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# Impact of 3D Imaging Techniques and Virtual Patients on the Accuracy of Planning and Surgical Placement of Dental Implants: A Systematic Review

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**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 24 November 2023 and was last updated on 24 November 2023.

## INTRODUCTION

**Review question / Objective** impact of 3D imaging techniques and virtual patients on the accuracy of planning and surgical placement of dental implants.

**Rationale** The amalgamation of 3D imaging and virtual patient technologies facilitates precise implant planning and improves surgical placement accuracy, ultimately advancing the field of dental implantology.

**Condition being studied** 3D imaging modalities, such as CBCT and CAD/CAM technology.

## METHODS

**Search strategy** PubMed ((((((((((Three-dimensional imaging) OR (3D imaging)) OR (3D digital dentistry)) OR (Computer-aided design)) OR (CAD)) OR (Computer-aided manufacturing)) OR (CAM)) OR (Cone beam computed tomography)) OR (CBCT)) OR (Computed tomography)) OR (CT)) AND (((((Virtual patients) OR (Virtual patient simulation)) OR (Virtual reality)) OR (Virtual environment)) OR (Augmented reality))) AND ((((Dental implants) OR (Dental implantation)) OR (Dental prosthesis)) OR (Dental fabrication))
ScienceDirect (3D imaging OR Cone beam computed tomography OR CBCT OR Computed tomography OR CT) AND (Virtual patients OR Virtual patient simulation) AND (Dental implants OR Dental implantation)
Google Scholar (Three-dimensional imaging OR 3D imaging OR 3D digital dentistry OR Computer-aided design OR CAD OR Computer-aided manufacturing OR CAM OR Cone beam computed tomography OR CBCT OR Computed tomography OR CT) AND (Virtual patients OR Virtual patient simulation OR Virtual reality OR Virtual environment OR Augmented reality) AND (Dental implants OR Dental implantation OR Dental prosthesis OR Dental fabrication)
Scopus (Three-dimensional imaging OR 3D imaging OR 3D digital dentistry OR Computer-

aided design OR CAD OR Computer-aided manufacturing OR CAM OR Cone beam computed tomography OR CBCT OR Computed tomography OR CT) AND (Virtual patients OR Virtual patient simulation OR Virtual reality OR Virtual environment OR Augmented reality) AND (Dental implants OR Dental implantation OR Dental prosthesis OR Dental fabrication).

**Participant or population** none the study is only related to technology 3D.

**Intervention** 3D Technology in Implants Placements.

**Comparator** Traditional Techniques.

**Study designs to be included** We took into account both descriptive (case control and cohort) and interventional (trials) based research that was written in English for this review.

**Eligibility criteria** inclusion of pertinent research examining the effects of 3D imaging techniques and virtual patients on the precision of dental implant planning and surgical placement, exclusion criteria were established Studies were excluded if they did not focus specifically on 3D imaging or virtual patients in the context of dental implant planning and placement.

**Information sources** Scientific studies that specifically addressed the use of AI in prosthodontics were taken from several reliable sources, including Google Scholar, Pub-Med via MEDLINE, Springer, and Scopus, EBSCO host (Dentistry & Oral Sciences Source database), Science Direct, and Web of Science (All databases: WOS, KJD, MEDLINE, RSCI, SCIELO). The extensive collection of publications was analyzed to only include prosthodon-ticsrelated articles. These publications were evaluated attentively before being included in the research process.

**Main outcome(s)** CBCT was the most commonly used scanning technique for dental implants.

**Additional outcome(s)** Efficiency of CBCT is also noteworthy, as it enables quick and convenient image acquisition with minimal radiation exposure compared to traditional CT scans.
CBCT allows precise treatment planning by facilitating accurate measurements and assessments of the available bone volume

**Data management** Data was processed in Microsoft Excel (Excel 365; Microsoft Corp., Redmond, WA, USA).

**Quality assessment / Risk of bias analysis** Two researchers independently assessed the risk of bias of the included articles using —JBI critical appraisal tools.

**Strategy of data synthesis** Two review authors used the studies to help select studies and document their decisions. This was done in two stages, with the first stage consisting of a ti-tle and abstract screening of all studies against the inclusion criteria, and the second stage being a full text assessment of papers that were deemed potentially relevant based on the initial screening , the review's authors, discussed and settled their differences by consensus after consulting the procedure.

**Subgroup analysis** Na.

**Sensitivity analysis** Na.

**Language restriction** Articles only in English were Selected.

**Country(ies) involved** Saudi Arabia, Armenia.

**Keywords** Three dimensional, CBCT, virtual reality, precision, dental implants.

**Dissemination plans** All the data and the article will be share after the publication.

**Contributions of each author**

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