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FREQUENCY AND CAUSES OF MOLAR TEETH EXTRACTION IN ADULTS AT BKCD MARDAN. A CROSS-SECTIONAL STUDY

Original Research

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ABSTRACT

Background: Molar extraction is among the most frequently performed dental procedures globally, yet its underlying causes and clinical determinants vary across populations. In many low- and middle-income countries, including regions of Pakistan, limited epidemiological data exist to characterize molar extraction patterns and the factors contributing to surgical intervention. Understanding these patterns is essential for strengthening preventive strategies, optimizing treatment planning, and improving oral health outcomes. This study addressed a key evidence gap by examining the frequency, causes, and predictors of molar extraction among adults attending BKCD Mardan.

Objective: To determine the frequency and primary causes of molar extraction among adults at BKCD Mardan and to identify demographic and clinical predictors associated with surgical extraction.

Methods: A cross-sectional study was conducted among 362 adults (≥18 years) undergoing molar extraction. Demographic characteristics, clinical findings, indications for extraction, and tooth-related variables were recorded using a structured proforma. Bivariate comparisons were performed using chi-square tests, and predictors of surgical extraction were evaluated using multivariable logistic regression. Adjusted odds ratios (AOR) with 95% confidence intervals (CI) were calculated to determine independent associations.

Results: Dental caries accounted for 45.0% of all extractions, followed by periodontal disease (19.9%) and impaction (14.9%). Most extractions involved lower molars (63.5%) and first molars (41.4%). Surgical extraction was required in 28.2% of cases. Significant predictors of surgical extraction included age ≥40 years (AOR 1.86; 95% CI 1.15–3.01), lower molars (AOR 1.75; p=0.042), third molars (AOR 3.13; p<0.001), and impaction (AOR 4.38; p<0.001). Caries as the primary indication reduced the likelihood of surgical extraction (AOR 0.49; p=0.013).

Conclusion: Caries remains the predominant cause of molar extraction at BKCD Mardan. Older age, lower molar involvement, third molar position, and impaction significantly increase the need for surgical extraction, underscoring the importance of early preventive care, timely diagnosis, and targeted management strategies.

Keywords: Caries, Cross-Sectional Studies, Dental Extraction, Impaction, Molar, Oral Health, Surgical Procedures, Operative.

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INTRODUCTION

Tooth extraction remains one of the most frequently performed dental procedures worldwide, with molar teeth disproportionately affected due to their early eruption, complex anatomy, and heightened vulnerability to caries and periodontal breakdown (1). As key contributors to mastication, occlusal stability, and overall oral function, the premature loss of molars can significantly impair chewing efficiency, alter dietary behaviours, increase temporomandibular strain, and ultimately diminish quality of life (2). Globally, dental caries persists as the foremost indication for molar extraction among younger adults, reflecting both the high caries susceptibility of posterior teeth and the inadequate access to timely restorative care in many regions (3). In contrast, periodontal disease predominates as the leading cause among older adults, driven by cumulative plaque exposure, attachment loss, and progressive deterioration of periodontal support (4). Third molars further contribute to the global extraction burden, with impaction, pericoronitis, and related complications often necessitating more complex surgical interventions involving flap elevation, bone removal, or tooth sectioning (5). The risk of molar pathology is influenced by a wide constellation of behavioural, socioeconomic, and systemic factors, including limited oral health literacy, poor dietary patterns, smoking, comorbid medical conditions, and restricted access to preventive or restorative dental services (6). While research from Pakistan consistently identifies dental caries and periodontal disease as the predominant reasons for tooth loss, most available studies examine overall extraction trends rather than molar-specific patterns, despite the fact that molars constitute a substantial proportion of teeth removed in clinical practice (7). Mardan District in Khyber Pakhtunkhwa presents a diverse demographic profile marked by socioeconomic variability, differing oral health behaviours, and unequal access to dental services, thereby making it an important setting for examining localized determinants of dental disease and extraction needs (8).

