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Assessment of Awareness, Knowledge and use of Digital Dental Technology among Dental Practitioners and Postgraduate Students: A Questionnaire Study.

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Abstract:
Digital dentistry currently encompasses a broad range of practices, particularly concerning intraoral scanning, 3D printing, and computer-aided design/computer-aided manufacturing (CAD/CAM). It has the benefit of making the transition process easier and boosting efficiency by enabling information transfer between physical and digital data. The use of computer aided technology has led to precise treatment planning and management of clinical practices with greater efficiency. Digital technology is an essential part of contemporary dentistry and has a big impact on dental practices both currently and in the near future.
Aim: *To assess the knowledge, awareness and the use of digital technology in dentistry among dental practitioners and dental postgraduate students.*
Materials and Methods: *A cross-sectional questionnaire based online survey was undertaken at C.S.M.S.S. Dental College and Hospital, Chhatrapati Sambhajinagar, Maharashtra, India between January 2024 and June 2024 amongst dental postgraduate students and dental practitioners across India. The questionnaire consisted of 20 questions which evaluated their awareness towards digital dentistry, its advantages and disadvantages, their knowledge and practices towards digital dentistry. The Chi-square test was used for statistical analysis.*
Results: *The feedback was positive towards the future use of digital dentistry. Of total 165 respondents,* 75.8 % *were aware regarding the use of the digital technology in dentistry. 84 % of the respondents had a positive perspective on the emerging influence of digital technology in dentistry. Out of all respondents, 56.1 % frequently employ digital technology in their dental practice, 38.4 % rarely employ it and 6.7 % have never utilized digital technology. A total of 64.2 % respondents think that impression made with an intraoral scanner is better than the conventional one and 80.4 % individuals are aware regarding the CAD/ CAM technology. 72.7 % of respondents felt that various advancements in digital technology will have a positive impact on dental practice. Almost all i.e., 99.4 % suggest the incorporation of digital technology in dental practice.*
Conclusion: *The majority of the participants were aware of digital technology, which yields good results. In order to fulfil the high standards of patient care, modern dentistry should place a special emphasis on the application of digitization in the workflow. The knowledge of digital technology and its application is vital for dental practitioners and postgraduate students. However, dental education courses and workshops should be organized to familiarize them with CAD/CAM and other emerging digital technologies which will usher in a new era in dentistry by offering contemporary solutions to time-honoured issues. This will produce a future generation of dentists who are knowledgeable about digital dentistry. With so much space for expansion, it will enable dentists to collaborate, provide the finest care possible to their patients, and build a more promising future.*
Keywords: *Digital dental technology, awareness, knowledge, CAD/CAM, intraoral scanners*

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I. INTRODUCTION

Modern dentistry has evolved significantly from traditional dental education. Along with a technological advancement, the advent of digital dentistry tools represents a fundamental restructuring of healthcare systems that includes everything from methods of treatment to patient-doctor communication. The way dental treatments are provided to patients has changed dramatically with the advent of digital dentistry in our dental offices.[1] Digital dentistry involves using computer-controlled equipment instead of traditional mechanical or electrical equipment for treatments.[2] Cone beam computed tomography (CBCT), 3D intraoral and facial scanners, 3D printers, and

integrated processing software, such as computer-assisted design/computer-assisted manufacturing (CAD/CAM) prosthetic software and dental implant planning software, are examples of cutting-edge digital technology that has been introduced to the field of dentistry.[3] The traditional impression making and manufacturing process has undergone significant modifications due to the advancement of digital technology, the introduction of computer-aided design (CAD), computer-aided manufacturing (CAM), and 3D printing.[4] The advent of these new methods and the significant developments in dental materials are revolutionizing dentistry as a whole.[5]

Benefits from the digitization of dentistry include the fusion of modern digital technologies with analog workflows. Improving the measured and perceived quality of care is the primary clinical benefit of their utilization. Digital dentistry software can help dentists make the best diagnostic-based decisions possible.[6] The potential to provide same-day chairside restorations and the increased demand for quick but efficient aesthetic dental care appeal to both patients and practitioners.[7] 3D intraoral imaging data can be superimposed on 3D radiographic and face imaging data. The software helps with orthognathic surgery planning, dental implant surgery planning, and orthodontic treatment planning. Digital technology has the potential to replace traditional methods.[8]

