

Awareness and Knowledge of Intra-oral Scanners among Dental Professionals in Gujarat: A Questionnaire-Based Study

¹Dr Kajal Vadhel, 3rd year Post Graduate Student, Department of Prosthodontics, Crown & Bridge, Government Dental College and Hospital, Ahmedabad– 380016, Gujarat University.

²Dr Rupal Shah, Professor, Head of Department and PG Guide, Department of Prosthodontics, Crown & Bridge, Government Dental College and Hospital, Ahmedabad– 380016, Gujarat University.

³Dr Hemal Agrawal, Professor and PG Guide, Department of Prosthodontics, Crown & Bridge, Government Dental College and Hospital, Ahmedabad– 380016, Gujarat University.

⁴Dr Tanmay Sakhare, 2nd year Post Graduate Student, Department of Prosthodontics, Crown & Bridge, Government Dental College and Hospital, Ahmedabad– 380016, Gujarat University.

⁵Dr Vedika Pathade, 3rd year Post Graduate Student, Department of Prosthodontics, Crown & Bridge, Government Dental College and Hospital, Ahmedabad– 380016, Gujarat University.

Corresponding Author: Dr Kajal Vadhel, 3rd year Post Graduate Student, Department of Prosthodontics, Crown & Bridge, Government Dental College and Hospital, Ahmedabad– 380016, Gujarat University.

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Abstract

Background: Intra-oral scanners (IOS) are transforming dental practice by enabling digital impressions that improve accuracy, efficiency, and patient comfort. Despite the global growth of digital dentistry, awareness and use of IOS among Indian dentists remain variable. This study aimed to assess the awareness, knowledge, and attitudes toward intra-oral scanners among dental professionals in Gujarat, India, using a questionnaire-based survey.

Materials and Methods: A cross-sectional online survey was conducted among 650 dental professionals across Gujarat. The questionnaire collected data on demographics, professional background, awareness and use of IOS, self-rated knowledge, perceived benefits and barriers, and intention to adopt IOS in practice. Responses were analyzed with SPSS v26 ($p < 0.05$). Descriptive statistics summarized frequencies and percentages, and chi-square tests examined associations between variables (e.g. qualification level and IOS usage).

Results: Of 650 respondents, 75.7% reported having heard of intra-oral scanners (Table 1), and 67.4% had used an IOS clinically. Most participants (56.3%) rated their IOS knowledge as “good,” with only 1.1% reporting no knowledge. A strong majority (80.9%) agreed that IOS improve clinical outcomes over conventional impressions. The most cited benefits were increased patient comfort (85.4%) and faster procedures (67.5%). Leading barriers were limited patient acceptance (63.7%), high cost (55.5%), and technical challenges (55.2%). Notably, 74.6% of respondents indicated they would consider incorporating IOS in the future. Chi-square analysis showed no significant association between qualification (BDS vs. MDS) and awareness of IOS ($\chi^2=0.28$, $p=0.89$). However, IOS usage was significantly higher among MDS holders (71.2%) than BDS holders (61.2%) ($\chi^2=6.82$, $p=0.03$).

Conclusion: Dental professionals in Gujarat demonstrated generally high awareness of intra-oral scanners, and many have adopted the technology in practice. Attitudes were largely positive, with most practitioners recognizing benefits for patient comfort and clinical efficiency. The main obstacles identified were cost, patient acceptance, and need for training. These findings suggest that continued education and support could further boost IOS adoption in the region. Integrating digital scanning into dental curricula and professional development may help bridge remaining gaps between knowledge and practice.

Keywords: Intra-Oral Scanner, Awareness, Digital Dentistry, Dental Professionals, Gujarat, Questionnaire Survey.

