3057: Abrasive Particle and Toothbrush Filament Effects on Dental Tissue Wear

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Introduction

Abrasive wear of sound dental hard tissues depends on the toothpaste abrasive particles and also the characteristics of the toothbrush delivering them[1]. However, the relative effects of soft versus hard brush filaments and the underlying mechanisms for these effects remain controversial.

Methods

Tooth specimens

- Bovine incisor enamel and dentin
- Embedded in epoxy resin as per BS 5136: 1981
- Enamel and dentin surfaces ground and polished to 3μm diamond finish
- Specimens kept hydrated

Brushing procedure and analysis methods

- 8 specimens (both of enamel and dentin) brushed with slurries of silica abrasives Sident 8, Sident 9 and Sident 10 using a novel brushing simulator[2]
- Abrasive slurries: 16.66%w/w in 0.5%w/w 7MF CMC and 10%w/w glycerol
- 150g brush-head loading on toothbrush (soft, medium and hard) heads
- 10,000 double brush strokes at 120 strokes/min
- Brushing temperature of 20°C
- Profilometric (Talysurf Series 2) assessment of abrasion depth and roughness Ra
- 3D surface analysis of specimens
- Data were analysed by single factor ANOVA with a significance of p=0.05

CTRL-16 brushing simulator consisting of a specimen bath and brushing rig assembled inside a Jeiotech SI300R incubator shaker unit

Healthy bovine incisors

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Mounted in cold cure resin and surfaces ground and polished to 3μm diamond finish

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Measure surface profiles before mounting in brushing machine

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Specimens brushed at 20°C with Sident 8, 9 and 10 silica slurries 10,000 times at 120 strokes/min and 150g brush-head load with three (soft, medium and hard) toothbrush-heads

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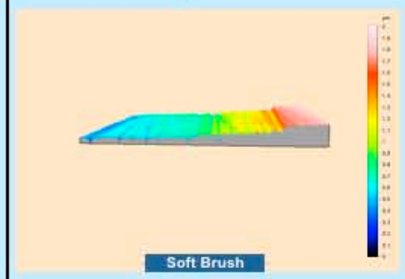
Rinse and analyse by surface profilometry

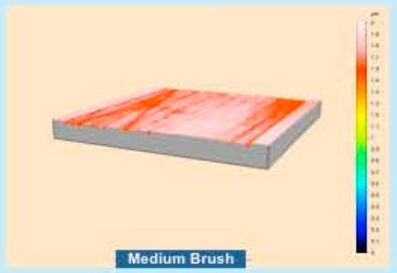
Objectives

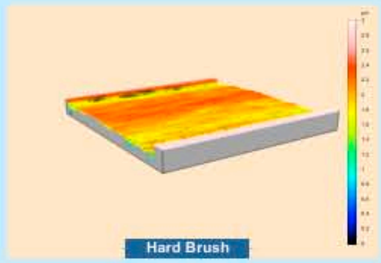
- Compare the abrasion (depth of wear and roughness) of bovine enamel and dentin after brushing with three silica abrasives (Sident 8, 9 and 10) and three (soft, medium and hard) toothbrushes.

Results

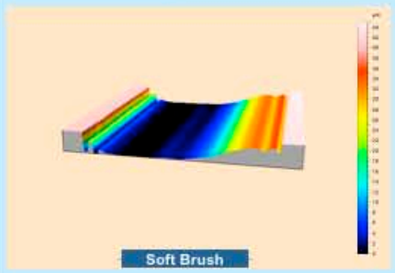
3D Profiles of Enamel with Sident 8

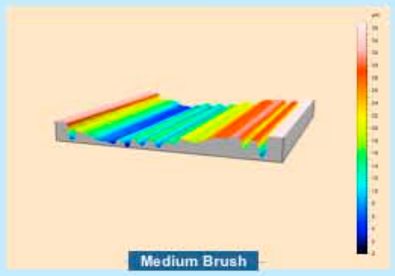


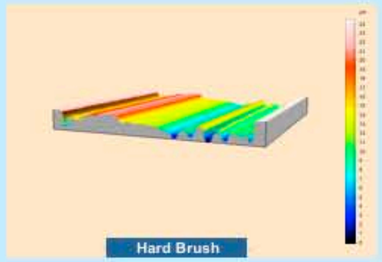


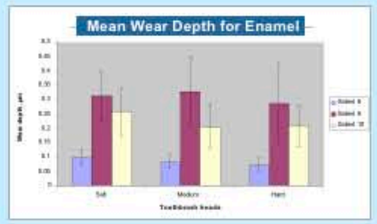


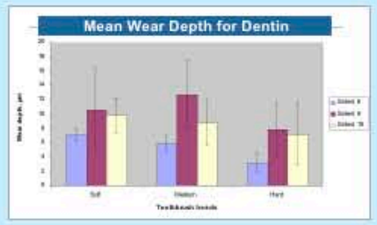
3D Profiles of Dentin with Sident 8

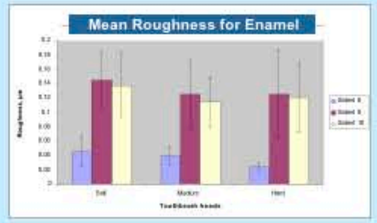


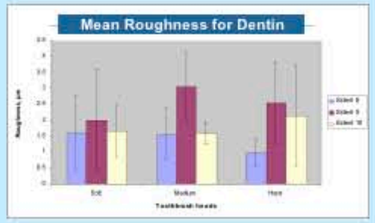












- Enamel and dentin specimens showed different susceptibility to wear with the 3 abrasives and to a lesser extent, with the 3 brush filament grades. Dentin showed much greater susceptibility to wear than enamel resulting in greater depth of wear and roughness.
- A ranking of Sident 8 < Sident 10 < Sident 9 for the silica abrasives was observed for mean depth of wear and roughness of specimens after brushing.
- There were no significant differences in the loss of enamel between the soft, medium and hard toothbrushes. However, significant differences in the loss of dentin were observed between the soft, medium and hard toothbrushes with the hard brushes being least abrasive.

Conclusions

- The present studies demonstrate that variations in tooth wear pattern are dependent on the abrasivity of the brushing slurry (Sident 8 < Sident 10 < Sident 9), but can also be modified by stiffness of the toothbrush filaments possibly reflecting heterogeneity in abrasive particle size and their delivery by the filaments.

References

1. Wiegand A., Schwerzmann M., Sener B., Magalhaes A.C., Roos M., Ziebolz D., Imfeld T. and Attin T., "Impact of toothpaste slurry abrasivity and toothbrush filament stiffness on abrasion of eroded enamel - an in vitro study", Acta Odonto Scand 2008, 66(4): 231-5.
2. Parry J., Harrington E., Rees G.D., McNab R. and Smith A.J., "Control of brushing variables for the in vitro assessment of toothpaste abrasivity using a novel laboratory model", Journal of Dentistry 2008, 36: 117-124

Acknowledgements

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