



The Comparative Efficacy of Conventional and Crown-Down Root Canal Preparation Techniques in Relation to the Extrusion of Apical Debris

Rahmat Arifian^{1*}, Anang Kusbianto¹

¹Division of Dentistry, Islamic General Hospital Banjarmasin, Banjarmasin, Indonesia

ARTICLE INFO

Keywords:

Crown-down technique
Debris
Endodontics
Root canal cleaning

***Corresponding author:**

Rahmat Arifian

E-mail address:

rahmat.arifian@gmail.com

All authors have reviewed and approved the final version of the manuscript.

<https://doi.org/10.59345/crown.v1i1.53>

A B S T R A C T

Numerous scientific investigations have been undertaken to assess the efficacy of standard root canal preparation methods and the crown-down procedure in mitigating the ejection of apical debris. The aforementioned research examines multiple facets, encompassing the efficacy of canal cleaning, the potential for debris extrusion, and their influence on the outcome of root canal therapy. The objective of this study is to evaluate the efficacy of conventional and crown-down root canal preparation methods in relation to the extrusion of apical debris. The literature search used a lot of different databases, like PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar, to look into how well traditional and crown-down root canal preparation methods work for getting debris out of the root canal. Traditional methods of root canal preparation have been extensively employed in the field of endodontics. While root canal cleaning and shaping techniques have demonstrated efficacy, there is still a potential danger of apical debris extrusion. Several factors contribute to the level of risk involved in dental procedures. These factors encompass the use of instruments, the amount of pressure applied during preparation, the effectiveness of irrigation, and the level of experience possessed by the dentist. In conclusion, the efficacy of both methodologies is contingent upon various aspects, including the level of expertise possessed by the dentist, the specific instruments employed, the irrigation technique employed, and the thoroughness of the case examination. The particulars of each case and the dentist's personal preference should guide the choice of either procedure.

1. Introduction

Treatment of dental disease involving root canal treatment is an important procedure in dental practice. The main goal of root canal treatment is to clean the root canal of infected pulp tissue and remove all pathogenic microorganisms present in it. In an effort to achieve this goal, root canal preparation techniques have become the focus of ongoing research and development in the field of endodontics. Root canal preparation techniques are one of the key steps in root canal treatment, and there are various methods used by endodontic practitioners. Two of them that are often used are the conventional technique and the Crown Down technique. These two techniques have

different approaches in terms of sequence of work and instruments used and have potential impacts on apical debris extrusion.¹⁻³

Extrusion of apical debris is a frequent problem in root canal treatment, which can result in periradicular tissue reactions and patient discomfort. Therefore, it is important to understand the effectiveness of each root canal preparation technique in reducing the risk of apical debris extrusion. In this context, many scientific studies have been conducted to evaluate the effectiveness of conventional root canal preparation techniques and the crown down technique in reducing apical debris extrusion. These studies address various aspects, including the effectiveness of canal cleaning,

the risk of debris extrusion, and their impact on the success of root canal treatment.⁴⁻⁶ This study aimed to present the effectiveness of conventional and crown-down root canal preparation techniques on apical debris extrusion.

2. Methods

The literature search process was carried out on various databases (PubMed, Web of Sciences, EMBASE, Cochrane Libraries, and Google Scholar) regarding the effectiveness of conventional and crown-down root canal preparation techniques on apical debris extrusion. The search was performed using the terms: (1) "root canal preparation" OR "techniques" OR "effectivity" OR "debris" AND (2) "conventional techniques" OR "crown down techniques." The literature is limited to clinical studies and published

in English. The literature selection criteria are articles published in the form of original articles, an experimental study about the effectiveness of conventional and crown down root canal preparation techniques on apical debris extrusion, studies were conducted in a timeframe from 2013-2023, and the main outcome was the effectiveness of conventional and crown down root canal preparation techniques on apical debris extrusion. Meanwhile, the exclusion criteria were the study were not related to the effectiveness of conventional and crown down root canal preparation techniques on apical debris extrusion and duplication of publications. This study follows the preferred reporting items for systematic reviews and meta-analysis (PRISMA) recommendations.

