

Knowledge, Attitude, and Practice of Digital Dentures Among Practising Dentists in the Mumbai Metropolitan Region: A Cross-Sectional Questionnaire Study

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ABSTRACT:

Digital dentures are increasingly being introduced into prosthodontic practice because of their potential to improve workflow standardization, denture accuracy, and record preservation. However, their successful clinical adoption depends on the knowledge, attitude, and practical exposure of dentists. To assess the knowledge, attitude, and practice regarding digital dentures among practising dentists in the Mumbai Metropolitan Region. A questionnaire-based observational cross-sectional study was conducted among practising dentists in the Mumbai Metropolitan Region using a web-based survey. A structured close-ended questionnaire assessed demographic details and responses related to knowledge, attitude, practice, perceived barriers, and future prospects of digital dentures. Data were analyzed using descriptive statistics, and qualification-wise comparisons were performed using tests for categorical variables. A p value of less than 0.05 was considered statistically significant. A total of 111 responses were analyzed. Most respondents had heard of digital dentures (93.7%), and 93.7% considered them a valuable innovation in prosthodontics. However, only 24.3% had tried fabricating digital dentures in clinical practice, and 24.3% reported hands-on experience. Formal curricular learning was reported by 30.6% of respondents. Most participants felt that affordability depended on locality (68.5%), and 50.5% reported multiple concurrent barriers to learning or practice. MDS respondents showed significantly greater clinical exposure, curricular learning, and academic exposure than BDS respondents. Practising dentists showed high awareness and a favorable attitude toward digital dentures, but practical exposure and routine use remained limited. The findings indicate a gap between awareness and implementation and support the need for stronger educational and hands-on training opportunities.

KEY WORDS: DDigital dentures; CAD-CAM dentures; Digital dentistry; Prosthodontics; Questionnaire survey

INTRODUCTION

Edentulism remains an important prosthodontic problem, particularly in older adults, and complete dentures continue to play a major role in restoring mastication, speech, esthetics, and quality of life. Conventional complete denture

fabrication has been used successfully for many years, but it involves multiple clinical and laboratory steps and is often time-consuming and technique-sensitive. In recent years, digital workflows have gained increasing attention because they offer a more standardized approach to denture fabrication and may reduce chairside and laboratory time while preserving digital records for future remakes ([1,2]

Digital complete dentures are fabricated using computer-aided design and computer-aided manufacturing technologies, usually through subtractive milling or additive three-dimensional printing. These methods have expanded the scope of removable prosthodontics by introducing new options for denture design, manufacturing precision, and workflow simplification. Reviews of currently available CAD-CAM complete denture systems have noted that digital workflows are becoming more clinically relevant as materials, software, and manufacturing systems continue to improve [3].

Accuracy of the denture base is one of the most important factors influencing retention, stability, and adaptation of complete dentures. Experimental studies have shown that digitally fabricated denture bases can achieve clinically acceptable adaptation. [4] reported that both milled and digital light processing-generated mandibular denture bases demonstrated intaglio surface adaptation within a clinically acceptable range. Similarly, [5] found that digitally fabricated maxillary denture bases showed favorable trueness and tissue surface adaptation when compared with conventional pack-and-press methods [6]. further observed that CAD-CAM milled and rapid prototyping methods showed better overall accuracy than conventional injection molding in their comparative evaluation of denture base fabrication techniques [4,5 & 6].

Despite these advancements, successful incorporation of digital dentures into routine practice depends not only on the technology itself but also on the clinician's knowledge, acceptance, and practical exposure. In a metropolitan region such as Mumbai, where digital dentistry is gradually becoming more visible in academic and private practice settings, it is important to understand how practising dentists perceive and use digital denture technology. Therefore, the present study was undertaken to assess the knowledge, attitude, and practice of digital dentures among practising dentists in the Mumbai Metropolitan Region.

