

## ORIGINAL RESEARCH

## Use of Digital Technology – Questionnaire Survey

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## ABSTRACT

**Background:** Digital dentistry includes treatments performed by means of digital or computer-controlled components rather than using mechanical or electrical equipment. The advancement of digital technology and the commencement of Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) and 3D printing has brought large changes to the traditional manufacturing method, where manual work is carried out after oral impression taking.

**Aim:** To conduct a questionnaire survey on use of digital technology in prosthodontic clinical practice among Prosthodontists in Tamilnadu and Pondicherry.

**Materials and methods:** A cross-sectional questionnaire based online survey was undertaken amongst 183 Prosthodontists in Tamilnadu and Pondicherry (Group 1 – Both private practitioners and teaching faculty, Group 2 – Private practitioners, Group 3 – Teaching faculty). The questionnaire consisted of 21 questions which evaluated their awareness, knowledge and practices towards digital dentistry. Statistical analysis was done using Chi-square test in each group, using Statistical Package for the Social Sciences (SPSS) version 23.0. The p-value 0.05 was considered significant.

**Results:** Majority of the study participants were private practitioners in the age group of 25 – 45 years (93%). Among the three groups private practitioners had good knowledge, practice and awareness about the application of digital technologies.

**Conclusion:** Most of the participants were aware about digital technology in dentistry. The private practitioners showed better understanding about the digital technology. However, to make them familiar with CAD/CAM, dental education programs, workshops and hands on program should be conducted which will allow a future generation of dentists who are knowledgeable about digital dentistry.

**Key words:** Computer-aided design computer-aided manufacturing, Dental practice, Digital dentistry, Prosthodontists

**How to cite this article:** Aswitha Ganapathy, Venkatakrishnan CJ, Jacob Mathew Philip, Kanmani Athinarayanan. Use of Digital Technology – Questionnaire Survey. *J Clin Prosth Impl* 2024;6(2):41-45. <https://doi.org/10.55995/j-cpi.2024009>

## INTRODUCTION

Digital dentistry pertains to the use of dental technologies or devices that incorporates digital or computercontrolled factors to carry out dental procedures rather than using mechanical or electrical tools.<sup>1</sup> Although conventional techniques in dental care have worked valuably for decades, for a simpler, faster, more accurate and more efficient workflow, there is an ample possibility in digital applications in the field of prosthodontics. The contemporary dental practice has innumerable options for conserving oral health and provides next to natural aesthetics with an enhanced approach, reduced treatment time, weakened error potential,

improved quality assurance. These reasons explicate instant day dentistry being called the Golden Age of Dentistry.<sup>2</sup>

The upcoming dental practice is close to the utilization of computer-based technology and virtual reality, which allows the dental surgeon to re-create apodictic life situations in patients.<sup>3</sup> Digital technology has impact on clinical treatment protocols, practice management, and patient motivation. CAD-CAM ceramics for improved function and aesthetics with fewer appointments, quick prototyping, stereolithography for the manufacturing of maxillofacial prostheses, digital radiography to help in diagnostics, and more others

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provide high degree of consistency, increased ease, and even fewer sittings.<sup>4</sup>

The high requirement for rapid but effectual aesthetic dental treatment, as well as the cognition to provide same day chair side restorations, is appealing to both patients and dentists.<sup>5</sup> The utilization of CAD/CAM technology has greatly innovated to serve patients and to simplify, as well as appraise the process of fabrication of dental restorations. As a result of this advancement, clinical technicians, dentists as well as patients are influenced.<sup>6</sup> According to this digital image, the dentist designs the adequate restoration directly on a computer screen using CAD/CAM software.<sup>7</sup> In designing complete denture and full mouth rehabilitation, the virtual facebow is developed to provide an alternative to the conventional facebow for the mounting of casts to an articulator.<sup>8</sup>

Three-dimensional virtual models of the patients face, bony structures and dentition can augment treatment planning for such individuals especially in the field of maxillofacial prosthodontics. The shape of the graft can be virtually planned and positioned in the defect area creating a virtual reconstruction placement (if required) onto the graft can also be planned. Obturators can be milled using CAD/CAM units for cleft closures.<sup>9</sup>

The usage of digital technology has become a primary part of contemporary dentistry. It is anticipated that this will alter the configuration of forthcoming dental practice.<sup>10</sup> Considering the above advantages and its vast applications in various fields of dentistry, it is of utmost importance to have a thorough knowledge regarding the use of CAD/CAM and to know its shortcomings and the slow adaption of digital technology.

