

Evaluation of the pattern dimensions of cast-metal posts in uniradicular teeth

Avaliação do padrão dimensional dos retentores intrarradiculares metálicos fundidos em dentes unirradiculares

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Resumo

Introdução: As dimensões corretas de um retentor intrarradicular são bastante relevantes para a longevidade de uma prótese. **Objetivo:** O objetivo deste estudo foi comprovar se as dimensões de retentores metálicos fundidos estão de acordo com critérios clínicos ideais. **Material e método:** Foram analisadas 285 radiografias periapicais de diagnóstico, totalizando 80 dentes, de pacientes que procuraram atendimento na Faculdade de Odontologia/UFG, no período de março de 2008 a outubro de 2012. Foram incluídas no estudo as radiografias periapicais de dentes unirradiculares, que apresentavam retentor intrarradicular metálico fundido. A avaliação radiográfica foi realizada em ambiente com pouca luminosidade e com auxílio de um negatoscópio com lupa. A dimensão dos retentores foi estabelecida através de um paquímetro digital considerando as seguintes medidas: a) comprimento do remanescente (CR); b) comprimento do retentor intrarradicular (CRI); c) suporte ósseo (SO), diâmetro méso-distal da raiz (DR); d) diâmetro méso-distal do retentor intrarradicular (DRI). Por meio de parâmetros de referência os retentores foram classificados em aceitáveis, com margem de erro de até 0,2 mm, ou deficientes. Para a análise descritiva os dados foram catalogados utilizando-se o software SPSS 17.0. **Resultado:** Quanto ao comprimento, pela análise da regra dos 2/3 apenas 23,75% dos retentores foram classificados como aceitáveis, enquanto na regra do fulcro dentário essa porcentagem foi de 37,5%. Com relação ao diâmetro méso-distal 52,5% dos retentores foram aceitáveis. **Conclusão:** Dentro dos limites deste estudo, pode-se concluir que os retentores metálicos fundidos avaliados não estão de acordo com os critérios clínicos ideais.

Descritores: Técnica para retentor intrarradicular; controle de qualidade; prótese parcial fixa.

Abstract

Introduction: Accurate dimensions of cast-metal posts are relevant to the survival of dental prostheses. **Objective:** The aim of this study was to verify if the dimensions of cast-metal posts accord with ideal clinical criteria. **Material and method:** For the evaluation, 285 periapical radiographs, from a total of 80 teeth, were taken from the charts of patients that attended the clinics at the Dental School of the Federal University of Goiás, from March 2008 to October 2012. Only periapical radiographs of single-rooted teeth with post and core were included in the study. The radiographic evaluation was conducted with the assistance of a magnifying glass and a view box, in a room with low luminosity. The dimensions of the post and core were established with the help of a digital caliper, and the following measurements were considered: a) LR (Length Remnant); b) LP (Length Post); c) BS (Bone Support); d) DR (Diameter Root); e) DP (mesiodistal diameter post). The post and core were classified as acceptable or deficient by reference values with a margin of error of 0.2 mm. For descriptive analysis, the data were cataloged using SPSS software (version 17.0). **Result:** With regard to the length of the post and core, only 26.25% and 43.75% of the post and core were classified as acceptable according to the two-thirds rule and fulcrum dental rule, respectively. With regard to the mesiodistal diameter of the post and core, 55% were classified as acceptable. **Conclusion:** Within the limits of this study, it can be concluded that the cast-metal posts evaluated do not accord with the ideal clinical criteria.

Descriptors: Post and core technique; quality control; partial fixed denture.

INTRODUCTION

Endodontically treated teeth usually exhibit pronounced coronal destruction¹ as a result of caries or endodontic treatment². When teeth are severally damaged, posts are indicated to retain stability for the final restoration¹. Additionally, factors such as quality of bone support and type of forces to which teeth will be submitted must be considered in the selection of restorative procedure³.

The posts are classified as conventional metallic and pre-fabricated⁴, and are indicated in situations with wide coronal destruction, when the remaining tooth is unable to retain the core. Four factors must be analyzed to promote a suitable retention to the post: length, wall inclination, width and surface characteristics⁵. The appropriate length of the post is synonymous with prostheses longevity; therefore, inadequate length will contribute to stress concentration in some areas, which can lead to radicular fractures⁵. Such fractures are more frequent when the intraradicular portion of the post is shorter than the crown length. These circumstances occur at a stress concentration in the apical portion of the post; the site of root fracture.

