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Review Article

Micro-Leakage Assessment of Class V Prepared by Conventional Methods VS Er:YAG Laser Restored by Composite Restoration. A Structured Review

Haythem SM[1], Al-Salami Abdulaziz[2]*, Bailoor Durgesh N[1], Bassuoni MW[1], Noor Mohamed R[1], Al-Shamrani A[1] and Al-Thomali Y[1]

[1]Faculty of Dentistry, Taif University, Makkah district, Taif, Kingdom of Saudi Arabia

[2]Fifth Year Clinical Student, Taif University, Makkah district, Taif, Kingdom of Saudi Arabia

***Corresponding Author:** Al-Salami Abdulaziz, Faculty of Dentistry, Taif University, Makkah district, Taif, Kingdom of Saudi Arabia.

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Abstract

Aim: This literature made to compare micro-leakage in class v prepared by Er:YAG laser and conventional bur.

Methodology Used: PubMed, LILACS, SciELO, Science Direct, and Scopus databases were search for published original articles about comparison of micro-leakage in class v prepared by Er:YAG and bur between 1997 until 2017.

Conclusion: Laser prepared cavities had lower micro-leakage scores than cavities prepared with conventional bur.

Keywords: *Micro-Leakage; Er:YAG Laser; Etch and Rinse Adhesive; Self-Etch Adhesive; Bur*

Introduction

Laser technology is the latest method and more widely used in dentistry due to better comfortable to patients. It used as a diagnostic aid, in cavity preparation, and in endodontic dentistry [1]. Nd:YAG (neodymium-doped yttrium aluminum garnet) was the first type of laser had effect on hard dental structure [2-3]. The Er:YAG (Erbi-um: yttrium-aluminum-garnet) laser was conducted by Zharikov in 1974 with a wavelength of 2940 nm [4]. This type of laser has matched the maximum absorbed by water more than other types [5]. This laser, in contrast to many other types of lasers, had the competence to eliminate enamel and dentin more effectively and efficiently [6]. The Er-YAG laser has been used to prepare cavities and its more comfortable method than a bur, which reducing need for local anesthesia, pain freedom and diminished pressure and noise as opposed to conventional rotary systems [7]. In terms of several surface characteristics of the prepared lased tooth, Er: YAG laser results in morphology significantly different to that of conventional mechanical preparation. Microscopically rough surfaces without demineralization, open dentinal tubules without smear layer production and dentin surface sterilization [8]. These features are postulated to increase enhancement the retention of restorative materials to dentin [9]. The marginal sealing of a restorative material has the ability to withstand with caries formation but a development of microleakage over time decrease the longevity of the dental restoration [10,1]. Microleakage is characterized by gap formation between the restorative material and cavity wall due to the failure of bonding the restorative material to cavity walls, leading to the passage of molecules, ions, bacteria and fluids [12]. Some factors are reported to affect the degree of microleakage, such as the difference in thermal expansion coefficient between the tooth and the restorative material, polymerization shrinkage, and shape of the cavity preparation [13]. Resin composite is commonly used direct restorative materials for tooth-colored indicated for class V cavities [14].

Methodology

The literature review was performed last two decades between 1997 until 2017. A database comprehensive systemically search

through PubMed, LILACS, SciELO, Science Direct, and Scopus. The keywords included micro-leakage, class V, Er:YAG laser and composite restoration. One specific question was constructed: Do class v cavity prepared by Er:YAG laser had a lower microleakage than conventional bur. The studies firstly analyzing and evaluate the title, abstracts, and full articles. Cross-sectional, longitudinal, and case report studies.

Discussion

Marginal integrity is the most critical issue that faces any dentist nowadays and is an important factor for the longevity of dental restorative material, particularly composite restoration. Lased cavity restored by the adhesive system in term of micro-leakage A Rüya Yazici., *et al*. found cavity preparation by laser or other cavity preparation technique in respect to micro-leakage restored by etch and rinse adhesive or one-step self-etch adhesive, similar micro-leakages scores irrespective to cavity preparation technique [15].

