

## ORIGINAL RESEARCH

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## Clinical possibilities and problems related to endodontic re-treatments.

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### Abstract

**Introduction:** Technological advancements in endodontic dental materials and equipment and tools for endodontic treatments have led to a major evolution in root canal treatment (RCT). **Aim of the study:** Analyzing how different factors affect the chances of successfully achieving an initial RCT is also related to finding clinical reasons for not achieving this goal. **Material and Methods:** The study was carried out on a total of 60 patients. The patients included in the study were divided according to the number, type of tooth, or group of teeth indicated for endodontic re-treatment (ERTs) as a result of the confirmed presence of persistent apical periodontitis. The aim of this study is to analyze how different factors affect the possibilities of achieving successful initial RCT. **Results:** The highest number of teeth initially treated endodontically and then presented with persistent apical periodontitis is presented under the category of molars in the value of about 52% of all teeth evaluated for this study. This value is followed by premolars at a value of about 32% and then by incisors at a value of 16%. The distribution of the affected teeth is 50% in maxilla and 50% in mandible, where both according to gender of patient and according to the arches where the teeth affected by the pathology of persistent apical periodontitis are included, the ratio is clearly 1:1. **Conclusions.** The primary reason for ERTs is the security of having an endodontically healthy tooth as an abutment for fixed prosthetic replacements and in rare cases it is indicated to be performed if the patient actually complains of pain. The clinical challenges of ERTs are mainly oriented around the application of the correct steps of the routine protocol of RCTs.

**Keywords:** endodontic re-treatment, apical periodontitis, clinical success.

### Introduction

The skill of the clinician determines whether root canal treatments (RCTs) are successful or unsuccessful, providing the clinician with the "professional gratification" of accomplishment or even the "murder of conscience" for clinical achievement [1,2]. However, this clinical picture must first be simplified, without discussing any personal matters of the professional, as the use of RCT with great clinical competence may result in unfavorable or even beneficial clinical outcomes [2-5].

In the field of endodontic re-treatments (ERTs), scientific research is oriented from the professional emotions of professional satisfaction or dissatisfaction, from the professional ego, and from the belief that one is a more accomplished professional than the first professional who came to the clinic with the endodontic success of the patient's tooth [1,3,6-10]. Since chronic apical periodontal

pathology provides a very good explanation for everything that happens and results in clinical failure, the term "post-endodontic treatment event" is more accurate than "clinical endodontic failure" [4,9,11-14].

Regardless of the fact that the clinical success of RCTs reaches high numbers, the clinical endodontic failure is expressed in a low percentage due to the large number of cases. The success of the ERT is another issue that is again interpreted by the endodontist as an expression of the emotions of professional satisfaction or dissatisfaction [15-19]. This is the key issue of ERTs since, in order to achieve success in cases of ERTs, the reason for the initial clinical success of the first RCT must first be clearly understood [1,6,19-23].

After finding the reason, the professional must find the modification in the routine RCT protocol to be suitable for the endodontic treatment to achieve clinical success at the end of it [17,24-27].

The reasons for endodontic clinical success, regardless of the fact that they can be numerous and diverse in their categorization, all appear with the pathology of persistent apical periodontitis, which is associated with specific clinical signs that are referred by the patient presenting for ERT [2,8,27-31]. The initial causes that come to mind are causes that explain the errors during the application of the routine RCT protocol, including the wrong opening of the pulp chamber, not finding all the pulp canals correctly, and errors in the chemical-mechanical processing of the canal or mistakes that have to do with the wrong apical filling or sealing of the root canals of the treated teeth [28-29,32-35].

Among the pathological causes that lead to the need for re-treatment can be included the promotion of epithelial tissue residues in the root canals, malassez residues, which can also lead to the reactivation or aggravation of the cyst as a pathology beyond the pathology of the persistent apical periodontitis [36-40]. Since persistent apical periodontitis is naturally infectious, it is understood that its causes are of an infectious nature, introducing persistent intraradicular bacteria, or bacteria of extra-canal origin, the reaction of a foreign body and cysts.

Looking at these subcategories, they can also be related to the specific procedures included in the initial RCT protocol [1,6,41-43]. If we divide them into two groups, the first group includes the bacterial origin of the post-treatment pathology, which can also be explained by the wrong opening of the pulp chamber and the wrong processing of the canal, while the second group includes the mechanisms of action of tissues or cells of the treated patient's host, which, in a reduced percentage, are somewhat less controllable by the endodontic clinician who checks the accuracy of the RCT application [44-50].

### Material and methods

The study is oriented around the collection of clinical data on ERTs, on the reasons for endodontic re-treatments, on clinical signs and complaints of patients about previous RCTs, in order to compare the values encountered. The aim of this study is to analyze how different

factors affect the possibilities of achieving successful initial RCT and to find the clinical reasons for not achieving this goal, which leads the patient to ERT. The dental canal morphological anatomy of the teeth affects the clinical approach and the correct application of predetermined protocols of RCTs, facts that are already known and supported by published literature sources. In this study, we intend to find the frequency of ERTs depending on the positioning of the tooth in the respective arches, depending on the type of tooth based on its function. The study is retrospective.

This study was approved by the Institutional Ethics Committee of Albanian University (02.06.2019), Tirana, Albania, according to national regulations.

