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Original Article

Frequency and Distribution of Mount-Hume Classification Among Patients Requiring Root Canal Treatment at Armed Forces Institute of Dentistry

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ABSTRACT

Objective: To assess the frequency and distribution of Mount-Hume classification in patients requiring root canal treatment.
Study Design: Cross-sectional study.
Place and Duration of Study: Armed Forces Institute of Dentistry, Rawalpindi, Pakistan, from Jan 2024 to Jan 2025.
Methodology: Patients visiting operative department of AFID requiring root canal treatment were included in this study. Mount-Hume classification was used for categorizing patients depending upon the lesion site and size of it. Data including demographics, tooth type, lesion site, lesion size and etiology was recorded.
Results: A total of 280 teeth from 254 patients were endodontically treated with greater female (58.27%) compared to male (41.73%) patients. Caries was the predominant etiological factor presenting in 264(94.29%) cases. Molars were the most affected tooth type in 167(59.64%) cases, followed by 77(27.5%) premolars and 36(12.86%) anteriors. Significant associations between tooth type and etiology (p<0.001), tooth type and lesion site (p<0.001), and tooth type and size of lesion (p<0.001) were observed. While, site of lesion was found to be significantly associated with etiology (p<0.001), but not with lesion size (p=0.280)
Conclusion: Caries was the most common etiology behind root canal treatments, with molars predominantly affected tooth. Advanced diagnostic tools and preventive interventions are needed to mitigate the burden of carious lesions requiring root canal therapy.
Keywords: Dental Caries, Endodontics, Root Canal Therapy, Tooth Loss.

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INTRODUCTION

Dental caries is one of the most prevalent oral health issues globally, and if not managed timely it can lead to invasive restorative interventions like root canal therapy (RCT) to prevent extractions.[1] In developing countries, the prevalence of dental caries is notably high, with estimates reaching 26%.[2] To ensure accurate diagnosis and delivery of effective treatment to the patients, a precise classification of carious lesions is necessary.[3]

According to recent studies, carious lesions are reported to cause about 35–45% of individuals to require restorative therapy in some capacity, with 20–25% ultimately requiring endodontic intervention.[4,5] Conventional classification systems, like GV Black's classification, mainly focus on the location of the lesion and cavity preparation design, but don't address the ambiguities of modern dental therapies.[6] Mount and Hume presented a novel classification system in response, which includes both the location and size of the carious lesions, to ensure minimally invasive restorative treatment options.[7] Mount-Hume system provides a multi-faceted approach, encouraging an in-depth understanding of lesion development and helps choose the most suitable technique and restorative materials.[8] Despite its substantial advantages over other systems, the inculcation into general practice has been slow.[9] In actual practice, only 12–15% of dentists regularly employ the Mount-Hume classification, but G.V. Black's approach is still more commonly used.[10] Nonetheless, there is still a scarcity of knowledge monitoring the use of the Mount-Hume classification system, particularly related to root canal therapies.

The limited use of the Mount-Hume classification system concerning endodontic therapy stipulates a substantial disparity in understanding its benefits for patients requiring root canal therapies. Based on the system's focus on lesion size and site individually, could help clinicians understand the degree of structural damage and improve endodontic treatment protocols. This study aims to explore the frequency and distribution of Mount-Hume classifications among patients undergoing endodontic therapy,

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hence monitoring its importance and potential benefits in endodontic treatment approaches and protocols.

METHODOLOGY

The cross-sectional study was performed at the Operative Department of the Armed Forces Institute of Dentistry (AFID), Rawalpindi, Pakistan, from August 2024 to December 2024 and its ethical approval was obtained from the institutional review board (IRB) of AFID vide letter no. The sample size was calculated using the WHO sample size formula for prevalence studies using a 95% confidence level, and a 0.05 margin of error. With a prevalence estimated at 8% for endodontically treated teeth (León-López *et al.*),[11] the minimum sample size was determined to be 113. Nevertheless, a total of 280 teeth were included to increase statistical power, permit subgroup analyses by lesion type and etiology, and enhance precision and generalizability of the findings. Further, the increased sample size was possible within the study's time frame without undue additional ethical burden. Non-probability consecutive sampling technique was followed.

Inclusion Criteria: Patients of either gender in the age range of 6-58 years, with no history of endodontic treatment or retreatment performed or diagnosed as requiring endodontic treatment upon clinical evaluation, were included.

Exclusion Criteria: Patients with incomplete dental records and history, deciduous teeth with endodontic involvement, and wisdom teeth in either of the 2 arches were excluded.

According to the Mount-Hume classification system, the carious lesions are categorized based on their anatomic site and extent of cavity progression. The carious lesions are classified by site, namely pits and fissures, contact areas, or cervical regions, and their size, ranging from Size 0 (initial enamel demineralization) to Size 4 (extensive cavitation including multiple surfaces). The unit of evaluation in this study was the tooth. The variables evaluated during the study were tooth type, patient demographics, pattern of carious lesions, and etiology of root canal treatment. The teeth were divided into different groups: upper molars, lower molars, upper premolars, lower premolars, upper anteriors, and lower anteriors. Structural proformas were used to collect data from the participants.