According to the literature, some criteria are to be adopted together or individually to determine the ideal length of the post. In this case, the ideal post is considered to have a length equal to two-thirds the total length of the remnant dental structure (two-thirds rule), half the length of the root⁶, a length equal to or greater than the crown of the future restoration¹ and half the bone support surrounding the root (dental fulcrum rule)⁶.

Selby⁷ systematically reviewed the likely failure of fixed prostheses and found that short and narrow posts, as well as conventional metallic posts, were the main factors leading to the failure of many endodontically treated teeth.

Although the techniques for obtaining the posts are very well defined and of great importance for the success of rehabilitative treatment, there are studies showing that even nowadays, the step of determining the dimensions (length and diameter) of metallic post retainers is often neglected⁸. This may explain the high rates of failure in teeth with this kind of treatment⁹.

Given the importance of the topic in the context of oral rehabilitation, the aim of this study was to prove the null hypothesis that the dimensions of metallic posts of patients seeking dental care at the Dental School of the Federal University of Goiás (UFG) accord with ideal clinical criteria.

MATERIAL AND METHOD

A total of 285 periapical radiographs, totaling 80 teeth, were analyzed. The radiographs were obtained from the medical records of patients seen in the disciplines of integrated clinical internship at the Dental School of UFG, from March 2008 to October 2012. There was not any damage on radiographs and patient identity was not revealed. Prior to data collection, the project was approved by the Ethics Committee in Research of UFG (protocol 147/12).

As inclusion criteria, only periapical radiographs of single-rooted teeth with metallic posts were selected. Unclear radiographs

of poor quality and those with distortion and an average degree of density and contrast were excluded.

Radiographic analysis was performed by two calibrated observers, in an environment with low light and a light box (model: Endo Bench) with magnifier (Protécni, Araraquara, Brazil). The dimensions (in mm) of the metallic posts were established with the aid of a digital caliper (Mitutoyo Model 500-144B, Mitutoyo Sul Americana, São Paulo, Brazil) taking into consideration the parameters illustrated in Figure 1.

The parameters were: LR (Length Remnant), LP (Length Post), BS (Bone Support), DR (Diameter Root), and DP (mesiodistal diameter post). Measurements for the diameter were performed in the middle third of the root.

Given the impossibility of determining the buccolingual diameter radiographically, the data regarding the diameter of posts in the present study are limited to the mesiodistal direction.

Radiographs were identified by ascending order of numbers. The average of three measurements (in mm) was obtained for each of the five parameters. The obtained values were applied to the formulations described in Table 1.

For the length of the two benchmarks, the two-thirds rule and the dental fulcrum were analyzed separately and together.

According to the adopted reference parameters, the posts were classified as acceptable or deficient. Measurements with a margin of error of up to 0.2 mm were considered acceptable. The cataloged data were evaluated by descriptive analysis using SPSS 17.0 software (SPSS Inc., Chicago, IL, USA).

RESULT

The results of the analysis of the 80 teeth with respect to the length, two-thirds rule and dental fulcrum rule, and the ideal diameter of the post are shown in Table 2.

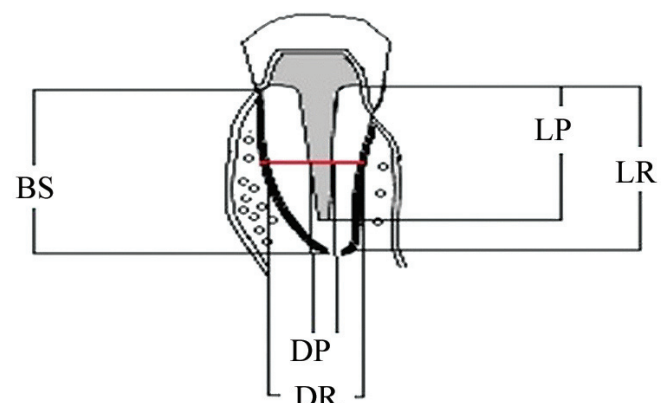


Figure 1. Parameters used in the study.

