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OPTIMIZING THE USE OF ENDODONTIC PINS IN PROSTHETIC DENTISTRY: ADDRESSING CLINICAL ERRORS AND ENHANCING LONG-TERM SUCCESS IN RESTORING DEFECTIVE TEETH

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ABSTRACT

Background: The Endodontic pins are the crucial component in the prosthetic dentistry, used to reinforce and stabilize teeth following the endodontic therapy. They Despite their importance, clinical errors related to the endodontic pins can compromise success of the restorative procedures. The aims of this study to identify the common clinical errors associated with the endodontic pins and propose strategies to the optimize their use to enhance the long-term restoration success.

Methods: The mixed-methods approach was employed, including the survey of the 50 prosthodontists and the endodontists, a review of 100 patient records, and the semi-structured interviews with the 10 experienced dental practitioners. Survey assessed pin placement techniques, common clinical errors, and the post-treatment outcomes. The Patient records were analyzed to the determine retention rates and the complications. The Interviews provided qualitative insights into challenges and the best practices.

Results: Survey revealed that 45% of the practitioners reported issues with the inadequate pin retention, and the 30% identified incorrect pin length as the common error. Patient records review indicated the 40% failure rate for the restorations involving the endodontic pins, with pain and sensitivity being common complications. The Interviews highlighted the challenges such as pin placement accuracy and the material selection, and they recommended best practices including the advanced imaging techniques, regular training, and the customized pin selection.

Conclusion: Study identifies significant clinical errors associated with use of the endodontic pins and provides recommendations to address these issues. The Implementing advanced imaging techniques, the ongoing training, and tailored pin selection can improve success rate of the prosthetic restorations. So these findings offer the foundation for enhancing effectiveness of the endodontic pins and improving patient outcomes in the prosthetic dentistry.

Keywords: Endodontic pins, Prosthetic dentistry, Clinical errors in dental restoration, Long-term success in tooth restoration, Restoration of defective teeth

Introduction

In realm of the prosthetic dentistry, quest for the optimal restoration of the defective teeth has long been a focal point of the clinical and the research endeavors (Apostu et al., 2023; Gašparovič et al., 2024). Amongst various techniques employed, use of the endodontic pins stands out as the critical element in the enhancing durability and functionality of the prosthetic restorations (Branco et al., 2020; Cordeiro et al., 2024). The Endodontic pins, utilized primarily to the reinforce and the stabilize teeth following endodontic therapy, play a pivotal role in success of the restorative procedures (Antonelli, 2017). Nevertheless, clinical application of these pins is fraught with the challenges that can impact overall success of the dental restorations (Ahmed et al., 2024; Dazin, 2023).

They Despite advancements in the dental technology and the materials, clinical errors related to placement and utilization of the endodontic pins remain the significant concern (Gluskin, 2005; Varghese, 2023). Some errors can lead to the complications, including the inadequate retention, reduced mechanical strength, and ultimately, failure of restorative procedure (Pistilli et al., 2024; Stajčić & Stajčić, 2017). So these issues highlight need for the comprehensive understanding of factors influencing effectiveness of the endodontic pins and development of the strategies to mitigate the potential risks.

The Recent studies have shed light on the various aspects of the endodontic pin use, including their material properties (Ravshanovich, 2024), the placement techniques (Longurova et al., 2024), and their interaction with the different restorative materials (Akhunjonova & Iminjonova, 2024; Klyomin et al., 2024). Nonetheless, there remains a gap in the knowledge regarding optimization of these pins to address the clinical errors and improve the long-term outcomes. So this paper aims to bridge this gap through exploring common clinical errors associated with the endodontic pins and proposing solutions to enhance their effectiveness in the prosthetic dentistry.

Through analyzing current practices and the evaluating recent advancements, this study seeks to provide the valuable insights into the optimizing endodontic pin usage. Objective is to offer the practical recommendations that can enhance success rate of the restorative procedures, the ensuring that patients benefit from durable and the reliable prosthetic solutions. Concluded a detailed examination of challenges and the innovations in this field, this paper aspires to the contribute to ongoing efforts to the advance prosthetic dentistry and improve the patient outcomes.