While only a small percentage of dentists in India regularly employ computer-aided design (CAD) and computer-aided manufacturing (CAM), these technologies have become commonplace in Western countries' dental practices. The majority of dentists in India are not particularly familiar with CAD/CAM, and even those that are are hardly inclined to employ it in everyday practice.[9]

Given the benefits and wide range of applications that digital technology offers in all areas of dentistry, it is crucial to understand how to utilize it properly and to be aware of its drawbacks, including its sluggish acceptance. Digital technology use is now a fundamental component of contemporary dentistry. There is anticipation that this will alter the course of dental practice in the future.[10]

There is a dearth of research on the current status of digital dentistry among Indian dentists. Therefore, the purpose of this study was to assess and understand the postgraduate students' and dental practitioners' knowledge, awareness, and practices about the usage of digital technology.

II. MATERIALS AND METHODS

A cross- sectional questionnaire based online survey using Google forms was undertaken at C.S.M.S.S. Dental College and Hospital, Chhatrapati Sambhajinagar, Maharashtra, India between January 2024 and June 2024 amongst dental postgraduate students and dental practitioners across India. The questionnaire consisted of 20 questions which evaluated their awareness towards digital dentistry, its advantages and disadvantages, their knowledge and practices towards digital dentistry.

Study Design: Cross- sectional study
Study Location: C.S.M.S.S. Dental College, Chhatrapati Sambhajinagar
Study Duration: January 2024 to June 2024
Sample size: 165
Sample size calculation: Sample size was estimated using the formula N=4xPQ/D2
N= sample size, P= highest prevalence, Q=100-P, D= acceptable error.
Therefore, the sample size calculated was 154. The study included a total of 165 respondents.

Inclusion and Exclusion criteria: The study included postgraduate students, teaching faculties from different dental institutions and private practitioners. Along with the questionnaire, informed consent was obtained from participants via google forms. Participants who refused consent to participate in the study were excluded.

Procedure Methodology:

A written informed consent was obtained from all the participants, a well-designed questionnaire was used to collect the data. The questionnaire included the socio-demographic characteristics of the respondents, including age, designation and years since their graduation, followed by 20 multiple choice questions regarding the knowledge and awareness and use of digital dental technology. The google form was distributed via the WhatsApp and Telegram groups to all the study participants.

A total of 165 responses were obtained in this study, out of which 82 were dental postgraduate students, 74 dental practitioners and 12 were dental practitioner and teaching faculty.

Data collection, compilation, and management were made easier with the use of an online questionnaire. A further advantage was that participants may take part in the study whenever it was convenient for them as it was online. The collected data was readily available right away and could be quickly imported into spreadsheets or specialized statistical tools for additional analysis. To assess the responses, Chi-square test was used for statistical analysis.

III. RESULTS

A total of 165 responses were obtained in this study, out of which 82 (49.7%) were dental postgraduate students, 74 (44.8%) dental practitioners and 12 (7.3%) were dental practitioner and teaching faculty (Fig. 1). 83.6% of participants had less than 5 years of experience, while 10.3 % had between 5–10 years and 6.6 % had more than 10 years.

81.2 % participants claim that their college or dental clinic is equipped with a computer/ laptop/ tablet, while rest 19.4 % do not use them. 56.1 % participants utilize computer software to manage patient records in their practice frequently, 15.2 % sometimes use it and 29.9 % participants does not use it.

