ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 12 | December - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

SURFACE SMOOTHNESS OF A SELF-POLISHING COMPOSITE WITH TWO DIFFERENT POLISHING SYSTEMS

Dentistry

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ABSTRACT

Aim: To determine the surface smoothness of a self-polishing composite, Solare Sculpt using two polishing systems. **Methodology:** Thirty composite discs of Solar Sculpt, a nanohybrid composite were prepared and allocated into three groups consisting of ten specimens for each group. Group A (control group) consisted of specimens which did not receive finishing and polishing. Group B and group C specimens were finished and polished using SofLex and SuperSnap respectively. Surface roughness (Ra) was estimated by using profilometer, and results were analyzed by one-way ANOVA and Tukey's multiple post hoc analysis. **Results:** Polishing with SofLex discs resulted in a mean surface roughness, Ra of 0.54 and Super Snap discs resulted 0.80. The unpolished group exhibited highest surface roughness and SofLex polishing system resulted in significantly smoother surface than Super Snap polishing system. **Conclusion:** SofLex group exhibited best polish when compared with Super Snap. Both polishing systems resulted in a significant improvement in surface smoothness of nanohybrid composite.

KEYWORDS

nanohybrid composite, polishing ability, SofLex, Super Snap

INTRODUCTION

The quest for esthetics in dentistry has led to the evolution of newer dental materials. There has been extensive research in the field of esthetic dentistry which has resulted in the introduction of improved restorative material. Composite resins have been the preferred choice due to their simplicity in fabrication. Nanohybrid resins had shown good clinical performance in terms of esthetics and reasonable mechanical properties [1,2,3].

A nanohybrid resin composite, Solare Sculpt was introduced which was claimed to have self-polishing ability. Earlier literature [4, 5] suggested that it exhibited adequate physical properties and clinical performance though there was no adequate literature regarding its polishing ability.

Surface smoothness is important for any restoration as rougher surfaces collect plaque and catch stains easily. This may result in secondary caries and surface discoloration [6,7,8]. Resin composite cured against mylar matrix exhibits a smoother surface. However, it leaves a resin rich surface layer that can be easily abraded in the oral environment exposing the filler particles resulting in a rougher surface. Thus, the restoration surface should be finished and polished to remove the resin rich layer and to attain a smooth and lustrous surface. Several polishing systems are available for the finishing and polishing of composite resins [9]. There are multi-step and single-step polishing systems. Earlier evidence [10, 11] revealed that multi-step polishing systems resulted in smoother surface than single-step polishing systems, but they require more time.

Of the multi-step polishing systems, Soflex is the most used polishing system which consists of discs coated with aluminium oxide particles [12, 13, 14, 15]. Few polishing systems contain silicon carbide particles impregnated on their disc. Polishing systems like Super Snap contain both types of particles. Coarse and medium discs are coated with silicon carbide whereas fine and superfine discs are coated with aluminium oxide particles [16]. Earlier researchers compared the efficacy of these two polishing systems on other nanohybrid composites [17, 18]. There were no studies reported yet regarding the polishing ability of the self-polishing composite, Solare Sculpt by using various polishing systems. Thus, the aim of this study was to determine the surface smoothness of Solare Sculpt when polished with multi-step polishing systems, SofLex and Super Snap.

MATERIALS AND METHODS

Thirty specimens of nanohybrid composite (Solare Sculpt, GC Ltd., GC India) were fabricated by using 3 mm thick and 10 mm diameter stainless steel metal molds. The composite was inserted into the mold in two 1.5 mm thick increments using a modeling instrument (OptraSculpt, Ivoclar Vivadent) to contour the material. Later the resin composite was light cured with Blue Phase C8 LED light curing unit (Ivoclar Vivadent, Schaan, Liechtenstein, UK). The resin composite was manipulated according to the manufacturer's instructions. A calibrated radiometer (Blue phase, Ivoclar Vivadent, Schaan Liechtenstein) was employed to verify the efficacy of light curing unit. The distance between the light source and the composite increment was standardized by placing curing light tip perpendicular to the mold surface at 1 mm from the surface of the increment. Later, the specimens were allocated into three groups.

The specimens were then transferred from the 10mm diameter and 3mm thick cylindrical metallic molds to the 10mm diameter and 2.5mm thick cylindrical metallic molds. Thus, the specimen surface was exposed for polishing the specimen. Each specimen was polished with a multi-step polishing system, SofLex (3M ESPE, St.Paul, MN, USA) in a sequential manner. The polishing procedure was standardised by applying light pressure for 15 seconds at 15,000 rpm using a Micromotor (Marathon, Saeyang Microtech, Korea) and slow speed contra-angle handpiece (NSK, Japan). To reduce variability, all specimen preparations and finishing and polishing procedures were performed by a single operator.

