

COMPARING POST REMOVAL KITS WITH OTHER SYSTEMS USED IN THE REMOVAL OF INTERRADICULAR POSTS FROM ROOT CANALS: A REVIEW

Doaa Alghamdi ^{1*}, Abeer Almosa ², Shaya Aldossary ³, Ibrahim Alkhurayef ³, Sarah Aburaisi ⁴

¹ General Dentist, Jeddah, Saudi Arabia.

² Dental student, Majmaah University, Al-zulfi, Saudi Arabia.

³ Dental student, Prince Sattam Bin Abdulaziz University, Al-Kharj, Saudi Arabia.

⁴ Prosthodontic department, College of dentistry, Riyadh Al Elm University, Riyadh, Saudi Arabia.

ABSTRACT

Aim: This literature review aimed to discuss the properties of post-removal kits and compare them with other systems used in removing inter radicular posts from root canals.

Methods: An electronic search of publications was made for the years 2000 to 2020. The databases included in the current study were PubMed, MEDLINE, Cochrane Library, Clinical Trial, and Saudi Digital Library.

Conclusion: The results suggested that the removal of fiber posts can be achieved in a shorter time and in a more conservative way by utilizing a post-removal kit as compared with an ultrasonic removal system. However, higher effectiveness and lower fracture resistance of the roots was achieved with ultrasonic vibration and diamonds than with post-removal kits. The number of microcracks after the post-removal and the amount of material on the walls of the root canal are not affected by the fiber post-removal method.

Key words: fiber post, post-removal kit, ultrasonic post removal, root canal.

Introduction

The restoration of endodontically treated teeth is complicated ^{1,2}. Pierre Fauchard utilized metal posts, called tenons, screwed into the roots of teeth to secure the bridges. Then wood supplanted metal, a wooden post installed between the root canal and the artificial crown. These wooden posts can retain liquid and swell, which usually causes fractures of the root ³.

A variety of core and post systems are now used in dentistry. Endodontic posts can be cast with the core, like nickel-chromium and gold posts, or they might be prefabricated, like stainless-steel and titanium posts. In recent times, non-metallic materials like fiber ceramic and reinforced composites have been presented as hypothetically acceptable substitute materials ^{1,4,5}.

Post and core procedure, whether as a single unit or a combination of individual units, is a restorative procedure wherein a post can be defined as a rigid extension positioned in the root canal space of an endodontically treated tooth so as to provide retention and stabilize a weakened tooth by providing support to the core. A core can be defined as a restorative material, used as a replacement foundation for an extensively damaged endodontically treated tooth, that is

built up on the remaining tooth structure or is incorporated into the post to provide an anchor for the crown used in final restoration ⁶.

Prefabricated and Cast Post and Core

The various core and post systems are divided into groups according to their structure, function, production method, and inventor name. In terms of production method, core and post systems are divided into two categories: cast and prefabricated.

Prefabricated cores and posts take a short period of time to place because they do not include any laboratory operation, and after completing the endodontic treatment and removing the gutta-percha in the pile gap, they can be immediately inserted. After the prefabricated post is appropriately pasted into the post space, a core material, like dental composite, can be stuffed around the pasted post. After the material has had an opportunity to harden and appropriately form into a crown arrangement, an impression of the dental crown can be made ⁷.

A cast core and post can be custom manufactured for teeth. A resin design is created by positioning a plastic burnout post into the post space, and a resin material is utilized to develop the teeth to an appropriate size ^{8,9}.

In case of root canal retreatment, in order to allow for non-surgical root canal retreatment, a post should be safely and easily removed in a less traumatic way. The capability to remove an existing post relies upon the type of material of which it is made. In many cases of fiber post removal, the clinician usually faces fiber posts of an unfamiliar source. In these cases, most removal kits will not work because they are specially prepared by the manufacturers. A universal fiber post removal system would be useful to enable fiber post removal in such cases ¹⁰.

Nonsurgical retreatment provides more favorable long-lasting results and is therefore preferred over endodontic surgery. However, sometimes this procedure is difficult and risky because of root weakening, perforations, and fractures of the remaining structure of the root. It may be time-consuming, and its success depends on the post type, length, and design, as well as the cementing agent, operator's skill, and chosen technique and instruments ¹¹.

However, depending on the post type, if techniques and equipment for post removal are selected properly, posts can be removed safely from the root canal, and complications are unlikely ¹².

Techniques Available for Post Removal

Various post-removal techniques have been promoted. Rotosonic vibration is an easy way to potentially loosen and remove a fully uncovered post. However, the relative performance among ultrasonic generators utilized for post removal should be fully understood before using them.

Many devices have been designed to mechanically remove the post. However, most of these devices, like the Masserann kit and the post puller, have had limited success because they often require an excessive removal of tooth structure, which can easily lead to perforations, ledges, or fracture of the root. The Gonon post extractor is a significant improvement over the Masserann and post puller devices because it is less invasive and has achieved a high degree of success. The concept of post-removal system kit was developed to significantly improve versatility and simplicity. The Egger post remover and Kodex twist/Tenax ParaPost fiber post-removal drill kits are further options for post removal ^{13, 14}.

