Journal of Biomedical and Pharmaceutical Research
Available Online at www.jbpr.in
CODEN: - JBPRAU (Source: - American Chemical Society)
NLM (National Library of Medicine): ID: (101671502)
Index Copernicus Value 2022: 83.058
Volume 13, Issue 5; 2024, 69-73

ISSN (Online): 2279-0594
ISSN (Print): 2589-8752

Review Article

Root Canal Treatment Failure: A Brief Review

Isha Tiwari[1], Shashirekha Govind[2]

[1]Postgraduate Trainee, [2] Professor and Head,

Department of Conservative Dentistry and Endodontics, Institute of Dental Sciences, Bhubaneswar, Siksha 'O' Anusandhan (Deemed to be) University, Odisha, India

Email: ishatiwari1107@gmail.com, shashirekhag@soa.ac.in

Article Info: Received: 05-09-2024 / Revised: 28-09-2024 / Accepted: 17-10-2024
Address for correspondence: Isha Tiwari
DOI: https://doi.org/10.32553/jbpr.v13i5.1170
Conflict of interest statement: No conflict of interest

Abstract:
Root Canal Treatment (RCT) is a pivotal dental procedure that offers a chance to salvage teeth marred by infection or damage. This article delves into the complexities of RCT failures, examining the intricate reasons behind such occurrences. Despite its high success rate, RCT can face challenges, leading to complications and patient dissatisfaction. In this comprehensive exploration, we dissect the multifaceted causes of RCT failures, including incomplete removal of infected tissue, inadequate cleaning and shaping, poor restoration, undetected canals, fractured instruments, and external damage. Understanding these factors is indispensable for both dental professionals and patients. Incomplete removal of infected tissue, even in minute quantities, can provide a breeding ground for bacteria, resulting in reinfection. Inadequate cleaning and shaping of the root canals might leave debris behind, causing persistent infections. Restorations, a critical step post-RCT, demand precision; any ill-fitted or damaged restoration can lead to leakage, permitting bacterial ingress. The complexity of tooth anatomy occasionally conceals additional canals, which, if left untreated, can be a source of reinfection. Moreover, fractured instruments, a rare yet challenging scenario, can harbour bacteria if not managed meticulously. External damage, whether from trauma or fractures post-RCT, threatens the treated tooth's integrity.
KEYWORD: RCT Failure, Endodontics, Root canal Therapy, Treatment Outcomes, Dental Microbiology.

INTRODUCTION

Root Canal Treatment (RCT) is a cornerstone in modern dentistry, offering a lifeline to infected or damaged teeth. Dental professionals can often salvage teeth that would otherwise face extraction by meticulously cleaning and shaping the intricate network of root canals and sealing them to prevent reinfection.[1] Despite the strides in dental technology and techniques, RCT has challenges like any medical procedure. RCT failures, though infrequent, can have significant consequences, ranging from persistent discomfort to the loss of the treated tooth.[2] Understanding the underlying

causes of RCT failures is paramount for dental professionals and patients. This knowledge not only sheds light on the complexities of the procedure but also equips both parties with the insights needed to minimize the associated risks. In this article, we will explore the multifaceted reasons behind RCT failures, including incomplete removal of infected tissue, inadequate cleaning and shaping, issues with restoration, undetected canals, fractured instruments, and external damage[3]. By delving into these factors, we aim to provide a comprehensive overview of the challenges dental professionals face in ensuring the success of RCT procedures.

As we navigate the intricacies of RCT failures, it becomes evident that prevention and mitigation are key. Dental professionals must continually refine their skills, staying abreast of the latest techniques and technologies to address each case's nuances effectively. Simultaneously, patients play a crucial role in the post-treatment phase, adhering to prescribed care guidelines and understanding the significance of oral hygiene in maintaining the integrity of the treated tooth[4]. By exploring the complexities of RCT failures, we embark on a journey toward better oral health outcomes. Through knowledge, awareness, and collaboration between dental professionals and patients, we can enhance the success rate of RCT procedures, ensuring that more smiles are preserved, one tooth at a time.[5]