Unsuccessful RCTs and the changes caused by them in the periapical hard tissues, significant changes at the microscopic level, but with sensitive clinical expressions and referable by the patient, affect the status of the oral cavity, expressed in the increased effect also of the etiological factors causing dental pathologies that increase with the increase in the number of years of their time-action.

In this perspective, this study aims to evaluate the initially unsuccessful endodontically treated teeth, seen in a comparative way with radiographic evaluation of the result of the ERT. The specific objectives of the study are to evaluate:

1. The number of teeth indicated for ERT, divided by gender of the patients included in the study.
2. The number of teeth indicated for ERT divided according to the arch to which the tooth belongs and according to the classification of the types of teeth depending on their function.
3. Evaluation of initial RCTs classified based on the quadrants of teeth indicated for ERTs in order to evaluate the approach, manual skill, and anatomical difficulty encountered during RCTs from this perspective.
4. The presence of periapical pathologies as an indication for ERT, evaluated on the basis of the clinical reason for the non-success of RCT.

The study of this topic is based on the processing of data collected from patients who had previously agreed to be included in the study. The patients included in the study were patients presenting to two dental clinics with the aim of ERT of the tooth or teeth presented with clinical or non-clinical signs of persistent apical periodontitis in the period May 2023-December 2023 (8 months). Stages of the work protocol:

- Demographic data of the patients were recorded,
- Radiographic examinations of teeth/teeth with persistent apical periodontitis were performed;
- The number of natural teeth was recorded;
- From the radiographic examination of the teeth, the reason for the clinical success of the initial RCT was evaluated;
- The classification of the teeth included in the study was performed based on the recorded radiographic signs of pathology of apical periodontitis presented after the initial RCT.

All patients included in the study were patients who underwent dental interventions of various specialties after recording the data necessary for the further processing indicated for this study. There was no predetermined randomization rule for the inclusion of patients in the registry. The inclusion or non-inclusion conditions of the patients were submitted to the inclusion criteria of the patients.

The criteria for the selection of patients included in the study are as follows:

1. Patients with persistent apical periodontitis after an initial RCT were selected.
2. Patients who were willing and able to cooperate for accurate data collection

3. Patients who agreed to be included in radiographic evaluation after verbal consent.

The statistical analysis of the data was carried out by means of the McNemar test for comparing the frequency of occurrence of persistent apical periodontitis depending on the gender of the patients and the type of tooth indicated for ERT. Fisher's Test was used to make the comparison in the 2x2 contingency table. p values smaller than 0.05 were considered statistically significant. The statistical analysis was carried out mainly by means of the MS Excel software.

The study was carried out on a total of 60 patients, of whom 23 patients were female and the remaining 37 were male. The patients included in the study were divided according to the number, type of tooth, or group of teeth indicated for ERT as a result of the confirmed presence of persistent apical periodontitis.

With the goal of collecting the most accurate clinical data, the correct implementation of the data recording protocol needed for further statistical processing specific to this study was needed.

## Results

The data collection was carried out based on the selection criteria of the patients included in this study, and after their processing for this study, they are presented in the following tables.

Table 1 shows data collected from the patients included in the study based on the number of root canal-treated teeth in the oral cavity, recorded and evaluated radiographically for this study, classified according to the category of patients' gender in male:female ratios.

**Table 1.** Distribution of patients based on the number of root canal-treated teeth in the oral cavity, according to sub-classifications 1 tooth, 2 more teeth, and gender of patients.

Endodontically treated teeth	1 tooth	2 or more teeth	Total	Fisher test P value
Male	30 – 50%	7 – 12 %	37 – 62%	<b>Statistic value is 0.3562.</b>
Female	16 – 27%	7 – 12%	23 – 38%	
<b>Total</b>	46 – 77%	14 – 24%	60 – 100%	
<b>Significance Level: .05</b>		<b>The result is <i>not</i> significant at <math>p &lt; .05</math>.</b>		

The gender of the patients and the type of tooth with persistent apical periodontitis is another piece of data collected from the patients included in the study. These data are presented in Table 2. Table 2 shows the data

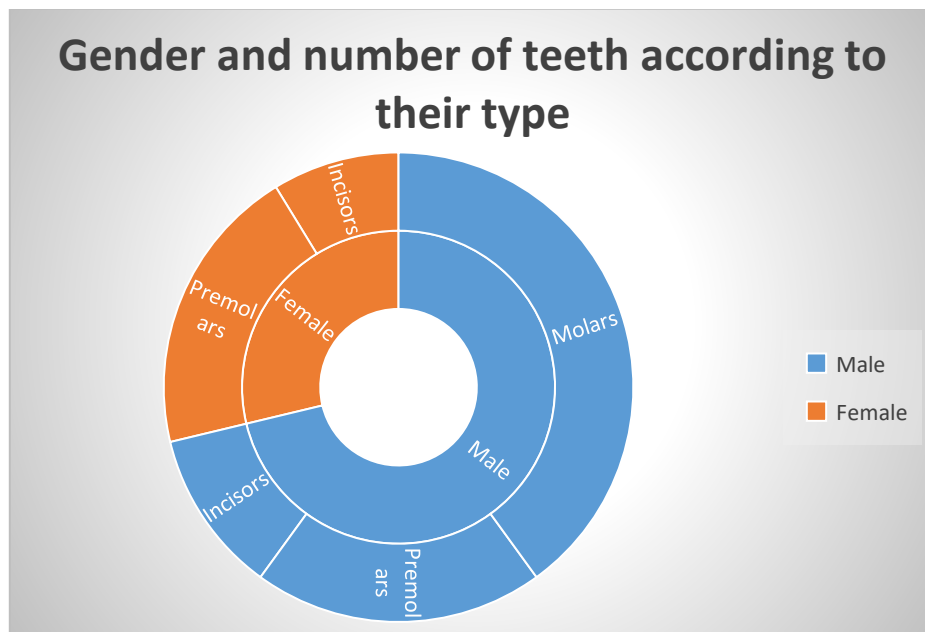
about how the gender of the patients can affect the appearance of persistent apical periodontal pathology in the oral cavity of the patients included in this study.