BKCD Mardan, a central dental care facility serving both urban and rural populations, receives a large volume of patients; however, limited epidemiological evidence exists regarding the frequency, causes, and predictors of molar extraction within this community (9). Understanding the distinction between simple and surgical extraction holds clinical importance, as surgical procedures are often dictated by factors such as impaction status, tooth angulation, extent of pathology, age, and other anatomical or patient-related considerations (10). International studies have highlighted associations between extraction patterns and demographic or health-related variables—including age, gender, smoking behaviour, systemic illness, and socioeconomic background—but the applicability of such findings to populations in Mardan remains uncertain (11). Addressing this knowledge gap is essential for strengthening preventive strategies, optimizing restorative care, improving resource allocation, and enhancing patient counselling in this region (12). Therefore, this study aims to determine the frequency and primary causes of molar extraction among adults presenting to BKCD Mardan and to identify demographic and clinical factors associated with the requirement for surgical extraction, thereby providing evidence to support improved preventive and clinical decision-making in local dental practice.

METHODS

This study employed a cross-sectional design to determine the frequency, causes, and determinants of molar tooth extraction among adults attending the BKCD Dental Unit, Mardan. The design was chosen to allow the assessment of extraction patterns and their associated demographic and clinical factors within a defined population at a single point in time, making it suitable for epidemiological evaluation. The study was conducted at BKCD Mardan, a major public dental facility that provides preventive, restorative, and surgical services to both urban and rural populations, thereby offering a representative clinical setting for understanding local oral health trends. Data were collected over a predefined period of approximately six months, during which all eligible patients presenting for molar extraction were considered for recruitment. The study population consisted of 362 adults aged 18 years or older who required extraction of at least one molar tooth. A non-probability consecutive sampling technique was used to ensure that all eligible patients presenting during the study duration were included until the required sample size was achieved. Inclusion criteria comprised adults presenting specifically for molar extraction with complete dental records and willingness to provide informed consent. Patients were excluded if they required extraction due to severe maxillofacial trauma involving multiple teeth, lacked essential clinical information, or declined participation (3,7). Before data collection commenced, ethical approval was obtained from the Institutional Review Board (IRB) of BKCD Mardan and written informed consent was secured from all participants following an explanation of the study purpose,

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procedures, potential risks, and benefits. Confidentiality and anonymity were strictly upheld by assigning unique identification codes and removing personal identifiers from the dataset.

Data were collected using a structured proforma that captured sociodemographic variables (age, gender, education level, occupation, residence, and smoking status) and clinical characteristics (tooth type, arch, reason for extraction, and extraction modality—simple or surgical). Reasons for extraction were categorized according to standardized diagnostic criteria, including dental caries, periodontal disease, impaction, prosthetic indications, failed root canal treatment, trauma, abscess or infection, orthodontic requirement, and other relevant causes. All clinical examinations were performed by trained dental surgeons using sterilized instruments under proper illumination, with radiographic evaluation when necessary to determine diagnosis and extraction complexity. Data were recorded immediately during or shortly after each procedure to minimize recall bias. The principal investigator cross-verified all entries for completeness and accuracy prior to data analysis. Postoperative outcomes, including complications occurring within seven days of extraction, were documented using standardized definitions. Data were entered and analyzed using statistical software version 26. Descriptive statistics, including frequencies and percentages, were calculated for all categorical variables. The chi-square test was used to evaluate associations between reasons for extraction and demographic or clinical characteristics, with statistical significance set at $p < 0.05$. A multivariable logistic regression model was applied to identify independent predictors of surgical extraction, and results were expressed as adjusted odds ratios with corresponding 95% confidence intervals to assess the strength of associations. All analyses adhered to recognized statistical and epidemiological standards to ensure methodological rigor.

