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Surface roughness evaluation of in vitro refinished dental ceramics followed by bleaching treatment

Avaliação in vitro da rugosidade superficial de ceramicas após repolimento e tratamento clareador

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ABSTRACT

Objective: The objective of this study was to evaluate the effect of refinishing process on dental ceramics roughness and the effect of bleaching treatment with 16% carbamide peroxide. **Material and methods:** Specimens of 5 x 3 x 1 mm were produced in two groups (n = 14 per group) of dental ceramics following manufacturers' instructions: IPS d.Sign (Ivoclar-Vivadent); and VMK-95 (Vita). A profilometer was used to evaluate the surface roughness (Ra values) of all ceramics acquiring 3 profiles with five 0.25 mm cut-off (λc) at 0.1 mm/s, in four times. The first time was baseline as a negative control, followed by bur roughening (91-126 μm-grit) to simulate an oclusal adjustment in the second time (positive control). After that, the specimens were submitted to refinishing treatments with diamond burs with fine (2135F – 37-44 μm-grit) and extra fine (2135FF – 20-40 μm-grit) diamond burs (third time); and polishing with abrasive cups and paste (fourth time). After refinishing, the two ceramics were divided into a bleached (BL) and non-bleached (NB), with 4 subgroups (n = 7 per group). Bleaching was performed daily for 6-h with 16% carbamide peroxide for 21 days, while NB groups were stored in artificial saliva. The effect of refinishing treatment on ceramics were evaluated by to 2-way ANOVA and Tukey's test; bleaching effect on refinished ceramics were evaluated by T test. **Results:** There were no statistical significant differences on surface roughness between ceramics on each refinishing treatments times. The adjustment of dental ceramics with diamond burs drastically increases the surface roughness. The solely treatment with fine and extra fine diamond bur reduced but did not reverse the ceramic surface roughness. The sequential refinishing with abrasive cups and paste reverted the surface roughness to values similar to baseline. Bleaching treatment did not affect the surface roughness of refinished ceramics. **Conclusion:** Acceptable surface roughness was obtained after refinishing with polishing abrasive cups and paste. The 16% carbamide peroxide treatment was not able to alter the refinished ceramic surface roughness.

KEYWORDS

Tooth bleaching; Ceramic; Carbamide peroxide; Dental Polishing.

RESUMO

Objetivo: O objetivo deste estudo foi avaliar o efeito do processo de repolimento na rugosidade de cerâmicas dentais e o efeito do tratamento clareador com peróxido de carbamida 16%. **Material e métodos:** espécimes de 5 x 3 x 1 mm foram produzidos em dois grupos (n = 14 por grupo) de cerâmicas odontológicas seguindo as instruções dos fabricantes: IPS D.Sign (Ivoclar-Vivadent) e VMK-95 (Vita). Um rugosímetro foi usado para avaliar a rugosidade superficial (Ra) de todas as cerâmicas adquirindo 3 perfis com cinco cortes de 0,25 mm (λc) a 0,1 mm/s, em 4 tempos. O primeiro tempo foi o valor inicial (controle negativo), seguido pelo segundo tempo no qual foi realizada a asperização por broca (granulação 91-126 μm) para simular um ajuste oclusal no segundo tempo (controlo positivo). Depois disso, as amostras foram submetidas a tratamentos sequenciais de repolimento com pontas diamantadas finas (2135F - granulação 37-44 μm) e extra finas (2135FF - granulação 20-40 μm), terceiro tempo; e polimento com taças abrasivas e pasta (quarto tempo). Após o repolimento, as cerâmicas foram divididas em 2 subgrupos: clareadas (BL) e não clareadas (NB), totalizando 4 sub-grupos (n = 7 por grupo). O clareamento foi realizado diariamente por 6 h, com peróxido de carbamida 16%, durante 21 dias, enquanto os grupos NB foram armazenados em saliva artificial. O efeito dos procedimentos de repolimento foram avaliados por 2-way ANOVA e teste de Tukey; o efeito do clareamento nas cerâmicas repolidas foi avaliado pelo teste T. **Resultados:** Não houve diferenças estatisticamente significativas na rugosidade superficial entre as cerâmicas entre os tempos em que foi avaliado o repolimento. O ajuste de cerâmicas odontológicas com pontas diamantadas aumenta drasticamente a rugosidade superficial. O tratamento apenas com a ponta diamantada fina e extra fina reduziu, mas não reverteu a rugosidade superficial das cerâmicas. O repolimento sequencial com taças e pasta abrasiva reverteu a rugosidade da superfície para valores semelhantes aos do controle. O tratamento clareador não afetou a rugosidade superficial das cerâmicas repolidas. **Conclusão:** Uma rugosidade superficial aceitável foi obtida após o repolimento sequencial levado até o uso de taças e pasta abrasiva. O tratamento com peróxido de carbamida 16% não alterou a rugosidade superficial das cerâmicas repolidas.