Similarly, a study conducted by Hossain., *et al*. found microleakage of composite resin restoration prepared by laser and conventional bur no significant difference between laser and bur in term of micro-lekage [16]. Also, in the study of Marotti et al found cavity prepared by Er,Cr:YSGG laser and bur affect the quality of composite resin had the same effectiveness of micro-leakage [17]. On the other hand, some studies found high microleakage in class v prepared by Er:YAG laser and bur using phosphoric acid. In the study of Shahabi., *et al*. assessed microleakage of composite restoration at the margin of cavities prepared by Er,Cr:YSGG laser compared to conventional cavities found higher microleakage occur with phosphoric acid etching in laser and bur cut surface than surfaces prepared with laser alone without addition conditioning [18]. Alike to Yamada., *et al*. showed lower microleakage in composite restoration prepared by laser without phosphoric acid etching used Compared to conventional bur [19]. In addition, Kohara., *et al*. found cavities prepared by laser without acid etching step was significantly lower microleakage than that by bur [20]. However, in another study by Bertrand et al. evaluate the performance of an etch-and-rinse adhesive system in cavities created by Er:YAG laser showed less microleakage of composite restoration if total acid etching in all the enamel and dentin walls was used before bonding [21].

Because Characteristics of Laser treated enamel tissues includes very rough surface and irregular similar to the pattern from etching with phosphoric acid. Laser-irradiated dentin SEM analysis showed open dentinal tubules, rough surfaces, free of a smear layer, sterilization of dentin and more intertubular dentin ablated [22] in contrast, bur cut dental tissues produced thick smear layers that cover the surface and less favor to resin bonding [23]. In study of Trelles K., *et al*. showed low power laser energy (1.5w) per pulse used in class v cavities and restored by self-etching adhesive system at fixed time had less microleakage noticed than high power laser energy (4w) because , low power energy had better surface tooth structure, dentinal tubule, and collagen condition were more favorable for stronger bonding to the wall of cavity prepared. In addition, more effective evacuated of heat than high power energy but low lower energy had the longer time for cavity preparation than high power energy [24]. In the study of Krmek., *et al*. found in this study cavity preparation by very short pulse mode 100us of laser combined with acid etch had lower microleakage level than long pulse mode. Although, very short pulse mode characterized by low pulse duration, rough surface, open dentinal tubules and high energies helped in a dissipation of heat greater than the diffusion of heat into tissues [25]. Benefits of laser irradiated dental tissues include Very effective removal of caries, reduced need of local anesthesia, less noise and vibration, more cavity conservative .comfortable to the patients, bacterial reduction and minimal injury to the pulp tissue [26].

Conclusion

As a limitation of the present study, the literature reviewed in this paper makes clear that Er:YAG laser had a lower microleakage in class v restored by composite restoration than bur .however, it depends on the adhesive system, type of composite restoration, laser setting and acid etch step used.

Recommended

Er:YAG laser is an alternative method for dental caries removal and cavity preparation. However, using this technology relies not on tissue composition and laser setting but also on physician knowledge and experience with this technology respectively.

Further Research

There are some studies had no significant difference in term of microleakage regarding preparation technique by laser or bur that further studies need to be clarified and to understand the cause of contradicting results and factors affect them.

Bibliography

1. Genovese MD and Olivi G. "Laser in paediatric dentistry: patient acceptance of hard and soft tissue therapy". *European Journal of Paediatric Dentistry* 9.1 (2008): 13-17.

2. Adrian JC., *et al*. "Laser and the dental pulp". *Journal of the American Dental Association* 83.1 (1971): 113-117.

3. Lobene RR., *et al*. "Interaction of carbon dioxide laser radiation with enamel and dentin". *Journal of Dental Research* 47.2 (1968): 311-317.

4. Keller U and Hibst R. "Tooth pulp reaction following Er-YAG laser application". *Proceedings of SPIE* 1424 (1991): 127-133.

5. Sonntag KD., *et al*. "Pulpal response to cavity prep-aration with the Er: YAG and Mark III free electron lasers". *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology* 81.6 (1996): 695-702.

6. Hibst R and Keller U. "Experimental studies of the application of Er: YAG laser on dental hard substances: I. Measurement of the ablation rate". *Lasers in Surgery and Medicine* 9.4 (1989): 338-344.

