TRACE-S: eligibility assessment of twenty records

Supplementary material 2

Final operational disposition: seven included records, eleven exclusions for unmet criteria, and two records not included because population information was insufficient. The latter remain unresolved in relevance accounting; operational closure does not establish ineligibility.

Assessment criteria

1. Original empirical study
2. Dental radiographic imaging
3. Artificial intelligence
4. Periapical lesion presence or absence
5. Permanent human dentition
6. Quantitative evaluation of the target task

Included: 3, 8, 9, 11, 15, 18 and 20. Direct population support: 8 and 15. Contextual population inference: 3, 9, 11, 18 and 20. Not included for insufficient information: 2 and 12.

Numbering follows the twenty-record assessment list. DOI and PMID are drawn from the preserved PubMed metadata. Evidence-location entries distinguish complete reports from abstracts or bibliographic captures. Contextual population interpretation had no prespecified evidentiary threshold; example images and adult age do not establish the dentition of every unit. Previous decisions are retained in the documentary archive.

Article 1 | Excluded — criterion not met

Noninvasive differential diagnosis of dental periapical lesions in cone-beam CT scans

Okada K, Rysavy S, Flores A, Linguraru MG. Noninvasive differential diagnosis of dental periapical lesions in cone-beam CT scans. Med Phys. 2015;42(4):1653–1665.

DOI: https://doi.org/10.1118/1.4914418

PMID: 25832055

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	No
Permanent human dentition	Unresolved
Quantitative evaluation of the target task	Not for the target task

Decision rationale

The study differentiates cysts from granulomas in previously identified lesions. It does not establish performance for lesion presence versus absence. Excluded for an incompatible target task.

Evidence location

PDF pages 2–3, purpose and methods.

Article 2 | Not included — insufficient information

Evaluation of artificial intelligence for detecting periapical pathosis on cone-beam computed tomography scans

Orhan K, Bayrakdar IS, Ezhov M, Kravtsov A, Özyürek T. Evaluation of artificial intelligence for detecting periapical pathosis on cone-beam computed tomography scans. Int Endod J. 2020;53(5):680–689.

DOI: https://doi.org/10.1111/iej.13265

PMID: 31922612

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Yes
Permanent human dentition	Unresolved
Quantitative evaluation of the target task	Yes

Decision rationale

Not included in the current synthesis because permanent human dentition, or separable results for that population, could not be established. Patient selection reports 153 periapical lesions from 109 patients without sufficient dentition characterization. The tooth-numbering error does not demonstrate that a primary tooth contributed to the lesion sample. This is insufficient information, not proven use of an ineligible population.

Evidence location

PDF page 3 (journal page 682), Patient selection; PDF page 4, Results.

Article 3 | Included

Artificial intelligence for the Computer-aided detection of Periapical lesions in cone-beam computed Tomographic images

Setzer FC, Shi KJ, Zhang Z, Yan H, Yoon H, Mupparapu M, Li J. Artificial Intelligence for the Computer-aided Detection of Periapical Lesions in Cone-beam Computed Tomographic Images. J Endod. 2020;46(7):987–993.

DOI: https://doi.org/10.1016/j.joen.2020.03.025

PMID: 32402466

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Yes
Permanent human dentition	Compatible by contextual inference
Quantitative evaluation of the target task	Yes

Decision rationale

Included on contextual population evidence: patients aged 19–71, referral for endodontic treatment and the radiographic/endodontic setting. The study evaluates 61 roots in 20 CBCT volumes and reports lesion detection performance. Permanent dentition is inferred, not explicitly confirmed for every unit; retained primary teeth are not expressly excluded.

Evidence location

PDF page 2, CBCT Selection; page 3, Results; page 4, Table 1.

Article 4 | Excluded — criterion not met

Artificial intelligence system seems to be able to detect a high proportion of periapical lesions in cone-beam computed tomographic images

Brignardello-Petersen R. Artificial intelligence system seems to be able to detect a high proportion of periapical lesions in cone-beam computed tomographic images. J Am Dent Assoc. 2020;151(9):e83.

