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Araştırma/ Research Article

EFFECT OF AIR-FLOW POLISHING ON SURFACE ROUGHNESS OF COMPOSITES AND PORCELAINS

AİR FLOW İLE YAPILAN PARLATMANIN PORSELEN VE KOMPOZİTLERİN YÜZEY PÜRÜZLÜLÜĞÜ ÜZERİNE ETKİSİ

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ABSTRACT

Purpose: The aim of this study was an evaluation to the affect of air-flow polishing on composite and porcelain specimens.

Materials and Methods:
One hybrid and one nano-hybrid composite systems were used for this study. Experimental groups which were 2 mm thickness and 10 mm diameter were consist of; metal- supported and metal-free porcelains, microhybrid and nanofil composites. Totally 4 groups of 10 specimens each according to material type.

Results
According to Two way analysis of variance there was no differences after air flow applying to specimens (P>0.05). There was statistically significant differences according to t test results among groups before and after air flow applying (P<0.05) but no differences was observed between porcelain and composite groups in terms of surface roughness.

Conclusion
Air flow is an easy and time-saving technique, but it induced rougher surfaces on restorative materials, therefore re-polishing process may be applied on restorative materials after air-flow polishing.

Key words: air flow, composites, porcelains, surface roughness

ÖZET

Amaç: Bu çalışmanın amacı, Air flow ile yapılan parlatmanın Porselen ve Kompozitlerin yüzey pürüzlülüğüne etkisini incelemektir.

Materyal ve Method:
Bu çalışma için bir hibrit bir nano-hibrit kompozit sistemleri kullanılmıştır. 2 mm kalınlığında ve 10 mm çapında olan deney grupları, metal destekli ve metal desteksiz porselenleri, mikrohibrit ve nanofil kompozitleri içermektedir. Materyal tipine göre her birinde 10 ar adet olmak üzere toplam 4 grup bulunmaktadır.

Bulgular
İki yönlü varyans analizi sonucuna göre örneklerde air flow uygulaması sonucunda bir farklılık görülmemiştir (P>0.05). T testi sonucuna göre gruplar arasında air flow uygulamasından önce ve sonrasına göre istatistiki olarak anlamlı sonuç bulunmuştur (P<0.05) fakat kompozit ve porselen grupları arasında yüzey pürüzlülüğü bakımından anlamlı bir farklılık gözlemlenmemiştir (P<0.05).

Sonuç
Air flow kolay ve daha az zaman alan bir tekniktir fakat restoratif materyaller üzerinde pürüzlü yüzeylere neden olur, bu yüzden air flow parlatması sonrasında restoratif materyallere tekrar cilalama işlemi uygulanabilir.

Anahtar kelimeler: air flow, kompozit, porselen, yüzey pürüzlülüğü

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INTRODUCTION

Composite resins are used for restoring in anterior and posterior teeth[1]. Smooth surface of the restorations clinically important, since it determines the esthetics and longevity of composite resin restorations. The presence of surface irregularities arising from instruments or other things may create clinical problems such as staining, plaque retention, gingival irritation, and caries[2,3].These can be repolished with diomond bars, aluminum oxide and silicon carbid finishing discs with polishing pastes[4].

The composite resins' surface do not abrade to the same degree due to different hardnesses. This property is closely related to the organic matrix, inorganic filler composition of the composites[5].

Dental porcelains are used frequently in dentistry because of their excellent biocompatibility, durability and improved esthetic properties[6]. A smooth ceramic surface is required because of healthy results. It may achieved by glazing or using polishing instruments. Glazing increase the fracture resistance and reduce the abrasiveness of the porcelain surface by sealing the open pores in the surface of the fired porcelain[1]. Therefore it is important for restoration success. Different polishing techniques can be used on porcelain surface instead of glazing[7] such as rubbers after the porcelain restorations cementation.

Periodontal therapy can achieved by removing of plaque and calculus from teeth with hand or machine driven instruments. Superiorities of airpolishers are rapid removal of tooth deposits, less invoked hypersensitivity, less implementer fatigue, and improved access to pits and fissures[8]. Air-flow devices used with pressurized air, abrasive powders and water. Because of easy using and time saving sonic and air polishing instruments have been more preferred [9]. Air flow is more effective than currets, ultrasonic scalers in the removal of stains and plaque[10], but there is harmful effects on the enemal, gingiva and root sufaces[11]. The effects of sonic scalers on hard and soft tissues have been investigated [12,13] but there is no study about air-polishing effects on porcelain and composite restorations' surface roughness.

