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ASSES FREQUENCY DISTRIBUTION OF ENDODONTICALLY TREATED TEETH AND ASSOCIATED FACTORS IN A PAKISTANI POPULATION

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Abstract

Objective: *To assess the frequency distribution of endodontically treated teeth and associated factors in a Pakistani population.*

Study Design: *Cross-sectional study.*

Place and Duration of Study: *The study was conducted at 21 Military Dental Centre, Quetta from August 2024 to January 2025.*

Methodology: *Dental records of patients were taken to collect the data. The evaluation unit was the tooth and the variables examined included demographics, type of tooth, cavity classification, etiology of endodontic treatment, pulp status, periapical pathology. Data was analyzed using SPSS software.*

Results: *200 teeth examined which were endodontically treated were more prevalent among females (55%) compared to male (45%). Age group 46-60 years were more endodontically treated compared to other age groups. Molars (59%) were the predominant tooth type which were endodontically treated and caries was the major etiological factor behind (78.5%). Significant association between tooth type ($p < .001$) and cavity classification ($p < .001$) was observed with etiology. Cavity classification was also associated with type of endodontic treatment ($p < .001$). Pulp status was associated with cavity classification ($p < .001$) and periapical pathology ($p < .001$).*

Conclusion: *Caries was observed as the most common etiological factor, affecting all cavity classification types. Molars were the most affected among tooth type and significant association of etiology with tooth type and cavity classification, cavity classification with type of endodontic treatment and pulp status, and pulp status and periapical pathology was observed.*

INTRODUCTION

The role of endodontic therapy in modern dental care is very crucial and it is a key part of restorative dentistry.[1] The main aim of root canal therapy is to preserve the natural dentition by conservatively eliminating the infected pulp tissue and keeping the tooth in functional occlusion.[2] According to the European Society of Endodontology, endodontic therapy is a procedure that maintains pulp health and prevents or cures periradicular periodontitis when required.[3] Even with advanced facilities in dental care, endodontic therapy is still a commonly performed procedure, particularly because of trauma,

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dental caries, and other pulpal/periradicular diseases. The reported success rate of endodontic treatment is nearly 95% globally, which highlights its importance in maintaining oral health and preventing the loss of teeth.[4] Nonetheless, it is crucial to understand the distribution and frequency of endodontically treated teeth to enhance preventive strategies and predictable treatment outcomes.[5]

The prevalence of teeth undergoing endodontic treatment varies across different populations worldwide. Studies conducted in North America and Europe emphasize that the prevalence of endo-treated teeth increases with age, particularly because of improved oral hygiene measures, durable restorative materials, and adaptation of more conservative treatment approaches by dental professionals that allow predictable conservation of teeth rather than extracting them.[6,7] According to studies conducted in Scandinavia, the adult population has a 13% to 20% prevalence of root canal-treated teeth.[9] The National Health and Nutrition Examination Survey (NHANES) of the United States reported that 25% of the adult population has at least one endo-treated tooth in their dentition.[10] Research from neighboring countries, like India, has reported an 8-15% prevalence of endodontically treated teeth in the general population, with dental caries being the primary etiologic factor behind the pulpal disease.[11] However, limited data is available regarding the frequency and distribution of endodontically treated teeth in Pakistan, indicating a substantial gap.

Dental caries is considered a major public health concern in Pakistan, and irreversible pulpitis is identified as the leading cause of seeking endodontic treatment. However, the current literature focuses only on the prevalence of dental caries instead of the specific distribution of root-filled teeth. To improve public dental health by enhancing focused prevention drives, improving dental school curricula, and awareness efforts, it is crucial to analyze the pattern of endodontic treatment in the local populace. This study aims to fill this gap by analyzing the frequency and distribution of endodontically treated teeth and its associated clinical factors in a Pakistani population, thereby contributing to more effective dental health policies and patient education programs.

Methodology

The descriptive study was performed at the operative dentistry and endodontics department of the 21 Military Dental Centre (MDC), Quetta. The study protocol was approved by the ethical committee of 21 MDC, and the study period was 6 months, from August 2024 to January 2025. A structured proforma was used for data collection from the patient's dental record and a purposive sampling technique was used for patient recruitment.