RESULTS

The analysis included 362 adult participants undergoing molar extraction. The largest age group was 30–39 years (n=102, 28.2%), followed by 18–29 years (n=88, 24.3%) and 40–49 years (n=72, 19.9%), whereas those aged ≥60 years constituted the smallest proportion (n=48, 13.3%), indicating that extractions were more frequent in younger and middle-aged adults. Males slightly predominated (n=198, 54.7%) compared with females (n=164, 45.3%). With respect to education, most participants had secondary education (n=110, 30.4%) or primary education (n=78, 21.5%), while 60 (16.6%) were illiterate, 68 (18.8%) had completed intermediate education, and 46 (12.7%) had graduate-level or higher qualifications. Occupationally, housewives or unemployed individuals formed the largest group (n=120, 33.1%), followed by laborers/workers (n=82, 22.7%) and professionals such as clinicians and teachers (n=70, 19.3%), whereas students, businesspersons, and retired individuals each contributed 30 cases (8.3%). Most participants resided in urban areas (n=210, 58.0%), with the remainder from rural settings (n=152, 42.0%). The majority were married (n=278, 76.8%), while 54 (14.9%) were single and 30 (8.3%) were widowed or divorced. Regarding smoking status, 98 (27.1%) were current smokers, 42 (11.6%) were former smokers, and 222 (61.3%) had never smoked. Chronic systemic diseases were reported by 86 participants (23.8%), whereas 276 (76.2%) reported no systemic comorbidity. In terms of tooth-related characteristics, most extractions involved mandibular molars (n=230, 63.5%), while maxillary molars accounted for 132 cases (36.5%). First molars were the most frequently extracted teeth (n=150, 41.4%), followed by second molars (n=138, 38.1%), with third molars comprising 74 extractions (20.4%). Simple forceps extractions constituted the majority of procedures (n=260, 71.8%), whereas 102 extractions (28.2%) required surgical intervention involving elevation and/or bone removal. Local anaesthesia alone was administered in 352 patients (97.2%), while general anaesthesia or intravenous sedation was used in 10 patients (2.8%). Antibiotics were prescribed to 220 participants (60.8%), while 142 (39.2%) did not receive antibiotic therapy. Postoperative complications within seven days were recorded in 28 patients (7.7%), whereas 334 (92.3%) had an uncomplicated early postoperative course. With respect to symptom duration prior to extraction, 120 patients (33.1%) sought care within one week of symptom onset, 160 (44.2%) presented within 1–4 weeks, and 82 (22.6%) delayed treatment for more than four weeks.

Dental caries was the most frequent primary indication for molar extraction, accounting for 163 cases (45.0%), with a slightly higher proportion among females (49.4%) than males (41.4%), although this difference did not reach statistical significance (p=0.12). Periodontal disease was the second most common reason (n=72, 19.9%), affecting 22.2% of males and 17.1% of females (p=0.21). Impaction contributed to 54 extractions (14.9%), with 13.1% of males and 17.1% of females undergoing extraction for this reason (p=0.29). Less frequent indications included prosthetic reasons (n=22, 6.1%), trauma or fracture (n=14, 3.9%), failed root canal treatment (n=18, 5.0%), abscess or acute infection (n=11, 3.0%), orthodontic indications (n=4, 1.1%), and other causes (n=4, 1.1%), with no statistically significant gender differences (all p>0.05). The overall comparison of extraction indications between males and females was not statistically significant (p=0.27), indicating a broadly similar distribution of causes across genders in this cohort. Multivariable logistic regression analysis identified several independent predictors of surgical molar extraction. Age ≥40 years was associated with a

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higher likelihood of surgical extraction compared with younger adults, with an adjusted odds ratio (AOR) of 1.86 (95% CI: 1.15–3.01; p=0.012). Extraction of mandibular molars was also significantly associated with surgical intervention (AOR 1.75; 95% CI: 1.02–2.98; p=0.042). Third molars had more than three times the odds of requiring surgical extraction compared with first and second molars (AOR 3.13; 95% CI: 1.72–5.68; p<0.001). Impaction emerged as the strongest predictor of surgical extraction, with an AOR of 4.38 (95% CI: 2.20–8.74; p<0.001). Conversely, dental caries as the primary reason for extraction was associated with a lower likelihood of surgical intervention (AOR 0.49; 95% CI: 0.28–0.86; p=0.013), reflecting that most carious molars were amenable to simple extraction. Male gender (AOR 0.76; 95% CI: 0.46–1.26; p=0.29), periodontal disease (AOR 1.25; 95% CI: 0.66–2.32; p=0.49), presence of systemic disease (AOR 1.20; 95% CI: 0.66–2.17; p=0.54), and current smoking status (AOR 1.48; 95% CI: 0.87–2.50; p=0.15) were not significantly associated with surgical extraction.