The aim of this study was to evaluate the affect of air polishing on the surface roughness of the composite and porcelain restorations. The hypothesis of this study was there would be surface roughness value differences in composite groups but not in porcelain groups.

MATERIAL AND METHODS

One hybrid and one nano-hybrid composite systems were selected in this study. Materials, ingredients and manufacturers used are given in Table 1 and 2. Four experimental groups were occurred as; metal- supported and metal-free porcelain groups, microhybrid and nanofil composite groups. Totally 4 groups of 10 specimens each according to material type.

Table 1. Composites that used in study

Product	Type	Type of Filler	% Filler	Mean Particle	Manufacturer	LOT
Filtek Z250	Microhybrid	Zirconia/ silica	82 (60)	0.01-3.5µ	3M ESPE	N/256417
Filtek ultimate	Nanofill	Zirconia/ silica	72.5(55.6)	0.6-10µ	3MESPE	20090511

Table 2. Porcelains that used in study

Product	Manufacturer	LOT
Noritake/Zirconium	Noritake dental supply co. limited/JAPAN	032100
Vitavm-9/Feldspathic	Vıta Zahnfabrik/ GERMANY	21980

Composite specimens preparation

10 disks, 2 mm in thickness and 10 mm in diameter specimens were fabricated with a custom made teflon mould from each composites. The mould consists two teflon pieces surrounding with a metal ring to easily separate after the polymerization of specimen (Fig 1), this mould can be used for fabricating another specimens again. The composite resin was slightly overfilled into the teflon mould and clasped between two glass plates and finger pressure was applied to extrude the excess resin. Then glass plates were removed and the tip of the light source (Bluephase Ivoclar Vivadent Schaan, Liechtenstein) was touched the specimens and applied for 40 seconds according to manufacturer's instructions.

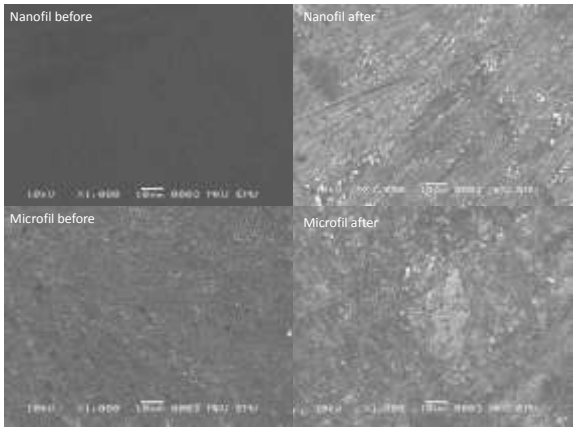

Fig 1: Surface roughness of the composites before and after air-flow polishing

Porcelain specimens preparation

12 mm diameter and 2 mm thickness disc shaped specimens were prepared for each of feldspathic and zirconium porcelains by one investigator who condensed the porcelains into a polyvinylsiloxane mold. After each specimen was mixed using the same amount of porcelain and liquid, placed into the mold and compressed with a plastic plunger. The excess moisture was absorbed by using a absorbent paper. After removal from the mold, the specimens were fired 900 °C in one furnace (P 300; Ivoclar-Vivadent, Liechtenstein) according to the manufacturer's directions.

Air-flow powder (3M Aspe AG/Germany) which consist of Glycidine was applied in all groups at 90° angle with air-flow device (AIR-FLOW Master; EMS, Nyon, Switzerland)

Evaluation of surface roughness

Surface roughness of the discs was evaluated using a profilometer (SJ 201 Mitotoyo Surf Test P/M; Mitutoyo Corp, Takatsu-ku, Japan) before and after surface treatment. To measure the roughness profile value in micrometer, a diamond stylus (tip radius, 5 µm) was moved across the surface under a constant load of 0.75 mN with a speed of 0.5 mm/s and a range of 350 µm. The instrument was calibrated using a standard precision reference specimen. Three traces were recorded for each specimen at 3 different locations in different positions (parallel, perpendicular, and oblique) giving 9 tracings per sample. The average of these 9 mean surface roughness measurements was used as the score for each sample. The scores were entered into a spreadsheet (Excel; Microsoft, Seattle, WA) for calculating descriptive statistics.