PALAVRAS-CHAVE

Clareamento dental; Cerâmica; Polimento dentário; Peróxido de carbamida.

INTRODUCTION

Ceramic systems have become increasingly popular due to their esthetic properties including conventional metal-ceramic, reinforced ceramics and metal free alumina and zirconia-based materials.

Dental ceramics are considered the most inert of all dental restorative materials, and the main property expected from ceramics is the chemical durability in the mouth, since dental prostheses must stand to degradation in the presence of saliva and a wide range of transitory solutions with variable pH [1].

As an indirect restorative material, the ceramic prostheses are manufactured out of buccal cavity and cemented in the prepared tooth after subjected to a superficial glaze treatment. However, occlusal adjustment of ceramic restorations with high granulation diamond burs may be necessary to correct interferences after cementation. These final adjustments may result in loss of ceramic glaze, [2,3] which raises some concerns because these materials requires to be refinished.

Ceramic prostheses must be adequately polished to be less susceptible to biofilm and bacterial accumulation, and reduce the potential of wearing opposing occlusal surfaces [3-8]. Also, the mechanical and physical strength of a ceramic restoration can be impaired by refinishing process due microcracks formation and can be more susceptible to later catastrophic fractures [9-11].

Thus, the superficial roughness of adjusted ceramic must be reduced with intraoral polishing techniques to achieve an acceptable smoothness and preserve the material as inert as possible [3]. Special attention for selection of adequate materials and instruments must be taken because polishing is usually a multistage process. The first stage starts with a rough abrasive and each subsequent stage uses a finer abrasive until the desired finish is achieved. There are a lot of polishing kits, rubber cups and discs in the market but the correct decreasing sequence of abrasive size must be respected.

If occlusal adjustment of a ceramic restoration has to be made after cementation there is always need for a careful intraoral polishing with polishing kits and discs [8]. Researches done on polishing techniques showed that the use of a refinishing kit followed by polishing paste or polishing stick application may create surfaces as smooth as glazed specimens. Polishing kits and discs were found more effective than the polishing pastes were used alone or combined with Sof-lex discs, resulting in improved surface smoothness[12].

To describe the overall texture of a surface it is common to use a profilometer and the results were stated by the parameter “roughness average” (Ra) that refers to the arithmetical average value of all absolute distances of the roughness profile from the center line within the measuring length [8]. Then, an adequate polishing technique is able to progressively reduce the length of fissures, cracks and flaws caused by diamond burs and also reduce the Ra value.

In addition, the prolonged exposure of fissures and cracks on ceramic surface to saliva and other substances as fluorides and bleaching agents may induce progressive flaws [13-19]. Bleaching agents are composed by high oxidant molecules which release H+ free radicals that are extremely unstable and reactive, and their acidic pH are described as the main cause of the detrimental dental side-effects [20-16]. Although, the effects on dental ceramics are still controversial, studies showed that bleaching agents may cause structural alterations on dental enamel and restorative materials that impair their physical properties and may lead to premature failure [14-19,27].

Therefore, refinishing procedures may induce fractures on ceramic surfaces that could be more severe if treated with bleaching agents impairing mechanically the durability and esthetics results.

This study tested two null hypotheses. The first null hypothesis was that sequential refinishing procedure with fine and extra fine diamond burs followed by abrasive cups and diamond pastes are not able to reduce surface roughness. The second null hypothesis is that treatment with 16% carbamide peroxide bleaching agents used to at-home treatment do not affect the roughness surface of refinished ceramic.

Then, the aim of this study was to evaluate the effect or refinishing process on dental ceramics roughness, and evaluate the effect of bleaching treatment with 16% carbamide peroxide on refinished ceramics.