DOI: https://doi.org/10.1016/j.adaj.2020.04.006

PMID: 32680587

Criterion	Assessment
Original empirical study	No
Dental radiographic imaging	Not assessed
Artificial intelligence	Not assessed
Periapical lesion presence or absence	Not assessed
Permanent human dentition	Not assessed
Quantitative evaluation of the target task	No original experiment

Decision rationale

Secondary commentary on the Orhan study, without an independent original investigation. Results from the commented study are not counted as a separate primary dataset.

Evidence location

Single-page commentary, Study summary.

Article 5 | Excluded — criterion not met

Artificial intelligence for detection of periapical lesions on intraoral radiographs: Comparison between convolutional neural networks and human observers

Pauwels R, Brasil DM, Yamasaki MC, Jacobs R, Bosmans H, Freitas DQ, Haiter-Neto F. Artificial intelligence for detection of periapical lesions on intraoral radiographs: Comparison between convolutional neural networks and human observers. Oral Surg Oral Med Oral Pathol Oral Radiol. 2021;131(5):610–616.

DOI: https://doi.org/10.1016/j.oooo.2021.01.018

PMID: 33653645

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Simulated lesions
Permanent human dentition	No
Quantitative evaluation of the target task	Yes, experimental model

Decision rationale

Experimental periapical defects were created in ten sockets prepared in bovine ribs. The model does not meet the permanent human dentition criterion, despite quantitative AI detection results.

Evidence location

PubMed abstract, Study Design; the supplied PDF is a bibliographic record, not the complete article.

Article 6 | Excluded — criterion not met

Dental enumeration and multiple treatment detection on panoramic X-rays using deep learning

Yüksel AE, Gültekin S, Simsar E, Özdemir ŞD, Gündoğar M, Tokgöz SB, Hamamcı İE. Dental enumeration and multiple treatment detection on panoramic X-rays using deep learning. Sci Rep. 2021;11(1):12342.

DOI: https://doi.org/10.1038/s41598-021-90386-1

PMID: 34117279

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Not established
Permanent human dentition	Unresolved
Quantitative evaluation of the target task	Not established for lesions

Decision rationale

DENTECT evaluates tooth numbering and treatment identification. A separate performance result for periapical lesion presence versus absence has not been established in the evidence reviewed. Excluded for the target-task mismatch; dentition also remains insufficiently documented.

Evidence location

Abstract and full text, treatment categories and model outcomes.

Article 7 | Excluded — criterion not met

Artificial intelligence in Endodontics: current Applications and future Directions

Aminoshariae A, Kulild J, Nagendrababu V. Artificial Intelligence in Endodontics: Current Applications and Future Directions. J Endod. 2021;47(9):1352–1357.

DOI: https://doi.org/10.1016/j.joen.2021.06.003

PMID: 34119562

Criterion	Assessment
Original empirical study	No
Dental radiographic imaging	Not assessed
Artificial intelligence	Not assessed
Periapical lesion presence or absence	Not assessed
Permanent human dentition	Not assessed
Quantitative evaluation of the target task	No original experiment

Decision rationale

Narrative review of AI applications in endodontics; no original diagnostic experiment meeting the target task.

Evidence location

Journal abstract describing a narrative review; the supplied PDF is a journal-page capture.

Article 8 | Included

Deep learning for categorization of endodontic lesion based on radiographic periapical index scoring system

Moidu NP, Sharma S, Chawla A, Kumar V, Logani A. Deep learning for categorization of endodontic lesion based on radiographic periapical index scoring system. Clin Oral Investig. 2022;26(1):651–658.

DOI: https://doi.org/10.1007/s00784-021-04043-y

PMID: 34213664

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Yes
Permanent human dentition	Yes, explicit sample criterion
Quantitative evaluation of the target task	Yes

Decision rationale

Included. Materials and methods, Data description, explicitly restricts inclusion to mature permanent mandibular teeth. The PAI-based model distinguishes healthy from diseased periapical regions and provides quantitative evaluation against expert labels. The full text resolves the previous population uncertainty.