Introduction

Digital technology is rapidly reshaping dentistry, and intra-oral scanners (IOS) represent a major innovation by capturing optical impressions that eliminate many

drawbacks of traditional methods. IOS devices use light (often laser or structured light) to scan dental arches and prepared teeth, producing high-resolution 3D models. These optical impressions improve patient comfort by avoiding cumbersome trays and impression materials, and they often enhance clinical accuracy and efficiency. In particular, intra-oral scanning is widely recognized for its precision in prosthodontics, implant planning, orthodontics, and other applications. However, adoption in routine practice varies. For example, an ADA clinical panel survey in the United States reported that about 53% of dentists use an IOS, with the rest citing barriers such as high cost. Similarly, a recent study of 450 dental clinics in Punjab (northern India) found that only 40% had any type of dental scanner, and just 25% used an IOS. These findings highlight that many dental professionals are either not aware of or have limited experience with scanning technology.

In India, limited data exist on dentists' familiarity with IOS. One small Gujarat study ($n=105$) found very high awareness (98% of participants had heard of IOS), but that study had a small sample. A cross-sectional survey in Saudi Arabia ($n=500$) reported that only 58% of graduates and practitioners were aware of IOS, and only 56.5% actively used them. These discrepancies may reflect differences in sample or awareness levels. Given Gujarat's large dental workforce, a broader assessment is needed. This study therefore surveyed 650 dental professionals in Gujarat to evaluate (1) the level of awareness and use of intra-oral scanners, (2) self-assessed knowledge and perceived clinical impact of IOS, and (3) perceived benefits, barriers, and future adoption intentions. Insights from this research can guide educational strategies and policy for digital dentistry in the region.

Materials and Methods

This observational study used a cross-sectional questionnaire delivered online to dental professionals in Gujarat. The survey instrument was developed to capture a wide range of information on intra-oral scanners. The questionnaire included sections on demographics (age, gender, city of practice), professional background (qualification, years of experience, practice setting), and specific items on IOS awareness and use. Key IOS-related questions were: whether the respondent had heard of intra-oral scanners (yes/no), sources of first information about IOS, whether they had ever used an IOS clinically, self-rating of IOS knowledge (categories such as “excellent,” “good,” “average,” etc.), and attitudes toward IOS (e.g., agreement that scanners improve outcomes). Other items addressed perceived benefits (e.g., patient comfort, accuracy) and barriers (e.g., cost, training), preferred clinical applications, and openness to future adoption.

A total of 650 completed questionnaires were collected (sample size predetermined by expected survey reach). Respondents included dentists working in various cities across Gujarat. Data were entered and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequencies and percentages) were calculated for all variables. Inferential analysis was conducted using chi-square tests to explore associations between categorical factors, such as qualification level (BDS, MDS, or other) versus awareness or usage of IOS. A p-value < 0.05 was considered statistically significant. The study adhered to ethical standards; participation was voluntary and anonymous.

Result

Respondent Demographics: All 650 dental professionals from Gujarat who responded were included. Participants represented a wide range of cities, with the highest from

Surat (13.4%), Patan (6.9%), Baroda (6.5%), and Valsad (5.4%), ensuring a mix of urban and semi-urban regions. Age-wise, 54.8% were aged 25–35 years and 27.1% were under 25, indicating a predominantly young respondent group. In terms of qualifications, 60.9% held MDS degrees, 35.7% BDS, and 3.4% other dental certifications. Most had 1–5 years of clinical experience (47.7%), while 16.2% had less than a year. The most common practice setting was private clinics (40%), followed by government hospitals (28.2%) and dental colleges (20%) (Table I).

Awareness and knowledge of Intra-oral Scanners: A substantial majority (75.7%) were aware of intra-oral scanners, having first heard about them mainly through CDE programs (34.2%) and dental college training (32.6%). About 67.4% reported actual usage of IOS in clinical settings. Knowledge levels were self-rated as “Good” by 56.3%, “Average” by 26.9%, and “Excellent” by 14.3%, suggesting generally positive familiarity with the technology.