MATERIAL & METHODS

Tooth Preparation:

The factors under study in the first hypothesis were "Dental Ceramic" in two levels: Fluorapatite-leucite glass-ceramic (IPS d.Sign) and Feldspathic ceramic (VMK 95), considering n = 14 per group; Table 1; and "Refinishing treatment" in four levels/times: Baseline; Adjustment procedure; Refinishing with fine and extra fine diamond burs; Refinishing with abrasive cup/paste; evaluated by surface roughness repeated measurements. The factors under examination in the second hypothesis were "Refinished dental ceramic" in two levels: Fluorapatite-leucite glass-ceramic (IPS d.Sign) and Feldspathic ceramic (VMK 95) and "Bleaching treatment" in two levels: submitted or not to the bleaching treatment (n = 7 per group). The response variable was surface roughness (Ra) in μm.

Specimens' preparation

Fourteen specimens with 5 x 3 x 1 mm of each ceramic, IPS d.Sign (Ivoclar Vivadent AG - Schaan, Principality of Liechtenstein) and VMK 95 (Vita Zahnfabrik - Bad Säckingen, Germany) were prepared according to manufacturers' instructions and had their surfaces sequentially polished by metallographic technique with diamond polishing pastes of 6, 3, 1, and 0.5 μm and polishing cloths with mineral oil lubricant (Top, Gold and Ram, Arotec Ind Com Ltda, Cotia - Brazil). The baseline surface roughness measurement was performed.

Surface roughness test

The profilometer used a microneedle to scan (TR200, Time Group Inc, Beijing, China) the surface roughness employing the parameter surface roughness average (Ra) in μm. Surface roughness was evaluated by a single blinded evaluator prior to and after each surface treatment. Three points were initially marked in order to ensure repeatable measurements of the profiles. From these points, two perpendicular and one transversal profile were obtained on the surface of each specimen, with a cut off of 0.25 mm (λc), and a speed of 0.1 mm/s. The surface roughness was recorded and the mean roughness value (Ra expressed in μm) was determined for each specimen before and after treatment.

Table 1 – Ceramic materials used in this study: commercial brand, lot, type, and chemical characterization*

Ceramic	Lot number	n	Type	Chemical characterization*
IPS d.Sign	K33292	7	Fluorapatite-leucite glass-ceramic	SiO_2; BaO; Al_2O_3; CaO; CeO_2; Na_2O; K_2O; B_2O_3;
		7		MgO; ZrO_2; P_2O_5; F; Li_2O; TiO_2; SrO; ZnO; and pigments
VMK 95	26590	7	Feldspathic ceramic	Al_2O_3; BaO; B_2O_3; CaO; Fe_2O_3; MgO; SiO_2; TiO_2; ZrO_2;
		7		CeO_2; Li_2O; K_2O; Na O; Glycerine; Butylene Glycol; Tin Oxide.

* Material Safety Data Sheet; Abbreviations: SiO_2: Silicon Oxide; BaO: Barium Oxide; Al_2O_3: Aluminum oxide; CaO: Calcium Oxide; CeO_2: cerium dioxide; Na_2O: Sodium Oxide; K_2O: Potassium Oxide, B_2O_3; Boron Oxide; MgO: Magnesium Oxide; ZrO : Zirconium Oxide; P_2O_5: Phosphorus pentoxide; F: Fluor; Li_2O: Lithium Oxide; TiO_2: Titanium Dioxide; SrO: Strontium oxide; ZnO: Zinc oxide; Fe_2O_3: Iron Oxide.

Surface refinishing treatment

The same single blinded operator performed the surface treatments with the specimens fixed in wax in the same position. The treatments with rotatory instruments were performed with manual pressure with horizontal movements from left to right side of the specimen for 20 s, after previous calibration performed in five specimens.

The surface treatments were evaluated four times. The baseline evaluation after initial polishment was considered the negative control. The second time was aimed at simulating the clinical adjustments of an occlusal surface with a diamond bur (positive control). This treatment was performed with a 2136 diamond bur (KG Sorensen, Barueri, SP, Brazil/ 91-126 μm-grit) at high speed under a constant water spray coolant, prior to surface roughness measurement.

The third time was aimed at verifying the refinishing procedure with fine (F) and extra fine (FF) diamond burs, the ceramic specimens were refinished with a fine 2135F diamond bur (Vortex, Sao Paulo, SP, Brazil) with a granulation of 37 - 44 μm-grit followed by an extra fine 2135FF diamond bur (Vortex, Sao Paulo, SP, Brazil) with a granulation of 20-40 μm-grit.