MATERIALS AND METHODS

Study design and setting: This questionnaire-based observational cross-sectional study was conducted to assess the knowledge, attitude, and practice regarding digital dentures among practising dentists in the Mumbai Metropolitan Region (MMR). The study was carried out as a web-based survey, which allowed inclusion of respondents from different clinical and academic practice settings within the region. The study was conducted according to the approved study protocol and in accordance with accepted ethical principles for questionnaire-based research. The respondents were informed about the objectives of the study before participation, and confidentiality of their responses was maintained throughout the study. As the study was non-interventional and based solely on an anonymous web-based questionnaire, no clinical procedure was involved.

Study population and eligibility criteria: The study population comprised practising dentists working in the Mumbai Metropolitan Region. Both Bachelor of Dental Surgery (BDS) graduates and Master of Dental Surgery (MDS) practitioners were considered eligible for participation. Dentists practising outside the Mumbai Metropolitan Region and undergraduate dental students were excluded from the study. Since the study was based on voluntary participation in an online questionnaire, withdrawal criteria were not applicable.

Sample size and survey approach: A target sample of 200 practising dentists was planned for the survey. The questionnaire was circulated electronically among eligible participants, and responses received from those who met the inclusion criteria were considered for analysis. Only completed responses were included in the final dataset. The web-based approach was chosen to improve accessibility and facilitate participation from dentists across different areas of the metropolitan region.

Study instrument: Data were collected using a structured, close-ended questionnaire designed for this study. The questionnaire included items related to demographic details such as qualification and specialty, followed by questions assessing knowledge, attitude, and practice regarding digital dentures. The knowledge component assessed awareness of the term digital dentures, prior exposure to the subject in the academic curriculum, and understanding of the digital denture workflow. The attitude component included questions related to the perceived value of digital dentures, their future role in prosthodontic practice, affordability, the need for additional undergraduate training, and confidence in using the technology in future. The practice component assessed previous fabrication of digital dentures, hands-on experience, and extent of academic exposure. Additional questions were included to identify perceived barriers to learning or practising digital denture fabrication and the expected impact of digital dentures on patient care.

Data collection procedure: The questionnaire was distributed through online platforms to practising dentists in the Mumbai Metropolitan Region. Before participation, the respondents were informed about the purpose and nature of the study. They were assured that the information provided by them would be kept confidential and used only for academic and research purposes. No open-ended questions were included in the survey.

Study variables and outcome measures: The primary outcome of the study was the assessment of knowledge, attitude, and practice related to digital dentures among practising dentists in the Mumbai Metropolitan Region. The main study variables included awareness of digital dentures, curricular learning, perception of their value in prosthodontics, opinion regarding their future use, confidence in adopting the

technology, actual clinical exposure, and hands-on experience. Secondary observations included perceived barriers to learning or implementation, opinion regarding affordability, expected impact on patient care, and views on the integration of digital denture training into the undergraduate curriculum.

Data management and statistical analysis: The collected responses were compiled in a master chart and reviewed for completeness before analysis. Categorical variables were summarized using frequencies and percentages. The findings were presented in tabular form for clarity. For subgroup comparisons, qualification-based differences between BDS and MDS respondents were assessed using appropriate tests for categorical data, such as the chi-square test or Fisher's exact test wherever required. A p value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

A total of 111 completed questionnaire responses were included in the analysis. Of these, 69 respondents (62.2%) were MDS practitioners and 42 (37.8%) were BDS practitioners. With respect to specialty distribution, 34 respondents (30.6%) belonged to Prosthodontics, Crown and Bridge, followed by Pediatric and Preventive Dentistry and Periodontology with 14 respondents (12.6%) each. Conservative Dentistry and Endodontics and Oral Medicine and Radiology each contributed 7 respondents (6.3%). In 35 responses (31.5%), the branch was not applicable or not specified, corresponding largely to BDS participants. The distribution of participant characteristics is shown in Table 1.

