to minutes after provocation [1]. The prevalence of DHS has been reported to range from 4% to 57% in many studies depending on the population samples studied. In patients affected by periodontitis, the DHS prevalence is even higher, ranging between 60% to 98%. [2] However, DHS cases are likely to increase, as more adults keep their teeth later into life. This condition may affect equally patients of any age and of both genders [3, 4].

Although different theories have been proposed for the mechanism involved in the DHS etiology, most studies gave support to Brannstrom’s hydrodynamic theory [5], according to which a stimulus applied to open dentinal tubules increases the flow of dentinal tubular fluid, with mechanical deformation of the nerves located into the inner ends of the tubules or in the outer layers of the pulp [6]. The type A delta fibers are supposed to be responsible for the dentinal sensitivity being probably activated by the hydrodynamic process [7].
The most common factors provoking DHS are abrasion, caused by inadequate intensity of tooth brushing; abfraction, caused by teeth flexion due to abnormal occlusal forces; parafunctions or occlusal disequilibrium; erosion, secondary to the presence of acids in the oral cavity in result of bulimia nervosa or gastroesophageal reflux; anatomic predisposition due to structural deficiency of the enamel-cement junction; cavity preparations in vital teeth that expose dentine or badly controlled dentinal acid conditioning. According to Garone-Filho, the abfraction caused by occlusal overload is the most common etiological factor related to DHS. Thus, an occlusal adjustment should be always associated to the treatment of DHS [7, 8, 9]. However, finding an adequate and long-lasting treatment effect is still a challenge.

Conventional therapies for DHS are based on the local application of desensitizing agents, either professionally, or at home. The most frequently used agents can be classified as protein precipitants [10], tubule-occluding agents [10, 11], and tubule sealants [12]. The sodium fluoride gel (NaF), which belongs to the tubule-occluding agents’ family, is the most commonly used agent.

Lasers have been more and more widely used for the last 25 years since they have been introduced as a possible treatment modality for DHS. The low-level power lasers, also called “soft lasers,” act directly on the nerve transmission, with a depolarization process that prevents the diffusion of pain to the central nervous system [13, 14]. However, their effectiveness seems poorer in higher degrees of DHS-affected people.

According to the specialized literature, both red and infrared wavelength lasers have been effective in the treatment of dentine hypersensitivity. Physical mechanisms are involved operating at different wavelengths and causing the dentine-pulp complex to respond to the irradiation with the obliteration of the dentinal tubules by a specific biological mechanism. The laser interaction with the dental pulp causes a photo-bio-modulating effect, increasing the cellular metabolic activity of the odontoblasts and obliterating the dentinal tubules by accelerating tertiary dentine production.

Pinheiro [15] reports that the tissue response depends on the active medium, wavelength, power density, emission mode, application method and by the optical properties of the target tissue. His study demonstrates that at all times the age range of 25 to 35 years treated with red laser presents a higher degree of dentinal desensitization. The lower degree of dentinal desensitization observed in 36-45-year-old patients may be a result of the presence of a higher quantity of intertubular dentine and the smaller lumen of the dentinal tubules. Our research included an additional factor – smoking electronic cigarettes of fourth generation. Few studies have related these devices, which can also be called “heat-not-burn” products (HTP), with the manifestations in the oral cavity. These products reduce the majority of harmful and potentially harmful constituents by more than 90%, while a study has shown that compared to cigarette smoke (CS) these devices affect the tooth tissues in a minor way. Another study relates these devices to conventional cigarettes and possible oral changes and demonstrates that the changes existing in HTP users are not significant about CS. Most importantly, it demonstrates that acute exposure to aerosols from these products does not cause high toxicity or adaptive responses in the oral tissues when compared to exposure to CS. On the other hand, this 4th generation devices have liquids of higher viscosity and the aerosols released are more likely to adhere to dental surfaces and soft tissues, thus facilitating bacterial adhesion, oral infections, dental caries (respectively causing a hypersensitivity symptom) and changes in the oral mucosa [16].

2. Patients and methods
A group of patients was selected complaining of sensitivity at the cervical area of teeth provoked by stimuli, such as air, touch and cold spray. The patients had a good level of oral hygiene, with intact teeth or small non-carious cervical lesions. They confirmed the absence of serious systemic and psychological diseases. The provoked pain symptoms were aggravated because some of the patients had started smoking IQOS electronic cigarettes. The patients were submitted to six sessions of DHS treatment with intervals from 48 to 72 hours each, as indicated by the manufacturer of the low-intensity laser device (Six Laser TS C, Atlantis, Bulgaria). We worked with an infrared diode laser, wavelength of 904 nm. The first, third and fifth procedures were with analgesic effect (30 W power, 9 Hz repetition rate, 2 m
23 s application time) and second, fourth and sixth procedures were with anti-inflammatory effect (30 W power, 1168 Hz repetition rate, 1 m 32 s application time).

The painful sensation was measured before each of the six sessions and immediately after treatment. The results were evaluated by using a four-point scale.

3. Results and discussion

Our results confirmed the efficacy of this treatment method – the hypersensitivity decreased from 3-4 to 1-2 points. However, one should take into consideration that evaluation of the effect depends on the patient’s interpretation and the smoking patients have stopped electronic cigarettes smoking during the treatment. This makes assessment extremely difficult.

Results for dentine hypersensitivity treatment by diode lasers of various wave-lengths have been reported in various clinical studies. Matsumoto et al. find 85% improvement of indexes in teeth treated by laser [17]; Aun et al. report successful treatment in laser irradiated teeth in 98% of the cases [18]; Yamaguchi et al. report effective improvement in 60% of cases in the group treated by laser and only 22.2% in the control group [19]; Kumazaki et al. show an improvement of 69.2% in the group treated by laser compared to 20% in the placebo group[20]; Gerschman et al. find in a double-blind study significant values in the treated group in relation to the placebo group: 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% [21].

Also, this is a safe method with no side effects.

4. Conclusions

Low-level laser therapy as a method for curing dentin hypersensitivity shows good treatment efficacy, but needs further continuous follow-up.

Acknowledgements

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