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Wear of ceramics systems with different surface applications in a chewing simulator

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Abstract

Objective: This study was aimed to compare the wear of four types of the ceramic dental materials with different surface treatments.

Material and Methods: Porcelain (low-fusing feldspathic, monolithic zirconia, lithium disilicate glass, and leucite glass-ceramic) samples (9 x 3 mm) were prepared with different surface treatments (glazed and mechanical polished). Samples were mechanically loaded in a chewing simulator (600.000 cyles of 50N) and 64 teeth were used to simulate as the antagonist. To evaluate the wear of the samples before and after the test, samples were scanned by 3D scanner, Dental Wings 7 Series. Then they were transformed into the digital platform. Surface analysis was performed by using an optical profilometer and scanning electron microscope. A sensitive digital scale was used for weight measurements of antagonist's teeth.

Results: It was a significant difference between the volume values of the groups with mechanical polish and the groups with glaze, except for zirconia samples ($p<0.05$). While the least change in volume and surface roughness was observed in the zirconia mechanic polished group (ZP), this change was not statistically significant ($p>0.05$). In terms of the weight measurement results of the antagonist teeth, while leucite reinforced overglazed group (PRG) has the highest weight loss as a result of wear, ZP group has the least weight loss.

Conclusion: It was concluded that glazed groups of ceramics lose more substances than polished groups, and that causes more wear on antagonist teeth. Zirconia ceramics showed less substance loss, and that causes less wear on antagonist teeth.

Keywords: Dental Ceramic Systems, Chewing Simulator, Surface roughness, polished and glazed surface, SEM.

Introduction

Dentistry focuses on oral function and material longevity as well as aesthetics. Therefore, the dentists have been searching for ideal restorative materials for more than a hundred years. Low light transmittance and the possible gingival coloration are the first negative aspects of metal-ceramic systems (1). With the development of technology and the tendency of the patients to naturalness, full ceramic restorations have gained importance in dentistry.

The marginal edge compatibility of these ceramics, their biological compatibility with tissues, color stability, chemical and wear resistance are the characteristics which make them attractive. However, these ceramics are fragile and have limited tensile strength. Many efforts have been made to eliminate these negative aspects and provide the desired aesthetics (2, 3, 4, 5).

The glaze is applied during the application of dental porcelain, for the purpose of increasing of the aesthetic characteristics, such as, gaining natural tooth appearance, reducing plaque retention, and making cleaning easy (6, 7). However, it is known that in most of the pre- or post-cementation processes, the glazed layer is removed by occlusal adaptations (8). In addition, in clinical studies, it has been reported that in the mouth the glazed layer is removed from dental porcelain in a period of six months (9).

Dental porcelain after the application of the shield glaze layer exhibits more rough and aesthetically reduced appearance. An increased surface roughness has been reported to have negative effects on restorative materials in terms of staining (10).

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Bollen et al., (11) reported that the restorations with an average surface roughness of more than 0.2 µm increase wear as well as the deposit of plaques. According to the data in the literature, restorations have also been described as being more abrasive as the surface roughness increases (12, 13).

The aim of this study is to investigate the abrasion and surface roughness variations as a result of the exposure of various specimen groups with dental porcelain systems with different contents, such as Feldspathic (Super Porcelain EX-3, Kuraray Noritake Dental Inc., Japan), zirconia (Katana Zirconia UTML, Kuraray Noritake Dental Inc.,Japan), leucite-reinforced (IPS empress CAD, IvoclarVivadent, Liechtenstein), lithium disilicate-reinforced (IPS e.max CAD, IvoclarVivadent, Liechtenstein) to a chewing simulator after glazing and polishing.

Material and method

In the study, which investigates the wear behavior of various dental porcelain systems used today, four dissimilar dental porcelain systems as Feldspathic, monolithic zirconia, leucite-reinforced, lithium disilicate-reinforced are determined for the investigation (Table 1).

It is decided to divide the groups with dental porcelains into two within their own group (n=8), and to apply various surface treatments for glazing and mechanical polishing to each subgroup. The porcelain specimen groups have reached to total 64. By the chewing simulation used, the antagonist of each specimen with dental porcelain, 64 premolar which were removed due to orthodontic and periodontal indications, were not lost due to mechanical and chemical reasons and without caries and fillings, were collected. Before the treatment of the enamel surface of the dental specimens, the residues on top of the dental specimens were cleaned by polishing at low speeds and the teeth were kept in 0.1% thymol solution until the day of the experiment in order to prevent degradation of the tooth tissue.

