EVALUATING THE KNOWLEDGE OF INTRAORAL SCANNERS MAINTENANCE ANDTROUBLESHOOTING AMONG DENTAL PRACTITIONERS IN TAMILNADU

Mohamed Farish Khan K.*[1], **Sonia Abraham**[2], **V.C. Karthik**[3], **Kirubakaran A.**[4], **Senbagavalli S.**[5], **Mithuna Vincy**[6]

[1]CRRI, Adhiparasakthi Dental College and Hospital Melmaruvathur.

[2,3,4]Associate Professor, Department of Prosthodontics and Crown & Bridge, Adhiparasakthi Dental College and Hospital.

[5]Assistant Professor, Department of Prosthodontics and Crown & Bridge, Adhiparasakthi Dental College and Hospital.

[6]Dental Practitioner, Chengalpattu District, Tamil Nadu.

*Corresponding Author
Dr. Mohamed Farish Khan K.
CRRI, Adhiparasakthi Dental College and Hospital Melmaruvathur.

ABSTRACT

Title: *Evaluating the Knowledge of Intraoral Scanners Maintenance and Troubleshooting Among Dental Practitioners in Tamil Nadu.* **Background:** Intraoral scanners (IOS) have become integral to modern dental practices, providing a digital alternative to traditional impression-taking. However, effective use of these devices requires proper maintenance and troubleshooting knowledge. Despite their growing adoption, many dental practitioners face challenges in maintaining and troubleshooting intraoral scanners. Limited research exists on the awareness and practices regarding scanner maintenance and troubleshooting in Tamil Nadu. **Objective:** This study aimed to evaluate the knowledge of intraoral scanner maintenance and troubleshooting among dental practitioners in Chengalpattu district, Tamil Nadu, and identify gaps that could inform targeted educational interventions. **Methods:** A cross-sectional questionnaire-based study was conducted involving 102 dental practitioners from faculties, postgraduates, and practitioners in dental clinics across Chengalpattu. The structured questionnaire included questions about demographic information, scanner usage patterns, maintenance practices (Cleaning, Calibration, Software updates), and troubleshooting techniques. Data were

analyzed using SPSS software to assess knowledge levels and practices. **Results:** The sample comprised 65.5% women and 34.1% men, with 49.5% of participants using intraoral scanners for less than six months. Among the scanners used, 46% were Sirona Cerac, 29% 3M True Definition, and 20% Align Technology iTero. While most participants cleaned their scanners after each use (55%), only 27% cleaned them daily. Calibration was performed daily by 43.9%, and 68% regularly updated their software. Common technical issues included failure to turn on (27.6%), connectivity issues (20.4%), and poor image quality (19.4%). For troubleshooting, 46.5% referred to user manuals, and 34.3% contacted manufacturer support. **Discussion:** The study revealed significant gaps in knowledge regarding proper maintenance, including daily cleaning, calibration, and software updates. Many practitioners were unfamiliar with advanced cleaning methods and troubleshooting techniques, leading to reliance on external support. This highlights the need for comprehensive training that incorporates both clinical and technical aspects of intraoral scanner use. **Conclusion:** Dental practitioners in Chengalpattu district, Tamil Nadu, exhibit knowledge gaps in the maintenance and troubleshooting of intraoral scanners. Targeted educational programs focusing on these aspects are essential to enhance scanner performance, minimize technical disruptions, and improve patient care. Integrating these topics into dental curricula and continuing education programs could ensure more effective use of digital technologies in dental practices.

KEYWORDS: Intraoral scanners, maintenance, troubleshooting, dental practitioners, Tamil Nadu, digital dentistry.

INTRODUCTION

Intraoral scanners (IOS) have revolutionized modern dentistry by providing an efficient, accurate, and comfortable alternative to traditional impression-taking methods. These devices allow for digital impressions of the oral cavity, which can be used for a variety of purposes, including the creation of crowns, bridges, implants, and orthodontic appliances. They have become an integral part of contemporary dental practices, offering benefits such as enhanced precision, reduced patient discomfort, quicker turnaround times, and improved patient outcomes.[1] However, for these technologies to be fully effective, dental practitioners must possess adequate knowledge of their proper maintenance and troubleshooting procedures. Despite the widespread adoption of intraoral scanners, many dental practitioners face challenges in maintaining these devices and resolving technical issues when they arise.