Evidence location

PDF page 2, Materials and methods / Data description; quantitative PAI outcomes in Results.

Article 9 | Included

Clinically applicable artificial intelligence system for dental diagnosis with CBCT

Ezhov M, Gusarev M, Golitsyna M, Yates JM, Kushnerev E, Tamimi D, Aksoy S, Shumilov E, Sanders A, Orhan K. Clinically applicable artificial intelligence system for dental diagnosis with CBCT. Sci Rep. 2021;11(1):15006.

DOI: https://doi.org/10.1038/s41598-021-94093-9

PMID: 34294759

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Yes
Permanent human dentition	Compatible by contextual inference
Quantitative evaluation of the target task	Yes

Decision rationale

Included based on patients aged at least 21 years, permanent tooth identification in Figures 4 and 5, and a clinical evaluation organized into 32 dental positions per CBCT. Permanent dentition is inferred jointly from these findings; absence of retained primary teeth is not explicitly stated. Figure 5 illustrates an incorrect localization between teeth 45 and 46. Table 3 provides lesion-specific sensitivity 0.8383 and specificity 0.9953. The 32-position description applies to the clinical evaluation and is not automatically extended to every training dataset.

Evidence location

PDF pages 11–12, Figures 4–5; page 12, inclusion criteria; page 13, clinical evaluation; Table 3.

Article 10 | Excluded — criterion not met

A Classification-Guided segmentation Algorithm based on deep learning for epithelium segmentation in Histopathological images of Radicular Cysts

Qiu L, Huang M, Xu X, Zhao W, Zhao L, Zhong H, Tang Y, Zhao J. A Classification-Guided Segmentation Algorithm Based on Deep Learning for Epithelium Segmentation in Histopathological Images of Radicular Cysts. Annu Int Conf IEEE Eng Med Biol Soc. 2021;2021:3779–3782.

DOI: https://doi.org/10.1109/EMBC46164.2021.9630552

PMID: 34892058

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	No, histopathology
Artificial intelligence	Yes
Periapical lesion presence or absence	No
Permanent human dentition	Unresolved
Quantitative evaluation of the target task	Not for the target task

Decision rationale

The algorithm segments epithelium in histopathological images of radicular cysts. It does not evaluate dental radiographic detection of periapical lesions.

Evidence location

Abstract and methods describing histopathological epithelium segmentation.

Article 11 | Included

Artificial intelligence application in assessment of Panoramic radiographs

Zadrożny Ł, Regulski P, Brus-Sawczuk K, Czajkowska M, Parkanyi L, Ganz S, Mijiritsky E. Artificial Intelligence Application in Assessment of Panoramic Radiographs. Diagnostics (Basel). 2022;12(1):224.

DOI: https://doi.org/10.3390/diagnostics12010224

PMID: 35054390

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Yes
Permanent human dentition	Compatible by contextual inference
Quantitative evaluation of the target task	Yes

Decision rationale

Included by documentary population inference from the permanent-tooth odontogram and numbering, together with the evaluation structure. There are 30 panoramic images and 960 missing-tooth assessments, consistent with 32 positions per image, plus 805 periapical assessments. The 32-position interpretation is derived, not an express sample declaration. Absence of retained primary teeth is not explicitly established. Lesion-specific sensitivity 0.390 and specificity 0.981 are reported.

Evidence location

PDF pages 2–3, Figure 1; page 4, Methods; page 5, Table 1; pages 6, 8–9, tooth identification and examples.

Article 12 | Not included — insufficient information

A U-Net Approach to Apical Lesion segmentation on Panoramic radiographs

Bayrakdar IS, Orhan K, Çelik Ö, Bilgir E, Sağlam H, Kaplan FA, Görür SA, Odabaş A, Aslan AF, Różyło-Kalinowska I. A U-Net Approach to Apical Lesion Segmentation on Panoramic Radiographs. Biomed Res Int. 2022;2022:7035367.

