

Retrospective Descriptive Study of Intraradicular Posts Using Electronic Health Records with a 14-year time series

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Introduction: Rehabilitating an endodontically treated tooth (ETT) can be challenging, as restorative approaches vary according to the type of intraradicular post used.

Aim: The purpose of this retrospective descriptive study was to evaluate ETT data collected over a 14-year period (2008 to 2021) to identify the profile of post usage.

Materials and Methods: Electronic Health Records (EHRs) related to ETTs over a 14-year period were extracted from a public institution. The data were filtered according to post type: cast metal post-and-core (CMP), fiberglass post-and-composite core (FPC), and prefabricated metal post-and-composite core (PMP). Deciduous teeth and incomplete or duplicate records were excluded. Variables such as age (< 30 years, 30 to 60 years, and > 60 years), tooth group, and year of the procedure were assessed. The data were analyzed using descriptive statistics (absolute and relative frequencies).

Results: A total of 176,277 EHRs were screened. The final sample consisted of 1,188 intraradicular posts. Most post-and-core placements were performed in individuals aged 30–60 years (62.7%). Maxillary incisors (31.7%) and maxillary premolars (20.1%) were the most frequently restored teeth, regardless of post type. CMPs accounted for the highest proportion of posts (75.2%), followed by FPCs (21.0%) and PMPs (3.8%). In all age groups, CMPs were the most frequently used. From 2014 to 2021, the number of post-and-core placements progressively decreased (10.27% to 3.20%), whereas the use of FPCs increased annually.

Conclusions: Analysis of EHRs over a 14-year period showed that CMPs were the most frequently used intraradicular posts (75.2%). However, the substantial increase in the use of FPCs reflects a shift in clinical decision-making.

Keywords: electronic health records; post and core technique; retrospective studies.

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INTRODUCTION

The implementation of Electronic Health Records (EHRs) has brought several benefits to patient care and clinical documentation¹. EHRs help organize data, improve administrative efficiency, and allow for the analysis of large amounts of patient information over extended time frames¹. This is particularly valuable in academic and public health settings, where

clinical data provide important insights into treatment trends, protocol adherence, predictive clinical performance and restoration longevity²⁻⁴.

In Dentistry, one area of interest is the rehabilitation of endodontically treated teeth (ETT). Different techniques and procedures for restoring an ETT have been employed over the last decades, including the placement of posts, a topic widely discussed in the literature^{5,6}. Intraradicular posts primarily provide retention

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for the coronal restoration of substantially compromised ETTs⁶. Clinical decision-making for post placement depends on several factors, such as the amount and arrangement of remaining coronal walls, the presence of a ferrule and the position of the tooth in the arch^{5,6}. Moreover, the choice of an intraradicular post system is influenced by the clinician's expertise, material availability, and institutional protocols⁷⁻⁹.

The mechanical properties and clinical performance of different post systems, comparing survival rates of ETT, have also been extensively studied^{2,5,10,11}. Despite the available information, previous systematic reviews and meta-analysis studies revealed no evidence for difference for survival and failure rates of ETT restored either with glass-fiber-reinforced or metal posts^{12,13}. Additionally, there is a scarcity of observational studies providing specific data on the prevalence of post-and-core placement and actual trends in clinical decision-making that could serve as indicators of clinical practice over time.

Understanding the frequency of intraradicular post use over time may help identify patterns and elucidate how clinical training influences restorative decision-making. This is particularly important for improving educational efforts in academic institutions and public service. In this context, this study provides important information on the trends in restorative approaches related to intraradicular posts, from cast metal post-and-core to prefabricated posts, in dental practice over the years. Thus, the aim of this study was to describe, over 14 years (2008 to 2021), data regarding intraradicular post-and-core placements in endodontically treated teeth, collected from a public dental school's records.