To mitigate these challenges, dental professionals must embrace advanced techniques and technologies. Magnification tools and dental operating microscopes enhance visibility, aiding in meticulously removing infected tissue. Nickel-titanium instruments and potent irrigation solutions ensure a thorough cleaning, leaving no room for debris[6]. Accurate diagnosis, facilitated by cone-beam computed tomography (CBCT), helps detect hidden canals, ensuring comprehensive treatment. Specialized techniques, like ultrasonics, are invaluable in managing fractured instruments and preserving the procedure's success. Patient education assumes equal importance; adherence to post-treatment care guidelines and oral hygiene practices can prevent external damage, reinforcing the efficacy of RCT.[7]

In this article, we emphasize the collaborative responsibility of dental professionals and patients in safeguarding the success of RCT. By recognizing the nuances of RCT failures and adopting proactive measures, dental professionals can enhance the precision and effectiveness of RCT procedures. Armed with knowledge and commitment, patients become partners in the process, ensuring the longevity of their treated teeth[8]. This extensive exploration sheds light on the challenges faced in RCT procedures and underscores the potential for improvement. By embracing continuous education, advanced technology, and patient engagement, the dental community can elevate the standards of RCT, ensuring the preservation of teeth and the smiles and satisfaction of countless patients.[9]Root Canal Treatment (RCT) is a meticulous dental procedure aimed at saving compromised teeth. However, despite the best efforts of dental professionals, RCT failures can occur for various reasons[10]. Understanding these factors is crucial for dentists and patients to enhance the success rate of RCT procedures.

Incomplete Removal of Infected Tissue

One of the primary causes of RCT failure is the incomplete removal of infected pulp tissue. Even a tiny portion left behind can harbour bacteria, leading to reinfection. Advanced techniques such as magnification and dental operating microscopes help dentists visualize intricate canal systems,

reducing the risk of leaving infected tissue behind[11].

Inadequate Cleaning and Shaping

Proper cleaning and shaping of the root canals are vital to success. Inadequate cleaning may leave debris or bacteria, causing persistent infections. Nickel-titanium instruments and irrigation solutions have significantly improved the cleaning process, ensuring a more thorough removal of contaminants within the canals[12].

Poor Restoration

After cleaning and shaping, the tooth must be adequately restored, usually with a crown. Ill-fitted or damaged restorations can lead to leakage, allowing bacteria to re-enter the tooth. Dental professionals must ensure precise restoration procedures, using high-quality materials and techniques to prevent this issue[13].

Undetected Additional Canals

Teeth often have complex canal systems; additional canals may go unnoticed during the initial treatment. Failure to treat all canals can lead to reinfection. Advanced diagnostic tools such as cone-beam computed tomography (CBCT) help identify these hidden canals, improving the accuracy of RCT procedures[14].

Fractured Instruments

Instruments used in RCT procedures can occasionally break inside the tooth. These fractured instruments can harbour bacteria if not appropriately managed, leading to failure. Dental professionals employ specialized techniques, such as ultrasonics, to safely remove fractured instruments, minimizing the risk of reinfection[15].

External Damage

Trauma or fractures in the treated tooth after RCT can compromise its success. Patients must be educated about post-treatment care, emphasizing the importance of avoiding trauma and maintaining good oral hygiene. Dentists can provide custom mouthguards to prevent injury, especially for patients prone to teeth grinding or sports-related trauma.[16]

RCT failures are multifactorial and require a comprehensive approach to prevention. Dental professionals must continually update their skills and utilize advanced technologies to enhance the precision and effectiveness of RCT procedures. Equally important is patient education, emphasizing the significance of post-treatment care and regular dental check-ups. By addressing these challenges, dentists and patients contribute to the long-term success of Root Canal Treatment, preserving natural smiles and promoting overall oral health. Root Canal Treatment (RCT) is a sophisticated dental procedure designed to salvage teeth affected by infection or damage, offering patients a chance to preserve their natural smiles. Despite its high success rate, RCT can face challenges leading to failure. However, by understanding the intricacies of these failures and addressing them proactively, dental professionals and patients can significantly enhance the outcomes of RCT procedures.[17] The discussion above has shed light on the common causes of RCT failure, such as incomplete removal of infected tissue, inadequate cleaning and shaping, poor restoration, undetected canals, fractured instruments, and external damage. These factors present unique challenges, emphasizing the need for precision, advanced techniques, and patient education.[18]

