Advances in
Dentistry & Oral Health

Research Article
Volume 1 Issue 1 - April 2016

Acad J Ped Neonatol

The Comparison of the Microleakage of Two Different Bulk-Fill Materials in Teeth Disinfected By Ozone Gas

Cellik Omer[1*], Yavuz Yasemin, Bahsi Emrullah and Yilmaz Huseyin Yadigar

Department of Restorative Dentistry, Dicle University, Diyarbakir

Submission: March 02, 2016; **Published:** April 04, 2016

***Corresponding author:** TCellik Omer, Department of Restorative Dentistry, Dicle University, 21280 Diyarbakir, Diyarbakır, Turkey, Tel: +90 0542 596 80 33; Email: omercellk.63@hotmail.com

Abstract

Aim: The aim of this in vitro study is to evaluate two different bulk fill restoration materials in ozone gas applied Class V cavities in terms of microleakage.

Material and Methods: 32 human molar teeth were used. All the teeth were divided into two main groups, ozone gas and control group, and both groups were then divided into subgroups in which bulk fill technique was applied by two different restoration materials. The occlusal and gingival leakage values of the slice surfaces were observed under the stereo optical microscope and the scores were recorded by an independent researcher. The results were statistically compared to Mann Whitney u test.

Results: In terms of microleakage on occlusal and gingival surfaces, no statistically significant difference was found between the main groups consisting of ozone gas and control group ($p>0.05$).

Conclusion: It was established that applying ozone gas as a cavity disinfectant didn't affect Microleakage.

Keywords:Bulk-fill, Composite, Microleakage, ozone, disinfectant.

Abbreviations: SDR: Smart Dentin Replacement; GCP: Glass Carbomer Cement; FAP: Fluoro Hydroxy Apatite; SEM: Scanning Electron Microscope

Introduction

Today it is possible to make more conservative cavity preparations protecting healthy tooth structure thanks to the developments in adhesive materials [1]. However, as a result of inadequate removal of the enamel and dentine that were effected by the cavity after conservative cavity preparations, the bacteria inside the cavity causes a major problem in restorative dentistry. This problem generally causes a secondary caries [2]. Among the cases which need to renew restorations, postoperative sensitivity and secondary caries developments are the leading reasons. Hence; after removing the caries in the cavity, removing the bacteria remaining in the dentine canals and the smear layer is crucial. It is advised to use cavity disinfectants, antibacterial materials, etching and laser in order to eliminate bacteria and remove their negative effects [3]. Today, in order to disinfect cavity antibacterial agents such as chlorhexidine gluconate, sodium hypochlorite (NaOCl), hydrogen peroxide (H_2O_2), iodine, bensalchonium chloride, ozone gas are used [4]. Due to its strong oxygenisation and oxidation features ozone gas, which has been used for a long time for the treatment of many medical diseases, is being widely used in dentistry. Ozone is a strong bactericide, virucide and fungicide agent that destroys the cell walls by oxidizing. Having an unstable structure ozone is a high biocompatible agent as it turns into its original form oxygen [5].

Long term clinical success of composite resin restorations depends on the adaptation between the cavity walls and restoration material. Balancing the shrinkage stress occurring in composite resins is crucial for durability and marginal integrity of restorations [6]. Since the production of composite resins, despite the developments of their many features, polymerization shrinkage and stress are still vital problems to be solved. This problem causes some negative effects such as bacterial invasion, secondary caries formation, postoperative sensitivity and pulp irritation [7]. Different methods such as changing the amount and size of the filling in the composite structure, developing different polymerization units, changing cavity designs, applying various devices of light and techniques are applied in order to decrease polymerization shrinkage. Recently, SDR (Smart Dentin Replacement) which is a bulk-fill resin material has been introduced in the market to reduce the polymerization shrinkage. It is claimed that with this newmaterial by modifying methacrylate units polymerization happens gradually and thus polymerization shrinkage lessens [8].