Table 1: Demographic characteristics of study participants (n = 362)

Variable	Category	n	%
Age (years)	18–29	88	24.3%
	30–39	102	28.2%
	40–49	72	19.9%
	50–59	52	14.4%
	≥60	48	13.3%
Gender	Male	198	54.7%
	Female	164	45.3%
Education level	Illiterate	60	16.6%
	Primary	78	21.5%
	Secondary	110	30.4%
	Intermediate	68	18.8%
	Graduate+	46	12.7%
Occupation	Housewife / Unemployed	120	33.1%
	Labor / Worker	82	22.7%
	Student	30	8.3%
	Professional (clinician/teacher/etc.)	70	19.3%
	Business	30	8.3%
	Retired	30	8.3%
Residence	Urban	210	58.0%
	Rural	152	42.0%
Marital status	Married	278	76.8%
	Single	54	14.9%
	Widowed / Divorced	30	8.3%
Smoking status	Current smoker	98	27.1%

Variable	Category	n	%
	Former smoker	42	11.6%
	Never smoker	222	61.3%
Chronic systemic disease	Yes	86	23.8%
	No	276	76.2%

Table 2: Tooth- and procedure-related characteristics (n = 362)

Variable	Category	n	%
Arch	Lower molar	230	63.5%
	Upper molar	132	36.5%
Specific tooth	1st molar	150	41.4%
	2nd molar	138	38.1%
	3rd molar	74	20.4%
Type of extraction	Simple (forceps)	260	71.8%
	Surgical (elevation/osseous removal)	102	28.2%
Anesthesia used	Local anesthesia only	352	97.2%
	General anesthesia / IV sedation	10	2.8%
Antibiotic prescribed	Yes	220	60.8%
	No	142	39.2%
Post-op complication within 7 days	Yes	28	7.7%
	No	334	92.3%
Time from symptom onset to extraction	< 1 week	120	33.1%
	1–4 weeks	160	44.2%
	> 4 weeks	82	22.6%

Table 3: Primary reasons for molar extraction by gender (n = 362)

Reason for Extraction	Male (n=198)	Female (n=164)	Total (n=362)	p-value
Caries	82 (41.4%)	81 (49.4%)	163 (45.0%)	0.12
Periodontal disease	44 (22.2%)	28 (17.1%)	72 (19.9%)	0.21
Impaction	26 (13.1%)	28 (17.1%)	54 (14.9%)	0.29
Prosthetic reasons	14 (7.1%)	8 (4.9%)	22 (6.1%)	0.41
Trauma / fracture	10 (5.0%)	4 (2.4%)	14 (3.9%)	0.19
Failed RCT	12 (6.1%)	6 (3.7%)	18 (5.0%)	0.32

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Reason for Extraction	Male (n=198)	Female (n=164)	Total (n=362)	p-value
Abscess / acute infection	6 (3.0%)	5 (3.0%)	11 (3.0%)	0.98
Orthodontic indication	2 (1.0%)	2 (1.2%)	4 (1.1%)	0.88
Other	2 (1.0%)	2 (1.2%)	4 (1.1%)	0.88
Overall Chi-square comparison	—	—	—	0.27

Table 4: Multivariable Logistic Regression Predicting Surgical Extraction (n = 362)

Predictor	β-Coefficient	Adjusted Odds Ratio (AOR)	95% CI for AOR	p-value
Age (≥40 yrs)	0.62	1.86	1.15 – 3.01	0.012
Male gender	–0.28	0.76	0.46 – 1.26	0.29
Lower molar	0.56	1.75	1.02 – 2.98	0.042
3rd molar vs. other molars	1.14	3.13	1.72 – 5.68	<0.001
Caries as reason for extraction	–0.70	0.49	0.28 – 0.86	0.013
Periodontal disease	0.22	1.25	0.66 – 2.32	0.49
Impaction	1.48	4.38	2.20 – 8.74	<0.001
Presence of systemic disease	0.18	1.20	0.66 – 2.17	0.54
Smoking (current vs none)	0.39	1.48	0.87 – 2.50	0.15