Table 1. Formulas applied to the dimensions of metallic posts

Dimensions	Analyze	Formulas
Length	Two-thirds rule	$2/3 \times LR$
	Dental fulcrum rule	$1/2 \times BS$
Diameter	Ideal diameter of post	$1/3 \times DR$

Table 2. Results of the analysis with respect to length and diameter of posts

		Acceptable	Disabled
Length	Two-thirds rule	21 (26.25%)	59 (73.75%)
	Dental fulcrum rule	35 (43.75%)	45 (56.25%)
	Dental fulcrum and two-thirds rules	21 (26.25%)	59 (73.75%)
	Diameter (mesiodistal)	44 (55.00%)	36 (45.00%)

Only 26.25% of the posts were classified as acceptable according to the two-thirds rule, and only 43.75% according to the dental fulcrum rule. Considering the two references of length together, the results were identical to those obtained with the two-thirds rule, with 26.25% of the posts considered acceptable. However, with respect to the diameter, there was a lower number of disabled posts, with 55% classified as acceptable.

DISCUSSION

With the increasing advancement of dental materials and with the advent of adhesive systems, many changes are occurring in the dental specialties² in reference to rehabilitation procedures. In this context, a growing number of studies suggest the use of fiberglass posts instead of the conventional metallic posts¹⁰. However, conventional metallic posts are still needed. Notably, there is a higher prevalence of this type of rehabilitative treatment, especially in undergraduate courses in dentistry, due to its low cost when compared with the use of fiberglass posts¹¹.

In the present study, most of the retainers (73.75%) were classified as deficient, taking into account the two-thirds rule. When considering the dental fulcrum rule, 56.25% of the retainers were considered deficient.

This type of deficiency concentrates the forces that will act away from the dental fulcrum, and can contribute to the fracture of the dental fulcrum, since the mechanical behavior between the prosthetic crown and post is the cross-resistance of a lever, wherein occlusion represents the strength of action, the apical portion of the root represents the fulcrum, and the strength of resistance is given by intraradicular¹².

Pinzetta et al.¹³ evaluated 96 teeth and found that 96.9% had posts with a length less than two-thirds of the remaining dental structure. Although inadequate length is one of the main reasons for failure in teeth with this kind of rehabilitative treatment¹⁴, a direct relationship of this factor with the longevity of the prosthesis cannot be established. Other important factors must be included in this analysis, such as antagonist quality and sex of the patient, which are important determinants of incident power for the prosthesis.

The effects of a short post include displacement by inadequate retention and root fracture introduced into the lower lever. Even with several in vitro and clinical studies indicating that the length of posts significantly affects retention and several other properties¹⁵, Morgano et al.¹⁶ found that most of the analyzed posts that failed

were less than half the length recommended by the literature. This shows the important influence of the length of posts in the success of this type of rehabilitative treatment.

With respect to radiographic diameter, 45% of cases (Table 2) presented below what is advocated in the literature. However, it is known that increasing the diameter of posts increases the retention and strength, but there is also an increased risk of fracture due to increased intraradicular wear on the remaining dentin. In vitro studies have confirmed the importance of maintaining healthy dental structure (intraradicular dentin) surrounding the post to prevent root fracture^{17,18}. Increasing the diameter of the post does not guarantee a significant increase in retention of the post¹⁹; however, it may increase the stiffness of the post and reduce the resistance to root fracture²⁰. Therefore, the diameter of posts must be controlled to not only preserve intraradicular dentin, but also resist root fractures.

Due to limitations in the information provided by periapical radiographs in this study, it was only possible to determine the mesiodistal diameter of the posts evaluated. This should be considered when interpreting the data.

Given the direct relationship between the dimensions of posts and the longevity of the tooth root, it is necessary to adopt well-defined criteria for predictability in treatments with these restraints.

A tooth that has received a post with the length following the two-thirds rule, but in which the sealing of the apical third root has been compromised and is subsequently attacked by a periapical lesion, is considered a failure. In this situation, even with a suitable mechanical post, there will be a need for corrective interventions, either by removing the post via endodontic retreatment or by surgery for sanitization of the periapical region.

Given the results of this study, the proposed hypothesis was rejected, revealing a clear need for change in clinical management with respect to the determination of the dimensions of posts. More than half of the teeth examined presented with posts with a length that did not follow the dental fulcrum rule. Knowing this can help professionals provide prosthetic treatments with greater clinical longevity.

CONCLUSION

Within the limits of this study, it can be concluded that the conventional metallic posts evaluated do not accord with the ideal clinical criteria.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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