The main objective of this research was to review *in vitro* studies in which various properties of post-removal kits are discussed and compared with other systems used in the removal of intraarticular posts from root canals.

Material and Methods

An electronic search of online databases and a hand search of published dental literature was carried out in July 2020. The electronic databases were accessed through an online portal. These databases included PubMed, MEDLINE, Cochrane Library, Clinical Trial, and Saudi Digital Library. The keywords used for the search were fiber post, post-removal kit, time, fracture resistance, remaining dentine thickness, effectiveness, and procedural errors. The exclusion criteria were non-English articles, studies published before the year 2000, unpublished studies including *in vivo* or *in situ* analyses, studies testing posts other than fiber posts, and studies with cementation of posts performed in other than human teeth (artificial devices or animal teeth). Around 193 relevant articles were identified. Reference lists of included studies were hand-searched for additional articles. After removing duplicates, 124 final articles were selected for the research.

To screen and assess eligibility, the guidelines of PRISMA were used. Consequently, a total of eight articles were finalized, of which six articles were selected ^{10, 15-19}. Figure 1 displays the PRISMA flow.

Result (Review):

Effectiveness

Anderson and Bowles evaluated the effectiveness of three methods of fiber post removal: the Kodex twist/Tenax ParaPost fiber post-removal drill kit, a combination of diamond bur/Peeso reamer, and a DT Light Post removal kit, and they report that the diamond/Peeso reamer burs tend to have a higher grade in effectiveness than the Kodex twist/Tenax ParaPost drills, which tend to be more effective than the DT Light Post removal kit ¹⁶. Lindemann and Herrero, evaluating the efficacy of various fiber post-removal methods, suggest that greater fiber post-removal effectiveness was achieved with ultrasonic vibration and diamonds than with other systems, including post-removal kits ¹⁵.

Residual Material (Post Cement)

Haupt and Hülsmann assessed the residual material using different post-removal techniques: the DT Light Post-removal kit, long-shaft round bur, and SonicFlex Endo. Post spaces were prepared for different types of fiber posts: glass fiber, quartz fiber, carbon fiber. The smallest quantity of residual material was identified when removal was carried out with a SonicFlex Endo and round bur, regardless of the type of post that was used. On the other hand, the removal of posts using the DT Light Post-removal kit was considerably more effective in removing glass fiber posts than carbon

fiber posts ($p < 0.05$). Regarding different post types, only the removal of carbon fiber posts with the DT Light Post-removal kit resulted in a considerably large quantity of residual material ($p < 0.05$)¹⁷. Arukaslan and Aydemir compared two different fiber post-removal systems—the DT Light Post-removal kit and ultrasonic vibration—and they identified no significant differences among groups ($p > 0.05$)¹⁰.

Procedural Errors (Failure)

Haupt and Hülsmann assessed the failure rate using the following post-removal techniques: the DT Light Post-removal kit, long-shaft round bur, and SonicFlex Endo. They reported that a total of 26 perforations and severe deviations from the root axis occurred: four with the DT Light Post-removal kit, 14 with the round bur, and eight with the SonicFlex Endo¹⁷. Arukaslan and Aydemir discovered that regarding microcrack formation, no significant difference was found between the post-removal kit system and the ultrasonic system ($p > 0.05$)¹⁰.

Fracture Resistance

Aydemir and Ylıdran compared two fiber post-removal techniques in terms of fracture resistance of the root. The fracture resistance value of the ultrasonic group was found to be significantly lower than that of the removal kit group ($p = 0.032$)¹⁸.

Time Required (efficiency)

Anderson and Bowles compared the average removal time for three fiber post-removal systems (the Kodex twist/Tenax ParaPost fiber post-removal drill kit, the diamond bur/Peeso reamer, and the DT Light Post-removal kit). The three subgroups did not vary significantly in mean removal time ($p = 0.08$)¹⁶. Four articles—Arukaslan and Aydemir, Haupt and Hülsmann, Lindemann and Herrero, and Aydemir and Ylıdran^{10, 15, 17, 18}—compared post-removal kits with the ultrasonic system and found substantial differences in removal time among the systems ($p < 0.05$). Fiber post-removal time for the ultrasonic group or round bur and sonic tip was significantly longer than the removal kit group.

Residual Dentine

Arukaslan and Aydemir discovered that after post-removal, the volume of dentine in the removal kit group was considerably higher than that of the ultrasonic group ($p = 0.011$)¹⁰; Lindemann and Herrero had the same result but with a different p-value ($p < 0.05$)¹¹. Haupt and Hülsmann compared three different types of post-removal systems, and they found that compared to Sonic Flex Endo and DT-Post-

removal kit most dentine was removed when the round bur was used¹⁷.

