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Effect of Er:YAG Laser and Desensitizer Containing Hydroxyethyl Methacrylate and Glutaraldehyde on Dentin Hypersensitivity: A Randomized Split-Mouth Clinical Trial

Neža Vatovec[1], Tomaz Ivanušič[2]

[1] Dr. Franc Derganc hospital Nova Gorica, Ulica padlih borcev 13A, 5290 Šempeter pri Novi Gorici, Slovenia
[2] Klinika DMD, Cesta II. grupe odredov 56, 1000 Ljubljana, Slovenia

ABSTRACT

Dentin hypersensitivity (DH) is exaggerated severe, sharp and sudden pain arising from dentin exposure. Stimuli can be thermal, tactile, evaporative, chemical or osmotic. This condition is very common and different treating options have been proposed.

DH usually occurs as the result of enamel or cementum loss or exposure of dentinal tubules. Brännström theory, which deals with the flow of dentinal fluid, is most widely accepted.

The mechanism of laser desensitization is the occlusion by partial melting after low-level irradiation. Er:YAG laser also has an analgesic effect on pulpal nerves, which can explain instant desensitization after treatment.

In this study we compared Er:YAG laser with desensitizer containing 5% glutaraldehyde and 35% hydroxyethyl methacrylate. The study was designed as prospective split-mouth randomized clinical trial. Perceived pain was assessed with compressed air before, immediately after treatment and at 6 months follow-up.

DH was successfully reduced in both groups, but statistically more significantly in the Er:YAG group. DH treatment with Er:YAG laser at low fluences is safe, minimally invasive and effective.

Key words: Er:YAG laser, desensitization, hypersensitive teeth.

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I. INTRODUCTION

Dentin hypersensitivity (DH) is exaggerated severe, sharp and sudden pain arising from dentin exposure. Stimuli can be thermal, tactile, evaporative, chemical or osmotic.[1]

The prevalence of this condition is very heterogenous, at around 1.3% to 92.1%, and the average from studies was 33.5%.[2] DH is most prevalent among females in their thirties.[3]

DH usually occurs as the result of enamel or cementum loss or exposure of dentinal tubules. This can happen due to attrition, abrasion, erosion, abfraction or gingival recession.[4] Based on the studies in the past, different theories have been proposed on DH. Brännström theory, which deals with the flow of dentinal fluid, is most widely accepted. Dentinal fluid flow away from the pulp is caused by drying, cooling, evaporation and hypertonic chemical stimuli. Heating causes the flow of dentinal fluid toward the pulp. The number of tubules in sensitive dentin is much higher, and those tubules are wider than those in non-sensitive dentin.[4, 5]

Different therapies are used in DH treatment, however, long-term efficacy is still doubtful.[6]

Gluma desensitizer, as one of the widely accepted and applied therapies, contains hydroxyethyl methacrylate (HEMA) and glutaraldehyde. Glutaraldehyde coagulates the proteins in the dentinal tubules. It reacts with the serum albumin in the dentinal fluid, causing its precipitation. HEMA occludes the dentinal tubules, forming deep resinous tags.[7]

The mechanism of laser desensitization is occlusion by partial melting after low-level irradiation. Er:YAG laser also has an analgesic effect on pulpal nerves, which can explain instant desensitization after treatment.[8]

The Er:YAG laser emits pulsed beams with a wavelength of 2940 nm. It is very well absorbed in water and hydroxyapathite.[9]

Erbium lasers have been used for treating DH. In a study conducted by Aranha and Eduardo10 the use of erbium lasers for treating DH caused by non-carious cervical lesions showed promising results by reducing DH and preserving vitality of the pulp.

With this study, we wanted to assess if DH treatment with Er:YAG laser is effective in the long term.

II. MATERIALS AND METHODS

The study was designed as prospective split-mouth randomized clinical trial. A total of 12 patients (6 men and 6 women), aged from 32 to 61, with 81 hypersensitive teeth were included. Patients with a least 2 hypersensitive teeth were included.

Exclusion criteria were: pregnancy, breastfeeding, use of sensitivity oral care products within the previous 8 weeks, xerostomia, dental prophylaxis or teeth whitening within the previous 8 weeks of screening, active caries or periodontitis and treatment of periodontal disease within 3 months of screening.