Perceptions and Clinical Impact: A combined 80.9% agreed or strongly agreed that IOS improves clinical outcomes. Key applications included implant planning (81.9%), digital record-keeping (65.1%), crown and bridge work (64.5%), and orthodontics (54.6%). The most cited advantages were increased patient comfort (85.4%), faster procedures (67.5%), and ease of digital storage and sharing (66.3%). Over three-fourths (77.1%) reported better patient acceptance of IOS compared to conventional impressions.

Interest and Future Adoption: When asked about their interest in learning more about intra-oral scanners, 65.7% answered “Yes,” 15.4% were unsure (“Maybe”), and 18.9% answered “No”. This indicates strong overall enthusiasm for additional education on IOS.

Similarly, 74.6% of respondents said they would consider incorporating intra-oral scanning into their practice in the future. Only 22.6% said “No” and 2.8% were uncertain. Thus, a significant majority appear open to adopting or expanding IOS use. This positive outlook suggests that continued professional development and decreasing barriers could lead to wider IOS integration in Gujarat dentistry.

Practice Patterns and Workflow Impact:
Common procedures for which IOS were regularly used included full-arch prostheses (75.9%), smile design (45.2%), and single-unit crowns (37.4%). A majority

(69.8%) felt IOS improved workflow efficiency, though a minority (13.4%) disagreed or strongly disagreed.

Adoption intent and barriers: Interest in learning more about IOS was expressed by 65.7% of respondents, and 74.6% showed willingness to incorporate IOS into their future practice. Reported barriers included limited patient acceptance (63.7%), high equipment cost (55.5%), technical issues (55.2%), and lack of training (50.3%). About 68% of users reported facing challenges like scanning inaccuracies (55.7%), difficulty with subgingival areas (52.9%), and software issues (42%) (Pie chart I).

Table 1: Descriptive statistics – Questionnaire

Qn.	Survey Question	Options (Response Choices)	Top Response	Percent
1	Which city do you practice in?	Multiple cities	Surat	13.4%
2	What is your age?	Below 25, 2535, 3645, Above 45	2535 years	54.8%
3	What is your qualification?	BDS, MDS, Other	MDS	60.9%
4	Years of clinical experience	<1 yr, 15 yrs, 610 yrs, >10 yrs	15 yrs	47.7%
5	Practice setting	Private, Govt, College, Corporate, Other	Private clinic	40.0%
6	Heard of intraoral scanners?	Yes, No	Yes	75.7%
7	Where did you first learn about them?	CDE, College, Colleagues, Online, Other	CDE	34.2%
8	Ever used intraoral scanner?	Yes, No	Yes	67.4%
9	Knowledge of intraoral scanners?	Excellent, Good, Avg, Poor, None	Good	56.3%
10	Do IOS improve outcomes?	Strongly agree to Strongly disagree	Agree	58.0%
11	IOS most beneficial for?	Implants, Digital, Ortho, etc.	Implant planning	81.85%
12	Interested in learning more?	Yes, No, Maybe	Yes	65.7%
13	Major barriers to adoption?	Cost, Training, Tech, Acceptance, etc.	Patient Acceptance	63.69%
14	Future incorporation of IOS?	Yes, No, Maybe	Yes	74.6%
15	Main advantages of IOS?	Comfort, Speed, Accuracy, etc.	Patient comfort	85.38%
16	Better patient acceptance?	Yes, No, Not sure	Yes	77.1%
17	Improved time efficiency?	Strongly agree to Strongly disagree	Agree	46.3%
18	Regular use/recommendation?	Full-arch, Crowns, Ortho, etc.	Full-arch prosthesis	75.85%
19	Prefer conventional in which cases?	Long-span, Edentulous, etc.	Long-span bridges	48.0%
20	Faced technical issues?	Yes, No, NA	Yes	68.0%
21	Types of issues encountered?	Training, Stitching, Glitches, etc.	Training challenge	66.31%
22	Biggest concern in IOS usage?	Cost, Maintenance, Training, etc.	Cost	50.5%