After that, the fourth time evaluated the surface roughness after polishing with abrasive cups and paste (OptraFine, Ivoclar Vivadent AG - Schaan, Principality of Liechtenstein). The ceramic specimens were treated with the diamond finisher F cup followed by the diamond polisher P cup, and the diamonds polishing paste HP (granulation of 2-4 μm) with nylon brushes, followed by the surface roughness evaluation.

One representative specimen with surface refinishing treatment of each ceramic was observed by scanning electron microscopy with 70x of magnification (SEM - FEI; Quanta 600F, Nederland, NE).

Bleaching treatment

After all refinishing procedures and roughness evaluation, ceramic specimens were used in an independent second evaluation. They were divided into two subgroups, with or without bleaching treatment (VMK 95 NB, VMK 95 BL, IPS d.Sign NB, and IPS d.Sign BL. IPS d.Sign BL and VMK 95 BL). The four experimental groups were challenged by 16% carbamide Peroxide- (Whiteness FGM, Joinville, SC-Brazil; pH≅6.0) to simulate an in vitro bleaching treatment, and the specimens of groups VMK 95 NB and IPS d.Sign NB were kept in artificial saliva for 21 days containing calcium and phosphate at a known degree of saturation (1.5 mmol/L Ca, 0.9 mmol/L PO_4), to mimic the remineralizing properties of saliva, and 50 mmol/L KCl, 20 mmol/L tri-hydroxymethylaminomathan buffer at pH 7.0, as described in previous studies [21,23-27].

The bleaching agent was applied for 6 h a day during 21 days, corresponding to 126 - h treatment [27]. Specimens were covered with 0.03 ml of the bleaching agent, placed in vacuum-formed custom trays, with a drop of artificial saliva and were stored in a plastic container at 37 ºC [27]. After each 6 - h periods of bleaching exposure, the specimens were washed with distilled water to remove the residual carbamide peroxide gel, and stored in a plastic container for the remaining day period with artificial saliva at 37 ºC. After the 21 days of treatment the surface roughness was evaluated.

Statistical analysis

To analyze the surface refinishing treatment the factors “Dental Ceramic”, “Refinishing” and the interaction between then were analyzed by split plot 2-way ANOVA and Tukey’s test. The effect of bleaching treatment was independently evaluated for each ceramic by T test.

RESULTS

No statistical significant interaction between “Dental Ceramic” and “Refinishing treatment” factors was observed ($p > 0.05$). No statistical significant differences on surface roughness were observed between the dental ceramics on each Refinishing treatment times ($p > 0.05$). Statistical significant differences were observed in the factor “Refinishing treatment”, then the first null hypothesis was rejected. Also, the two ceramics roughened with diamond burs showed similar surface morphology (Figure 1B and 2B). There was a statistical significant increase in the surface roughness of ceramics after adjustment procedure (Table 2), with the highest numbers of pits and more altered surface (Figure 1B and 2B) when compared to baseline (Figure 1A and 2A).

The refinishing with fine and extra fine diamond burs statically reduced the surface roughness after adjust procedure (Table 2), but the surface roughness was still higher than baseline value with less shallow pits than adjusted one (Figure 1C and 2C).

The refinished procedure with abrasive cups and paste statistically reduced the surface roughness obtained with refinished with fine and extra fine diamond burs at a level statistically similar to baseline values (Table 2). Pits and fissures were removed. The means and standard deviations are described in Table 2 and are graphically represented in Figure 3.

Table 2 – Surface roughness (Ra) of each ceramic and standard deviations (in brackets) at each evaluation period after surface treatment, and the results of Tukey’s test for ceramics

Surface Treatment	IPS d.Sign NB	IPS d.Sign BL	VMK 95 NB	VMK 95 BL	Ceramics
Baseline	0.142 (0.018)	0.164 (0.037)	0.237 (0.049)	0.280 (0.093)	0.206 (0.077) A
Adjustment procedure	2.339 (0.391)	2.751 (0.610)	2.134 (0.635)	2.503 (0.760)	2.432 (0.622) C
F/FF diamond burs	0.919 (0.098)	1.059 (0.163)	0.876 (0.141)	0.911 (0.152)	0.940 (0.150) B
Abrasive cup/paste	0.337 (0.052)	0.339 (0.040)	0.359 (0.084)	0.317 (0.025)	0.338 (0.054) A

* Different letters indicate statistical significant differences among surface treatments (line).

