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Can splinting scan bodies, artificial landmarks, or geometric references improve the accuracy of complete arch implant intraoral digital scans? A systematic review and meta-analysis

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ADMINISTRATIVE INFORMATION

Support - None.

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 07 April 2024 and was last updated on 19 April 2024.

INTRODUCTION

Review question / Objective Could splinting scan bodies, using artificial landmarks, or adding geometric references improve the accuracy of complete arch implant intraoral digital scans?

Rationale Intraoral scanners (IOSs) face notable limitations when scanning full edentulous arches. The accuracy of IOSs can be compromised due to the absence of stable tissue landmarks, increased distance between scan bodies, and challenges in distinguishing between multiple identical scan bodies in such clinical scenarios.

Condition being studied The accuracy of intraoral scans for full-edentulous arches, which will be rehabilitated with implant-retained restorations, using either splinted scan bodies, artificial landmarks, or geometric references.

METHODS

Search strategy "dental implants" OR "edentulous" OR "edentulous mouth" OR "edentulous jaw" OR "edentulous arch" OR "complete arch" OR "full arch" OR "full jaw" OR "complete jaw" OR "tooth loss" OR "implant-supported dental prosthesis" OR "implant restoration" OR "implant prosthesis" OR "implant rehabilitation" OR "multiple implants" OR "multi-unit implants" AND "digital dentistry" OR "dental impression technique" OR "implant impression" OR "optical device" OR "optical system" OR "intraoral scanner" OR "intraoral scan" OR "optical impression" OR "digital impression" OR "digital scanner" OR "digital scan" OR "optical scan" OR "intraoral scanning" OR "digital scanning" OR "optical scanning" OR "dental scanner" OR "intraoral scanning device" OR "computer-aided design" OR "computer aided manufacturing" OR "CAD-CAM" OR "Computer assisted design" OR "computer assisted manufacturing" OR "digital

technology" OR "artificial landmark" OR "scan body" OR "scanbody" OR "scanbodies" OR "scan bodies" OR "splint" OR "splinted scan body" OR "splinted scanbody" OR "splinted scanbodies" OR "splinted scan bodies" OR "splinting" OR "geometric" OR "geometry" OR "framework".

Participant or population Full-arch implant rehabilitation.

Intervention Optical impression with intraoral scanners using splinted scan bodies, artificial landmarks, or auxiliary geometric references.

Comparator Standard intraoral digital scan.

Study designs to be included in vitro studies.

Eligibility criteria The inclusion criteria consist of English-language in vitro studies published in peer-reviewed journals that compare the accuracy of intraoral scans obtained from fully edentulous arches with implants, utilizing either artificial landmarks or splinting scan bodies, against the standard type of scan. Exclusion criteria encompass articles focusing on implant-retained single unit restorations, fixed partial dentures, and other types of investigations, such as ex vivo, in vivo, or clinical studies, pilot studies, case reports/series, narrative/systematic reviews, book chapters, expert opinions, analyses with insufficient/missing data, letters to the editor, editorial and commentary reports, as well as studies published in languages other than English, and those not meeting the eligibility requirements.

Information sources PubMed, Embase, Scopus, Web of Science, the Cochrane Library, Google Scholar.

Main outcome(s) Final scan accuracy.

Data management Records will be entered into a reference management program (Endnote 21; Clarivate Analytics) for screening purposes. Two reviewers will independently extract the necessary data from the included papers using a standardized Excel form.

Quality assessment / Risk of bias analysis QUIN Tool.

Strategy of data synthesis Inter-rater reliability between assessors will be calculated using Cohen's Kappa coefficient. The study groups will be compared using a standardized mean difference (SMD) analysis. SMD will be calculated by pooling the data using a random-effects model with the DerSimonian and Laird method. The analysis will be performed using the meta package (v4.17-0) in the R Statistical environment (v4.1.2; R Core Team 2021, Vienna, Austria). Heterogeneity of effect-size estimates will be assessed using the Cochran (Q) test and inconsistency score (I2). Significant heterogeneity will be considered if the I2 value exceeds 50% and the p-value for the Q test is less than 0.1.

Subgroup analysis Subgroup analysis will be conducted to identify potential sources of heterogeneity by considering moderator variables with the highest likelihood.

Sensitivity analysis Moreover, the reliability of the pooled results will be assessed using a "leave-one-out" sensitivity analysis approach, where each study will be excluded one by one to evaluate the impact of its exclusion on the overall results and the heterogeneity between studies. Potential publication bias will be statistically assessed using Begg's and Egger's regression tests.

Language restriction Only English articles will be considered.

Country(ies) involved Spain.

Keywords intraoral scanning; accuracy; complete dentulous arch; artificial landmarks; splinting scanbody; dentistry.

Contributions of each author

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