

DENTAL POST TECHNIQUE: IS TEACHING PROPERLY VALUED? A RADIOGRAPHIC EVALUATION OF THE QUALITY OF DENTAL POSTS

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ABSTRACT

The aim of this study was to evaluate the quality of dental posts, through 250 periapical radiographs of patients with at least one dental element with dental post. The type of post used, the quality of the endodontic treatment, the length of the posts and the existence or not of any space between the post and the endodontic filling material were analyzed. Of a total of 463 posts, 324 were cast metal cores, 118 were prefabricated metallic posts and 21 were non-metallic prefabricated posts. 127 cast metal cores and 69 prefabricated posts were cemented on teeth without endodontic treatment or with unsatisfactory endodontic treatment. 35 cast metal cores, 12 metallic prefabricated posts and 6 non-metallic prefabricated posts were considered satisfactory. It was observed a large number of failures, which may contribute to fractures or other types of failure in teeth with dental posts.

KEYWORDS: Post and Core Technique. Quality Indicators. Health Care. Materials Failure Analysis.

DOI: <https://doi.org/10.14436/2447-911x.16.1.126-135.oar>

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INTRODUCTION

One of the great challenges of dentistry continues to be the rehabilitation of teeth submitted to endodontic treatment, due to their lower mechanical resistance when compared with teeth with pulp vitality.¹ Endodontically treated teeth become weakened due to the loss of dental structure, mainly dentin, as a result of coronary fractures, carious lesions, erosion, abfraction and the endodontic treatment itself.²

Therefore, in view of the need to rehabilitate such dental elements, a careful evaluation must be made of both the quantity and the quality of the remaining dental structure.³ From a mechanical point of view, the remaining dental structure and the dental material filling are interdependent in producing the final strength of the prepared dental element. Thus, one contributes to increasing the structural resistance of the other.⁴

For the correct indication and selection of prefabricated dental posts or cast metal cores, it is necessary for the professional to be aware of the biomechanical or clinical principles that determine the procedure's success. Some factors must be considered, as they influence the post and core selection. These factors include: the root length, tooth anatomy, root width, channel configuration, and amount of coronary dental structure.⁵

During post selection, one of the most important criteria for success is the preservation of the dental structure. A system should be chosen that promotes the least possible destruction of the healthy dental structure, which reduces the probability of fracture of the root re-

mainer. However, the diameter of the post should be sufficient for preserving its rigidity and for providing the minimum necessary retention. The diameter of the post should be up to 1/3 of the root diameter, and the thickness of the dentin should be greater in the vestibular face of the anterior teeth due to the greater force incidence in this situation.⁴ The amount of coronary dental structure remaining is extremely important and should be at least 1.5 to 2.0 mm.⁶

The length of the post should be equal to or greater than the clinical crown. As a general rule of thumb, the length of the post should amount to 2/3 of the total length of the dental root. In cases where bone loss is observed, ideally, the length of the post should be equivalent to half of the bone support of the root involved. In addition, consideration should be given to maintaining at least 4 mm of endodontic filling material to ensure effective sealing.

Along with the concern of having a short post—or one that is shorter than the ideal length—is the concern of having empty space between the end of the post and the plug material. The ideal is that there is never any space.⁸

Although these criteria are considered to be primordial in the manufacture of a dental post, clinical practice has demonstrated that they are not always followed,⁸ and this may be one of the main reasons for the large number of fractures and other associated failures.⁹

In view of the above, the objective of this study was to evaluate the quality of dental posts that dentists or undergraduate students have placed, using periapical and panoramic radiographs of patients each with at least one dental element with a dental post.

METHODS

This study received approval from the research ethics committee of the Federal Fluminense University where the study was conducted (CAAE 74178217.6.0000.5626). The study first involved randomly selecting 250 records of patients who each had at least one dental restoration featuring a dental post. Once selected, the panoramic radiographs were analyzed for counts and the periapical radiographs were analyzed for measurements to quantify the variables described in Chart 1.

