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Adhesion of Oral Streptococci to All-Ceramics Dental Restorative Materials

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INTRODUCTION: In the oral cavity all exposed surfaces, human tooth tissues as well as restorative and reconstructive materials, are rapidly coated with a salivary pellicle, to which early colonizing bacteria, mostly oral streptococci, adhere. These are the first steps in the formation of the oral biofilm, called dental plaque, the major cause of caries, periodontal, and other oral infection-induced diseases.

All-ceramic restorations for medical and dental purposes have gained importance due to their high strength, biocompatibility and excellent aesthetic properties [l]. The present study investigated the adherence of two early colonizers, *Streptococcus sanguinis* and *S. oralis*, and of two caries-associated bacteria, *S. mutans* and *S. sobrinus*, to four different all-ceramic dental materials with experimentally-formed salivary pellicle. In addition, surface roughness and hydrophobicity were determined.

METHODS: Test specimens (Table 1, Fig. 1) were incubated first with saliva, then with a bacterial suspension for one hour in a flow chamber *in vitro* which mimics the environmental conditions in the oral cavity [2]. Numbers of adherent bacteria were determined after staining by fluorescence microscopy (Fig. 1). Roughness (Ra) and water contact angle (CA) were measured [2]. A glass similar to enamel with regard to microbial adhesion *in vitro* served as control [2].

Table 1. Surface roughness Ra (µm) and contact angles CA (degrees) of the dental ceramics (Vita, Bad Säckingen, Germany) and the control glass (Vetter, Ammerbuch, Germany) used.

Type of material	Ra (µm)	CA (degree) after saliva-coating
Glass (Borosilicate)	0.24	43.8
Vita Mark II, MK	0.26	44.3
In-Ceram Aluminia, ICA	1.33	44.1
In-Ceram Zirconia, ICZ	1.34	46.0
In-Ceram, YZ	0.26	44.8

RESULTS: On all materials tested, *S. mutans* and *S. sobrinus* adhered approximately ten-fold less than *S. sanguinis* and *S. oralis* (Fig. 2). All salivary-coated specimens showed similar hydrophilic surface properties. Surface roughness of the all-ceramics MK and YZ showed no difference to glass, while ICA and ICZ yielded 5-fold higher values (Table 1). All bacterial suspensions were hydrophilic as measured by hexadecane partitioning. Surface roughness and hydrophobicity of the materials had no distinctive influence on the adherence.

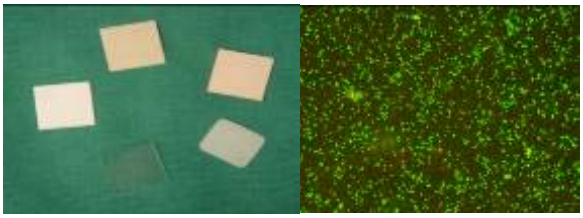

Fig. 1: All-ceramics used MK, ICA, ICZ, YZ (left, counter-clockwise) and glass (transparent). Streptococci adhered to glass (right).

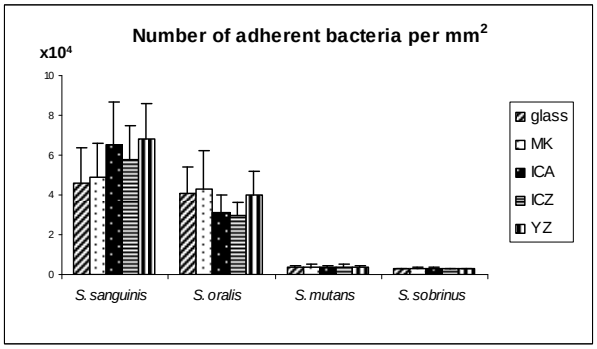

Fig. 2: Adherent streptococci on test materials and control (mean±SD, n=5).

DISCUSSION & CONCLUSIONS: The results showed that irrespective of the materials tested, *S. sanguinis* and *S. oralis* adhered to much higher degrees than *S. mutans* and *S. sobrinus*. Future investigations should focus on the material-pellicle interactions in order to understand and control the adherence of these important initial colonizers. This *in vitro* model provides a useful tool to study the initial adherence of oral bacteria to new or modified dental materials.

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