



SUCCESS RATE OF ENDODONTIC TREATMENTS PERFORMED BY UNDERGRADUATE STUDENTS OF THE UNIVERSITY OF SOUTHERN SANTA CATARINA

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ABSTRACT

Introduction: Apical periodontitis is an inflammatory disease of the periradicular tissues caused by microbial (re)contamination of the root canal system. Due to its direct relationship to the quality of endodontic treatment, it is extremely important to carry out longitudinal and cross-sectional studies, following-up treatments carried out in universities. Aim: To evaluate the success rate of endodontic treatments performed by undergraduate students of the University of Southern Santa Catarina - UNISUL, Pedra Branca, between August 2015 and July 2017.

Materials and Methods: One hundred twenty-four patients with endodontic treatment were contacted. Of these, only 27 attended for treatment follow-up, adding up to a total of 32 treatments analyzed. All teeth were clinically and radiographically evaluated, and the potential indicators related to endodontic treatment success or failure were analyzed. The frequencies of each criterion were calculated, and the data analyzed using the Chi-Square test ($\alpha = 5\%$).

Results: 9 cases (28.13%) were considered failure, either because they were associated with symptoms or because there was a periapical alteration. In addition, 88.88% of the failure cases had temporary restorative material. Association was observed only between the number of root canals and symptoms ($P = 0.049$). Two of the 3 treated teeth with multiple root canals showed symptoms at the follow-up. The endodontic success rate was 71.87%.

Conclusion: The success rate of the 32 endodontic treatments performed by undergraduate students from UNISUL was 71.87%.

KEYWORDS: Endodontics, Radiography, Treatment Outcome.

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INTRODUCTION

Apical periodontitis (AP) is an inflammatory disease of the periradicular tissues caused by microbial (re)contamination of the root canal system. Due to its high prevalence in

several countries and its direct relationship to the quality of endodontic treatment,¹ it is extremely important to carry out longitudinal and cross-sectional studies, following-up treatments carried out in universities. Advances in terms of techniques and

materials are frequently reported in the scientific endodontic literature. However, when it comes to the epidemiological literature, there are few references.²⁻⁴

In order to evaluate the endodontic treatment success or failure,

the American Association of Endodontics established clinical and radiographic criteria.⁵ Among the success factors, stands out, for example, the absence of persistent symptoms and the absence of sinus tract associated with the treated tooth, and presence or evidence of bone repair within the periapical lesion.

Endodontic follow-up studies are carried out in different populations in several countries.⁶ The success rate of endodontic treatments of teeth with AP differs between studies, ranging from 51% to 95%.⁶⁻⁷ Clinical cases associated with endodontic failure after two to five years of follow-up have been related, in most studies, to poor and low quality root canal filling.⁶⁻⁷ Unsatisfactory root canal treatment increases the chances of intracanal infection appearance or persistence - the main cause of post-treatment periapical disease⁸ - being a decisive factor in the prognosis of therapy failure.⁴

Bearing in mind that the Dentistry Course of UNISUL is recent and root canal treatments started to be carried out during the second semester of 2015, the objective of the present study was to evaluate the success rate of endodontic treatments performed by undergraduate students from UNISUL, Pedra Branca, between August 2015 and July 2017.

MATERIALS AND METHODS

This study was approved by the Human Research Ethics Committee of the University of Southern Santa Catarina (n°. 2.358.506). All patients over the age of 18 who had at least one endodontically treated tooth carried out in between August 2015 and July 2017 were included in the study. After

analyzing the medical history and identifying the endodontic treatment, patients were called to the follow-up. Firstly, patients signed the Free and Informed Consent Form (IC). Then, all pre and intraoperative information contained in the endodontic clinical record and the information obtained from observing the final radiograph (after treatment conclusion) were entered into a database in an Excel spreadsheet. The data collected and analyzed are described in table 1.

The determination of postoperative conditions was carried out through clinical and radiographic examination (Table 1). Upon clinical examination, it was observed whether there was any mucosa alteration, such as the presence of sinus tract or swelling. The tooth was also subjected to the vertical percussion test, with the aid of a mirror handle, by gently tapping the incisal/occlusal region, to the long axis direction. The patient's response, positive or negative for painful symptoms, was recorded. It was also

Table 1. Pre, intra and postoperative information, and distribution of followed-up endodontically treated teeth according to the variables analyzed.