Association with Qualifications: Chi-square tests examined whether awareness and usage of IOS differed by educational qualification (BDS, MDS, or other). There was no significant association between qualification and having heard of intra-oral scanners ($\chi^2 = 0.28, p = 0.89$). Roughly three-quarters of each qualification category reported awareness (BDS: 76.7%; MDS: 75.3%; Other: 72.7%; overall 75.7%). In contrast,

there was a significant association between qualification and having used an IOS ($\chi^2 = 6.82, p = 0.03$). Among MDS graduates, 71.2% had used an IOS, compared to 61.2% of BDS practitioners (and 63.6% of those with other qualifications). This suggests that specialist training is linked to higher adoption of scanning technology (Table II).

Pie chart 1: What is your biggest concern regarding the regular use of intraoral scanners?

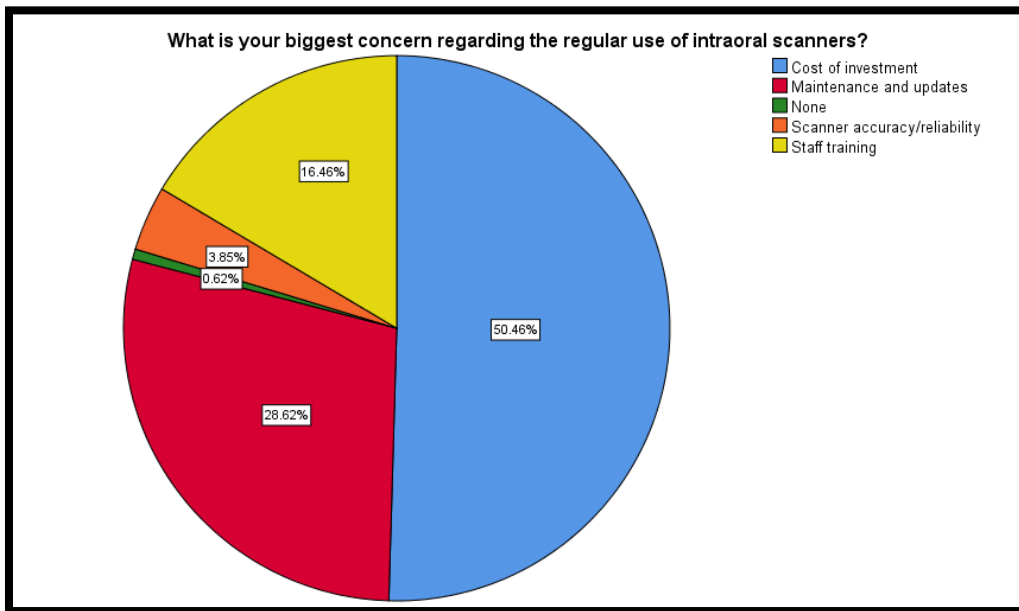


Table 2-Association between Qualification vs Usage of Intra oral scanners

		What is your qualification?			Total	
		BDS	MDS			
Have you ever used an intraoral scanner in your clinical practice?	No	Count	90	114	8	212
		% within What is your qualification?	38.8%	28.8%	36.4%	32.6%
	Yes	Count	142	282	14	438
		% within What is your qualification?	61.2%	71.2%	63.6%	67.4%
Total		Count	232	396	22	650
		% within What is your qualification?	100.0%	100.0%	100.0%	100.0%
Chi Square			6.82			
P Value			0.03*			

Discussion

This study provides a comprehensive look at intra-oral scanner awareness, knowledge, and attitudes among dental professionals in Gujarat. Our finding is that 75.7% of respondents had heard of IOS indicates substantial familiarity with the concept. The discrepancy may arise from differences in sampling: the present study's larger and more diverse sample likely reflects a more realistic average awareness level.