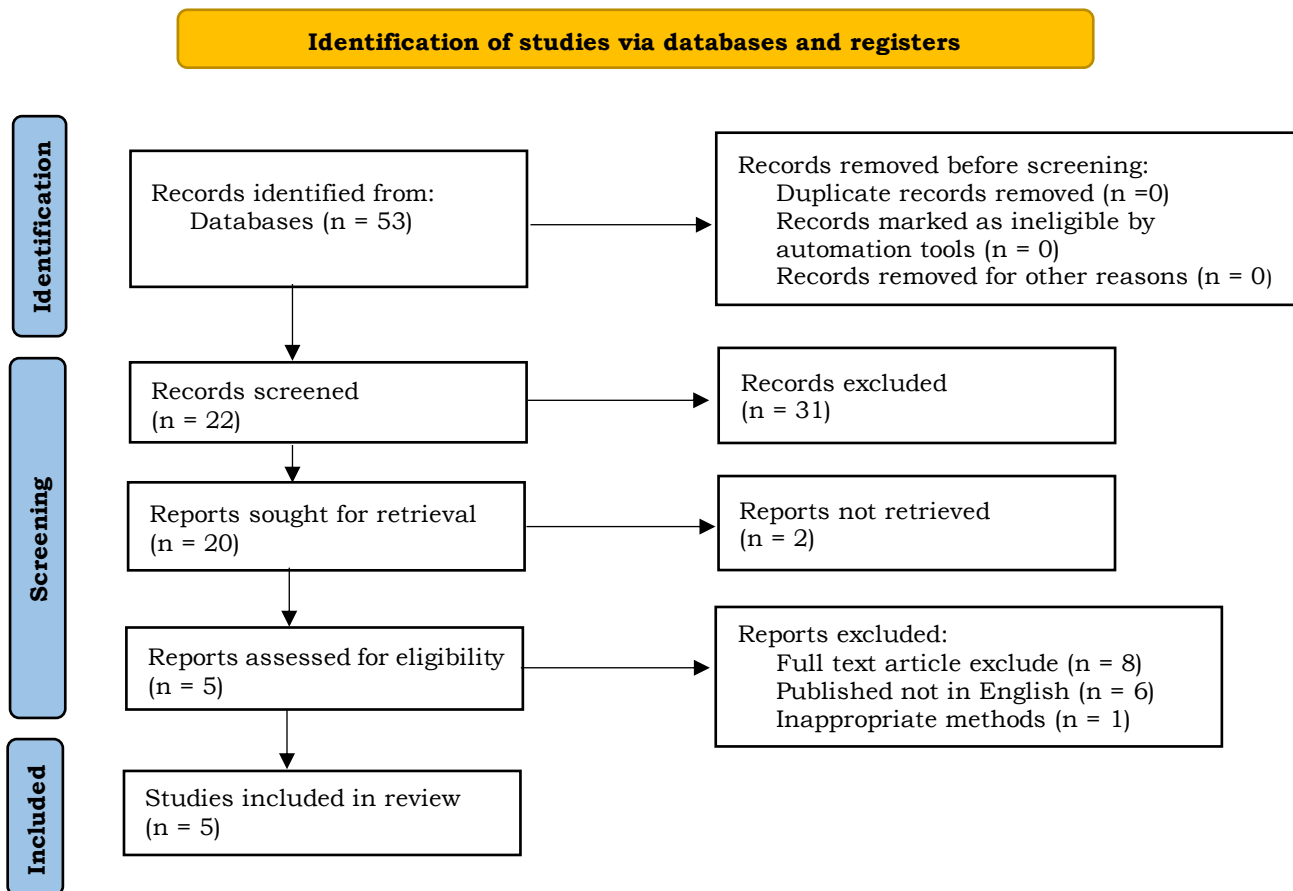


Figure 1. PRISMA flowchart.

