Artificial Intelligence for Interproximal Caries Detection in Pediatric Population

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Introduction

- **Purpose of this study is to assess performance of dentists using Artificial Intelligence (AI) for caries detection**
- AI is used for many dental support functions like landmark detection, tooth identification, caries diagnosis, scheduling, and billing
- Pediatric population at high caries risk may benefit from early caries identification
- Pediatric Dental Residents at University of Texas Health Science Center , San Antonio (UTHSCSA) in the best position for study

Materials and Methods

- **Hypothesis: AI software will improve performance of dental residents for interproximal caries detection**
- Bitewing radiographs are standard of care for interproximal caries detection
- Paired case-control study 20 bitewing radiographs
- To classify caries according to ADA Classification (E0-D3):
  - E0: No caries, E1: Enamel caries ½, E2: Enamel caries >½, D1: Dentin caries ⅓, D2: Dentin caries ⅔, D3: Dentin caries >⅔
- Training provided prior to study via presentation and test bitewings on AI software
- Residents asked to complete a four questions satisfaction survey at end of study
- Positive predictive value (PPV), Negative predictive value (NPV), Sensitivity, Specificity analysis conducted to evaluate provider performance
- Study completed between May 2023 to October 2023

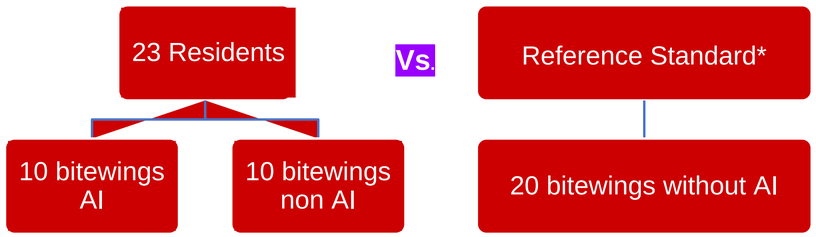
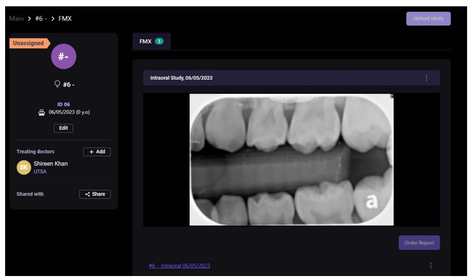


Figure 1 - Study design

* 2 Pediatric Dentists + 1 Oral Radiologist



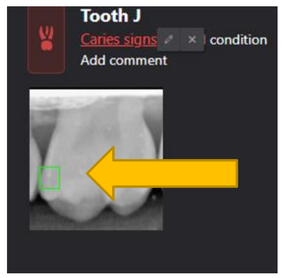


Figure 2- Diagnocat Interface

Results

- 7,290 surfaces were analyzed
- 62% surfaces were included
- AI tool for interproximal caries diagnosis does not improve performance of pediatric dental residents
- Observational hypothesis: AI can be used as a screening tool for caries diagnosis

	Sensitivity	Specificity	PPV	NPV
With AI	0.95 (0.91, 0.98)	0.78 (0.68, 0.85)	0.88 (0.82, 0.92)	0.91 (0.83, 0.96)
Without AI	0.91 (0.86, 0.95)	0.87 (0.78, 0.93)	0.94 (0.89, 0.97)	0.82 (0.73, 0.90)
p value			0.043 (p < .05)	

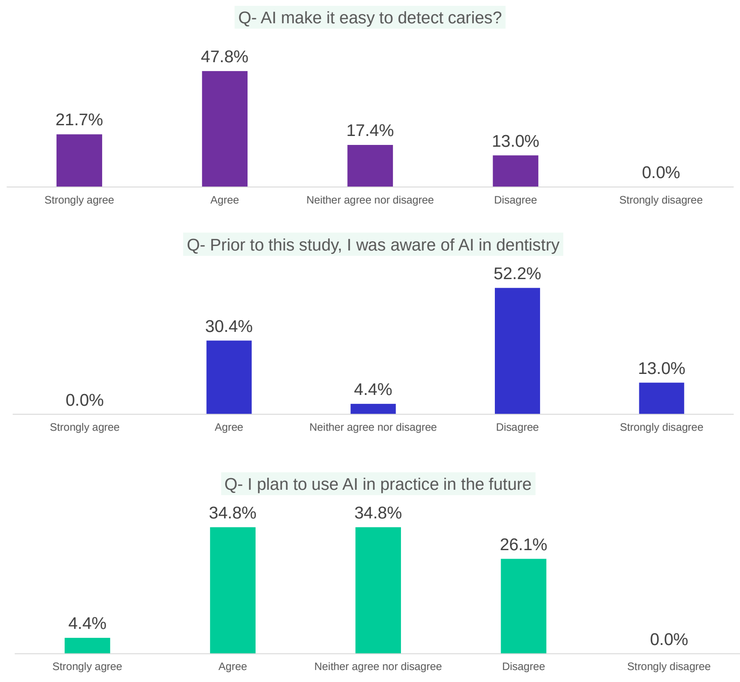
Table 1 – AI Vs. Non-AI Results

	Sensitivity	Specificity	PPV	NPV
Provider without AI	0.90 (0.86, 0.93)	0.81 (0.79, 0.83)	0.49 (0.45, 0.54)	0.98 (0.97, 0.98)
AI independently	0.82 (0.69, 0.91)	0.87 (0.81, 0.92)	0.67 (0.54, 0.79)	0.94 (0.89, 0.97)
p value		0.049 (p < .05)		

Table 2 – AI as Screening Tool Results

Survey Results

- 68% agreed or strongly agreed AI made it easy to detect caries
- 38% agreed or strongly agreed to future use of AI in practice



Total Units of Analysis			
Tooth surface	**mesial surface (N=3645)**	**distal surface (N=3645)**	**Total (N=7290)**
E0	**1924 (52.8%)**	**1926 (52.8%)**	**3850 (52.8%)**
E1	**69 (1.9%)**	**91 (2.5%)**	**160 (2.2%)**
E2	**46 (1.3%)**	**46 (1.3%)**	**92 (1.3%)**
D1	**46 (1.3%)**	**46 (1.3%)**	**92 (1.3%)**
D2	**114 (3.1%)**	**161 (4.4%)**	**275 (3.8%)**
D3	**0 (0%)**	**46 (1.3%)**	**46 (0.6%)**
Inconclusive	366 (10.0%)	298 (8.2%)	664 (9.1%)
Not Diagnosable	367 (10.1%)	253 (6.9%)	620 (8.5%)
Discard	713 (19.6%)	778 (21.3%)	1491 (20.5%)

Table 3 – Units of Analysis (surfaces)

Discussion

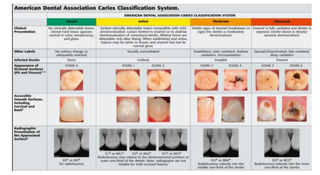
- Dentin or enamel caries diagnosis is important as it determines treatment outcome
- Excluded surfaces were not diagnosable from overlap, previously restored, inconclusive due to charting error or faculty disagreement
- No FDA approved primary tooth software at time of study
- Mantel-Hanzel test for power analysis for 23 providers.

Limitations

- Only one AI software available for study of primary teeth and not FDA approved
- Training was limited to presentation and provider manual
- No washout period between readings
- Manual charting may have led to higher excluded surfaces from the study

Conclusion

- In this study AI tool does not significantly improve performance of pediatric dental residents for interproximal caries diagnosis
- AI can be used as a screening tool for interproximal caries diagnosis



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