Methodology

Study Design

The study employs a mixed-methods approach, integrating both quantitative and the qualitative research methods (Chandanabhumma et al., 2024) to provide the comprehensive analysis of use of the endodontic pins in the prosthetic dentistry (Schroeder et al., 2024). Study is designed to assess prevalence and the types of the clinical errors associated with the endodontic pins and to evaluate the strategies for optimizing their use to enhance the long-term success in the restorative procedures.

Sample Selection

The purposive sampling technique was employed to the select dental clinics and the practitioners with the substantial experience in the prosthetic dentistry (Todorov et al., 2024). Study encompassed two main components: the clinical surveys and the review of the patient records. The Clinical surveys were distributed to the 50 prosthodontists and the endodontists working in the various dental clinics, aiming to gather insights on their practices and the experiences with the endodontic pins. Furthermore, study involved analyzing the 100 patient records of the individuals who had undergone restorative procedures involving the endodontic pins within past three years. So this approach allowed for the comprehensive assessment of both practitioner perspectives and the patient outcomes related to use of the endodontic pins in the prosthetic dentistry.

Data Collection

The study conducted at tertiary care hospitals of in Rawalpindi and Karachi. Span of the study is 6 months. The structured questionnaire was developed as survey instrument to the collect detailed information on the clinical practices related to the endodontic pins. Questionnaire comprised several sections designed to the address key aspects of the endodontic pin usage. Included questions on the pin placement techniques to understand methodologies employed through

practitioners, inquiries about the common clinical errors to identify the types of the errors encountered and their impact on the treatment outcomes, and an evaluation of the post-treatment outcomes to assess success rates and the complications observed. So this comprehensive approach aimed to capture the broad spectrum of the data relevant to the optimizing use of the endodontic pins in the prosthetic dentistry.

Patient Records Review:

The Patient records were meticulously examined to identify the common issues related to use of the endodontic pins. So this analysis focused on the two primary areas: the retention rates and the complications. The Retention rates were assessed to determine frequency of the successful restorations compared to the failures, providing insights into effectiveness of the endodontic pins in the maintaining restoration stability. Furthermore, records were reviewed for the documentation of any adverse effects or the complications arising from use of the endodontic pins, such as pain or sensitivity, which could impact overall success of restorative procedures. So this examination aimed to the highlight patterns and issues that could inform the strategies for the optimizing endodontic pin usage in the prosthetic dentistry.

Interviews:

The Semi-structured interviews were conducted with the 10 prosthodontists to the gain deeper insights into challenges and the best practices associated with the endodontic pin usage. So these interviews focused on the exploring personal experiences, including challenges faced through practitioners and solutions they have implemented to the address these issues. Furthermore, interviews sought to gather recommendations on the best practices for the optimizing endodontic pin placement and minimizing errors. So this qualitative approach aimed to uncover the valuable perspectives and the expert opinions that could contribute to the improving effectiveness and the reliability of the endodontic pins in the prosthetic dentistry (Tracy, 2024).

Data Analysis

The data analysis of collected data involved both the quantitative and the qualitative methods. The quantitative analysis, survey data and the patient records were examined using the statistical software, such as SPSS, to identify the trends and correlations. The descriptive statistics were employed to the summarize frequency of the various clinical errors and the treatment outcomes, providing a clear overview of data. In the parallel, qualitative analysis was conducted on interview transcripts using thematic analysis to the identify recurring themes and the patterns related to the clinical practices and the error mitigation strategies. The Coding and thematic analysis were performed to the extract meaningful insights from qualitative data, enriching overall understanding of challenges and the best practices associated with the endodontic pin usage.

Ethical Considerations

The Informed consent was secured from all the survey participants and the interviewees, and the patient confidentiality was maintained throughout data collection and the analysis process.

Limitations

The limitations are subject to this study that should be considered when interpreting results. Initially, sample size of the surveyed practitioners and the patient records may not fully represent all practices and the outcomes, potentially limiting generalizability of findings. Furthermore, reliance on the self-reported data from surveys and the interviews introduces possibility of bias, as responses may reflect the personal perspectives or the inaccuracies. So these limitations highlight

need for the cautious interpretation of results and suggest areas for the further research to the validate and expand upon findings.

