COMPARISON OF SURFACE SMOOTHNESS, POST POLISHING OF VARIOUS HYBRID COMPOSITES AT VARIOUS PRICE POINTS. AN IN-VITRO STUDY.

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1. Introduction:

The properties of the surface of dental restorations are considered one of the important properties in dental restorations. The surface properties like surface roughness or smoothness are factors that influence the appearance and plaque retention of the restoration which affects the overall success of the restoration(Yuan et al. 2016). There is literature that states that the surface qualities of composite restorations depend on the composition of the material, instrument used and operator skill(Jung et al. 2007; Watanabe et al. 2006; Zimmerli et al. 2011)

Resin-based composite that is constituted of resin matrix and filler particles is a very commonly used direct restorative material. The Filler particles present within these composite has a significant influence over the final outcome of finishing and polishing of these composites(Chiang et al. 2016). Usually, the finer filler sized composites after completing finishing and polishing show a smoother surfaces(Antonson et al. 2011).

The surface roughness of various composite micro-hybrid systems is needed for clinical practice. With new, up in coming composites in the market, it is needed for there to be an ability for clinicians to distinguish between these various products. These composites also are made available in the market at various price points stating various physical properties. This leads to a scenario where the composite material with the best physical properties, i.e., surface roughness needs to be as economically sustainable to the dentist and patient as possible without compromising on its physical qualities.
Coltene has claimed that through internal data that its line of sub-micron hybrid composites show the lowest surface roughness post-polishing, compared to various companies. Its methods of polish in its study was also not clinically relevant. There may also be bias present within the study that needs to be addressed.

2. Materials and methodology:

The composites used in this study include Mani Micro (Mani Inc.,Japan), Tetric Te Econom (Ivoclar Vivadent AG, Liechtenstein), Tetric EvoCeram (Ivoclar Vivadent AG, Liechtenstein) and Coltene Brilliant EverGlow (COLTENE Group, Altstatten, Switzerland). Details given in Table1. The Sof-lex abrasive diskpolishing system was used (3M ESPE, MN, USA). Details given in table 2.

Table a Composites used in study

Material	Abbreviation	Classification	Composition	Filler Ratio (wt%/vol%)	Manufacture
Coltene Brilliant Everglow	CBE	Sub-Microhybrid	Methacrylates, Photoinitiators, Ethanol, Water		Coltene
Tetric EvoCeram	TEC	Nanohybrid	Dimethacrylate, barium glass,ytterbium fluride, oxides mixture, prepolimer	75-76/53-55	Ivoclar vivodent
Mani Micro	MM	Microhybrid	Glass powder, diurethane dimethacrylate, silicon dioxide, Bis-GMA, Tetramethylene dimethacrylate	75/53	Mani Inc

Tetric Te Econom	TTE	Microhybrid	arium glass, ytterbium trifluoride, mixed oxide and copolymers	76/60	Ivoclar vivodent

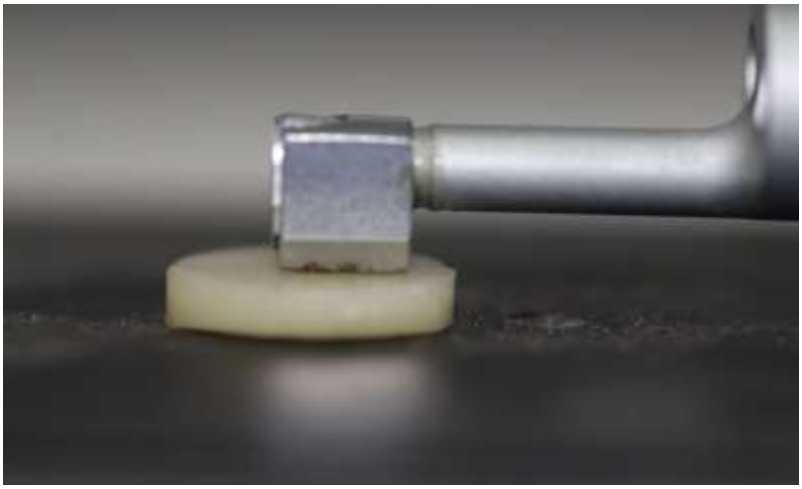
Table b Polishing System used in study

Polising Systems	Average Particle Size
SofLex Red (aluminum oxide)	60 micro metres (electrostatically coated)
SofLexMedium orange (aluminum oxide)	30 micro metres (electrostatically coated)
SofLex Light orange (aluminum oxide)	30 micro metres (slurry coated)
SofLex Yellow (aluminum oxide)	3 micro metres

