Analyzing Tooth Extraction Pattern in Orthodontics: A Comprehensive Study on Demographics and Malocclusion Factors

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Abstract – This study investigates the patterns of tooth extraction in orthodontic treatment, focusing on demographics and malocclusion factors. Understanding these patterns is crucial for optimizing dental alignment and improving overall dental function and aesthetics. To determine the frequency and distribution of tooth extraction patterns in orthodontic patients and explore the relationship between extraction patterns and demographic characteristics, malocclusion types, and treatment outcomes. This study was conducted at the Department of Orthodontics, Khyber College of Dentistry, Peshawar, over four months (March to June 2023), this study included 370 patients aged 15 to 40 years. Using non-probability convenient sampling, data on demographics, extraction patterns, and malocclusion types were collected from patient records. Ethical approval was obtained, and data analysis was performed using SPSS version 26. The sample comprised 177 males (47.8%) and 193 females (52.2%). Age distribution was 15-20 years (54.1%), 21-25 years (31.6%), 26-30 years (3.8%), 31-35 years (6.2%), and 36-40 years (4.3%). In total, 298 patients (80.5%) underwent orthodontic treatment with extraction, while 72 patients (19.5%) were treated without extraction. Premolars were the most frequently extracted teeth, particularly maxillary premolars (66.8%). Class II malocclusion was the most prevalent (75.7%), followed by Class I (14.9%) and Class III (9.5%). The study highlights the prevalence of specific extraction needs and malocclusion types, guiding personalized orthodontic treatment strategies. Tooth extractions, particularly of premolars, play a significant role in managing malocclusion. The gender distribution and age demographics align with similar studies, emphasizing the importance of tailored orthodontic care. Understanding these patterns helps in planning effective treatment strategies to achieve optimal dental alignment and functional outcomes.

Keywords – Oral health, Malocclusion, Dental aesthetic index, Orthodontic treatment, Dental anomalies, Malocclusion classification, Dental hygiene, Orthodontic extraction trends.

1. Introduction

Oral health is crucial for overall well-being, encompassing more than just healthy teeth. It protects against long-term disorders that impact craniofacial and dental health, such as cleft palate, mouth cancer, and oral tissue lesions [1] The alignment of the upper and lower teeth when they are at rest or when chewing is referred to as normal occlusion, and it represents how the masticatory system functions [2]. Malocclusion refers to abnormal positioning of teeth within the same arch or between upper and lower arches, impacting craniofacial development and masticatory function. It involves deviations in intra- and/or intermaxillary relationships beyond normal ranges [3]. Malocclusion arises from a complex interplay of genetic predisposition, environmental influences, and habitual oral behaviors such as mouth breathing, tongue thrusting, and abnormal tongue resting positions, which collectively exert stress on the maxillofacial and dentoalveolar structures, potentially causing jaw abnormalities and misalignment of dental arches [4].

Malocclusion encompasses various types of dental misalignments like Class I malocclusion, for instance, is characterized by normal molar relationships but may exhibit issues like crowding and crossbites, where upper teeth slightly overlap lower teeth. Class II malocclusion, also known as distocclusion or overjet, involves the upper teeth protruding forward relative to the lower teeth, with two subdivisions: Class II division 1 where upper front teeth are proclined, and Class II division 2 where they are retroclined. In contrast, Class III malocclusion, or mesiocclusion, features the lower first molar's buccal groove positioned mesially compared to the upper first molar, resulting in a negative overjet [5, 6]. Tooth extraction is frequently required to treat complex malocclusions because of various reasons, including the kind of malocclusion, treatment goals, and selected procedure. Many times, the type of malocclusion requires the extraction of particular teeth. Sometimes, a malocclusion might spontaneously cure itself if extractions are timed strategically [7].

In orthodontic therapy, extraction choices have a big impact on treatment duration, patient and family satisfaction, occlusion, and aesthetics. Even though they were once controversial, extractions are now commonly recognized as essential to standard care, making it necessary to comprehend the prevalence and rationale behind adult patients' decisions to undergo extractions as opposed to none [8]. Research conducted at UERJ's Orthodontic clinic between 1980 and 2011 found that tooth extraction rates have decreased by 20% over a 32-year period. It was discovered that patients with Class I malocclusion had fewer extractions of first premolars than patients with Class II malocclusion. At the beginning of the 20th century, there was worry that orthodontic extractions may jeopardize occlusion and ideal appearance [9].