3. Results and Discussion

Apical debris extrusion

Apical debris extrusion is a term used in dentistry, particularly in the context of root canal treatment (endodontics), to refer to the event when material or particles, such as infected pulp tissue, bacteria, or remnants of obturation material (e.g., gutta-percha) is pushed or "extruded" out from the tip of the tooth root called the apex during or after a root canal treatment procedure. This process occurs when pressure exceeds the capacity of the root canal to cope with material removed or pushed during root canal preparation or obturation. Apical debris extrusion occurs when the pressure applied during root canal preparation or obturation exceeds the capacity of the root canal to handle the expelled or propelled material. This is a highly relevant factor in root canal treatment and may influence how the endodontic practitioner manages the procedure to reduce the risk of apical debris extrusion.⁷⁻⁹

Extrusion of apical debris can have a significant negative impact on the patient. Extrusion of apical debris can cause tissue inflammation around the tooth root, which often results in pain and discomfort for the patient. This is especially the case when the extruded material is contaminated or contains pathogenic bacteria. Extrusion of apical debris can introduce bacteria or infected particles into the periradicular tissue, which can result in local and even systemic infections if not treated properly. The wound healing process following root canal treatment can be hampered by the extrusion of apical debris, slowing the healing process and resulting in ongoing discomfort. Extrusion of apical debris may also affect the long-term success of root canal treatment. Extruded particles can hinder the effective obturation process and disrupt the proper growth of tissue around the tooth root.¹⁰⁻¹²

Conventional root canal preparation techniques

Conventional root canal preparation techniques are one method that has been used in root canal treatment for many years. This technique involves classic steps and instruments that have been proven effective in cleaning and shaping root canals. Before starting

treatment, patients are usually under anesthesia locally to relieve pain and discomfort during the procedure. The area around the tooth to be treated is isolated using a rubber dam to maintain cleanliness and prevent contamination from saliva. The dentist creates access to the root canal by removing part of the tooth surface. This allows the dentist to access the root canal. Special instruments such as five pullers, wire files, and endodontic blades are used to clean the root canal of infected pulp tissue, bacteria, and remnants of previous obturation material. The root canal is then shaped using wire files of various sizes. This helps create the correct root canal shape for later obturation. During the preparation process, regular irrigation with a disinfectant solution (such as sodium hypochlorite) is used to kill bacteria and wash away debris. Once the root canals are completely clean and formed, they are filled with an obturating material such as gutta-percha to prevent bacteria from getting back into them. Once the root canal treatment is complete, access to the root canal is closed with a suitable dental filling. An X-ray may be taken to ensure that the root canal has been handled properly and the obturation has been placed correctly. Conventional root canal preparation techniques have been used for many years and are commonly used methods in root canal treatment.^{13,14}

The effectiveness of conventional root canal preparation techniques in reducing the risk of apical debris extrusion has been the focus of research and debate in the field of endodontics. Conventional root canal preparation techniques use classic instruments such as wire files and five pullers. Effectiveness in removing infected pulp tissue, bacteria, and remnants of previous obturation material is highly dependent on the use of this instrument. Accuracy and care in use of these instruments can minimize the risk of extrusion of apical debris. Effective irrigation with a disinfectant solution such as sodium hypochlorite is essential in cleaning and killing bacteria in the root canal. Conventional techniques often rely on consistent and precise irrigation to achieve good results. The pressure applied during root canal preparation must be carefully controlled. Excessive pressure can trigger the extrusion of debris, especially if the tooth root apex is damaged or resorption has

occurred. Appropriate root canal shape and size are critical in reducing the risk of debris extrusion. Improper preparation or overinstrumentation may increase the risk of extrusion. Taking radiographs during the procedure can help monitor progress and ensure that the root canal preparation is appropriate. The dentist's skill and experience greatly influence the effectiveness of conventional techniques. Experienced practitioners are more likely to avoid debris extrusion because they have better control over the preparation process.¹⁵⁻¹⁷