Glass carbomer cement (GCP fill first Scientific Dental, GmbH Elmshorn, Germany) has been developed from glass ionomer cement and introduced as a new restoration material. Nano sized calcium fluorapatite crystals, which are in glass carbomer, form fluorohydroxyapatite crystals (FAP) by starting and helping remineralisation [9]. Glass carbomer cement has thinner particles than traditional glass ionomer cement and this is thought to increase the formation of fluorapatite and develop the physical features of the material [10]. The aim of this in vitro study is to evaluate two different bulk fill restoration materials in ozone gas applied Class V cavities in terms of microleakage.

Materials and Methods

In this study, 32 human molar teeth that had been extracted due to the periodontal indication were used. Each teeth was carefully examined for any kind of caries, breakages, fractures or pre-restorations in advance. Then, all the soft additions on the tooth surface was removed with the help of a scaler and the surface was cleaned with pumice and polishing disc. The teeth had been kept in distilled water at room temperature until they were studied. Standard Class V cavities were prepared on the buccal surfaces of all teeth under water and air cooler with cylindrical diamond bur (Plus, BR31B, P.R.C). Each cavity was prepared with 3mm mesio- distal width, 2 mm occlusal-gingival width, and 1,5 mm depth. Gingival margins of cavities were extended 1 mm under the enamel cement junction line. All the surfaces of the cavities bevelled 0,5 mm. Finally, all the teeth were divided into two main groups, ozone gas and control group, which were then divided into subgroups to which two different restoration materials with bulk-fill technique were applied and each subgroups contained eight teeth.

Group I (Ozone- Sdr)

Ozone gas (Prozone, W&H, Bürmoos, Austria) was applied to the class V cavity surface with a suitable applicator for 6 sec. Then, the bonding agent of the same firm Xeno V (Dentsply DeTrey Kostanz, Germany) which is a 7th generation self-etch adhesive system was applied to the cavity two layers with brush was cured by using LED (Light Emitting Diode-Elipar Freelight, 3M ESPE, Germany) light device for 20 sec. After that; SDR, (Surefil SDR flow, Dentsply, Caulk, USA) which is a methacrylate based bulk-fill resin composite, with a single application to the cavity was cured for 20 sec. by using LED light device.

Group Ia (Ozone-Glass Carbomer)

Ozone gas was applied to the cavity surfaces with suitable applicator for 6 seconds (Prozone, W&H, Bürmoos, Austria). And then Glass Carbomer (GCP fill first Scientific Dental,GmbH Elmshorn, Germany) was placed to the cavity via application forceps which was mixed for 15 seconds by the mixer.And then coated with protective surface material,GCP Gloss (GCP Gloss first Scientific Dental,GmbH Elmshorn, Germany). Finally the restorations were done with 90 seconds light cure at 60 C temperature CarboLED light device (Carboled GCP Dental, Austria).

Group II (Control-SDR)

7thgeneration adhesive system Xeno V was applied double application to the cavities which has no disinfection appliance with a single use brush and cured for 20 seconds by LED light device. And then methacrylate based bulk-fill resine composite SDR (Surefil SDR flow,Dentsply, Caulk,USA) was applied to the cavity and cured for 20 seconds by LED light device.

Group IIa (Control Glass Carbomer)

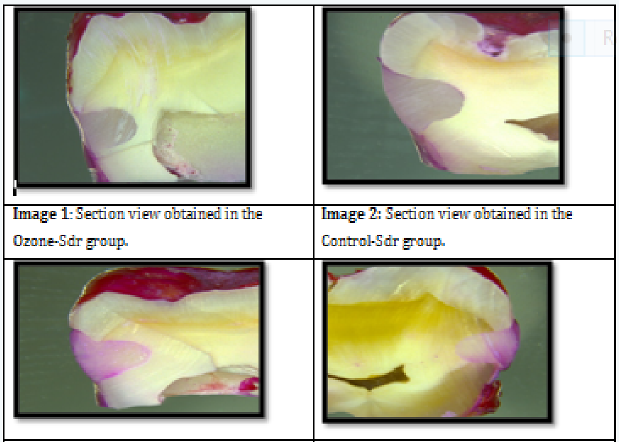

Image 1: Section view obtained in the Ozone-Sdr group.

