Detecting Dental Caries and Furcation Involvement through Artificial Intelligence

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Background

In today's booming artificial intelligence (AI) industry, workers across all professions are looking at how AI could be incorporated into everyday use. As pediatric dentists, we look forward to working alongside AI powered programs that could assist our efficiency and clinical judgement in the practice setting. One such way would be having AI help detect the presence of dental caries and furcation involvement so we could improve both efficiency and accuracy in terms of treatment planning. In this research project, we will be testing the accuracy of AI detected caries and furcation involvement compared to clinical findings by a board-certified pediatric dentist. A collection of pediatric bitewing radiographs will be examined and assessed by an AI software. The results will give insight into the current expectations of AI in dentistry as well as what improvements can be made for the future.

Abstract

Purpose: The purpose of this research project is to test the accuracy of artificial intelligence (AI) detected dental caries and furcation involvement lesions compared to radiographic findings by a board-certified pediatric dentist.
Methods: A total of 15 pediatric (ages 13 and below) bitewing radiographs will be examined and assessed by Diagnocat, an artificial intelligence dental platform. The bitewings will be submitted for evaluation and detection of dental caries and furcation involvement lesions by Diagnocat. The results from Diagnocat will be compared to the dental caries and furcation lesions found radiographically by a licensed pediatric dentist. The percentage accuracy of the AI detection will be calculated.
Results: Of the 15 radiographs, 4/15 were 100% match in findings between Diagnocat AI software and the board-certified pediatric dentist. 9/15 had 1 discrepancy and 2/15 had 2 discrepancies.
Conclusion: Artificial intelligence has shown potential as a valuable tool in pediatric dentistry by closely matching the diagnostic performance of a board-certified pediatric dentist, with minimal discrepancies in carious lesion detection.

Purpose

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References

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Methods and Materials

Materials:
Diagnocat (Dental AI Software)
15 Pediatric Dental Bitewings
Board Certified Pediatric Dentist
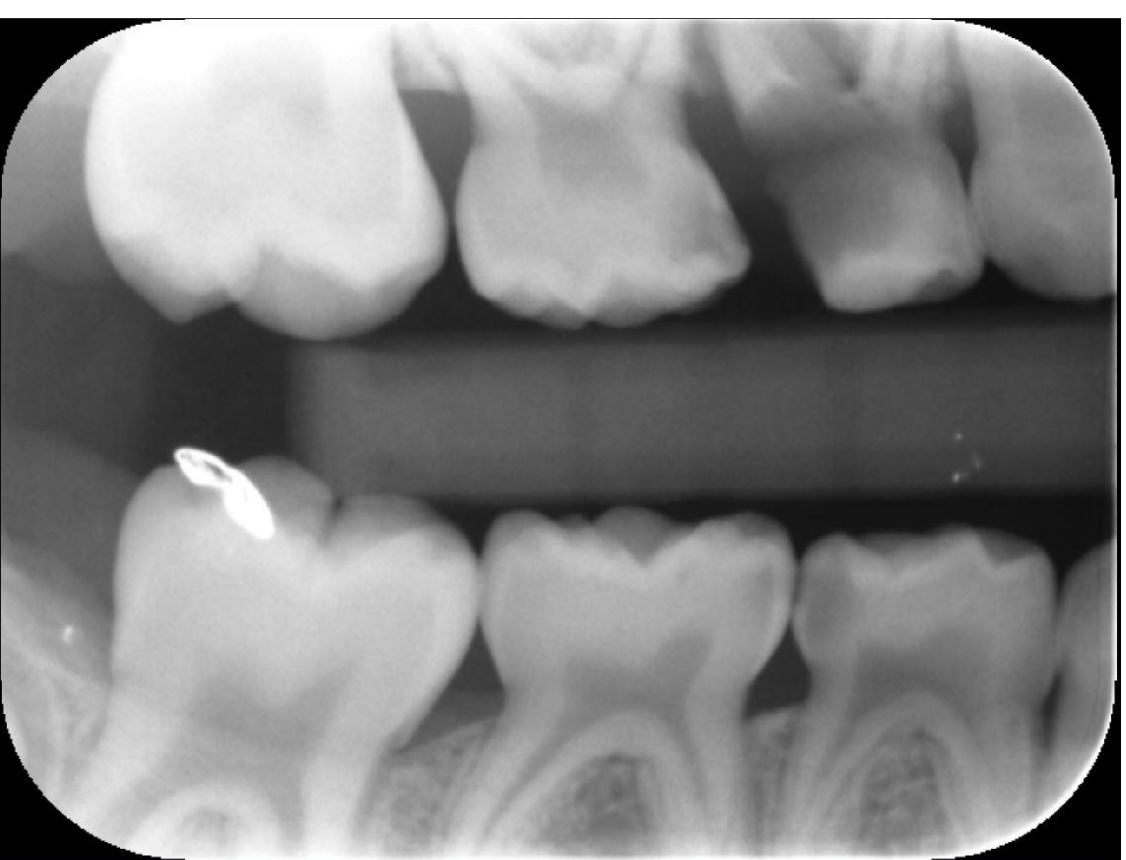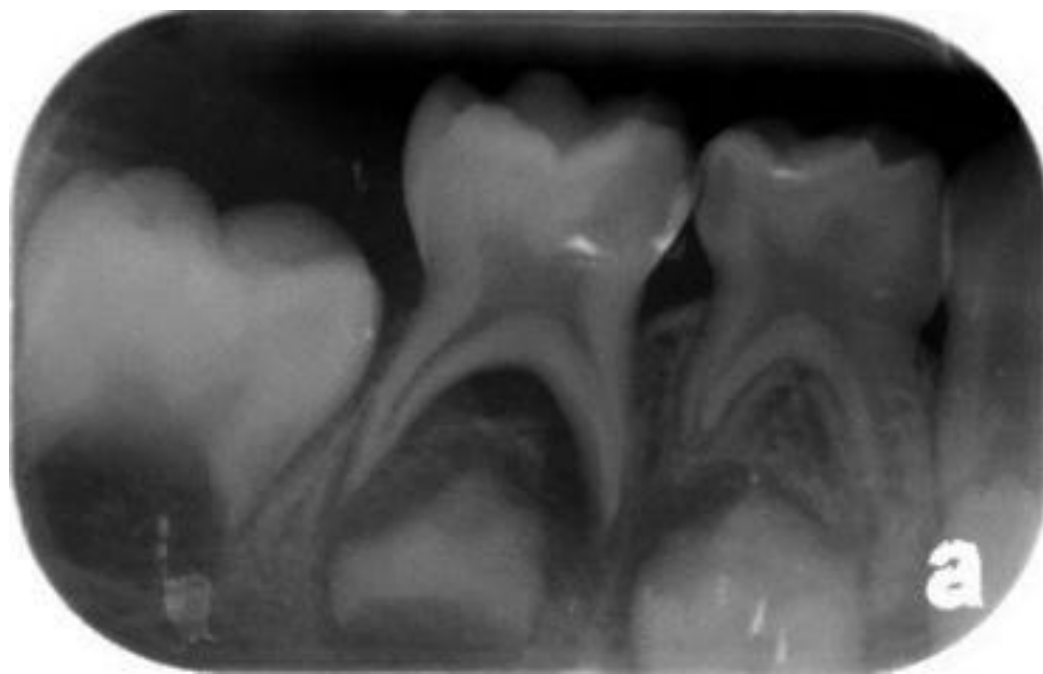
Method:
A total of 15 pediatric (ages 13 and below) bitewing radiographs will be examined and assessed by Diagnocat, an artificial intelligence dental platform. Some bitewings will contain carious decay and other ones will also present with furcation involvement. The bitewings will be submitted for evaluation and detection of dental caries and furcation involvement lesions by Diagnocat. The results from Diagnocat will be compared to the dental caries and furcation lesions found clinically by a board-certified pediatric dentist from the Rutgers School of Dental Medicine Pediatric Dentistry Department. The percentage accuracy of the AI detection will be calculated.