Statistical analysis

Two way analysis of variance and Covariate test followed from the t-test for statistical analysis were used to determine differences in terms of surface roughness among specimens.

SEM analysis

Surface roughnesses of the specimens were evaluated with Scanning Electron Microscope before and after air-flow polishing.

RESULTS

According to Two way analysis of variance there was no differences after air flow applying to specimens (P>0.05) (Table 3). There was statistically significant differences according to t test results among groups before and after air flow applying (Table 4) (P<0.05) and no differences between porcelain and composite groups in terms of surface roughness (Table 5). SEM examination was confirmed the more rougher values after air flow application Fig 2 and 3.

Table 3. Two-way analysis of variance results in terms of surface roughness among four groups

Source	SS	DF	MS	P
Corrected Model	14,611(a)	4	3,65	0,00
Intercept	12,081	1	12,08	0,00
Before	3,967	1	3,97	0,00
Group	1,249	3	0,42	**0,38**
Error	13,800	35	0,39	
Total	111,154	40		
Corrected Total	28,412	39		

Table 4. t test results before and after applying air flow to specimens.

Air flow	Mean	N	SD	P
Before	0,69	40	0,69	**0,00**
After	1,43	40	0,85	

Table 5. Covariate test results to evaluate composite and porcelain surface roughness differences

Source	SS	Df	MS	P
Corrected Model	a 14,373	2	7,19	0,00
Intercept	13,603	1	13,60	0,00
Before	3,794	1	3,79	0,00
Two group	1,010	1	1,01	0,11
Error	14,039	37	0,38	
Total	111,154	40		

a.R Squared=,506 (Adjusted R Squared= ,479)

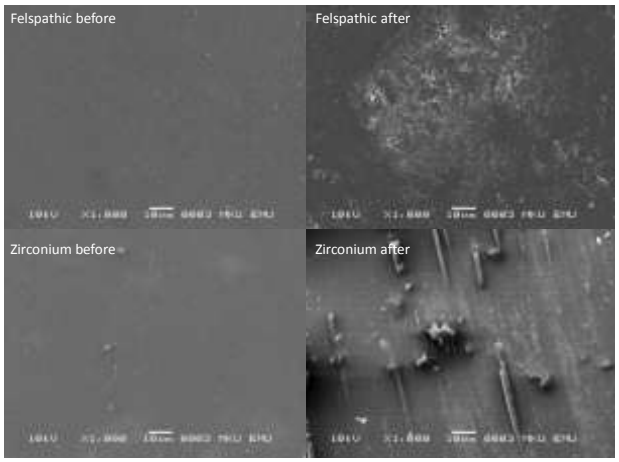

Fig 2: Surface roughness of the porcelains before and after air-flow polishing

DISCUSSION

Air flow devices are fabricated firstly to remove soft deposits and stains from tooth surfaces. While improved strength and durability of aesthetic restorative materials have resulted in increased usage, the effect of air polishing on these new improved materials has not been determined so far. The hypothesis of this study was partially rejected. Porcelains were affected from the air-flow application as well as composite specimens.

The Ra, Rz, Lt, Lc parameters that obtained with a profilometer is describe the surface texture of the restorative materials. The Ra parameter describes the surface roughness and can be defined as the arithmetical average value of all absolute distances of the roughness profile from the center line within the measuring length[14].

According to a study the effect of an air-polishing system which used sodium bicarbonate powder on the surface roughness of different restorative materials and they found that the restorative materials surface roughness were changed after air-flow application as our study[15].

Gutmann et al was conducted to evaluate the surface effects of the air-flow in vivo on hybrid composite, microfilled composite, amalgam, and glass ionomer restorations for 10 seconds pre and post-treatment surfaces were not significant. The differences of this study may arise from in vivo application of air-flow[16].