Image 2: Section view obtained in the Control-Sdr group.

Image 3: Section view obtained in the Ozone-Glasscarbomer group.

Image 4: Section view obtained in the Control-Glasscarbomer group.

Figure 1: Stereo microscobe images of samples taken from each group (x57).

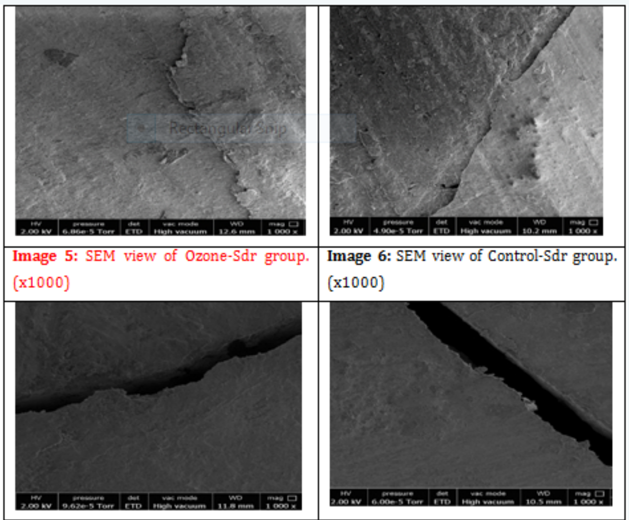

Image 5: SEM view of Ozone-Sdr group. (x1000)

Image 6: SEM view of Control-Sdr group. (x1000)

Image 7: SEM view of Ozone-Glasscarbomer group. (x1000)

Image 8: SEM view of Control-Glasscarbomer group. (x1000)

Figure 2: SEM images of the samples taken from each group (x1000).

How to cite this article: TCellik O, Yavuz Y, Bahsi E , Yilmaz H Y. The Comparison of the Microleakage of Two Different Bulk-Fill Materials in Teeth Disinfected By Ozone Gas. Adv Dent & Oral Health. 2016; 1(4): 555570.

15 seconds mixed Glass Carbomer material was placed to the cavites with application forceps to the cavited which has no application. And then restoration surface was coated with protective material and cured by CarboLED device at 60 C for 90 seconds. All samples were kept in incubator (Nüve Incubator EN 500 Ankara TURKEY) at 37°C for 24 hours before finishing and polishing.Finşshing and polishing were done after 24 hours later by aluminum coated discs (Sof-Lex,3M ESPE, St. Paul, MN, USA). After the samples were kept in incubator at 37°C for 24 hours,they were thermal cycled for 1500 times (30 seconds) at 5±27°C and 55±2°C. And then all teeth's apexes were sealed with flowable composite and coated with acid resistant nail polish 1mm away from the restoration borders.All samples were kept in %0,5 basic fuchsine and incubated at 37°C for 24 hours (Nüve Incubator EN 500,Ankara,Turkey). And then samples are washed in order to remove excess blot. Teeth were seperated buccal-lingual/palatinal direction with a 0,2 mm thick diamond seperator (Horico, Diamond Instruments, Germany) and micromotor (DEGA z, ceramic, Made in P.R.C) under water irrigation. Occlusal and gingival microleakage degrees were observed under stereooptic microscope with x57 magnify by an individual researcher and scores were recorded (Figure 1). 1 teeth was selected from each groups randomly and surface morphology between the resine tooth hard tissue was examined under scanning electron microscope (FEI, Quanta FEG 250,Germany) at various magnifications and photographed (Figure 2). Similar standart scoring system was used about the microleakage values like [11] scoring system was shown at Table1.

Table 1: The criteria used in the evaluation leakage scores.