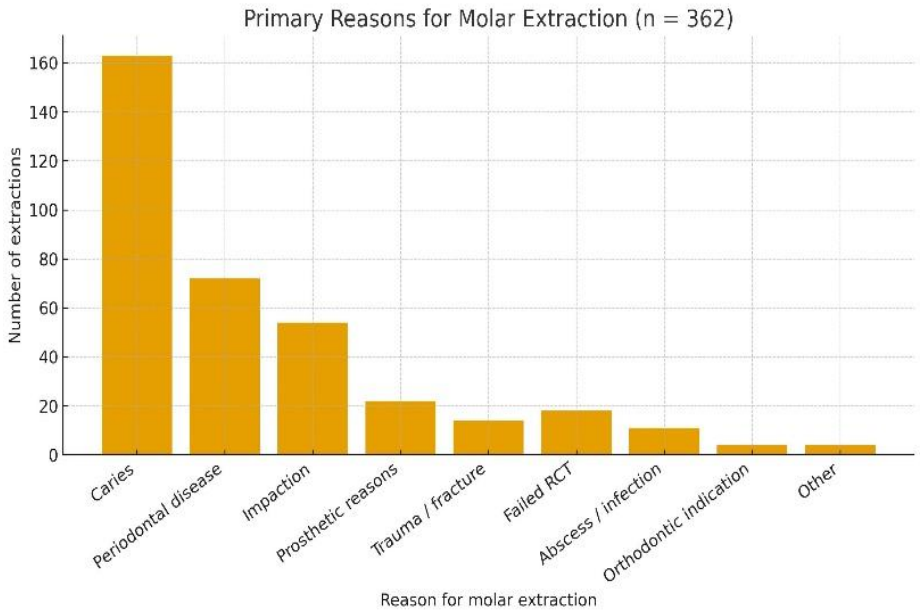

Figure 1 Primary Reasons for Molar Extraction (n=362)

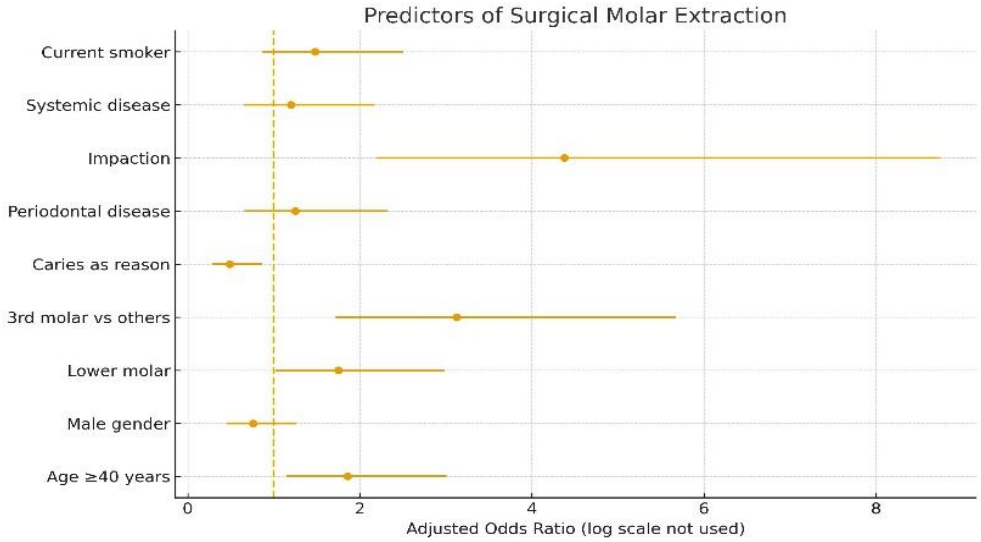

Figure 2 Predictors of Surgical Molar Extraction

DISCUSSION

The present study explored the frequency, causes, and predictors of molar extraction among adults attending BKCD Mardan, providing important insights into local oral health patterns and treatment needs. Dental caries emerged as the predominant cause of extraction, accounting for nearly half of all cases, a finding consistent with research from Pakistan and other low- to middle-income countries where limited access to oral health services, poor dietary habits, and inadequate preventive care continue to drive high caries prevalence (12,13). The predominance of caries highlights ongoing challenges in early disease detection and timely restorative intervention, suggesting a persistent gap between disease onset and treatment seeking that ultimately leads to tooth loss (14). Periodontal disease accounted for approximately one-fifth of extractions and was more common among older participants, reinforcing evidence that cumulative plaque exposure, declining periodontal support, and age-related systemic vulnerabilities contribute substantially to tooth loss with advancing age (15). Tooth-specific findings also aligned with established epidemiological patterns. Lower molars were extracted more frequently than upper molars, and first molars represented the largest share of extractions, likely reflecting their early eruption, complex occlusal anatomy, and prolonged exposure to cariogenic and periodontal risk factors (16,17). Third molars demonstrated a strong association with surgical extraction due to impaction, consistent with earlier studies that noted the high prevalence of impacted mandibular third molars and the need for surgical intervention because of anatomical constraints, angulation, or recurrent pericoronitis (18). The identification of age ≥40 years as a significant predictor of surgical extraction further suggested that older adults may present with teeth showing advanced pathology or structural compromise, requiring more complex procedures (19).

