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The Adoption and Impact of Dental Scanners in Dental Clinics across Punjab, India: Need of the Hour - A Questionnaire Study

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Abstract **Original Research Article**

Background: The aim of this article was to determine the adoption and impact of dental scanners in dental clinics across Punjab, India. ***Materials and Methods***: A questionnaire was distributed via Google Forms to 450 dental clinics to gather data on the usage, benefits, and challenges associated with dental scanners. The findings highlight the growing trend of digital dentistry and its implications for clinical practice. ***Results***: The survey conducted across 450 clinics in Punjab revealed that 60% of clinics do not use dental scanners, highlighting a significant gap in the adoption of this technology. Among the 40% of clinics that do use dental scanners, 25% utilize intraoral scanners, 10% use extraoral scanners, and 5% employ both types. The majority of these clinics have adopted dental scanners relatively recently, with only a small percentage using them for more than five years. ***Conclusion***: Intra Oral Scanner (IOS) system is less time consuming when compared with other conventional methods. In terms of patient benefits, it reduces pain and discomfort. Ease of communicating with patients and educate them by providing video presentations before delivering any appliance or prostheses. Advanced technology is reshaping the future of digital dentistry, not only in orthodontics but also in other fields of dentistry as well.

Keywords: Dental scanners, digital dentistry, intraoral scanners, Punjab, India, clinical practice, questionnaire survey.

INTRODUCTION

Digital technology has revolutionized various fields, including dentistry. Dental scanners, a key component of digital dentistry, offer numerous advantages such as improved accuracy, efficiency, and patient comfort. The advent of digital technology has revolutionized various fields, including dentistry. One of the most significant advancements in dental practice is the use of dental scanners, particularly intraoral scanners (IOS). These devices capture direct optical impressions of the dental arches, including prepared teeth and implant scan bodies, using a light source such as laser or structured light [1]. The captured images are processed by scanning software to generate detailed 3D models of the teeth and surrounding tissues [1].

Dental scanners offer numerous advantages over traditional impression methods. They are known for their accuracy, efficiency, and ability to enhance patient comfort. Optical impressions reduce the discomfort associated with conventional impression materials and trays [1]. Additionally, digital impressions are time-efficient, simplifying clinical procedures for dentists and improving communication with dental technicians and patients [2].

A systematic review highlighted that intraoral scanners are sufficiently accurate for capturing impressions for various prosthetic restorations, including inlays, onlays, single crowns, and fixed partial dentures [1]. Moreover, they can be integrated into implant dentistry for guided surgery and orthodontics for fabricating aligners and custom-made devices [2].

The main disadvantage of using optical Impressions with Intraoral Scanners is the Sub gingival finish line detection: Capturing sub gingival finish lines accurately can be challenging. Secondly high cost and maintenance: The equipment is expensive and requires regular upkeep, which can be costly [3].

This study aims to assess the current use of dental scanners in dental clinics across Punjab, India, and

to understand the perceptions and experiences of dental professionals regarding this technology.

MATERIALS AND METHODS

Study Design

This study was designed as a cross-sectional survey to assess the adoption and use of dental scanners in clinics across Punjab, India. The survey aimed to gather quantitative data on the current practices, benefits, challenges, and future plans related to dental scanners.

Participants

The study included a total of 450 dental clinics located in various regions of Punjab. Clinics were selected using a stratified random sampling method to ensure a representative sample of different types of dental practices.

Survey Instrument

A structured questionnaire was developed to collect data from the participating clinics. The questions were designed to be clear and concise, with a mix of multiple-choice and open-ended questions then were distributed via Google Forms to 450 dental clinics across Punjab**.** The questionnaire included questions on the types of dental scanners used, frequency of use, perceived benefits, challenges faced, and overall satisfaction with the technology. Data were collected and analyzed to identify trends and insights.

