

Organization's analysis of levels of oral health care and their influence on the success of endodontic therapy

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ABSTRACT

Introduction: The quality of crown restoration plays an important role in endodontic treatment success. **Objective:** This study aimed to analyze the presence and quality of crown restorations (CR) performed in patients subjected to endodontic treatment (ET) in a Dental Specialty Center DSC (DSC), in addition to assessing how effective health care provided to users of Brazilian Unified Public Health System (SUS) is. **Methods:** All patients who had completed ET in a DSC in northeastern Brazil from June to December 2013 were assessed. The presence/absence of CR and its quality, as well as the presence/absence of symptoms were assessed. **Results:** Of the 108 teeth subjected to assessment, 32.4% were found without a definitive restoration, of which 10.2% did not present CR of any kind. As regards patients' symptoms, they

were present in 15.7% of the assessed sample, of which 58.9% presented with no final CR or inadequate CR. As for success, regardless of ET quality, clinical examination revealed that whenever appropriate CRs were present, the best results were achieved ($P < .05$). Combination between inadequate CR and adequate ET offered 58.33% success rate, without statistical bias for any outcome ($P < .05$). The worst results were found when inadequate or absent CR were combined with inadequate ET. **Conclusions:** Under the conditions of this study, it was possible to conclude the majority of ETs performed remained without proper CR even six months after completion. Additionally, the presence/quality of CRs of paramount importance to treatment success.

Keywords: Public health. Permanent dental restoration. Endodontics.

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Introduction

Analysis of health care systems, carried out from an international perspective, shows systems are predominantly fragmented, focused on acute conditions and acute exacerbation of chronic conditions.¹

In Brazil, the Unified Health System (SUS) is divided into levels of care: primary, secondary and tertiary. All three levels are part of a large Health Care Network potentially defined as organizational arrangements of health-related actions and services of different technological densities that integrated through technical support systems, logistics and management, aim to ensure total care.²

In Dentistry, primary care is provided by Basic Health Units responsible for general treatment; whereas secondary care is provided by Dental Specialty Centers (DSC) responsible for specialized treatment, such as the modality; and tertiary care is represented by hospitals providing highly complex services.

The main purpose of endodontic therapy is to eliminate bacterial contamination present in the root canal system (RCS).³ Up to date, no method previously described is able to completely eliminate microorganisms. For this reason, one more objective has been added to endodontic treatment: the need to prevent recontamination of the root canal system by remaining bacteria or microorganisms from the oral cavity.⁴ Studies reveal the prognosis of endodontic treatment (ET) is positively correlated with the quality of root canal filling; therefore, effective filling/sealing of the space previously occupied by pulp tissue is of paramount importance for the success of treatment.⁵⁻⁹ Regardless of filling material or techniques employed, no endodontic treatment is able to achieve complete sealing of the RCS.^{3,10} Those findings have been supported by studies showing that even root canal filling that seem adequate might allow leakage over time.¹¹⁻¹⁵

Epidemiological studies have investigated the influence of crown leakage, i.e. bacteria leakage from oral cavity, over endodontic success. Their results have focused attention on the importance coronary restoration (CR) quality can exert on endodontic success, since these microorganisms penetrate through root canal space and, therefore, can trigger and perpetuate pulp and periapical diseases. Nevertheless, variation found between the results achieved by those studies sustain controversy regarding the potential of

this impact on endodontic treatment success rates.^{5,7,15}

Regarding Brazilian public health services, notable governmental investments resulted in the creation of the Smiling Brazil Program, a Federal Government initiative responsible for the expansion of the secondary oral health care network throughout the country. Undoubtedly, it is possible to notice that access to ET in public health care has exponentially increased; however, the accomplishment of definitive restorations by basic oral health care apparently does not follow such growth.

According to the guidelines issued by the Brazilian Oral Health National Policy, reorganizing oral health care in all levels of attention is pointed as a guiding principle of the program. Such system has the principle of total oral health to be achieved by means of a reference and counter-reference system (articulated between primary and secondary care) and efficiency to ensure quality and solution in treatment.^{1,16}

Studies trying to correlate the quality of crown restoration with the success of endodontic therapy still present controversial results.^{5,7,15} Further, it is evident that there is a limited number of studies addressing this issue within the Health Care Networks of Brazil. Those facts not only justify the theme discussed herein, but also bring contributions and reflection on the organizational structure of the different levels of care provided in the country.

