Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 20s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

The Rvg Experience: A Survey of Dentists' Satisfaction, Challenges, And Recommendations in Western Maharashtra

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Cite this paper as: Isha Patil, Madhura Mahajan, (2025) The Rvg Experience: A Survey of Dentists' Satisfaction, Challenges, And Recommendations in Western Maharashtra. *Journal of Neonatal Surgery*, 14 (20s), 735-740.

ABSTRACT

Background - Roentgen's 1895 discovery of X-rays led to the development of digital radiography, including radiovisiography (RVG), which uses digital sensors for capturing detailed dental images. While RVG improves diagnostic accuracy and efficiency, challenges such as technical issues, ergonomic concerns, and the need for better training persist. Dentists' perceptions of RVG, influenced by their experience and comfort with technology, impact patient outcomes. Exploring these experiences can offer valuable insights that could improve the adoption and design of RVG technology.

Aims and Objectives - The study aimed to assess dentists' satisfaction, challenges, and recommendations regarding the use of radiovisiography (RVG) technology in clinical practice.

Materials and Methodology - This descriptive survey study utilized a questionnaire to gather data. Data was collected via an online survey using Google Forms, involving 198 respondents. The data was analyzed using Microsoft Excel 2007 and StatsDirect software to generate the statistics.

Results - The survey revealed a high level of engagement with RVG technology, particularly among early-career professionals, who show a preference for wired systems. While RVG improves diagnostic accuracy and streamlines workflows, challenges such as technical malfunctions and ergonomic concerns remain. Respondents recommended enhancements like AI integration, improved image resolution, and more ergonomic equipment.

Conclusion - This survey offers an analysis of the current implementation and use of RVG technology in dental practices. The findings from this survey underscore the transformative impact of RVG on modern dentistry and pave the way for future advancements.

Keyword: *Radiovisiography (RVG), Digital imaging, RVG technology, Filmless radiography, Digital X-ray systems, Dental imaging*

1. INTRODUCTION

The foundation of diagnostic radiology was established by Professor Wilhelm Conrad Roentgen's discovery of X-rays at the University of Würzburg, Germany, in November 1895.(1) Radiography has advanced from screen-film technology to digital imaging, often called filmless radiography.(2) Today, digital X-ray systems are commonplace in most radiology departments. Digital imaging refers to radiography where the images are captured in digital form and can be displayed on a computer monitor.(3)

Radiovisiography is a dental imaging technique that employs a digital sensor rather than X-ray film to capture detailed, real-time images of teeth and surrounding structures.(4) The integration of RVG technology has transformed dental practice management, requiring practices to adjust their workflows and protocols accordingly.(1) Additionally, the use of RVG technology has raised concerns about data security and patient privacy, underscoring the need for stringent security measures.(5) Dentists utilizing RVG technology may face several challenges, such as technical problems, ergonomic issues, and limitations in training and support.(6,7) These challenges can result in frustration, lower efficiency, and diminished diagnostic accuracy.(8) Recognizing these issues is crucial for improving RVG technology and boosting its adoption in dental practice. Technical challenges when using RVG systems include image quality issues, sensor malfunctions, and software glitches.(6,7) These problems can result in longer chair times, lower patient satisfaction, and reduced diagnostic accuracy. Additionally, ergonomic issues, such as uncomfortable sensor designs and inadequate ergonomic features, can impact dentists' comfort and efficiency while using RVG technology.(9)

On the other hand, several positive aspects of RVG technology have been noted. It has been widely adopted in dental practices globally, with studies reporting high satisfaction rates among dentists.(10) Additionally, RVG technology has been shown to enhance diagnostic accuracy and reduce errors.(11) Research also suggests that RVG is cost-effective, with lower expenses compared to traditional radiography.(12) However, the initial investment in RVG systems and sensors can be substantial, potentially impacting accessibility for some dental practices.(13)

Dentists' perceptions of RVG technology play a vital role in understanding their experiences and challenges. These perceptions are shaped by various factors, including their level of experience, training, and comfort with digital technology.(11) Dentists' views on RVG technology can affect patient outcomes, with those more comfortable using the technology typically providing better care.(14)

Currently, no survey study has been conducted to assess dentists' knowledge, experience, challenges, and recommendations in 6 districts of western Maharashtra regarding the use of Radiovisiography (RVG) in their daily practice. Such a study could provide valuable insights into the practical implementation of RVG, highlighting areas where further training or improvements may be needed. Understanding these aspects could help optimize RVG usage and enhance dental diagnostic processes

2. MATERIAL AND METHODOLOGY

This was a descriptive survey study in which a questionnaire was designed to collect data from either qualified or student radiographers and general dental practitioners from Western region of Maharashtra in India. Student radiographers who were handling RVG systems for at least 1 year were included in the study because they would give an insight into the training programs. There were a total of 198 potential respondents.