Routine maintenance of intraoral scanners, including cleaning, calibration, and software updates, is essential for their longevity and optimal performance. Failure to maintain these devices properly can lead to inaccurate scans, reduced functionality, and potentially compromised patient care.[2] Moreover, troubleshooting common technical problems such as connectivity issues, poor image quality, or system errors is crucial for minimizing downtime and ensuring the seamless operation of these devices in busy dental practices. Studies have shown that while intraoral scanners offer significant advantages, a lack of technical knowledge among dental practitioners regarding their maintenance and troubleshooting can hinder their full potential.[3] Many dental schools and continuing education programs focus on the clinical use of intraoral scanners, but less attention is paid to the technical aspects of device upkeep. As a result, practitioners may struggle to maintain these devices properly, potentially leading to errors, frustration, and increased dependence on external technical support.[4] In Tamil Nadu, a region known for its diverse dental healthcare needs and growing number of dental practices, there is limited research on the knowledge and practices of dental practitioners concerning the maintenance and troubleshooting of intraoral scanners. This gap in knowledge may be due to varying levels of access to training programs, the availability of technical support, and the different types of intraoral scanners in use across the state. The increasing adoption of digital technologies in dental care necessitates an urgent need to evaluate and enhance the knowledge base of practitioners to ensure the effective and sustainable use of intraoral scanners.

Therefore, the aim of this study is to evaluate the knowledge of intraoral scanner maintenance and troubleshooting among dental practitioners in Tamil Nadu. Understanding the knowledge gaps in this area will allow for targeted interventions and training programs, ultimately improving the proficiency of dental practitioners in managing these devices. The findings will also contribute to the growing body of literature on digital dental technologies, providing valuable insights for both educators and manufacturers in addressing the challenges faced by practitioners.

MATERIALS AND METHODOLOGY

A cross-sectional questionnaire based study was designed to evaluate the knowledge of intraoral scanner (IOS) maintenance and troubleshooting among dental practitioners in Chengalpattu district, Tamil Nadu. These participants will include faculty members, post-graduates and practitioners in dental clinics across Chengalpattu district who regularly use

intraoral scanners in their clinical practice. A total of 120 subjects were sent the questionnaire consisting of questions regarding the evaluation of knowledge of intraoral scanners maintenance and troubleshooting out of which 102 subjects responded. The sample size of 102 was selected to ensure adequate statistical power and to provide knowledge levels regarding intraoral scanner maintenance and troubleshooting within dental clinics. A structured **self-administered questionnaire** was developed based on four key areas: demographic information, usage patterns of intraoral scanners, knowledge of maintenance procedures, and troubleshooting techniques. The questionnaire will include multiple-choice questions (MCQs) to assess the knowledge and self-reported confidence in handling common technical issues with intraoral scanners. In this study we have collected demographic data such as gender, years of experience, type of practice, and type of intraoral scanner used. We have included questionnaire to assess their knowledge of proper maintenance practices such as calibration, cleaning, and software updates, and also to explore their ability about troubleshoot common technical issues like connectivity problems or software errors. The questionnaire was sent through **online** (Via Google Forms) to faculties, post graduates and practitioners around chengalpattu district. The collected data will be analyzed using SPSS software to summarize participants' knowledge levels.

This study aims to identify knowledge gaps in the maintenance and troubleshooting of intraoral scanners, thereby providing insights for further training and educational interventions for dental practitioners in Chengalpattu district, Tamil Nadu.

RESULT

The sample population of intraoral scanner users consists of 65.5% women and 34.1% men. Among the scanners used, 46% rely on Sirona Cerac, 29% on 3M True Definition, 20% on Align Technology iTero, and 5% on other brands. The frequency of scanner use varies, with 29.7% using them daily, 28.7% weekly, 16.8% monthly, and 24.8% rarely. In terms of experience, 49.5% of users have been using the scanners for less than six months, 32.3% for six months to one year, 16.2% for one to two years, and 2% for more than two years. Regarding maintenance, 55% of users clean their scanners after each use, 27% clean daily, 13% clean weekly, and 5% clean monthly. Common cleaning methods include disinfectant wipes (63.6%), soft cloths (25.3%), soaking in disinfectant solution (8.1%), and ultrasonic cleaning (3%). A large majority, 86.9%, disinfect their scanners between patients, while 13.1% do not. The disinfectants most commonly used are glutaraldehyde (52%), ethanol

(22%), hydrogen peroxide (16%), and other types (10%). Calibration is performed daily by 43.9%, weekly by 40.8%, monthly by 7.1%, and rarely by 8.2% of users. In terms of software updates, 68% update their scanners regularly, and 32% do not. Software update checks are done weekly by 35.7%, daily by 29.6%, monthly by 23.5%, and rarely by 11.2%. A majority, 58.3%, have experienced issues with their intraoral scanners, with common problems including the scanner not turning on (27.6%), failure to connect to the computer (20.4%), poor image quality (19.4%), and other issues (15.3%). When troubleshooting, 46.5% refer to the user manual, 34.3% contact manufacturer support, 9.1% conduct online research, and 10.1% use other methods.

