

# Wear performance of dental ceramics after grinding and polishing treatments.

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## Abstract

**AIM:** The aim of this in vitro study was to determine the two-body wear resistance of different dental ceramics after grinding and polishing treatments.

**MATERIAL AND METHODS:** Standardized specimens were prepared from three zirconia and two veneering ceramics and were subjected to different surface treatments. Zirconia ceramics were polished, ground and repolished, veneering ceramics were ground and repolished. One zirconia ceramic was investigated with a superficial glaze. Human enamel was used for reference. Surface roughness R(a) was determined using a profilometric contact surface measurement device. Two-body wear tests were performed in a chewing simulator with steatite and enamel antagonists, respectively. Specimens were loaded pneumatically in a pin-on-block design for  $1.2 \times 10^5$  mastication cycles (50 N, 1.2 Hz, lateral movement: 1 mm, mouth opening: 2 mm) under simultaneous thermal cycling (600 cycles, 5/55 °C). Wear depths of specimens were determined using a 3D laser scanning device, wear areas of steatite antagonists were measured by means of light-optical micrographs. Means and standard deviations were calculated, and statistical analysis was performed using one-way analysis of variance (ANOVA) and the Bonferroni multiple comparison test for post hoc analysis ( $\alpha=0.05$ ). Scanning electron microscopy was applied for evaluating the wear performance of ceramics and antagonists.

**RESULTS:** No wear was found for polished, ground and repolished zirconia. Compared to the wear depths of the enamel reference with  $274.1 \pm 187.4 \mu\text{m}$  versus steatite and  $123.3 \pm 131.0 \mu\text{m}$  versus enamel, relative wear depths of porcelains ranged between  $0.54 \pm 0.07$  and  $0.62 \pm 0.09$  with steatite antagonists and between  $0.66 \pm 0.26$  and  $1.04 \pm 0.27$  with enamel antagonists. Relative wear areas of steatite antagonists (enamel reference:  $1.25 \text{ mm}^2$ ) varied between  $0.84 \pm 0.13$  and  $1.90 \pm 0.29$  for zirconia and between  $1.97 \pm 0.38$  and  $2.47 \pm 0.40$  for porcelains. Enamel antagonists generally showed wear, cracks or even fractures, but revealed smooth surfaces when opposed to polished/ground/repolished zirconia and ploughed surfaces when opposed to ground/repolished porcelains or glaze.

**CONCLUSIONS:** Zirconia ceramics yielded superior wear behavior and lower antagonistic wear compared to porcelains. A trend to higher ceramic and antagonistic wear was shown after grinding treatments.