40 teeth were treated with Gluma desensitizing agent (Heraeus Kulzer GmbH, Wehreim, Germany) and 41 teeth were treated with low-energy Er:YAG laser LightWalker (Fotona d.o.o., Ljubljana, Slovenia). Perceived pain was assessed on scale from 0 to 10 (VAS score) with compressed air before, immediately after treatment and at 6 months follow-up.

Gluma desensitizer was applied on dry teeth for 30 seconds with a microbrush. Teeth in the laser group were irradiated for 60 seconds with 15 pulses per second (frequency of 15 Hz). Each 300 μs long pulse had 5 mJ of energy. A H14 handpiece with an 8 mm long cylindrical tip (1.3 mm diameter) was used. During irradiation patients reported slight discomfort. No other side effects were reported.

III. RESULTS

Sensitivity was reduced in both groups. Mean sensitivity after 6 months as measured by VAS score dropped to an average score of 3.71 in the LASER group and 2.28 in the GLUMA group, respectively (Figure 1).

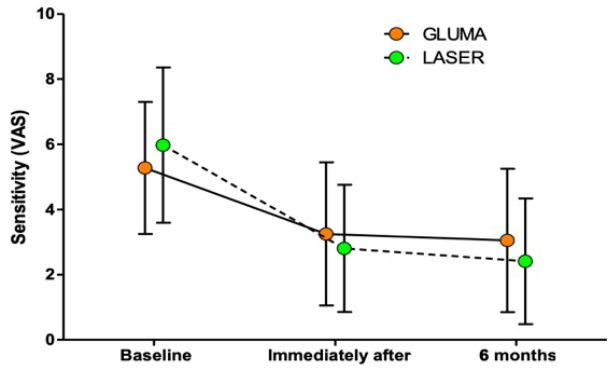

Fig. 1: Mean sensitivity before, immediately after and at 6 months follow-up for the GLUMA and LASER groups (Pain perception on VAS scale).

Improvement of the VAS score from before to after treatment was more significant in the LASER group (P<0.001). The difference was even bigger at the 6-month follow-up (P<0.001) (Figure 2).

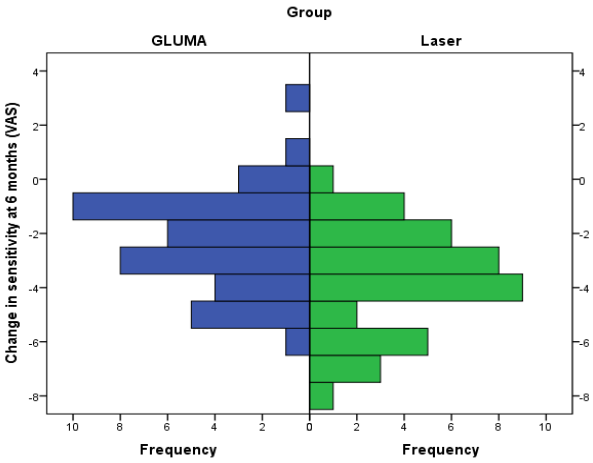

Fig. 2: Frequency of change in sensitivity (VAS score) at 6 months follow-up.

IV. DISCUSSION

Treating DH consists of reducing dentinal fluid movement by narrowing or occluding open tubules. This translates into blockage of nerve stimuli transmission to odontoblasts, inhibiting pain. Different therapies are used in DH treatment, however, long-term efficacy is still doubtful.[6]

Studies has shown that desensitizer containing 5% glutaraldehyde and 35% hydroxyethyl methacrylate (Gluma desensitizer, Heraeus Kulzer GmbH, Wehreim, Germany), is an effective desensitizing agent. [7, 11]

Different lasers are described in the literature for treating DH. Most of them concluded that lasers are a promising tool for treating DH.[12] Nd:YAG laser was first described in the literature for DH treatment, although other wavelengths like Er:YAG are also effective. [11]

For this study we chose Er:YAG laser with low fluences. The mechanism of laser DH treatment is occlusion by partial melting after low-level irradiation. Er:YAG laser also has an analgesic effect on pulpal nerves, which can explain instant desensitization after treatment. [6]

In this study we compared Er:YAG laser with desensitizer containing 5% glutaraldehyde and 35% hydroxyethyl methacrylate. DH was successfully reduced in both groups, but statistically more significantly in the Er:YAG group. Desensitizer

containing 5% glutaraldehyde and 35% hydroxyethyl methacrylate showed a statistically significant reduction in DH scores over other materials. [13] According to our study, irradiating with Er:YAG laser should be a preferred method for treating DH.

