

Factors affecting accuracy in additive manufacturing of provisional dental prosthesis: A systematic review

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 12 March 2024 and was last updated on 12 March 2024.

INTRODUCTION

Review question / Objective The PICO strategy was formulated to develop the search strategy: (P)opulation: provisional dental prosthesis (I)ntervention: AM (C)omparison: not applicable (O)utcome: the accuracy of prosthesis. The PICO question was “What are the factors affecting the accuracy in additive manufacturing of provisional dental prostheses?”

Condition being studied Provisional or interim prostheses are commonly used in dentistry during the turnaround time between tooth preparation and completion of the definite treatment. Provisional prostheses represent an important phase during the rehabilitation process and thus should be the same as definite restorations in all aspects, except for the material from which they are fabricated. They can assist in maintaining periodontal health

and promote guided tissue healing by providing a matrix for surrounding gingival tissues. This is especially useful with treatment involving highly esthetic areas. Provisional treatment can also provide an important tool for the psychological management of patients. Interim prostheses are fabricated to enhance esthetics and function, provide stabilization, and may also act as a reference in designing the definite prosthesis. Additive manufacturing, or 3D printing or prototyping, creates a 3D object by stacking materials layer upon layer. In contrast to the subtractive method, the additive method saves material as it only uses as much the amount as the final product, and can produce more complex geometries. 3D-printed provisional restorations are known to have sufficient mechanical properties for intraoral use compared to conventionally cured provisional materials but the potential factors may affect accuracy are not well reviewed.

METHODS

Participant or population This review included in vitro or clinical studies that assessed the factors that influence the accuracy of AM provisional dental prostheses. The inclusion criteria were defined as follows: Provisional/temporary/transitional/provisional/interim/immediate dental prostheses. The exclusion criteria were defined as follows: Studies tested not dental prostheses, e.g. facial or limb prostheses.

Intervention Additive manufacturing techniques to fabricate the provisional dental prostheses, including: 1 Vat Photopolymerization; 2 Material Extrusion; 3 Powder Bed Fusion Processes; 4 Material Jetting.

Comparator Not applicable.

Study designs to be included This review included in vitro or clinical studies. The inclusion criteria were defined as following: In vitro/clinical studies; English-language studies. The exclusion criteria were defined as following: Case reports; Case series; Dental techniques or workflows; Non-English-language studies.

Eligibility criteria This review included in vitro or clinical studies that assessed the factors that influence the accuracy of AM provisional dental prostheses. The inclusion criteria were defined as following: In vitro/clinical studies reporting on the factors that influence the trueness, precision, marginal or internal fit, marginal quality, dimensional change of provisional dental prostheses; English-language studies. The exclusion criteria were defined as following: Case reports; Case series; Dental techniques or workflows; Non-English-language studies; Studies tested not dental prostheses, e.g. facial or limb prostheses; Studies not tested prosthesis fabricated by AM techniques; Studies that did not assess influential factors of AM dental prostheses; Studies that did not use dental prosthetic samples.

Information sources An electronic search of five databases (Web of Science, PubMed, Medline, Embase, Scopus) was conducted by two reviewers (Tingmin Zhang and Yuying Zheng) separately to retrieve English-language original articles published between January 1, 1975, and December 31, 2023.

Main outcome(s) Accuracy of provisional dental prostheses, including trueness, precision, volumetric change, dimensional change, marginal and internal fit.

Quality assessment / Risk of bias analysis The assessment of risk of bias followed the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomized experimental studies). The nine items in this scale were as follows with yes, no, unclear or not applicable:

- 1: Is it clear in the study what is the 'cause' and what is the 'effect'?
- 2: Were the participants included in any comparisons similar?
- 3: Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?
- 4: Was there a control group?
- 5: Were there multiple measurements of the outcome both pre and post the intervention/exposure?
- 6: Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?
- 7: Were the outcomes of participants included in any comparisons measured in the same way?
- 8: Were outcomes measured in a reliable way?
- 9: Was appropriate statistical analysis used?

The same two independent reviewers conducted the assessment, in cases of unresolved agreement, the same third reviewer was consulted for resolution.

Strategy of data synthesis The data for the systematic review are derived from the results and conclusions of studies included, and are organized and classified accordingly based on the excel sheet designed previously by two independent reviewers, the same third reviewer was consulted for resolution.

Subgroup analysis NA.

Sensitivity analysis NA.

Language restriction English.

Country(ies) involved China.

Keywords Accuracy; Additive manufacturing; CAD-CAM; Provisional prosthesis; Influential factor.

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