How is AI Transforming Pediatric Dental Care?

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Abstract

Artificial Intelligence (AI) is revolutionizing pediatric dentistry, offering innovative solutions to improve children's oral health and treatment outcomes. Recent advancements in AI-driven technologies, particularly Convolutional Neural Networks (CNNs), have significantly enhanced caries detection and radiographic characterization accuracy. This poster presentation explores the cutting-edge applications of AI in pediatric dental care, from improved caries detection using Convolutional Neural Networks (CNNs) to AI-assisted CAD/CAM systems for optimized restorations. We'll examine how AI enables personalized preventive care plans and revolutionizes behavioral management through virtual and augmented reality technologies

Materials and Methods

- A comprehensive literature review was conducted using electronic databases including PubMed, Google Scholar, and Cochrane Library
- The search period covered publications from 2011 to 2025, focusing on the most recent advancements in AI applications for pediatric dentistry.
- Keywords used in the search included: "AI AND pediatric dentistry," "artificial neural networks AND pediatric dentistry," "convolutional neural networks AND pediatric dentistry," and "machine learning AND pediatric dentistry"

Result

Aspect	Diagnostic Accuracy	Behavior Management	Communication	Treatment Personalization
Traditional Methods	Relies on manual analysis of X-rays and clinical observations	Managed solely by dentist-patient interaction	Manual explanation of treatment plans to parents and children	Generalized treatment plans based on standard protocols
Artificial intelligence Methods	• AI-powered tools, such as Convolutional Neural Networks (CNNs), have significantly improved caries detection and early diagnosis of enamel defects, with accuracy rates as high as 95% in some studies • AI systems outperform traditional diagnostic methods by identifying subtle dental anomalies that may be missed by human clinicians, enabling earlier intervention and better outcomes	• Virtual reality (VR) and augmented reality (AR) technologies powered by AI reduce anxiety in young patients by creating immersive, distraction-based environments during treatments • AI-driven educational tools gamify oral hygiene learning, improving compliance with brushing and flossing habits among children	AI visualizations help dentists explain diagnoses and treatments to parents, increasing case acceptance and trust in the care process	Tailored plans addressing each child's unique needs and risk factors

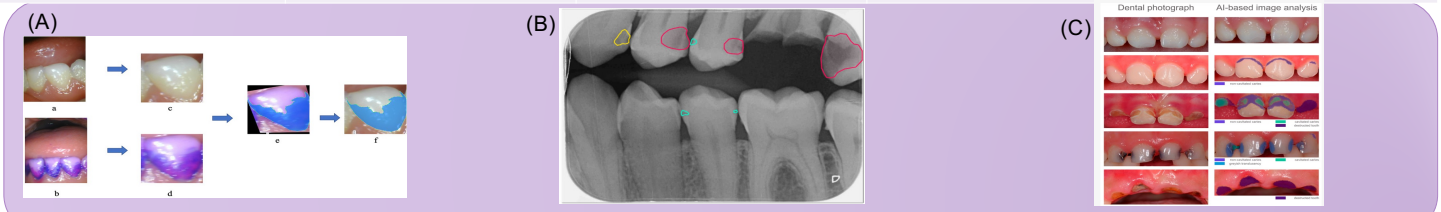

Fig. 1: Examples of AI applications: A-B) Deep learning-based dental plaque detection on primary teeth C) AI based image analysis for caries detection [9-11]

Discussion

Impact on Pediatric Dentistry

- The integration of AI has revolutionized diagnostic precision and treatment efficiency in pediatric dentistry. By enabling early detection of caries and other dental issues, AI reduces the need for extensive interventions, benefiting both patients and providers

Challenges

- Data privacy concerns and the need for professional training remain barriers to widespread adoption of AI technologies in dental practices.
- Integration into existing workflows requires investment in infrastructure and adaptation by dental teams

Future Prospects

- Continued advancements in machine learning algorithms could further enhance diagnostic accuracy and expand the scope of personalized care.
- Tele-dentistry powered by AI may improve access to pediatric dental care in underserved areas

Conclusion

Artificial Intelligence is transforming pediatric dentistry by enhancing diagnostic accuracy, personalizing treatment plans, improving behavioral management, and fostering better communication with patients and parents. These advancements not only improve oral health outcomes but also create a more positive experience for young patients. Despite challenges such as data privacy concerns and integration costs, the potential of AI to revolutionize pediatric dental care is undeniable. Embracing these innovations will pave the way for a future where dental visits are more efficient, effective, and child-friendly

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