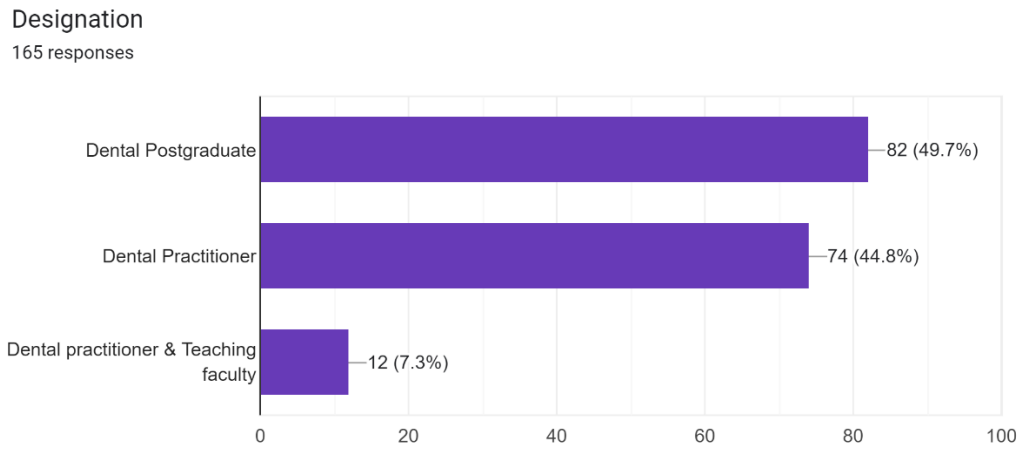


Figure 1

Out of all the responses, 75.8 % were aware regarding the use of the digital technology in dentistry, 15.8 % were somewhat aware and 9.1% participants were not at all aware (Fig. 2). 31.5 % of them received training for digital dental workflow, 27.9 % witnessed demonstrations only and 43 % individuals did not receive any training (Fig. 3).