**Table 2.** Categorization of patients depending on gender and number, by type, of teeth initially treated endodontically and presented with persistent apical periodontitis.

Patients	Incisors	Premolars	Molars	Total
Male	7 – 9%	12 – 16%	24 – 32%	44 – 58%
Female	5 - 7%	12 – 16%	15 – 20%	32 – 42%
<b>Total</b>	12 – 16%	24 – 32%	39 – 52%	76 – 100%

Figure 1 shows the data from Table 2 on the influence of gender on the number of teeth with persistent apical periodontitis in the oral cavity, classified by the type of teeth according

to the gender classification of the patients included in the study.



**Figure 1.** Graphical presentation of the data of table 3 showing how gender affects the number of teeth with persistent apical periodontitis and the type of these teeth.

Table 3 shows the same data as Table 2, but it is easier to understand the distribution of the teeth included in the study depending on the gender of the patient and the jaws where

persistent apical periodontal pathology is presented regardless of the number of teeth treated and retreated afterwards.

**Table 3.** Categorization of patients according to the positioning of the teeth in the jaws and gender, also showing the calculation of dependency or not.

Number of clinical cases	Mandible	Maxilla
Male	19 – 32%	18 – 30%
Female	11 – 18%	12 – 20%
<b>Total</b>	<b>30 – 50%</b>	<b>30 – 50%</b>

Table 4 shows the data about the unsuccessful RCT of teeth based on the classification of patients by gender and the classification of

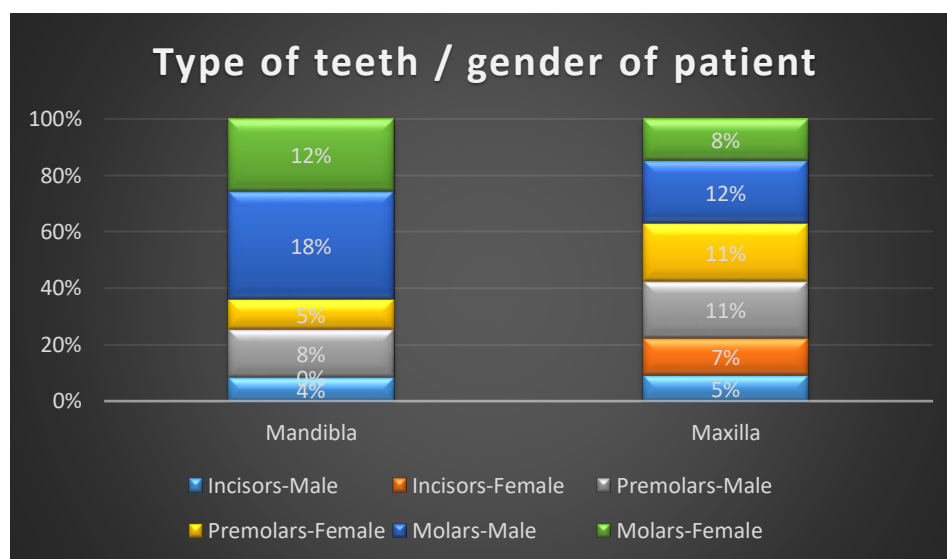
teeth according to their position in which arch and according to their type as incisors, premolars, and molars.

**Table 4.** Data on the initial RCT of teeth in the oral cavity presented with persistent apical periodontitis, classified according to the type of tooth, positioning in the arch, and gender of the affected patient.

Endodontically treated teeth	Incisors		Premolars		Molars		Total
	Male	Female	Male	Female	Male	Female	
<b>Mandible</b>	3 - 4%	0 – 0%	6 - 8%	4 - 5%	14 - 18%	9 - 12%	<b>36 – 47%</b>
<b>Maxilla</b>	4 - 5%	5 – 7%	8 - 11%	8 – 11%	9 - 12%	6 - 8%	<b>40 – 53%</b>
<b>Total</b>	<b>7 - 9%</b>	<b>5 - 7%</b>	<b>14 - 19%</b>	<b>12 – 16%</b>	<b>23 - 30%</b>	<b>15 - 20%</b>	<b>76 – 100%</b>

Figure 2 shows the data of table 4 according to the categorization of patients depending on the

type of root canal-treated teeth and the gender of the patients.



**Figure 2.** Graphic presentation of the data presented in table 4, on the distribution of patients according to the number of root canal-treated teeth and the gender of the patients.