The man known as the "father of orthodontics,"Edward Angle, criticized orthodontists who advocated extracting teeth to treat severe overbites in the upper jaw and teeth [10]. According to a case study, 3% presented with Class I malocclusion, 5% with Class II, and 0% with Class III, resulting in a total of 6-7% of cases requiring tooth extraction for orthodontic treatment across different malocclusion classes [11, 12]. After Edward Angle death in 1930, Charles Tweed reviewed patients that had not had extractions and discovered that 80% of them lacked stability, functional goals, periodontal health, and face aesthetics. The late 1940s saw a rise of extraction-based orthodontic procedures as a result of Tweed's subsequent advocacy for extractions to improve post-treatment outcomes [13]. About 50% of orthodontic patients undergo treatment involving extraction, often targeting first premolars. Environmental and genetic factors contribute to various dental anomalies, complicating treatment when not promptly identified or managed [14].

Extraction methods have been extensively utilized for malocclusion correction over the past 20 years, frequently focusing on the second premolar. In order to avoid difficulties, clinicians recommend extracting impacted third molars prior to orthodontic treatment, particularly for patients who frequently experience dental abnormalities Therefore, during the orthodontic treatment careful investigation are necessary and the extraction of any tooth if necessary for the correction of others teeth should be extracted [15, 16].

2. Methodology

The study was conducted at the Department of Orthodontics, Khyber College of Dentistry, Peshawar, over a duration of approximately four months from March to June 2023, including patients coming to seek orthodontic treatment. The sample size of 370 patients was determined using the formula $n = P(1-P)(Z/E)^2$, based on a prevalence (P) of 45%, a Z-score of 1.96 (for a 95% confidence interval), and an expected error (E) of 0.05. Non-probability convenient sampling was employed to select patients aged 15 to 40 years with Class I, Class II, or Class III malocclusion, including both males

and females. Exclusion criteria involved patients with missing or extracted teeth.

Data collection was conducted after obtaining approval from the Undergraduate & Research Committee and written permission from the Head of the Orthodontic Department Khyber college of dentistry Peshawar. Information, including demographic variables (age, gender), frequency and patterns of teeth extractions, and types of malocclusions, was extracted from patient records using a structured proforma. Oral consent was obtained from all study participants, and each participant was provided with a proforma to independently complete. After collecting the required data, data analysis was performed using SPSS version 26, employing descriptive statistics to calculate percentages and prepare graphs and tables for all variables.

3. Results

The demographic data from the study participants reveals that 370 patients were examined, comprising 177 males (47.8%) and 193 females (52.2%). The age distribution of patients between 15 to 40 years was categorized as follows: 15-20 years were 200 (54.1%), 21-25 years were 117 (31.6%), 26-30 years were 14 (3.8%), 31-35 years were 23 (6.2%), and 36-40 years were 16 (4.3%). Notably, the majority of patients (54.1%) were in the 15-20 year age group as shown in **Table1**.

In the study, 298 patients (80.5%) underwent orthodontic treatment with extraction, while 72 patients (19.5%) were treated without extraction based on their malocclusion type. Among those treated without extraction, 71 patients (19.2%) were noted. Patients treated with extraction had varying numbers of teeth removed: 5 patients (1.4%) had one tooth extracted, 247 patients (66.8%) had two teeth extracted, and 47 patients (12.7%) had four teeth extracted as depicted in **Table2**.

The study provides detailed insights into tooth extraction patterns and malocclusion classifications during orthodontic treatment. Extraction frequencies by quadrant include: Maxillary Right quadrant with 96 (25.9%) of patients have no tooth extraction, 228 (61.6%) patients undergoing 1st premolar extraction, , 2 (0.6%) patients shows extraction of lateral incisor and 44 (11.9%) patients shows extraction of 3rd molars. Maxillary Left quadrant with 96 (25.9%) of patients have no tooth extraction, 1 (0.3%) shows extraction of central incisor, 1 (.3%) patient shows extraction of lateral incisor, 228 patients (61.6%) undergoing 1st premolar extraction and 44 (11.9%) patients shows extraction of 3rd molar. Mandibular Right quadrant with 300 (8l.l%) of patients have no tooth extraction, 2 (0.5%) shows extraction of central incisor, 2 (0.5%) patient shows extraction of lateral incisor, 45(12.2%) patients show extraction of 1st premolar, and 21 (5.7%) patients shows extra premolar. Mandibular Left quadrant with 300 (81.1%) of patients have no tooth extraction, 3 (0.8%) shows extraction of central incisor, 1 (0.3%) patient shows extraction of lateral incisor, 45 (12.2%) patients show extraction of 1st premolar, and 21 (5.7%) patients shows extraction of 2nd premolar as shown in **Table 3**.