Microleakage scores	
0	No dye penetration at all
1	Dye penetration up to half of cavity wall
2	Dye penetration the whole of cavity wall
3	The cavity walls and floor dye penetration
4	Partially or totally reached the pulp dye penetration

Results

The leakage scores obtained from the research are given in Table 2. In our study, the groups were statistically compared to Mann Whitney test, a Non- Parametric test, as the data didn't have normal distribution (P>0.05). The occlusal and gingival leakage values of main groups obtained by statistical evaluation are given in Table 3. In terms of microleakage on occlusal and gingival surfaces, no statistically significant difference was found between the main groups consisting of ozone gas and control group (p>0.05). When the means were checked, both in occlusal and gingival less microleakage was observed in ozone gas applied groups. Both in ozone gas applied group and the control group no significant difference was found between SDR and glass carbomer materials in terms of microleakage on occlusal and gingival margins (p>0.05). It was also found that there was no statistically significant difference when the groups were individually evaluated in terms of microleakage on occlusal and gingival margins (p>0.05).

Table 2: The examination results obtained of microleakage values of the occlusal and gingivale margin line (O: Occlusal, G: Gingival).

Cavity Disinfectants	Restoration Materials	Microleakage scores									
		0		1		2		3		4	
		O	G	O	G	O	G	O	G	O	G
Ozone	SDR	13	12	3	3	0	1	0	0	0	0
	Glasscarbomer	14	12	2	1	0	3	0	0	0	0
Control	SDR	9	9	7	5	0	1	0	1	0	0
	Glasscarbomer	12	8	4	3	0	3	0	2	0	0

Table 3: Statistical analysis of the results obtained from the main group occlusal and gingival margin leakage values.

Groups		Occlusal	Gingival
Ozone	Minimum	0	0
	Maximum	1	2
	Median	,00	,00
	Range	1	2
Control	Minimum	0	0
	Maximum	1	3
	Median	,00	,00
	Range	1	3

Discussion

One of the most important parameters of the clinically success of adhesive restorations is minimising the microleakage occurring between the tooth and restoration interface. The microleakage occurring in restoration tooth interface causes marginal discoloration, post operative sensitivity, pulpal reactions and secondary caries. Microleakage test is widely used by the researchers to assess the performance of the materials introduced to the market. Despite various methods used for this aim, dye leakage method is mostly preferred as it is fast, easy an economic [12]. Another method used for microleakage studies is the scanning electron microscope (SEM). In this method, the

 How to cite this article: TCellik O, Yavuz Y, Bahsi E , Yilmaz H Y. The Comparison of the Microleakage of Two Different Bulk-Fill Materials in Teeth Disinfected By Ozone Gas. Adv Dent & Oral Health. 2016; 1(4): 555570.

