#2609

Surface roughness of micro-hybrid composite using various polishing systems

STEINMETZ C., MARGUIER A., JACOMINE L., LEMOY C., GAUTHIER C., PLOUX L., ETIENNE O.
Dental Faculty – University of Strasbourg - STRASBOURG - FRANCE

Introduction:

Achieving the smoothest surface roughness of resin-based composites is a primary challenge for their clinical success. In particular, the roughness is known to positively enhance the bacterial adhesion. Thereby the purpose of polishing procedures is to decrease surface roughness in order to enhance aesthetics and longevity of resin-based composites.

In fact, polishing system's efficiency depends on the hardness and size of the abrasive particles but also on the method of abrasion (discs, wheels, pastes, 1-step or 2-steps polishers). However no solid evidence has been found to state which polisher is the best, because composite' polishing ability varies according to their composition and the polishing system used. Among others, the quality of the surface finish and polish can be characterized by the measurement of the surface roughness using a profilometer.

Objective :

To evaluate the effects of seven different polishing systems, from simplest to most complex, on the final roughness of a microhybrid composite

Material and methods :

1

Table 1 : composition of G-Aenial anterior, GC

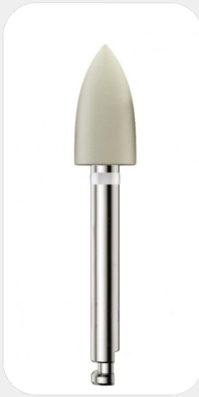
	Classification	Resin	Fillers	Particles size	Fraction of fillers
G-aenial anterior (GC)	Micro-hybrid	UDMA without Bis-GMA	Prepolymerized fillers Silica glass Pyrogenic silica	16 – 17 µm 850 nm 16 nm	76 (% weight)

Six commercial polishing systems from different manufacturers were tested on a micro-hybrid composite. Forty-two discs of the microhybrid composite (G-aenial Anterior, GC, Belgium) were made in a metallic mold, light-cured between plates of glasses and randomly divided into seven groups (n=6).

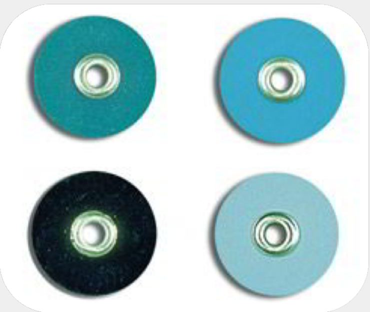
2

Silicon carbide papers
(grid P120,P320,P600)

KompoLine
(Komet)



Maximus
(Kenda)



Sof-Lex
(3M ESPE)

CompoSystem
(Komet)

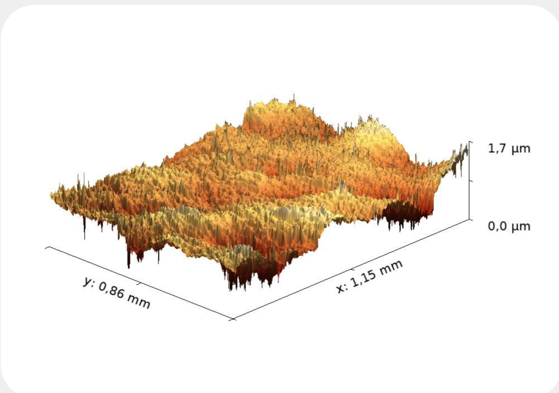
Enamel Plus Shiny
(Micerium)

Twist Dia
(Kuraray)

All specimens were first roughened by silicon carbide papers (grid P120, P320, P600) on a polishing machine. According to publications, P600 grit paper is similar to a finish step using a fine diamond bur (25 µm).

Then, six groups of samples (n=6) were each one finished with a different polishing system, according to manufacturers' recommendations. Six samples were kept as a group control after being polished by silicon carbide papers for later comparisons.

3



The average surface roughness (Ra) was characterized by a 3D optical microscope based on white light interferometry (WLI). Three random measurements were made on each disc prior to their analyze using Vision® and Gwyddion® softwares.

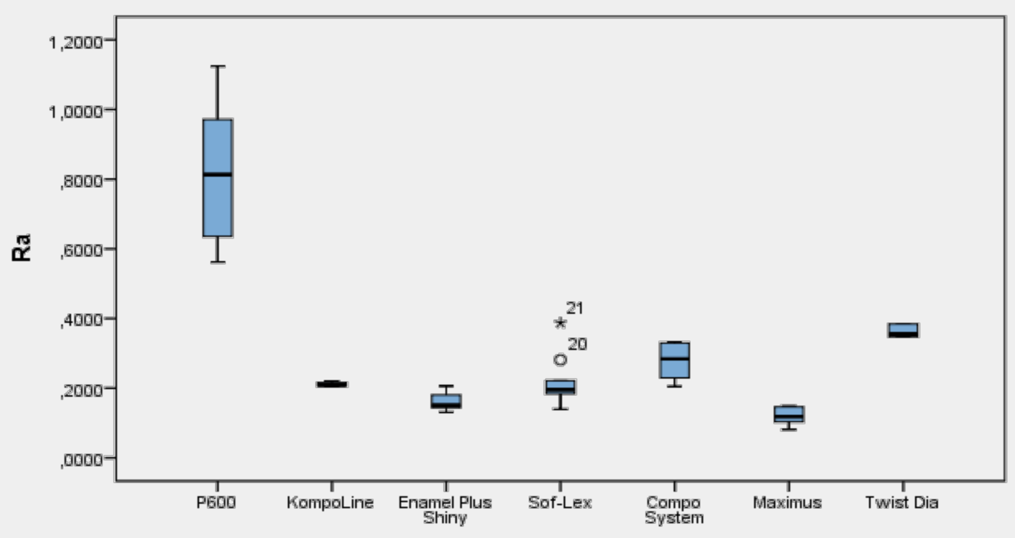
Results:

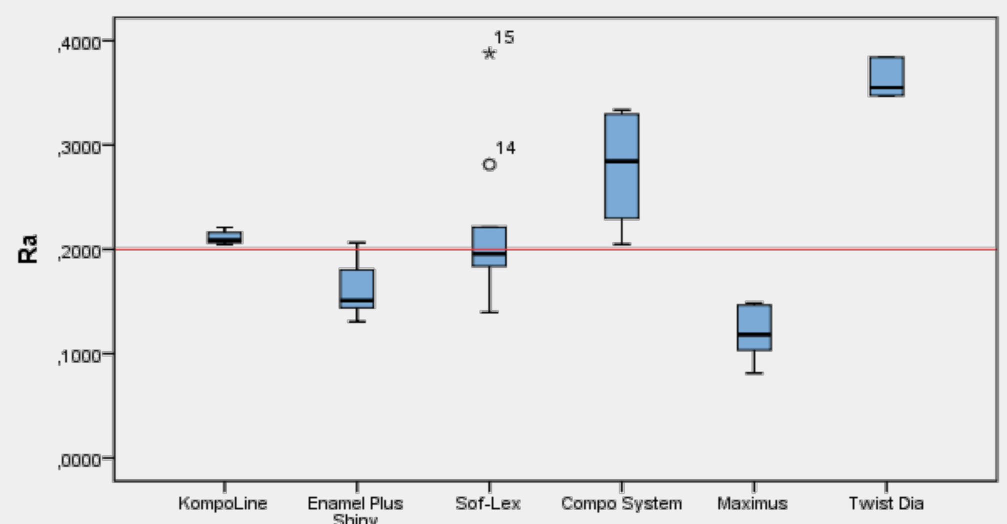
Non-parametrical univariate analysis of variance : Kruskal Wallis test

Table 1 : distribution of Ra values for each polishing system (µm)

	Mean	Std deviation	Minimum	Maximum	Median
Silicon carbide papers (P600)	0.82	0.22	0.56	1.12	0.81
KompoLine	0.21	0.01	0.20	0.22	0.21
Enamel Plus Shiny	0.16	0.03	0.13	0.21	0.15
Sof-Lex	0.22	0.08	0.14	0.39	0.20
CompoSystem	0.28	0.05	0.20	0.33	0.28
Maximus	0.12	0.03	0.08	0.15	0.12
Twist Dia	0.36	0.02	0.35	0.38	0.36

Figure 1 & 2 : Boxplots for distribution of Ra values with and without P600 group (µm)





The surfaces polished by Maximus, Enamel Plus Shiny kit and Sof-Lex discs were significantly smoother (p<0.5) than surfaces polished by the silicon carbide paper P600, and were measured below the Ra threshold of 0.2 µm. Maximus and Enamel Plus Shiny kit produced significantly smoother surfaces than the Twist Dia wheel system (p<0.5). The average surface roughness of samples polished by the 3-steps CompoSystem discs and 2-steps Kompoline system were not statistically different (p>0.5).

Conclusions:

In our study, the microhybrid composite G-aenial Anterior was best polished with the 1-step system Maximus (Kenda), Enamel Plus Shiny kit (Micerium) and Sof-Lex discs (3M Espe). The roughest surfaces after polishing were obtained when using rubber wheels. Interestingly, the smoothest surfaces were equally obtained with the simplest and the most complex polishing systems tested.

- Anusavice K., Shen C., Rawls H., *Philips' science of dental materials*. 12 ed. St. Louis: Saunders; 2013. 571 p.
- Jefferies S.R., *Abrasive finishing and polishing in restorative dentistry: a state-of-the-art review*. Dent Clin North Am. 2007; 51(2): 379-97, ix.
- Kaizer M.R.,et al., *Do nanofill or submicron composites show improved smoothness and gloss? A systematic review of in vitro studies*. Dent Mater. 2014; 30(4): e41-78.
- Berthault G, et al., *Les nouveaux composites : évaluation et intérêts cliniques pour les restaurations en technique directe*. Revue d'odonto-stomatologie. 2008; 37: 177-97.
- Bollen C., Lambrechts P., Quirynen M., *Comparison of surface roughness of oral hard materials to the threshold surface roughness for bacterial plaque retention: a review of the literature*. Dent Mater. 1997; 13(4): 258-69.

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