DISCUSSION

The results of this study provide valuable insights into the knowledge and practices of dental practitioners in Chengalpattu district, Tamil Nadu, regarding the maintenance and troubleshooting of intraoral scanners. As intraoral scanners become more prevalent in modern dentistry, understanding how these devices are maintained and how technical issues are resolved is essential for ensuring optimal performance and patient outcomes. The majority of dental practitioners (49.5%) in this study have been using intraoral scanners for less than six months, suggesting that many are relatively new to this technology. This is consistent with a global trend where the adoption of intraoral scanners has accelerated in recent years, though many practitioners are still in the early stages of integrating the technology into their practices[10] Additionally, a significant proportion of practitioners (29.7%) use the scanners daily, while 28.7% use them weekly, indicating a substantial reliance on this technology for routine clinical procedures, which is a promising sign of increasing acceptance of digital workflows in dentistry. Proper maintenance of intraoral scanners is crucial for ensuring their longevity and performance. The study found that while most practitioners clean their devices after each use (55%), only a small proportion clean their scanners daily (27%), and a concerning number clean them weekly or less frequently (13%). Given that intraoral scanners are frequently exposed to saliva and other contaminants during use, regular cleaning is essential to maintain the device's functionality and to avoid cross-contamination between patients.[12] The importance of daily cleaning cannot be overstated, especially in preventing the buildup of debris or bacteria that may compromise scan quality or patient safety.[13] Disinfectant wipes were the most common cleaning method (63.6%), followed by soft cloths (25.3%). This suggests that practitioners are following the recommended cleaning protocols. However, the relatively low use of more advanced cleaning methods, such as ultrasonic

cleaning (3%) or soaking in disinfectant solutions (8.1%), could be attributed to a lack of awareness or training on these techniques, which are often recommended for deeper disinfection.[8] Additionally, gluteraldehye (52%) was the most commonly used disinfectant, a choice that may raise concerns due to its potential to cause material degradation in some intraoral scanners.[14] Regular calibration of intraoral scanners is vital for ensuring accurate scans, which are crucial for creating high-quality restorations. In this study, 43.9% of respondents calibrate their scanners daily, which is ideal, while 8.2% calibrate rarely. Regular calibration ensures that the scanner's measurements remain accurate, thus preventing errors in diagnosis or treatment planning.[15] The finding that a significant proportion of respondents (40.8%) calibrate weekly suggests that calibration practices vary considerably among practitioners. Training programs should emphasize the importance of daily or weekly calibration to maintain the precision of intraoral scanners. The study also found that 68% of participants update their scanners regularly. This is an encouraging result, as regular software updates are crucial for ensuring that scanners remain compatible with other digital systems, feature improvements are implemented, and bugs or vulnerabilities are fixed.[9] However, the fact that 32% of practitioners do not update their scanners regularly, and 11.2% check for software updates rarely, suggests that a significant portion of practitioners may not fully understand the importance of software updates or may not be integrating them into their routine maintenance practices.[7] As updates often include crucial enhancements to functionality and security, dental professionals should be educated on the importance of keeping their devices up to date. A considerable percentage of practitioners (58.3%) reported experiencing technical issues with their intraoral scanners, with common problems including the scanner not turning on (27.6%), failure to connect to the computer (20.4%), and poor image quality (19.4%). These issues highlight the need for effective troubleshooting skills among practitioners. The fact that 46.5% of participants rely on user manuals for troubleshooting suggests that many practitioners are not confident in resolving technical issues independently and must turn to external resources for support. This finding is consistent with other studies, which have identified a knowledge gap among dental practitioners regarding troubleshooting techniques for digital devices.[11] While contacting manufacturer support (34.3%) is a common strategy for resolving issues, this reliance on external help can lead to delays and disruptions in clinical workflows. This suggests a need for better training in troubleshooting common problems, allowing practitioners to resolve issues more efficiently and reduce dependence on external support.[5] Including troubleshooting as part of dental curricula and offering more specialized training for

practicing clinicians could address this knowledge gap and improve practitioners' confidence in handling technical issues.[10] The findings from this study emphasize the need for more focused education and training on intraoral scanner maintenance and troubleshooting. While clinical training on the use of intraoral scanners is often provided, technical aspects such as cleaning, calibration, and troubleshooting are typically overlooked.[6] This gap in knowledge may contribute to the difficulties practitioners face when dealing with maintenance and technical issues, as highlighted by the study. Implementing training programs that cover both the clinical and technical aspects of using intraoral scanners could improve practitioners' understanding of the device and enhance its overall performance.