MATERIAL AND METHODS

Ethics committee and data collection

This is an observational, retrospective and descriptive study. It was conducted at the Dental Clinic of the Dental School and approved by the ethics committee. Data came from the EHRs of individuals treated by undergraduate students under professional supervision between 2008 and 2021. In this study, we considered the procedure involving intraradicular posts performed as the unit of analysis, not the individual. Although the data were obtained from EHRs only the records relating to the specific procedure of interest were included in the analysis.

The confidentiality and anonymity of the individuals included in the database were preserved through consecutive numerical identification.

Eligibility criteria

This study included records from individuals whose maxillary and/or mandibular anterior and posterior permanent endodontically treated teeth received dental restorations involving intraradicular posts. Exclusion criteria were: records from individuals who received direct restorative procedures after endodontic treatment; records from individuals who received only interim intraradicular posts; deciduous teeth; and records with incomplete data, duplication, or entry errors.

Data extraction, filtering and grouping

Initially, a survey of EHRs was performed in the "Romeu System" database from 2008 to 2021 (14 years). A specific search for the words "core" and "post" resulted in an initial sample extracted as a spreadsheet containing only the patient identification number, complete procedure title, year, patient age, and treated tooth.

From this, initial filtering was performed to exclude duplicate records, incomplete data, and entry errors. Deciduous teeth were excluded, leaving only permanent teeth that had undergone endodontic treatment and received an intraradicular post.

Using Excel's "SEARCH" tool, the first data filtering was performed, and the records were divided by the procedure year. A second filtering was then performed, grouping patients by age: A – patients up to 30 years, B – patients between 30 and 60 years, and C – patients older than 60 years. Subsequently, a final filtering step replaced each specific tooth number identifier with more generalized dental groups: UI (upper incisors), LI (lower incisors), UC (upper canines), LC (lower canines), UP (upper premolars), LP (lower premolars), UM (upper molars), LM (lower molars).

With the entire sample separated by procedure year, age group, and dental group, restorative procedures were quantified using Excel's "SEARCHV" tool to identify which procedures were performed following endodontic treatment.

The initial data collection resulted in an Excel spreadsheet extracted from the

EHR system, containing 176,277 records, corresponding to the number of procedures performed on patients who had teeth endodontically treated at the Dental School over the 14-year period.

At the end of this first filtering, patient record numbers were also excluded to ensure anonymity. Data from the year 2020 were excluded because no procedures were performed due to the suspension of clinical services during the SARS-CoV-2 pandemic; inclusion of this year could interfere with the statistical analysis.

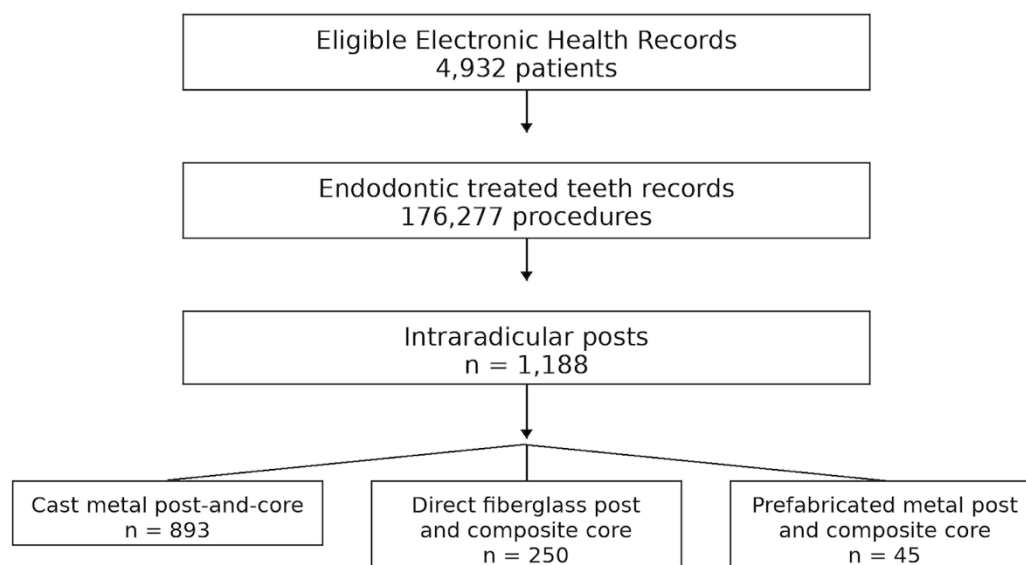
The data were organized in Microsoft Excel spreadsheets (Microsoft Corp., Redmond,