Table 5 shows the data collected from the patients included in the study where ERT was performed, classified on the basis of the reason

for ERT based on the patient's history and the preliminary radiographic evaluation.

**Table 5.** This table shows the data on the reason for ERT evaluated from the data of the patients' anamnesis and the initial radiographic examination, depending on the patient's gender.

Patients Reason for endodontic re-treatment	Male	Female	Total of patients
Dental prosthetics	21 – 35%	16 – 27%	37 – 62 %
Routine examination	5 – 8%	1 – 2%	6 – 10%
Periodontology	1 – 2%	0 – 0%	1 – 2%
Dental pain	9 – 15%	5 – 8%	14 – 23%
Orthodontics	0 – 0%	1 – 2%	1 – 2%
Dental Therapy	1 – 2%	0 – 0%	1 – 2%
<b>Total</b>	<b>37 – 62%</b>	<b>23 – 38%</b>	<b>60 – 100%</b>

Table 6 shows data on clinical challenges encountered during unsuccessful RCT.

**Table 6.** This table presents the collected data based on the clinical reasons for the endodontic failure of the initial RCT of the teeth included in the study.

No.	Number of clinical cases Reason for endodontic failure	Number of clinical cases	Treatment protocol
	Treatment protocol		
1	Opening of the pulp chamber	12 – 20%	86%
2	Canal endodontic processing	25 – 42%	
3	Incorrect treatment protocol	5 – 8%	
4	Periapical tissue changes	10 – 16%	
	Tooth anatomy		
5	Tooth-root morphology	7 – 12%	15%
6	Bifurcation % of deviation	1 – 3%	
	Total	60 cases	100%

## Discussions

Based on the data in Table 1, the distribution of patients by gender is clearly visible. The condition for the inclusion of patients in the study was not reaching a number of patients with a 1:1 ratio by gender. Here it is clear that the selection of patients was carried out in accordance with the inclusion criteria mentioned above and without assuming the achievement of a preconditioned ratio according to gender. However, this ratio for this study was a 2:1 male:female ratio. Data supported by Kirkevang et al. where it is stated that women have more teeth treated

endodontically due to persistent apical periodontitis than men, and molars are the ones that occupy the main place [45].

Based on the data in table 1 regarding the number of teeth with persistent periodontitis depending on the number of affected teeth in the oral cavity expressed also depending on the gender of the patients, the male:female ratio for cases where there is 1 tooth affected by persistent periodontitis is 2:1, and in cases where there are 2 or more affected teeth, this ratio goes to 1:1 values. The sample of patients selected for this study is more similar to cases where in the same oral cavity there are 2 or

more teeth affected by persistent apical periodontitis. Despite this similarity, it is noted that again, the comparison and assessment according to the Fisher test gender have no direct impact on the frequency of persistent apical periodontitis in the oral cavity, supported by the calculation of the p value that does not show significant significance. This is supported by the study of Solette et al. [44].

Based on data in Table 2, it is clear that the highest number of teeth initially root canal-treated and then presented with persistent apical periodontitis is presented under the category of molars in the value of about 52% of all teeth evaluated for this study. This value is followed by premolars at a value of about 32% and then by incisors at a value of 16%. Thus, depending on the number of teeth affected by persistent apical periodontitis according to their type, the ratio of incisors: premolars; molars is presented in the values of 1:2:3, where the most affected teeth are molars. Data are also supported in other studies [44,45].

From the data in table 2, a closer male-female ratio of 1:1 can be seen in terms of the number of teeth affected by persistent apical periodontitis. Age, gender, and race have no influence on the clinical success rate of root canal-treated teeth. This result is supported by Nazih Shaaban Mustafa et al. [46].

Table 3 with its data once again shows that gender not only does not affect the frequency of persistent apical periodontitis pathology but also the distribution of this pathology in the oral cavity as assessed by the position in the oral cavity of the affected tooth. In the inclusion of patients in this study based on the inclusion criteria, this uniformity of the sample of patients taken for radiological evaluation of the aforementioned pathology is clearly expressed in Table 3, where the distribution of the affected teeth is 50% in the maxilla and 50% in the mandible, where both according to gender and according to the arches where the teeth affected by the pathology of persistent apical periodontitis are included, the ratio is clearly 1:1. Data that are consistent with other studies [47,48]. In this uniformity of the sample of teeth, we try to show in Table 4 the

distribution of teeth according to their type and positioning in the arch.

Based on the data in Table 4, what is observed is that the ERT in the highest frequency is performed in the mandibular molars in the male gender in the value of 18% and in the mandibular incisors in the female gender in the value of 0% as the most reduced frequency [1]. Considering the type of teeth, 16% for the incisors, but with higher values for the female gender in the maxillary teeth; for premolars, this value goes to 35%, with the highest value for maxillary premolars, regardless of gender, i.e., the same for women and men; for molars, a frequency of 50% is observed in values where the highest frequency is in mandibular molars in men and the lowest in maxillary molars in women in a ratio of almost 2:1. In terms of endodontic re-treatment depending on the type of teeth according to the function and according to the positioning in the arch, it is noticed that there are significant differences depending on the gender of the patient [27,34,50].