7. Keller U., *et al*. "Erbium: YAG laser application in caries therapy. Evaluation of patient perception and acceptance". *Journal of Dentistry* 26.8 (1998): 649-656.

8. Buyukhatipoglu I and Secilmis A. "The use of erbium: yttrium-aluminum-garnet laser in cavity preparation and surface treatment: 3-year follow-up". *European Journal of Dentistry* 9.2 (2015): 284-287.

9. Stiesch-Scholz M and Hannig M. "In vitro study of enamel and dentin marginal integrity of composite and compomer restorations placed in primary teeth after diamond or Er: YAG laser cavity preparation". *Journal of Adhesive Dentistry* 2.3 (2000): 213-222.

10. Makishi P., *et al*. "Assessment of current adhesives in class I cavity: non-destructive imaging using optical coherence tomography and microtenisle bond strength". *Dental Materials* 31.9 (2015): e190-e200.

11. Jokstad A. "Secondary caries and microleakage". *Dental Materials* 32.1 (2015): 11-25.

12. Kimyai S., *et al*. "Comparison of microleakage of three adhesive systems in class V composite restorations prepared with Er,Cr: YSGG laser". *Photomedicine and Laser Surgery* 28.4 (2010): 505-510.

13. Kidd EAM. "Microleakage: a review". *Journal of Dentistry* 4.5 (1976): 199-206.

14. Corona SA., *et al*. "Microleakage of class V resin composite restorations after bur, air-abrasion or Er: YAG laser preparation". *Operative Dentistry* 26 (2001): 491-497.

15. A Rüya Yazici., *et al*. "Comparison of the Er,Cr: YSGG laser with a chemical vapour deposition bur and conventional techniques for cavity preparation: a microleakage study". *Lasers in Medical Sciences* 27.1 (2012): 23-29.

16. Hossain M., *et al*. "Ablation depths and morphological changes in human enamel and dentin after Er: YAG laser irradiation with or without water mist". *Journal of Clinical Laser Medicine and Surgery* 17.3 (1999): 105-109.

17. Marotti J., *et al*. "Influence of etching with erbium, chromium: yttrium-scandium-gallium-garnet laser on microleakage of class V restoration". *Lasers in Medical Sciences* 25.3 (2010): 325-329.

18. Shahabi S., *et al*. "Microleakage of composite resin restorations in cervical cavities prepared by Er,Cr: YSGG laser radiation". *Australian Dental Journal* 53.2 (2008): 172-175.

19. Yamada Y., *et al*. "Microleakage of composite resin restoration in cavities pre-pared by Er: YAG laser irradiation in primary teeth". *European Journal of Paediatric Dentistry* 3.1 (2002): 39-45.

20. Kohara EK., *et al*. "Morphological and microleakage studies of the cavities prepared by Er: YAG laser irradiation in primary teeth". *Journal of Clinical Laser Medicine and Surgery* 20.3 (2002): 141-147.

21. Bertrand MF., *et al*. "Er: YAG laser cavity preparation and composite resin bonding with a single-component adhesive system: relationship between shear bond strength and microleakage". *Lasers in Surgery and Medicine* 38.6 (2006): 615-623.

22. Fried DN Ashouri., *et al*. "Mechanism of Water Augmentation During IR Laser Ablation of Dental Enamel". *Lasers in Surgery and Medicine* 31.3 (2002): 186-193.

23. De Munck J., *et al*. "Micro-tensile bond strength of two adhesives to Erbium: YAG-lased vs. bur-cut enamel and dentin". *European Journal of Oral Sciences* 110.4 (2002): 322-329.

24. Trelles K., *et al*. "Microleakage in Class V cavities with self-etching adhesive system and conventional rotatory or laser Er,Cr: YSGG". *Laser Therapy* 21.4 (2012): 255-268.

25. Silvana Jukić Krmekr., *et al*. "A three-dimensional evaluation of microleakage of class V cavities prepared by the very short pulse mode of the erbium: yttrium-aluminium-garnet laser". *Lasers in Medical Sciences* 25.6 (2010): 823-828.

26. Matsumoto K., *et al*. "Clinical Assessment of Er,Cr:YSGG Laser Application for Cavity Preparation". *Journal of Clinical Laser Medicine and Surgery* 20.1 (2002): 17-21.

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