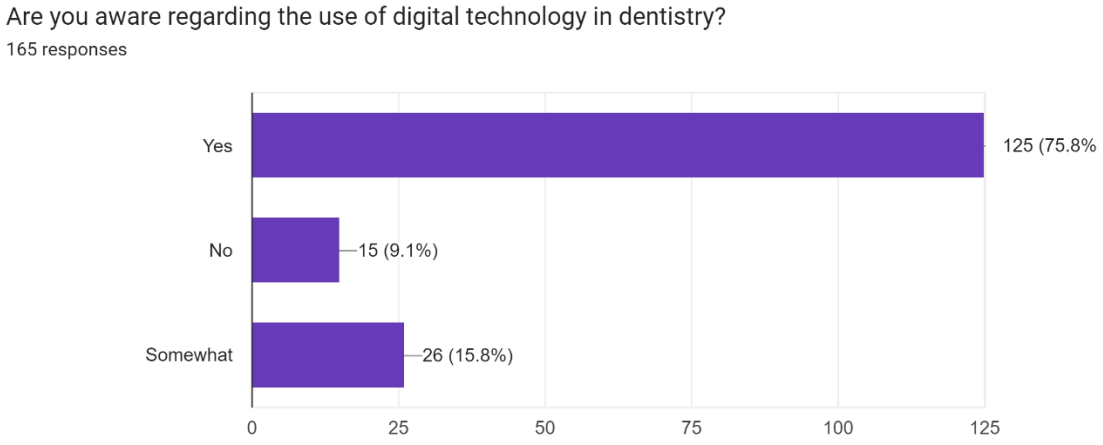


Figure 2

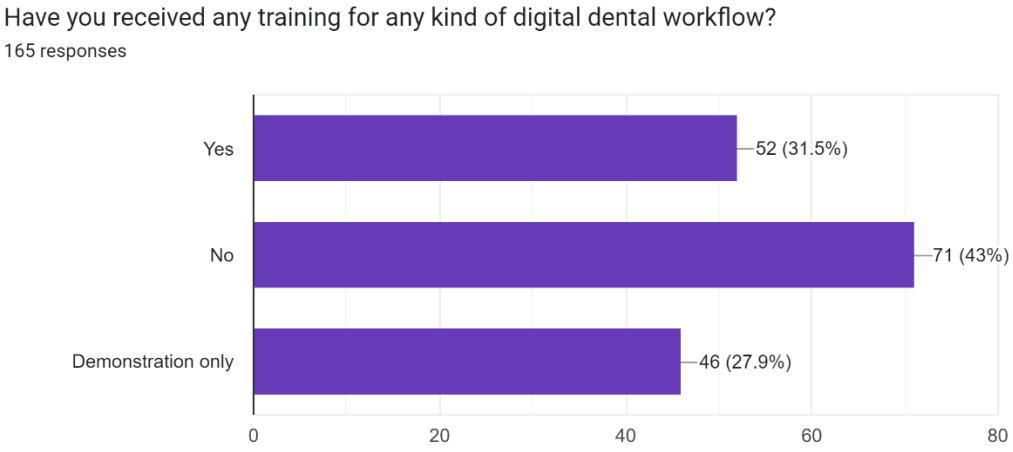
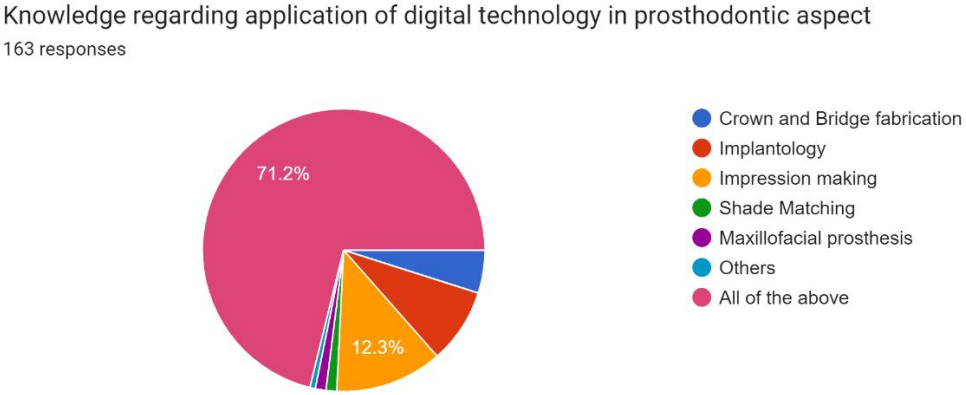


Figure 3

Of all the responses, 86.6 % have digital radiographs (RVG) in their college/ clinic and 14.6 % does not have it. 71.2 % individuals were aware regarding the application of digital technology in all aspects of prosthodontics such as crown and bridge fabrication, implantology, impression making, shade matching and maxillofacial prosthesis etc., while 12.3 % were aware only about digital impression making and 8.6 % regarding digital implantology and 4.9 % about crown and bridge fabrication (Fig. 4).

84 % of the respondents had a positive perspective on the emerging influence of digital technology in dentistry, while 17.2 % had a neutral perspective and 0.6 % felt negative about it (Fig. 5). 65.6 % participants conveyed that their patients respond positively towards the digital systems in their dental office, 33.8 % felt that patients respond neutrally and 2.5 % conveyed negative response.

Out of all the respondents, 56.1 % frequently employ digital technology in their dental practice, 38.4 % rarely employ it and 6.7 % have never utilized digital technology. 92 % of the participants believe that digital technology is helpful in saving time in dental office, 6.7 % are not sure about it and 1.8 % felt the opposite.



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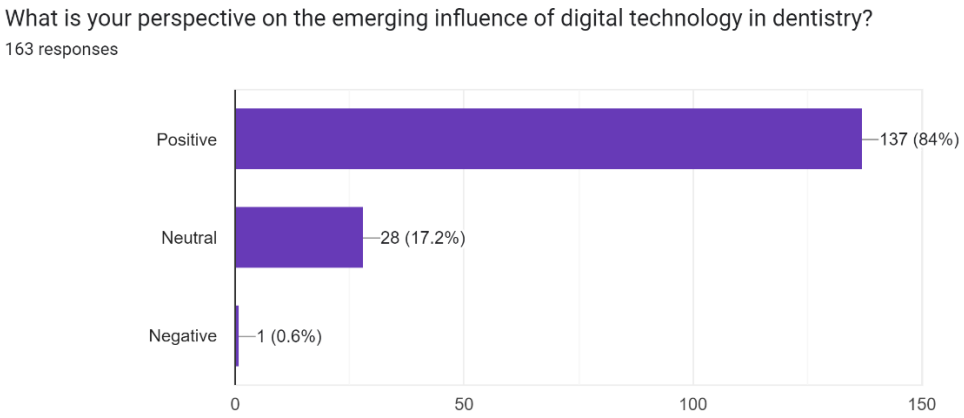