WA, USA) and analyzed using descriptive statistics. Relative and absolute frequencies were calculated for categorical variables (type of post-and-core, tooth group, age group, and year of placement).

RESULTS

A total of 4,932 patient EHRs were assessed from 2008 to 2021. During this period, 176,277 records were screened for eligibility. After applying the inclusion criteria, the final dataset consisted of 1,188 intraradicular posts in permanent teeth (Figure 1).

Figure 1. Chart flow of the study.



Source: Authors.

Among the 1.188 intraradicular posts analyzed over the 14-year period, most procedures were performed on patients aged 30-60 years (62.7%), followed by those over 60 years (32.5%), while only 4.8% were performed on patients under 30. Overall, upper incisors (31.7%) and upper premolars (20.1%) were the

most frequently restored teeth, regardless of the type of intraradicular post used. The majority were cast metal post-and-core restorations (75.2%), followed by direct fiberglass posts with composite cores (21.0%), and prefabricated metal posts with composite cores (3.8%) (Table 1).

Table 1. Distribution of posts-and-cores according to clinical variables over the 14-year period (*n* = number of occurrences, % = percentage).

(continues)

Variable		n	%
Age group	<30	57	4.8
	30-60	745	62.7
	>60	386	32.5
	Total	1188	100

(conclusion)

Tooth Group	Upper incisor	377	31.7
	Lower incisor	76	6.4
	Upper canine	125	10.5
	Lower canine	48	4.0
	Upper premolar	239	20.1
	Lower premolar	139	11.7
	Upper molar	84	7.1
	Lower molar	100	8.5
	Total	1188	100
Post-and-cores types	Cast metal post and core	893	75.2
	Direct fiberglass post and composite core	250	21.0
	Prefabricated metal post and composite core	45	3.8
	Total	1188	100
	n	%	
	<30	57	4.8
	30-60	745	62.7
	>60	386	32.5
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	Upper incisor	377	31.7
	Lower incisor	76	6.4
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	Total	1188	100
	Cast metal post and core	893	75.2
	Direct fiberglass post and composite core	250	21.0
	Prefabricated metal post and composite core	45	3.8
	Total	1188	100

According to Table 2, cast metal post-and-core was the most prevalent type of intraradicular post across all tooth groups. Among the three

types of posts evaluated, upper incisors and upper premolars were the most frequently restored teeth, while lower canines and lower incisors were the least common.

Table 2. Distribution of post-and-cores ($N = 1,188$) according to the tooth group (n = number of occurrences, % = percentage).

(continues)

Tooth Group*	Cast metal post-and-core		Direct fiberglass post-and-composite core		Prefabricated metal post-and-composite core	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
UI	276	23.2	86	7.2	15	1.3
LI	65	5.5	11	0.9	0	0.0
UC	97	8.2	25	2.1	3	0.3
LC	37	3.1	10	0.8	1	0.1

UP	178	15.0	45	3.8	16	1.3
LP	113	9.5	24	2.0	2	0.2
UM	55	4.6	23	1.9	6	0.5
LM	72	6.1	26	2.2	2	0.2
Total	893	75.2	250	21.0	45	3.8

*UI (upper incisors), LI (lower incisors), UC (upper canines), LC (lower canines), UP (upper premolars), LP (lower premolars), UM (upper molars), LM (lower molars).

Table 3 shows that patients aged 30-60 years represented the age group with the highest frequency of placement for all post-and-core types. In this age range, cast metal post-and-core remained the most prevalent (47.81%).