Pre and intraoperative information		N	%
Age	> 45 years	11	40.74
	< 45 years	16	59.26
Gender	Male	6	22.23
	Female	21	77.77
Residence	Palhoça	27	100
	Other	0	0
Tooth	Anterior	17	53.13
	Posterior	15	46.87
Jaw	Mandible (lower)	12	37.5
	Maxilla (upper)	20	62.5
Root canal	Single	29	90.63
	Multiple	3	9.37
PAI	Absent (PAI = 1 or 2)	20	62.5
	Present (PAI ≥ 3)	12	37.5
Root canal filling length	Adequate (1 mm short of the radiographic apex)	24	75
	Inadequate (≥ 2 mm short of the radiographic apex);	8	25
	Overfilled	0	0
Root canal filling density	Adequate/homogeneous	22	68.75
	With empty spaces	10	31.25
Root canal perforation	Absent	32	100
	Present	0	0
Fractured Instrument	Absent	32	100
	Present	0	0
Number of sessions	Single	0	0
	Multiple	32	100
Postoperative information			
Signs and symptoms	Absent	26	81.25
	Present	6	18.75

observed whether the tooth was restored and, if so, the restorative material present, whether temporary or permanent.

Digital periapical radiographs were acquired by using a conventional X-ray device (Dabi Atlante Spectro 70x selectronic, Ribeirão Preto, SP, Brazil) and image receptors of Intraoral phosphor plates S2 - Periapical (Dürr Dental, Bietigheim- Bissingen, Baden-Württemberg, Germany). All radiographs were taken following the same standardization, and then the plates were scanned (VistaScan Mini View, Dürr Dental). The scanned images had their brightness and contrast treated with the aid of the DBSWIN software (DBSWIN 5.10.1, Dürr Dental). Afterwards, they were saved as JPEG, for later analysis by a single, previously calibrated examiner. Only Zoom tool was allowed.

To identify teeth with AP, the periapical index (PAI) was used. It consists of five categories; each representing a step on an ordinal scale from sound periapical bone to severe AP. Calibration to PAI was performed as described by Ørstavik et al.⁹ A tooth assigned score 1 or 2 was diagnosed as healthy; whether the scores 3, 4 or 5 were given it a diagnosis of AP. Endodontic success was characterized by the absence of signs and symptoms, and absence of AP (PAI 1 or 2) or presence of periapical lesion in repair phase. It was considered as endodontic failure teeth with signs and/or symptoms, and presence of AP (PAI \geq 3), either due to maintenance, increase or appearance.

STATISTICAL ANALYSIS

The study population was described and the association between

success and pre, intra and post-operative conditions were studied, in order to identify the potential indicators related to the endodontic treatment success/failure. The frequencies of each criterion were calculated, and the data analyzed using the Chi-Square test ($\alpha = 5\%$). All analyzes were performed using the SPSS 21.0 software (IBM, Armonk, NY, USA).

RESULTS

General data are shown in table 1. One hundred twenty-four patients were contacted for the endodontic follow-up. However, only 27 (21.77%) attended for clinical radiographic control. Three patients had two teeth with endodontic treatment, and one patient had three treated teeth. Therefore, 32 endodontic treatments were analyzed. Of the 124 patients, 56 no longer had the same phone number; 30 were willing to participate in the research but did not appear on the day of the control; and 11 could not attend on the established dates.

Regarding the age of the patients, 59.26% corresponded to the age group below 45 years; and women represented the most notable portion of the sample (77.77%). All patients lived in the municipality of Palhoça (Santa Catarina, Brazil).

Of the 32 endodontic treatments evaluated, most were performed on anterior teeth (53.13%), upper teeth (62.5%), and presented a single canal (90.63%). In addition, all treatments were performed in multiple sessions.

The analysis of radiographs taken immediately after endodontic treatment conclusion showed only 37.5% of teeth associated with periapical

lesions (PAI \geq 3). Regarding the quality of root canal filling, 75% were performed at the appropriate length and 68.75% presented adequate / homogeneous density. There were no cases of perforation or instrument fracture during treatment.

Upon clinical examination performed during follow-up, it was observed that 100% of teeth were restored, but less than half (43.75%) had permanent material. Associated painful symptoms were observed in 18.75% of cases, characterized as positive during the vertical percussion examination.

Upon radiographic examination at the follow-up, 23 teeth (71.87%) did not show any sign of AP (PAI 1 or 2) (Fig. 1). In 6 cases the periapical lesions were in the regression phase, evidenced by the continual formation of bone tissue (Fig. 2). However, in 3 cases AP was observed only in the follow-up (PAI \geq 3), that is, they appeared after the endodontic treatment (Fig. 3).