Therefore, based on the aforementioned facts, the present study had the objective of conducting an epidemiological survey on the existence/quality of CRs performed in patients subjected to ET within a minimum period of six months after completion in a DSC. Additionally, it also aimed at assessing the success of endodontic treatment performed in the DSC, particularly in terms of quality of CRs and root canal filling.

Material and methods

Data collection was performed at the Regional Dental Specialty Center in Sobral/Ceará, a medium-sized city in northeastern Brazil. The city was the first to receive an establishment of this nature in the country. This DSC was chosen due to being a center funded by a Public Health Consortium comprising 24 municipalities, the Government of the State of Ceará, and the Ministry of Health. Therefore, it provides care

to patients from various municipalities, in addition to being considered a reference site for secondary care in the studied area.

This observational and transversal clinical study was first approved by the Research Ethics Committee of Universidade Federal do Ceará (UFC) (#501.950/2013). A search on data of all patients whose endodontic treatment was completed between June and December of 2013 in DSC was performed. Such search was carried out through analysis of the daily controls described by the clinicians. After a minimum period of six months since endodontic treatment completion, contact with patients was initiated to schedule follow-up appointments. Efforts were made to contact the greatest number of patients; however, patients with incorrect or non-existent telephone numbers were excluded from the study. Similarly, patients who did not attend to the appointment for more than three times were also excluded. Patients that did not present complete radiographic records were included only in the epidemiological survey.

At each appointment, patients were clinically assessed considering the presence or absence of CR. Cases in which CR was present, we observed CR quality, which restorative material was sealing the crown access and whether it had appropriate marginal fitting. Additionally, questions were made about the presence or absence of symptoms and clinical signs of endodontic failure (vertical or horizontal pain to percussion or of another nature; presence of fistula or mobility) were searched. Data of the first interview and clinical examination were recorded and then combined with data from radiographic assessment. Subsequently, periapical radiographs were performed by means of the bisecting angle technique employing periapical positioning devices.

Quality of endodontic procedures was assessed by analyzing initial, final and follow-up periapical radiographs of each case, as well as endodontic treatment quality. Therefore, the radiographs were digitized and inspected by two previously calibrated examiners equipped with predetermined criteria adapted from Siqueira et al⁷ (Table 1). Data were recorded in order to determine the values of inter-examiner agreement. Similarly, to ensure validity of observations, some evaluations were performed in

duplicate, without notice, in order to allow intra-examiner agreement. Cases in which discrepancies were detected, a third examiner was consulted in order to determine the classification of the case. Data were subjected to Kappa test and subsequently statistically assessed by means of chi-square test with significance level set at $P < .05$.

Results

A total of 89 patients were assisted, totalizing 108 teeth of which 13 were excluded with regard to ET success assessment because of incomplete radiographic records or lack of radiographic quality.

Table 2 presents data obtained by the epidemiological survey on the presence/absence and quality of definitive CRs performed after ET completion at the DSC. Results showed that 32.4% of patients did not present definitive CRs even after a minimum follow-up period of six months; adding up cases with inadequate CRs, the amount raises up to 50.9%. Table 3 shows data related to patients' symptoms, with most cases being associated with absent or inappropriate CRs.

Regarding observations made by examiners, Kappa test demonstrated agreement rates of 81.3% and 100% both inter- and intra-examiner, respectively. Table 4 presents endodontic treatment success rates based on the quality of restorative and endodontic procedures. Chi-square test was able to determine statistically significant differences between the quality of restorative and endodontic treatments ($P < .05$).

Discussion

Fragmented health care systems have been a health and economic disaster worldwide. In general, no population is seen as accountable for the issue, which makes population-based management impossible. In those systems, primary health care does not communicate effectively with secondary health care, and both levels do not communicate neither with the tertiary health care nor with support systems. In this context, primary health care should not a communication center role, coordinating care. Brazil has advanced by means of public health policies employed in recent years, so as to form a functional and complete Health Care Network.¹

Table 1. Criteria used for radiographic assessment.