Based on the data in Table 5, it is clear that there is a high tendency for prosthetic replacements and for the safety of the endodontic health of the tooth that will serve as a prosthetic cult, a tendency that is expressed in the values of 62%, where the male gender has a tendency of 35% and female gender in the value of 27%. The second reason why ERT is required is pain, one of the clinical signs of persistent apical periodontitis. And this is more expressed in the male gender in the value of 15% and in the female gender in the value of only 8%. Here, persistent periodontitis differs from the clinical signs of an acute pathology, while the routine examination of the teeth establishes painless chronic apical periodontitis only in 10% values, almost half of the incidence of persistent chronic apical periodontitis. Data supported by the study conducted by Rawski et al. [49]. These data are also supported by Tabussum et al. [50].

From the data presented in Table 6, it is clearly shown that the most frequent reason for clinical failure of the initial RCT is the treatment protocol and the way of opening the pulp chamber; mainly, this is evidenced by clinical cases due to the presence of cervical

shoulders in the mesial areas of the molars and in the lingual areas of the incisors. This element is evaluated radiographically from the orientation of the canal filling material. However, 12% is the endodontic error due to the morphology of the root canal-treated tooth, mainly the bayonet curves at the roots of the premolars (4,7,12,25,34). The presence of a deep bifurcation in the root of the tooth is expressed in almost 3% of clinical cases, whereas 42% is the error of the operator in the processing of the canal, i.e., in not finding the correct length of the canal, which in its continuity is also visible in the radiograph. The presence of inadequate isolation of the apical third of the tooth root is found in 16% of clinical cases where this fact is also expressed by the presence of periapical changes visible on radiographs. (19,25,32) Mummification as an old method of RCT is expressed in 8% of clinical cases included in this study. Seen in the angle of view if they are anatomy and morphology of the tooth, the reason why clinical success is not achieved, this element is expressed in 15% of cases clinical, while the professional's manual and theoretical ability to achieve clinical endodontic success that is expressed in 85% reasons for endodontic errors (25,43).

## Conclusions

The gender of the patient has no direct influence on the frequency of persistent apical periodontitis in the oral cavity; this is expressed by the number of teeth affected by the condition. Depending on the number of teeth affected by persistent apical periodontitis according to their type, the ratio of incisors: premolars: molars is presented in the values 1:2:3, where the most affected teeth are molars. ERTs as a reason for clinical application have in fewer cases the pain and in more frequent cases the security of having a root canal-treated tooth for fixed prosthetic replacements. The clinical challenges of ERTs are mainly oriented around the application of the correct steps of the routine protocol of ERTs. In infrequent clinical cases, professionals encounter anatomical and morphological difficulties of the teeth.

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## Conflict of interest

None to declare.

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## References

- Abbott PV. Present status and future directions: Managing endodontic emergencies. *Int Endod J.* 2022 May;55 Suppl 3:778-803. doi: 10.1111/iej.13678. Epub 2022 Jan 13. PMID: 34958512.
- Gulabivala K, Ng YL. Factors that affect the outcomes of root canal treatment and retreatment-A reframing of the principles. *Int Endod J.* 2023 Mar;56 Suppl 2:82-115. doi: 10.1111/iej.13897. Epub 2023 Feb 10. PMID: 36710532.
- Aga N, Thakur MK, Agwan MAS, Eisa M, Habshi AY, Azeem S. Evaluation of Quality of Endodontic Re-Treatment and Changes in Periapical Status. *J Pharm Bioallied Sci.* 2021 Jun;13(Suppl 1):S379-S382. doi: 10.4103/jpbs.JPBS\_814\_20. Epub 2021 Jun 5. PMID: 34447114; PMCID: PMC8375949.
- Alharmoodi R, Al-Salehi S. Assessment of the quality of endodontic re-treatment and changes in periapical status on a postgraduate endodontic clinic. *J Dent.* 2020 Jan;92:103261. doi: 10.1016/j.jdent.2019.103261. Epub 2019 Dec 9. PMID: 31821854.
- Jin HR, Jang YE, Kim Y. Comparison of Obturation Quality between Calcium Silicate-Based Sealers and Resin-Based Sealers for Endodontic Re-treatment. *Materials (Basel).* 2021 Dec 23;15(1):72. doi: 10.3390/ma15010072. PMID: 35009220; PMCID: PMC8745997.

