INPLASY

Advancements of 3D Imaging Technology in Root Canal Therapy: A Systematic Review

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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 11 March 2024 and was last updated on 11 March 2024.

INTRODUCTION

*R*eview question / Objective To highlight the advancement of 3D technologies utilized for root canal therapy.

Condition being studied Advancements in 3D imaging (innovations or improvements in 3D imaging technology relevant to root canal therapy, impact on diagnostic accuracy, treatment planning, and treatment outcomes, comparison of traditional 2D imaging with 3D imaging modalities).

METHODS

Search strategy An advanced search strategy was developed and performed using different databases, including PubMed, ScienceDirect, Scopus, The Cochrane Library, and Google Scholar, from January 2003 to February 2024.

Different keywords and Medical subject headings (MeSH) were used, such as "Three dimensional imaging" OR "3D imaging" OR "digital imaging" OR "cone beam computed tomography [MeSH Terms]" OR "CBCT" AND "root canal therapy [MeSH Terms]" OR "root canal treatment".

Participant or population Clinical indications for root canal therapy, outcomes related to the use of 3D imaging in planning and performing root canal procedures.

Intervention 3D imaging technology.

Comparator Visualization of root canal anatomy using 3D imaging), detection of complex root canal morphology.

Study designs to be included Preferred Reporting for Systematic Reviews and Meta-analysis

(PRISMA) were followed for better reproducibility and transparency of the literature search process to perform this study.

Eligibility criteria Studies evaluated the 3D technology for the diagnosis or assessment of root canal therapy, studies with defined comparison groups, randomized controlled trials (RCTs) and non-RCTs, and published in English after 2003.

Information sources An advanced search strategy was developed and performed using different databases, including PubMed, ScienceDirect, Scopus, The Cochrane Library, and Google Scholar, from January 2003 to February 2024.

Main outcome(s) With the passage of time, there has been an advancement in 3D technology in terms of resolution and voxel sizes, which increased its accuracy and success rate. However, there is still a need for refinement and further innovation in 3D imaging techniques to address specific challenges and improve outcomes in endodontic interventions.

Data management For data extraction, a Microsoft Excel sheet was used. The included variables were study characteristics (study ID, country, study design, sample size, age, gender, clinical conditions), intervention (3D imaging technology) characteristics (type of 3D imaging technology used, specific features, capabilities of the imaging technology, any technological advancements or modifications over time), types of root canal procedures (clinical indications for root canal therapy, outcomes related to the use of 3D imaging in planning and performing root canal procedures). In addition, root canal anatomy (visualization of root canal anatomy using 3D imaging), detection of complex root canal morphology (e.g., accessory canals, isthmuses), role of 3D imaging in identifying and treating anatomical variations), root dimension measurements (accuracy and precision of root dimension measurements using 3D imaging, comparison with traditional methods of measuring root dimensions, implications for treatment success and prognosis), clinical outcomes (clinical outcomes associated with the use of 3D imaging in root canal therapy, success rates of root canal procedures performed with the aid of 3D imaging, complications, recurrence rates, and patient satisfaction related to 3D-guided treatments). Advancements in 3D imaging (innovations or improvements in 3D imaging technology relevant to root canal therapy, impact on diagnostic accuracy, treatment planning, and treatment outcomes, comparison of traditional 2D imaging with 3D imaging modalities).

Quality assessment / Risk of bias analysis For the quality assessment of the in-vitro studies, the QUIN assessment tool was utilized. Each study was evaluated according to twelve items and rated as yes (1-2 points), no (0 points) or not applicable. Each research paper was graded according to points response. Scores 70% were a low risk of bias [21]. For non-RCTs, Risk of Bias (RoB) for Non-Randomised Studies- Interventions (ROBINS-I) was utilized, and assessment was done in seven domains, including confounding, selection of participants, intervention classification, deviation, missing outcome data, outcome measurement, and reporting outcomes.

Strategy of data synthesis Different databases such as PubMed, ScienceDirect, The Cochrane Library, Scopus, and Google Scholar were searched for relevant literature. In the identification phase of the PRISMA, 5015 articles were extracted, and 566 duplicates were identified using Endnote X9 referencing software, and then the duplicates were removed. In the screening phase, 4449 articles were screened to select the most appropriate articles for full-text assessment. During this process, 4363 articles were excluded as they were considered irrelevant, and some of the articles were reviews, as indicated in Figure 1. In the eligibility phase, 86 articles were assessed through the strict eligibility criteria set for the final selection of the articles. Among 86 articles, 70 were excluded due to different reasons (Figure 1). Finally, in the included phase, 16 articles were selected to be included in the present systematic review.

Subgroup analysis The data was compiled from a variety of articles: • Author(s), year of publication, country, study design.

Sensitivity analysis Not Applicable.

Language restriction Only articles in English.

Country(ies) involved Saudi Arabia.

Keywords Three-dimensional, CBCT, diagnosis, treatment, root canal treatment, endodontic.

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

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