There have been surveys done to assess the knowledge and attitude of undergraduate students in India towards the use of CAD/CAM<sup>11</sup> and the knowledge, awareness and practices of the use of digital technology and its implications in dentistry among dental postgraduate students and dental practitioners were assessed.<sup>12</sup> However, the research to investigate the practice about digital technologies among prosthodontists in India is scarce. Hence this study was aimed to conduct the survey among prosthodontists in Tamilnadu and Pondicherry about the use of digital technologies in their clinical practices.

## MATERIALS AND METHOD

A sample of 183 Prosthodontists (calculated based on 95% confidence interval and 0.5 standard deviation) were selected for this cross-sectional questionnaire study. (Group 1 – Both private practitioners and teaching faculty, Group 2 – Private practitioners, Group 3 – Teaching faculty)

Teaching prosthodontic faculties from different dental institutions and private practitioners in Tamilnadu and Pondicherry, a member of Indian

Prosthodontic Society and prosthodontists who gave consent and agreed to take part in the survey were included in the study. The undergraduate students and Interns, general dentists and other specialists and the participants who refused to give consent were excluded from the study.

The custom questionnaire was designed, comprising of 21 questions in which all were closed ended questions. The questionnaire was divided into parts which included the demographic details, knowledge, awareness and practice about digital technologies.

The data was gathered by sending the link of the online form via emails and WhatsApp to all the study participants after obtaining consent from the study participants. If any issue surfaced while filling out the questionnaire form, the investigator resolved it immediately during the study duration. The resultant data was tabulated and subjected to statistical analysis to draw the conclusion from the resultant study.

## STATISTICAL ANALYSIS

The individual responses obtained from all participants were collated on MS Excel sheet. Statistical analysis was carried out using Statistical Package for the Social Sciences (SPSS) Software version 23.0 and Chi-square test was utilised to check if there was any significant association between the questionnaire items and the type of practitioner with a significance level of p-value <0.05.

## RESULTS

Among 183 prosthodontists, 92 were females and 91 were males. Majority of the study participants were private practitioners i.e, 116 prosthodontists in the age group of 25 – 45 years. (Table 1). Teaching faculty were only 22 prosthodontists, minimum among the study groups. 45 prosthodontists were both private practitioners and teaching faculty.

Demographic Details		Frequency	Percentage
Gender	Females	92	50.3
	Males	91	49.7
	Total	183	100.0
Age Group	25 - 45	170	92.9
	Above 45	13	7.1
	Total	183	100.0
Designation	Both private practitioner and teaching faculty	45	24.6
	Private practitioner	116	63.4
	Teaching faculty	22	12.0
	Total	183	100.0

Table 1: Demographic Details of the Study Participants.

All the study participants of 3 groups had good knowledge regarding the application of the digital technologies in the specialty of Prosthodontics, However, there was no significant difference (p > 0.05) in the knowledge between the participants in the three groups. (Table 2).

Group	All the applications	Application in Crown and Bridge	Application in Implant restoration	Application in Impression making	Application in Maxillofacial prosthesis	P value (Chi-Square)
Both private practitioner and Teaching faculty (n=45)	29 (64.4%)	16 (35.5%)	0	0	0	0.311
Private practitioner (n=116)	57 (49.1%)	43 (37%)	11 (9.4%)	4 (3.4%)	1 (0.8%)	
Teaching faculty (n=22)	14 (63.6%)	5 (22.7%)	2 (9.1%)	1 (4.5%)	0	
<b>Total</b>	100 (54.6%)	64 (35%)	13 (7.1%)	5 (2.7%)	1 (0.5%)	

Table 2: Comparison of Knowledge of the Study participants regarding application of digital technology in prosthodontic aspects.

Table 3 reveals that majority of the study participants had positive perspective on the emerging influence of digital technology in dentistry. However, there was no significant difference ( $p > 0.05$ ) in the perspective between the participants in the three groups.

Group	Neutral	Positive	P value (Chi-Square)
Both private practitioner and Teaching faculty (n=45)	7 (15.5%)	38 (84.4%)	0.630
Private practitioner (n=116)	20 (17.2%)	96 (82.7%)	
Teaching faculty (n=22)	2 (9.1%)	20 (90.9%)	
<b>Total</b>	29 (15.8%)	154 (84.2%)	

Table 3: Comparison of perspectives on the emerging influence of digital technology in dentistry

Group	Never	Often	Rare	P value (Chi-Square)
Both private practitioner and Teaching faculty (n=45)	0	28 (62.2%)	17 (37.7%)	0.360
Private practitioner (n=116)	1 (0.8%)	55 (47.4%)	60 (51.7%)	
Teaching faculty (n=22)	0	14 (63.6%)	8 (36.3%)	
<b>Total</b>	1 (0.5%)	97 (53%)	85 (46.4%)	

Table 4: Comparison on the frequency of usage of Digital technologies

Majority of the study participants reported frequent usage of digital technologies in their dental practice. However, there was no significant difference ( $p >$

0.05) in the usage of digital technologies between the participants in the three groups. (Table 4).

