Journal of Dental Education

WILEY

ADEA THE VOICE OF DENTAL EDUCATION

ADVANCING THROUGH INNOVATION

AI vs. Dental Students: A Comparison of Periapical Radiolucency Detection in Radiographs

Daria Mages[1] | Ane Poly[1] | Roberta Pileggi[1] | Anita Gohel[2]

[1]Department of Endodontics, University of Florida College of Dentistry, Gainesville, Florida, USA | [2]Department of Oral & Maxillofacial Diagnostic Sciences, University of Florida College of Dentistry, Gainesville, Florida, USA

Correspondence: Ane Poly (polydarocha.a@ufl.edu)

Received: 22 July 2025 | **Revised:** 19 December 2025 | **Accepted:** 1 January 2026

1 | Problem

Periapical radiolucencies (PARLs) are significant diagnostic indicators in dentistry, often associated with underlying pathologies such as occlusal trauma, infections, cysts, or nonodontogenic diseases, like malignancies [1]. Early and accurate detection of these radiolucencies is essential for preventing disease progression and guiding appropriate treatment [2].

Traditionally, PARL detection has relied on the clinical judgment and expertise of dental professionals. However, for dental students, accurate radiographic interpretation remains challenging due to limited clinical experience and minimal exposure to varied cases. Moreover, human error, particularly in detecting small or subtle lesions, can lead to inconsistent radiographic diagnoses and hinder appropriate patient care [3].

Recent advancements in artificial intelligence (AI) have introduced tools capable of analyzing dental radiographs with high accuracy [4]. No published studies have examined the use of AI-assisted image analysis specifically within endodontic diagnostic education.

2 | Solution

One such tool is Overjet (Overjet Inc., Boston, Massachusetts), a deep learning-based AI software that identifies and classifies PARLs by size, location, and likelihood of pathology in periapical radiographs. This pilot study aimed to evaluate the diagnostic performance of AI compared to that of dental students in detecting PARLs on periapical radiographs.

A total of 89 dental students, comprising 47 third-year (D3) and 42 fourth-year (D4) students, from the University of Florida College of Dentistry volunteered to participate. The dental curriculum is a 4-year program that concludes in May. All participants had completed coursework in radiology and had clinical experience, with D4s having approximately one additional year of experience in radiograph interpretation compared to D3s.

A dataset of 15 periapical radiographs with 41 PARLs confirmed by a board-certified radiologist was used. These radiographs included a range of lesion sizes and locations to ensure diagnostic complexity (Table 1). Lesion sizes were categorized based on Estrela et al. [5] as follows: Small: ≤ 2 mm or > 2 to ≤ 4 mm; medium: > 4 mm and ≤ 6 mm.

In May 2025, students reviewed the images under standardized conditions on calibrated monitors. They were instructed to record the presence or absence of PARLs. The AI software simultaneously analyzed the same images, automatically detecting radiolucencies (Figure 1).

3 | Results

The AI software significantly outperformed both D3 and D4 participants in overall diagnostic accuracy (Table 2), sensitivity (AI: 95%, D3: 72%, and D4: 85%), and specificity (AI: 90%, D3: 80%, and D4: 88%) ($p < 0.05$). The AI software performs reliably when evaluating teeth with caries or those that have undergone endodontic treatment; however, isolated widening of the apical periodontal ligament space, particularly in the absence of caries, may not be consistently detected by the software.

TABLE 1 | Descriptive summary of the lesion characteristics across 15 study cases.

Case ID	Location	Teeth number	Number of lesions	Lesions' size[a]
1	Posterior maxilla	3, 4	01	> 2, ≤ 4 mm
			02	> 4, ≤ 6 mm
2	Posterior maxilla	13, 14	02	≤ 2 mm
			01	> 2, ≤ 4 mm
3	Posterior mandible	18, 19, 20	02	≤ 2 mm
			01	> 2, ≤ 4 mm
			03	> 4, ≤ 6 mm
4	Posterior maxilla	2, 4	02	≤ 2 mm
			01	> 2, ≤ 4 mm
5	Posterior maxilla	2	01	> 2, ≤ 4 mm
6	Anterior maxilla	8	01	> 4, ≤ 6 mm
7	Posterior maxilla	14	01	≤ 2 mm
			02	> 2, ≤ 4 mm
8	Posterior maxilla	13	01	> 4, ≤ 6 mm
9	Posterior mandible	29	01	> 4, ≤ 6 mm
10	Posterior maxilla	2	01	≤ 2 mm
			01	> 2, ≤ 4 mm
11	Anterior maxilla	9	01	≤ 2 mm
12	Anterior maxilla	8	01	> 2, ≤ 4 mm
13	Posterior maxilla	3, 4	02	≤ 2 mm
14	Posterior mandible	30	01	≤ 2 mm
			01	> 2, ≤ 4 mm
15	Posterior mandible	30	01	≤ 2 mm
			01	> 2, ≤ 4 mm

[a]Small, ≤ 4 mm; Medium, > 4 mm and ≤ 6 mm [5].

TABLE 2 | Accuracy of AI, D3, and D4 examiners by lesion size.

Lesion size	AI software	D3	D4
≤ 2 mm:	95%	65%	78%
> 2, ≤ 4 mm:	100%	70%	77%
> 4, ≤ 6 mm:	100%	82%	82%
Overall:	92%	72%	85%

Note: D3 = third-year dental student; D4 = fourth-year dental student.

Our pilot study suggests that using AI to detect PARLs can enhance diagnostic accuracy. Therefore, the long-term impact of AI-assisted diagnoses training should be further explored. The high sensitivity and specificity of AI, particularly in identifying small lesions, underscore its potential as a valuable educational tool to reduce missed diagnoses and improve early intervention outcomes. AI can complement human judgment, and so these findings highlight an opportunity to integrate AI into dental curricula to support the development of students' diagnostic skills.

