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Try new and beautify you with 3D world of paediatric dentistry

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ABSTRACT

Background / Introduction: Dental treatment of children poses significant challenges for clinicians. The conventional impression-making procedures in young children are considered cumbersome and difficult due to several clinical factors in dentistry. In recent years, digital Intra-oral sensors (IOS), three-dimensional printing (3D Printing) technology and Computer- Aided Design/Computer-Aided Manufacturing (CAD-CAM) technology have been described in existing literature related to different aspects of paediatric dentistry.

Aim: To assess the knowledge, attitude and practice of the use of 3D printing technology in paediatric dentistry among post-graduate students and paediatric dentists in India.

Methodology: Post-graduate students and pedodontists in India were included in this study. A survey with the google forms online tool was utilised in this study. Responses received were included for evaluation.

Results: 75.2% were aware about 3D printing used specifically for pediatric dentistry, 106 (47.7%) participants wanted to know more regarding 3D printing through live demonstrations. A statistically insignificant difference was found in the knowledge and practices based on gender, education, and experience with P value ≤ 0.05.

Conclusion: Through survey we found that although post-graduate students and pediatric dentists in India showed enough understanding, had positive attitude about 3D printing, just a few percent of them were unable to successfully incorporate this technology into their routines.

Keywords: *3D printing, Pediatric dentists, post-graduate students, Pediatric Dentistry.*

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1. INTRODUCTION

One of the foremost objectives of paediatric oral health is delivering the most effective dental care attainable to young patients including those with special health care needs. Nevertheless, paediatric dental services must consider the finest and most recent evidence-based dental innovations and advancements to improve children's compliance with dentistry and to instill a positive dental attitude about teeth. Ensuring that children receive dental treatment in a relaxed and amicable manner is a desirable outcome for any established dental care program.[1]

Dental treatments required for pediatric patients such as space maintainers, occlusal splints, myofunctional appliances, and habit-breaking appliance undergo impression-making procedure, and which is said to be the most difficult to manage children's behavioural issues and gagging reflex. Conventional impression-making techniques from earlier times are still widely used but these methods used to develop appliances for dental care concerns with pediatric patients can present an array of obstacles, including longer and repeated dental visits.[1] When compared to the conventional impression procedure, 3D dental impressions generated with additive manufacturing techniques are less expensive and time-consuming.[2] In the field of forensics, 3D printing is used in cases of bite marks, age estimation,etc.[3] 3D printing is also used in root canal treatment of teeth with calcified pulp canal and periapical pathology.[4]

The first 3D printing technology was released in 1986.[5] Through the creation of enormous prospects in a variety of industries, three-dimensional (3D) printing established the path for advancement in the technological paradigm shift.[6] The current 3D printing technologies are also applied in pediatric endodontic therapies, in cleft lip and palate and special health care needs patients. In light of dentistry's shift from manual to digitalization and imitation, it is necessary to use modern tools to get better and more fulfilling outcomes.[7] Owing to these circumstances, this survey was designed to find out how many pediatric dentists and post- graduate students in pediatric department currently employ these contemporary techniques or plan to do so in the future.

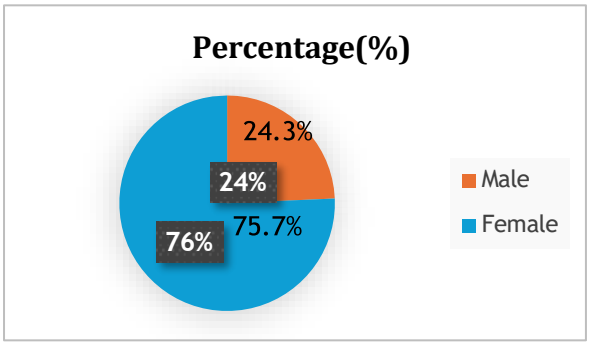
2. MATERIALS AND METHODS

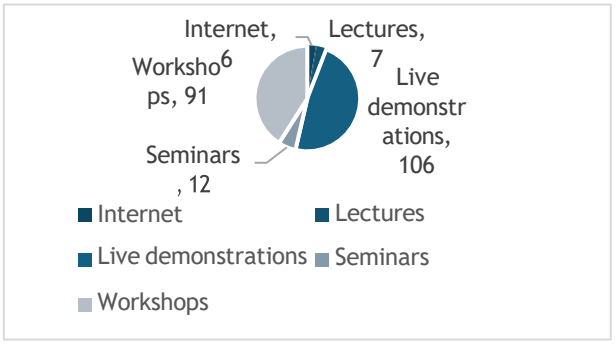
A descriptive cross-sectional questionnaire-based study was conducted among pediatric dentists and post-graduate students in India. After acquiring approval from the Institutional Ethical Committee, the study was conducted through an online survey. In this study, a self- created questionnaire was employed comprising of 18 questions were employed. 5 questions were about demographic data, 6 questions regarding to the knowledge about 3D printing, 4 questions pertaining to the attitude towards the use of 3D printing technology, and the remaining 3 questions were related to the current practices regarding 3D printing. Subject experts verified the questionnaire and the recommended changes were made. In a pilot study, five practicing pediatric dentists completed and discussed the questionnaire, evaluating the questions' validity and content.

