

Wear performance of substructure ceramics and veneering porcelains.

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Source

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Abstract

AIM:

The aim of this in vitro study was to compare the two-body wear resistance of substructure zirconia and veneering porcelain versus steatite and human enamel antagonists, respectively.

MATERIALS AND METHODS:

Two-body wear tests were performed in a chewing simulator with steatite and enamel antagonists (enamel cusps). A pin-on-block design with a vertical load of 50N for 1.2×10^5 cycles; ($f=1.6\text{Hz}$; lateral movement: 1mm, mouth opening: 2mm) was used for the wear test. For quantification of the wear resistance, wear tests were performed with standardized steatite spheres. Human enamel was used as a reference. Five zirconia ceramics and four veneering porcelains were investigated. One zirconia ceramic was tested with superficial glaze, which was applied after polishing or sandblasting, respectively. Surface roughness $R(a)$ (SP6, Perthen-Feinprüf, G) and wear depth were determined using a 3D-Profilometer (Laserscan 3D, Willytec, G). SEM (Quanta FEG 400, FEI, USA) pictures were used for evaluating wear performance of both, ceramics and antagonists.

RESULTS:

No wear was found for zirconia substructures. Veneering porcelain provided wear traces between $186.1 \pm 33.2 \mu\text{m}$ and $232.9 \pm 66.9 \mu\text{m}$ (steatite antagonist) and $90.6 \pm 3.5 \mu\text{m}$ and $123.9 \pm 50.7 \mu\text{m}$ (enamel). Wear of the steatite antagonists varied between $0.812 \pm 0.256 \text{mm}^2$ and $1.360 \pm 0.321 \text{mm}^2$ for zirconia and $1.708 \pm 0.275 \text{mm}^2$ and $2.568 \pm 0.827 \text{mm}^2$ for porcelain. Enamel generally showed wear, cracks or even fractures at the ridge, regardless whether opposed by zirconia or porcelain/glaze. Enamel was polished, when opposed to zirconia, or plowed, provoked and grinded, when opposed to porcelain/glaze.

CONCLUSION:

The results of the wear test with steatite or enamel antagonists indicated no measurable wear on zirconia surfaces. Porcelain showed higher wear than zirconia, but comparable or lower wear than an enamel reference. Antagonistic wear against zirconia was found to be lower than wear against porcelain.

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