Brazilian Dental Science

Subject: [BDS] Editor Decision

Laura Calvache:

We have reached a decision regarding your submission to Brazilian Dental Science, "3D-printed hybrid resin under hydrothermal aging with different post-polymerization times: Microstructure, optical, and mechanical properties ".

Our decision is: Resubmit

Reviewer A:
Recommendation: Resubmit for Review

Questionnaire

Does the manuscript contain new and significant information to justify publication?*

Yes

Does the Abstract (Summary) clearly and accurately describe the content of the article?

Yes

Is the problem significant and concisely stated?

No

Are the methods or research design described comprehensively? Is the statistical analysis adequate?

Yes

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Are the interpretations and conclusions justified by the results?

Yes

Is adequate reference made to other work in the field?

Yes

Is the language acceptable?

Yes

Manuscript Structure

Length of article is:*

Adequate

Number of tables is:

Adequate

Number of figures is:

Adequate

Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable).

none.

Rating

Interest*

Good

Quality

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Good

Originality

Good

Overall

Good

Recommendation

Major Revision

Would you be willing to review a revision of this manuscript?

Yes

Comments

Comments to the Author

Major revision. Upon reading the manuscript, a few questions arose regarding: besides the organic/inorganic fraction, does gravimetric analysis provide enough information to characterize the nature of the material, and whether it can indeed be considered a hybrid? References supporting the use of this method for this purpose should be included. Is the observed presence of inorganic particles sufficient to significantly alter the failure mechanism compared to conventional photopolymerizable resins? Does the investigated material actually contain a ceramic load? The term “3D-printed hybrid resin” immediately suggested to me a ceramic content based on the title; however, what does the literature say regarding this terminology? It is recommended to clarify this point in the Introduction to provide the reader with a better understanding. It is recommended to review and standardize the terminology according to the actual composition of the material. Based on the data presented in the tables, the term “3D-printed inorganic-filled resin” may be more appropriate.
-The sentence “Technological advancements driven by computational engineering,

such as CAD/CAM (Computer-aided design/Computer-aided manufacturing) and 3D printing technology, have had a transformative impact on dentistry" contains a conceptual inaccuracy. 3d printing should not be presented as a technology parallel to CAM, as additive manufacturing is a modality within the CAM process. This sentence should be revised to clarify that CAM encompasses both subtractive and additive manufacturing approaches, including additive manufacturing technologies such as 3D printing.

-The hypothesis section should be reformulated to improve clarity and scientific rigor. The article postulates three null hypotheses, each addressing a specific outcome of the study: (1) Post-polymerization time and hydrothermal aging do not significantly affect the mechanical properties of the 3D-printed hybrid resin; (2) Post-polymerization time and hydrothermal aging do not significantly affect the optical properties of the 3D-printed hybrid resin; (3) Post-polymerization time and hydrothermal aging do not significantly affect the microstructural characteristics of the 3D-printed hybrid resin.

-The inclusion of a table reporting the resin batch number and composition according to the manufacturer's information is recommended to improve material traceability and methodological transparency.

-The specimen dimensions and geometries used in this study are not referenced to any ISO standard for polymer-based dental materials, such as ISO 4049 or related standards. As a result, it is unclear whether the adopted dimensions for flexural testing, elastic modulus determination, microhardness evaluation, optical analysis, and FT-IR measurements comply with standardized testing protocols, which limits the comparability of the results.

-In addition, the manuscript does not justify how the number of specimens per group was determined. It is not stated whether the sample size was defined based on a pilot study, previous literature, or an experimental rationale. No statistical power analysis is reported, raising concerns about the adequacy of the sample size and the reliability of the statistical outcomes. A power analysis should be performed and explicitly reported in the methodology to support the selected number of specimens.

-The manuscript should also specify the number of specimens analyzed by EDS and report the SEM magnification used for the microstructural evaluation.

-The experimental design is difficult to follow in its current form. The authors should include a table summarizing the study design, clearly indicating the experimental groups, post-polymerization times, aging conditions, sample sizes, and the corresponding analyses performed for each outcome.