Characteristic	Category	n (%)
Qualification	BDS	42 (37.8)
	MDS	69 (62.2)
Specialty/branch	Not applicable/not specified	35 (31.5)
	Prosthodontics, Crown & Bridge	34 (30.6)
	Pediatric and Preventive Dentistry	14 (12.6)
	Periodontology	14 (12.6)
	Conservative Dentistry and Endodontics	7 (6.3)
	Oral Medicine and Radiology	7 (6.3)

Knowledge and practice related to digital dentures: Awareness regarding digital dentures was high, with 104 respondents (93.7%) reporting that they had heard of the term. However, only 27 respondents (24.3%) had tried to fabricate a digital denture in their clinic, and an identical proportion reported hands-on experience with digital denture fabrication. Learning about digital dentures through the formal

curriculum was reported by 34 respondents (30.6%), while 77 (69.4%) stated that they had not learned about the topic in their curriculum. Regarding academic exposure, the most common response was "rarely" in 56 respondents (50.5%), followed by "never" in 21 (18.9%), "frequently" in 20 (18.0%), and "occasionally" in 14 (12.6%). These findings are presented in Table 2.

Variable	Response	n (%)
Heard of the term digital dentures	Yes	104 (93.7)
	No	7 (6.3)
Tried to fabricate digital dentures in clinic	Yes	27 (24.3)
	No	84 (75.7)
Learned about digital dentures in curriculum	Yes	34 (30.6)
	No	77 (69.4)
Hands-on experience with digital denture fabrication	Yes	27 (24.3)
	No	84 (75.7)
Exposure to digital denture content in academic curriculum	Frequently	20 (18.0)
	Occasionally	14 (12.6)
	Rarely	56 (50.5)
	Never	21 (18.9)

Attitude, perceived barriers, and future prospects: Most respondents expressed a favorable attitude toward digital dentures. A total of 62 respondents (55.9%) strongly agreed and 42 (37.8%) agreed that digital dentures are a valuable innovation in prosthodontics. Regarding future replacement of conventional dentures, 63 respondents (56.8%) believed that digital dentures would completely replace conventional dentures, whereas 48 (43.2%) felt that a combination of both approaches would be ideal. With respect to affordability, 76 respondents (68.5%) felt that affordability depended on locality, 28 (25.2%) considered digital dentures affordable, and 7 (6.3%) considered them non-affordable.

For undergraduate training, 62 respondents (55.9%) strongly agreed and 28 (25.2%) agreed that students should receive more training on digital denture fabrication. Confidence in using digital denture technology in the future was reported as very confident by 48 respondents (43.2%), somewhat confident by 28 (25.2%), and requiring further learning and training by another 28 (25.2%), while 7 respondents (6.3%) reported that they were not confident. The most common perceived barrier was the presence of multiple simultaneous barriers, reported by 56 respondents (50.5%). With regard to future prospects, 76 respondents (68.5%) expected a revolutionary improvement in patient care, and 55 (49.5%) strongly agreed while 35 (31.5%) agreed that digital denture training should be integrated more strongly into the undergraduate curriculum. These data are summarized in Table 3.

Table 3. Attitude toward digital dentures, perceived barriers, and future prospects

Variable	Response	n (%)
Digital dentures are a valuable innovation in prosthodontics	Strongly agree	62 (55.9)
	Agree	42 (37.8)
	Neutral	7 (6.3)
Belief that digital dentures will replace conventional dentures in future	Yes, completely	63 (56.8)
	A combination of both is ideal	48 (43.2)
Affordability of digital dentures for patients	Affordable	28 (25.2)
	Depends on locality	76 (68.5)
	Non-affordable	7 (6.3)
Need for more undergraduate training	Strongly agree	62 (55.9)
	Agree	28 (25.2)
	Neutral	14 (12.6)
	Disagree	7 (6.3)
Confidence in ability to understand and use digital denture technology in future	Very confident	48 (43.2)
	Somewhat confident	28 (25.2)
	Need some learning and training sessions	28 (25.2)
	Not confident	7 (6.3)
Perceived barriers to learning or practicing digital denture fabrication	All above	56 (50.5)
	Limited resources	14 (12.6)
	Lack of teaching in curriculum	14 (12.6)
	Lack of hands-on training	14 (12.6)
	High cost of equipment	7 (6.3)
	None	6 (5.4)
Perceived impact on patient care	Revolutionary improvement	76 (68.5)
	Moderate improvement	35 (31.5)
Recommendation for greater integration into undergraduate curriculum	Strongly agree	55 (49.5)
	Agree	35 (31.5)
	Neutral	7 (6.3)
	Disagree	14 (12.6)

