

# INPLASY

## Diagnostic accuracy of artificial intelligence in detecting soft tissue calcifications and ossifications on dental radiographs: a systematic review and meta-analysis

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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.

**INPLASY registration number:** INPLASY202660038

**Amendments** - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 7 June 2026 and was last updated on 7 June 2026.

### INTRODUCTION

**Review question / Objective** What is the diagnostic accuracy of artificial intelligence in patients with soft tissue calcification compared to the conventional approach.

**Condition being studied** Soft tissue calcification detection by AI.

### METHODS

**Participant or population** patients having soft tissue calcifications who had images.

**Intervention** AI.

**Comparator** detection by conventional methods "human experts."

**Study designs to be included** Original studies investigated AI for soft tissue calcifications.

**Eligibility criteria** In our study, we included scientific work that is original, report the use of artificial intelligence in the detection of soft tissue calcification, and the work published in English language. On the other hand, we excluded systematic review, narrative reviews, in vitro studies case reports, and technical reports.

**Information sources** PubMed, Scopus, and Web of Science databases.

**Main outcome(s)** Diagnostic accuracy, expressed as the proportion-based measures that could be consistently extracted across studies, namely sensitivity (recall), precision (positive predictive value), and the F1-score.

**Quality assessment / Risk of bias analysis** The risk of bias associated with each study will be evaluated using the Quality Assessment of Diagnostic Accuracy (QUADAS-2), which will have been completed by two independent reviewers. The QUADAS-2 is a validated instrument that has four domains to assess diagnostic accuracy. These

include patient selection, index test, reference standard, and flow and timing. In addition to this assessment of diagnostic accuracy studies as it pertains to general health research, methodological quality specifically related to artificial intelligence in dental research through an additional supplement check list developed for studies examining dental artificial intelligence is evaluated.

**Strategy of data synthesis** The data is extracted for the included study based on a predefined criteria which include author & year, studied condition, sample size, imaging modality used, ai model, comparator, outcome.

**Subgroup analysis** Predefined subgroup analyses were developed to examine possible sources of heterogeneity based upon the type of soft tissue calcification examined (carotid artery calcification, tonsillolith, sialolith, or other); the imaging modality used (panoramic radiography vs. cone beam computed tomography); the artificial intelligence architecture employed (Convolutional Neural Network, Object Detection Models, or Segmentation Models); the validation strategy employed (internal vs. external validation); and the methodologic quality of each study (low risk of bias [QUADAS-2] vs. high risk of bias). Out of these predefined analyses, only one subgroup analysis was able to be completed due to limitations. This subgroup analysis compared imaging modalities regarding pooled sensitivity (9 panoramic radiography studies vs. 4 cone beam computed tomography studies). The remaining subgroup analyses were unable to be conducted due to different types of limitations. The limitation of stratifying by type of calcification occurred because while carotid artery calcification had a good number of studies representing this category, there was only one study per sialolith, tonsillolith, and mixed-calcification category reporting an outcome that could be pooled. The limitation of stratifying by validation strategy occurred because nearly all studies validated internally, thus providing too few externally validated studies to create a comparable group. The limitation of comparing by AI architecture did not occur due to the heterogeneous nature of the models studied. For example, models often combined an object-detector backbone with either transformer or segmentation components, preventing their classification into clean architectural categories. Additionally, a comparison by risk of bias was deemed not useful, as limiting the analysis to those studies reporting a poolable outcome resulted in only three low-risk and three high-risk studies being identified. Since most studies were rated as

unclear, such comparisons would have been underpowered. A leave-one-out sensitivity analysis was also performed to evaluate the effect of individual studies on the pooled sensitivity estimate.

**Sensitivity analysis** Leave-one-out analysis, in which each study was removed in turn, confirmed that no single study exerted undue influence on the pooled sensitivity; in every iteration the recomputed estimate remained within the original confidence interval. The overall finding was thus robust to the exclusion of any individual study.

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

**Keywords** Artificial intelligence; deep learning; carotid artery calcification; soft tissue calcification; panoramic radiography; cone-beam computed tomography; diagnostic accuracy; meta-analysis.

#### **Contributions of each author**

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