Data

X-Ray #	Dr. Mohan (Board-Certified Pediatric Dentist)	Diagnocat (Dental AI Software)	100% match in carious findings?	# of finding discrepancies	Furcation Involvement Detection
1	#19O	#19 O, #20 O	No	1	No
2	NONE	#19 DO	No	1	No
3	#T MO, #S DO, #A MO, #B DO	#A MO, #B DO, #S DO, #T MO	Yes	0	No
4	#3O, #30O	#3O, #30O	Yes	0	No
5	NONE	#I DO	No	1	No
6	#K MO, #L DO	#I O, #K MO, #L DO	No	1	No
7	#29 DO	#28D, #29 DO	No	1	No
8	#TO, #T MO, #S DO	#BO, #S DO, #T M,O	No	1	No
9	#T MO, #S DO, #B DO	#S DO, #T MO	No	1	No
10	#19 O, #J MO	#J MO, #19 O	Yes	0	No
11	#I DO/#J MO, #L DO, #K MO	#K MO, #L DO	No	1	No
12	NONE	#3O, Resorbing #A, #T MOD, #30 Secondary caries	No	2	No
13	#J MO, #L DO	#J MO	No	1	No
14	#I DO	#I DO, #J M, #R D	No	2	No
15	#A DOM, #B DO, #S DO, #T MO	#A DOM, #B DO, #S DO, #T MO	Yes	0	No

Results

Our results show that of the 15 radiographs, 4/15 had 100% match in dental carious findings between the Diagnocat AI software and the board-certified pediatric dentist. 9/15 radiographs had one discrepancy in carious findings. 2/15 had two discrepancies in carious findings. There were no more than two finding discrepancies between Diagnocat (AI) and the board-certified pediatric dentist. The Diagnocat AI software did not detect any furcation involvement.

Discussion - Limitations

Due to the learning curve of using artificial intelligence to read radiographs, there were multiple challenges faced, including trial and error in properly uploading the radiographic images, which resulted in delay obtaining results. In this project, a total of 15 radiographs were used. A larger sample size could provide a more accurate representation of AI's ability to detect carious lesions in various types of teeth and decay. Furthermore, bitewings may not be the most optimal radiograph for detecting furcation involvement. Perhaps periapical radiographs could be used in future studies to access AI's ability to detect furcation involvement lesions.

Conclusion

Upon evaluation of the final results, it is evident that artificial intelligence can serve as a helpful asset in pediatric dentistry. Although there were only 4 radiographs in which there was a 100% match in carious detection between AI and a board-certified pediatric dentist, none of the radiographs resulted in more than two discrepancies, with 9 of them having only one discrepancy. This shows that AI is able to detect carious lesions quite closely to a licensed dental professional. In addition, in eight of the radiographs that resulted in discrepancies, AI detected additional carious lesions. While the accuracy of AI detected lesions can be questioned, it would still be a helpful tool in identifying potential carious lesions easily missed by human professionals. In conclusion, AI can create a more efficient clinical experience through assisting in detecting dental defects and treatment planning. As technology continues to advance, integrating AI into clinical dentistry holds great promise for enhancing diagnostic accuracy, supporting clinical decision-making, and shaping the future of pediatric dentistry.