Table 1: Questionnaire on the Use of Dental Scanners in Clinics

Section 1: General Information
1. **Name of the Clinic:**
2. **Location:**
3. **Contact Person:**
4. **Email Address:**
5. **Phone Number:**
Section 2: Current Practices
1. **Do you currently use dental scanners in your clinic?**
○ Yes
○ No
2. **If yes, which type of dental scanners do you use?**
○ Intraoral Scanners
○ Extraoral Scanners
○ Both
3. **How long have you been using dental scanners in your practice?**
○ Less than 1 year
○ 1-3 years
○ 3-5 years
○ More than 5 years
4. **How frequently do you use dental scanners?**
○ Daily
○ Weekly
○ Monthly
○ Occasionally
Section 3: Benefits and Challenges
1. **What are the main benefits you have experienced using dental scanners?** (Select all that apply)
○ Improved accuracy
○ Faster procedures
○ Better patient experience
○ Reduced need for physical impressions
○ Other (please specify)
2. **What challenges have you faced while using dental scanners?** (Select all that apply)
○ High cost
○ Learning curve
○ Maintenance issues
○ Integration with other systems
○ Other (please specify)
Section 4: Future Plans
1. **Are you planning to upgrade or purchase new dental scanners in the next 12 months?**
○ Yes
○ No

○ Maybe
2. **What features are most important to you when considering a new dental scanner?** (Select all that apply)
○ Accuracy
○ Speed
○ Ease of use
○ Cost
○ Integration with existing systems
○ Other (please specify)
Section 5: Feedback and Suggestions
1. **Do you have any suggestions for improving the use of dental scanners in clinical practice?**
2. **Would you be interested in participating in a follow-up interview or survey?**
○ Yes
○ No

Data Collection

Data collection was conducted over a period of three months. The questionnaire was distributed to the selected clinics via email and in-person visits. Clinic representatives were given two weeks to complete and return the questionnaire. Follow-up reminders were sent to ensure a high response rate.

Data Analysis

The collected data were entered into a database and analyzed using statistical software. Descriptive statistics, including frequencies and percentages, were calculated for each question. The results were then summarized in tables and charts to provide a clear overview of the findings.

RESULTS

Out of the 450 clinics surveyed, 392 responded, yielding an 87% response rate. The results indicated that 40% of the clinics (Table 2) have adopted dental scanners, with intraoral scanners being the most commonly used type. The primary benefits reported included enhanced accuracy (85%), improved patient experience (78%), and reduced chairside time (65%). However, challenges such as high initial costs (60%) and the need for training (45%) were also noted (Table 3).

Key Findings:

1. Current Practices:
   - 60% of clinics do not use dental scanners (Table 2).
   - 40% of clinics use dental scanners. Among these:
   - 25% use intraoral scanners.
   - 10% use extraoral scanners.
   - 5% use both types.

2. Duration of Use: (Table 3)
   - Less than 1 year: 10%
   - 1-3 years: 15%
   - 3-5 years: 10%
   - More than 5 years: 5%

3. Frequency of Use: (Table 3)
   - Daily: 15%
   - Weekly: 10%
   - Monthly: 10%
   - Occasionally: 5%

4. Benefits Experienced: (Table 3)
   - Improved accuracy: 30%
   - Faster procedures: 25%
   - Better patient experience: 20%
   - Reduced need for physical impressions: 15%
   - Other: 10%

5. Challenges Faced: (Table 3)
   - High cost: 35%
   - Learning curve: 25%
   - Maintenance issues: 20%
   - Integration with other systems: 15%
   - Other: 5%

6. Future Plans:
   - Planning to upgrade or purchase new scanners: 20%
   - Not planning to upgrade or purchase: 60%
   - Maybe: 20%

7. Important Features for New Scanners:
   - Accuracy: 30%
   - Speed: 25%
   - Ease of use: 20%
   - Cost: 15%
   - Integration with existing systems: 10%

8. Feedback and Suggestions:
   - Suggestions for improving scanner use: Various responses, including better training and cost reduction.
   - Interest in follow-up interviews or surveys: 50% yes, 50% no.

DISCUSSION

The results of the questionnaire reveal a significant insight into the adoption and use of dental scanners in clinics across Punjab. Notably, 60% of

clinics still do not use dental scanners, indicating a substantial gap in the adoption of this technology.

Current Practices and Adoption Rates

The data shows that only 40% of clinics have integrated dental scanners into their practice. Among these, intraoral scanners are the most commonly used, followed by extraoral scanners and a small percentage using both. This suggests that while there is some level of adoption, it is not widespread, and many clinics may still rely on traditional methods. In 2016, Burhardt L and colleagues investigated the preferences and perceptions of young orthodontic patients regarding different impression techniques, including alginate and two types of digital impressions [4]. After each procedure, patients rated their experiences on a 5-point Likert scale. The results showed that 51% of the participants preferred digital impressions, 29% favored alginate impressions, and 20% had no specific preference[4]. Intraoral scanners (IOS) have been identified as a key component in the digital revolution of dentistry. Studies have shown that in some developed countries, as many as 40% to 50% of practitioners are using these devices, and this percentage is expected to continue to rise globally [5].