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-Conclusions related to clinical indication, particularly the recommendation of a 32-minute post-polymerization time, should be presented more conservatively. The limitations of the in vitro model should be clearly acknowledged, along with the need for further clinical validation.
-There is an inconsistency between the Discussion and the Conclusion regarding the effect of hydrothermal aging on flexural strength. In the Discussion, the authors report an increase or maintenance of flexural strength after aging, especially at longer post-polymerization times, whereas the Conclusion states that hydrothermal aging reduced flexural strength. The Conclusion should be revised to accurately reflect the reported results, qualifying the effect of hydrothermal aging according to post-polymerization time. The authors should clearly define whether the localized increase in flexural strength observed after hydrothermal aging is related to a transient polymer plasticization effect or whether it may be associated with interactions involving the inorganic phase. The manuscript should unequivocally clarify whether flexural strength increases, decreases, or depends on post-polymerization time following hydrothermal aging, ensuring consistency among the Results, Discussion, and Conclusion sections.

Reviewer B:
Recommendation: Revisions Required

Questionnaire

Does the manuscript contain new and significant information to justify publication?*

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Are the methods or research design described comprehensively? Is the statistical analysis adequate?

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Is adequate reference made to other work in the field?

Yes

Is the language acceptable?

Yes

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Adequate

Number of figures is:

Adequate

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Please state any conflict(s) of interest that you have in relation to the review of this paper (state "none" if this is not applicable).

None

Rating

Interest*

Good

Quality

Average

Originality

Good

Overall

Average

Recommendation

Minor Revision

Would you be willing to review a revision of this manuscript?

No

Comments

Comments to the Author

Overall, the study is strong and relevant for dental materials and additive manufacturing, but several points could substantially improve quality and publishability.

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The manuscript addresses an important problem by optimizing post-polymerization time and understanding hydrothermal aging effects on 3D-printed hybrid resins for long-term dental restorations. The combination of SEM/EDX, gravimetry, FT-IR, mechanical testing, and optical analysis is a major strength. Few studies integrate chemical composition with mechanical and optical performance in a single framework.

Major Concerns

1. Sample size is small and uneven across tests. Some groups use n=3 (elastic modulus and hardness), which is statistically weak and increases the risk of type II error and inflated variance. For research, especially with multiple factors, n ≥ 10 is usually recommended. This limits the reliability of conclusions, especially for elastic modulus and hardness.

2. There is inconsistency between “three-point bending” and formula description. The text states “Three-point Bending Strength”, but the equation used: Flexural strength = $(Fl)/(2bh^2)$ does not match ISO 4049 three-point bending formula (which is typically $3Fl / 2bh^2$). Additionally, the abstract and keywords mention biaxial flexural strength, while the method describes three-point bending. This creates confusion and may raise concerns about methodological accuracy.

3. FT-IR methodology describes irradiation during acquisition, which is unusual since samples were already post-cured. It is unclear whether DC refers to: Residual conversion during FT-IR exposure, or total conversion after post-curing and aging. Clarify why additional light exposure was applied during FT-IR and how baseline and final spectra were defined for DC measurements.

4. Interpretation of increased flexural strength after aging needs stronger mechanistic support. The explanation relies heavily on plasticization and compressive surface stress assumptions without direct evidence (e.g., water sorption, fractography, DMA).

Minor Concerns

1. There are terminology inconsistencies, please carefully review the grammar.

- “De longo duração” instead of “de longa duração”.
- “Post-curing” vs. “post-polymerization” used interchangeably.
- “Inicial” instead of “Initial” in tables.
- “bard fracture” instead of “bar fracture”.
- Avoid the term “prosthetic pieces”, which is not standard scientific terminology.

2. SEM figures lack scale bars and clearer contrast. Arrow colors referenced in captions may not be easily visible in print.

3. Check tables formatting. Some commas used instead of decimal points (e.g., translucency values). Tables and heading color could be standardized, some are grey, and one is black.

4. Duplicate references for Sharma et al. (2005) appear twice. Reference [27] appears to combine two unrelated citations in one entry.

Clinical Interpretation

1. The recommendation of 32 minutes post-curing is reasonable and well supported by combined mechanical and optical outcomes. However, the statement that the material is suitable for “long-term restorations” should be softened due to lack of fatigue, wear, and bonding tests.

2. Color changes (ΔE00) should be interpreted using established perceptibility and acceptability thresholds (e.g, clinically acceptable color match: $\Delta E00 \leq 1.8$; clearly perceptible difference: $\Delta E00 > 0.8$). Although statistical differences are reported, the manuscript does not clearly relate the measured values to clinical acceptability, and several groups exceed commonly accepted thresholds.

Please check the following article:
- Paravina RD, Pérez MM, Ghinea R. Acceptability and perceptibility thresholds in dentistry: A comprehensive review of clinical and research applications. J Esthet Restor Dent. 2019 Mar;31(2):103-112. doi: 10.1111/jerd.12465. Epub 2019 Mar 20. PMID: 30891913.