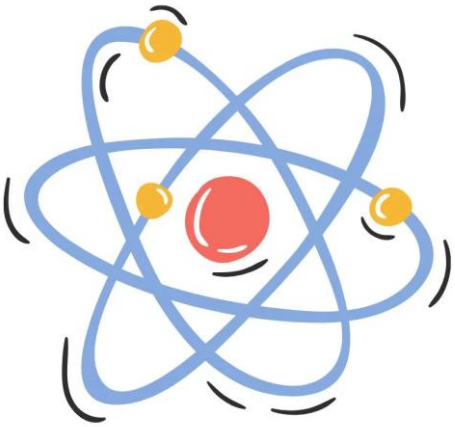

JOURNAL OF DYNAMICS AND CONTROL

VOLUME 8 ISSUE 12

GLOSS GOALS: COMPARING SMOOTHNESS IN RESIN COMPOSITE DENTISTRY

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ABSTRACT: AIM: This study aimed to investigate and compare the surface roughness of composite restorative materials after finishing and polishing. **Objectives:** 1. To evaluate the surface roughness of different composite restorative materials after finishing and polishing. 2. To compare the surface roughness of different composite restorative material after finishing and polishing. **Materials and Methods:** Data were collected from 100 samples at the Department of Conservative Dentistry and Endodontics, Seema Dental College and Hospital, Rishikesh, Uttarakhand, over a four-month period. Specimens were prepared using metallic molds, resulting in two groups of 50 samples each. **Results:** The intergroup comparison of surface roughness between two resin-based composites revealed a significant difference ($p < 0.05$), with Te-Economic Plus showing higher roughness compared to D-Tech Compomax, based on independent t-tests of 50 samples per group. **Conclusion:** The study found that filler composition and matrix structure significantly affect the surface roughness of composite restorations. D-Tech Compomax exhibited smoother surfaces than Te-Economic Plus, highlighting the importance of material selection and polishing techniques in improving restoration quality. Further clinical studies are needed for validation.

Keywords: resin-based composite materials, metallic molds, glass slabs, transparent mylar strips, a light cure unit, a finishing kit, an incubator, and a profilometer.

INTRODUCTION

Achieving esthetically pleasing and durable restorations remains a key objective in modern dentistry. Composite resins, first introduced over 50 years ago, have become a popular choice due to their aesthetic appeal and functional benefits.[1]

However, challenges such as surface roughness and wear continue to impact their long-term success. Recent advancements in nanotechnology have introduced new-generation composite resins that promise better color matching and enhanced mechanical strength. These include nanofill and nanohybrid composites, which offer improved properties, yet their performance still heavily relies on effective finishing and polishing techniques.[2,3]

Polishing is crucial because it directly influences the surface smoothness of restorations. A smooth surface reduces plaque accumulation, bacterial adhesion, and enhances the overall aesthetic outcome. Additionally, surface roughness,

which ideally should be less than 0.2 µm, plays a key role in preventing plaque retention and reducing the risk of secondary caries.[4,5] The choice of polishing system—whether silicone discs, tungsten carbide burs, or diamond pastes—can result in varying degrees of surface smoothness, ultimately affecting the material's appearance and longevity.[5,6]

The timing of polishing procedures also impacts the final surface characteristics. Immediate finishing, for example, can lead to heat generation, potentially affecting the material's surface integrity.[7,8] Recent studies have examined various polishing systems and their effects on the surface properties of composite resins. However, the variation in results underscores the need for ongoing research to identify the most effective polishing methods for different composite materials.[9,10]

This study aims to evaluate the impact of finishing and polishing techniques on the surface roughness of composite resins. By examining these factors, the study seeks to provide guidelines for achieving optimal esthetics and durability in dental restorations.

Materials and Method:

The specimens were prepared in the Department of Conservative Dentistry and Endodontics, Seema Dental College and Hospital. Two commercially available posterior composite restorative materials, D-Tech Compomax and Te-Economic Plus, were tested. These materials were divided into two groups, A and B, with 50 samples in each group.

Specimens were standardized using metallic molds with dimensions of 9×3.5 mm. To obtain flat surfaces free of defects or entrapped air, the specimens were prepared on a glass slab covered with a transparent Mylar strip and a glass slide. The restorative material was placed in a single increment into the mold using a hand instrument. Another Mylar strip was placed over the filled mold, and a glass slide was gently pressed against it to expel excess material.

Each specimen was light-cured for 30 seconds using a light cure unit calibrated at 1000 mW/cm². The tip of the curing unit was standardized at a 1 mm distance from the specimen by placing it in direct contact with the glass slide.

The specimens were finished and polished using a standardized finishing kit. Discs were discarded after a single use. Between polishing steps, all specimens were rinsed with water and air-dried thoroughly. Final polishing was completed,

and all specimens were stored at 37°C with 100% relative humidity for 24 hours to simulate clinical conditions.