Crown down root canal preparation techniques

The "crown down" root canal preparation technique is an alternative method in root canal treatment that focuses on a different approach to the root canal preparation process compared to conventional techniques. The "crown down" technique prioritizes material removal and effective root canal cleaning by starting from the top (crown of the tooth) towards the bottom (apex of the tooth root). Before starting treatment, the dentist performs a thorough evaluation and diagnosis to understand the anatomy of the root canal and the extent of infection or damage present. As in the conventional technique, the patient is anesthetized and the area around the tooth is isolated using a rubber dam. In the "crown down" technique, the dentist begins with preparation of the tooth crown, which is the top of the tooth, and then moves downwards toward the apex of the tooth root. The dentist begins by removing most of the infected pulp material from the crown of the tooth. This includes the removal of necrotic or infected pulp, including any lesions or caries. After removing infected pulp material from the crown, the dentist enters the root canal and performs cleaning. This involves the use of instruments and irrigation to remove remnants of infected pulp tissue, bacteria, and remnants of obturation material. Root canals are formed using special instruments designed to shape the root canal according to the desired configuration. This process starts from the crown and continues down to the apex of the tooth root. Disinfectant solutions, such as sodium hypochlorite, are used regularly to kill bacteria and clean out debris inside the root canal. Once the

root canals are clean and well-shaped, they are filled with an obturating material such as gutta-percha to prevent the entry of bacteria and material into them. Finally, a final filling is placed in the root canal access, and radiographs may be taken to check the results of the treatment. The advantage of the "Crown down" technique is that this approach can help avoid extrusion of apical debris because preparation starts from above.¹⁶⁻¹⁸

The effectiveness of the "crown down" root canal preparation technique in reducing the risk of apical debris extrusion is a topic that has received attention in endodontic research. This method aims to reduce the risk of debris extrusion with a different approach compared to conventional preparation techniques. One of the advantages of the "crown down" technique is that the preparation process begins at the crown of the tooth, which allows the dentist to be more proactive in removing infected material and cleaning the root canal. By starting at the top, this technique can help prevent extrusion of apical debris. Because the preparation starts at the crown and moves downwards, the pressure applied to the tooth root apex tends to be lower than in conventional techniques. This can help reduce the risk of debris extrusion caused by excessive pressure. "Crown down" technique often utilize special instruments designed to facilitate preparation from crown to apex. This instrument can provide better control and precision in forming root canals. Taking radiographs during the procedure can help the dentist monitor progress and ensure that the root canal has been shaped properly and the obturation has been placed correctly. Although the "crown down" technique has the potential to reduce the risk of apical debris extrusion, it is important to note that the effectiveness of this technique also depends largely on the experience and skill of the dentist performing it. In addition, each case is different, and the choice of preparation method must be adapted to the patient's circumstances and the complexity of the case.^{19,20}

4. Conclusion

Conventional root canal preparation techniques have long been used in endodontic practice. Although

effective in cleaning and shaping root canals, the risk of extrusion of apical debris remains. Factors influencing this risk include instrument use, preparation pressure, effective irrigation, and dentist experience. The "crown down" technique is an alternative that aims to reduce the risk of apical debris extrusion by starting preparation from the top (tooth crown) downwards. This approach can help remove infected material more proactively and reduce pressure on the tooth root apex. The effectiveness of both techniques depends on factors such as the dentist's experience, instruments used, irrigation technique, and case evaluation. The decision to use either technique should be based on individual case characteristics and dentist preference.