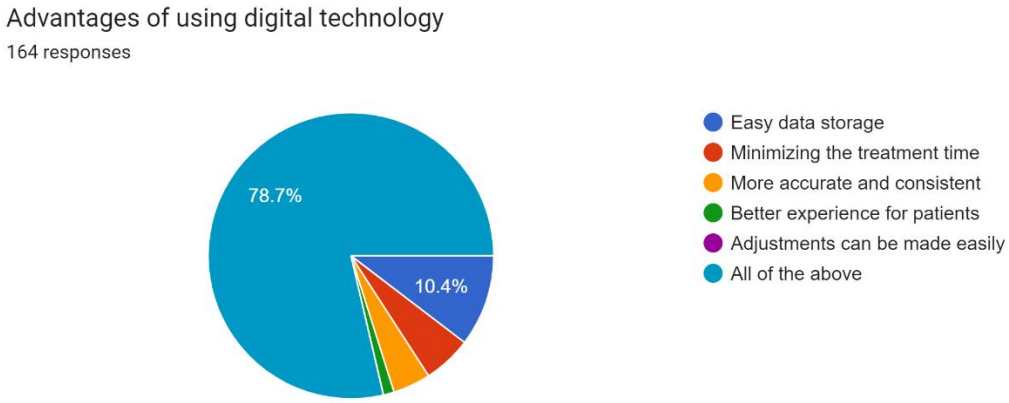
Figure 5

A total of 64.2 % respondents think that impression made with an intraoral scanner is better than the conventional one, while 29 % felt that it was maybe better and 7.4 % feel that conventional impressions are better. 80.4 % individuals are aware regarding the CAD/ CAM technology in dentistry, 12.3 % are somewhat aware and 8.6 % are not at all aware about it.

39.6 % strongly agreed, 47 % agreed, 15.9 % were neutral while 0.6% disagreed with the statement "Digital technology will replace traditional techniques in fabricating dental restorations and will have a positive impact on our profession." Of all the respondents, 86 % believe that digital technology has a significant impact on the income and growth, 12.2 % felt it maybe has an effect and 2.4 % felt it does not have an effect.

Out of all the respondents, 78.7 % agreed with many advantages of digital technology which includes easy data storage, minimized treatment time, more accuracy and consistency, provides better experience for the patients and adjustments can be made easily. While 10.4 % thought that digital technology allows easy data storage as the only major advantage. 5.5 % agree that it minimizes the treatment time and 4.3 % felt it is more accurate and consistent (Fig. 6).

46.3 % respondents felt that the disadvantages of digital technology are that it is more expensive, needs more equipment, is difficult to manipulate and requires timely maintenance and more operating staff. 39 % of the individuals state that the major disadvantage among them is that digital technology is very expensive. 6.7 % felt that it needs more equipment and 4.9 % are worried about the maintenance and 2.9 % regarding the operating staff shortage (Fig. 7).



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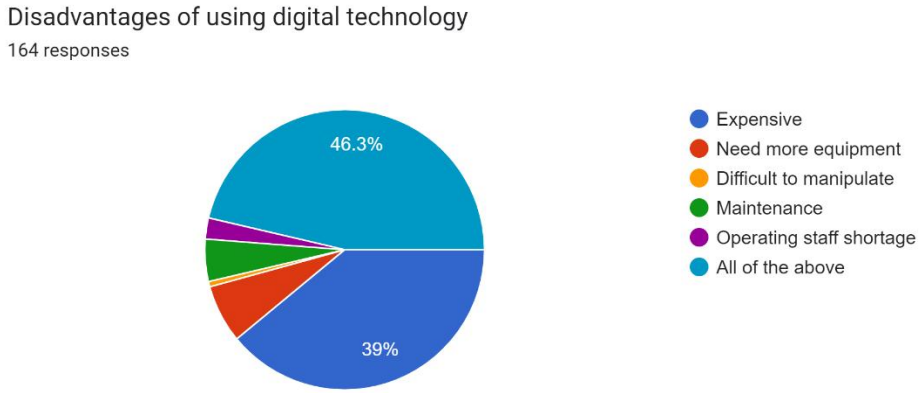

