



Evaluation of the Therapeutic Efficiency of Diode Laser Radiation with a Different Exposure at the Hypersensitivity of the Dentine

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Abstract

Materials and methods of research: the results of the therapeutic efficacy of diode laser radiation with different duration of action (30 and 60 seconds) on the exposed section of dentin were studied using the example of clinical investigation of patients with gingival recession accompanied by HD. In total, 28 teeth were examined of 16 patients in two groups. The sensitivity of the dentin was evaluated with respect to the tactile (with the help of the periodontal probe when probing the dentin neck) and the cold stimulus (air stream) on a digital scale from 0 to 10 points. After each stage, the determination of the viability of the pulp by means of Electric Pulp Testing (EPT) was also performed. The digital material is processed using the conventional methods of variational statistics.

Results testify to the elimination of pain of patients of both groups in the treatment of HD using a diode laser with a wavelength of 830 nm. Moreover, the effectiveness of treatment in both groups is not accompanied by undesirable side effects, does not damage the vital activity of the pulp. This is evidenced by EPT data. However, the patients of the second group (60 sec.) after the first stage of treatment (and even a week after the initial irradiation), have a 2.7 times more effective reliable decrease of HD than in first group.

Keywords: Diode laser; Dentine hypersensitivity; Gingival recession

Introduction

At the modern level of dentistry, first of all use of physical methods is progressive in the complex diagnosis and treatment of oral diseases. These include phototherapy, in particular, laser therapy. In recent years, laser systems are increasingly being used in various fields of dentistry.

Currently proposed lasers are divided into soft radiation lasers, supporters of which postulate their "bio stimulating" effect on soft tissues, and hard radiation lasers used for the implementation of invasive stages of treatment. Hard radiation lasers are used mainly in dental surgery, in therapy of periodontal diseases and endodontics. Owing to researches, four types of lasers can be called suitable for laser endodontics: yttrium-aluminum garnet lasers with erbium, gas lasers, yttrium-aluminum garnet lasers with neodymium and diode lasers. The main advantage of the latter is high efficiency (up to 60%). Besides, they combine the advantages of carbon dioxide and neodymium lasers: high tissue dissection efficiency and high coagulation efficiency, respectively. These qualities of the diode laser make it possible to use it in complex therapy on soft tissues of the human mouth. Depending on the type of pathology, low-intensity (for conservative) or high-intensity (for surgical) laser therapy is chosen. For this purpose, the parameters of the laser radiation are corrected: the radiation regime, the wavelength, the radiation power.

In clinical dentistry, the hypersensitivity of dentin is one of the most difficult to treat pathologies. By origin, dentine hyperesthesia can be connected with the loss of hard tooth tissues (abrasion, erosion, etc.) and is not connected with it (hyperesthesia of the dentin of naked necks and roots of teeth in periodontal diseases accompanied by recession of the gum). The problem is widespread and occurs in all age groups. It is characterized by fulminant, short, acute pain, arising from chemical, physical, mechanical, osmotic stimuli. There is hydrodynamic theory proposed by Brännström M., Åström A. in 1964, which is the most acceptable theory to explain the occurrence of pain at HD [1]. It explains the occurrence of pain by the displacement of biological fluid in the dentinal tubules under thermal, physical and chemical stimuli: a pulp - dentine fluid is displaced, which irritates the nerve endings of the pulp.

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Table 1: Evaluation of the effectiveness of treatment of dentin hypersensitivity in the groups of research (in points).

group	n=16	exposition (second)	Results of the treatment	
I	8	30	Stage I	
			Before treatment	8,72 ± 1,42
			In 15 minutes after treatment	3,15 ± 0,60
			Stage II (after 7 days)	
			Before treatment	3,11 ± 0,61
			In 15 minutes after treatment	1,25 ± 0,74
II	8	60	Stage I	
			Before treatment	8,53 ± 1,44
			In 15 minutes after treatment	1,07 ± 0,72
			Stage II (after 7 days)	
			Before treatment	1,03 ± 0,41
			In 15 minutes after treatment	0,38 ± 0,52

Many methods have been proposed for the treatment of DG, however, most of them are either ineffective or have short-term effectiveness [2]. In recent years laser therapy has been proposed for the treatment of DG, the mechanism of action of which depends on the type of laser.

Low-intensity laser radiation has a photobiomodulation effect, which increases the metabolic activity of odontoblasts, which leads to the formation of tertiary dentin and obturation of Dentinal Tubules (DT). High-intensity laser radiation is based on thermal, hydrodynamic, and photochemical effects, which causes destruction of the DT by exposing them to constriction and obturation [3-7].

Purpose of the research

The purpose of the research is to perform an analysis of the therapeutic efficiency of diode laser radiation with a wavelength of 830 nm with different exposure in the treatment of HD of teeth with gingival recession.