Malocclusion classifications reveal that Class II malocclusion was treated in 280 patients (75.7%), Class I in 55 patients (14.9%), and Class III in 35 patients (9.5%) as shown in **Table4.** These findings highlight the prevalence of specific extraction needs and malocclusion types, guiding personalized orthodontic treatment strategies for optimal dental alignment and functional outcomes.

Table 1: Demographic data of patients.

S.#	Variables		n	%
1	Gender	Male	177	47.8
		Female	193	52.2
2	Age	15-20 years	200	54.1
		21-25 years	117	31.6
		26-30 years	14	3.8
		31-35 years	23	6.2
		36-40 years	16	4.3

Table 2: Extraction during orthodontic treatment.

S.3	Variables		Frequency	Percentage
1	Extraction during orthodontic treatment	Patients with ortho-extraction	298	80.5
		Patients with non-extraction	72	19.5
2	No. of teeth extraction	Patients without tooth extraction	71	19.2
		Patients with single tooth extraction	5	1.4
		Patients with two teeth extraction	247	66.8
		Patients with four teeth extraction	47	12.7

Table3: Types of tooth extraction during orthodontic treatment

s.#	Variables	Patients without tooth extraction	Patients with central incisor extraction	Patients with lateral incisor extraction	Patients with 1st premolar extraction	Patients with 2nd premolar extraction	Patients with 2nd molar extraction	Patients with 3rd molar extraction
1	Maxillary right quadrant status	96	0	2	228	0	0	44
2	Maxillary left quadrant status	96	1	1	228	0	0	44
3	Mandibular right quadrant status	300	2	2	45	21	0	0
4	Mandibular left quadrant status	300	3	1	45	0	21	0

Table4.

Variables		n
Malocclusion classification	Class I malocclusion	55
	Class II malocclusion	280
	Class III malocclusion	35

4. Discussion

Teeth are vital for speech, mastication, and aesthetics, being the hardest substances in the human body [17]. Their absence can impair speech, aesthetics, and chewing, significantly impacting quality of life. However, extractions for orthodontic reasons can create space necessary for teeth alignment, improving overall dental function and appearance [18]. Treating complex malocclusions often necessitates tooth extraction, influenced by factors like medical history, dental condition, patient attitude, caries risk, and oral hygiene. Different malocclusion types require varied extraction patterns. Some malocclusions may self-correct over time [19]. The decision to extract teeth is influenced by a number of criteria, including the kind of malocclusion, the intended course of therapy, and the selected methods. In this study, tooth extraction for orthodontic therapy was performed on somewhat more female (52.2%) than males (47.8%). Our results are supported by the gender distribution observed in a comparable study including 451 undergraduate students at a Finnish institution, wherein a greater proportion of orthodontic treatments were performed on female than on males [20]. At the Armed Forces Institute of Dentistry in Rawalpindi, Pakistan, tooth agenesis rates were higher in males, likely due to a larger female patient base. The study emphasized the common occurrence of teeth deviations and highlighted the frequent need for premolar extractions to address crowding and improve facial aesthetics [21, 22].

The ideal teeth for the treatment of crowding are premolars; both in upper and lower arch and in anterior and posterior teeth [23]. In our study, premolars were the most extracted teeth. The study from Brazil's Bauro Dental School's Orthodontic Department observed a gradual decline in the extraction of all four premolars over 35 years, while the protocol for extracting two upper premolars remained consistent [24]. Similarly, in our study, maxillary premolar extractions (66.8%) were more frequent than other teeth for orthodontic reasons. This frequency reflects the percentage of orthodontic patients opting for treatment involving extraction of one, two, or more teeth.

In our study, 80.5% of cases underwent treatment with extraction, while 19.5% were treated without extraction, varying by malocclusion type. A study from UERJ's Orthodontic clinic between 1980 and 2011 showed higher extraction rates in patients with Class II malocclusion compared to Class I, with no significant gender differences noted [25]. In our findings, Class II malocclusion was most prevalent (75.7%), followed by Class I (14.9%) and Class III (9.5%). These differences can be attributed to factors like oral hygiene practices, awareness of orthodontic treatments involving extraction, habits such as thumb sucking, and sample size variations [25, 26].

5. Conclusion

In summary, our study concludes that a majority of orthodontic patients were young females aged 15 to 20 years, predominantly treated with extraction therapy. Most commonly, patients underwent extraction of only two teeth (one per quadrant), with maxillary first premolars being the most frequently removed. The distribution of malocclusion types showed a prevalence of Class II, followed by Class I and Class III malocclusions among treated cases. These findings highlight typical demographics and treatment patterns in orthodontic practice, guiding clinical approaches and patient care strategies.

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