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Comparative Accuracy of Intraoral Scanning, Intraoral Photogrammetry, and Extraoral Photogrammetry for Full-Arch Implant Rehabilitation in Completely Edentulous Patients – Systematic Review and Network Meta-Analysis

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ADMINISTRATIVE INFORMATION**Support** - None.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202660100**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 20 June 2026 and was last updated on 20 June 2026.**INTRODUCTION**

Review question / Objective PICO: “In completely edentulous patients requiring full-arch implant-supported rehabilitation, are there differences in accuracy among intraoral scanning (IOS), intraoral photogrammetry (IPG), and extraoral photogrammetry (EPG) for digital implant impressions?”

Condition being studied Edentulous patient.**METHODS****Participant or population** The population comprised complete-arch implant-supported rehabilitations in edentulous arches.**Intervention** The interventions included digital impression techniques based on IOS, IPG, and EPG.**Comparator** Comparators consisted of the alternative digital workflows evaluated within the

included studies. The primary outcome was mean linear deviation, whereas secondary outcomes included trueness, precision, angular deviation, and overall implant position transfer accuracy.

Study designs to be included The literature review was conducted following guidelines for systematic reviews and meta-analyses in accordance with PRISMA (Preferred Reporting Items for Systemic Reviews and Meta-Analyses, <http://www.prisma-statement.org> (accessed on 27 October 2025)).**Eligibility criteria** The inclusion criteria were as follows: in vitro studies published in peer-reviewed journals evaluating the lineal deviations at intraoral photogrammetry, intraoral scanning, and extraoral photogrammetry for complete-arch implant impressions. Studies were not restricted by language or year of publication. The exclusion criteria were as follows: systematic literature reviews, clinical trials, clinical cases, case series, and editorials.

Information sources Electronic databases: PubMed/Medline ; Scopus; Web of Science.

Main outcome(s) The primary outcome was mean linear deviation.

Quality assessment / Risk of bias analysis

Publication bias was assessed using the trim-and-fill method, which estimates the number of potentially missing studies to achieve funnel plot symmetry, and was visually represented using funnel plots.

Strategy of data synthesis The combination of the in vitro studies included in the meta-analysis was performed using a random-effects model with the inverse variance method to estimate the mean percentage reduction in contamination and surface roughness, as well as the mean differences (MD) in cell adhesion. The meta-analyses were presented using forest plots.

Heterogeneity among the included studies was assessed using the I² statistic, considering low heterogeneity when values ranged between 25–50%, moderate between 50–75%, and high when >75%. Differences between subgroups were evaluated using the Q test, with statistical significance set at $p < 0.05$. Cochran's Q test was also performed.

Subgroup analysis Differences between subgroups were evaluated using the Q test, with statistical significance set at $p < 0.05$. Cochran's Q test was also performed.

Sensitivity analysis Sensitivity analyses were performed using a leave-one-out approach, whereby each study was sequentially removed from the meta-analysis to evaluate its influence on the pooled estimates and the overall heterogeneity.

Country(ies) involved Spain.

Keywords Dental Implants; Complete-Arch Rehabilitation; Digital Impressions; Intraoral Scanning; Intraoral Photogrammetry; Extraoral Photogrammetry; Photogrammetry; Accuracy; True-ness; Precision; Network Meta-Analysis.

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