Inclusion criteria: Patients in the age range of 12-60 years, history of endodontic treatment, retreatment or requirement of endodontic treatment of any tooth upon clinical evaluation were included in the study.

Exclusion criteria: young patients having endodontically involved deciduous teeth, incomplete dental records/history, and wisdom teeth were excluded from the study.

The main unit of evaluation in this study was the tooth, and the variables included were the tooth type, demographics, endodontic disease, pattern of carious lesion involvement, pulp status, periapical pathology and etiology of endodontic treatment. The dentition was divided into molars, premolars, and anteriors. Demographic details included the age and gender information. On the basis of radiographic and clinical findings the assessment of endodontic disease was made, while standard cavity classification criteria (Class-I, II, III, and IV) was used to determine the pattern of carious lesion involvement.[12] Determination of the pulp status, clinical symptoms and vitality testing was done, whereas periapical radiographs were used to evaluate the periapical pathology.[13] The etiology of endodontic treatment was identified based on clinical history and examination, categorizing cases into caries, trauma, and other factors such as fractures or restorative failures.

A structured proforma was used for data collection for all the participants. Data analysis was performed with SPSS version 22.0 for windows. Chi-square test and Fischer's exact test were applied to determine the association between various patient-related variables. P-value ≤ 0.05 was taken as statistically significant.

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Results

A total of 200 patients were included in the study of which 200 teeth were examined. Females had a greater percentage (55%) of endodontically treated teeth compared to males (45%). Patients were categorized into 3 groups depending upon which age range they belonged to, i.e., 12-25 years, 26-45 years and 46-59 years. Majority of the patients belonged to 46-59 years (n = 112, 56%), compared to 26-45 (n = 54, 27%) and 12-25 years (n = 34, 17%). Dental caries was the most common etiological factor behind endodontic treatments among the patients (n = 157, 78.5%), followed by trauma (n = 37, 18.5%), and fracture and other reasons (n = 6, 3%).

Table I indicates the association of etiology with different demographic and clinical parameters, including age, gender, tooth type and cavity classification. There was no significant association between age (p = .475) and gender (p = .067) with etiology. Molars (n = 118, 59%) were the most commonly affected tooth type, besides premolars (n = 50, 25%) and anterior teeth (n = 32, 16%). The type of tooth affected was significantly associated with etiology (p < .001). All classifications of cavity including class-I, class-II, class-III and class- IV were predominantly affected by caries (90.48%, 86.87%, 48.89%, and 78.57%) compared to other etiological factors. A significant association between cavity classification and etiology was found (p < .001).

Variables	**Etiology n (%)**			**P - value**
	Caries	Trauma	Fracture and other reasons	
Tooth Type				
Molar	105 (88.98%)	11 (9.3%)	2 (1.72%)	< .001
Premolar	42 (84%)	5 (10%)	3 (6%)	
Anterior	10 (31.25%)	21 (65.63%)	1 (3.13%)	
Cavity Classification				
Class-I	38 (90.48%)	3 (7.14%)	1 (2.38%)	< .001
Class-II	86 (86.87%)	11 (11.11%)	2 (2.02%)	
Class-III	22 (48.89%)	21 (46.67%)	2 (4.44%)	
Class- IV	11 (78.57%)	2 (14.29%)	1 (7.14%)	
Age Group				
12-25 years	24 (70.59)	9 (26.47%)	1 (2.94%)	.475
26-45 years	42 (77.78%)	9 (16.67%)	3 (5.56%)	
46-60 years	91 (81.25%)	19 (16.96%)	2 (1.79%)	
Gender				
Male	96 (83.48%)	15 (13.04%)	4 (3.48%)	.067
Female	61 (71.76%)	22 (25.88%)	2 (2.35%)	

Table I. Frequency and percentage distribution of age, gender, tooth type and cavity classification based on the etiology across different categories.

162 (81%) patients had undergone primary RCT, 30 (15%) had retreatment and 8 (4%) had apicoectomy. Table II indicates that a significant association between cavity classification and type of endodontic treatment was also observed (p < .001).