References

1. F. Sirotheau Corrêa Pontes, F. Paiva Fonseca, A. Souza de Jesus, et al., "Nonendodontic Lesions Misdiagnosed as Apical Periodontitis Lesions: Series of Case Reports and Review of Literature," *Journal of Endodontics* 40, no. 1 (2014): 16–27.

2. A. C. Georgiou, J. W. R. Twisk, W. Crielaard, P. Ouwerling, A. H. Schoneveld, and S. V. Van Der Waal, "The Influence of Apical Periodontitis on Circulatory Inflammatory Mediators in Peripheral Blood: A Prospective Case–Control Study," *International Endodontic Journal* 56, no. 2 (2023): 130–145.

3. M. Goldman, A. H. Pearson, and N. Darzenta, "Reliability of Radiographic Interpretations," *Oral Surgery, Oral Medicine, and Oral Pathology* 38 (1974): 287–293.

4. W. I. Ibraheem, S. Jain, M. N. Ayoub, et al., "Assessment of the Diagnostic Accuracy of Artificial Intelligence Software in Identifying Common Periodontal and Restorative Dental Conditions (Marginal Bone Loss, Periapical Lesion, Crown, Restoration, Dental Caries) in Intraoral Periapical Radiographs," *Diagnostics* 15, no. 11 (2025): 1432.

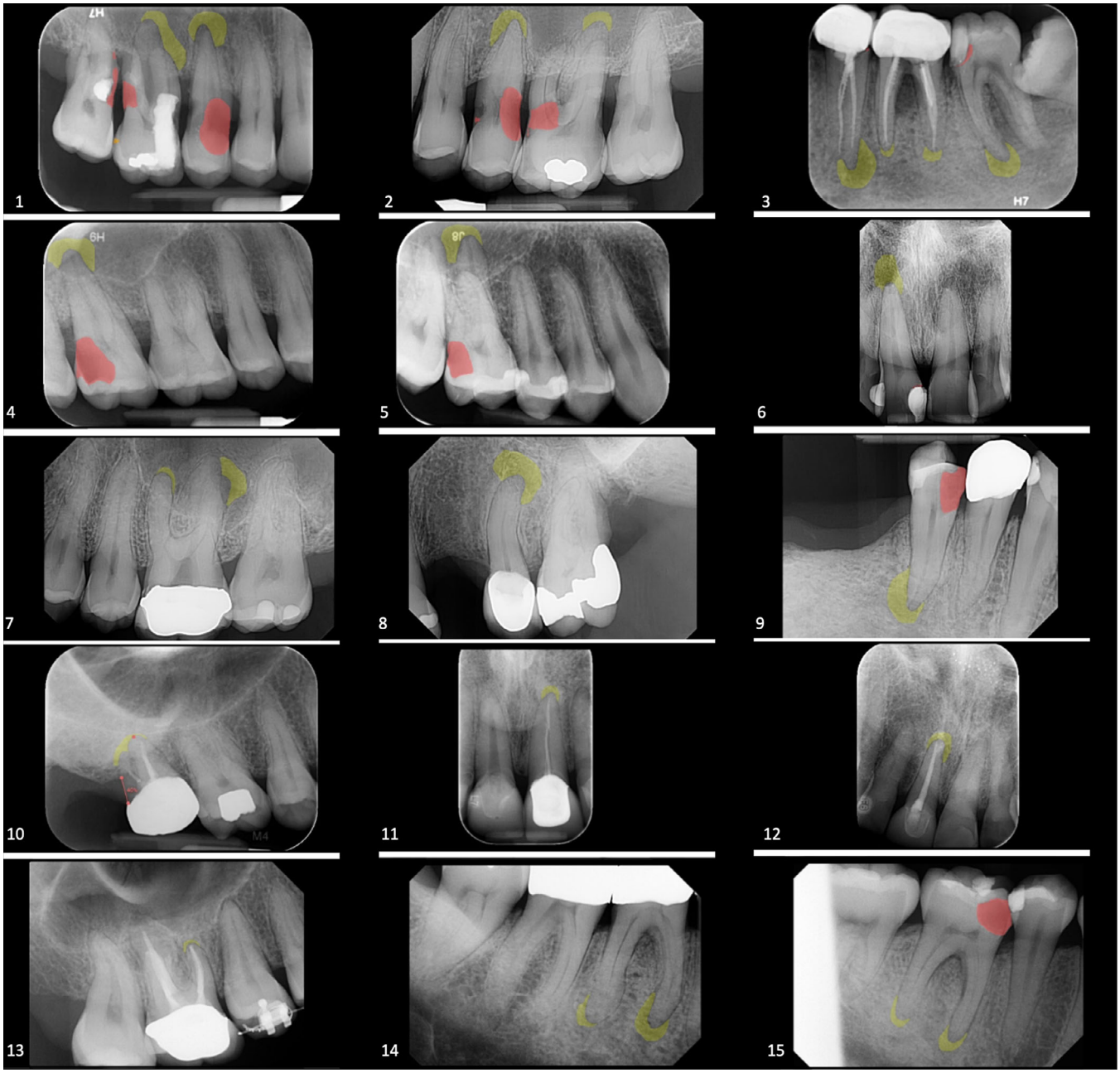

FIGURE 1 | Example of AI software output indicating PARLs (yellow) and caries lesions (red) throughout the 15 study cases.

5. C. Estrela, M. R. Bueno, B. C. Azevedo, J. R. Azevedo, and J. D. Pécora, "A New Periapical Index Based on Cone Beam Computed Tomography," *Journal of Endodontics* 34, no. 11 (2008): 1325–1331.