Data were analyzed with IBM statistical package for social sciences (SPSS) Statistics version 26. Mean±SD was found for the continuous variable age. Frequencies and percentages were calculated for categorical variables such as gender, tooth type, Mount-Hume lesion size, lesion site, and etiology. To evaluate the relationship between Mount-Hume classifications (size, site) and etiology, the Fischer's Exact test was used. Because there are several categories and there are low expected frequencies in cells in some contingency tables, a Monte Carlo simulation method for the Fischer's Exact test was used to get valid p-values, as Fisher's Exact Test is computationally infeasible for large tables. The *p*-value of ≤0.05 was used to determine statistical significance.

RESULTS

The study included 254 patients and a total of 280 teeth were treated through endodontic procedures, including more female patients (58.27%) compared to male patients (41.73%). 146(57.48%) patients belonging to the age group 46-60 years required endodontic therapy while those belonging to the age group 26-45 years were 64(25.20%), and in age group 10-25 year were 44(17.32%) while the mean age of patients was 41.68±12.59 years. Lower molars were the most affected tooth type, presenting in 96 cases (34.29%), followed by upper molars 71(25.36%), upper premolars 51(18.21%), lower premolars 26(9.29%), lower anteriors 19(6.79%) and upper anteriors 17(6.07%).

The most common etiology factor behind root canal treatment was caries, presenting in 264(94.29%), and both fractures in 8(2.86%) and trauma in 8(2.86%) cases were less commonly found. A significant association was found between tooth type and etiology ($p<0.001$) as indicated in Table-I.

Table-II illustrates the prevalence of Mount-Hume lesion site and size categories among various types of teeth in root canal treatment patients. Lesion Site 1 was most commonly seen in maxillary and mandibular molars (91.55% and 88.54%, respectively), whereas Site 2 was seen more often in premolars and anteriors. Sites 3 and 4 were seen mostly in anterior teeth, especially lower anteriors (Site 4: 26.32%). As far as lesion size is concerned, Size 3 predominated overall, particularly in the case of molars, while Size 4 was relatively more common in lower premolars and anteriors. Tooth type was statistically associated with both site and size of lesions ($p<0.001$).

Table-III shows the association of lesion location and size, by the Mount-Hume classification, with the etiology underlying root canal treatment. Lesion Sites

Table-I: Association Between Tooth Type and Etiology of Root Canal Treatment, Stratified by Mount-Hume Classification Criteria (n = 280 Teeth)

Tooth Types	Etiology			*p*- value
	Caries n=264	Trauma n=8	Fracture n=8	
Upper molarsn(%)	71(100%)	0(0%)	0(0%)	<0.001
Lower molarsn(%)	95(98.96%)	0(0%)	1(1.04%)	
Upper premolarsn(%)	51(100%)	0(0%)	0(0%)	
Lower premolarsn(%)	26(100%)	0(0%)	0(0%)	
Upper anteriorsn(%)	12(70.59%)	3(17.65%)	2(11.76%)	
Lower anteriorsn(%)	9(47.37%)	5(26.32%)	5(26.32%)	

Table-II: Mount-Hume Classification of Lesion Site and Size by Tooth Type in Patients Requiring Root Canal Treatment (n = 280 Teeth)

Variables	Tooth Types						*p* - value
	Upper molars n=65	Lower molars n=100	Upper premolars n=51	Lower premolars n=26	Upper anteriors n=17	Lower anteriors n=19	
Lesion Site							
Site 1	65(91.55%)	85(88.54%)	0(0%)	0(0%)	1(5.88%)	0(0%)	<0.001
Site 2	6(8.45%)	15(15.63%)	51(100%)	24(92.31%)	11(64.71%)	14(73.68%)	
Site 3	0(0%)	0(0%)	0(0%)	2(7.69%)	5(29.41%)	0(0%)	
Site 4	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	5(26.32%)	
Lesion Size							
Size 1	0(0%)	0(0%)	0(0%)	0(0%)	1(5.88%)	0(0%)	<0.001
Size 2	6(8.45%)	14(14.58%)	36(70.59%)	10(38.46%)	8(47.06%)	5(26.32%)	
Size 3	39(54.93%)	70(72.92%)	15(29.41%)	3(11.54%)	8(47.06%)	9(47.37%)	
Size 4	26(36.62%)	12(12.5%)	0(0%)	13(50%)	0(0%)	5(26.32%)	

1, 2, and 3 were most frequently caused by caries, representing more than 90% of the cases for each site. Lesion Site 4 was associated with non-caries etiology (100%). Lesion Size 4 had a relatively higher percentage of cases with trauma (11.59%) and fracture (11.59%) as compared to those of smaller lesion sizes, but this association between etiology and lesion size was not statistically significant (p=0.280). Lesion site and etiology were also significantly associated (p<0.001).