A single operator performed all polishing treatments to ensure consistency. Care was taken to achieve flat, polished surfaces. Surface roughness was measured using a profilometer at three distinct points on each specimen: one at the center, one at the periphery, and one midway between these points. The average roughness value (Ra, μm) was recorded.

The data were analyzed statistically. Normal distribution was confirmed using the Shapiro-Wilk test. Intergroup comparisons were conducted using the independent t-test, with statistical significance set at $P \leq 0.05$.

Result:

The surface roughness (Ra) of the two composite materials was measured after standardized finishing and polishing procedures. D-Tech Compomax displayed lower mean roughness values compared to Te-Economic Plus, indicating a smoother surface finish.

Statistical analysis supported these findings. The Shapiro-Wilk test confirmed that the data followed a normal distribution, allowing the independent t-test to be applied. The results of the t-test revealed a statistically significant difference between the two groups ($p < 0.05$), with D-Tech Compomax showing superior surface smoothness.

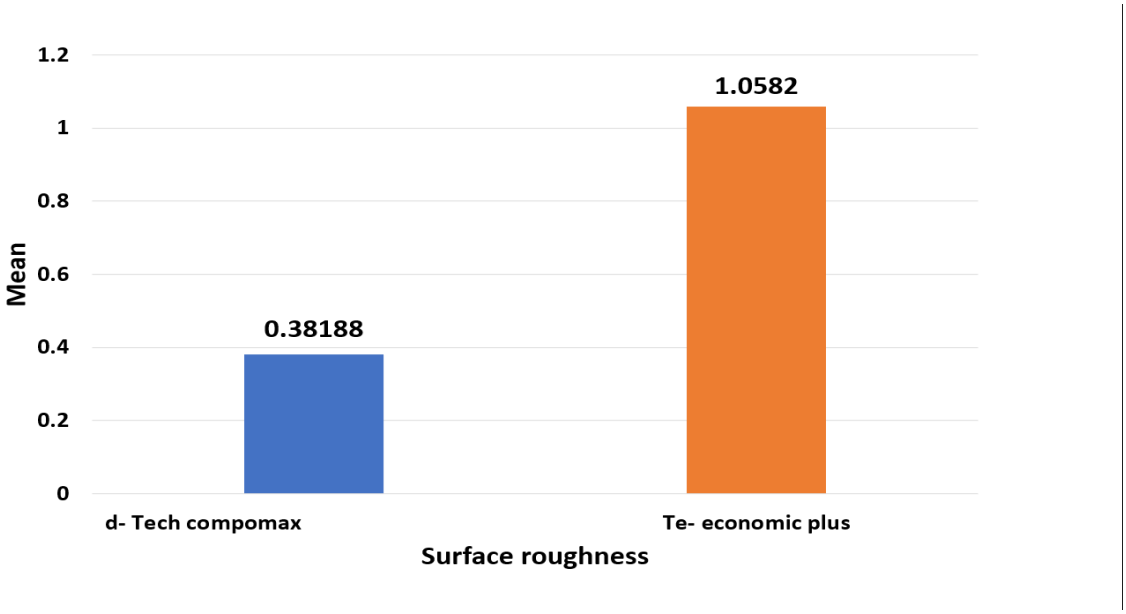
Table 1 summarizes the mean, standard deviation, and standard error of the Ra values for both materials. Graph 1 visually illustrates the comparative surface roughness, emphasizing the smoother finish achieved with D-Tech Compomax. These findings underscore the impact of material composition on the effectiveness of finishing and polishing protocols.

Table 1

Mean, SD, SE of Ra values in Two groups

		N	Mean	Std. Deviation	Std. Error Mean
Surface roughness	d- Tech compomax	25	.38188	.105678	.021136
	Te- economic plus	25	1.05820	.549689	.109938
t value					-6.04
P value					0.001

Table 2



DISCUSSION

In restorative dentistry, the completion of finishing and polishing procedures was essential to achieve the desired anatomical and morphological integrity of the tooth, ensuring both clinical durability and aesthetic appeal.[11] These procedures enhanced the optical compatibility of restorations with natural enamel tissue and mitigated the risk of discoloration and staining over time.[12,13] Previous studies highlighted the efficacy of polyester strips in achieving smoother composite restoration surfaces; however, final contouring was required for optimal

results.[14,15] In this study, a single polishing system, the multi-step Super Snap (Shofu, Inc., Kyoto, Japan), was employed to standardize the polishing regimen.

This investigation evaluated two commercially available posterior composite restoration materials: D-Tech Compomax and Te-Economic Plus. These materials were chosen for their distinct filler compositions and matrix formulations. Advancements in composite technology, particularly in nanofiller development, had previously improved the mechanical and aesthetic properties of these materials. The composition of composites significantly influenced surface roughness, which was critical for their clinical performance.