Preparation of Porcelain Specimens

Dental porcelains were standardized as circle-based cylinders in 9 mm diameter and 3 mm height. The size control of all specimens was provided by an electronic caliper with a precision of 0.01 mm.

Preparation of Feldspathic Porcelain Specimens

By a conventional method (hand work), porcelain EX-3 low heat feldspathic system (Kuraray Noritake Dental Inc., Miyoshi, Japan) was prepared. As the manufacturer indicated, considering that the material size would change during firing, the specimen was poured into PEEK (Polyether ether ketone) molds designed as 10% larger dimensions than the desired 9 x 3 mm dimensions. Feldspathic porcelains which were prepared by handwork, as indicated by the manufacturer, dried at 600˚C for 7 minutes. Then the vacuum process was started and finished at 920˚C. The entire firing procedure was terminated at a temperature increase of 45˚C per minute at 930˚C. Of the 16 specimens prepared, glazing was applied to 8 specimens and mechanical polish was applied to the other 8. Firing and glazing operations were performed in Ivoclar Vivadent Programat EP 3000 (IvoclarVivadent, Schaan, Liechtenstein).

Preparing Monolithic Zirconia-Ceramics

Monolithic Zirconia CAD/CAM system was prepared in Katana Zirconia UTML (Kuraray noritake dental Inc., Miyoshi, Japan) Yenamak CAD/CAM. Zirconia discs engraved in CAD/CAM system were subjected to the sintering process in accordance with the directive given by the manufacturer. Sintering was applied at a 10˚C per minute heating rate up to a furnace temperature of 1550’C for 2 hours, and the temperature of the furnace was cooled by 10˚C per minute to the room temperature. Of the 16 zirconia specimens prepared, glazing was randomly applied to 8 specimens and mechanical polish was applied to the other 8.

Table 1. Ceramic used in the study

Ceramics	Manufacturer	Lot No	Surface Application	Code
Super porcelain EX-3 (felsdpathic porcelain)	Kuraray noritake dental Inc. Japan	DUYLM	Overglazing Mechanic Polishing	SPG SPP
Katana zirconia UTML	Kuraray noritake dental Inc. Japan	DQUGJ	Overglazing Mechanic Polishing	ZG ZP
IPS e.max CAD (lithium disilicate reinforced porcelain)	Ivoclar Vivadent, Liechtenstein	X50772	Overglazing Mechanic Polishing	MXG MXP
IPS empress CAD (leucite reinforced porcelain)	Ivoclar Vivadent, Liechtenstein	U22412	Overglazing Mechanic Polishing	PRG PRP

Table 2. The glazed procedure of porcelain samples according to the manufacturer's instructions

	CT (min)	HR (˚C)	V_1 (˚C)	V_2 (˚C)
Low Fusing Porcelain	5	50 ˚	650 ˚	910 ˚
Monolithic Zirconia	5	65	600 ˚	
Lithium Disilicate Ceramic	6	60˚	450 ˚	724˚
Leucite Reinforced Ceramic	6	100 ˚	450 ˚	789 ˚

CT: Closing time HR:Heating Fire V: Vacuum

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Preparing Lithium Disilicate Glass-Ceramics

In the system of CAD/CAM, prepared lithium disilicate glass porcelain discs were fired according to the instructions of the manufacturer. The first firing operation was held increasing the heat by 90˚Cper minute up to 820˚C after a process of drying at 403˚C for six minutes. During the first firing process, the first vacuuming operation was held between 550˚C and 820˚C. After waiting for 10 seconds at 820˚C, the second firing operation got started. During the operation, the heat got increased by 30˚C per minute up to 840˚C. During the operation the vacuuming operation kept continued. After the specimens were kept stable at 840˚C for 7 minutes, to cool down for a long time. Of the 16 specimens prepared, 8 of them were separated for glazing and 8 for mechanical polishing.

Preparing Leucit Glass-Ceramics

Leucit glass-ceramic was prepared by CAD/CAM system. Of the 16 specimens prepared, glazing was applied to the 8 of them and mechanic polishing was applied to the other 8 ones.

Glazing Procedure of The Samples

Firing and glazing operations were performed in Ivoclar Vivadent Programat EP 3000 (IvoclarVivadent, Schaan, Liechtenstein) for all porcelain samples (Table 2).

Extraoral Mechanical Polishing of The Samples

The same polishing process was applied extra orally to the porcelain samples reserved for mechanical polish. First of all the samples were cleaned ultrasonically. All the surfaces were prepared by using first abrasive paper and then polished with using white then blue disc (Reddish Stone, Italia) a diamond paste with 40 µm particles (Zirkopol; Feguramed, Germany) for 60 seconds each surface.