Table-III: Association Between Lesion Site and Size (Based on Mount-Hume Classification) and Etiology of Root Canal Treatment (n=280 Teeth)

Variables	Etiology			*p*-value
	Caries n=264	Trauma n=8	Fracture n=8	
Lesion site				
Site 1	146(99.32%)	1(0.68%)	0(0%)	< 0.001
Site 2	111(91.74%)	2(1.65%)	8(6.61%)	
Site 3	7(100%)	0(0%)	0(0%)	
Site 4	0(0%)	5(100%)	0(0%)	
Lesion size				
Size 1	1(100%)	0(0%)	0(0%)	0.280
Size 2	78(98.73%)	0(0%)	1(1.27%)	
Size 3	132(91.67%)	6(4.17%)	6(4.17%)	
Size 4	53(76.81%)	2(11.59%)	1(11.59%)	

DISCUSSION

In this study, the frequency and distribution of the Mount-Hume classification were analyzed among those patients who required root canal therapy. According to the findings, the most commonly affected teeth were the mandibular molars, followed by maxillary molars and premolars, respectively. Caries was the principal cause of endodontic treatment, while dental trauma and fractures were noticed less commonly. There was also a significant association observed between the etiology and tooth type involved, as well as the lesion size and site. In molars, Site 1 lesions were more frequently observed, while Site 2 lesions were more prevalent in premolars and anterior teeth.

The findings of our study concur with existing literature specifying that molars, specifically mandibular molars, are at greater risk of developing carious lesions because of the intricate occlusal anatomy and being subject to masticatory forces as highlighted by Paiva *et al*.[12] The most common occurrence of Site 1 lesions in molars as indicated in the current study is consistent with that of León-López et al. (2023), who found that mandibular first molars were the most treated teeth (36.71%), followed by

maxillary first molars (24.15%). In addition, dental caries was found to be the primary etiology, representing 84.07% of all root canal treatment cases.[13] Oliveira *et al*., suggested that the occlusal fissures of molars are high-risk areas for plaque accumulation and the development of carious lesions, reinforcing the present study's finding of a significant association between the site of lesion and tooth type. This also adds strength to the anatomical and functional susceptibility of molars, since Olivieri *et al*., also highlighted that structural complexity and crack-prone characteristics enhance the vulnerability of posterior teeth.[14] The current research is also in agreement with Mukhaimer who had reported that maxillary and mandibular first molars were most commonly related to periapical radiolucencies. Such association supports the premise that anatomical complexity and functional load of posterior teeth, especially molars, render them more prone to carious lesions as well as the resultant pulpal or periapical pathoses, and therefore root canal treatment is more commonly required compared to anterior teeth.[15]

The results of this study concur with those of Sakulratchata *et al*.,[16] who found that 73.6% of primary molar proximal carious lesions extended beyond the enamel-dentin junction, which is comparable to the 72.92% of lower and 54.93% of upper molars with Size 3 advanced lesions in the current study. Likewise, the findings concur with Khan *et al*.,[17] who reported that molars represented 79.7% of the total number of teeth treated with root canals for caries. In the present analysis, caries was the reason in 100% of upper molars, 98.96% of lower molars, and 100% of premolars, whereas trauma and fractures were found to mostly occur in anterior teeth agreeing with the findings of Khan *et al*. In addition, Site 1 lesions were found in 91.55% of the upper molars and 88.54% of the lower molars, which depicts the great susceptibility of molars to occlusal caries, in agreement with Sakulratchata *et al*., and Khan *et al*. According to Teixeira et al. approximately 30% of anterior teeth had non-carious cervical lesions (NCCLs) in the adult population over the age of 40 years,18 a pattern that concurs with our findings. Nevertheless, in contrast to the conclusions of Beg *et al*., who observed a significant association between fissure type and caries incidence e.g., narrow, deep fissures and 84% caries incidence[19] while, this study did not found a significant association between etiology and lesion size (p=0.280), which can indicate that some other contributing elements like diet, oral hygiene, and fluoride use may have more significant roles to play in the progression of the lesions.

Further longitudinal research studies should be conducted to assess the development and progression of Mount-Hume classified lesions over time and their influence on treatment outcomes. Moreover, studies using the latest imaging technologies like cone-beam computed tomography (CBCT) might improve the precision of lesion classification and contribute to better clinical decision-making and standard treatment protocols. Further research exploring the role of preventive measures in reducing the incidence of large lesions requiring endodontic treatment should also be carried out.

CONCLUSION

The study demonstrates the distribution patterns of Mount-Hume classification in teeth that have undergone endodontic treatment, showing that Site 1 lesions are more common and molars are the most afflicted. The need of focused preventative measures is highlighted by the strong correlation between tooth type and lesion site.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

TK & NAR: Data acquisition, data analysis, critical review, approval of the final version to be published.

SMHS & HRUE: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SHN & AA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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