DOI: https://doi.org/10.1155/2022/7035367

PMID: 35075428

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Yes
Permanent human dentition	Unresolved
Quantitative evaluation of the target task	Yes

Decision rationale

Not included in the current synthesis because the dentition of the 470-image sample, or separately extractable results for permanent human teeth, could not be established. The figures illustrate permanent teeth but do not characterize the entire assessed population. This is an information-based non-inclusion, not evidence that the sample contained primary teeth.

Evidence location

PDF page 2, Radiographic Data Preparation; page 5, Figures 4–5 and performance tables.

Article 13 | Excluded — criterion not met

FDG-PET/CT for oral focus assessment in head and neck cancer patients

Schwaninger DR, Hüllner M, Bichsel D, Giacomelli-Hiestand B, Stutzmann NS, Balermpas P, Valdec S, Stadlinger B. FDG-PET/CT for oral focus assessment in head and neck cancer patients. Clin Oral Investig. 2022;26(6):4407–4418.

DOI: https://doi.org/10.1007/s00784-022-04403-2

PMID: 35254526

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	No
Periapical lesion presence or absence	Lesions assessed without AI
Permanent human dentition	Unresolved
Quantitative evaluation of the target task	Not an AI performance test

Decision rationale

The study compares FDG-PET/CT with dental radiographs for oral focus assessment. It does not investigate an AI model for the target diagnostic task.

Evidence location

Abstract and study methods, comparison of FDG-PET/CT with dental imaging.

Article 14 | Excluded — criterion not met

Value of FDG-PET/MR in Oral Focus assessment in head and neck cancer Patients-A Feasibility Study

Valdec S, Bosshard FA, Hüllner M, Schwaninger DR, Stocker L, Giacomelli-Hiestand B, Stadlinger B. Value of FDG-PET/MR in Oral Focus Assessment in Head and Neck Cancer Patients-A Feasibility Study. Front Med (Lausanne). 2022;9:809323.

DOI: https://doi.org/10.3389/fmed.2022.809323

PMID: 35386916

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	No
Periapical lesion presence or absence	Lesions assessed without AI
Permanent human dentition	Unresolved
Quantitative evaluation of the target task	Not an AI performance test

Decision rationale

The study compares FDG-PET/MR with dental focus assessment, including conventional radiographs. No AI diagnostic model for the target task is evaluated.

Evidence location

Abstract and methods, oral focus assessment by FDG-PET/MR.

Article 15 | Included

Automatic detection of Periapical Osteolytic lesions on cone-beam computed tomography using deep Convolutional Neuronal Networks

Kirnbauer B, Hadzic A, Jakse N, Bischof H, Stern D. Automatic Detection of Periapical Osteolytic Lesions on Cone-beam Computed Tomography Using Deep Convolutional Neuronal Networks. J Endod. 2022;48(11):1434–1440.

DOI: https://doi.org/10.1016/j.joen.2022.07.013

PMID: 35952897

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Yes
Permanent human dentition	Yes, explicit sample criterion
Quantitative evaluation of the target task	Yes

Decision rationale

Included. The Discussion explicitly states that exclusively adult teeth with finished apex development were included. The selection criteria also require completed root development. The study evaluates 144 CBCT volumes, comprising 2128 teeth, with lesion detection and quantitative comparison against reference annotations.

Evidence location

PDF page 2, CBCT Data Set Selection; page 3, Training and Validation; page 6, Discussion.

Article 16 | Excluded — criterion not met

Artificial intelligence in Dentistry: Past, Present, and future

Agrawal P, Nikhade P. Artificial Intelligence in Dentistry: Past, Present, and Future. Cureus. 2022;14(7):e27405.

DOI: https://doi.org/10.7759/cureus.27405

PMID: 36046326

Criterion	Assessment
Original empirical study	No
Dental radiographic imaging	Not assessed
Artificial intelligence	Not assessed
Periapical lesion presence or absence	Not assessed
Permanent human dentition	Not assessed
Quantitative evaluation of the target task	No original experiment

Decision rationale

Review of AI applications in dentistry, without an original experiment meeting the target task.