DH treatment with Er:YAG laser in low fluences is safe, minimally invasive and long-term effective.

V. CONCLUSIONS

Irradiation with Er:YAG laser shows superior results in reducing DH compared to traditional desensitizers containing glutaraldehyde and hydroxyethyl methacrylate. Further research is needed to optimise Er:YAG parameters for DH treatment.

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REFERENCES

1. Holland GR. Guidelines for the design and conduct of clinical trials on dentine hypersensitivity. J Clin Periodontol. 1997;24(11):808-813. doi:10.1111/j.1600-051X.1997.tb01194.x
2. Favaro Zeola L, Soares PV, Cunha-Cruz J. Prevalence of dentin hypersensitivity: Systematic review and meta-analysis. J Dent. 2019;81:1-6. doi:10.1016/j.jdent.2018.12.015
3. Kopycka-Kedzierawski DT, Meyerowitz C, Litaker MS, et al. Management of dentin hypersensitivity by practitioners in The National Dental Practice-Based Research Network. J Am Dent Assoc. 2017;148(10):728-736. doi:10.1016/j.adaj.2017.05.003
4. Davari A, Ataei E, Assarzadeh H. Dentin hypersensitivity: etiology, diagnosis and treatment; a literature review. J Dent (Shiraz, Iran). 2013;14(3):136-145. Accessed June 24, 2021. http://www.ncbi.nlm.nih.gov/pubmed/24724135
5. Brännström M, Åström A. A Study on the Mechanism of Pain Elicited from the Dentin. J Dent Res. 1964;43(4):619-625. doi:10.1177/00220345640430041601
6. Yu X, Liang B, Jin Fu XB, et al. Comparative In Vivo Study on the Desensitizing Efficacy of Dentin Desensitizers and One-bottle Self-etching Adhesives for mechanical. Oper Dent. Published online 2010:279-286. doi:10.2341/09-346-C
7. Joshi S, Gowda AS, Joshi C. Comparative evaluation of NovaMin desensitizer and Gluma desensitizer on dentinal tubule occlusion: A scanning electron microscopic study. J Periodontal Implant Sci. 2013;43(6):269-275. doi:10.5051/jpis.2013.43.6.269
8. Yu CH, Chang YC. Clinical efficacy of the Er:YAG laser treatment on hypersensitive dentin. J Formos Med Assoc. 2014;113(6):388-391. doi:10.1016/j.jfma.2013.02.013
9. Gurgan S, Kiremitci A, Cakir FY, Yazici E, Gorucu J, Gutknecht N. Shear bond strength of composite bonded to erbium:yttrium-aluminum-garnet laser-prepared dentin. Lasers Med Sci. 2009;24(1):117-122. doi:10.1007/s10103-007-0532-0
10. Aranha ACC, De Paula Eduardo C. Effects of Er:YAG and Er,Cr:YSGG lasers on dentine hypersensitivity. Short-term clinical evaluation. Lasers Med Sci. 2012;27(4):813-818. doi:10.1007/s10103-011-0988-9
11. Oliveira Lopes A, Cecília A, Aranha C. Comparative Evaluation of the Effects of Nd:YAG Laser and a Desensitizer Agent on the Treatment of Dentin Hypersensitivity: A Clinical Study. doi:10.1089/pho.2012.3386
12. Simões TMS, Melo KCB, Fernandes-Neto J de A, et al. Use of high-and low-intensity lasers in the treatment of dentin hypersensitivity: A literature review. J Clin Exp Dent. 2021;13(4):e412-e417. doi:10.4317/jced.57783
13. Abuzinadah SH, Alhaddad AJ. A randomized clinical trial of dentin hypersensitivity reduction over one month after a single topical application of comparable materials. Sci Rep. 2021;11(1):6793. doi:10.1038/s41598-021-86258-3