Online google forms were utilized in this study which was made available to the participants through a link, and convenience sampling was performed. This link was promoted through email, social media and potential survey participants were invited to participate in the survey. Each participant received the questionnaire with an informed consent form, and a participant information sheet. Responses which were received till 12 weeks were included for evaluation. The responses were recorded in an excel sheet. Statistical analysis was done using Chi-Squaretest. A P-value less than 0.05 was considered significant. Descriptive analysis through frequency distribution was calculated.

Results - 222 responses were obtained. Out of total participants, 75.7% were female participants and 24.3% were male participants (Graph 1).

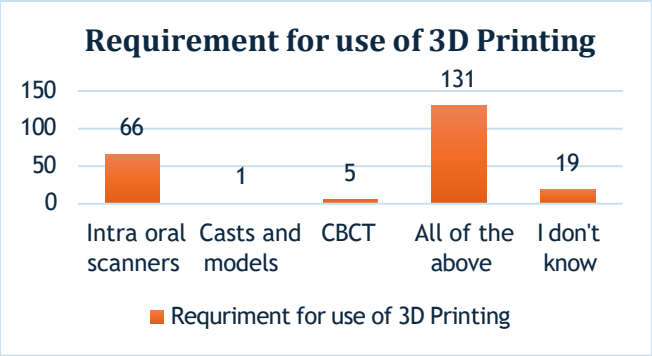
Knowledge - Out of 222 participants, 167 participants (75.2%) were aware about 3D printing used specifically for pediatric dentistry (p-value 0.788). 106 (47.7%) participants were willing to increase their knowledge regarding 3D printing through live demonstrations, 91 participants (41%) through workshops, 12 participants (5.4%) through seminars, 7 participants (3.2%) through lectures and least with internet i.e. 6 participants (2.7%) (Graph 2). According to 66 participants, intraoral scanners are also essential for the use of 3D printers. 19 participants were unaware of the additional measures required to operate 3D printers. Just 2.5% and 0.5% of participants, respectively, stated that they required CBCT and cast and models to make use of 3D printers respectively (Table 1). The knowledge of participants about applications of 3D printing showed varied results.





Graph 1. Gender distribution **Graph 2. Medium of information**

Attitude - 91.9% and 1.8% participants thought that the disadvantage of using 3D printing is its cost and it is hard to perform respectively (Table 2). Very few participants (29.3%) thought that 3D printing will be used in routine pediatric practice in near future for selected pediatric applications and 16.7% were against it. 95% participants showed interest to obtain updated information regarding it (p-value 0.719). Only 12.2% participants used 3D printing for diagnostic purpose (p-value 0.051).



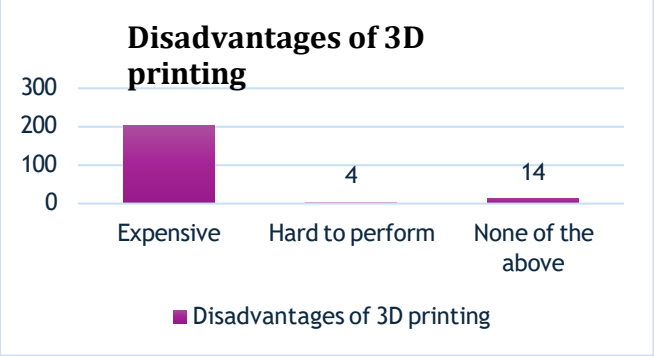
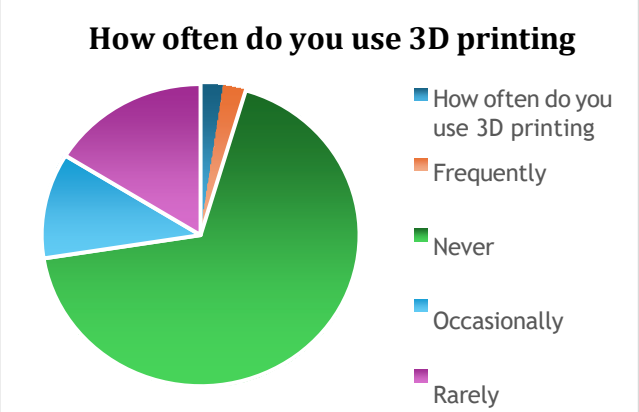
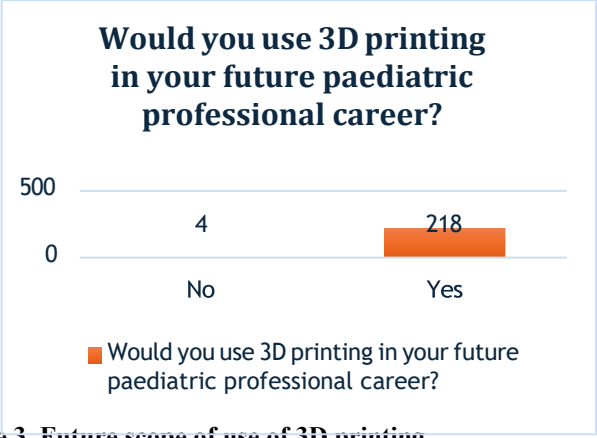