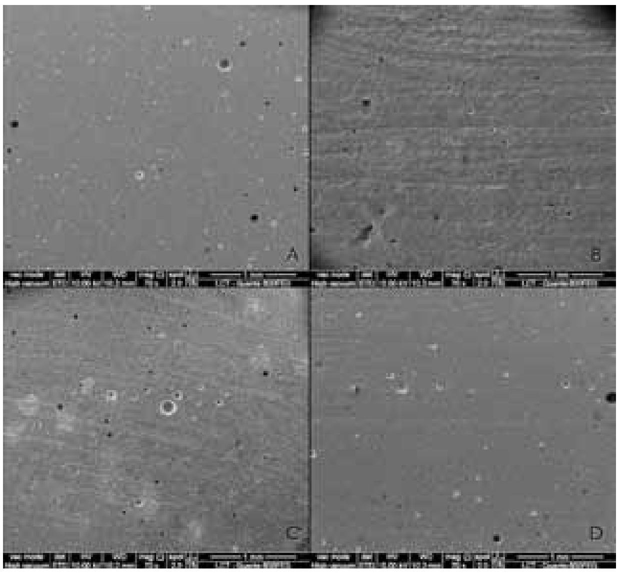

Figure 1 – Scanning electron microscopic (SEM) photograph representative of the IPS d.Sign ceramic (70x magnification). A- ceramic surface after metallographic polishment. B- ceramic surface after adjustment with a diamond bur. C- ceramic surface after refinishing with fine and an extra fine diamond bur. D- ceramic surface after refinishing with first and second abrasive cups and after with polishing paste.

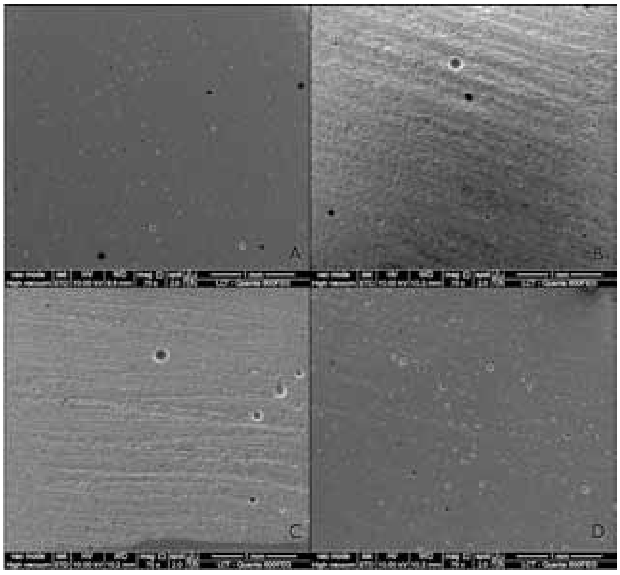

Figure 2 – Scanning electron microscopic (SEM) photograph representative of the VMK 95 ceramic (70x magnification). A- ceramic surface after metallographic polishment. B- ceramic surface after adjustment with a diamond bur. C- ceramic surface after refinishing with fine and an extra fine diamond bur. D- ceramic surface after refinishing with first and second abrasive cups and after with polishing paste.