Porcelain specimens used in this study were examined before and after the experiment and their volume values were recorded. Pre and post-treatment weight values of dental specimens used as antagonists of porcelain specimens were recorded.

In order to evaluate the wear of the porcelain specimens before and after the test, specimens were scanned by 3D scanner, Dental Wings 7 Series (Dental Wings, Montreal, Canada) and in order to examine they were transformed into the digital platform Geomagic Control X (3D Systems, Rock Hill, USA). Their volume data were obtained through this program. The weights of dental antagonists were measured at the assay balance, A&D Weighing GR-300 lab balance (A&D Instruments Limited, United Kingdom).

Chewing Simulation Test

Occlusal simulation operation for porcelain specimens which were used in the study was implemented by SD Mechatronik Chewing Simulator CS-4.8 biaxial fatigue testing (SD Mechatronik GMBH, MiesbacherStraße 34 D-83620 Feldkirchen-Westerham, Germany).

For simulation, porcelains were placed into the clips by burying them in (9mm x 3mm) acrylic resin, the dental antagonists were also placed into the clips by burying them in (9mm x 7mm) acryl. The specimens and teeth were put in the simulation tool kit and it was calibrated (Fig. 1).

Surface Roughness Test

In order to examine the pre- and post-trial 3D values of surface roughness of porcelain specimens, an Optical Profilometer (Phaze View/Zee Scope, France) was used. For the analysis, GetPhase software was used. The analysis of the surface roughness for each specimen was performed at an area of 1 mm2 and for 1 analysis by shifting 25 µm, 40 images were taken and overlapped. Surfaces of each glazed and mechanically polished random samples of porcelain groups were analyzed via scanning electron microscope (FEG-SEM, Mira 3 XMU, Brno, CZ).

As the data obtained in this study by loading into SPSS (Ver.22.0) parametrical test hypothesis were applied for the evaluation, in (Kolmogorof-Simirnov) independent groups, the Probability Test between two means, Variance Analysis, Tukey Test, and the Test of Significance for the difference of means were used and the deviation was taken as 0,05.

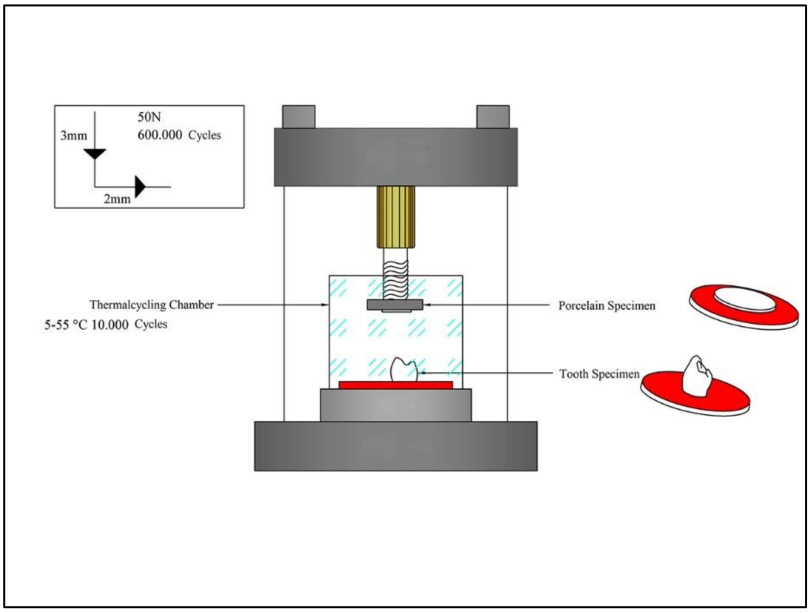

Figure 1. Schematic view of the chewing simulation device

Results

In the study, the baseline values obtained from porcelain and the volume values obtained after wear have been presented in Table 3 and the weight values of antagonist's teeth are presented in Table 4.

Of porcelain specimens exposed to wear on their surfaces by chewing simulation, the groups applied overglazing are found to have the highest volumetric change results in PRG group, and the least volumetric change results in ZG group. When the groups which were applied mechanical polishing compared to each other, it is determined that we have results that are similar to the groups applied glazing.

Within the binary comparison of the same porcelain groups which were applied glazing and the groups which were applied mechanical surface polishing, it is observed that there are statistically differences except for the zirconia porcelain group ($p \leqslant 0.05$). Within all porcelain systems which were applied mechanical polishing and glazing, it is determined that the groups which applied glazing have higher ceramic volume change than mechanical polished groups have (Table 3, Figs. 2,3). As a result of the examination of data concerning wear on all samples, it is observed that while the most worn sample group is PRG, the least worn ones are within the ZP samples (Figs. 2,3).

