INPLASY

Evidence-Based Material Selection in Digital Prosthodontics: A Network Meta-Analysis Integrating Mechanical Risk and Clinical Time Efficiency

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ADMINISTRATIVE INFORMATION

Support - King Khalid University.

Review Stage at time of this submission - Completed but not published.

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 17 January 2026 and was last updated on 17 January 2026.

INTRODUCTION

Review question / Objective To evaluate and compare fracture resistance and workflow time efficiency across CAD/CAM prosthetic materials fabricated using digital workflows through systematic review and network meta-analysis.

Rationale CAD/CAM materials used in digital prosthodontic workflows range greatly in mechanical properties and time to fabrication. While single arm studies have looked at fracture resistance or time-efficiency outcomes separately, there remains a lack of consistent comparative evidence among these materials. Network meta-analysis is essential for systematically assessing CAD/CAM materials through mechanical and time-to-fabrication comparisons which will develop performance rankings for digital workflow applications.

Condition being studied CAD/CAM prosthetic restorations manufactured using digital workflows in prosthodontics.

METHODS

Search strategy Literature searches were performed in PubMed, Scopus, ScienceDirect, Web of Science, and Cochrane Library from inception until December 2025. Keywords and mesh terms related to CAD/CAM materials, digital workflow, fracture resistance, and time efficiency were used. Relevant articles were retrieved from references of included studies manually.

Participant or population Clinical patients and laboratory specimens involving CAD/CAM prosthetic restorations fabricated using digital workflows.

Intervention Digitally fabricated prosthetic restorations produced using CAD/CAM materials and workflows.

Comparator Different CAD/CAM materials and conventional (non-digital) prosthetic fabrication workflows.

Study designs to be included Randomized and non-randomized clinical studies, as well as laboratory-based in vitro and in situ experimental studies.

Eligibility criteria Included studies were randomized controlled trials, non-randomized clinical trials and in vitro/in situ experimental studies testing CAD/CAM prosthetic materials made using digital workflows. Trials needed to report on fracture resistance and/or time efficiency and include comparison to another material/ workflow. Articles not reporting original research (reviews, case reports, opinion) or lacking extractable outcome data were excluded.

Information sources Electronic database searches were conducted in PubMed, Scopus, ScienceDirect, Web of Science, and the Cochrane Library. Manual screening of reference lists of included studies was performed to identify additional eligible publications.Information.

Main outcome(s) Primary outcomes included fracture resistance of CAD/CAM prosthetic materials and total fabrication time efficiency in digital workflows.

Additional outcome(s) Relative ranking of CAD/ CAM materials and workflows based on network meta-analysis, including SUCRA probabilities, and assessment of publication bias and inconsistency within the evidence network.

Data management Data were extracted independently using standardized data extraction forms and compiled in spreadsheet software. Consistency and accuracy of extracted data were verified before statistical synthesis.

Quality assessment / Risk of bias analysis The methodological quality of included studies was evaluated using RoB 2 for randomized trials, ROBINS-I for non-randomized clinical studies, and the QUIN tool for laboratory-based in vitro and in situ studies.

Strategy of data synthesis Separate network meta-analyses were conducted for fracture resistance and time efficiency outcomes. Random-effects models were utilized for all analyses. Mean differences and 95% confidence intervals were reported for outcome results, and rank probabilities were presented as surface under the cumulative ranking curves (SUCRA). Analyses of network structure, consistency, heterogeneity, and publication bias were also conducted for interpretation.

Subgroup analysis No formal subgroup analyses were conducted. Analyses were stratified by outcome domain to address differences between clinical and experimental evidence.

Sensitivity analysis Sensitivity analyses were conducted using alternative modeling approaches, including comparison of frequentist and Bayesian network meta-analysis results, to evaluate the stability of effect estimates.

Language restriction The review was restricted to studies published in English.

Country(ies) involved USA, Saudi Arabia , Spain , Mexico.

Keywords CAD/CAM materialsDigital workflowsProsthodonticsFracture resistanceTime efficiencyNetwork meta-analysis.

Dissemination plans Results will be disseminated via publication in a peer-reviewed journal and through presentations at national and international scientific meetings.

Contributions of each author

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