According to Kazuhiro et al study with using NaHCO3 which is the most commonly used air-polishing agent, damage to the cementum and dentin due to air polishing is minimal and they suggest that air polishing is an effective dental treatment [17].

Pelka et al stated that defect depth and volume loss was occurred after applying air flow on composites as this study[18].

The limitation of this study was the specimen surfaces were flat but clinically, composite resin and porcelain restorations have an irregular shape with convex and concave surfaces. Furthermore, the application of air-flow procedure used in this study may be difficult to perform clinically.

CONCLUSION

Air polishing is an easy and time-saving instrumentation technique, but it induced rougher surfaces on restorative materials, therefore re-polishing may be applied on restorative materials after air-flow polishing.

REFERENCESS

1-Yap AU, Yap SH, Teo CK, Ng JJ. Finishing/polishing of composite and compomer restoratives: effectiveness of one-step systems. Oper Dent 2004;29:275-9.

2-Reis AF, Giannini M, Lovadino JR, dos Santos Dias CT. The effect of six polishing systems on the surface roughness of two packable resin-based composites. Am J Dent 2002;15:193-7.

3-Bertrand MF, Leforestier E, Muller M, Lupi-Pegurier L, Bolla M. Effect of surface penetrating sealant on surface texture and microhardness of composite resins. J Biomed Mater Res 2000;53:658-63.

4-Barbosa SH, Zanata RL, Navarro MFL, Nunes OB. Effect of Different Finishing and Polishing Techniques on the Surface Roughness of Microfilled, Hybrid and Packable Composite Resins. Braz Dent J 2005:16:39-44.

5-Bollen CM, Lambrechts P, Quirynen M. Comparison of surface roughness of oral hard materials to the threshold surface roughness for bacterial plaque retention: a review of the literature. Dental Mater 1997;13:258-69.

6-Anusavice KJ. Phillips' science of dental materials. 10th ed. Philadelphia: WB Saunders Company; 1996. p.598-600.

7-Ancowitz S, Torres T, Rostami H. Texturing and polishing: The final attempt at value control. Dent Clin North Am 1998;42:607-12.

8-Brown DM, Barnhart RC. A scientific foundation for clinical use of air-polishing systems. Part I. A review of the literature. J Prac Hygn 1995;4:36-40.

9-Drisco CL, Cochran CL, Blieden T,Bonwsma QJ, Cohen R, Damoulis O, Fine JB, Greenstein G,Hinrichs J,Somerman MJ, Lacomo V, Genco RJ. Position paper: sonic and ultrasonic scalers in periodontics. Research science and theraphy committee of the American Academy of periodontology. J Periodontol 2000;43:31-4.

10-Kontturi-Narhi V, Markkanen S, Markkanen H. Effects of air-polishing on dental plaque removal and hard tissues as evaluated by scanning electron microscopy. J Periodontol 1990;61:334–8.

11-Tada K, Kakuta K, Ogura H, Sato S.Effect of particle diameter on air polishing of dentin surfaces. Odontology 2010:98:31-6

12-Bhaskar SN, Grower MF,Cutright DE. Gingival healing after hand and ultrasonic scaling biochemical and histologic analysis. J Periodontol 1972;43:31-34.

13-Boyde A. Airpolishing effects on enemal, dentine, cement and bone. Br Dent . 1984;156: 287-91.

14-Whitehead SA, Shearer AC, Watts DC, Wilson NHF. Comparison of methods for measuring surface roughness of ceramic. J Oral Rehabil. 1995;22:421-7.

15-Lubow RM, Cooley RL. Effect of an air-powder abrasive instrument on restorative materials. J Prosthet Dent 1986;55:462-5

16-Gutmann MS, Marker VA, Gutmann JL. Restoration surface roughness after air-powder polishing. Am J Dent. 1993;6:99-102.

17-Kazuhiro Tada, Kiyoshi Kakuta, Hideo Ogura, Soh Sato. Effect of particle diameter on air polishing of dentin surfaces. Odontology 2010;98:31-6.

18-Pelka MA, Altmaier K, Petschelt A, Lohbauer U. The effect of air-polishing abrasives on wear of direct restoration materials and sealants. J Am Dent Assoc 2010;14:63-70.

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