Table 3. Distribution of post-and-cores ($N = 1,188$) according to the age group (n = number of occurrences, % = percentage).

Age group	Cast metal post-and-core		Fiberglass post-and-composite core		Prefabricated metal post-and-composite core	
	n	%	n	%	n	%
<30	30	2.53	24	2.02	03	0.25
30-60	568	47.81	149	12.54	28	2.36
>60	297	25.00	77	6.48	12	1.01
Total	895	75.33	250	21.04	43	3.61

Regarding annual distribution, a progressive increase in the number of post-and-core placements was observed between 2008 and 2014, with a higher concentration of patients aged 30-60 years, predominantly treated with cast metal post-and-core. During this period, no prefabricated post-and-core placements were recorded. From 2014 to 2021, a progressive decrease in post-and-

core placements was recorded, mainly represented by a reduction in the 30-60 age group. However, a slight increase in the number of procedures was observed in the <30 and >60 age groups. During this latter period, a slight increase was also observed in both direct fiberglass posts with composite cores and prefabricated metal posts with composite cores (Table 4).

Table 4. Annual distribution of post-and-cores according to the age group over 14 years.

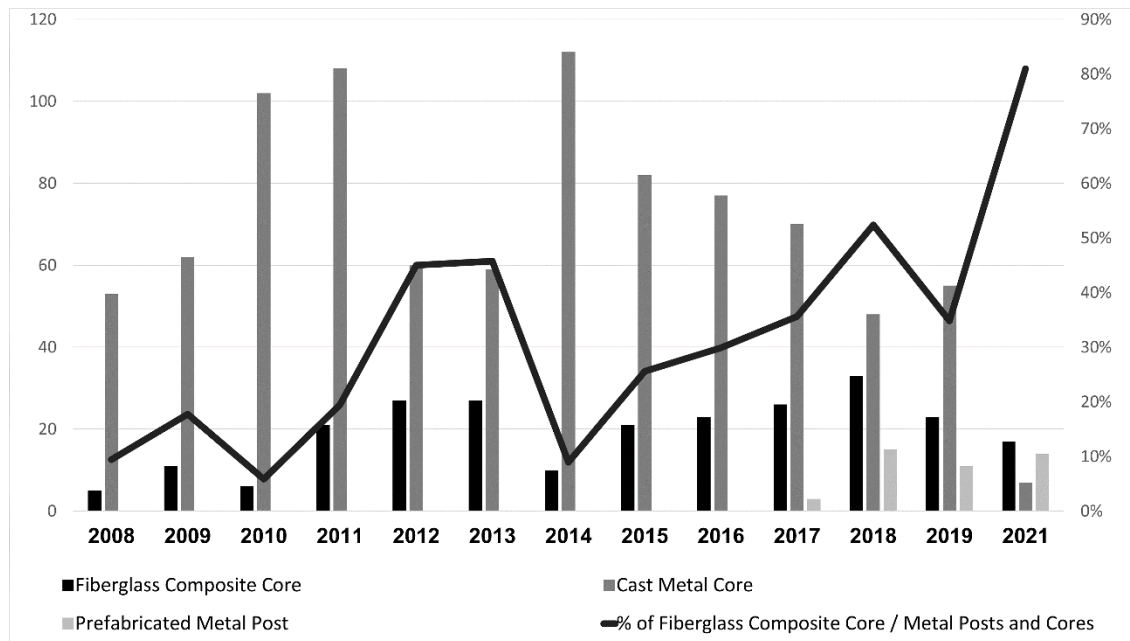
Year	<30			30-60			>60			n	%
	FPC	CMP	PMP	FPC	CMP	PMP	FPC	CMP	PMP		
2008	0	2	0	5	44	0	0	7	0	58	4.88
2009	6	7	0	5	37	0	0	18	0	73	6.14
2010	1	2	0	5	58	0	0	42	0	108	9.09
2011	0	2	0	15	76	0	6	30	0	129	10.86
2012	0	0	0	13	38	0	14	22	0	87	7.32
2013	1	0	0	21	45	0	5	14	0	86	7.24
2014	0	2	0	9	80	0	1	30	0	122	10.27
2015	3	4	0	8	50	0	10	28	0	103	8.67
2016	6	2	0	7	40	0	10	35	0	100	8.42
2017	1	7	0	14	38	3	11	25	0	99	8.33
2018	2	1	0	20	23	11	11	24	4	96	8.08
2019	2	0	1	14	34	6	7	21	4	89	7.49
2021	2	1	2	13	5	8	2	1	4	38	3.20
Total	24	30	3	149	568	28	77	297	12	1188	100