morphology of the surface between the restoration material and the tooth is observed. SEM analysis can be used with dye method in order to confirm the data [13]. In this study, dye method and SEM analysis were used together due to their advantages. The most important factor in margin leakage is the polymerization shrinkage occurring in restorative materials. Today, various application methods and materials have been developed to decrease microleakage. Despite the fact that these methods reduce leakage, they are incapable of removing it completely. For these reasons, it is crucial to remove the bacteria which remain in the cavity and may cause a potential secondary caries. For this purpose, using cavity disinfectants is advised [14]. Ozone gas which has been widely used recently and can be formed in the upper levels of the atmosphere is a natural disinfectant. It has a wide range of usage because of its strong antibacterial, antiviral and antifungal effects. Ozone gas, which can be obtained by dissolving the oxygen in the air, turns into oxygen after the disinfection process because of its instable structure. This quality makes the ozone gas the only disinfectant leaving no remains or wastes [15]. Nevertheless a drawback in the use of ozone gas as a disinfectant is it can cause polymerization inhibition as in other oxidative materials [16]. Dukic et al. [17] reported ozone doesn't effect on microleakage in their study in which they observed the effect of ozone on leakage with nanoparticuled fissure sealant and fluid composite materials. In their study which compared the effects of ozone gas and various cavity disinfectants on microleakage, Gunes et al. [18] reported the least microleakage values were gathered from the ozone applied group. Kapdan et al. [19] reported cavity disinfectants doesn't effect microleakage in their comparative study in which they studied the microleakage and bonding of compomer restorations in deciduous teeth to which they applied ozone gas and chlorhexidine as cavity disinfectant. Our results are also in parallel with the studies mentioned above. We observed the least leakage values in ozone gas applied teeth. It is claimed by the manufacturers that a new developed technology bulk-fill resin composites can be applied up to 4 mm single time, without any negative effect about marginal unity, polymerization stress and convertion degree. Moreover manufacturers have repoted that bulk-fill resins have showed less polymerization stress than present flowable composites and traditional composites. It is stated that this situation will minimize negativities like microleakage due to the polymerization stress, secondary caries, post-operative sensitivity and pulp irritation. A bulk-fill composite resin SDR contains polymerization modulators which reduce polymeriation shrinkage stress. Thanks to this polymerization process becomes slowly and shrinkage stres reduces [20]. Koyuturk et al. [8] reported successful results about the microleakage with SDR restorations in their study which they compared SDR and posterior composite with total etch and self etch adhesive systems. Scotti et al. [21] reported less microleakage on dentine with bulk-fill restorations whilst they reported similar results on enamel in their study which they compared one nanohybrite and two bulk-fill composite. Also we have observed no differences about microleakage at both occlusal and gingival lines with our SDR restoraitons in ozone and control groups. Glass carbomer cements are new developed restoration materials in order to eleminate negative properties of glass ionomer cements. Nano sized dust particles and fluorapatite were added to this new product. Glass carbomer is a restorative material which cures chemically, has different shades, nano fill and has a special surface polish that cures with heat [22]. Çehreli et al. [23] grouped traditional glass ionomer cement, compomer and glass carbomer cement with and without protector in deciduous teeth. Due to the their results they reported the most microleakage at the glass carbomer without protector and the least microleakage at the glass carbomer with protector. Upadhyay et al. [24] reproted the least microleakage value at nano ionomer cement and no significant difference among the materials in their study which they compared traditional glass ionomer, resin modified glass inomer and new developed nano ionomer cement. We established no differences between occlusal and gingival microleakage values in our study which we tested glass carbomer and SDR materials at ozone applied and no disinfection applied teeth about the microleakage.

Conclusion

As the conclusion of our study, we can tell that ozone gas disinfection of the cavity before the restoration does not effect microleakage. And we came to conclusion that SDR and new developed Glass Carbomer Cement have similar properties about microleakage. But we are in the opinion that long term clinical studies should be done in order to prove the validity of these results.

References

1. Baglar S, Dalli M, Colak H, Ercan E, Hamidi MM (2010) Effects of Two Different Restorative Materials on Microleakage of Class V Cavities. Cumhuriyet Dental Journal 13(1): 9-14.
2. Tuzuner T, Ulusoy TA, Baygin O, Yahyaoglu G, Yalcın I (2012) Evaluation of the effectiveness of commercially antibacterial gels on micro-tensile bond strength applicable as cavity disinfectants. Cumhuriyet Dent J 15(4): 288-296.
3. Karaaslan SE, Altintas S, Cebe A, Usumez A (2010) Effect of Photo-Activated Disinfection on Microleakage of Composite Restorations. J Dent Fac Hacettepe Uni 34(1-2): 2-9.
4. Dinc G (2012) Antibacterıal Properties Of Cavıty Disinfectants, Effects On Bond Strength and Mıcroleakage (Revıew). J Dent Fac Ataturk Uni 6: 66-75.
5. Atabek D, Sungurtekin E, Oztas N (2012) The Effect Of Hıgh Mineralized Agents Combined wıth Ozone Therapy on Fissure Caries Lesions. J Dent Fac Gazi Uni 29(3): 165-171.
6. Rengo C, Spagnuoli G, Ametrano G, Goracci C, Nappo A, et al. (2015) Marginal leakage of bulk-fill composites in Class II restorations: A micro CT and digital microscope analysis. International Journal of Adhesion & Adhesives 60: 123-129.
7. Ilie N, Hickel R (2011) Investigations on a methacrylate-based flowable composite based on the SDR technology. Dent Mater 27(4): 348-355.