Dental professionals play a pivotal role in the prevention of RCT failures. Staying updated with the latest advancements in dental technology, utilizing tools like dental operating microscopes and cone-beam computed tomography (CBCT) for accurate diagnosis, and employing specialized

techniques to manage complexities such as fractured instruments are essential. Additionally, precise restoration procedures and post-treatment care guidance are vital to ensure the long-term success of RCT. [19] The patient's role in maintaining the treated tooth's integrity is equally crucial. Following prescribed post-treatment care guidelines, practising good oral hygiene, and using custom mouthguards, if necessary, can prevent external damage and reinfection, contributing significantly to the overall success of RCT.[20]

CONCLUSION

In conclusion, the collaborative efforts of dental professionals and patients are crucial to minimizing RCT failures. By addressing the challenges discussed in this article and fostering a partnership focused on oral health, the dental community can ensure that Root Canal Treatment remains a reliable and effective solution, allowing patients to enjoy the benefits of a healthy and natural smile for years. Through education, awareness, and a commitment to excellence, the future of RCT remains bright, promising continued success and satisfaction for practitioners and patients alike.

REFERENCES

1. Ng YL, Mann V, Gulabivala K. A prospective study of the factors affecting outcomes of non-surgical root canal treatment: part 1: periapical health. Int Endod J. 2011;44(7):583-609.
2. Siqueira JF Jr, Rôças IN, Alves FR, Campos LC. Periradicular status related to the quality of coronal restorations and root canal fillings in a Brazilian population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005;100(3):369-374.
3. Ricucci D, Siqueira JF Jr. Fate of the tissue in lateral canals and apical ramifications in response to pathologic conditions and treatment procedures. J Endod. 2010;36(1):1-15.
4. Nair PN. Pathogenesis of apical periodontitis and the causes of endodontic failures. Crit Rev Oral Biol Med. 2004;15(6):348-381.
5. Sjögren U, Hagglund B, Sundqvist G, Wing K. Factors affecting the long-term results of endodontic treatment. J Endod. 1990;16(10):498-504.
6. Torabinejad M, Fouad AF, Walton RE. Endodontics: Principles and Practice. 5th ed. Elsevier; 2014.
7. Ingle JI, Bakland LK, Baumgartner JC. Ingle's Endodontics. 6th ed. BC Decker Inc; 2008.
8. Peters OA, Schönenberger K, Laib A. Effects of four Ni-Ti preparation techniques on root canal geometry assessed by micro computed tomography. Int Endod J. 2001;34(3):221-230.
9. Schilder H. Cleaning and shaping the root canal. Dent Clin North Am. 1974;18(2):269-296.
10. Siqueira JF Jr, Rôças IN. Clinical implications and microbiology of bacterial persistence after treatment procedures. J Endod. 2008;34(11):1291-1301.
11. Haapasalo M, Shen Y, Wang Z, Gao Y. Irrigation in endodontics. Br Dent J. 2014;216(6):299-303.
12. Ricucci D, Siqueira JF Jr. Biofilms and apical periodontitis: study of prevalence and association with clinical and histopathologic findings. J Endod. 2010;36(8):1277-1288.
13. Bystrom A, Claesson R, Sundqvist G. The antibacterial effect of camphorated paramonochlorophenol, camphorated phenol and calcium hydroxide in the treatment of infected root canals. Endod Dent Traumatol. 1985;1(5):170-175.
14. Alves FR, Andrade-Junior CV, Marceliano-Alves MF, et al. Adjunctive steps for disinfection of the mandibular

molar root canal system: a correlative bacteriologic, micro-computed tomography, and cryopulverization approach. J Endod. 2016;42(10):1471-1477.
15. Peters LB, Wesselink PR. Periapical healing of endodontically treated teeth in one and two visits obturated in the presence or absence of detectable microorganisms. Int Endod J. 2002;35(8):660-667.
16. Nair PN. On the causes of persistent apical periodontitis: a review. Int Endod J. 2006;39(4):249-281.
17. Nair PN, Henry S, Cano V, Vera J. Microbial status of apical root canal system of human mandibular first molars with primary apical periodontitis after "one-visit" endodontic treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005;99(2):231-252.
18. Sundqvist G, Figdor D, Persson S, Sjögren U. Microbiologic analysis of teeth with failed endodontic treatment and the outcome of conservative re-treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998;85(1):86-93.
19. Siqueira JF Jr, Rôças IN. Diversity of endodontic microbiota revisited. J Dent Res. 2009;88(11):969-981.
20. Friedman S, Mor C. The success of endodontic therapy--healing and functionality. J Calif Dent Assoc. 2004;32(6):493-503.