

Objective

To review suggested protocols for finishing and polishing additive-manufactured denture base, and to provide best practices based on the available literature.

Introduction

Advances in additive manufacturing have revolutionized the fabrication of complete denture bases, offering a faster and more customizable alternative to traditional methods. However, the polishability of these 3D-printed materials remains a crucial factor for ensuring clinical success, as smooth denture surfaces are essential for patient comfort and reducing microbial adhesion. This literature review aims to explore the current evidence on finishing and polishing protocols for additively-manufactured denture bases, focusing on achieving a clinically acceptable surface roughness of 0.2 μm . By summarizing these findings, this review provides insights into best practices for polishing 3D-printed denture base materials.

Materials & Methods

An electronic search of English-language literature from 2000 to 2023 was conducted using PubMed and Google Scholar databases. The search aimed to explore protocols for finishing and polishing 3D-printed dentures. The following keywords were utilized: finishing, polishing, digital dentures, 3D-printed dentures, additive manufacturing, and surface roughness.

Eleven articles were selected for revision.

Results

Conventional polishing

Lathe with pumice slurry
90 seconds
1500 rpm

Lathe bristle brush with universal polishing diamond paste
15 seconds
3000 rpm

Do not let rag wheel dry out



Fig. 1. Polishing lathe for conventional polishing

Alternative methods

Chairside polishing kits

Coating with unpolymerized resin

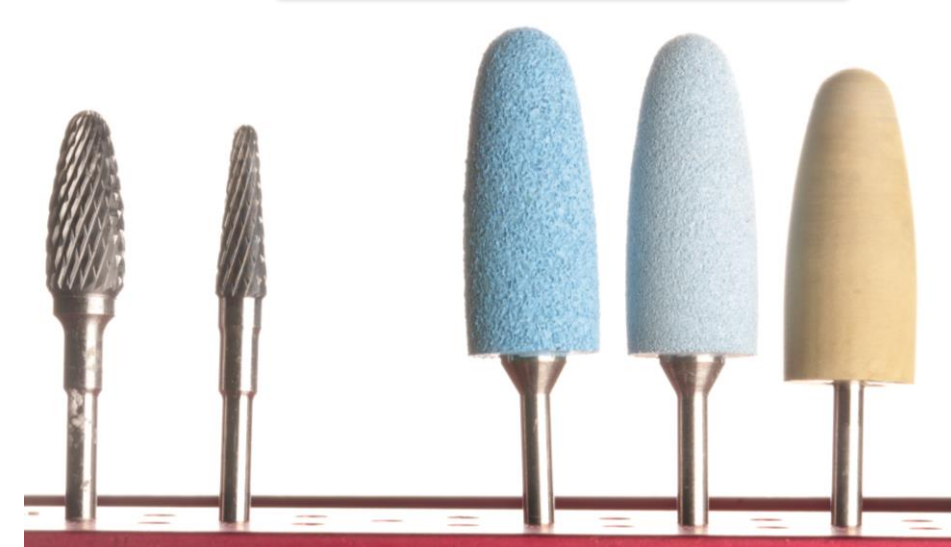


Fig. 3. Chairside denture polishing kit



Fig. 4. Coating with resin



Fig. 2. Diamond polishing paste

Clinically acceptable surface roughness 0.2 μm

Author	Study Focus	Methods	Key findings	Conclusion
Al-Dulaijan (2023)	Effects of different polishing protocols od 3D-printed acrylic denture base resins.	Compared chairside polishing kits (Microdont, Shofu) with conventional polishing (pumice slurry, polishing paste).	Chairside polishing kits produced comparable surface roughness (Ra, Rz) to conventional methods.	Chairside polishing kits are effective when lab access is limited.
Ei Samahy (2023)	Physicomechanical properties of milled vs. 3D-printed denture base resins.	Polishing with pumice slurry and polishing paste; evaluated thermocycling effects.	Polishing reduced surface roughness in 3D-printed materials; thermocycling had no effect on roughness.	Polishing significantly improves surface roughness in 3D-printed materials.
Al-Dulaijan (2022)	Surface roughness and hardness of 3D printed resins.	Investigated post-curing times and printing orientation effects on roughness.	No significant difference in Ra with post-changing orientation; minor variation at 45 curing time on and 90 degrees attributed to printing layer.	No impact of post-curing time on roughness.
Gulce Cakmak (2022)	Surface roughness and color stability of 3D-printed denture base materials.	Simulated brushing and thermocycling; polishing with pumice slurry and polishing paste.	After polishing, all materials achieved Ra of 0.2 μm .	Polishing reduces surface roughness across all materials to acceptable clinical levels.
Di Fiore (2022)	Comparison of flexural and surface properties of milled, 3D-printed, and heat polymerized PMMA.	Tested for surface roughness and microbial adhesion.	Surface roughness after polishing was similar across milled, 3d-printed, and heat-polymerized PMMA, with the Ra threshold for plaque accumulation.	Appropriate polishing procedures prevent microbial adherence and high surface roughness regardless of PMMA type.
Kraemer Fernandez (2020)	Surface Characteristics of milled and 3D-printed denture base materials.	Polished using pumice slurry and paste, with optional coating using unpolymerized resin.	Conventional polishing yielded better surface smoothness than coating, but coating is a viable alternative.	Coating acceptable but conventional polishing offers superior results.
Suk shim (2020)	Printing accuracy, mechanical properties, surface characteristics of 3D printed resins.	Evaluated different printing orientation (0, 45, 90).	45 degrees had the highest surface roughness; 0 degrees had the lowers.	Printing orientation affects surface roughness and mechanical properties.

Table 1. A review summarizing recent studies on surface roughness and polishing techniques for 3d-printed denture bases.

Additional considerations

Printing layer thickness

Printing orientation

Discussion

Based on the reviewed literature, various protocols for finishing and polishing additively-manufactured denture bases demonstrate that both conventional and chairside techniques can achieve clinically acceptable surface roughness levels, typically around 0.2 μm . Studies, such as those by Al-Dulaijan (2023) and Kramer Fernandez (2020), highlight that chairside polishing kits offer comparable results to traditional laboratory methods, making them a viable option when lab access is limited.

Coating protocols, though less effective than polishing, remain within clinically acceptable parameters and may serve as an alternative when rapid finishing is needed. Overall, while multiple approaches can achieve satisfactory results, the variability in material types and the lack of comprehensive research across all 3D-printed denture materials suggest that further studies are necessary to refine best practices for polishing these emerging materials.

Conclusion

Conventional polishing and chairside polishing techniques may be used to polish various additively-manufactured denture base materials; however, the available literature did not investigate all available 3D-printed materials on the market.

References

