INPLASY

Digital Advantage: Comparing Fracture Resistance and Time Efficiency of CAD/CAM Prosthesis Materials- Systematic Review and network Meta-analysis

INPLASY2025100005
doi: 10.37766/inplasy2025.10.0005
Received: 2 October 2025
Published: 2 October 2025

Saini, R; kaur, K; Kanji, MA; AlShahrani, A.

Corresponding author:
Ravinder Saini

rsaini@kku.edu.sa

Author Affiliation:
King Khalid University.

ADMINISTRATIVE INFORMATION

Support - King Khalid University.

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

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2025100005

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 2 October 2025 and was last updated on 2 October 2025.

INTRODUCTION

Review question / Objective To evaluate and compare the fracture strength and time efficiency of various prosthesis materials fabricated within a fully digital workflow.

Rationale Comparative evidence on the mechanical strength and time efficiency of CAD/CAM materials remains fragmented, creating a need for a comprehensive synthesis to guide clinical decision-making.

Condition being studied Fabrication and performance of implant-supported prostheses, primarily for single or multiple posterior tooth replacements.

METHODS

Search strategy A comprehensive search was conducted in PubMed, Scopus, ScienceDirect, and Cochrane Library using related keywords.

Participant or population Adult patients undergoing implant-supported prosthetic rehabilitation and in vitro/in situ models simulating prosthesis fabrication and use.

Intervention Prostheses fabricated with digital workflows using materials like PMMA, zirconia, hybrid ceramics, PEEK, and Vita Enamic.

Comparator Conventional workflows involve traditional impressions, stone casts, analog fabrication, and non-digital processing.

Study designs to be included Randomized controlled trials (RCTs), non-randomized clinical studies, in vitro studies, and in situ simulations.

Eligibility criteria Studies with adult humans or valid in vitro/in situ models reporting fracture strength or time efficiency; excluding pediatric, animal studies, fully edentulous, unrelated cases, reviews.

Information sources Electronic databases searched included PubMed, Scopus, ScienceDirect, and Cochrane Library.

Main outcome(s) Fracture strength and total time efficiency for prosthesis fabrication.

Additional outcome(s) Clinical and laboratory efficiency measures, procedural cost, patient/clinician satisfaction, and prosthetic success or complications.

Data management Data were extracted independently by two reviewers using a standardized form in EndNote, with disagreements resolved by a third reviewer.

Quality assessment / Risk of bias analysis Risk of bias was assessed using the Cochrane RoB2 tool for RCTs, ROBINS-I for non-randomized studies, and the QUIN tool for in vitro studies.

Strategy of data synthesis A network meta-analysis was conducted using both frequentist and Bayesian frameworks in MetaInsight, with random-effects models and SUCRA rankings for treatment hierarchy.

Subgroup analysis By material type ,study design, and workflow type.

Sensitivity analysis Leave-one-out and exclusion of high-risk studies to test robustness.

Language restriction Included only English-language publications.

Country(ies) involved Saudi Arabia, United States of America, India.

Other relevant information This analysis follows PRISMA-NMA guidelines.

Keywords Digital workflow; CAD/CAM; prosthodontics; fracture strength; time efficiency; zirconia; PMMA; hybrid ceramics; implant-supported prosthesis.

Dissemination plans Will be published in a peer-reviewed journal.

Contributions of each author

Author 1 - Ravinder Saini - Methodology, Project administratin, Visualization.
Email: rsaini@kku.edu.sa
Author 2 - Kanwalpreet kaur - Supervision, Data Curation, Data synthesis, Statistical expertise.
Email: drkanwalpreet@yahoo.co.in
Author 3 - Masroor Ahmed Kanji - Funding acquisition, Project administration.
Email: mkanji@kku.edu.sa
Author 4 - Ahid AlShahrani - Publications.
Email: aalshahrani1@kku.edu.sa