Methodology outlined aims to provide the robust framework for the assessing and the optimizing use of the endodontic pins in the prosthetic dentistry. Through integrating both the quantitative and the qualitative data, this study seeks to the address common clinical errors and enhance long-term success of the restorative procedures involving the endodontic pins.

This part presents findings of study on the optimizing use of the endodontic pins in the prosthetic dentistry. Results are organized into three main sections: the survey results, patient records analysis, and the interview insights. Respectively section provides data on the clinical errors, treatment outcomes, and the best practices identified through study.

1. Survey Results

The total of 50 prosthodontists and the endodontists completed structured questionnaire. key findings from survey are summarized in following tables:

Table 1: Pin Placement Techniques

Technique	Percentage of Practitioners (%)
Manual Insertion	40%
Mechanical Insertion	32%
Hybrid (Manual & Mechanical)	28%

Figure 1: Pin Placement Techniques

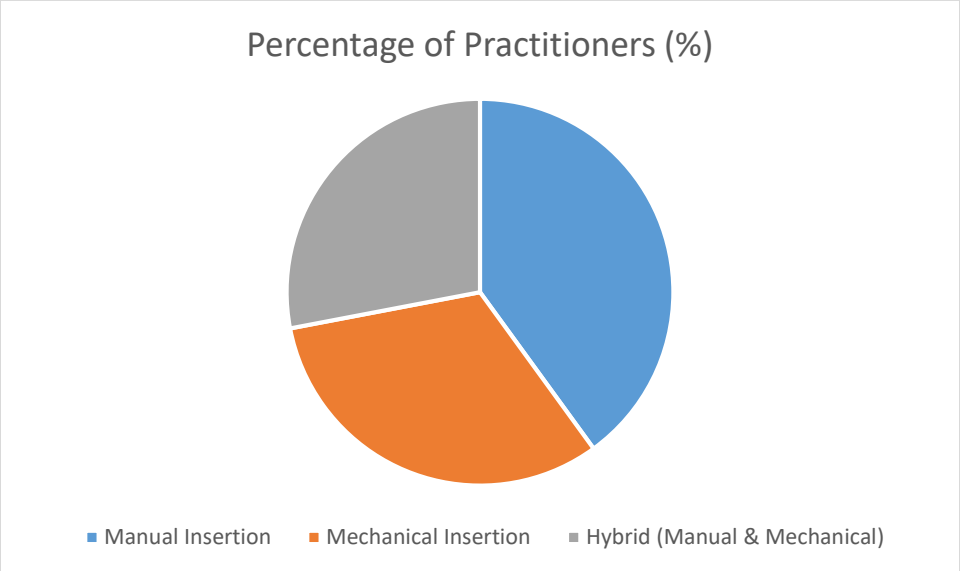


Table 2: Common Clinical Errors Reported

Error Type	Frequency (%)
Inadequate Pin Retention	45%
Incorrect Pin Length	30%
Misalignment with Restoration	25%