Table 3. Volume (mm3) values obtained after chewing simulation and baseline of porcelain samples used in the study (Mean ± SD)

	Baseline Mean±SD	After Process Mean±SD	p
SPG	190.3788±0.14990	187.0975±0.14762	0.001*
SPP	190.5875±0.24933	189.0250±0.24871	0.001*
ZG	190.6400±0.29052	190.2950±0.29617	0.001*
ZP	190.4838±0.32772	190.3738±0.32601	0.001*
PRG	190.5863±0.23360	180.7663±0.25304	0.001*
PRP	190.4025±0.18227	183.5787±0.26199	0.001*
MXG	190.6325±0.17310	183.5550±0.20466	0.001*
MXP	190.7613±0.10077	188.4563±0.07110	0.001*

*p<0,05

Table 4. The average weight of antagonist teeth against ceramics specimens (Mean ± SD) (g)

	Baseline Mean±SD	After Process Mean±SD	p
SPG	1.0725±0.01035	0.9850±0.01604	0,001*
SPP	1.0663±0.01061	0.9963±0.01685	0,001*
ZG	1.0763±0.01061	1.0175±0.01282	0,001*
ZP	1.0675±0.01832	1.0313±0.01727	0,001*
PRG	1.0588±0.01458	0.8925±0.01581	0,001*
PRP	1.0663±0.01685	0.9612±0.01458	0,001*
MXG	1.0638±0.01061	0.9500±0.01604	0,001*
MXP	1.0612±0.01553	0.9813±0.01642	0,001*

*p<0,05

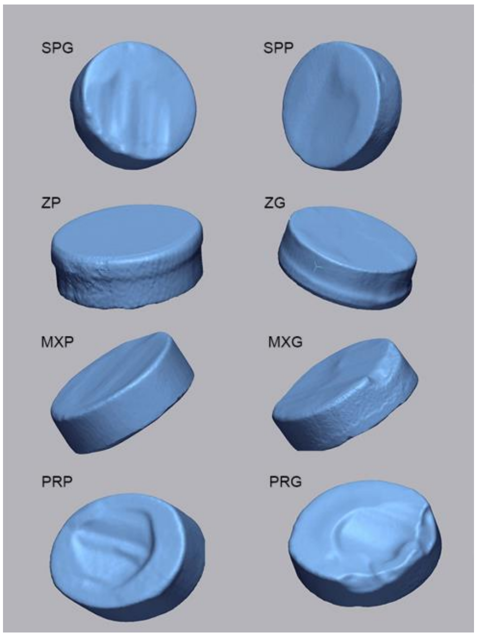

Figure 2. Post-wear 3D images of ceramic sample groups

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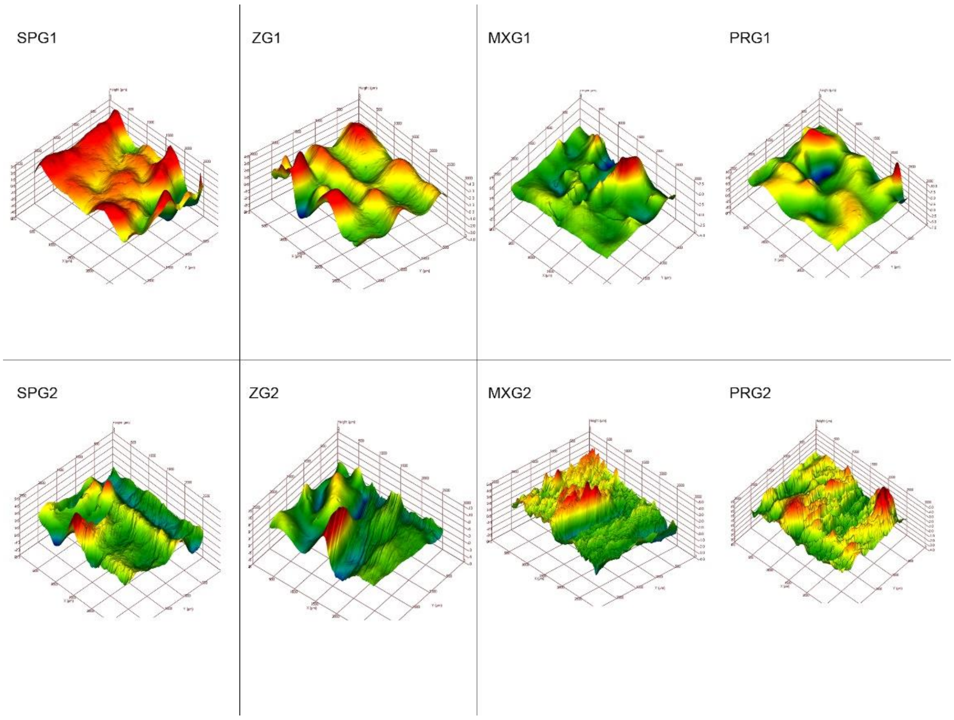

