

## Artificial Intelligence in Preventive Dentistry: Enhancing Early Detection of Dental Caries

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### ABSTRACT

Identifying and addressing cavities has proven to be particularly difficult for professionals in the field of preventive dentistry due to the shortcomings of traditional visual and radiographic examinations that capture images of demineralized and weakened enamel. Developing technologies in the field of digital imaging and artificial intelligence (AI) have the potential to capture images of early carious lesions with greater accuracy. The purpose of this article is to offer the preliminary potential clinical role of AI-driven intraoral imaging in the early detection of caries.

**Keywords:** Caries Detection; Digital Dentistry; Intraoral Imaging; Preventive Dentistry and Artificial Intelligence.

### INTRODUCTION

The World Health Organization (WHO) and many health professionals consider and treat dental caries as a prominent global health concern. Preventive dentistry has made breakthroughs, yet one of the most common problems involves the inability to identify early-stage dental caries in a dental examination.[1] Enamel lesions and occlusal caries are often not spotted using the traditional methods of bitewing radiography and visual-tactile examinations. Innovative technologies in digital dentistry have developed artificial intelligence driven diagnostic tools that can evaluate intraoral images to identify and analyze small carious regions that have the potential to be easily missed by the eye. [2] AI algorithms are built, analyzed, and trained to detect caries on clinical images, allowing programmers to assist in the detection of caries.[3]

### DESCRIPTION

This articulation describes a preliminary observational study evaluating the pros that may come from the use of AI in intraoral imaging when trying to identify early caries for the first time. As a part of a pilot observation, a practice was conducted in a regular dental practice setting, where digital intraoral photographs were captured via a high resolution intraoral camera and during the routine patient examination. The photographs were then able to be analyzed using a prototype AI-based software designed to identify the early stages of demineralization. [4]

The software analyzed these photographs to look for:

- Opacity changes on the Surface
- White spot lesions
- Enamel microstructural irregularities

The preliminary observations showed that the AI system was able to notify obscure early stages of dents and lesions, which were missed during the initial visual examination. The pointed out lesions were then reviewed by the clinicians and in several instances corroborated to be the right level of demineralization. The adjunctive AI did not altogether replace the clinical responsibility but rather acted as a subservient principle. Furthermore, the technology also allowed for the optimization of patient education. The flagged photographs were able to help the dentist visually explain to the patient the level of caries risk, which was able to elicit the patient to take immediate preventative action.

### Potential Advantages

AI-assisted diagnostic systems may provide several benefits in routine dental practice:

- 1. Improved Early Detection:** Capturing early detection of demineralization before cavitation occurs. [1, 5]
- 2.Enhanced Diagnostic Consistency:** Minimizing diagnostic subjectivity and variability amongst clinicians.

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**3. Patient Engagement:** Visual tools improve patient understanding of oral health conditions.

**4. Preventive Treatment Planning:** Early detection makes it possible to implement remineralization therapies instead of restorative interventions.

## CONCLUSION

Future Perspectives AI-assisted intraoral imaging is a new technology in preventive dentistry that shows a lot of potentials. Early evidence suggests that AI technology improves the detection of early carious lesions and the implementation of preventative treatment by dentists. If the technology keeps improving, it is likely that AI-based systems will be a common diagnostic tool in dentistry. This will enhance the overall health of the population. Research related to the use of AI in diagnostic systems paired with electronic health records and teledentistry is a relevant area of research to explore.

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