Figure 7

72.7 % of the total respondents think that incorporating digital technology such as digital shade matching, intraoral scanners, digital radiographs, software for smile designing and designing of maxillofacial prosthesis, T scan for digital occlusion and TMJ analysis, etc. will be helpful in their clinical dental practice. 10.6 % would want to incorporate intraoral scanners for digital impressions. 7.5 % individuals would want to expand their digital practice by addition of T scan. 3.1 % want to try software for digital smile designing and 1.9 % want equipment for digital shade matching (Fig. 8).

99.4 % of the participants felt that digital workflow should be included in the curriculum. 86.6 % individuals thought that early exposure to the digital workflow training in the curriculum will create a future generation of dentists who will be more competent in the current trend of dental practice, 10.4 % thought it may be a possibility and 3.7 % respondents do not think so.

A total of 162 respondents i.e., 99.4 % suggest the incorporation of digital technology in dental practice (Fig. 9).

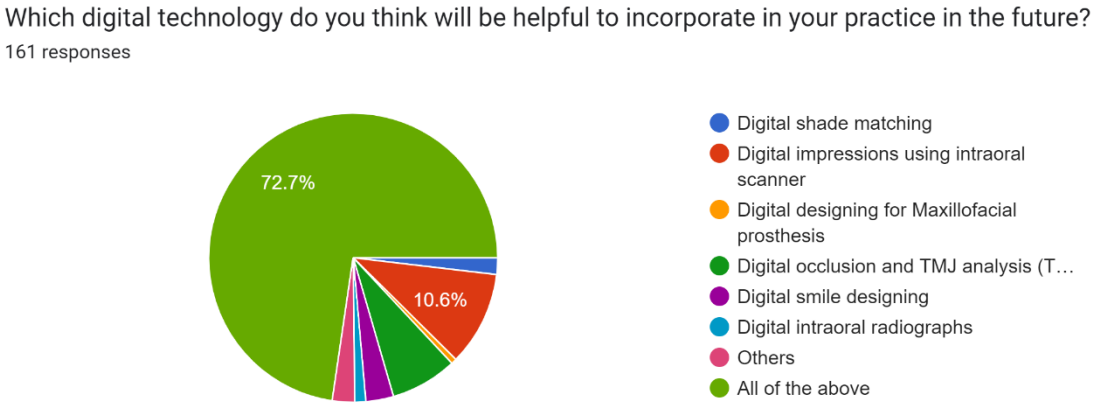

Figure 8

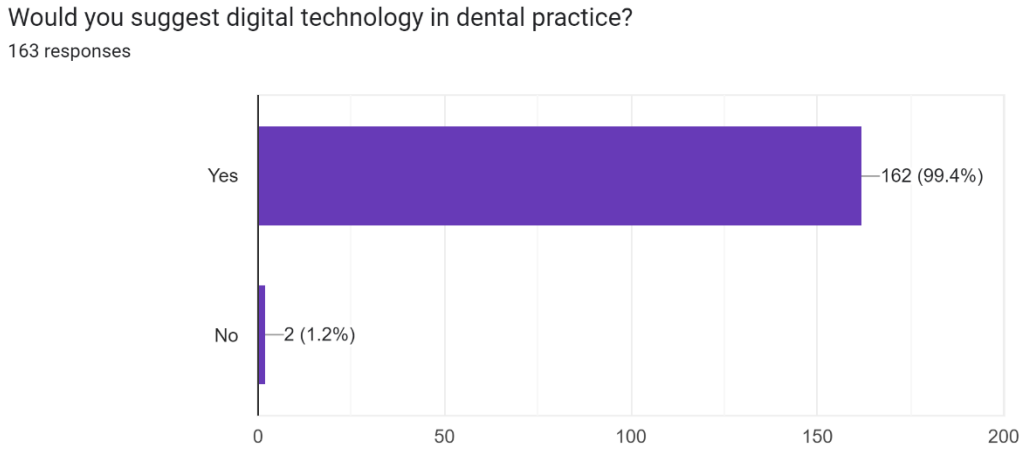

Figure 9

IV. DISCUSSION

The world is changing due to the digital revolution, and the field of dentistry is no exception. It's critical that dentists comprehend and be knowledgeable about this emerging trend. The purpose of this study was to fill a vacuum in the literature by investigating dentists' perceptions, knowledge, and awareness of digital dentistry in India. With more data in hand, we will be better equipped to guide ongoing dental education in this essential field. Studies have shown that patients are satisfied with digital dentistry, in addition to the greater accuracy and comfort it provides for dental professionals.

Understanding digital technology is crucial because of its many benefits, including patient compliance and speedy, aesthetically pleasing outcomes. Sharing information is almost trivial, which makes it much simpler for dentists to present their work, discuss their educational experiences, and solicit case recommendations.[11] According to present study, majority of the respondents were of the opinion that immediate and easy data transfer and minimization of the treatment time are at any point few of the major advantages of the digital dental technology. This was in accordance with the studies of Nayakar D et al and Udhayaraja P et al.[9, 10]

Digital dentistry, including intraoral scanners, CAD/CAM, and 3D printing, has been increasingly popular in recent decades.[12] The use of intraoral scanners to create digital impressions offers the benefit of 3D previsualization of the preparation, as well as a decrease in the possibility of distortion and material consumption during impression creation. Additionally, it avoids the issues related to traditional impression-making, such as gagging. The respondents believed that it provides higher accuracy because there are no errors related to contraction or expansion of the imprint and model materials.[13] Throughout the design process, the CAD/CAM produces visuals that aid in decision-making. The current study also showed how improvements in diagnostic skills impact the quality of care by offering novel solutions to common dental issues.[14]