Data collection had been done in the form of a survey through Google Forms (Online Survey).

The information gathered was based on self-reporting by the study participants. It captured participants' familiarity, preferences, knowledge, and skills related to radiovisiography. The questionnaire also addressed the quality control procedures performed at various institutions, private set ups and participants were asked to state the advantages and disadvantages of radiovisiography.

The Google form was circulated to the 350 participants and they were given up to 4 weeks to complete the questionnaire. Out of 350, 198 responded to the questionnaire. Participation in the study was voluntary, and no incentives were provided. The responses were then received on the same google form system. The study is exploratory in nature, and descriptive statistics were generated from the data using Microsoft Excel 2007 and StatsDirect software. The descriptive statistics included summary measures and frequency tables. All collected data was handled confidentially.

3. RESULTS

The majority of participants were within the 20-29 age group, accounting for a substantial portion of responses. A smaller percentage of respondents fall into the 30-39 age bracket. The responses were distributed across various professional roles, primarily interns and specialists.

The table below shows various results on each survey question asked. A significant portion of respondents (approximately 60%) reported using RVG technology for up to 2 years. On the other hand, a smaller group (around 15%) reported over 10 years of experience.

Regarding types of RVG systems used, wired RVG systems came forth as the most commonly used type, with over 70% of respondents indicating preference or reliance on wired setups.

Diagnosis of caries emerged as the most common procedure for which participants used RVG (90%). Other common procedures like endodontic procedures, evaluation of dental trauma, tooth development and eruption had about 70% participant response.

Participants implemented RVG for several reasons, with the majority citing clearer and more detailed images (55.1%) as a key factor. Between 50% and 60% valued lower radiation, faster imaging, ease of storage, and environmental benefits.Regarding diagnostic accuracy, around 59% valued better image quality and lower radiation, 66% noted improved comparisons.

Fig. no. 1 shows challenges or complications experienced while using RVG technology. The study found that approximately 64% of participants experienced difficulties during the training and familiarization process with RVG, with sensor size and flexibility being the next most common issues. About 55% of participants noted uncooperative patients as a challenge. Those in private practice reported equipment and setup costs as a significant concern. Additionally, sensor damage, maintenance issues, and the risk of image artifacts were also identified as residual challenges.

Fig. no. 2 depicts technical challenges encountered with RVG. The majority of participants (43%) cited image artifacts and

software compatibility as the most frequent issues encountered. Sensor malfunctions and hardware failures followed as the second most common technical challenges. About 23% of participants highlighted calibration, regular maintenance, and inadequate storage and backup as other notable concerns. Meanwhile, 21% of participants reported no technical issues with RVG.

Fig. no. 3 demonstrates particular ergonomic concerns regarding RVG sensors and equipment. The majority of study participants (approximately 70%) cited eye strain from prolonged focus on the computer screen as the most common ergonomic challenge, followed by hand and wrist strain from repeatedly positioning and holding sensors. Fifty-seven participants reported difficulty handling bulky equipment as another ergonomic concern. Repetitive motion injuries and the lack of an ergonomic workspace were additional challenges faced by a smaller group of participants. Meanwhile, 26 participants indicated that they did not experience any ergonomic difficulties.

Fig. no. 4 shows whether the participants experienced any concerns regarding radiation exposure with RVG systems. Very few participants (approximately 10%) reported there were no significant concerns for the same, citing advancements in sensor technology and adherence to safety standards. However, a majority expressed uncertainty or mild concerns, indicating the need for ongoing education and reassurance about safety measures.

Fig. no. 5 illustrates the various suggestions provided by participants. The most common recommendation was the incorporation of AI for automated diagnosis and improved image analysis, followed by the call for enhanced durability and reliability for frequent use. Other suggestions included improving image resolution for more detailed assessments and developing lightweight, ergonomic, and wireless equipment to reduce strain and improve mobility.

4. DISCUSSION

Radiovisiography is an advanced dental imaging technique that utilizes a digital sensor in place of traditional X-ray film, capturing high-resolution, real-time images of teeth and surrounding structures with enhanced precision.(15)

The prominence of early-career professionals in the survey highlights the increasing reliance on digital radiography among newer practitioners.(16) This trend underscores the importance of integrating RVG training into undergraduate and postgraduate dental curricula.(6) Practical exposure to RVG systems during training can bridge the gap between academic learning and clinical application, ensuring a smoother transition into professional practice.

