

## INTRODUCTION

One of the goals of composite resin restorations is to mimic the tooth itself. In addition to biological function, it is also important that the restoration appear esthetically like the tooth so that it appears invisible. Aside from shade matching, translucency, etc. it is important that the restoration also appear shiny as the tooth itself.

In this study, the surface luster, after long-term toothbrushing, of an improved experimental direct resin, Kerr Experimental (KE), was compared to several existing direct resins of known clinical luster. The KE is an experimental hybrid composite containing submicron structural filler 0.4  $\mu$  av. and discrete Silica nanoparticles, 50 nm av. The existing materials evaluated were Prodigy Point 4 Enamel (P4E), Filtek Supreme Enamel (FSE), and Heliomolar (HM).

## OBJECTIVE

The purpose of this study is to compare the surface luster, after long-term toothbrushing, of an improved experimental small particle hybrid direct filling resin to several existing hybrid and microfill resins of known clinical luster.

## MATERIALS

Kerr Experimental (KE), LN: 329VB46B, Kerr Corp.  
 Point 4™ Enamel(P4E), LN: 212-820, Kerr Corp.  
 Filtek Supreme Enamel (FSE), LN: 2AA, 3M Corp.  
 Heliomolar™ (HM), LN:919-965, Ivoclar Corp.

## METHOD

A new improved hybrid direct composite, Kerr Experimental (KE) was tested for surface luster under toothbrush wear and compared with existing direct composites of known clinical luster. The existing products were Point 4™ Enamel (P4E), a microhybrid composite, Filtek Supreme Enamel (FSE), a nanoparticle composite and Heliomolar (HM), a microfill composite (control). The toothbrush method of testing and gloss measurements were previously described in abst. # 2690, J. Dent. Res. V. 81, Special Issue, March 2002. The equilibrium gloss of three samples of each material are reported after 15 hrs. of automatic toothbrushing with dentifrice. The means and s.d. were calculated and anova analysis ( $p < 0.05$ ) of the data was performed to determine significant differences between the means.

## RESULTS

Material	KE	P4E	FSE	HM
Initial Gloss [ I ], (%)	72.3 (2.3)	65.1 (1.5)	82.3 (0.6)	71.1 (2.1)
Equi. Gloss [ a ], (%)	51.7 (3.2) <sup>a</sup>	51.6 (1.5) <sup>a</sup>	21.5 (1.8) <sup>c</sup>	40.5 (3.8) <sup>b</sup>



Figure 1a: Surface gloss under 60° reflected light, KE vs. P4E.



Figure 1b: Surface gloss under 60° reflected light, KE vs. HM.

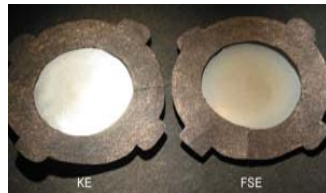


Figure 1c: Surface gloss under 60° reflected light, KE vs. FSE.



Figure 2: Toothbrush-Wear Apparatus

## DISCUSSION

Hybrid composite resin restorations tend to lose their luster over time in clinical service. The mechanism is believed to be due to wear of the surface of the restoration by mastication of food or by toothbrushing. Wear exposes filler particles on the surface of the restoration allowing diffuse interaction of light with the exposed particles.

In this study, the surface luster, after long-term toothbrushing of an improved experimental direct composite resin, Kerr Experimental (KE), was compared to existing resins of known clinical luster. KE is an experimental microhybrid resin which contains fillers that are approximately 67% particulate filler, 0.4 microns average, along with 33% discrete Silica nanoparticles, 50 nanometers average. The particle sizes are below the wavelength of visible light, minimizing the interaction with light and resulting in a high surface luster. Point 4™ Enamel (P4E), is also a microhybrid resin with particles 0.4 microns average, but does not contain discrete nanoparticles. Filtek Supreme™ Enamel (FSE), is a nanoparticle resin, which also contains nanoparticle clusters. Heliomolar™ (HM), is a microfill resin with established clinical luster (control).

The surface gloss as a function of toothbrushing time follows the equation:  $Y = a + be^{-x}$ , where [ Y ] = 60 ° Gloss (%), [ a ] = Equilibrium Gloss (%), [ b ] = constant and [ x ] = Time (hrs.)<sup>1</sup>. The initial gloss, [ I ], (%), after 2 weeks storage in 37°C water and equilibrium gloss, [ a ], (%) after 15 hrs. toothbrushing are reported in the table.

In the attached table, the Equilibrium Gloss of KE was 51.7% vs. 51.6% for P4E. Both materials showed high gloss and were not significantly different (Fig. 1a). The equilibrium gloss of HM was 40.5% (fig. 1b) and 21.5% for FSE (Fig. 1c). Both HM and FSE had significantly lower gloss than KE and P4E. FSE was significantly lower in gloss than HM. Visually, HM may also be described as a glossy surface, whereas FSE was a matte surface.

The high gloss surfaces of KE, P4E and HM help confirm the theory of light interaction on exposed filler particles of a resin restorative. All have an average filler particle size below the wavelength of visible light and consequently remain shiny over time. HM and P4E have been reported to remain shiny over time. FSE is reported to be a nanoparticle resin, but contain large clusters. Exposure of large cluster particles may be a reason that FSE results in a matte finish.

## CONCLUSION

Direct composite resins containing discrete nanoparticles and/or hybrid filler of particle size below the wavelength of visible light, retain high surface gloss after long-term toothbrush wear.

## REFERENCES

1. J. Cruz, V. Bui, A. Kobashigawa and E. Shellard: "Surface Luster of Indirect Composite Resins after Toothbrush Wear."; Abst. # 2690, J. Dent. Res. V. 81, Special Issue A, March 2002.