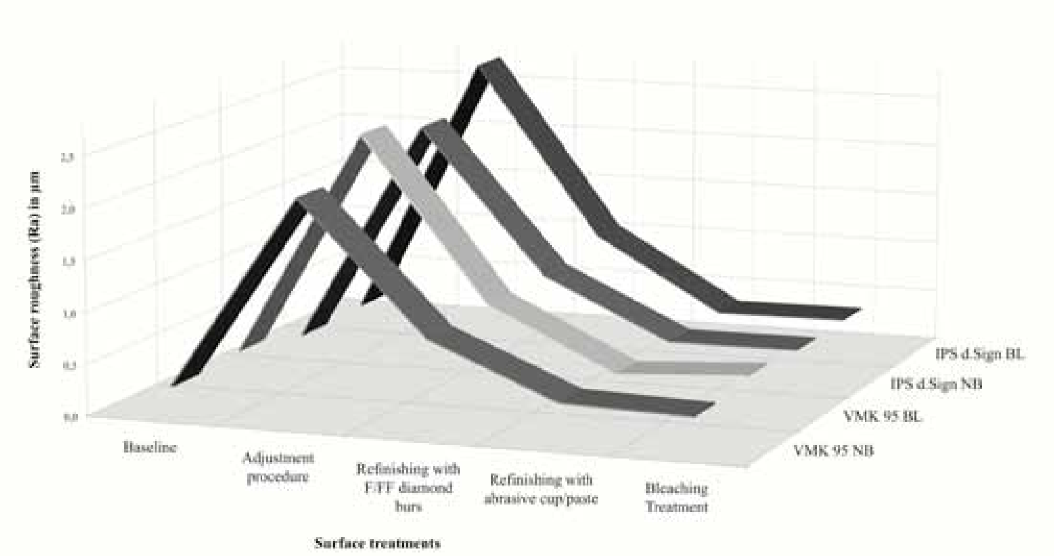

Figure 3 – Surface roughness (Ra) of each ceramic as a function of surface treatment.

The T test showed no statistical significant differences between bleached and non-bleached groups for both studied refinished ceramics, and the second null hypothesis was accepted. The means and standard deviations are described in Table 3 and are graphically represented in graph 1.

Table 2 – Surface roughness (Ra) of each ceramic and standard deviations (in brackets) at each evaluation period after surface treatment, and the results of Tukey's test for ceramics

	Bleaching Treatment	
Ceramics	**NB**	**BL**
IPS d.Sign	0.341 (0.080)	0.350 (0.078)
VMK 95	0.321 (0.080)	0.372 (0.091)

DISCUSSION

Dental ceramic has found an increased number of applications in recent years, it is used in metal-ceramic and all-porcelain crowns and bridges for the restoration of anterior and posterior teeth [28]. Ideally, porcelain restorations should maintain their glazed surface, but the need to perform an adjustment before cementation or right after cementation is very frequent. The adjustment with diamond burs produced an irregular surface, leaving easily identifiable fissures (Figures. 1B and 2B).

This adjustment procedure removes the glazed surface, leading to the initiation of microcracks, which under continuous wear and in the presence of moisture may result in pronounced destruction of the ceramic [7]. Also, to avoid abrasive wear of the opposing dentition, and plaque accumulation the best finish and least abrasive surface need to be achieved by ceramic refinishing. Commercial porcelain refinishing kits are claimed to restore the surface finish on porcelain after adjustments in circumstances that preclude laboratorial reglazing [30].

In the present study, specimens of two ceramic systems were produced and submitted to a metallographic polishing to produce a smooth surface (Figures. 1A and 2A) with roughness average (Ra) approximately of 0.2 μm (Table 2). This roughness average is close to a glazed ceramic [13] and a condition that leads to bacterial accumulation similar to that observed on the least rough surface [31]. This baseline value was considered as the gold standard to polishing. Although the studied ceramic had different compounds, there were no significant differences in roughness values between porcelain independent of treatment which may be supposed attributed to a relation with diamond abrasive particles size and physical properties.

The refinishing procedure using in a decreasing granulation order of abrasive diamond burs (F and FF) statistically reduced the remarkable morphological alterations on ceramic surface caused by diamond burs. However, a non-clinically acceptable rough surface with fewer pits, grooves and undercuts could be observed by scanning electron microscopy (Figures 1C and 2C). Additionally, the surface roughness reduction by refinishing only with F and FF diamond burs result in a higher rough surface than baseline control situation due to 20-40 μm diamond grain. Another research showed that a refinishing kit with a grain finer than 15 μm would be more appropriate for porcelain adjustments to permit a surface smoothness comparable to the original glaze [30].

After the final polishing with abrasive cups and polishing paste an uniform peeling was achieved (Figures 1D and 2D) with a flat surface and surface roughness non different from baseline control surface accepting the first hypothesis of the study, that a diamond bur adjusted roughness surface of a ceramic may be refinished with fine and extra fine diamond burs followed by abrasive cups and diamond pastes. These results are in agreement with Jung [32] to whom showed that IPS-Empress ceramic specimens were able to be polished to lower roughness values with a rubber polisher and diamond gel [32].

A study evaluated the effect of two polishing diamond pastes for ceramic polishing applied by four different vehicles a dental rubber cup, Robinson bristle brush, felt wheel, and buff discs and found no significant differences between the two pastes, but among vehicles the rubber cup resulted in the highest roughness average with a mean of 0.255 μm (Ra) the other groups were similar and showed a roughness average ranging from 0.087 to 0.119 μm [2] Sasahara et a. [33] found that the use of a polishing paste after the sandpaper discs or after the rubber wheel resulted in a reduction of the Ra value for ceramics. Rubber or discs followed by diamond paste were the best surface treatments for d.sign porcelain [33].