* FPC = Fiberglass post-and-core, CMC = Cast metal post-and-core, PMP = Prefabricated metal post-and-composite core.

Figure 2 illustrates the overall distribution of post-and-core materials over the 14-year period. In recent years, there was a notable increase in the use of direct fiberglass posts with composite

cores, while the use of cast metal post-and-core systems decreased progressively. In the final year of the study, direct fiberglass posts with composite cores became the most frequently used.

Figure 2. Absolute frequency of fiberglass post-and-composite core over prefabricated and cast metal post-and-cores.



Source: Authors.

DISCUSSION

This study describes characteristics and trends in intraradicular post-and-core placements in endodontically treated teeth over 14 years (2008-2021), based on data collected from a public dental school's records.

The frequency of post-and-core placement was highest in patients aged 30-60 years, regardless of post type. Although few observational studies on ETT restorations have focused on this data, some studies present a high frequency of post-and-core restorations in a similar age distribution^{14,15}. Another retrospective study² revealed a higher distribution of cast metal post-and-core in older than in younger individuals.

Furthermore, results similar to this study have been reported for other types of dental treatments³. In fact, the main findings of the Brazilian National Oral Health Survey (2010)¹⁶ revealed that individuals aged 35-44 years represent the largest proportion of the population and those with the greatest number of restored teeth. Although individuals over 60 years did not represent the most prevalent group in our sample,

their number was still considerable. A cross-sectional study conducted in Brazil¹⁷ indicated a lower rate of dentate individuals in the population over 60 years, which may explain the lower frequency of post-and-core restorations in this group compared to the 30-60 age group found in our study. The same study also highlights the need for retreatment in the elderly population due to a higher frequency of inadequate treatments in root-filled teeth. Despite the evident demand for dental treatment in this population, studies show that elderly people often visit the dentist only when experiencing pain or discomfort¹⁸. This behavior may partly explain the results observed in our study.

In the present study, post-and-cores were commonly placed in maxillary teeth, most frequently in incisors followed by premolars. These results agree with a previous study¹⁹. Conversely, this study differs from others where posterior teeth^{2,14,20,21} had the highest frequency of post-and-core restorations. Intraradicular posts primarily provide retention for the coronal restoration of ETTs and are thus predominantly considered for the restoration of weakened maxillary anterior teeth with thin dentinal walls⁶

due to the higher risk of failure². On the other hand, the clinical performance of posterior teeth does not seem to be affected by the use of intraradicular posts⁵. The consistency between our results and those of the aforementioned studies reveals that tooth type remains an important factor in post placement within academic protocols, although a systematic review found similar failure rates for both anterior and posterior teeth treated with post-and-core restorations²². Our results also reflect the significant influence of aesthetics, as patients seek more restorative services when anterior teeth are involved².

Overall, over the 14-year period, there was a predominance of cast metal posts over both prefabricated types. In contrast, results from other academic centers report a higher prevalence of fiberglass posts^{2,14,19,20} or prefabricated metal posts^{15,21,23} over cast metal post-and-core placement. Nevertheless, it is important to consider that most of these studies analyzed shorter observation periods, and data were collected more recently than in our study, which may account for the discrepancy in results.