Final crown restoration quality	
Condition	Characteristics
Adequate	Intact and radiographically adapted permanent restoration.
Inadequate	Unadapted permanent restoration; permanent restoration with recurrent carious processes.
Absent	Presence of temporary restoration; lack of restoration sealing the access cavity.
Endodontic treatment quality	
Condition	Characteristics
Adequate	All root canals were filled; absence of empty spaces in filling material; fillings from 0.0 to 2.0mm from the radiographic apex; Good condensation of filling material.
Inadequate	Unfilled canals or little condensed canals; filling more than 2.0mm from the radiographic apex; over-filling in any canal.
Endodontic treatment success	
Condition	Characteristics
Success	Normal periodontal ligament (equal or shorter in comparison to endodontic treatment final radiograph); normal adjacent alveolar bone.
Failure	Presence of periapical radiolucency (greater as revealed by endodontic treatment final radiograph).

Data adapted from Siqueira et al.⁷

Table 2. Epidemiological data of CR presence/absence and quality.

	Number of patients	Number of teeth	Patients with definitive restoration		Patients without restorations	
			Adequate	Inadequate	Provisional	Absent
Occurrence	89	108	53	20	24	11
Percentage	-	100%	49.1%	18.5%	22.2%	10.2%

Table 3. Data of presence/absence of symptoms.

	Number of patients	Number of teeth	Patients with symptoms	Restoration condition			
				Inadequate	Provisional	Absent	
Occurrence	89	108	17	7	8	0	2
Percentage	-	100%	15.7%	41.1%*	47.1%*	0.0%*	11.8%*

*Percentages calculated based on the total number of cases with symptoms.

Table 4. Endodontic treatment success rates in terms of restorative and endodontic procedures quality.

CR	Quality of treatment		Success rate
	Endodontic treatment		
Adequate	Adequate		88.46% ^a
Inadequate	Adequate		58.33% ^{a,b}
Absent	Adequate		42.86% ^{a,b}
Adequate	Inadequate		83.33% ^a
Inadequate	Inadequate		20.00% ^b
Absent	Inadequate		20.00% ^b

^{a,b} Differing superscripts suggest significant difference in endodontic treatment success according to χ^2 test ($p < 0.05$).

Taking the Brazilian situation and the analysis of information presented herein as examples, it is possible to realize certain deficiency in the system of reference and counter-reference articulating the three levels of care. The gateway to health care in Brazil is the Basic Health Unit. Whenever a patient is referred to the DSC in order to have endodontic treatment carried out, this same patient must return to the Basic Health Unit for treatment completion with final restoration. Nevertheless, the system remains ineffective while total care remains deficient.

Similarly to most studies on the subject, this research is a transversal study, therefore, it presents as main limitation the fact that information available were recorded at the time of evaluation.^{5,7,9,15,17-18} However, the fact that all patients assessed by this study were taken care of at the same establishment allowed assessment of patient records and initial radiographs. Therefore, differently from most studies, it was possible to detect an increase, regression or stabilization of potentially preexisting periapical lesions, thus allowing greater accuracy in final diagnosis. Additionally, this study did not entirely consider radiographic evaluation, for this reason, data related to the presence and absence of symptoms could also be analyzed. However there is some limitation inherent to radiographic assessment due to the low sensitivity of the method, which may lead to underestimation of results.

The present study initially aimed to assess the frequency of patients having endodontic treatments at the DSC completed and crown accesses definitively restored. Within a minimum period of six months after endodontic therapy, 32.4% of patients did not present definitive CR of any kind, in other words, they remained with provisional restoration, or even more alarming, without any type of crown sealing. Considering all patients, 67.6% presented definite CRs; however, even if CR was present, 18.5% of them were considered inadequate, with only 49.1% of teeth properly restored. It is important to emphasize that marginal fitting was the only aspect taken into consideration when analyzing the appropriateness or not of CRs. Comparison of data found in our study was not possible since, up to date, there is lack of similar studies in the literature. However, present outcomes draw attention to the need for potential interventions

in the current organizational structure of public oral health care system in Brazil.