Nine cases (28.13%) were considered failure and, consequently, indicated for retreatment, either because they were associated with symptoms (6 cases), or because there was a periapical alteration (3 cases). Of these 9 treatments, 5 cases were related to unsatisfactory root canal filling, regarding the obturation length (under-filled), the density (empty spaces in the obturation form), or both. In addition, 88.88% of the failure cases had temporary restorative material. Association was observed only between the number of root canals and symptoms ($P = 0.049$). Two of the 3 treated teeth with multiple root canals showed symptoms at the follow-up. Thus, the endodontic success rate was 71.87%.

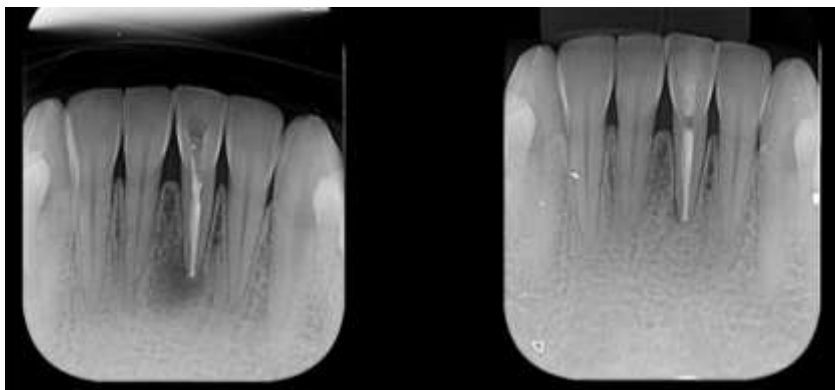


Figure 1. Total regression of the periapical lesion associated with the root apex of element 31 after 1 year and 7 months.

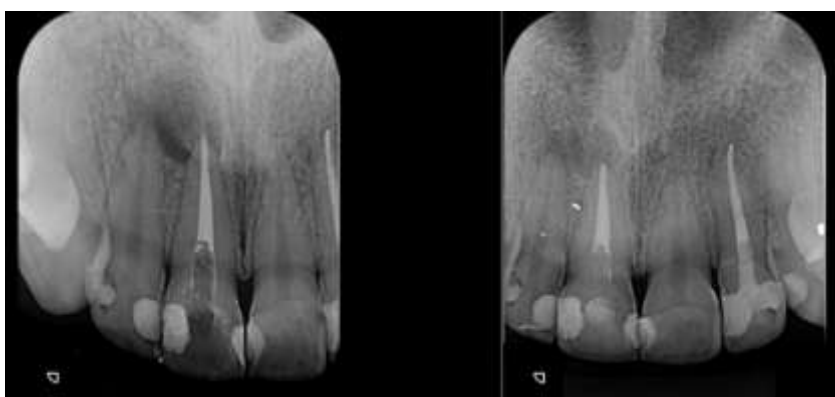


Figure 2. Periapical lesion in repairing phase associated with the root apex of element 11 after 1 year and 7 months.

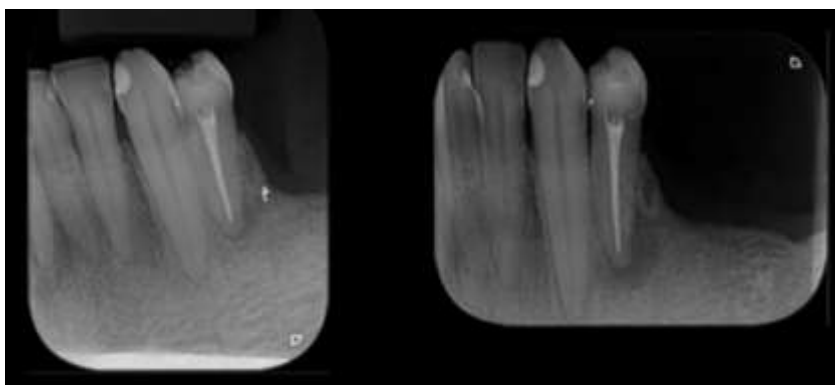


Figure 3. Periapical lesion associated with the root apex of element 34 after 1 year and 10 months.

DISCUSSION

It is known from previous studies that root canal filling length, homogeneity, and existing complications all influence endodontic treatment outcome.¹⁰ In addition, preoperative, intraoperative, and postoperative parameters also contribute to endodontic failure or success. AP detection, for example, represents an important preoperative

factor that may influence the outcome of root canal treatment; thus, early diagnosis is essential.¹¹⁻¹² The diagnosis is made by clinical examination and imaging resources. Periapical radiographs are still the choice most routinely employed. Although the cone beam computed tomography allows the AP detection after 7 days of its appearance,¹³ it is not part of the routine for diagnosis in most Universities. The most popular PAI, used in the present

study, in which periapical lesions are classified into 5 scores,⁹ is based on a 2-dimensional (2D) radiologic method and cannot be applied to 3-dimensional imaging.