Evidence location

Review article and narrative discussion of AI applications.

Article 17 | Excluded — criterion not met

Present status and future directions: Imaging techniques for the detection of periapical lesions

Cotti E, Schirru E. Present status and future directions: Imaging techniques for the detection of periapical lesions. Int Endod J. 2022;55 Suppl 4:1085–1099.

DOI: https://doi.org/10.1111/iej.13828

PMID: 36059089

Criterion	Assessment
Original empirical study	No
Dental radiographic imaging	Not assessed
Artificial intelligence	Not assessed
Periapical lesion presence or absence	Not assessed
Permanent human dentition	Not assessed
Quantitative evaluation of the target task	No original experiment

Decision rationale

Narrative review of imaging techniques for periapical lesion detection, without an original AI diagnostic experiment.

Evidence location

Abstract identifying a narrative review of imaging techniques.

Article 18 | Included

Automatic classification system for Periapical lesions in cone-beam computed tomography

Calazans MAA, Ferreira FABS, Alcoforado MLMG, Santos AD, Pontual ADA, Madeiro F. Automatic Classification System for Periapical Lesions in Cone-Beam Computed Tomography. Sensors (Basel). 2022;22(17):6481.

DOI: https://doi.org/10.3390/s22176481

PMID: 36080940

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Yes
Permanent human dentition	Compatible by contextual inference
Quantitative evaluation of the target task	Yes

Decision rationale

Included by contextual population inference from selection of human endodontically treated maxillary molars and their clinical and radiographic characteristics. The final sample comprises 1000 molars from 885 CBCT examinations. Permanent dentition is not expressly declared and inclusion or exclusion of primary teeth is not specified. The model evaluates lesion presence versus absence.

Evidence location

PDF page 6, Database and Figure 2; page 7, Table 2.

Article 19 | Excluded — criterion not met

The efficiency of artificial intelligence methods for finding radiographic features in different endodontic treatments - a systematic review

Ramezanzade S, Laurentiu T, Bakhshandah A, Ibragimov B, Kvist T, Bjørndal L. The efficiency of artificial intelligence methods for finding radiographic features in different endodontic treatments - a systematic review. Acta Odontol Scand. 2023;81(6):422–435.

DOI: https://doi.org/10.1080/00016357.2022.2158929

PMID: 36548872

Criterion	Assessment
Original empirical study	No
Dental radiographic imaging	Not assessed
Artificial intelligence	Not assessed
Periapical lesion presence or absence	Not assessed
Permanent human dentition	Not assessed
Quantitative evaluation of the target task	No original experiment

Decision rationale

Systematic review synthesizing other studies. It is not an original primary experiment of periapical lesion detection.

Evidence location

Abstract and methods identifying a systematic review.

Article 20 | Included

Automatic feature segmentation in dental Periapical radiographs

Ari T, Sağlam H, Öksüzoğlu H, Kazan O, Bayrakdar İŞ, Duman SB, Çelik Ö, Jagtap R, Futyma-Gąbka K, Różyło-Kalinowska I, Orhan K. Automatic Feature Segmentation in Dental Periapical Radiographs. Diagnostics (Basel). 2022;12(12):3081.

DOI: https://doi.org/10.3390/diagnostics12123081

PMID: 36553088

Criterion	Assessment
Original empirical study	Yes
Dental radiographic imaging	Yes
Artificial intelligence	Yes
Periapical lesion presence or absence	Yes
Permanent human dentition	Compatible by contextual inference
Quantitative evaluation of the target task	Yes

Decision rationale

Included by contextual population inference from adult patient selection and figures showing permanent teeth. The study reports 1169 periapical radiographs and lesion-specific sensitivity 0.92, precision 0.85 and F1 0.88. The images are examples; the article does not explicitly establish absence of retained primary teeth across all assessed units.

Evidence location

PDF page 2, Patient Selection; page 5, Figure 3; page 6, lesion-specific outcomes.