Since cast metal posts were introduced into clinical practice earlier than fiberglass posts, their selection may have been related to familiarity and well-established academic protocols, explaining their prevalence in this study, especially in the early years of the analyzed period. In fact, the clinical decision-making process can be influenced by experience, training⁸, and patient population²⁴. These findings also highlight the relevance of longitudinal studies for identifying not only current patterns but also transitions over time.

Although cast metal post-and-core was the most frequent in this study, its use decreased, particularly in the later years of the analyzed period. In the most recent period, an increase in fiberglass post placement was observed, revealing a shift in clinical decision-making. For a long time, cast metal post-and-core has been traditionally used for the restoration of ETTs^{6,25}. The advancement of adhesive post retention systems has changed the requirements for root canal preparation, allowing for less invasive techniques to restore an ETT⁶. Furthermore, fiberglass posts are characterized by their biocompatibility, biomechanical advantages, aesthetic characteristics, single-visit placement, and lower cost¹¹. Consequently, fiberglass post systems have been increasingly adopted over time and used more frequently in both dental education^{14,19,20} and clinical practice⁸. Hence, our findings may corroborate the trend toward using materials with more favorable

mechanical behavior as a clinical decision in oral rehabilitation.

Despite all the mentioned reasons that may justify a shift in clinical practice, a systematic review stated that both prefabricated fiberglass posts and cast metal posts seem to be acceptable options and present good clinical success rates at short- to medium-term follow-up²². More recently, a randomized clinical study¹¹ revealed no difference between metal and fiberglass posts after 15 years; however, teeth restored with prefabricated fiberglass posts showed better clinical success and survival. In this sense, more clinical studies with long-term follow-up should be conducted to provide strong evidence capable of guiding clinical decision-making.

Identifying clear, evidence-based trends within academic environments is crucial, as it allows educators to assess whether the techniques and materials being taught constitute the most effective approach for student learning and, ultimately, for patient care. This academic evaluation directly impacts society, as the competencies solidified during a student's training have a high probability of being translated into daily clinical practice upon graduation. Therefore, establishing dental school protocols and professional dental practice on robust, long-term scientific evidence is an investment not only in student education but also in the future standard of care delivered to the public.

Some limitations of this study should be considered. First, the retrospective study design limits control over other variables that may influence the clinical decision-making guiding the placement of a specific post type, such as the number of remaining coronal walls, presence of a ferrule, root canal anatomy, and patient profile. As a result, analysis of these variables was not possible. Additionally, incomplete reporting in the EHRs led to the exclusion of some records, affecting the data results. Another limitation refers to the exclusion of data from the year 2020 due to the suspension of academic dental services during the COVID-19 pandemic. This event may also have impacted patient behavior in subsequent years, leading to a reduction in the number of procedures recorded in 2021.

Furthermore, the analysis presented herein is primarily descriptive in nature. While this approach effectively characterizes the trends and patterns in post selection within the studied academic setting, it does not establish causal inferences or adjust for potential confounders through multivariate modeling. It should be

noted, however, that this methodological choice does not inherently compromise the validity of the observed descriptive data, which remain valuable for identifying prevailing clinical practices and informing future hypothesis-driven research. Finally, the data was obtained from a single academic institution, which limits the generalizability of the findings.

CONCLUSION

In conclusion, the frequency of cast metal post-and-core use in endodontically treated teeth was highest. Nevertheless, its use decreased while the frequency of direct fiberglass posts with composite cores increased over the 14-year period, as did the use of prefabricated metal posts with composite cores in the most recent years.

AUTHOR'S CONTRIBUTIONS

Pedro Bastos Cruvinel: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, writing – original draft, Writing – review & editing.

Bruna Neves de Freitas: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – review & editing.

Gabriel Figueiredo de Carvalho: Formal analysis, Investigation, Data curation, Writing – original draft.

Luciano Luiz Finco: Software, Validation, Investigation, Formal analysis, Data curation, Writing – review & editing.

Karen Pintado-Palomino: Methodology, Investigation, writing – original draft, Writing – review & editing.

Camila Tirapelli: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, writing – original draft, Writing – review & editing, Supervision, Project Administration.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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