The multivariable analysis underscored several clinically meaningful relationships. Lower molars, third molars, and impacted teeth significantly increased the likelihood of surgical extraction, reflecting the anatomical complexity and higher incidence of impaction in these regions. Conversely, carious teeth were more often managed with simple extraction, indicating that caries severity among included cases was generally amenable to forceps removal without elevation or bone removal (20). Postoperative complications occurred in less than 10% of cases, suggesting adherence to standard surgical protocols and effective perioperative care. Some factors traditionally linked with extraction difficulty—including gender, systemic disease, and smoking status—were not significantly associated with surgical intervention. Although some international studies have suggested that males and smokers may experience more complicated extractions due to differences in bone density, oral hygiene practices, or inflammation (21), such associations were not observed in this population. Differences in oral health behavior, access to care, or sample characteristics may explain these variations. The absence of significant associations for systemic disease may reflect the relatively small proportion of affected participants or variations in disease severity. The implications of these findings emphasize the critical role of preventive strategies. Strengthening community-based oral health education, ensuring accessible restorative services, and introducing early screening for periodontal disease could reduce the burden of advanced

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pathology leading to extractions. The high frequency of impaction-related surgical extractions also indicates the value of timely assessment of third molars, particularly in younger adults, to mitigate complications associated with delayed intervention.

The study possessed several strengths, including a relatively large sample size, standardized data collection procedures, and the use of multivariable regression to identify independent predictors of surgical extraction. However, certain limitations should be acknowledged. As a single-center study, the findings may not fully represent patterns across the broader district or province. The cross-sectional design limited the ability to establish temporal relationships or explore longitudinal outcomes, such as healing patterns or long-term functional consequences. The study relied on clinical records and patient recall for some variables, introducing the possibility of misclassification or recall bias. Additionally, the lack of detailed categorization of systemic diseases prevented deeper assessment of their relationship with extraction complexity. Future research could benefit from multi-center designs, broader geographic representation, and the inclusion of radiographic indices such as root morphology, bone density, or impaction classification to better predict surgical difficulty (22). Longitudinal studies examining postoperative outcomes, healing trajectories, and patient-reported experiences would further enrich understanding of molar extraction trends and improve clinical decision-making. Overall, the findings reinforce the need for targeted preventive and restorative interventions, timely management of third molars, and strengthened oral health literacy to reduce the reliance on extractions as a primary treatment modality and to minimize surgical complexity in adult dental care populations.

CONCLUSION

This study identified dental caries as the primary reason for molar extraction among adults attending BKCD Mardan, with periodontal disease and impaction also contributing substantially to tooth loss. Lower and first molars were most commonly affected, while third molars and impacted teeth were strongly linked with the need for surgical intervention. Older age further increased the likelihood of complex extractions, whereas gender, systemic disease, and smoking status showed no meaningful influence on extraction type. These findings underscore the importance of strengthening preventive oral health measures, promoting early management of caries and periodontal conditions, and ensuring timely evaluation of impacted teeth. Enhancing oral health awareness and improving access to affordable dental care hold the potential to reduce avoidable extractions and preserve long-term molar function in the adult population.

AUTHOR CONTRIBUTIONS

Author	Contribution
Mehwish Gul	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Iqbal Bacha*	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Aqsa	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Maryam Wazir	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Shahab Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Gul Sher	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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REFERENCES

1. Taylor GD, Bulmer V. Advances in knowledge and practice benefiting the health and management of first permanent molars in children. Br Dent J. 2025;238(2):92-8.

2. Lodi G, Azzi L, Varoni EM, Pentenero M, Del Fabbro M, Carrassi A, et al. Antibiotics to prevent complications following tooth extractions. Cochrane Database Syst Rev. 2021;2(2):Cd003811.

3. Vinayahalingam S, Kempers S, Limon L, Deibel D, Maal T, Hanisch M, et al. Classification of caries in third molars on panoramic radiographs using deep learning. Sci Rep. 2021;11(1):12609.