1. Number of teeth with cemented posts
2. Type of cemented post (Cast metal core X Pre-fabricated post)
3. Presence of endodontic treatment performed (Yes X No)
4. Properly performed endodontic treatment (Yes X No) * the presence of an unclogged root canal in the apical region was considered, not taking into account possible endodontic difficulties, such as conduit calcifications, among others. Thus, it was classified as acceptable (space between 0 and 1.0 mm between filling material and dental apex) and as correct (proportions with margin of error of 0.2 mm).
5. Post length (Suitable X Inadequate) * posts of adequate length should be at least 2/3 of the root length of the tooth, ^{4,7} i.e., posts with a length less than 2/3 of the root were considered to be inadequate. In addition, only the portion surrounded by alveolar bone was considered to be root length. Proportions with a margin of error of 0.2 mm were accepted as correct.
6. Quality of the remaining endodontic filling material (Satisfactory X Unsatisfactory) * Satisfactory endodontic treatment should present a homogeneous image of the filling material and should also show a minimum of 3 to 4 mm of an apical seal, ¹⁰ that is, only the element that had this minimum of 3 to 4 mm of apical seal was considered to be satisfactory. Proportions with a margin of error of 0.2 mm were accepted as correct.
7. Presence of space between the post and the filing material (Yes X No) * The possibility of the plunger effect, which may lead to fracture of the dental element, is evaluated. ⁸ Proportions with a margin of error of 0.2 mm were considered to be correct.

Chart 1: Variables analyzed.

It should be noted that because the study location is a school clinic, it is routine to request panoramic radiographs and to complete periapical examinations for all patients who initiate clinical care in the institution. Thus, the authors were able to evaluate the patients before they started any interventions, thus ensuring that nothing would interfere with the results. The goal was not to evaluate the time elapsed since the treatments were made or to determine whether undergraduate students or dental surgeons with more or less professional experience performed them (as the radiographic measurements were performed in new or previously attended at the clinic school in question). The objective of the work was only to evaluate the quality of the retainers.

RESULTS

The randomly selected records revealed the placement of 463 dental posts, of which 324 were cast metal cores, 118 were prefabricated metal posts, and 21 were nonmetallic prefabricated posts (glass fiber, carbon, quartz, or other non-metallic material).

Initially, all elements with some cemented posts were considered quantitatively, including those performed on dental elements without endodontic treatment. In this case, however, the case was already considered to be a restorative technique failure, and the other analyses were not considered. Thus, dental elements each with a cast metal core and 16 dental elements each with a prefabricated post were excluded due to the lack of endodontic treatment, with 15 being metallic and one being non-metallic (Table 1).

Table 1:

Frequency of endodontic treatment in cases treated with dental posts (n = 463).

	WITH ENDODONTIC TREATMENT	WITHOUT ENDODONTIC TREATMENT	EXCLUDED FROM RESEARCH
Cast metal core	285	39	39
Metallic pre-fabricated post	103	15	15
Non-metallic pre-fabricated post	20	1	1
Total (% of the initial total - n = 463)	408 (88.1%)	55 (11.9%)	55 (11.9%)

The total used for the analysis of the quality of the endodontic treatment (i.e., satisfactory or not) was 408 cases treated with dental posts. The results of the analysis of the quality of the endodontic treatment can be observed in Table 2. After this analysis, 141 teeth/retainers were also eliminated from the following analysis (88 cast metal cores, 44 metal prefabricated, and nine non-metallic prefabricated ones) because as the posts were placed in teeth with unsatisfactory endodontic treatment, they were also considered to be restorative failures.

Thus, when it came to analyzing the quality of the restorative treatment according to the other variables (the adequate length of the retainer, adequate remnant of the filling material, and adequate space between the retainer and the filling material), the total number of cases evaluated was 267. The result of the analysis is described in Tables 3 to 5.

Figures 1 to 4 exemplify the clinical situations of retainers that were considered to be unsatisfactory.

Table 2:

Frequency of endodontic treatment quality (n = 408).

	WITH ADEQUATE ENDODONTIC TREATMENT	WITHOUT ADEQUATE ENDODONTIC TREATMENT	EXCLUDED FROM RESEARCH
Cast metal core	197	88	88
Metallic pre-fabricated post	59	44	44
Non-metallic pre-fabricated post	11	9	9
Total (% of the initial total - n = 463)	267 (57.7%)	141 (30.4%)	141 (30.4%)

Table 3:

Frequency of the qualitative analysis of the length of the post, considering the satisfactory endodontic treatment. Percentage in brackets considering only the total number of posts with adequate endodontic treatment in total and within each type of post (n = 267, cast metal core = 197, pre-fabricated metallic posts = 59, and pre-fabricated non-metallic posts = 11).