Practice experience with IOS was also relatively high: 67.4% reported having used an intra-oral scanner. This is higher than the 53% usage rate found in the ADA survey of US dentists and far above the 25% of clinics in Punjab that reported using any IOS. The growth in adoption may reflect the recent expansion of digital dentistry. Importantly, MDS-qualified respondents used scanners significantly more than BDS-qualified (71.2% vs. 61.2%), suggesting postgraduate training encourages equipment use. This aligns with expectations that specialists (e.g. prosthodontists, orthodontists) are early adopters of new technology.

Self-assessed knowledge was generally positive: most dentists in this survey felt at least "good" about their IOS knowledge. This confidence may stem from the fact that many had learned about scanners in formal training or CDE events. Indeed, continuing education programs and dental school curricula were the primary information sources identified. This underscores the importance of structured learning; prior studies have shown that formal training increases comfort with digital tools. Nonetheless, about 15.7% rated their knowledge as average/poor, indicating room for broader education.

Participants overwhelmingly believed in the clinical benefits of IOS. Over 80% agreed that digital scanning improves clinical outcomes. They highlighted patient comfort and faster workflows as top advantages,

consistent with literature demonstrating reduced discomfort and time savings with IOS. The majority also noted better patient acceptance of IOS (77%), suggesting patients prefer the digital approach. These positive attitudes are encouraging and mirror findings in other surveys where dentists reported high satisfaction with IOS (over 90% in the ADA report).

Among clinical applications, respondents perceived the greatest value of IOS in implant planning and full-arch prosthodontics. This matches the known strengths of IOS in capturing implant scan bodies accurately and managing complex restorative cases. Routine use in single crowns and smile design (37-45%) was moderate, indicating gradual expansion into general practice. Fewer respondents used IOS regularly for aligners or inlays (16-23%), implying these applications are still emerging in the region.

Despite these advantages, significant barriers remain. Cost was a leading concern: over half (55.5%) identified high initial investment as a barrier, and 50.5% cited it as their top concern. This echoes global trends where the expense of IOS is frequently mentioned. Patient acceptance was surprisingly the most common barrier (63.7%); some practitioners still find patients unfamiliar or hesitant about new technology. Technical challenges and lack of training were also major issues, with 66.3% of users experiencing a steep learning curve. These findings suggest that while the concept of IOS is accepted, practical hurdles in equipment handling and patient buy-in slow widespread integration.

The associations tested showed that awareness of IOS is similar across education levels, indicating that knowledge campaigns have broadly reached all dentist categories. However, actual usage differs by qualification, implying that further encouragement of scanner use among general practitioners (BDS) could be beneficial.

This study's findings are largely consistent with other recent research. The Saudi study likewise found a positive stance toward IOS but noted low routine usage due to gaps in knowledge. The Punjab survey highlighted that many Indian clinics have yet to adopt digital scanning. Our data, by contrast, show a higher penetration of IOS in Gujarat, possibly reflecting regional differences or more aggressive outreach by scanner manufacturers. The positive attitudes seen here (most dentists eager to learn more and adopt IOS) suggest that Gujarat's dental community is on a trajectory toward greater digitization.

Limitations: The study relied on self-reported data and convenience sampling, which may introduce bias. Also, the questionnaire was administered online, possibly favouring respondents with internet access. Despite these limitations, the large sample size (650) and wide geographic coverage lend strength to the conclusions.

Conclusion

Dental professionals in Gujarat demonstrated substantial awareness and usage of intra-oral scanners. The majority of respondents recognized clinical benefits of IOS in terms of patient comfort and efficiency, and many have already incorporated scanning into their practices. However, barriers such as cost, technical challenges, and patient acceptance were identified. The significant interest in further learning and future adoption indicates that with proper support through training programs, cost reductions, and patient education scanner adoption is likely to grow. Incorporating IOS training into dental education and continuing professional development could accelerate this process. Overall, this study highlights a broadly positive attitude toward digital impressions among Gujarat dentists, while pinpointing areas for intervention to achieve more uniform adoption of IOS technology.

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