### DISCUSSION

Digital technologies commenced to affect the dental fraternity in the form of audio-visual aids in both teaching and patient education. Advances in computerization, optics, miniaturization and laser technologies enabled capture of dental impression in 1980's.<sup>13</sup> Early 1980s also created the way for computer-aided design/computer-aided manufacturing (CAD/CAM) technology. CAD-CAM initially was in use for sanctioning design in aircraft and automotive industries; it was first patented in dentistry by Dr. Duret (1984).<sup>14</sup> Since then, the technology has been acquired in two directions—the intraoperative application for single appointment restoration (using prefabricated ceramic monoblocks) and paralleled by, CAD/CAM systems for commercial production centres and dental laboratories.<sup>15</sup>

There are numerous domains of digital dentistry available, and many more are being researched. Few of them are as follows: Digital radiography, Intraoral imaging/optical impressioning, Computeraided design/computeraided manufacturing (CAD/CAM), Shade matching, Digital smile designing, Virtual articulators and digital facebows etc.<sup>16</sup> Hence, it is important for prosthodontists to be updated and have a better understanding and knowledge about the same.

The primary necessity of knowing about digital technology is its momentous benefits which are patient compliance, rapid and aesthetic results. Data sharing is nearly unstrained which makes it far easier for the dentist to show their work, share their learning experiences and ask for suggestions on cases.<sup>17</sup>

The maximum number of prosthodontists are well equipped with computer (91.8%) and they use softwares for their clinical records(77%). They also have good awareness (92.3),opinion (93) and underwent training (78) regarding digital technology. Many prosthodontists have RVG but not OPG in their clinics The emerging influence of digital technology in dentistry has positive responses both by the clinicians as well as the patients. Prosthodontists have a good knowledge that digital technology would help in all their aspects. They strongly believed that impression made with the intraoral scanner is better than the conventional one and it is time saving too. They do believe that digital dental technology will replace traditional techniques in fabricating dental restorations and will have a positive impact as well as income growth in their profession. Most of the prosthodontist had a good knowledge about the advantages and disadvantages of using digital technology. 98.9% suggests digital technology in dental practice and 33% suggests for digital shade matching and digital designing.

Majority of the prosthodontists (33%) were willing to use digital shade matching and digital designing in our study. About 66%, digital impressions with intraoral scanners present with an advantage of 3D previsualization of the preparation and reducing the risk of distortion and material usage during impression making.<sup>18</sup> It also prevents gagging which are associated with conventional impression making. It is shown to render superior accuracy which was agreed on by the respondents as there are no errors associated with contraction or expansion of impression and model materials.<sup>18</sup> According to Nayakar,<sup>12</sup> 87.78% (237 respondents) were of the opinion that immediate data transfer and retrievability of scan data at any point was one of the major advantages of CAD/CAM in the clinical scenario followed by ease in lab authorisation and communication. This was a contravene to a survey carried out by Udhayaraja P et al,<sup>11</sup> who considered time efficiency (48%) and precise fit (20%) as a major advantage.

A survey conducted by Palanisamy S and Hegde C<sup>19</sup> on the knowledge of CAD/CAM among undergraduate students of an Institute in Karnataka showed that they have only shallow knowledge of the same, but in our study the prosthodontists have adequate knowledge about the digital technologies. Kusuma et al<sup>20</sup> knowledge about digital dentistry among postgraduate students, the findings suggested that there is a need for more specialized education and training programs in digital dentistry to address the knowledge and skills among the postgraduate dental students.

Sharab et al<sup>21</sup> conducted a survey on perception, awareness, and attitude toward digital dentistry among pre-dental students and the results highlighted the need to emphasize structured self-learning, self-evaluation, and an enhanced comprehension of the research included in dentistry curriculum. Almost all respondents highlighted the fact that digital dentistry would have a positive impact on our profession which was in accordance with a survey conducted by Tran D et al<sup>22</sup> among United Kingdom dentists. Hence, we should work towards gaining more knowledge and create a future generation of dentists who will be well versed with digital dentistry. The primary weakness of the current study was the lower sample size among the various practitioner types, which made it difficult to better understand how knowledge and awareness are perceived about digital dentistry and its implications on dental practice a large number of participants can be included.

## CONCLUSION

Digital dentistry is a new era in dentistry that offers contemporary solutions to traditional problems that will benefit both patients and dentists. To embrace this new technology and raise dentists' knowledge and awareness, we should hold continuing dental

education programmes, workshops, or hands-on courses.

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