Polishing Procedure and Toothbrush Abrasion Effect on Composite Surface Quality

A. Utterodt; A. Rist; M. Eck; A. Erdrich, Heraeus Kulzer GmbH, Wehrheim, Germany

1679

Introduction:

Surface quality of dental restorations is one of the most important factors that determine the success of a restoration [1]. The smooth surface of a restoration provides both optimum esthetics and low plaque accumulation [2].
Polishing procedure should lead to an initial high quality surface, but is affected by physical and chemical interactions in the mouth (tooth brushing, eating etc.).

Objectives:

This study examined the effect of toothbrush abrasion on gloss and surface roughness of 4 different composites, which were polished to an initial high level surface quality under comparable condition.

Methods:

The studied composite materials were the two different micro-hybrid-composite materials Tetric EvoCeram (TEC, Icoclar Vivadent) and Venus (VE, Heraeus Kulzer) as well as the two nano-hybrid-composites Grandio (GR, Voco) and an experimental composite (EC, Heraeus Kulzer). Therefore 16 flat specimen of each composite were prepared. Half of the specimen (n=8) were mechanically polished (pol.), the other half were grounded with 320-grit SiC paper to create a surface with a comparable roughness (unpol). The prepared surfaces were treated with 100000 cycles of a toothbrush abrasion (TA) in a sawtooth mode for both groups.

Figure 1: tooth brush abrasion device

Measurement:

Gloss is defined as percentage of the totally reflected light from a perfect mirror (= 100 %). Reflection (%) and surface roughness average R_a (µm) were measured with a surface laser scanner (UBM) before and after TA.

Statistical analysis corresponding to ANOVA and Mann-Whitney was executed by WINSTAT software.

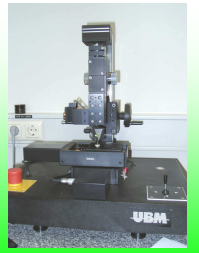

Figure 2: UBM-Scanner

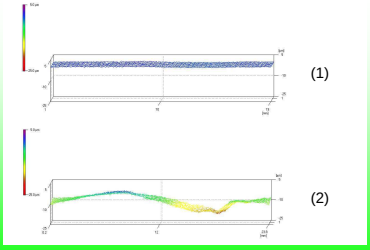

Figure 3: surface scan before (1) and after (2) abrasion

Results:

A significant difference in gloss and roughness was found between the pol. and unpol. groups ($p \leq 0,05$). After TA the reflection of the two groups was changed to a similar level, whereas the difference between VE (unpol./pol.) was not significant while EC and TEC (unpol./pol.) was still significant. The best gloss results after TA were achieved with EC (pol:4,9%/unpol: 5,2%) and TEC (pol:6,0%/unpol:5,8%).
In the pol. group the roughness was found on a significant higher level after TA for all composites.
Roughness was found significantly reduced after 100000 cycles TA in the unpol. group for all materials, but an enduring TA process (500000 cycles) led to a higher roughness for the microhybrid-composites compared to the nanohybrid-composites.

1. Gloss (as reflection) in [%]

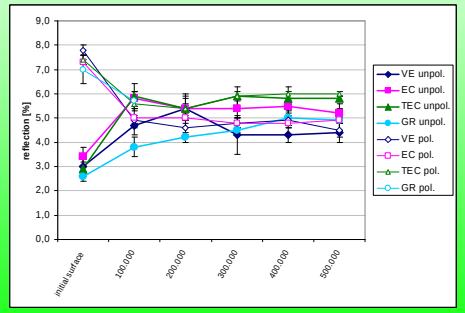

Figure 4: Reflection in [%] during brush abrasion test

2. Roughness in [µm]

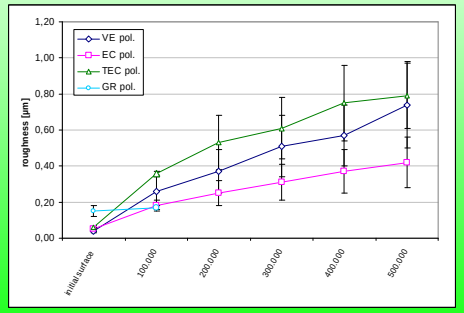

Figure 5: Roughness in [µm] of the polished composite materials

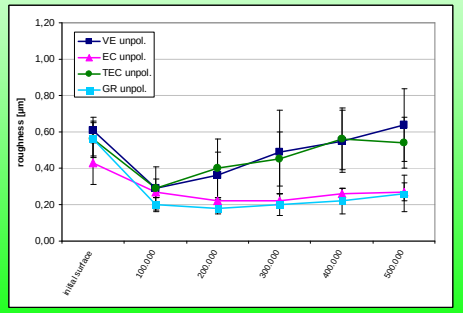

Figure 6: Roughness in [µm] of the unpolished composite materials

Conclusions:

The gloss of polished composites was clearly reduced by the simulated toothbrush abrasion, however it was still on a higher level than in the unpolished group. The different performance regarding roughness of the polished composite is due to the particle size distribution of the composite material.

References:

[1] Lu, H., Roeder, L. B., Lei, L., Powers, J.M.: Effect of surface roughness on stain resistance of dental resin composites. J Esthet Restor Dent 2005;17: 102-8.

[2] Hotta M., Hirukawa, H., Aono,M.: The effect of glaze on restorative glass-ionomer cements. J Oral Rehabil 1995; 22: 197-201