Specimen preparation:

Each composite sample was placed in a stainless-steel mould (8mm diameter, 2mm thickness) and packed against a mylar matrix strip sandwiched between a glass slab. The samples were light cured for 60 seconds totally, with 30 seconds on each side with

All samples were light cured for 60s in total with each side being cured for a 30s duration with DTE O-Light Plus Light Cure Unit (Guilin Woodpecker, China). Ten samples were prepared per group: Group CBE (Coltene Brilliant Everglow), Group TTE (Tetric Te Econom), Group MM (Mani Micro) and Group TEC (Tetric EvoCeram). Samples with visible voids were discarded. All samples were then stored in distilled water at 37 degrees C for 24 h



Finishing and polishing procedures:
With the Sof-Lex discs (four-step procedure), each group was polished: The medium (red) disc was applied for 20 seconds, washed, and dried with an air/water syringe for a total of 10 seconds in Step 1, the course (dark orange) disc was used in Step 2 the medium grit was applied for 20 seconds before being rinsed and dried with an air/water syringe for a total of 10 seconds. The fine (light orange) disc was applied in Step 3, washed for 20 seconds, and then dried for a total of 6 seconds using an air/water syringe. Step 4, a superfine (yellow disc) was used for 20 seconds before being rinsed and dried for a total of 6 seconds with an air/water syringe.All preparations were performed by one operator. Polishing disks were used using light hand pressure. Polishing disks were replaced after use on each sample. Samples were cleaned with distilled water and air dried before starting the next finishing and polishing step(Zhang et al. 2021).

Surface roughness measurement:

Multiple Comparisons
Dependent Variable: Surface Roughness
Tukey HSD

(I) GROUP	(J) GROUP	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
coltene brilliant everglow	tetric T Economy	-.299	.372	.852	-1.36	.76
	mani micro	-1.267*	.372	.017	-2.33	-.20
	Tetric evocream	.015	.372	1.000	-1.05	1.08
tetric T Economy	coltene brilliant everglow	.299	.372	.852	-.76	1.36
	mani micro	-.968	.372	.081	-2.03	.10
	Tetric evocream	.313	.372	.833	-.75	1.38
mani micro	coltene brilliant everglow	1.267*	.372	.017	.20	2.33
	tetric T Economy	.968	.372	.081	-.10	2.03
	Tetric evocream	1.281*	.372	.016	.22	2.34
Tetric evocream	coltene brilliant everglow	-.015	.372	1.000	-1.08	1.05
	tetric T Economy	-.313	.372	.833	-1.38	.75
	mani micro	-1.281*	.372	.016	-2.34	-.22
*. The mean difference is significant at the 0.05 level.						

A surface profilometer (Surttest SJ-210 Portable Surface Roughness Tester, Mitutoyo America Corporation) was used to measure the surface roughness. The stress force was 0.75 mN, the standard cutoff was 1.0 mm, the transverse length was 0.8 mm, the amplitude height was 2.5 mm, and the stylus speed was 0.5 mm/s. For each specimen, two perpendicular measures of surface roughness were taken, and the average of these numbers was used.

3. Result:

ANOVA					
Surface Roughness					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.464	3	1.821	5.274	.010
Within Groups	5.526	16	.345		
Total	10.990	19			

Surface Roughness			
Tukey HSD[a]			
GROUP	N	Subset for alpha = 0.05	
		1	2
Tetric evocream	20	.16	
coltene brilliant everglow	20	.18	
tetric T Economy	20	.48	.48
mani micro	20		1.45
Sig.		.833	.081
Means for groups in homogeneous subsets are displayed.			
a. Uses Harmonic Mean Sample Size = 5.000.			

4. Discussion:

Current composites can be polished to be comparable in surface smoothness to unpolished tooth enamel which usually has a surface roughness Ra of 0.20 to 0.23. Composite values in line with other studies comparing similar parameters. Barbosa SH et al stated similar results in 2017 using similar composites.

Form the results it can be assumed that Nano and Sub Micron hybrid composites such as the coltene Brilliant Everglow and Tetric Evo Ceram show greater polishability as compared to micro hybrid comosites.

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