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COMMENTARY

WEAR RESISTANCE OF PACKABLE RESIN COMPOSITES AFTER SIMULATED TOOTHBRUSHING TEST

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This study evaluated the effect of toothbrushing on material loss and surface roughness of five packable composites (Filtek P60, SureFil, Solitaire, Alert, Prodigy Condensable), one microhybrid composite (Z100), and one microfilled composite (Silux Plus). This was an interesting study because dental researchers and clinicians tend to concentrate on occlusal wear, forgetting that toothbrushing may contribute to overall material loss, rendering the surface rougher and more plaque retentive. The investigators fabricated composite disks in a mold, immediately polished them with the Sof-Lex disk system, and then stored them for 2 weeks to allow water absorption to occur. Once the weight of the specimens had stabilized, the specimens were weighed and surface roughness was assessed. They were then subjected to 100,000 strokes with a soft, nylon-bristled toothbrush at a constant load while immersed in a slurry of water and dentifrice. Subsequently, the specimens were reassessed for weight and surface roughness.

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A challenge in this type of research is assessing the weight of the specimens. Composites absorb and lose moisture, affecting the weight of the specimens. The authors took precautions to account for this by soaking the specimens for 2 weeks prior to initiating weighing of the specimens and by maintaining them in a moist environment throughout the duration of the study. However, since the specimen weight must be determined to a level of accuracy of 0.0001 g, very small changes in moisture level can have a significant impact on the results, and the reader should bear this in mind.

Not surprisingly, the investigators found that all specimens were significantly lighter after toothbrushing. However, only three of the composites (SureFil, P60, Silux Plus) were significantly rougher. There was no correlation between surface roughness and weight loss. These results are interesting from several standpoints.

First, one of the often-touted advantages of microfilled composites is that they maintain their surface smoothness while in service. However, the microfilled composite evaluated in this study (Silux Plus) became rougher. From the appearance of the scanning electron micrographs provided in the article, it would seem that the roughness was a result of filler particle plucking. This is likely due to the loss of the prepolymerized, so-called "organic filler" particles incorporated into the material. Since these filler particles have been thoroughly cured prior to being ground up and incorporated into the resin, there are relatively few carbon double bonds available to react during the polymerization of the composite. As a result, these particles may not be well bonded to the set composite, which may render them more prone to "plucking" under function.

Another interesting finding was that one composite (Filtek P60) became significantly rougher from toothbrushing, whereas two others (Z100 and Prodigy Condensable) did not, despite the fact that all three are listed as having identical average filler particle size and very similar filler loading by weight. This points out the importance of factors other than average filler particle size in determining wear resistance and surface smoothness. One of the most important is filler particle size distribution since the surface smoothness is determined by the largest particles present, not the average particle size, within the composite. Unfortunately, these data are not reported in the study. Another factor to consider is filler load by volume since this gives a better idea as to how much of the surface area is taken up by filler particles versus resin. In this regard, Filtek P60 is the lowest of the three, albeit only fractionally so compared with Prodigy Condensable. A final consideration is the resin matrix, which is different among the three, with P60 being the only one containing bisphenol A polyethylene glycol diether dimethacrylate and urethane dimethacrylate.

This research points out the multifactorial nature of composite wear. Varying factors can account for material loss and surface roughness, only a few of which are mentioned in this commentary. Other factors, some of which are brought up by the authors, include toothbrush stiffness and composition, dentifrice characteristics, and composite particle hardness. An additional conclusion of this study made by the authors deserves to be emphasized. That is, packable composites do not provide superior performance over other types of restorative composites (hybrid, minifilled, midifilled, microhybrid, microfilled). The choice to use a packable composite should be made on the basis of handling characteristics and not on the perception of improved performance.