Figure 3. Optical profilometer images of glaze applied ceramic sample groups (1) baseline, (2) after abrasion in the chewing simulation device

Table 5. Ra (nm) (Mean ± SD) values of ceramic samples used in the study.

	Baseline Mean±SD	After Process Mean±SD	p
SPG	95.275±0.5092	131.750±0.5043	0,001*
SPP	99.513±0.1727	104.113±0.1642	0,001*
ZG	97.713±0.7298	202.388±0.7772	0,001*
ZP	99.288±0.3682	104.025±0.3454	0,001*
PRG	91.525±0.4833	304.888±4.0551	0,001*
PRP	96.088±0.8610	221.863±0.4173	0,001*
MXG	96.400±0.1309	308.338±1.3244	0,001*
MXP	90.613±0.0835	150.938±0.4689	0,001*

*p<0,05

The statistical results of the weight changes of the dental specimens which we used as antagonists of porcelain samples in the study are given in Table 4. When the weight measurements have been compared to each other after the operation, both the groups which were applied glazing and the groups which were applied mechanical polishing within their own subgroups, the difference is found statistically significant (p<0,05).

Among the groups which were applied glazing, it is observed that while the loss of dental weight is the least in ZG group, it is the highest in PRG. Among the groups which were applied mechanical polishing, while it is observed that the loss of dental weight for antagonist teeth is the least in ZP group, it is the highest in PRP. When the dental weights belonging to the same porcelain groups are binary compared, whereas the difference in the samples including leucite is statistically significant (p<0,05), the difference is observed not to be significant in other groups (p>0.05).

In this study, the baseline obtained from pre-wear process of the porcelain systems, the surface roughness (Ra) values obtained from the samples of porcelain systems in the post-wear process and their standard deviation values have been given in Table 5. When this table is analyzed, it is observed that the difference between the surface roughness (Ra) values obtained after the baseline and abrasion processes is the highest in PRG group and it is the least in ZP group. When the (Ra) values were analyzed belonging to data, after glazing and mechanical polishing applications, it is remarkable that the (Ra) values of baseline are below 100 nm in all specimen groups. Besides it is observed that the (Ra) values obtained after the wear process by chewing simulator had relatively increased more in the groups applied glazing than in the groups which applied mechanical polishing (Table 5, Fig. 4).

SEM Results

Figure 5 represents the SEM topographical electron images of all samples. As seen from SEM images, abrasion was observed in all sample groups.

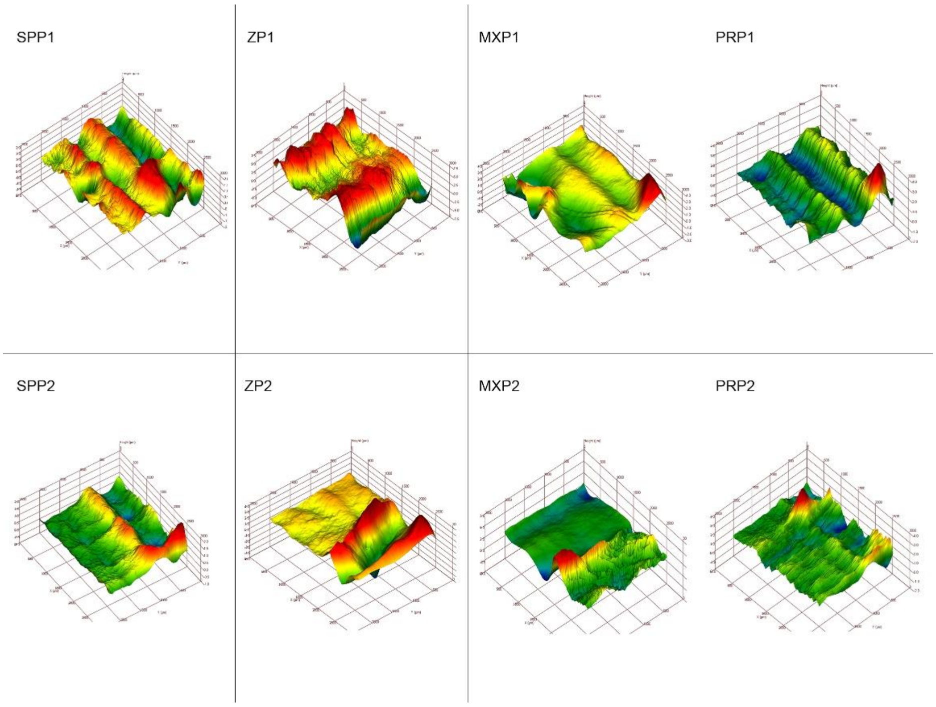

Figure 4. Optical profilometer images of porcelain specimens with mechanical polishing (1) baseline, (2) after wear in the chewing simulator