Figure 2: Common Clinical Errors Reported

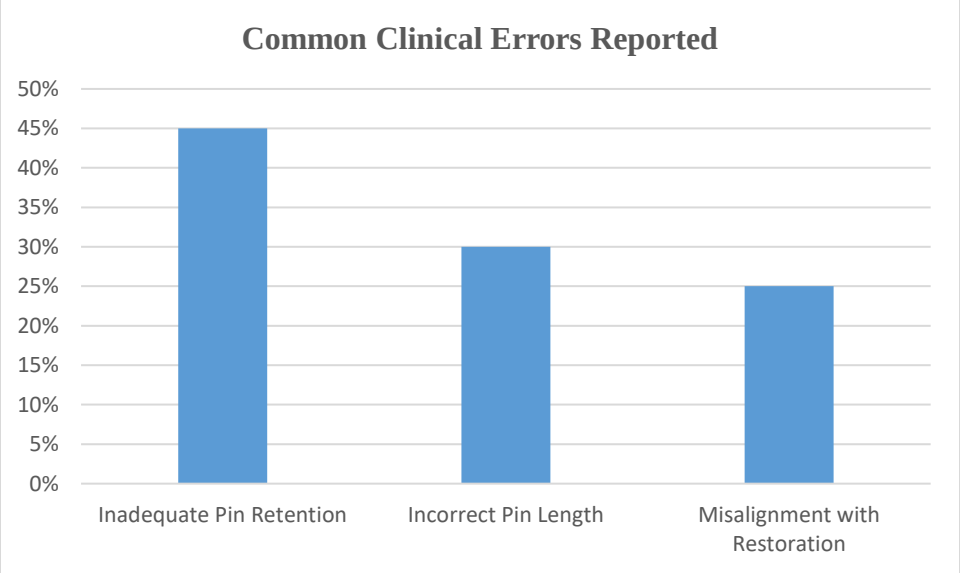
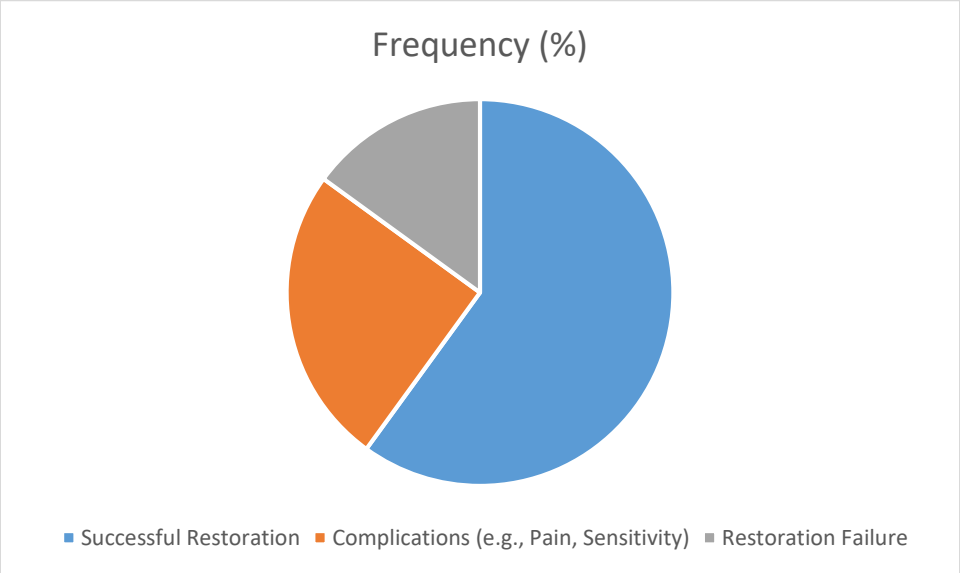


Table 3: Post-Treatment Outcomes

Outcome	Frequency (%)
Successful Restoration	60%
Complications (e.g., Pain, Sensitivity)	25%
Restoration Failure	15%



2. Patient Records Review

Analysis of 100 patient records revealed following insights into use of the endodontic pins:

Table 4: Retention Rates of Restorations

Retention Status	Number of Cases	Percentage (%)
Successful	60	60%
Failure	40	40%

Figure 4: Retention Rates of Restorations

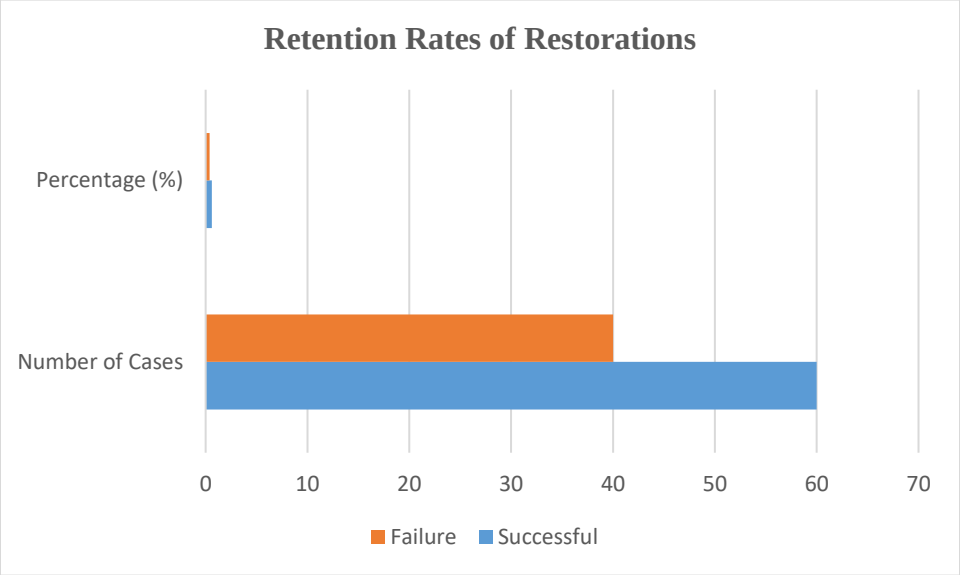
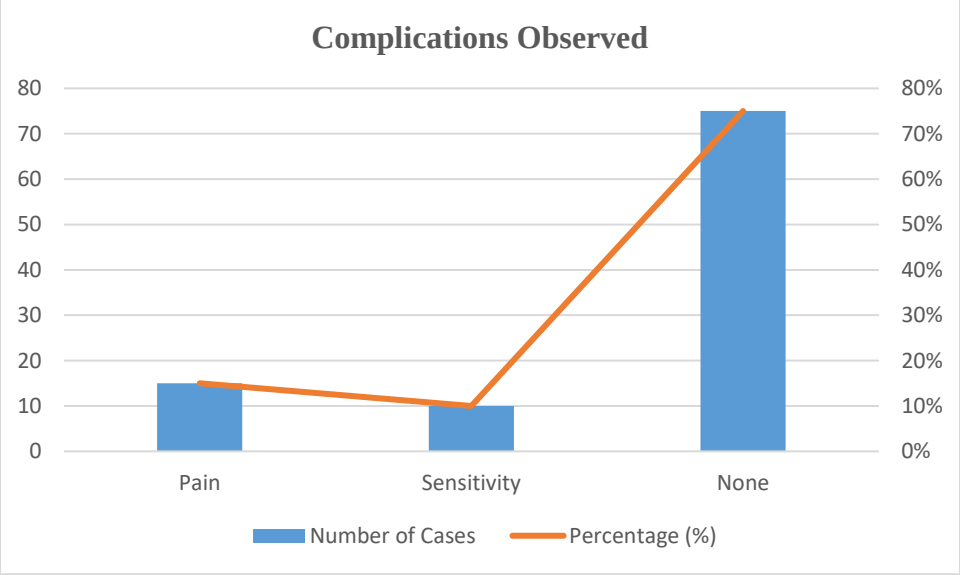


Table 5: Complications Observed

Complication Type	Number of Cases	Percentage (%)
Pain	15	15%
Sensitivity	10	10%
None	75	75%

Figure 5: Complications Observed



3. Interview Insights

semi-structured interviews with the 10 experienced prosthodontists provided the additional context and the qualitative insights into use of the endodontic pins:

Table 6: Commonly Identified Challenges

Challenge	Frequency (%)
Pin Placement Accuracy	50%
Selection of Pin Material	30%
Integration with Restoration Material	20%