In the present study, the endodontic treatment outcome of a select number of patients treated at UNISUL between August 2015 and July 2017, was assessed on both clinical and radiographic criteria, as recommended by the European Society of Endodontology¹⁴ and American Association of Endodontics.⁵

Although 124 patients underwent endodontic treatment during this period, only 21.77% attended for clinical and radiographic follow-up. This low rate of patients is in line with reports in the literature,¹ and limits the extrapolation and generalization of results. Therefore, the findings of the present study represent the clinical condition of the 32 endodontic treatments analyzed.

Of the 12 cases (37.5%) with periapical lesion associated with the root apex when endodontic treatment was concluded, 50% progressed to full regression in the follow-up; the other 50% were in repair phase. These findings corroborate with the literature, which shows that preoperative AP presence might be a factor with significant impact on periapical status and with adverse influence on treatment outcome,¹⁵⁻¹⁶ Of the total followed-up cases, only 9.37% (3 cases) presented an image compatible with periapical lesion (PAI \geq 3), not previously observed, which implies the failure of the therapy. This percentage, however, is much lower than the relatively high prevalence shown in other studies, which ranges from 30% to 65%.^{7,17-18} Still, of these 3 cases, 2 were teeth with multiple canals. Bearing in

mind that treatments are performed by undergraduate students, it is possible that the anatomical complexity of the root canal system has hindered the correct disinfection and root canal filling. The high prevalence of inadequate treatments has been strongly related to the high prevalence of AP after endodontic treatment.⁷

Of the 9 unsuccessful cases, 5 had inadequate root canal filling, either because they were under-filled or with empty spaces in the obturation material. Deficient root canal fillings are related to a less favorable prognosis and are one of the main causes of failure in endodontic therapy.¹⁹ Even if the steps prior to obturation are performed properly, if the hermetic sealing and the complete root canal filling is not obtained, the chances of failure become high.²⁰ In inadequately treated teeth, there is increased chance for persistence or emergence of intraradicular infection, which is the prime cause of post-treatment apical periodontitis.⁶ It is worth pointing out that the quality of treatment was inferred by the quality of filling as determined by radiographic analysis. Nevertheless, in the present study, teeth ranked as adequately treated were also considered as endodontic failure due to the positive response to the vertical percussion test (18.75%).

Another factor that may exert some influence on the endodontic outcome, whether due to periradicular status or percussion pain, is the quality of coronal restoration.²¹ In the present study, a high prevalence of teeth with inadequate coronal restorations, i.e. temporary restorations (56.25%), was observed. Of the 9 unsuccessful cases, 8 (88.88%) teeth were restored with temporary material. Coronal leakage has also been demonstrated to contribute to

treatment failure. The optimum outcome seems to depend on the tooth being adequately treated as a continuum, with both endodontic treatment and coronal restoration following acceptable standards. The role of coronal restoration in the continuum is certainly to help prevent reinfection, but restoration of occlusal function may also influence bone healing and remodelling after endodontic treatment.⁷ One study reported that good post endodontic restorations resulted in significantly more successful cases when compared with good endodontics (80 vs 75.7%), and poor restorations resulted in significantly more periradicular inflammation cases when compared with poor endodontics (30.2 vs 48.6%).²²

In the present study, the overall success rate was 71.87%, higher than the 61% found by Moreno et al⁷ (2013) and inferior than the 85% found by Craveiro et al⁴ (2015). Nonetheless, previous studies, most performed by general clinicians in a large number of countries, have reported high frequencies of periradicular lesions and poorly filled root canals.^{2,19,23-25}

Evaluations such as the proposed in the present study stands as an important source of information because it allows an analysis of the overall health situation and the prevalence of both disease and treatment in a given population at a certain point in time. Data on the current situation of a given disease or the quality of treatment in a selected population may serve as a basis for the establishment of intervention strategies and further improvements in provision of healthcare services.

CONCLUSION

Despite the limited sample size, the results of this study partially corroborate with data from previous studies. It confirms the importance of identified predictors, including the quality of initial treatment and number of root canals, as significant factors in the treatment outcome. Thus, based on the 32 endodontic treatments performed by undergraduate students of the University of Southern Santa Catarina, Pedra Branca, between August 2015 and July 2017, the success rate was 71.87%.

Within the limits of this study, this work highlights the reliability of the initial endodontic treatment when performed by academic undergraduation students.

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The authors deny any conflict of interest.

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