Comparison according to qualification: Qualification-wise comparison demonstrated statistically significant differences for several variables. Previous clinical fabrication of digital dentures was reported by 27 of 69 MDS respondents (39.1%), whereas none of the 42 BDS respondents reported such experience ($p < 0.001$). Similarly, learning about digital dentures in the curriculum was more frequent among MDS respondents than BDS respondents (39.1% vs 16.7%; $p = 0.023$). A significant difference was also observed in perception of digital dentures as a valuable innovation: 48 MDS respondents (69.6%) strongly agreed compared with 14 BDS respondents (33.3%), while neutrality was reported only among BDS respondents (16.7%) ($p < 0.001$).

Exposure to digital denture-related content also differed significantly between the two qualification groups ($p < 0.001$). Frequent exposure was reported only among MDS respondents (29.0%), whereas “never” was more common among BDS

respondents (33.3% vs 10.1%). Confidence regarding future use showed a significant association with qualification ($p = 0.034$), with “very confident” being reported by 50.0% of BDS respondents and 39.1% of MDS respondents, while lack of confidence was reported only among MDS respondents (10.1%). Affordability perception also differed significantly between groups ($p = 0.015$). In contrast, no statistically significant association with qualification was observed for awareness of the term digital dentures ($p = 0.084$), belief regarding complete future replacement of conventional dentures ($p = 0.148$), perceived impact on patient care ($p = 0.914$), or recommendation for curricular integration ($p = 0.157$). The detailed comparison is presented in Table 4.

The present study showed that awareness of digital dentures among practising dentists in the Mumbai Metropolitan Region was high, but this did not translate into equivalent levels of clinical use or hands-on experience. This gap between

awareness and implementation is clinically important because adoption of digital dentures depends not only on knowing the term, but also on exposure to scanning, digital design, manufacturing workflow, and post-processing steps. A similar pattern was reported by [7], who found high awareness of

digital dentures among dentists, while actual practice and confidence remained lower. Likewise, [8] reported that perception toward digital dentistry was generally favorable, but emphasized that stronger educational exposure and practical training were still needed for meaningful clinical integration.

Table 4. Qualification-wise comparison of selected variables

Variable	Response	BDS n (%)	MDS n (%)	p value
Heard of the term digital dentures	Yes	42 (100.0)	62 (89.9)	0.084
	No	0 (0.0)	7 (10.1)	
Tried to fabricate digital dentures in clinic	Yes	0 (0.0)	27 (39.1)	<0.001
	No	42 (100.0)	42 (60.9)	
Learned about digital dentures in curriculum	Yes	7 (16.7)	27 (39.1)	0.023
	No	35 (83.3)	42 (60.9)	
Digital dentures are a valuable innovation in prosthodontics	Strongly agree	14 (33.3)	48 (69.6)	<0.001
	Agree	21 (50.0)	21 (30.4)	
	Neutral	7 (16.7)	0 (0.0)	
Affordability of digital dentures for patients	Affordable	7 (16.7)	21 (30.4)	0.015
	Depends on locality	35 (83.3)	41 (59.4)	
	Non-affordable	0 (0.0)	7 (10.1)	
Confidence in ability to understand and use digital denture technology in future	Very confident	21 (50.0)	27 (39.1)	0.034
	Somewhat confident	7 (16.7)	21 (30.4)	
	Need some learning and training sessions	14 (33.3)	14 (20.3)	
	Not confident	0 (0.0)	7 (10.1)	
Exposure to digital denture content in academic curriculum	Frequently	0 (0.0)	20 (29.0)	<0.001
	Occasionally	7 (16.7)	7 (10.1)	
	Rarely	21 (50.0)	35 (50.7)	
	Never	14 (33.3)	7 (10.1)	
Perceived impact on patient care	Revolutionary improvement	28 (66.7)	48 (69.6)	0.914
	Moderate improvement	14 (33.3)	21 (30.4)	
Recommendation for greater integration into undergraduate curriculum	Strongly agree	21 (50.0)	34 (49.3)	0.157
	Agree	14 (33.3)	21 (30.4)	
	Neutral	0 (0.0)	7 (10.1)	
	Disagree	7 (16.7)	7 (10.1)	