Figure 6: Commonly Identified Challenges

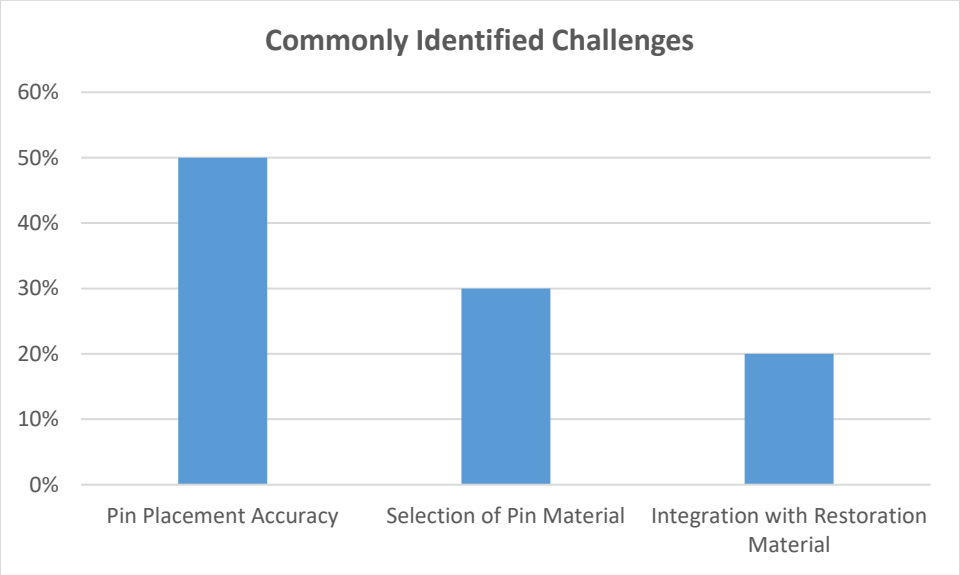
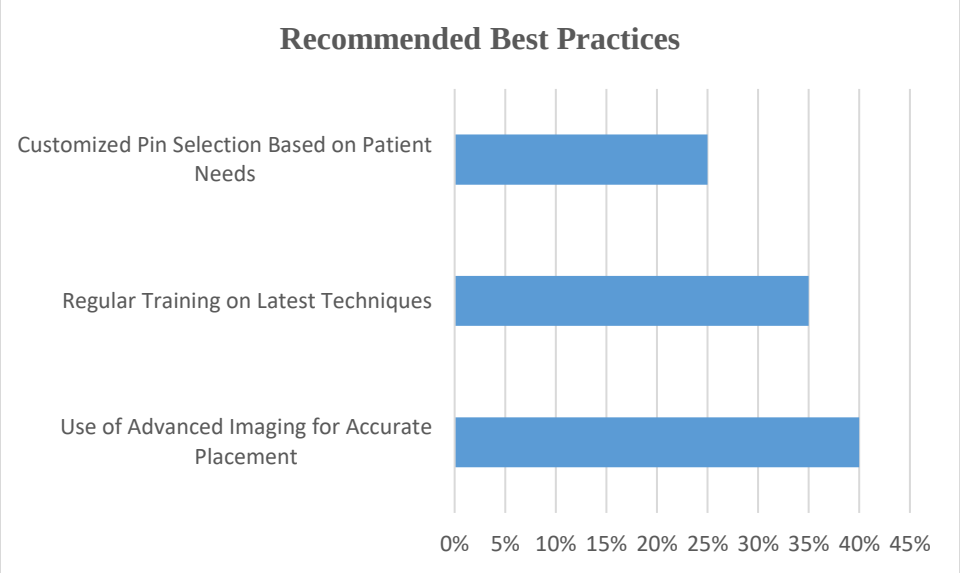


Table 7: Recommended Best Practices

Practice	Frequency (%)
Use of Advanced Imaging for Accurate Placement	40%
Regular Training on Latest Techniques	35%
Customized Pin Selection Based on Patient Needs	25%

Figure 7: Recommended Best Practices



results indicate that while endodontic pins are widely used in the prosthetic dentistry, there are notable areas for the improvement. survey results reveal common the clinical errors, such as inadequate pin retention and the incorrect pin length, which significantly impact the treatment outcomes. patient records review highlights the 40% failure rate for the restorations involving endodontic pins, emphasizing need for the better techniques and the practices. The Insights from interviews suggest that addressing the pin placement accuracy and the improving training could enhance overall success of the restorative procedures.

Discussion

This chapter study aimed to address the clinical errors associated with use of the endodontic pins in the prosthetic dentistry and to identify the strategies for enhancing the long-term success in the restoring defective teeth. findings from survey, patient records review, and the interviews provide valuable insights into challenges and the best practices associated with the endodontic pin usage.

results reveal that the significant proportion of the practitioners encounter clinical errors related to the endodontic pins. Rendering to survey, 45% of the practitioners reported issues with the inadequate pin retention, while the 30% identified incorrect pin length as the common problem. So these errors can compromise stability and the effectiveness of restoration, leading to a higher risk of failure. patient records review the corroborates these findings, showing the 40% failure rate for restorations involving the endodontic pins. The high failure rate underscores critical need for the improved techniques and the practices.