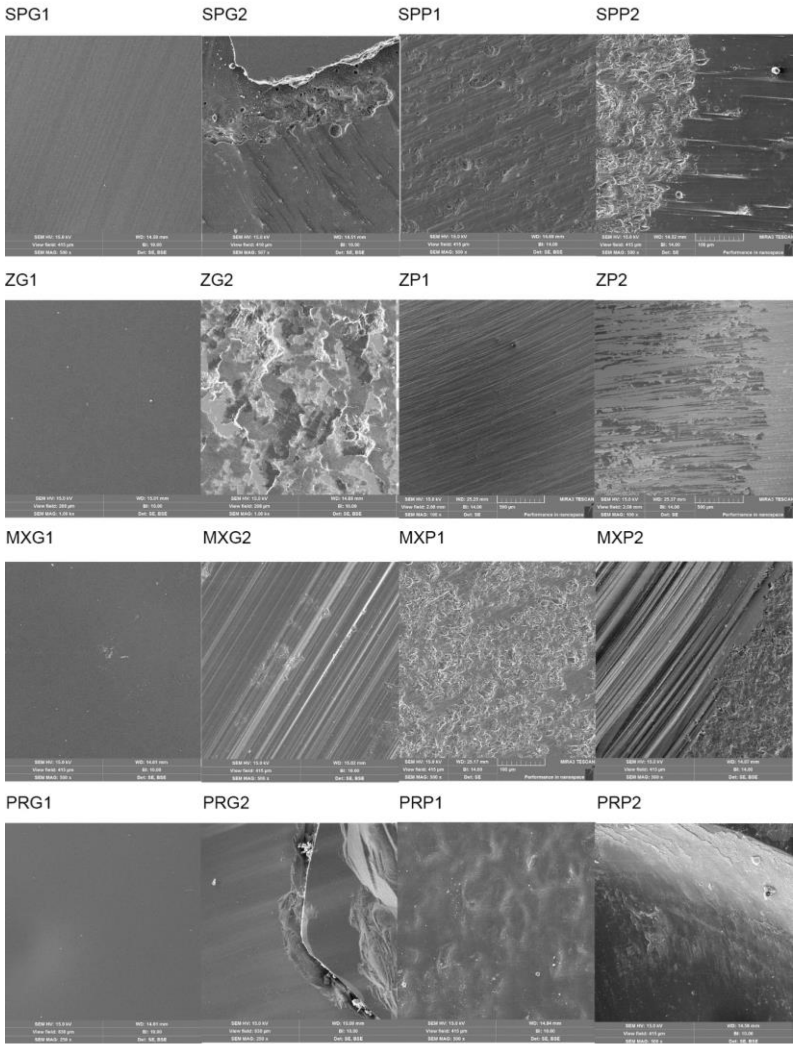

Figure 5. SEM images of glaze and mechanical polishing applied porcelain sample groups (1) baseline, (2) after wear in the chewing simulator

For SEM pictures of SPG1 and SPG2, the initial surface seems to be smooth but after the operation, the wear track is seen in the form of delamination and compression and scratches from the upper left to lower right region. The grooves are visible and the inner porosity is seen due to delamination after compression whose compression strength is low and fracture toughness is among the lowest as around 1 MPa. √ m. The scratches are seen parallel to the fractured area and left the surface from edges.

For SPP1 and SPP2, the surface is polymerized accordingly and has surface pores due to the high amount of polymer composite. Polymer surface was adhesively deformed and worn by the contact of antagonist tooth. The easier wear loss was seen due to damage of the polymer interface, on the polymer loss, there can be seen some scratches which continues to deform the polymer to increase the wear loss.

In SEM pictures of ZG1 and ZG2, prior to test, the surface is seen very smooth and low Ra is observed. During the test time, the brittle ceramic-like fracture morphology is seen on the polymer adhesive wear surface. The lost regions are of ceramics with brittle structure as well as cross-linked polymers. The whiter the fractured regions, the higher the ceramic content is observable and blackish regions are binding polymers, cross-linked.