A previous study analyzing the procedures performed in primary care in Brazil indicates a decrease in restoration rates across the country, at the expense of collective procedures.²⁷ Another issue subject to discussion would be the fact that 10.2% of cases did not present any type of restorative procedures or sealing, which could immediately justify endodontic retreatment, since several studies reveal that periods ranging between 19 and 42 days are sufficient for complete root canal recontamination.^{10,14,19} These outcomes can be considered significant; however, 50.9% of cases presented without CR of any kind, with provisional restorations, or inadequate definitive restorations. Thus, it was possible to verify that a large number of endodontic treatment modalities performed with public funding did not present adequate crown sealing. This suggests a potential need for endodontic retreatment due to exposure of those teeth to oral microorganisms. This assumption is based on studies²⁰ which demonstrated that provisional restorative material, even glass ionomer cements, are unable to prevent crown leakage 15 days after exposure to masticatory forces.²⁰⁻²³

As for outcomes related to the presence of symptoms, it was possible to verify that 15.7% of patients still presented some type of pain, with the most frequent symptom being pain to vertical percussion. Of these, 11.8% were found without any type of sealing material, while 47.1% presented with inadequate CRs. However, those findings could not be compared to previous results, since no studies of this nature were found in the literature.

In order to ensure the potential influence exerted by the presence or absence of CRs as well as CRs quality over endodontic therapy success, the present study conducted a radiographic assessment that allowed not only data cross-check, but also definition of the role played by those findings, as well as the influence exerted by CR quality over endodontic therapy success. Therefore, clinical conditions that presented appropriate CRs had tendency towards treatment success, which was statistically proven, regardless of ET quality. Success rates of 88.46% and 83.33% were observed in adequate and inadequate endodontic treatment, respectively ($p < 0.05$).

Conversely, the combination between inadequate or absent CRs with inadequate ET presented the lowest success rates, only 20% ($P < .05$). Such findings corroborated several studies identifying higher success rates when appropriate CR and adequate endodontic treatment were combined, and lower success rates when inadequate or absent CRs were combined with inadequate endodontic treatment.^{5,7,9,15,17-18,24}

However, the main point of discussion is presented when comparing the role of endodontic treatment as being the major factor influencing the success of this therapy. In the present study, the combination of appropriate CR with inadequate endodontic treatment presented a tendency towards success with percentages of 83.33%. Nevertheless, the combination of inadequate CR and adequate endodontic treatment presented a percentage of 58.33%, without tendency towards outcomes of any kind. Such findings do not reach a consensus in the literature; however, Ray and Trope¹³ as well as Kirkevang et al¹⁸ found similar results to those achieved in this study, suggesting greater impact of CRs quality on endodontic treatment success than endodontic treatment quality itself. Regardless of the results achieved and potential trends identified by one or another study, it is important to emphasize that the presence or absence and quality of CRs are capable of influencing endodontic treatment success rates, as described by Gillen et al.²⁵ The authors carried out a systematic review and found that both endodontic treatment and CR play a fundamental role in endodontic therapy success.

Secondary care might reflect how effective basic care is; however, despite expansion of the number of oral health teams and setting up of Dental Specialty Centers, the following question arises: Do qualitative increase or any change in the diversity and mainly on the quality of dental procedures offered to user population really exist.²⁶

The aforementioned issues suggest changes in the organizational structure of Brazilian health care system, among which is the inclusion of restorative procedures after endodontic treatment in secondary care, thus highlighting the need for experts in Restorative Cosmetic Dentistry in the Dental Specialty Center teams. Besides that, a substantial increase of funds for basic care is rendered necessary in order to ensure that clinicians have adequate structure and suitable material to perform more complex restorative procedures. Additionally, establishing a rigorous protocol of reference and counter-reference able to maintain secondary care informed about the completion of definitive restorative procedure is also necessary.

Conclusion

Under the conditions of this study, it was possible to conclude that the majority of endodontic treatment cases performed in the DSC remained without appropriate crown sealing even six months after endodontic treatment completion. Additionally, the quality of crown restorations exerted greater influence over endodontic treatment success than CR quality. Based on those results, it is possible to notice that the concept of individual and total care still needs to be consolidated in order to achieve effective treatment.

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