ANALYZED VARIABLE	CAST METAL CORE	METALLIC PRE-FABRICATED POST	NON-METALLIC PRE-FABRICATED POST
Appropriate length	82 (30.7%; 41.6%)	17 (6.4%; 28.8%)	7 (2.6%; 63.6%)
Short post	113 (42.3%; 57.4%)	42 (15.7%; 71.2%)	4 (1.5%; 36.4%)
Long post	2 (0.8%; 1.0%)	0	0

Table 4:

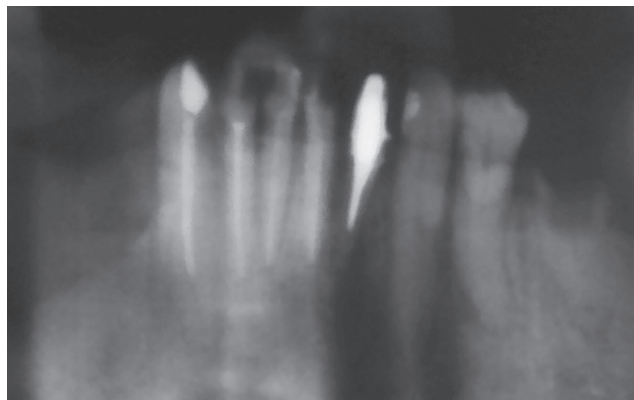
Frequency of the qualitative analysis of the quantity of remaining endodontic filling material, considering the satisfactory endodontic treatment. Percentage in brackets considering only the total number of posts with adequate endodontic treatment in total and within each type of post (n = 267, cast metal core = 197, pre-fabricated metallic post = 59, and pre-fabricated non-metallic post = 11).

REMAINING ENDODONTIC FILLING MATERIAL	CAST METAL CORE	METALLIC PRE-FABRICATED POST	NON-METALLIC PRE-FABRICATED POST
Adequate	187 (70%; 94.9%)	58 (21.7%; 98.3%)	11 (4.1%; 100%)
Inadequate	10 (3.7%; 5.1%)	1 (0.5%; 1.7%)	0

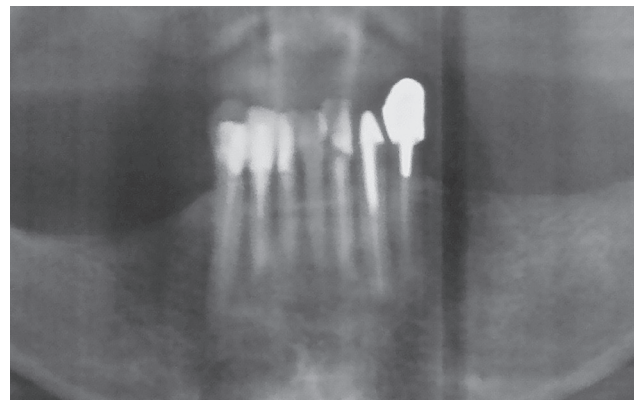
Table 5:

Frequency of the qualitative analysis of the presence of space between the post and the remaining filling material, considering satisfactory endodontic treatment. Percentage in brackets considering only the total number of posts with adequate endodontic treatment in total and within each type of post (n = 267, cast metal core = 197, pre-fabricated metallic post = 59, and pre-fabricated non-metallic post = 11).

ADEQUATE SPACE BETWEEN POST AND FILLING MATERIAL	CAST METAL CORE	METALLIC PRE-FABRICATED POST	NON-METALLIC PRE-FABRICATED POST
Yes	115 (43.1%; 58.4%)	39 (14.6%; 66.1%)	9 (3.4%; 81.8%)
No	82 (30.7%; 41.6%)	20 (7.4%; 33.9%)	2 (0.8%; 18.2%)

**Figure 1:**

Tooth 32 restored with post, without the previous realization of endodontic treatment.

**Figure 2:**

Teeth 33, 34, 42, and 43 restored with posts of inadequate lengths.



Figure 3:

Tooth 21 demonstrating the presence of space between the pre-fabricated post and the endodontic filling material.

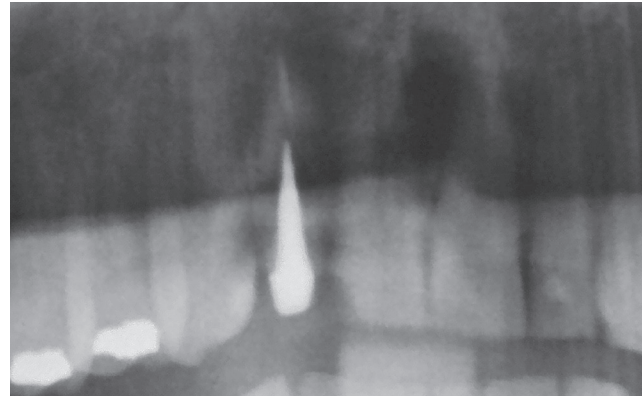


Figure 4:

Tooth 12 demonstrating the presence of space between the cast metal core and the endodontic filling material.