Discussion:

When root canal treatment has failed due to periapical pathosis, a fiber post must be removed safely and effectively to allow endodontic retreatment^{12, 19, 20}. The purpose of this study was to discuss the properties of post-removal kits and compare them with other systems used in removing interradicular posts from root canals.

Successful retreatment of endodontically-treated teeth requires effective removal of the posts without any possible errors. Lindemann *et al.*¹⁵ found that ultrasonics and diamonds were superior to removal kits in achieving the effectiveness of the post-removal, and it is likely that better removal effectiveness might be achieved with subsequent use of ultrasonic instrumentation after the removal kits. Haupt and Hülsmann used 3D imaging technology works with two flat-panel detectors, which allow exploration of root canals at a resolution of about 150 μm in the high contrast region to assess the incidence of failure, and they found that most failures, including fracture and perforations, occurred when post removal was carried out with the round bur.

Several recent studies have investigated the removal time of different types of fiber posts. An *in vitro* study assessed the removal times of fiber posts after failure and concluded that fiber posts were easily retrievable using fiber post-removal kits²¹. This review suggested that removal kits were significantly more efficient, while the diamond bur and ultrasonic handpiece took a longer time to be removed^{10, 15, 17, 18}.

Further studies are needed to evaluate fracture resistance and the amount of remaining dentin with each of the post-removal systems.

Conclusion

The results suggested that the removal of fiber posts can be achieved in a shorter time and in a more conservative way by utilizing a post-removal kit as compared with an ultrasonic removal system. However, higher effectiveness and lower fracture resistance of the roots was achieved with ultrasonic vibration and diamonds than with post-removal kits. The number of microcracks after the post-removal and the amount of material on the walls of the root canal were not affected by the fiber post-removal method.



PRISMA 2009 Flow Diagram

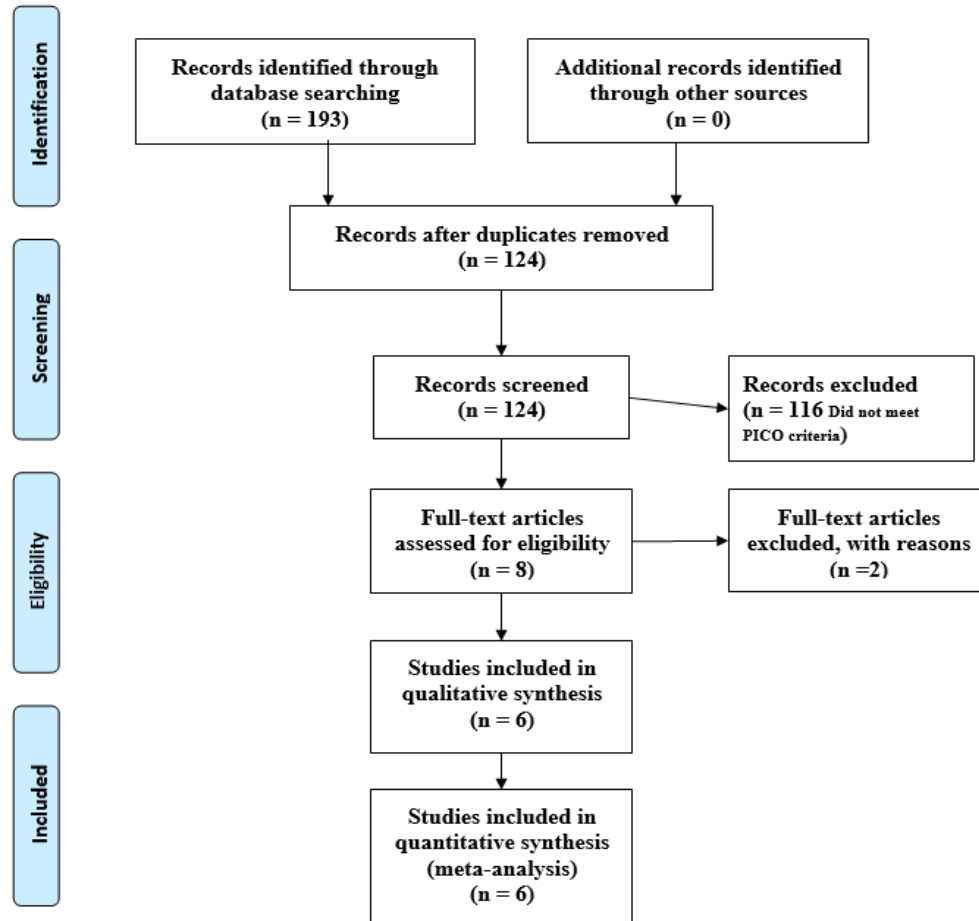


Figure 1: PRISMA Flow Diagram

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Corresponding Author

Doaa Alghamdi

General dentist, Jeddah, Saudi Arabia.

Email: Doaa.ghamdi @ hotmail.com /
Doaa_alghamdi @ hotmail.com

Contact number: +966595177233

Postal code: 21442