Surface roughness analysis, conducted using a profilometer, provided quantitative insights into the surface morphology of the specimens. The findings revealed significant differences between the two composites. D-Tech Compomax demonstrated significantly lower surface roughness compared to Te-Economic Plus, underscoring its potential for achieving smoother restorations.

Rigorous statistical analysis was applied to the collected data. The Shapiro-Wilk test confirmed a normal distribution, allowing further analysis with the independent t-test. This analysis revealed a statistically significant difference in surface roughness between the two groups ($p < 0.05$), with D-Tech Compomax showing superior smoothness compared to Te-Economic Plus.

In conclusion

The study demonstrated that the surface texture of composite restorations is closely linked to their filler composition and matrix design. D-Tech Compomax produced smoother surfaces compared to Te-Economic Plus when subjected to uniform finishing and polishing methods. These findings emphasize the critical role of selecting appropriate materials and applying precise polishing techniques to achieve optimal smoothness, which is essential for reducing plaque adhesion and minimizing the risk of secondary caries. To further substantiate these findings, additional research under clinical conditions and long-term assessments is recommended.

References:

1.Vinagre A, Barros C, Gonçalves J, Messias A, Oliveira F, Ramos J. Surface Roughness Evaluation of Resin Composites after Finishing and Polishing Using 3D-Profilometry. International Journal of Dentistry. 2023 Nov 14;2023.

2. Augusto MG, de Andrade GS, Mathias-Santamaria IF, Dal Piva AMdO, Tribst JPM. Comparison of Polishing Systems on the Surface Roughness of

Resin Based Composites Containing Different Monomers. J Compos Sci. 2022; 6:146.

3. Berglund J, Adell O. Surface roughness and ion release properties of a bioactive restorative material: Predicta Bioactive Bulk-fill. 2022

4. Rapone B, Pedone S, Carnevale A, Plantamura P, Scarano A, Demelio A, Demelio GP, Corsalini M. Profilometer comparison of the surface roughness of four denture base resins: An In Vitro study. Applied Sciences. 2022 Feb 10;12(4):1837.

5. Reddy VRB, Sheetal BG, Madhu AP, Jaiswal S, Chandrashekar B, Chandra A, Priyanka M. Finishing and Polishing of Composite's – A Review. IP Indian J Conserv Endod. 2021;6(1):7-10.

6. Aydın N, Topçu FT, Karaoğlanoğlu S, Oktay EA, Erdemir U. Surface roughness and color change of composites. J Clin Exp Dent. 2021;13(5): e446-54.

7. Jaramillo-Cartagena R, López-Galeano EJ, Latorre-Correa F, Agudelo-Suárez AA. Effect of polishing systems on the surface roughness of nano-hybrid and nano-filling composite resins: A systematic review. Dentistry Journal. 2021 Aug 12;9(8):95.

8. Komalsinghsakul A, Klaophimai A, Laovanitch Shrisatjaluk R, Senawongse P. Effect of the surface roughness of composite resins on the water contact angle and biofilm formation. Mahidol Dent J. 2019;39(2):75-84.

9. Dutra DAM, Pereira GKR, Kantorski KZ, Valandro LF, Zanatta FB. Does Finishing and Polishing of Restorative Materials Affect Bacterial Adhesion and Biofilm Formation? A Systematic Review. Oper Dent. 2018;43(1):37-52.

10. Aydin N, Karaog˘lanog˘lu S, Kılıçarslan MA, Oktay EA, Ersöz B. Effect of Wet and Dry Polishing Conditions by Two Finishing and Polishing Systems on the Surface Roughness and Color Changes of Two Composite Resin Restoratives: An Vitro 41 Comparative Study. J Adv Oral Res. 2022;13(1):127-34

11. Mohammed NM, Kola MZ, Alqahtani HH, Alqahtani MD, Alghmlas AS, Berglund J. Evaluation of Surface Roughness of Different Direct Resin-based Composites. J Int Soc Prevent Communit Dent. 2017;7:104-9.

12. Alfawaz Y. Impact of Polishing Systems on the Surface Roughness and Microhardness of Nanocomposites. J Contemp Dent Pract. 2017;18(8):647-51.

13. Madhyastha PS, Hegde S, Srikant N, Kotian R, Iyer SS. Effect of finishing/polishing techniques and time on surface roughness of esthetic restorative materials. Dent Res J. 2017;14(5):326-30

14. Kumari MC, Bhat KM, Bansal R. Evaluation of surface roughness of different restorative composites after polishing using atomic force microscopy. J Conserv Dent. 2016;19:56-62..

15. Tabatabaei MH, Arami S, Farahat F. Effect of Mechanical Loads and Surface Roughness on Wear of Silorane and Methacrylate-Based Posterior Composites. J Dent Tehran Univ Med Sci. 2016;13(6)