6. Dioguardi M, Di Gioia G, Illuzzi G, Arena C, Caponio VCA, Caloro GA, Zhurakivska K, Adipietro I, Troiano G, Lo Muzio L. Inspection of the Microbiota in Endodontic Lesions. *Dent J (Basel)*. 2019 May 1;7(2):47. doi: 10.3390/dj7020047. PMID: 31052361; PMCID: PMC6630690.
7. Zubizarreta-Macho Á, Ferreiroa A, Agustín-Panadero R, Rico-Romano C, Lobo-Galindo AB, Mena-Álvarez J. Endodontic re-treatment and restorative treatment of a dens invaginatus type II through new technologies. *J Clin Exp Dent*. 2019 Jun 1;11(6):e570-e576. doi: 10.4317/jced.55840. PMID: 31346380; PMCID: PMC6645261.
8. Bağ İ, Çalışkan S, Erenel AO, Sevimli KN, Candan M. Does the Modality of Dental Treatment Affect the Treatment Prognosis and the Necessity of Re-Treatments? *Children (Basel)*. 2023 Oct 19;10(10):1705. doi: 10.3390/children10101705. PMID: 37892368; PMCID: PMC10605608.
9. Kaviani N, Marzoughi S, Shafahi M, Salari-Moghaddam R. The frequency and the etiology of re-treatment in patients and candidates for dental procedure under general anesthesia. *Dent Res J (Isfahan)*. 2023 Jan 18;20:9. PMID: 36820139; PMCID: PMC9937936.
10. Rohra MR, Shah PB, Arora AV, Kapoor SV, Rana HB. Evaluation of volumetric substance loss and precision in targeted endodontic re-treatment with guided versus conventional access cavity preparations: An in vitro study. *J Conserv Dent*. 2023 Mar-Apr;26(2):221-225. doi: 10.4103/jcd.jcd\_618\_22. Epub 2023 Mar 16. PMID: 37205887; PMCID: PMC10190081.
11. de Kuijper MCFM, Meisberger EW, Rijpkema AG, Fong CT, De Beus JHW, Özcan M, Cune MS, Gresnigt MMM. Survival of molar teeth in need of complex endodontic treatment: Influence of the endodontic treatment and quality of the restoration. *J Dent*. 2021 May;108:103611. doi: 10.1016/j.jdent.2021.103611. Epub 2021 Feb 19. PMID: 33617944.
12. Al-Abdulla N, Bakhsh A, Mannocci F, Proctor G, Moyes D, Niazi SA. Successful endodontic treatment reduces serum levels of cardiovascular disease risk biomarkers-high-sensitivity C-reactive protein, asymmetric dimethylarginine, and matrix metalloprotease-2. *Int Endod J*. 2023 Dec;56(12):1499-1516. doi: 10.1111/iej.13979. Epub 2023 Oct 3. PMID: 37787168.
13. Bardini G, Cotti E, Congiu T, Caria C, Aru D, Mercadè M. Medium- and Long-Term Re-Treatment of Root Canals Filled with a Calcium Silicate-Based Sealer: An Experimental Ex Vivo Study. *Materials (Basel)*. 2022 May 13;15(10):3501. doi: 10.3390/ma15103501. PMID: 35629528; PMCID: PMC9145273.
14. Francisco PA, Delboni MG, Lima AR, Xiao Y, Siqueira WL, Gomes BPFA. Proteomic profile of root canal contents in teeth with post-treatment endodontic disease. *Int Endod J*. 2019 Apr;52(4):451-460. doi: 10.1111/iej.13021. Epub 2018 Oct 28. PMID: 30284721.
15. Saimir Heta, Ilma Robo, Vera Ostreni, Eva Haxhiu, Jona Resuli, Blerta Rumano, & Sonila Kapaj. (2022). Aging and Dental Health (Middle Age Versus Geriatric Age). *Journal of Innovations in Medical Research*, 1(4), 1–13. Retrieved from <https://www.paradigmexpress.org/jimr/article/view/297>
16. Francisco PA, Delboni MG, Lima AR, Xiao Y, Siqueira WL, Gomes BPFA. Proteomic profile of root canal contents in teeth with post-treatment endodontic disease. *Int Endod J*. 2019 Apr;52(4):451-460. doi: 10.1111/iej.13021. Epub 2018 Oct 28. PMID: 30284721.
17. García-Guerrero C, Mendoza-Beltrán W, Roldan-Roldan M, Villa-Machado P, Restrepo-Restrepo F. Vertical root fractures: A time-dependent clinical condition. A case-control study in two colombian populations. *J Clin Exp Dent*. 2021 Nov 1;13(11):e1104-e1111. doi: 10.4317/jced.58701. PMID: 34824696; PMCID: PMC8601699.
18. Van Den Munckhof T, Patel S, Koller G, Berkhout E, Mannocci F, Foschi F. Schneiderian membrane thickness variation following endodontic procedures: a retrospective cone beam computed tomography study. *BMC Oral Health*. 2020 May 6;20(1):133. doi: 10.1186/s12903-020-01122-6. PMID: 32375759; PMCID: PMC7204013.
19. Faus-Llácer V, Pérez RL, Faus-Matoses I, Ruiz-Sánchez C, Zubizarreta-Macho Á, Sauro S, Faus-Matoses V. Efficacy of Removing Thermafil and GuttaCore from Straight Root Canal Systems Using a Novel Non-Surgical Root Canal Re-Treatment System: A Micro-Computed Tomography Analysis. *J Clin Med*. 2021 Mar 18;10(6):1266. doi: 10.3390/jcm10061266. PMID: 33803810; PMCID: PMC8003142.
20. Toopalle SV, Yadav I, Gupta A, Chauhan N, Abraham D, Singh A, Mrinalini, Sharma M, Lalfakwami S. Effect of Laser Therapy on Postoperative Pain and Endodontic Retreatment: A Systematic Review and Meta-Analysis. *Int Dent J*. 2023 Nov 18;54(12):6539(23)00945-0. doi: 10.1016/j.identj.2023.10.012. Epub ahead of print. PMID: 37985344.
21. Chen GY, Wu ZF, Lin YT, Cheng KI, Huang YT, Huang ST, Hargono A, Li CY. Association between General Anesthesia and Root Canal Treatment Outcomes in Patients with Mental Disability: A Retrospective Cohort Study. *J Pers Med*. 2022 Feb 3;12(2):213. doi: 10.3390/jpm12020213. PMID: 35207701; PMCID: PMC8876241.
22. Uzunoglu-Özyürek E, Askerbeyli-Örs S, Türker SA. Evaluation of the amount of remained sealer in the