How to cite this article: TCellik O, Yavuz Y, Bahsi E , Yilmaz H Y. The Comparison of the Microleakage of Two Different Bulk-Fill Materials in Teeth Disinfected By Ozone Gas. Adv Dent & Oral Health. 2016; 1(4): 555570.

8. Koyuturk AE, Tokay U, Sari ME, Ozmen B, Cortcu M, et al. (2014) Influence of the bulk fill restorative technique on microleakage and microtensile of class II restorations. Pediatric Dental Journal 24(3): 148-152.

9. Zainuddina N, Karpukhinab N, Lawc VR, Hill GR (2012) Characterisation of a remineralising Glass Carbomer® ionomer cement by MAS-NMR Spectroscopy. Dent Mater 28(10): 1051-1058.

10. Moshaverinia A, Ansari S, Moshaverinia M, Roohpour N, Darr JA, et al. (2008) Effects of incorporation of hydroxyapatite and fluoroapatite nanobioceramics into conventional glass ionomer cements (GIC). Acta Biomater 4(2): 432-440.

11. Demirci M, Ozer F, Kusdemir M, Sancakli HS, Karakaya S (2007) Effects on microleakage in class V cavities of different methods of application of the adhesive system. Selcuk Dental Journal 16: 29-38.

12. Gonulol N, Ozer S, Demirel N (2014) Microleakage evaluation of giomer flowable composites and adhesive systems in Class V cavities. Acta Odontol Turc 31(1): 18-22.

13. Ayyildiz S, Uyar AH, Yuzugullu B (2009) Microleakage And The Evaluatıon Methods in Dentistry. J Dent Fac Ataturk Uni 19(3): 219-226.

14. Celik C, Ozel Y, Karabulut E (2007) Effect of Cavity Disinfectant Application on Microleakage of Different Dentin Adhesive Systems. J Dent Fac Ataturk Uni 17(2): 7-12.

15. Azarpazhooh A, Limeback H (2008) The application of ozone in dentistry: a systematic review of literature. J Dent 36(2): 104-116.

16. Pires TP, Ferreira CJ, Oliveira AS, Silva JM, Melo RP (2013) Effect of Ozone Gas on the Shear Bond Strength to Enamel. J Appl Oral Sci 21(2): 177-182.

17. Dukic W, Dukic OL, Milardovic S (2009) The influence of Healozone on microleakage and fissure penetration of different sealing materials. Coll Antropol 33(1): 157-162.

18. Gunes S, Bahsi E, Ince B, Colak H, Dalli M, et al. (2014) Comparative Evaluation of the Effects of Ozone, DiodenLaser, and Traditional Cavity Disinfectants on Microleakage. Ozone: Science & Engineering 36: 206-211.

19. Kapdan A, Oztas N (2015) Effects of chlorhexidine and gaseous ozone on microleakage and on the bond strength of dentin bonding agents with compomer restoration on primary teeth. Journal of Dental Sciences 10(1): 46-54.

20. Czasch P, Ilie N (2013) In vitro comparison of mechanical properties and degree of cure of bulk fill composites. Clin Oral Investig 17(1): 227-235.

21. Scotti N, Comba A, Gambino A, Paolino SD, Alovisi M, et al. (2014) Microleakage at enamel and dentin margins with a bulk fills flowable resin. Eur J Dent 8(1): 1-8.

22. Altan H, Altan A, Arslanoğlu Z. Glass Ionomer Cement, Derivates and Glass Carbomer Cement Journal of Clinical Sciences 2013; 6(4): 1319-1322.

23. Cehreli SB, Tirali RE, Yalcinkaya Z, Cehreli ZC (2013) Microleakage of newly developed glass carbomer cement in primary teeth. Eur J Dent 7(1): 15-21.

24. S Upadhyay, A Rao (2011) Nanoionomer: Evaluation of microleakage. J Indian Soc Pedod Prev Dent 29(1): 20-24.