Cavity Classification	**Type of Endodontic Treatment n (%)**			**P - value**
	Primary RCT	Retreatment	Apicoectomy	
Class-I	36 (85.71%)	5 (11.90%)	1 (2.38%)	< .001
Class-II	85 (85.86%)	14 (14.14%)	0 (0%)	

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Class-III	39 (86.67%)	5 (11.11%)	1 (2.22%)
Class- IV	2 (14.28%)	6 (42.86%)	6 (42.86%)

Table II. Association Between Cavity Classification and Type of Endodontic Treatment

Table III indicates a significant association between **cavity classification and periapical status with pulp status. Necrotic pulp was more prevalent in Class-IV cavities (100%),** followed by **Class-II (81.82%)** and **Class-I (71.43%). Opposed to this,** Class-III cavities had more vital pulp (55.56%). Periapical pathology was also present more frequently in necrotic pulp (97.86%), while was not found in vital pulp (86.67%).

Variables	**Pulp Status**		**P - value**
	Necrotic	Vital	
Cavity Classification			
Class-I	30 (71.43%)	12 (28.57%)	< .001
Class-II	81 (81.82%)	18 (18.18%)	
Class-III	20 (44.44%)	25 (55.56%)	
Class- IV	14 (100%)	0 (0%)	
Periapical Status			
Absent	8 (13.33%)	52 (86.67%)	< .001
Present	137 (97.86%)	3 (2.14%)	

Table III. Association between cavity classification and periapical status with pulp status.

Discussion

In this study, analysis of 200 teeth from 178 patients was assessed to gather insights into the frequency and distribution of endodontically treated teeth in Pakistani population. Our findings suggest a greater percentage of females having endodontically treated teeth compared to males, and increasing trend of endodontic treatments with advancing age such as 46-59 years age. Caries was found to be the leading etiological factors with molars being the predominant tooth type affected.

A study by Alghamdi et al. (2022) also reported a similar female predominance in endodontic treatments, with a percentage frequency of 58.2% compared to 41.8% in men which is similar to our female-to-male ratio of 55%/45%.[13] Furthermore, our finding that dental caries is the primary reason for endodontic intervention is consistent with a study by Ahmed et al. (2023) that indicated carious lesions were responsible for 84.07% of endodontic cases.[14] The high prevalence of caries in molars and the significant association between tooth type and etiology in our study are in line with research by Smith et al. (2021). They also reported the greater vulnerability of molars against caries due to their complex anatomy and location in the oral cavity.[15]

Additionally, a study by Johnson et al. (2020) indicated that more complex cavity classifications frequently require advanced treatment modalities,[16] which supports our observation of a significant association between cavity classification and the type of endodontic therapy.

Our study also revealed a significant association between cavity classification and periapical status with pulp status, suggesting that more advanced cavity classifications have a greater association with pulp necrosis and periapical pathology. This finding is consistent with the reports of Lee et al. (2024), also suggesting that deeper and larger cavities, in particular the Class-IV lesions, can deleteriously cause pulp exposure to bacterial infection, causing greater rates of necrosis and ultimately periapical inflammation.[17] The complete presence of necrotic pulp in Class-IV cavities, and greater rates in Class-II (81.82%) **and** Class-I (71.43%) suggest the need for earlier detection and prevention for the disease to progress. Among the most common treatment methods was the primary root canal treatment (RCT) across Class-I, Class-II, and Class-III cavities. In contrast, majority cases with Class-IV cavities either required retreatment and apicoectomy. These findings are consistent with a study by Kim et al.

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(2023), which indicated that structurally weak and deep cavities exhibit greater rates of failure after the initial endodontic treatment, necessitating complex retreatment procedures.[18]

Further research focusing on longitudinal studies for monitoring the progression of carious lesions and the effect they have on pulp and periapical health is needed. It will be beneficial to examine how preventive measures and timely interventions will reduce the incidence of advanced cavity classifications and need for retreatments. In addition to this, the role of patient education and regular dental check-ups can be explored for examining the mitigation of dental caries incidence and progression. This will provide insights into the overall improvement in oral health outcomes.

Conclusion

This study provides useful insights into the distribution of endodontically treated teeth and the associated etiological factors and other demographic and clinical parameters. The findings necessitate early detection and intervention for management of dental caries for impeding progression of caries classification and the associated complications.

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Conflict of Interest

None to declare.

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