Group 3 specimens received polishing with Super Snap polishing system. A four-step procedure was used to polish the composite discs in a sequential manner. Initially coarse black discs were used with light pressure at 12000 rpm. It was followed by medium (violet), fine (green) and superfine (red) discs.

Table 1: Surface Roughness (Ra) Values Of Control And Test Groups

Groups	Group A (Control)	Group B (SofLex)	Group C (Super Snap)
Mean Ra	1.35^{A}	0.54^{B}	0.80^{C}
SD	0.22	0.10	0.24

*Values with different superscript alphabets indicate statistically significant difference in rows.

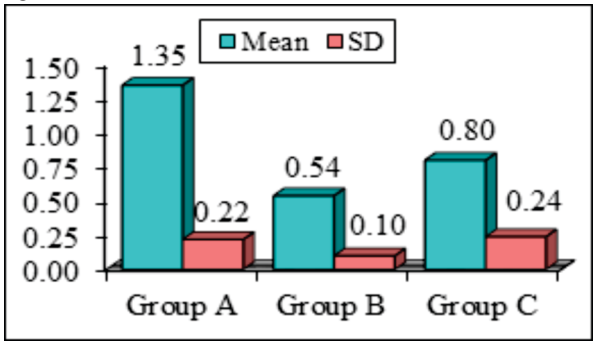

Figure 1: Comparison of three study groups (A, B, C) with mean surface roughness (in µm) on Y axis

RESULTS

The mean surface roughness (Ra) values are depicted in table 1. The control group which consisted of unfinished and unpolished samples exhibited the highest surface roughness. Bar graph (figure 1) reveals that group C (Super Snap group) exhibited higher surface roughness than group B (Sof-Lex group). There was a significant difference between the groups when One-way ANOVA was performed for statistical Analysis. Tukey's post hoc analysis revealed that the difference between all the groups was statistically significant. It can be interpreted as Sof-Lex polishing system provided significantly better smoothness than Super-Snap polishing system. The standard deviation in Sof-Lex group was lower than that of Super Snap which shows the reliability of its polishing performance.

DISCUSSION

Surface quality of a restoration is critical for its longevity and aesthetic appearance. Rougher surfaces possess high surface energy that attract plaque accumulation and surface discoloration. Plaque accumulation at margins may lead to marginal discoloration, recurrent caries, and pulpal involvement. It also may lead to tooth discoloration and gingival inflammation.

Various factors affecting the polishability of a resin composite are heterogeneity of the material, filler type, content, particle size, polishing medium, time and polishing technique [10, 19]. Composite restoration surface polymerized against the mylar matrix results in highest surface smoothness due to resin impregnation, but it is more susceptible to staining due to its high organic content. This layer should be removed completely for restoration's longevity as it causes unwanted residual stress and deformation [20, 21]. Hence, there was no group where composite was cured against mylar matrix which contains resin rich zone in this study. Another reason for not using mylar matrix is lack of feasibility of its use in all clinical situations. The control group consisted of unpolished specimens as the objective of the study is to determine the effect of polishing system on nanohybrid resin [22].

Solare sculpt is a nanohybrid containing fillers that impart self-polishing ability to the composite. Smoother surfaces will not allow plaque collection. Shintani et al.[21] reported an imperceptible difference in plaque accumulation on polished surfaces when Ra values range between 0.7µm and 1.4µm. Thus, the surface roughness of restorations should not exceed 1.4µm to prevent bacterial accumulation.

Statistical analysis of the experiment revealed that both polishing systems performed significantly well. The test group polished with Sof-Lex polishing system exhibited lower surface roughness than the group polished with Super Snap. This is in accordance with earlier studies conducted on nanohybrid composites [16, 18, 22, 23]. Of these, few studies [18,23] tested the polishability of hybrid composites whereas others [16, 22] tested polishability of different types of composites (nanocomposites and microfilled composites) along with nanohybrids.

The results of this study are in contrast with few earlier studies where Super-Snap has exhibited better polishing ability than Sof-Lex. Uppal et al [24] studied the Filtek Z 250XT nanohybrid which contains BIS-EMA and PEGDMA additionally in its matrix and nano zirconia and nano silica particles as fillers. Solare sculpt composite contains Bis-GMA, Bis-MEPP, UDMA and TEGDMA as matrix and 300nm strontium glass fillers. In another study [25], polishing systems were compared by using IPS Empress Direct which contains dimethacrylate as matrix; 400nm Barium glass and Ba-Al-fluorosilicate glass particles as fillers. Thus, the contradictory result could be due to the differences in composition of the composites.

CONCLUSION

Self-polishing nanohybrid composite requires additional polishing steps to achieve optimal smoothness. SofLex polishing system produced superior smoothness than SuperSnap.

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