- dental tubules following re-treatment with and without solvent. *J Conserv Dent.* 2020 Jul-Aug;23(4):407-411. doi: 10.4103/JCD.JCD\_445\_20. Epub 2021 Jan 16. PMID: 33623245; PMCID: PMC7883780.
23. Schwendicke F, Rossi JG, Krois J, Basso M, Peric T, Turkun LS, Miletić I. Cost-effectiveness of glass hybrid versus composite in a multi-country randomized trial. *J Dent.* 2021 Apr;107:103614. doi: 10.1016/j.jdent.2021.103614. Epub 2021 Feb 19. PMID: 33617942.
24. Baraba A, Rajda M, Baršić G, Jukić Krmek S, Šnjarić D, Miletić I. Efficacy of Shock Wave-Enhanced Emission Photoacoustic Streaming (SWEEPS) in the Removal of Different Combinations of Sealers Used with Two Obturation Techniques: A Micro-CT Study. *Materials (Basel).* 2023 Apr 21;16(8):3273. doi: 10.3390/ma16083273. PMID: 37110109; PMCID: PMC10143831.
25. Qutieshat A, Singh G. Breaking the error chain with SEE: cascade analysis of endodontic errors in clinical training. *Med Educ Online.* 2023 Dec;28(1):2268348. doi: 10.1080/10872981.2023.2268348. Epub 2023 Oct 8. PMID: 37807696; PMCID: PMC10563643.
26. Georgiev K, Pecheva A. Deviant morphology of the root canal system in mandibular premolars: clinical cases. *Folia Med (Plovdiv).* 2022 Feb 28;64(1):176-180. doi: 10.3897/folmed.64.e58877. PMID: 35851898.
27. Pedrazzi V, Oliveira-Neto JM, Sequeira-Byron P, Fedorowicz Z, Nasser M. WITHDRAWN: Hand and ultrasonic instrumentation for orthograde root canal treatment of permanent teeth. *Cochrane Database Syst Rev.* 2019 Feb 7;2(2):CD006384. doi: 10.1002/14651858.CD006384.pub4. PMID: 30730577; PMCID: PMC6366532.
28. Garg M, Srivastava V, Chauhan R, Pramanik S, Khanna R. Application of platelet-rich fibrin and freeze-dried bone allograft following apicoectomy: A comparative assessment of radiographic healing. *Indian J Dent Res.* 2023 Jan-Mar;34(1):40-44. doi: 10.4103/ijdr.ijdr\_810\_22. PMID: 37417055.
29. Bruhnke M, Naumann M, Böse MWH, Beuer F, Schwendicke F. Health economic evaluation of forced orthodontic extrusion of extensively damaged teeth: up to 6-year results from a clinical study. *Clin Oral Investig.* 2023 Sep;27(9):5587-5594. doi: 10.1007/s00784-023-05178-w. Epub 2023 Jul 27. PMID: 37498335; PMCID: PMC10492751.
30. Dube K, Dube A, Jain P, Ghosh S, Paul B, Bhatnagar N. Maxillary Mucinous Adenocarcinoma Mimicking a Lesion of Endodontic Origin: A Rare Case Report. *Eur Endod J.* 2023 Jan;8(1):101-104. doi: 10.14744/eej.2022.29200. PMID: 36748450; PMCID: PMC10098463.
31. Cortellini P, Cortellini S, Bonaccini D, Stalpers G, Mollo A. Treatment of Teeth with Insufficient Clinical Crown. Part 1: One-Year Clinical Outcomes of a Minimally Invasive Crown-Lengthening Approach. *Int J Periodontics Restorative Dent.* 2021 Jul-Aug;41(4):487-496. doi: 10.11607/prd.5660. PMID: 34328465.
32. Al Raisi H, Dummer PMH, Vianna ME. How is Endodontics taught? A survey to evaluate undergraduate endodontic teaching in dental schools within the United Kingdom. *Int Endod J.* 2019 Jul;52(7):1077-1085. doi: 10.1111/iej.13089. Epub 2019 Mar 9. PMID: 30706491.
33. Ferracane JL, Hilton TJ, Funkhouser E, Gordan VV, Gilbert GH, Mungia R, Burton V, Meyerowitz C, Kopycka-Kedzierawski DT, Group NDPC. Outcomes of treatment and monitoring of posterior teeth with cracks: three-year results from the National Dental Practice-Based Research Network. *Clin Oral Investig.* 2022 Mar;26(3):2453-2463. doi: 10.1007/s00784-021-04211-0. Epub 2021 Oct 9. PMID: 34628545; PMCID: PMC8898304.
34. Ferracane JL, Hilton TJ, Funkhouser E, Gordan VV, Gilbert GH, Mungia R, Burton V, Meyerowitz C, Kopycka-Kedzierawski DT, Group NDPC. Outcomes of treatment and monitoring of posterior teeth with cracks: three-year results from the National Dental Practice-Based Research Network. *Clin Oral Investig.* 2022 Mar;26(3):2453-2463. doi: 10.1007/s00784-021-04211-0. Epub 2021 Oct 9. PMID: 34628545; PMCID: PMC8898304.
35. Chang Y, Choi M, Wang YB, Lee SM, Yang M, Wu BH, Fiorellini J. Risk factors associated with the survival of endodontically treated teeth: A retrospective chart review. *J Am Dent Assoc.* 2024 Jan;155(1):39-47. doi: 10.1016/j.adaj.2023.09.022. Epub 2023 Dec 6. PMID: 38054916.
36. Matoso FB, Quintana RM, Jardine AP, Delai D, Fontanella VRC, Graziotin-Soares R, Kopper PMP. XP Endo Finisher-R and PUI as supplementary methods to remove root filling materials from curved canals. *Braz Oral Res.* 2022 Apr 15;36:e053. doi: 10.1590/1807-3107bor-2022.vol36.0053. PMID: 35442382.
37. Gallicchio V, Lodato V, De Santis R, Rengo S. Fracture Strength and Failure Modes of Endodontically Treated Premolars Restored with Compact and Hollow Composite Posts Subjected to Cyclic Fatigue. *Materials (Basel).* 2022 Feb 1;15(3):1141. doi: 10.3390/ma15031141. PMID: 35161083; PMCID: PMC8840014.
38. Parirokh M, Hatami N. Conservative Treatment of an Infected Lateral Canal: A Case Report with a 4-Year Follow-up. *Iran Endod J.* 2022 Summer;17(3):156-160. doi: 10.22037/iej.v17i3.37496. PMID: 36704091; PMCID: PMC9869010.
39. Umer F, Adnan N, Khan M, Qureshi MB. The Dilemma Of Management Of Cystic Lesions; An Uncertain Way Forward: A Case Report. *J Pak Med*