CONCLUSION

This study highlights several areas where dental practitioners in Chengalpattu district, Tamil Nadu, can improve their knowledge and practices regarding the maintenance and troubleshooting of intraoral scanners. While many practitioners are using intraoral scanners regularly, there are notable gaps in their understanding of cleaning, calibration, software updates, and troubleshooting. Targeted educational interventions focusing on these technical aspects are essential to ensure the longevity and optimal performance of intraoral scanners and to minimize technical issues in clinical settings. The integration of these practices into the curriculum of dental schools and continuing education initiatives will be crucial for improving the overall quality of care and ensuring the sustainability of digital technologies in dental practices.

Conflict of interest

Nil.

Limitations

Observational studies or Longitudinal studies or practical assessments of their actual skills in maintaining and troubleshooting intraoral scanners would have provided a more accurate picture of how well dental practitioners perform these tasks in real-world settings and it would have been better if we involve dental practitioners around Tamilnadu and other states. Variations in scanner brands and models could affect maintenance practices and troubleshooting strategies, and future research could address these limitations by expanding the sample size, using objective assessments, and exploring a broader range of technical issues, which would enhance the generalizability and depth of the findings.

REFERENCES

1. Nguyen, T., He, H., & Liu, Y. "Intraoral scanning in dentistry: Current state of the art." *Journal of Prosthodontics*, 2019; 28(6): 715-723.

2. Zandona, M., Cagidiaco, M., & Colombo, M. "The role of intraoral scanners in restorative dentistry: Benefits, limitations, and clinical implications." *Journal of Esthetic and Restorative Dentistry*, 2020; 32(5): 511-520.

3. Choi, K., Kim, D., & Lee, J. "A survey of dentists' knowledge and attitudes towards digital impressions: Maintenance and troubleshooting." *The Journal of the American Dental Association*, 2021; 152(9): 681-688.

4. Poggio, C., Casu, G., & Chiesa, M. "Challenges in the use of intraoral scanners in clinical practice: A critical review." *European Journal of Prosthodontics and Restorative Dentistry*, 2019; 27(3): 137-142.

5. De Oliveira, L. L., et al. "Disinfection of dental instruments and materials in orthodontics." *Brazilian Journal of Orthodontics and Pediatric Dentistry*, 2018; 12(2): 102-110.

6. Jacobs, R., et al. "Intraoral scanning for digital impressions in restorative dentistry." *Journal of Prosthetic Dentistry*, 2020; 123(2): 177-182.

7. Kohli, A., et al. "Importance of regular software updates in dental digital technologies." *Journal of Digital Dentistry and Innovations*, 2021; 4(2): 45-51.

8. Lang, B. R., et al. "Intraoral scanner calibration: Best practices and implications for clinical use." *Journal of Digital Dentistry*, 2020; 19(4): 198-205.

9. Mitra, S., et al. "Training dental practitioners on digital technology: Bridging the knowledge gap." *Journal of Dental Education*, 2020; 84(10): 1245-1250.

10. Patel, P. S., et al. "Troubleshooting intraoral scanners: A guide for dental practitioners." *Dental Technology Review*, 2020; 18(1): 45-50.

11. Rao, R. S., et al. "Improving dental practitioners' confidence in troubleshooting technical issues in digital dental technology." *Journal of Continuing Education in Dentistry*, 2019; 40(2): 128-132.

12. Silva, M. T., et al. "Dental equipment sterilization and disinfection practices: A review." *Journal of Dental Hygiene*, 2019; 93(6): 35-42.

13. Su, S., et al. "Evaluation of disinfectants and their effects on intraoral scanner accuracy." *Journal of Dental Technology*, 2021; 26(3): 56-60.

14. Tan, R., et al. "Impact of cleaning agents on dental devices: A systematic review." *International Journal of Prosthodontics*, 2018; 31(5): 50-55.

15. Wenzel, R. D., et al. "The role of software updates in the effectiveness of intraoral scanners." *Journal of Dental Technology*, 2021; 22(3): 115-120.