The present study also suggests that the major disadvantages of the digitalization in dentistry includes the high cost and need for equipment and staff shortage along with the lack of knowledge regarding the use of digital technology. These findings were in accordance to the survey performed by Udhayaraja P et al., where high cost was considered a major factor.[9]

Majority of the respondents did not attend any training programmes or workshops on use of digital technology and CAD/CAM, therefore they felt that there was a need to increase teaching in the undergraduate and postgraduate courses this was in accordance with a survey conducted by Tran D et al., which concluded that dental education and professional development courses do not go hand in hand and to bridge this gap, universities should conduct evidence based teaching of CAD/CAM technology in these courses.[15]

As this survey showed, postgraduate students and young dental practitioners made up the majority of the study population and they represent the future of dentistry. Therefore, it is necessary to include informative curriculum reforms related to digital dentistry and to encourage these students and practitioners to participate in CDE, comprehensive hands-on programs in the field of digital dentistry. This suggestion was also made in a survey by Pandey S et al., where he proposed that dentists should participate in CDE programs to broaden their awareness and deepen their understanding of the use of digital dentistry procedures.[16]

The vast majority of participants emphasized that digital dentistry would positively influence our field. Therefore, we should endeavour to increase our knowledge and produce a new generation of dentists who are knowledgeable about digital dentistry.

V. CONCLUSION

The majority of the participants were aware of digital technology, which yields good results. In order to fulfil the high standards of patient care, modern dentistry should place a special emphasis on the application of digitization in the workflow. The knowledge of digital technology and its application is vital for dental practitioners and postgraduate students. However, dental education courses and workshops should be organized to familiarize them with CAD/CAM and other emerging digital technologies which will usher in a new era in dentistry by offering contemporary solutions to time-honoured issues. This will produce a future generation of dentists who are knowledgeable about digital dentistry. With so much space for expansion, it will enable dentists to collaborate, provide the finest care possible to their patients, and build a more promising future.

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