Academia Journal of Medicine

Review Paper | **AJM** | **ISSN: 2663-8290 (Online)**

Open Access **https://medjournal.co.in/index.php/ajm** **Volume 7, Issue 1**

Digitalization of Pediatric Dentistry: A Review

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Article History

Received: 15-01-2024
Revised: 28-01-2024
Accepted: 01-02-2024
Published: 25-02-2024

How to Cite

Prudhvi KB, Akhila SK, Usha MCH, Malathi Y, Apoorva G, PVM UMA. Digitalization of Pediatric Dentistry: A Review. Acad J Med 2024; 7(1): 6-10.

Abstract

In recent years, digitization has revolutionized various sectors, with pediatric dentistry being no exception. This review comprehensively summarizes the impacts and advancements of digitization in pediatric dentistry. The utilization of digital technologies has notably enhanced diagnostic accuracy, treatment planning, patient engagement, and educational tools for both dental practitioners and their young patients. Through the integration of digital radiography, intraoral scanning, three-dimensional printing, and teledentistry, the field has seen improvements in patient comfort, reduced procedure durations, and the personalization of dental care. The review aims to highlight the latest developments, potential challenges, and future directions in the digital realm of pediatric dentistry.

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Keywords

Digital Dentistry, Pediatric Dentistry, Oral Health, Children

DOI **https://doi.org/10.62245/ajm.v7.i1.2**

1. INTRODUCTION

Pediatric dentistry, dedicated to the oral health of children from infancy through the teenage years, requires a delicate balance between advanced care and a child-friendly approach. The advent of digital technology has brought about significant changes in how dental care is provided to this sensitive demographic. The purpose of this review is to explore the digitization trajectory within pediatric dentistry, assessing its influence on clinical operations, patient outcomes, and educational potentials.[1]

As dental practitioners adopt innovative digital tools, the landscape of pediatric dental care is evolving. Digital radiography offers reduced radiation exposure, crucial for younger patients, while intraoral scanners eliminate the need for traditional impressions, often a source of discomfort for children. The use of three-dimensional (3D) printing technology not only expedites the creation of dental appliances but also allows for an interactive experience when explaining procedures to children. Furthermore, teledentistry has emerged as a valuable resource for providing access to dental care in underserved areas, ensuring continuity of care through virtual consultations and remote diagnostic capabilities.[1,2]

The digitization of pediatric dentistry encompasses not only clinical tools but also extends to educational resources for both professionals and patients. Innovative software and applications provide interactive and engaging learning platforms, aiding in the management of dental anxiety and fostering preventive dental habits from an early age.[1,2]

This review assesses these digital advancements while considering the unique challenges pediatric dentists face when integrating technology into their practice. It discusses the current state, benefits, limitations, and ethical considerations of applying digital technologies to pediatric dentistry. Through this examination, we aim to provide a comprehensive picture of the present and future role of digitization in enhancing pediatric oral health care.

2. VARIOUS APPLICATION OF DIGITAL DENTISTRY IN PEDIATRIC DENTISTRY[1,3-5]

2.1. Diagnostic Enhancements: The use of digital radiography in pediatric dentistry allows for immediate image acquisition and reduced radiation exposure. Its applications include detecting cavities, assessing tooth and root growth, and monitoring the status of incoming teeth.

2.2. Intraoral Cameras: High-resolution images captured by intraoral cameras aid in better visualization of oral conditions, thus engaging young patients in their oral health by showing them what the dentist sees.

2.3. Computer-Aided Design/Manufacture (CAD/CAM): CAD/CAM technologies provide the advantage of same-day dentistry for crowns and other restorations, particularly beneficial for children who may struggle with multiple dental visits.

2.4. 3D Printing: Personalized models, orthodontic appliances, and even space maintainers can now be created quickly and precisely, improving the fit and comfort for the pediatric patient.

2.5. Patient Comfort and Engagement: VR and AR can be used to distract children during procedures and educate them about their oral health in an interactive way.

2.6. Digital Impressions: They are more comfortable than traditional methods, reducing the gag reflex and discomfort associated with conventional impressions.

2.7. Interactive Dental Apps: Gamification and interactive apps promote dental hygiene in an entertaining way, helping children to adopt healthy oral habits early on.

2.8. Online Educational Resources: Videos and tutorials tailored for young patients help demystify dental procedures and reduce anxiety.

2.9. Virtual Consultations: They facilitate access to dental care, follow-ups, and enable preliminary assessments without the need for an in-person visit.

2.10. Artificial Intelligence (AI)*: AI algorithms help in diagnosing pathologies from radiographs and predicting treatment outcomes, enhancing the accuracy of diagnostics.

2.11. Data Analytics: Big data analytics can help in understanding trends in pediatric oral health and in developing targeted preventive strategies.

3. INTEGRATION CHALLENGES

Despite the benefits, challenges such as the high cost of technology, the need for training, and data security concerns must be addressed. Furthermore, ensuring equal access to digital dental services to avoid creating or exacerbating health inequities is essential.[2,]

4. INTEGRATION CHALLENGES

Digital Dentistry offers various advantage in pediatric dental care which are as follows: [2,4,7,8]

4.1. Enhanced Patient Comfort: Digital tools often reduce the need for invasive procedures, making dental visits less stressful for children.

4.2. Improved Diagnosis: Digital X-rays and intraoral cameras offer high-resolution images for more accurate diagnoses.

4.3. Efficiency: Procedures can be done faster with digital tools, reducing chair time and increasing practice throughput.

4.4. Education and Engagement: Interactive digital systems can educate children about dental hygiene in a fun and engaging way.

4.5. Customization: 3D printing and CAD/CAM technology allow for tailored dental appliances like crowns and space maintainers.

4.6. Data Management: Electronic health records enable easier tracking of a patient's dental history and treatment progression.

4.7. Tele-dentistry: Video consultations save time for parents and can assist in remote areas where dental care access is limited.

5. LIMITATIONS OF DIGITAL PEDIATRIC DENTISTRY

Apart from advantages digital dentistry has some limitations which are as follows:[4,5]

5.1. Cost: Initial investment and maintenance of digital technology can be high for dental practices.

5.2. Learning Curve: Dentists and staff need to be trained to use new digital tools effectively, which takes time and resources.

5.3. Technological Reliability: Digital tools and software can fail or malfunction, potentially causing delays in treatment.

5.4. Accessibility: Not all practices might have the resources to implement digital methods, limiting availability for some patients.

5.5. Constant Updating: Technology rapidly evolves, necessitating ongoing updates and additional expenses to stay current.

6. FUTURE DIRECTIONS

Digital pediatric dentistry is poised for growth, with prospects like AI diagnostics, AR gamified learning, and advanced 3D printing promising more personalized and minimally invasive care. Teledentistry and wearable tech will bolster preventive practices and patient engagement. Innovations must balance costs, accessibility, and user-friendliness to truly enhance children's dental health outcomes.

7. CONCLUSION

The continuous advancements in digital technologies present a transformative potential for pediatric dentistry. While the aim is to revolutionize both preventive and therapeutic approaches to oral healthcare for the younger population, the field must address the limitations related to cost, training, and technological reliability. As digital pediatric dentistry evolves, the key goal will be to harness these innovative

tools to enhance the quality, accessibility, and personalization of dental care, ensuring children have positive dental experiences from an early age. With a focus on patient-centered care, embracing these prospects can help build a stronger, healthier foundation for lifelong oral health.

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