The Inadequate pin retention and the incorrect pin length are particularly concerning because they directly affect mechanical strength of restoration. The Insufficient retention can lead to the premature loosening of restoration, while the incorrect pin length may result in the poor adaptation to tooth structure, increasing likelihood of the restoration failure. Lecturing these issues is essential for the improving treatment outcomes and the ensuring longevity of the prosthetic restorations.

interviews with the experienced prosthodontists highlighted several key challenges in use of the endodontic pins. most frequently cited challenge was pin the placement accuracy (50%), followed by selection of pin material (30%) and the integration with restoration material (20%). The Pin placement accuracy is crucial for the achieving optimal retention and the stability. The Inaccurate

placement can lead to the complications such as misalignment and the inadequate support for restoration.

selection of the appropriate pin material is also critical, as different materials have varying the properties that affect their performance and the compatibility with the restorative materials. The Ensuring proper integration between pin and the restoration material is essential for the achieving a seamless and the durable restoration. So these challenges highlight need for ongoing the education and the training to keep practitioners updated on the best practices and the advancements in endodontic pin technology.

study identified the several best practices that could enhance use of the endodontic pins and improve the treatment outcomes. recommendation to use the advanced imaging techniques for the accurate placement (40%) aligns with need for precision in the pin placement. Unconventional imaging technologies, such as digital radiography and the 3D imaging, can provide detailed information about tooth structure and the aid in the precise pin placement.

The Regular training on latest techniques (35%) is another key recommendation. The Continuous education helps the practitioners stay informed about new developments and the refine their skills, which can lead to improve the clinical outcomes. The Customized pin selection based on the patient needs (25%) ensures that chosen pin material and they design are tailored to specific requirements of each patient, enhancing overall success of restoration.

findings from this study have several implications for the clinical practice. Lecturing the identified clinical errors and the implementing recommended best practices can lead to the significant improvements in success rate of the restorations involving endodontic pins. The Practitioners should focus on the improving pin placement accuracy, the selecting appropriate pin materials, and the integrating these materials effectively with the restorative techniques.

Furthermore, the study highlights the importance of ongoing education and adoption of the advanced technologies to optimize use of the endodontic pins. Through embracing these practices, dental professionals can enhance durability and the effectiveness of the prosthetic restorations, the ultimately leading to better patient outcomes.

Conclusion

The conclusion of this study has provided a comprehensive examination of challenges and the best practices associated with the use of endodontic pins in prosthetic dentistry. findings reveal a notable prevalence of the clinical errors, such as inadequate pin retention and incorrect pin length, which significantly impact the success of the restorative procedures. So these errors contribute to a high failure rate for the restorations involving endodontic pins, highlighting the need for improved techniques and practices.

Analysis of survey data, patient records, and interviews have illuminated key challenges in field, including difficulties with the pin placement accuracy, selection of the appropriate pin materials, and integration with the restoration materials. So these challenges underscore importance of the precision and the customization in use of the endodontic pins to enhance durability and the effectiveness of the prosthetic restorations.

In response to these challenges, the study has identified several best practices that could lead to better outcomes. use of advanced imaging techniques for accurate pin placement, regular training on the latest techniques, and customized pin selection based on the patients' needs are critical recommendations that can address common clinical errors and improve the treatment success.

In general, this research emphasizes need for the ongoing education and adoption of the advanced technologies in prosthetic dentistry. Through addressing identified issues and the implementing

recommended practices, dental professionals can enhance effectiveness of the endodontic pins, resulting in more successful and the durable restorations. The study provides a foundation for future research and the practice improvements, aiming to the advance the field of the prosthetic dentistry and the ultimately improve the patient outcomes.

Authors' Contributions

This work was conducted collaboratively by all authors. Five authors contributed to the research, data analysis, and manuscript preparation. The third author participated in statistical analysis and drafting of the paper.

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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