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Original research

Impact of additional polishing on the roughness and surface morphology of dental composite resins

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ABSTRACT

Objectives: This study evaluated the surface roughness and morphology of microfilled (Durafill VS) and nanohybrid (Evolu-X) composite resins submitted to different finishing/polishing systems, with or without further additional polishing.
Methods: 70 specimens were fabricated and distributed to 14 sample groups ($n = 5$ per group). The Mylar strip (MS) was the control group. Sof-Lex Pop-on (SP) and Praxis TDV (PTDV) were finishing/polishing systems used in the experimental groups. Additional polishing was performed with either a felt disc moistened with diamond paste (FP), or just a silicon carbide brush (SCB). Roughness (Ra) was measured and scanning electron microscopy (SEM) images were obtained. Data were subjected to two-way ANOVA and Tukey ($p < 0.05$).
Results: The SP (0.186 and 0.250 μm) finishing/polishing systems produced a smoother surface compared with a PTDV (0.208 and 0.296 μm). The Evolu-x (EVO) resin showed lower roughness. After the additional polishing with FP, there was no difference between the resins tested and values of roughness. SEM suggests smoother Durafill VS (DUR) surface when polishing is carried out with PTDV + FP. SP provided an Evolu-x surface with fewer grooves and scratches. Evolu-x surfaces treated with PTDV and SP + SCB had a more irregular topography.
Conclusion: Furthermore, the FP offered a smoother and uniform texture to the surface of both resins independent of the previous treatment. The SCB offered a smoother texture to the surface of the DUR resin than EVO.

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Impacto do polimento adicional na rugosidade e morfologia da superfície de resinas compostas

Palavras-chave:
Resina composta
Polimento dentário

RESUMO

Objetivos: Este estudo avaliou a rugosidade da superfície e morfologia de resinas compostas, microparticulada (Durafill VS [DUR]) e nano-híbrida (Evolu-X [EVO]), submetidas a diferentes sistemas de acabamento/polimento, com ou sem polimento mais adicional.

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Rugosidade superficial
Materiais dentários
Microscopia eletrónica de varredura

Métodos: Setenta espécimes foram fabricados e distribuídos para 14 grupos de amostras (n = 5 por grupo). A tira de poliéster (MS) foi o grupo controlo. Sof-lex Pop on (SP) e Práxis TDV (PTDV) foram os sistemas de acabamento/polimento utilizados nos grupos experimentais. Polimento adicional foi realizado com disco de feltro com pasta de diamante (FP) ou somente escova de carboneto de silício (SCB). Rugosidade (Ra) foi medida e imagens foram obtidas através de microscopia eletrónica de varredura (MEV). Os dados foram submetidos a ANOVA de 2vias e de Tukey ($p < 0,05$).

Resultados: O sistema SP (0,186 e 0,250 μm) de acabamento/polimento produziu uma superfície mais lisa em comparação com um PTDV (0,208 e 0,296 μm). A resina EVO mostrou menor rugosidade (0,186 e 0,208 μm). Após o polimento adicional com FP, não houve nenhuma diferença entre as resinas testadas e os valores de rugosidade ($p < 0,05$). SEM sugeriu uma superfície mais lisa na DUR quando o polimento foi realizado com PTDV + FP. O sistema SP forneceu para EVO uma superfície mais uniforme, com menos sulcos. No entanto, as superfícies tratadas com PTDV e SP + SCB tinham uma topografia mais irregular.

Conclusão: O FP ofereceu uma textura mais lisa e uniforme sobre a superfície de ambas as resinas, independente do tratamento anterior. O SCB ofereceu uma textura mais lisa para a resina DUR do que para a EVO.

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Introduction

A variety of materials are developed to improve polishing and longevity of composite resin restorations. This situation is desirable for dentists and patients because most smooth surfaces prevent biofilm accumulation, gingival irritation, secondary caries and color change.[1–3]

In esthetic situations, microfilled and nanohybrid composite resins can be used.[4] In addition to the concentration and type of filler particles, the monomers present and finishing systems/polishing used are variables that may influence the final surface polishing of composites.[5–10] Several studies show that the smoother surface of a resin composite is obtained by Mylar strip,[11–17] but the dental anatomy hampers its use. Therefore, some products are commercially available for finishing and polishing, such as burs, rubber, and abrasive discs (containing diamond, aluminum oxide or silicon carbide), which are capable of providing a smooth surface.[18–22] Recently, silicon carbide brushes emerged in the market to be used as a final/additional polishing method in composite resins. However, it is not known if additional polishing using silicon carbide brush is able to reduce the surface roughness of microfilled and nanohybrid composites.

This study evaluated the surface roughness and morphology of microfilled and nanohybrid composite resins submitted to different finishing/polishing systems, with or without further additional polishing. The null hypothesis was that there would be no significant differences in surface roughness and morphology of each composite tested after additional polishing.

Materials and methods

Two composite resins were used in this study. The first was microfilled (Durafill VS, Heraeus-Kulzer, Gruner Weg, Hanau, Germany) and the other was a nanohybrid resin (Evolu-X, Dentsply, Petrópolis, RJ, Brazil). The chemical components of these composites are listed in Table 1. A single operator fabricated 35 circular specimens (8 mm diameter, 2 mm height) per composite. A Teflon custom mold was placed on a glass plate and filled with composite. Verification of curing light intensity was performed by the radiometer Demetron (Kerr/Sybron Dental, USA). It was positioned vertically the active tip of the curing light on the central part of the photosensitive area of radiometer and ligated for 20 s. After, the composite surface was then covered with a Mylar strip and photoactivated for 20 s with a Coltolux light-emitting diode (1264 mW/cm^2 irradiance; Coltène/Whaledent, Altstätten, Switzerland). The 70 specimens were removed from the mold and stored in plastic containers containing distilled water at 37 °C for 24 h before finishing/polishing procedures and distributed to 14 sample groups ($n = 5$ per group).

First, 5 samples of each resin were separated as control. For the remainder, the aluminum oxide discs Sof-Lex Pop-On (3M ESPE Dental Products, St. Paul, MN, USA) and Práxis TDV (TDV Dental Ltda., Pomerode, SC, Brazil) were used, then two additional polishing materials: Felt Discs (TDV Dental Ltda.), Diamond Gloss™ polishing paste (KG Sorensen, Sao Paulo, Brazil and a Silicon Carbide Brush – Astrobrush™ (Ivoclar Vivadent, Amherst, NY, USA) (Tables 1–3). The specimens were divided into groups according to resin type and finishing and polishing systems ($n = 5$ per group).

All the specimens from groups 2, 3, 4, 9, 10 and 11 received treatment with SP, from coarse grains to fine grains, in a total of four grains applied for 30 s. The same procedures were applied for the groups 5, 6, 7, 12, 13 and 14, with PTDV. Each disc was used for only one specimen, washed with air/water spray to remove residues, and dried by air jet. The specimens were subjected to Ultrasonic Cleaner (Unique, Sao Paulo, Brazil; 25 kHz power, 120 W frequency) at the end of the finishing process

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