DISCUSSION

The initial analysis of the first values obtained revealed that in the studied population, cast metal cores compared with prefabricated ones are still predominately used (Table 1). Although uncovering this was not one of the initial objectives of the study, these values, to a certain extent, demonstrate a trend and/or a preference in terms of the technique used by dentists in the region where the study was

carried out (Rio de Janeiro). Unfortunately, no data can be compared with this to assess whether this series reflects a local, regional, or national reality, or if these values were the result of chance. However, this tendency and/or preference is contrary to most current concepts related to the selection and use of intra-radicular retainers.¹⁰

In the data presented in Tables 1 and 2, it can be seen that the sum of elements excluded from the study due to the lack of endodontic treatment, or due to the inadequate quality of this treatment, was high (196 cases, 42.3% of the total). From this point of view, it is fundamental to

understand that it is not necessary to discuss whether flaws occurred more in cast metal cores or in prefabricated posts, as, in fact, the error by the dentist in this respect would lead to the failure of any of the techniques. The values found here differ from those that Bonfante et al. (2000)⁸ obtained, as they found only 0.5% of the unsealed roots; however, the quality of the endodontic treatment was not analyzed. Here, an important discussion about the teaching of the technique of intra-radicular retainers is already in order, although it should be assumed that one of the basic requirements for the placement of a dental post is the existence of well-developed endodontic treatment. The exclusion of 42.3% of the teeth due to the lack of endodontic treatment (n = 55) or due to the existence of poorly performed endodontic treatment (n = 141) suggests that dentists are not giving due emphasis to this first pre-basic requirement, and this in itself already represents a flaw in the technique. It is imperative to observe that the technique of placing posts is usually taught in undergraduate courses on restorative dentistry disciplines, usually related to fixed prosthodontics or operative dentistry, and it is often taught before the endodontics discipline. However, the student may not have had exposure to endodontics at that moment of his or her training, or he or she may not value this prerequisite very much, fixing his or her learning much more on the technical part of placing posts. Unfortunately, this mistake can have long-term repercussions. It is thus up to the later disciplines, perhaps even using the results of this study as an example, to demonstrate the importance of this first prerequisite, giving it the proper emphasis so that errors such as this can decrease.

With respect to the data presented in Tables 3 and 4, a large number of seals of inadequate length can be observed. In this case, in almost all of the samples, the retainers were smaller than the ideal size¹¹, which could compromise their retention. On the other hand, only 11 patients presented remnants of inadequate filling material (less than 3 mm, the minimum acceptable value able to maintain the apical sealing obtained in endodontic treatment). Dentists understand the need to maintain this apical seal and normally prepare the root canal properly; however, when completing the treatment, they end up using posts of inadequate length, as evidenced by the number of elements with space between the retainer and the sealing material as seen in Table 5 (n = 104).

The presence of this space often means that the preparation has an adequate extension inside the conduit but was poorly reproduced directly or indirectly, was poorly reproduced via the casting process, or underwent ineffective adaptation and/or cementation. Another possibility is the professional's failure to observe that the length of the post was smaller, suggesting that the failure of the post or the was not verified or that a radiograph was not taken to verify the placement of the retainer—and if it was realized, it was tolerated.

The literature is relatively poor concerning the possible sequelae of this empty space, although its potential for bacterial proliferation is known due to contamination during the steps of making the core, for example, and in lateral conduits, thus leading to the development of periapical lesions.⁸

Note that the need for endodontic retreatment is common due to the development of apical lesions, which also occur when a retainer extends too far in the interior of the root canal.

CONCLUSION

In the data analyzed, it is possible to observe a large number of failures in the confection of dental posts, either in the indication, in the extension, or in the length of the same. Thus, it is believed that these iatrogenies may contribute to the current high rate of fractures of endodontically treated teeth and intra-root posts, as well as to the high rate of teeth that need to be treated again.

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How to cite: Barbosa SB, Albuquerque EG, Passos IAG, Marins SS, Warol F, Scarparo A, Barceleiro MO. *Dental Post Technique: Is teaching properly valued? A radiographic evaluation of the quality of dental posts*. J Clin Dent Res. 2019 Jan-Apr;16(1):126-35.

Submitted: November 11, 2018 - Revised and accepted: December 19, 2018.

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» Patients displayed in this article previously approved the use of their facial and intraoral photographs.