4. Nedeljkovic A, Milosavljevic M, Mladenovic K, Janjic V, Schimmel M, Mladenovic R. Clinical outcomes of novel CAD/CAM-designed functional space maintainers produced via additive and subtractive methods: A randomized controlled trial. J Dent. 2025;155:105608.

5. Thakkar AB, Patel M, Makwani D, Mehta M, Panchal M, Kanani H. Comparative assessment of the effectiveness of low-level laser therapy and chitosan in postoperative pain and bleeding management after primary molar extraction: A randomized clinical study. J Indian Soc Pedod Prev Dent. 2025;43(1):111-9.

6. Hayawi MWA, Assy Z, Forouzanfar T, Toedtling V, Brand HS. [Distal surface caries in the mandibular second molar in the presence of a partially erupted/impacted third molar]. Ned Tijdschr Tandheelkd. 2024;131(11):479-86.

7. Splieth CH, Eissa M, Zeitoun N, Mustafa Ali MAL, Schmoeckel J, Alkilzy M, et al. Distribution of space loss after premature extraction of primary molars. Quintessence Int. 2025;56(7):548-54.

8. Palotie U, Tseveenjav B, Vehkalahti MM. Early failures and further re-interventions of direct posterior restorations at Public Dental Service 15-year retrospective observation. J Dent. 2025;161:105991.

9. Yuan GH, Wang Y. [Etiology and clinical treatment strategies for second primary molars without permanent tooth germs]. Zhonghua Kou Qiang Yi Xue Za Zhi. 2024;59(7):738-44.

10. Alqanas S, Alsahiem J, Aljami A, Alsudairi N, Ahmad S, Sharma S, et al. Factors related to spontaneous space closure following early first permanent molar extraction: A systematic review. Int J Paediatr Dent. 2025;35(3):625-38.

11. Bakar M, Duane B. Has children's oral health-related quality of life improved more following necrotic primary molars pulpectomy or extraction? Evid Based Dent. 2024;25(2):85-6.

12. Toedtling V, Forouzanfar T, Brand HS. Historical aspects about third molar removal versus retention and distal surface caries in the second mandibular molar adjacent to impacted third molars. Br Dent J. 2023;234(4):268-73.

13. Lindahl O, Ventä I. Level of difficulty of tooth extractions among roughly 100,000 procedures in primary care. Clin Oral Investig. 2023;27(8):4513-20.

14. Shmuly T, Winocur-Arias O, Kahn A, Findler M, Adam I. Maxillary Tuberosity Fractures Following Third Molar Extraction, Prevalence, and Risk Factors. J Craniofac Surg. 2022;33(7):e708-e12.

15. Silva FG, Campos PH, Rangel M, Alencar CJF, Novaes TF, Diniz MB, et al. Multidisciplinary approach to multiple dental anomalies in pediatric patients: a case report with 4-year follow-up. Gen Dent. 2024;72(5):27-30.

16. Sabri R. Multidisciplinary management of permanent first molar extractions. Am J Orthod Dentofacial Orthop. 2021;159(5):682-92.

17. Malas V, Eliasson A. Planned and unplanned follow-up visits after mandibular third molar surgery in the Public Dental Service in Örebro. Acta Odontol Scand. 2021;79(3):182-7.

18. Guldiken IN, Gulsever S, Malkoc Y, Yilmaz ZC, Ozcan M. Prophylactic third molar removal: are oral surgeons and orthodontists aligned in preventive approaches? BMC Oral Health. 2024;24(1):1072.

19. Vranckx M, Lauwens L, Moreno Rabie C, Politis C, Jacobs R. Radiological risk indicators for persistent postoperative morbidity after third molar removal. Clin Oral Investig. 2021;25(7):4471-80.

20. Gürses M, Gürses G. Risk factors for distal caries of second molars adjacent to mesioangular or horizontal partially erupted mandibular third molars: a cross-sectional study. Br Dent J. 2024;236(12):971-5.

21. Hamza B, Papageorgiou SN, Patcas R, Schätzle M. Spontaneous space closure after extraction of permanent first molars in children and adolescents: a systematic review and meta-analysis. Eur J Orthod. 2024;46(6).

22. Butzin S. To prophylactically extract or not to extract partially erupted mesio-angularly impacted lower third molars? Br Dent J. 2021;231(8):445-8.