These results confirm that finishing produced by intermediate components of the proprietary finishing kit did not totally reduce the roughness of the ceramic surface. It was necessary to complete the polishing sequence with diamond paste to achieve a surface, which approached roughness characteristics of glazed porcelain [29]. Although the study was performed in a flat surface, clinically a complete finish procedure including the use of abrasive diamond burs (F and FF), abrasive cups and paste may be necessary to reduce the surface roughness after occlusal adjustment of a ceramic previous cemented inlay or onlay restoration.

Significant correlation was found between the roughness of the surface and the biaxial strength, the smoother the surface, the stronger the sample [10]. Also, cracks in the porcelain originated from flaws are propagated with flexural pressure, resulting in lower flexural strength, which indicates that the increase in surface roughness of the porcelain can be interpreted as a reduction in flexural strength. The larger the surface roughness in the porcelain, the lower the flexural strength [11]. Then to achieve a less rough as possible surface also improve the physical and mechanical properties of the dental prosthesis [10,11].

On the other hand, when a porcelain-veneered ceramic restoration with a flaw on the surface is placed in the mouth, moisture may hasten the breakdown of bonds between silica atoms over time through a process called slow crack growth. Even if the restorations are not subject to excessive occlusal loading, fracture can occur due to static fatigue [9]. Also, a lot of transitory fluids may interact with porcelain, including hydrogen peroxide from bleaching gels. According to Turker & Biskin [14,15], a significant decrease in porcelain microhardness was observed after 240 h of treatment with 10% carbamide peroxide, and a spectral analysis of showed a decrease in the SiO_2 content, which is the main component of the matrix [14,15]. Thus, its lower in content would affect other properties in long term. Some alterations were expected because the contact and possible diffusion of free radicals of H+ or H_3O+ produced by bleaching agents [20] that may selectively leach alkali ions and cause the dissolution of the ceramic glass network [1]. Also, hydrogen peroxide in pure aqueous form is weakly acidic to reduce breakdown and extend shelf life [20], and the low pH may also affect the ceramic matrix. Then, the prolonged exposure of hydrogen peroxide could potentially affect dental porcelain exposed to at-home bleaching as showed by some studies. Since the refinished porcelain lost the glaze treatment it could be potentially affected by hydrogen peroxide based bleaching gels.

In this study it was selected a 16% carbamide peroxide as bleaching agent to simulate an accidentally exposure of ceramic restoration in at-home bleaching technique. The carbamide peroxide has a slightly acidity and slowly breaks down in hydrogen peroxide producing about 5.7% hydrogen peroxide [20] that may be able to ionize and produce free radicals. However, simultaneously is released ammonia (NH3) which is able to buffer the low pH 20 and reduce demineralization effects [34].

However, a stability on surface roughness of refinished ceramic against bleaching agents was observed in the present study and the second study hypothesis may be accepted, treatment with 16% carbamide peroxide bleaching agents used to at-home treatment do not affect the roughness surface of refinished ceramic. At our knowledge no other research evaluated the effect of bleaching treatment on a refinished ceramic, but these results are in agreement with Ourique et al. [35] that found no statistical differences in the surface roughness of ceramics treated with 10% or 16% carbamide peroxide for 126 - h [35]; and other studies which showed no significant changes in physical properties after treatment with 15% carbamide peroxide for 56 h, 6.5% hydrogen peroxide for 14 h, 38% hydrogen peroxide for 30 min or 45 min [17-19].

Regardless of the type of ceramic or pretreatment, any adjusted on restoration should be reglazed or subjected to a refinishing sequence [36]. Since the ultimate goal of refinishing of a dental porcelain is the attainment of a well-polished surface as a substitute for glazed porcelain [7], and based on the results found in this study, it may be suggested that clinical refinishing of roughened ceramic surfaces after occusal adjustment with diamond burs may be well obtained using fine and extra fine diamond burs followed by abrasive rubber tips and diamond paste.

CONCLUSION

• Ceramic refinishing with fine and extra fine diamonds burs are not able to produce a smooth surface

• The treatment with rubber cups and abrasive paste are efficient in revoming the groves and fissures and consequently creating a less rough surface.

• The treatment with 16% carbamide peroxide do not impair refinished ceramics surfaces.

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