- Assoc. 2023 Nov;73(11):2269-2272. doi: 10.47391/JPMA.8601. PMID: 38013545.
40. Ali A, Saraf P, Kamatagi L, Khasnis S. Comparative Assessment of Canal Transportation, Dentin Loss, and Remaining Root Filling Material by Different Retreatment Files An In vitro Cross-Sectional Study. *Contemp Clin Dent*. 2021 Jan-Mar;12(1):14-20. doi: 10.4103/ccd.ccd\_31\_20. Epub 2021 Mar 20. PMID: 33967532; PMCID: PMC8092085.
41. Srirangarajan S, Shashidara R, Ramya R, Harika S, Pritham SN, Ravi RJ, Malagi P, Srikumar P, Ashish S. Mistaken identity of polymorphous low-grade adenocarcinoma treated as periapical lesion in anterior maxilla: A case report. *Aust Endod J*. 2023 Sep;49 Suppl 1:470-475. doi: 10.1111/aej.12723. Epub 2022 Nov 30. PMID: 36448772.
42. Vandana K, Shruti G, Babu J N. Knowledge, attitudes, and perceptions toward informed consent and its implications among dental professionals in South India: A cross-sectional study. *J Indian Assoc Public Health Dent* 2022;20:407-14
43. Saimir Heta, Kers Kapaj, Rialda Xhizdari, Ilma Robo; "Dental Ethics versus Malpractice, as Phenomenon with a Growing Trend"; *International Journal of Medical and Health Sciences; World Academy of Science, Engineering and Technology*; January 2024, vol. 205(1). 26 – 30.
44. Solete, Pradeep. (2021). Association of Age, Gender and Tooth Related Study on Patients Undergoing Endodontic Retreatment. *International Journal of Dentistry and Oral Science*. 3976-3980. 10.19070/2377-8075-21000812.
45. Kirkevang LL, Hörsted-Bindslev P, Ørstavik D, Wenzel A. Frequency and distribution of endodontically treated teeth and apical periodontitis in an urban Danish population. *Int Endod J*. 2001 Apr;34(3):198-205. doi: 10.1046/j.1365-2591.2001.00370.x. PMID: 12193265.
46. Mustafa NS, Kashmoola MA, Majeed KRA, Qader OAJA. Assessment of the success rate of endodontically treated patients attending outpatient polyclinic. *Eur J Dent*. 2018 Oct-Dec;12(4):540-545. doi: 10.4103/ejd.ejd\_377\_17. PMID: 30369800; PMCID: PMC6178677.
47. Alnowailaty Y, Alghamdi F. Prevalence of Endodontically Treated Premolars and Molars With Untreated Canals and Their Association With Apical Periodontitis Using Cone-Beam Computed Tomography. *Cureus*. 2022 Jun 3;14(6):e25619. doi: 10.7759/cureus.25619. PMID: 35795507; PMCID: PMC9250691.
48. Hollanda, Augusto & Alencar, Ana & Estrela, Cyntia & Bueno, Mike & Estrela, Carlos. (2008). Prevalence of endodontically treated teeth in a Brazilian adult population. *Brazilian dental journal*. 19. 313-7. 10.1590/S0103-64402008000400005.
49. Rawski AA, Brehmer B, Knutsson K, Petersson K, Reit C, Rohlin M. The major factors that influence endodontic retreatment decisions. *Swed Dent J*. 2003;27(1):23-9. PMID: 12704945.
50. Tabassum S, Khan FR. Failure of endodontic treatment: The usual suspects. *Eur J Dent*. 2016 Jan-Mar;10(1):144-147. doi: 10.4103/1305-7456.175682. PMID: 27011754; PMCID: PMC4784145.

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