



**Karolinska
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Division of Periodontology, Department of Dental Medicine

Surface roughness – causal factors – and its relation to bacterial adhesion

AKADEMISK AVHANDLING

som för avläggande av odontologie doktorsexamen vid Karolinska Institutet offentligen försvaras i Sal 4U, Alfred Nobels allé 8.

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av

Georg Tellefsen

Leg tandläkare

Huvudhandledare:

Dr. Med. Sc. Gunnar Johannsen
Karolinska Institutet
Institutionen för Odontologi

Bihandledare:

Professor Anders Gustafsson
Karolinska Institutet
Institutionen för Odontologi

Associate Professor Anders Liljeborg
Kungliga Tekniska Högskolan
Institutionen för nanostructure physics

Associate Professor Lars Linder
Karolinska Institutet
Institutionen för Odontologi

Extern mentor:

Associate Professor Hans Rydén
Karolinska Institutet
Institutionen för Odontologi

Fakultetsopponent:

Odont Dr. Nils Ravald
Linköpings Universitet
Institutionen för medicin och hälsa

Betygsnämnd:

Associate Professor Stefan Eriksson
Karolinska Institutet
Institutionen för fysiologi och farmakologi (FYFA)

Professor Maude Wikström
Göteborgs Universitet
Sahlgrenska Akademien
Institutionen för Odontologi

Associate Professor Hans Preber
Karolinska Institutet
Institutionen för Odontologi

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ABSTRACT

Inflammation around teeth and dental implants is considered to be due to microorganisms producing biofilm and thereby initiating the inflammatory reaction. The etiology is not yet fully understood though many risk factors have been identified, e.g. smoking, oral hygiene, stress etc.

That surface roughness plays a role both in the development of the biofilm and discoloration of teeth is nowadays beyond doubt. To create a smooth surface is an important part of the oral hygiene regime. Toothbrushing with and without toothpastes can influence the surface roughness in different ways. The ultimate goal is to remove the biofilm together with the discoloration without removing the tooth substance and in the same time create a surface that is smooth in order to prevent the development of new biofilm and discoloration.

Hence the importance of having a reliable method for measuring toothpaste and toothbrush abrasivity is obvious. This is also applicable regarding the development of new dental filling materials especially in the anterior region where, besides bacterial accumulation, discoloration otherwise can be a problem.

The present thesis is based on four in vitro studies which all utilizes the profilometer technique for analysis of surface roughness caused by toothbrushing with and without toothpastes. In one of the studies, the additional effect of surface roughness on bacterial accumulation is investigated.

The main findings from the present thesis are that the profilometer technique, described in paper I, constitutes a possibility to measure the abrasive effect of a toothpaste or toothbrush in both a qualitative, (i.e. the roughness of the surface) and quantitative, (i.e. how much of the surface that have been abraded), way. Furthermore, it has been shown that a softer toothbrush can cause equal or even more abrasion than a harder one and that toothbrushing with toothpastes on dental materials influences the materials in different ways, i.e. causing either rougher or smoother surfaces. Finally, the bacterial accumulation on titanium was not influenced by the surface roughness.

Although, these studies being in vitro studies, the impact on the clinical reality is huge. The “gold standard” for measuring toothpaste abrasivity has been challenged, the opinion that softer toothbrushes always should be recommended is also questioned. It is extremely important for manufacturers of dental materials to consider the wear resistance as far as toothbrushing with toothpastes is concerned. Periimplantitis is a worldwide growing problem, where the present study has focused on surface roughness which constitutes an important aspect that needs further research.

Keywords: Abrasivity, toothpastes, toothbrushes, dental materials, biofilm