
AI in Dental Radiography

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Evolving Role of Artificial Intelligence in Radiological Imaging
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Why does it matter?

Dentistry is defined as the **evaluation, diagnosis, prevention and/or treatment** (nonsurgical, surgical or related procedures) of diseases, disorders and/or conditions of the oral cavity, maxillofacial area and/or the adjacent and associated structures and their impact on the human body; provided by a dentist¹.

Most Common dental diseases are tooth decay (caries) and gum diseases (periodontal diseases). Infections, cysts, granulomas and tumors are also observed as radiolucencies in dental radiographic images.



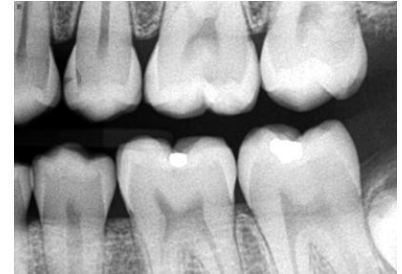


Why does it matter?

Compared to radiologists, dentists have less training, acquired during their dental studies. At the same time dentists evaluate, diagnose, prevent or treat which is also a comprehensive workflow.

Dentists may;

- Miss 28 to 49 percent of periapical radiolucencies (depending on experience) in their visual assessment of dental radiographic images².
- Misdiagnose in determining the depth of cavities up to 40 percent^{3,4}.
- Misdiagnose teeth as diseased up to 20 percent^{3,4}.





How can AI help?

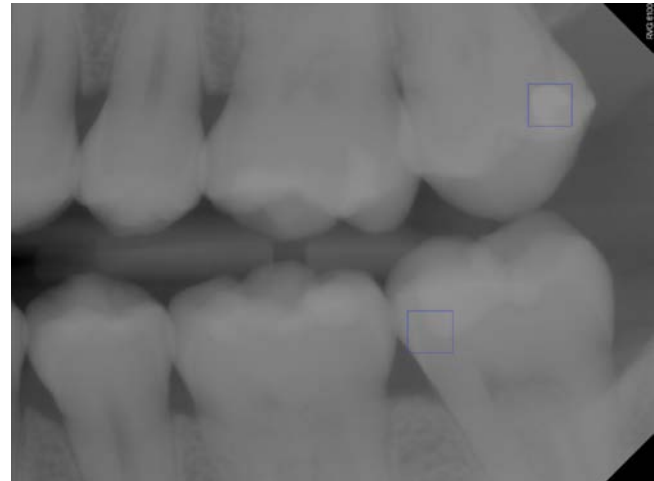
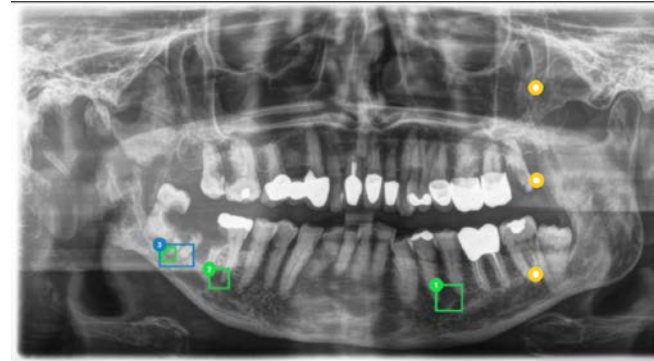
Improve Dentist Diagnostic Accuracy

Promote Early Detection

Reduce the Rate of Missed Treatable Diseases

Reduce Misdiagnosis and Unnecessary Treatments

Improve Patient Quality of Life





Challenges and recent regulatory updates

Challenges:

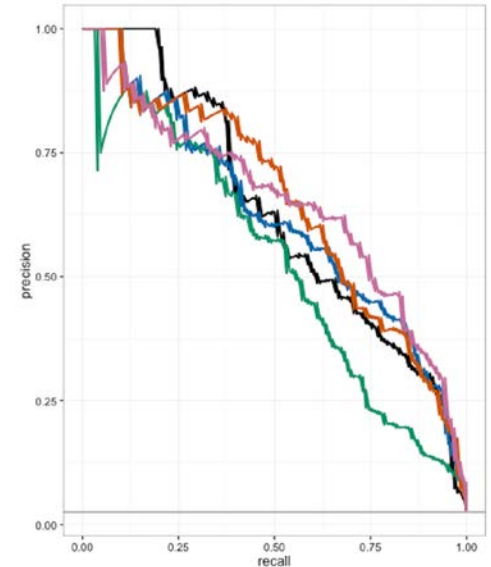
Significant Clinical Decision Variability Between Dentists

- Larger Training Datasets for Superior Model Performance
 - Cost and Time Burden
- Designing Robust Clinical Studies
 - Ground Truthing
 - Clinical Reader Performance
- Developing Models for Wider Range of Pathologies

Recent Regulatory Updates:

Down-classification on Medical Image Analyzers (MYN) from Class III to Class II

- Important regulatory update (21 CFR 892.2070) published on 01/22/2020
 - Allows a feasible regulatory pathway for dental (CAdE) devices





References

¹ ADA Definition of Dentistry, American Dental Association House of Delegates, 10/21/97.

<http://www.centreoms.com/admin/storage/news/ADA%20Definition%20of%20OMS%20and%20Dentistry.pdf>

² Ekert T, Krois J, Meinhold L, Elhennawy K, Emara R, Golla T, Schwendicke F (2019) Deep Learning for the Radiographic Detection of Apical Lesions. J Endod. 2019 Jul;45(7):917-922.e5. doi: 10.1016/j.joen.2019.03.016. Epub 2019 Jun 1

³ Valizadeh S, Goodini M, Ehsani S, Mohseni H, Azimi F, Bakhshandeh H (2015) Designing of a Computer Software for Detection of Approximal Caries in Posterior Teeth. Iran J Radiol 12 e16242.

⁴ White SC, Hollender L, Gratt BM (1984) Comparison of xeroradiographs and film for detection of proximal surface caries. J Am Dent Assoc 108 755–9.