In ZP1 and ZP2, the surface is parallel smooth by mechanical polishing, but the worn surface is seen in grooves. The compression and adhesive structure is seen. The lowest Ra change and wear loss may indicate the low amount of material removal. The whiter regions are still the ceramic phase and black and grey ones are of polymer or filler type.

MXG1 and MXG2 are seen smooth prior to tests. But after tests, a total areal removal is seen by produced grooves with deep valleys. The deformed areas are also under compression and regional material loss is seen. MXP1 and MXP2 are looked like as SPP1 and SPP2, respectively. The polymerized surface is seen and the polymer removal after test is observable. The parallel grooves are very deep and high material is therefore seen.

PRG1 is also very smooth before test and the brittle and sudden fracture is seen after the test. Within the fracture, a high wear loss can be seen and on the worn surface, there are some more scratches that indicate that during the test, the material resisted fracturing but the fracture strength was exceeded by the load of antagonist tooth.

PRP1 and PRP2 have pore free surface with an average roughness value and the surface is only compressed without any significant groove but high deformation. This deformation may lead to wear loss in a certain amount. Some surficial pores are seen due to contact of antagonist and deformation regions.

Discussion

The physical factors that are exposed to teeth and dental restorations are often seen as mechanical wear. What is expected from dental restorations is that they resist to mechanical and physical wear in the oral cavity and have fewer wear characteristics against the counter tissues. In terms of classification, mechanical wear is named as the atrium formed by two-body interaction (2-body) and wear as a result of three-body interaction (3-body). These two types of mechanical wear continuously occur in the mouth (14).

Chewing simulators are used to reflect the oral environment to the laboratory environment (14, 15). In the study, in order to optimally simulate the in vivo environment, we have implemented 600.000 chewing simulations in 1 Hz frequency by applying 50N force, with a 2 mm horizontal and 3 mm vertical move. In parallel with this process, 10.000 thermal cycles have been applied to the materials at 5-55 ° C in order to expose the materials to wear which is similar to the environment in the mouth. This simulation thus simulates an oral environment of approximately 2.5 years (15, 16).

In this study, in order to obtain a real-like simulation, natural teeth that were not lost due to chemical and physical factors, the teeth without caries and fillings, and the teeth which were not newly extracted for orthodontic and periodontal reasons, were used. In the light of previous studies, the extracted teeth were waited in % 0.1 thymol solution after cleaning plaques on them (17, 18).

During the chewing simulation process of this study, for the contact standardization, among the teeth showing cusp-like morphological structures, only buccal cusps are provided to contact with the teeth (14). Although there are many literature studies on wear and material losses, measurements of wear value have been performed differently (19, 12, 14, 20, 13, 17, 18). Some researchers measure the wear values according to changes in height of materials and the depth of lost area (21, 22). However, such measurements assume that the wear area is a homogeneous structure and does not care much about the morphological structure. In the literature, it is stated that the wear and material loss are also calculated according to the mass change in the materials (19, 23). However, the disadvantages of weight measurements are that the moisture content in the tooth tissue is not under definite control and this may adversely affect the measurements (18). In the study, the wear values of porcelain samples have been determined according to the volumetric changes and the calculations of the weight measurements of the wear belonging to the teeth used as the antagonist.

In a study, it is reported that the lithium disilicate-containing ceramics are the most abrasive than the leucite-containing porcelains, and there is no significant difference between zirconia and stainless steel crowns in terms of wear of their antagonists (18). In addition that in the same study, it is stated that among the restorative materials, in terms of their own wear, the lithium disilicate-containing porcelains are the groups with the highest material loss and zirconia and stainless steel crowns are the groups with the least material loss(18).

In another study, zirconia specimens are reported to signify less wear than feldsphatic and lithium disilicate specimens (24). In the study examining the wear on enamel tissues of feldsphatic and leucite-containing ceramics which have various pH values, it is reported that the porcelain specimens which have high pungency levels cause less wear on the antagonist teeth than the porcelain specimens which have low pungency levels do (25). In parallel with the findings of the studies above, we have observed that zirconia porcelains with almost twice pungency value cause less wear on their antagonists than the groups with feldsphatic, leucite, and disilicate-containing.

In a study in which the effects of glazing and mechanical polishing operations applied to the zirconia porcelains on antagonist teeth have been examined, glazed porcelains are reported to specify high wear and erosion characteristics (17). The results of this study indicate that the groups which were applied glazing and mechanical polishing of zirconia porcelains do not have significant differences in terms of wear and erosion. Except for the zirconia porcelain groups used in the study, all glazed groups are observed to lose more material and to abrade their antagonist teeth more. On the other hand, a study that is similar to ours, it is reported that feldsphatic porcelains with mechanical polishing abrade less teeth tissue than glazed specimens do (26).