Table 1. Requirements for use of 3D Printing **Table 2. Disadvantages of 3D printing**

Practices - The response of the participants on application of 3D printing in their future pediatric dentistry practice showed varied results. 11.3% participants used 3D printing occasionally, 2.3% used it frequently and always, 16.2% used it rarely and 68% participants never ever need it in their practice (Graph 3). A total of 98.2 % participants wanted to use 3D printing in their future paediatric professional career (Table 3). There were no statistically significant association found in knowledge, attitude and practice about 3D printing technology among post-graduate students and paediatric dentists in India based on gender, education and years of experience.





Graph 3. Frequency of use of 3D printing **Table 3. Future scope of use of 3D printing**

3. DISCUSSION

For a young patient, especially one with a physical or mental disability, or a child with TMJ problems or orofacial deformities, the rehabilitation procedure can occasionally become extremely time-consuming, difficult, and physically and psychologically distressing.[8] Customized 3D-printed patient-based models assist dentists or students in training for crown and veneer preparation in challenging pediatric rehabilitation cases, such as amelogenesis imperfecta or dental fluorosis.[8] Thus, this study was planned to evaluate knowledge, attitude and practice about 3D printing technology in pediatric dentistry among post-graduates and pedodontists in India.

Parikh Maitry et al. evaluated Indian orthodontist's understanding, attitudes, and 3D printing practices where 47.5% of orthodontist's reported using this technology in this study[7], Dhokar et al. assessed the knowledge and practices of dental practitioners regarding the use of 3D printing in dentistry in which 38.7% of the dental practitioners had some experience of it[9], whereas only 11.3% of participants reported having some experience in the current study. This could be because only pediatric dentistry postgraduates and pedodontists were included.

Some significant insights from the current study stated that 75.2% were aware about 3D printing used specifically for pediatric dentistry, 11.3% occasionally used 3D printing, and only 29.3% of participants believed that 3D printing would soon be utilized in routine practice for specific pediatric applications. Therefore, the study's core outcome is that, despite the literature on 3D printing's uses in dentistry, post-graduates and practitioner's practical understanding of the technology is insufficient to apply it in their daily practice.

A study by Dhokar et al.[9] evaluated that 52.5% of participants correctly answered that 3D printers require CBCT, intra-oral scanners, casts, and models for printing whereas current research showed intraoral scanners, CBCT, cast and models are necessary for using 3D printers, according to 66 participants, 2.5% and 0.5% of participants, respectively. Hence, ensuring that when compared to the traditional imprint approach, intraoral scanners significantly improve patient perception and comfort, making them a good choice for children. On investigation into the reasons why dentists were unable to adopt these technologies, Pabst et al. discovered that high costs (36.6%) were the main obstacle.[10,11] Our research revealed comparable findings, that the disadvantages of using 3D printing are that it is expensive and difficult to accomplish. As far as we are aware, there is a lack of research evaluating the skills and knowledge of post- graduates and pedodontists using 3D printing, hence it's important to have advancement in it. The study's participant population implies that there is a probability that participants who are not already using this technology in their daily practice, plan to do so in the future. The relatively small sample size maybe the sole limitation that can be attributed to our research. We believe that more studies are necessary to demonstrate that 3D printing is a beneficial tool for post-graduates and pediatric dentists alike.

4. CONCLUSION

According to this survey, post-graduates and pediatric dentists in India showed sufficient knowledge, positive attitude, and practice-based approach about 3D printing; yet failed to fully apply this technology in their daily practice. Accurate understanding of 3D printing and imaging modalities is necessary for improved treatment outcomes and prediction, as well as for improved patient happiness and perception in pediatric dentistry.

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