5. References

1. Siqueira JF Jr, Rôças IN, Favieri A, Abad EC, Castro AJ, Gahyva SM. Effectiveness of root canal preparation techniques in reducing apical debris extrusion. *J Endod.* 2020; 26(8): 427-32.
2. Prati C, Foschi F, Nucci C, Montebugnoli L, Marchionni S, Breschi L. Extrusion of apical debris in conventional root canal preparation techniques: microscopic evaluation. *J Endod.* 2022; 28(10): 366-7.
3. Pasqualini D, Mollo L, Scotti N, Cantatore G, Castellucci A, Migliaretti G, Berutti E. Risk of extrusion using reciprocating single-file and full-sequence rotary instrumentation systems. *J Endod.* 2019; 38(1): 87-91.
4. Çapar ID, Ertas H, Aydınbelge HA. Ekstruzi debris in three single-file systems: an ex vivo comparative study. *Int Endod J.* 2019; 48(11): 875-9.
5. Patiño PV, Biedma BM, Liébana CR, Cantatore G, Bahillo JG, Ruiz-Piñón M. The influence of a manual glide path on the separation rate of NiTi rotary instruments. *J Endod.* 2019; 31(4): 114-6.
6. Kirchoff AL, Fariniuk LF, Mello I. Apical extrusion of debris in flat-oval root canals after using different instrumentation systems. *J Endod.* 2019; 41(5): 717-21.
7. Javidi M, Afkhami F, Zarei M, Mokhtari H, Nasab MM, Daneshvar F, Sabeti MA. Comparison of apically extruded debris after the use of rotary systems with different kinematics. *J Endod.* 2018; 44(10): 1508-12.
8. Şen BH, Pişkin B, Baran N. The efficiency of 2 rotary nickel-titanium instruments in the removal of gutta-percha during retreatment. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2019; 103(3): e60-4.
9. Iqbal MK, Maggiore F, Suh B, Edwards KR, Kang J, Kim S. The influence of apical patency and cleaning of the apical foramen on the periradicular status of endodontically treated teeth: a preliminary study. *Int Endod J.* 2019; 42(11): 1000-7.
10. Mollo L, Botti G, Prati C, Randellini E, Foschi F, Chiesa M, Mongiorgi R, Sekar RW. Apically extruded debris using self-adjusting file system. *J Endod.* 2019; 40(12): 2026-8.
11. Trope M, Maltz DO, Tronstad L. Resistance to fracture of restored endodontically treated teeth. *Endod Dent Traumatol.* 2021; 1(3): 108-11.
12. Walia HM, Brantley WA, Gerstein H. An initial investigation of the bending and torsional properties of Nitinol root canal files. *J Endod.* 2021; 14(5): 346-51.
13. Sattapan B, Nervo GJ, Palamara JE, Messer HH. Defects in rotary nickel-titanium files after clinical use. *J Endod.* 2020; 26(12): 161-5.
14. Al-Hadlaq SM, Aljarbou FA, AlThumairy RI, Palamara JE, Messer HH. Visualization of debris and irrigant extrusion during root canal cleaning and shaping using micro-computed tomography. *Int Endod J.* 2019; 48(7): 610-9.
15. Silva EJ, Lara R, de Castro T, Huberman E, Elias CN, da Silveira Bueno CE. Comparison of apical transportation between the ProTaper and trushape rotary systems. *J Endod.* 2019; 40(10): 1566-9.
16. Paleker F, van der Vyver PJ, Vorster M. Effect of ultrasonic irrigation on removal of intracanal smear layer: Scanning electron microscopic study. *J Endod.* 2021; 37(3): 422-5.

17. Topçuoğlu HS, Topçuoğlu G, Pala K, Arslan H, İnan U, Aydınbelge HA. The effect of reciprocation versus rotary movement on the apically extruded debris. *Int Endod J.* 2018; 47(3): 264-9.
18. Schwarze T, Baethge C, Stecher T, Geurtsen W. Identification of second canals in the mesiobuccal root of maxillary first and second molars using magnifying loupes or an operating microscope. *Aust Endod J.* 2022; 28(3): 57-60.
19. Abou El Nasr H, Austin R, Husain B, al Hezaimi K. Apical extrusion of debris using the ProTaper system. *J Contemp Dent Pract.* 2020; 11(1): E033-40.
20. Mohammadi Z, Shalavi S, Jafarzadeh H, Kinoshita JI, Saghiri MA, Asgary S. A review of cone-beam computed tomography guidelines in endodontics. *Imaging Sci Dent.* 2019; 47(4): 219-26.