



Is zirconia the Best Available Technology (BAT) for Dental Restorations?

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Editorial

Patients with missing tooth structure should receive restorations that at least mimic or exceed the functional and esthetic requirements of the remaining teeth. This can be accomplished by using a strong substructure and a translucent layer of porcelain, therewith mimicking the structure of a natural tooth. The technology that is regarded as best available technology (BAT) is computer aided design (CAD) and computer aided milling (CAM) of a reduced substructure of zirconia and subsequently milling the outer contour in hardened paste glass ceramic, known as prosthetic mimetic restorations [1]. However, at present most restorations produced by CAD/CAM technology are monolithic products of either color and structure graded zirconia or lithiumdisilicate glass ceramic. That the best available technology is not used has economical reasons, because direct milling of the final restoration from one block of material is easier than having to mill a second porcelain layer. The three materials involved in present restoration differ considerably in their Vickers surface hardness: zirconia in all its modifications 1200, lithium disilicate glass ceramic 700 and PRIMERO 470, while human enamel has hardness between 390 and 450. Because zirconia has four times the hardness of metal, initial concern about antagonist abrasion could with numerous studies be negated.

Most previous work conducted on the wear behavior of dental enamel has focused mainly on wear rates and surface damage. There is, however, scarce information regarding the subsurface damage (SSD) arising from sliding contact fatigue. Enamel probes were submitted to cyclic contact fatigue test in off-axis mouth-motion cycling machine with 200 N load and 2 Hz frequency in distilled water at 37°C for up to 106 cycles a zirconia, lithiumdisilicate and PRIMERO indenter. Subsurface damage of enamel is often covered with a smearing layer generated by wear mechanisms and rather difficult to directly observe and detect by optical microscopy. Subsurface damage was therefore assessed using sagittal and transverse sections of the samples and lateral, median and cone cracks observed and quantified. Massive crack formation in enamel probes opposing monolithic zirconia was observed. The zirconia caused twice as much crack in the enamel probe as lithiumdisilicate and three times more cracks than the PRIMERO indenter. Both wear and subsurface fracture in enamel are determining factors for the long-term decay of teeth. We must fear for the subsurface integrity of zirconia opposing enamel on the long term and the use of porcelain glassceramics should remain the "best available technology".

References

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