Materials and Methods of Research

The material for the research was the data from the results of clinical research of patients with gingival recession accompanied by HD. The research involved 16 patients aged from 25 to 35 years. Patients were divided into 2 groups: 8 patients in each group, with one or two sensitive teeth. A total of 28 teeth were examined. The research does not include patients with restorations and cracks in the teeth, caries, chronic periodontal diseases; patients who in the last 72 hrs took analgesics, tranquilizers, antihistamines, sedatives, antibiotics or underwent surgical intervention on the periodontium in the last 6 months.

The applicable device is laser diode "Laser Smile". The characteristics of diode laser radiation were: wavelength 830 nm., power 12 watts, exposure 30 and 60 seconds, operating mode - continuous, non-contact. The course of treatment consisted of 2 stages with a weekly interval. HD was determined 2 times during each visit: before treatment and 15 min after the laser (immediate effect). The next, additional measurement was performed 7 days after the treatment (late effect).

The sensitivity of the dentin was evaluated with respect to the tactile (with the help of the periodontal probe when probing the dentin neck) and the cold stimulus (air stream) on the digital scale

from 0 to 10 points: 0 points - no pain, 1-3 points - only discomfort, 4-6 points - mild pain, 7-9 points - strong, but tolerable pain, 10 points - strong, intolerable pain. After each stage, the determination of the viability of the pulp by means of Electric Pulp Testing (EPT) was also performed.

The treatment was carried out in the following order: first professional cleaning of teeth: removal of plaque, stones and polishing with the use of brushes and abrasive paste. Then, with the help of cotton rolls, the teeth under examination were isolated from saliva, the vestibular surfaces of the teeth were dried with cotton swabs. After that, this surface was affected with a cold stream of air, the HD was determined, laser treatment was performed, and the HD was again determined. First group consisted of patients, during the treatment of which exposure of the laser beam was 30 seconds; in second group exposure of the laser beam was 60 seconds.

The data of the table indicate that in both groups HD was high and made up to 8.72 ± 1.42 and 8.53 ± 1.44 in the first and second groups, respectively. After treatment, at the end of first stage (15 minutes after) in both groups there was a significant decrease of HD ($p < 0.001$), in the first group - up to 3.15 ± 0.60 , i.e. approximately 2.6 times, and in the second group - up to 1.07 ± 0.72 , i. e. approximately 7 times. At the second stage of treatment (7 days after) in the first and second groups there is a dynamic decrease of HD, respectively - 1.25 ± 0.74 and 0.38 ± 0.52 . The obtained data are confirmed by the clinical picture: by the end of the first stage of treatment the patients of the first group have noted a change of strong pain from a cold stimulus to a feeling of discomfort, while the patients of the second group have noted the absence of pain and any unpleasant sensations. By the end of the second stage of treatment the patients in the first group have complete absence of complaints, while the patients of the second group noted slight discomfort from time to time. EPT indicators in both groups were within the norm. The results of evaluation of the effectiveness of treatment are presented in stages in (Table 1).

Results and Discussion

The results of the study showed that in the treatment of HD of patients with gingival recession, the use of a diode laser with a wavelength of 830 nm. at different exposures, effectively eliminates pain in both groups. Moreover, the effectiveness of treatment in both groups is not accompanied by undesirable side effects, does not damage the vital activity of the pulp. This is evidenced by the data of EPT, which throughout the treatment and later did not show any deviations from the norm. However, in the second group of patients (60 seconds) the acute pain from the cold stimulus completely disappeared soon after the first stage of treatment, and even a week after the initial irradiation, and in the second group - only by the end of the second stage.

The rapid, desensitizing effect of laser therapy observed in the researches is explained by the mechanism of action due to which a diode laser can cause changes in the neural transmission network inside the pulp (blockade of nerve impulse transmission), rather than structural changes in the dentin layers, as observed in other methods of treatment [4,8]. Besides, laser therapy stimulates normal physiological functions of cells, contributing to the formation of tertiary (replacement) dentin, which in its turn leads to internal obliteration of the dentinal tubules [5,6]. In fact, laser irradiation contributes to the restoration and functioning of the "dentine-pulp" complex, preserving the viability of the pulp.

Conclusion

Use of a diode laser with a wavelength of 830 nm showed a decrease of the sensitivity of dentin to thermal and tactile stimuli in both study groups 15 minutes and 7 days after and after first application.

On the basis of the results obtained in the treatment of HD of 14 teeth with gingival recession, measuring the initial degree of sensitivity according to the given digital scale of pain, we conclude that:

1. A diode laser with a wavelength of 830 nm, eliminates the hypersensitivity of the dentin of teeth at gingival recession.

2. Immediate and remote therapeutic results of the effect of a diode laser with a wavelength of 830 nm with an exposure time of 60 seconds are 3 times more effective than with an exposure time of 30 seconds.

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