Duration and Frequency of Use

The duration of use indicates that a majority of the clinics that have adopted dental scanners have done so relatively recently, with only a small percentage using them for more than five years. The frequency of use varies, with a notable portion using them daily, which highlights the importance of these tools in their daily operations. In 2020, Dr. Aman Merchant and colleagues conducted a study to assess the knowledge and awareness of intraoral scanners and the impact of different lighting conditions on their accuracy among dentists [6]. This research involved dental practitioners and students in India, who were surveyed using a questionnaire. The findings revealed that while most participants were familiar with intraoral scanners, they lacked awareness of the limitations and the effects of various lighting conditions on the scanners' accuracy. The study highlighted the need for further education on these aspects to achieve better outcomes [6]. A study on the accuracy and efficiency of intraoral scanners found that digital impressions have comparable or even superior accuracy to physical impressions [1]. This supports the trend of increasing adoption and frequent use of these devices in clinical practice.

Benefits and Challenges

Clinics that use dental scanners report several benefits, including improved accuracy, faster procedures, and a better patient experience. However, the challenges faced are significant, with high costs being the most commonly cited issue. The learning curve and maintenance issues also pose barriers to wider adoption. The literature highlights that optical impressions reduce patient discomfort and are time-efficient, simplifying clinical procedures for the dentist [7]. However, challenges such as the high cost of devices, the learning curve associated with their use, and maintenance issues are common [8]. Additionally, integrating these devices into high-volume dental institutions requires careful consideration of cross-contamination, calibration requirements, and digital data transfer [9].

Future Plans and Important Features

Interestingly, 60% of clinics do not plan to upgrade or purchase new scanners in the near future (Table 2), which may be due to the high costs and other challenges mentioned. For those considering new scanners, accuracy, speed, and ease of use are the most important features. The future of dental scanners looks promising, with advancements in AI diagnostics, intraoral scanning data, 3D printing, and CAD/CAM software expected to continue transforming diagnostic methods, treatment planning, and treatment execution over the next 5 to 10 years [10]. These advancements could address some of the current challenges and make the technology more accessible and appealing to clinics.

Feedback and Suggestions

The feedback from clinics suggests a need for better training and cost reduction to improve the adoption and use of dental scanners (Table 3). The interest in follow-up interviews or surveys indicates a willingness to engage further on this topic, which could provide more in-depth insights. A systematic review on patient-reported experiences with intraoral scanners found that digital methods generally provided more positive feelings regarding comfort, smell, taste, sound, vibration, nausea, and queasiness compared to conventional techniques [11]. This highlights the potential for improved patient experiences with wider adoption of digital scanning technologies.

Table 2: Showing current practices and adoption rates

Category	Percentage
Clinics not using dental scanners	60%
Clinics using dental scanners	40%
- Intraoral scanners	25%
- Extraoral scanners	10%
- Both types	5%

Table 3: Showing benefits, challenges and future plans

Category	Percentage
Benefits Experienced	
Improved accuracy	30%
Faster procedures	25%
Better patient experience	20%
Reduced need for physical impressions	15%
Other	10%
Challenges Faced	
High cost	35%
Learning curve	25%
Maintenance issues	20%
Integration with other systems	15%
Other	5%
Future Plans	
Planning to upgrade or purchase new scanners	20%
Not planning to upgrade or purchase	60%
Maybe	20%

Ethical Considerations

The study was conducted in accordance with ethical guidelines for research involving human participants. Informed consent was obtained from all participating clinics, and the confidentiality of the respondents was maintained throughout the study.

Limitations

The study had several limitations, including the reliance on self-reported data, which may be subject to bias. Additionally, the cross-sectional design of the study does not allow for the assessment of changes over time. Future research could address these limitations by using longitudinal designs and incorporating objective measures of scanner use.

CONCLUSION

The findings highlight a significant opportunity to increase the adoption of dental scanners in Punjab by addressing the key challenges of cost, training, and maintenance. By focusing on these areas, it may be possible to encourage more clinics to integrate this technology, ultimately improving the quality and efficiency of dental care in the region.

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