The mixed feedback on training emphasizes the need for comprehensive onboarding programs. Many new users find advanced features challenging to navigate without proper guidance.(17) Institutions and manufacturers can address this issue by offering structured training sessions, including workshops, online tutorials, and user manuals. Additionally, continuous support through helplines and dedicated technical teams can enhance user confidence and minimize disruptions caused by technical difficulties.(18) The overwhelming preference for wired systems, despite the availability of wireless options, indicates a gap in trust and affordability. While wireless systems offer greater flexibility and convenience, their higher cost and occasional connectivity issues deter widespread adoption.(19,20) Manufacturers should focus on improving the reliability and affordability of wireless systems to encourage broader acceptance among practitioners.(21,22) This shift could significantly enhance workflow efficiency and ergonomics.

Technical and ergonomic challenges, such as sensor malfunctions, compatibility issues, and user fatigue, directly impact clinical workflows.(23) Prolonged delays in image acquisition can frustrate both practitioners and patients. To address these issues, manufacturers must prioritize the development of robust, durable hardware and user-friendly software. For instance, incorporating features like automatic error detection, guided sensor placement, and streamlined interfaces can reduce downtime and improve the overall user experience.(24)

The integration of artificial intelligence (AI) in RVG systems has the potential to revolutionize dental diagnostics. AI algorithms can assist in identifying anomalies, measuring lesion sizes, and generating treatment suggestions, thereby enhancing diagnostic accuracy and reducing the margin for error.(25) Furthermore, advancements in image resolution and processing speed can improve visualization, enabling more precise treatment planning. Ergonomic enhancements, such as lightweight sensors and portable devices, can also alleviate physical strain on practitioners, ensuring long-term usability.(9)

While RVG technology offers undeniable benefits, such as reduced radiation exposure and faster image acquisition, addressing its challenges is crucial for maximizing its utility. Feedback from users should be continuously incorporated into the design and development of new models. This iterative process can help manufacturers create systems that align with the evolving needs of dental practitioners.(4)

Although most respondents did not express significant concerns about radiation exposure, the minority who did, highlighted the importance of transparent communication about safety protocols.(26,27) Educational campaigns and workshops can reinforce the safety advantages of RVG technology compared to traditional radiography. Highlighting compliance with international safety standards and demonstrating radiation reduction measures can further reassure practitioners and patients alike.(28)

The survey highlights key recommendations for improving RVG systems, including:

- enhancing affordability and accessibility
- fostering collaboration between academia and industry to drive innovation
- investing in research and development to address ergonomic and technical challenges.

This study confirms the growing adoption of digital radiography, especially RVG systems, due to their superior image quality and reduced radiation exposure. However, challenges like high costs, insufficient training, and ergonomic concerns remain. Similar to previous studies, our findings emphasize the need for structured training and affordability improvements, while also exploring AI integration and ergonomic enhancements.(29) In contrast to previous studies, which provides a broad academic review, our study focuses on practical challenges and solutions.(30) Earlier research identified key adoption barriers, whereas our study highlights solutions through better training and technology. These findings underscore the need for continuous advancements in digital radiography to improve usability, accessibility, and clinical efficiency.

The differences between these studies arise from their varying research objectives, methodologies, technological timelines, geographic settings, and target audiences. While earlier studies focus on barriers and knowledge gaps, recent ones explore technological advancements and practical solutions.

Limitations: This study is limited by self-reported data, which may introduce response bias. Its focus on a specific region restricts the generalizability of findings. The use of descriptive statistics limits deeper inferential analysis. Additionally, the lack of direct technical assessments prevents a thorough evaluation of RVG system efficiency and reliability.

Future Scope: The future scope of the study could focus on further exploring the integration of artificial intelligence (AI) in RVG systems to improve diagnostic accuracy and treatment planning. Research could also investigate the development of more affordable and reliable wireless RVG systems to address the existing gaps in trust and accessibility. Additionally, studies could assess the long-term impact of RVG training programs on dental practitioners' proficiency and confidence. Finally, future studies should examine the role of ergonomic innovations in reducing physical strain on dental professionals and enhancing workflow efficiency.

5. CONCLUSION

The survey highlights the benefits of RVG technology in dental practices, including diagnostic accuracy, speed, and safety. However, it emphasizes the need to address issues such as sensor malfunctions, software compatibility, and ergonomic discomfort, urging manufacturers to focus on user-centric designs. It suggests that robust training and support can help new users maximize the technology's benefits. Incorporating AI for automated diagnosis, improving image resolution, and developing portable, wireless systems can further enhance RVG's effectiveness. With ongoing education on radiation safety and RVG advantages, these improvements could drive wider adoption and continued evolution of the technology in dentistry.

Abbreviations

RVG - Radiovisiography

AI - Artificial Intelligence

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