There is enough energy to provide continuous t-m phase transitions in the zirconia structure. This conversion, manifested by volume increase, creates compressive stresses around cracks in the structure and prevents crack propagation, and increases the mechanical strength of the material. This mechanism, in the literature, is called 'Transformation Toughening'. The transformation mechanism of zirconia which is not present in other dental ceramics increases the mechanical properties of zirconia to a high degree (27, 28). We could identify that as zirconia has the conversion toughness characteristic, there are fewer differences on the surfaces of zirconia specimens and they cause the least wear on antagonist teeth.

It is stated that materials with low fracture toughness are more easily broken and rough surfaces are formed, and broken glass particles enter the environment as a third abrasive body, and as a result all these increase the wear effect (29, 30). In this study, within various porcelain systems, among the porcelain specimens applied glazing and mechanic polishing, the highest wear loss was seen in leucite containing porcelain systems (Table 2). We can relate this to the fracture toughness of materials. Because the bending strength of leucite-including porcelains is low as 120-160 MPa, and their fracture toughness is about 1.3 MPa.m1/2, which are lower than both zirconia and lithium-disicilate porcelain systems. However, in the current study, although the bending strength of feldsphatic porcelains both in the groups applied glazing and the groups applied mechanical polishing is (60-70MPa) and their fracture strength is (0,92-1,26 MPa.m½), it was seen that they caused less wear and less erosion on the antagonist teeth than leucite and lithium-disilicate porcelain specimens did due to the lowest surface roughness and smoothness. This is also incompatible with other studies in the literature (24, 31). It can be said that this discrepancy may be related to the structural and morphological variations of the teeth used as antagonists during the operation and it also occurs due to the differences in our experimental conditions.

In the analysis of wear and erosion characteristics of dental porcelains, it will be wrong to solely analyze the toughness of the materials and their fracture toughness, besides that it shouldn't be forgotten that the surface roughness is also a major factor. It is explained that as long as the surface roughness of restorations increases, they become more abrasive (13). In addition that, it is reported that the increase of surface roughness causes an increase in the area of the materials and a decrease in surface energy, therefore it can cause an increase in bacteria and plaque retention (11, 32, 33, 34).

Kohles et. al. (2004)(39) reports that the measurement method of the devices used for the surface operations significantly affects the data of roughness. On the measurements of the surface topography, there are mechanic profilometer devices and optical profilometer devices which provide qualitative data as electron microscopes do and there are devices which provide quantitative data as atomic force microscopes (35).

It was reported that during the operations the metal ends and the contact surface mechanical profilometer may be damaged and thus this affects the accuracy of the measurement (36). Accordingly, we have performed measurements using an optical profilometer (Phase View ZeeScope France) tester for surface roughness tests.

In a study, the wear characteristics of various composite materials (zirconia, lithium-disilicate ceramic, composite resin) were examined in comparison to the antagonist of natural teeth after a simulation of 4800 cycles. After the operation, it was found that the increase of surface roughness (Ra) of all materials was statistically different (37). In another study in which various porcelains exposed to 240.000 chewing cycles under 50N force, it has been reported that in comparison with the antagonist teeth, there are significant differences between feldsphatic porcelains which were applied mechanical polishing and zirconia specimens, and that more surface roughness in feldspathic specimens occur and this causes more abrasion on teeth (38). In another study, after dividing zirconia, feldsphatic and lithium-disilicate porcelains into groups as rough, glazed, and polished, their abrasions are examined in comparison to the tooth and it is reported that the groups with glazing perform more wear than the other groups (31).

The findings of the study show that the composites of the materials may affect the degree of wear of the material and the level of erosion of the opposing tissues. It is seen that leucite-containing porcelains have the highest wear on themselves and on their antagonist tooth tissue among the groups applied glazing and mechanical polishing (Figs.3, 4). The leucite group is followed by porcelain systems containing lithium-disilicate. As formerly mentioned, we can relate this condition to fracture strength and hardness rather than the toughness of the materials.

Conclusion

It is not forgotten that the glaze layer of the dental porcelains is removed both in the natural oral environment, by occlusal non-compliance, and by the duration of their use, and that the removed layers become rough and they will cause more abrasion and erosion. In this case, the dentist, in the control sessions, by performing mechanical polishing within the mouth, could increase both mechanical and aesthetic properties.

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