The positive attitude observed in the present study is understandable in light of the growing evidence supporting digital complete denture workflows. Systematic review evidence suggests that CAD-CAM complete dentures are not inferior to conventional dentures and may offer additional advantages such as better retention, improved mechanical properties, reduced chairside time, and preservation of digital records for future remakes [10]. Experimental studies have also shown that CAD-CAM dentures, particularly milled dentures, demonstrate superior fit compared with conventionally fabricated dentures, which may explain why many clinicians increasingly regard digital dentures as a valuable innovation in prosthodontics [11]. Similarly, [12] found that milled PMMA denture bases showed better adaptation than printed and conventionally fabricated denture bases, supporting

the perception that digital methods may improve prosthesis accuracy.

In the present study, MDS respondents showed greater curricular exposure, greater clinical experience, and significantly more prior fabrication of digital dentures than BDS respondents. This finding is logical because postgraduate training provides more specialty-based exposure, especially in prosthodontics and related digital workflows. The importance of such training has been highlighted in earlier literature [13]. demonstrated that a complete denture workflow based on intraoral scans is feasible, but such techniques require familiarity with digital records, maxillomandibular relationship registration, and appropriate case selection [14] also noted that although digital workflows may improve clinician-reported

and patient-related outcomes in several aspects, adoption still depends on practical understanding, operator learning curve, and clinical infrastructure. Therefore, the present finding that many respondents supported stronger undergraduate integration of digital denture training appears justified and reflects a real educational need.

Another notable finding was that affordability was considered dependent on locality by most respondents, and the most frequently reported barriers were multiple concurrent obstacles, limited resources, lack of curricular teaching, lack of hands-on training, and high equipment cost. These responses reflect the current practical situation in removable digital prosthodontics. Although digital denture systems may reduce appointments and improve workflow efficiency, the required infrastructure remains expensive and is not uniformly available across all practice settings. Earlier survey-based work has also identified cost, equipment access, and insufficient practical training as major barriers to adoption [7,8]. Clinically, this suggests that digital dentures are presently being viewed more as a promising adjunct or evolving alternative rather than a universal replacement for conventional dentures in all settings.

This study has certain limitations. It was a cross-sectional, questionnaire-based survey and therefore depended on self-reported responses, which may be influenced by recall bias or response bias. The sample was restricted to practising dentists in one metropolitan region, so the findings may not be generalizable to other regions or institutional settings. In addition, the questionnaire assessed perceived knowledge and practice rather than objectively measured competence. Future studies should include multicentric samples, validated scoring systems for knowledge and attitude, and subgroup analysis based on specialty, years of experience, and type of practice. Longitudinal or interventional studies evaluating the effect of structured teaching modules, hands-on workshops, and continuing dental education programs on actual adoption of digital denture workflows would provide stronger evidence for curriculum planning and clinical implementation.

CONCLUSION

Digital dentures were widely recognized by practising dentists in the Mumbai Metropolitan Region and were generally viewed positively as an emerging advancement in prosthodontics. However, actual clinical use, hands-on experience, and curricular exposure remained limited, indicating a gap between awareness and implementation. Within the limits of this study, the findings suggest a need for stronger educational exposure and practical training to support more confident and effective adoption of digital denture technology.

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