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Original article

Prevalence and Distribution of Impacted Teeth in a Libyan Subpopulation: A Retrospective Study at the LIMU Dental Centre

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Abstract
This observational, cross-sectional, retrospective study investigated the prevalence and distribution of impacted teeth among Libyan patients attending the Dental Centre at the Libyan International Medical University (LIMU) between May 2021 and February 2023. Out of 1553 panoramic radiographs, 1113 met the inclusion criteria. Impacted teeth were identified in 610 patients (54.8%), with nearly equal distribution between the upper (27.8%) and lower (27%) arches. The upper left region showed the highest frequency of impaction (14.6%). Statistical analysis revealed a significant association between age and tooth impaction ($p \cong 0.00$), particularly among patients under 30 years, while gender showed no significant influence ($p > 0.05$), except for the upper right arch ($p = 0.017$). The most commonly impacted teeth were the upper right third molars and upper canines. The study concludes that age and tooth location are key factors in impaction prevalence, whereas gender plays a minimal role.
Keywords. Impacted Teeth, Prevalence, Frequency, Panoramic Images, Libyan International Medical University.

Introduction

Tooth impaction occurs when a tooth is prevented from erupting due to a barrier in its path, which can cause several problems. These include root resorption of adjacent teeth, orofacial pain, infections, and the development of cysts or tumors [1]. Tooth impaction is a common issue that has been studied in several countries [2–5], including Brazil, Bangladesh, Saudi Arabia, and Latin American countries [6–8]. The most commonly impacted tooth varies depending on the country, with the mandibular third molar being the most commonly impacted tooth in Brazil, lower third molars being the most commonly impacted in Bangladesh, and maxillary canines being the most commonly impacted in Saudi Arabia. In addition, it was also reported that the prevalence of impacted teeth was more frequent in females than in males [7]. However, there is limited data available on the prevalence of impacted teeth in Libya.

Tooth impaction is associated with various factors, including age, timing of tooth eruption, ethnicity, and radiographic evaluation criteria [6,9]. Local factors contributing to tooth impaction may include: lack of space in the dental arch, root dilaceration, trauma, and ectopic positioning of the tooth buds. Systemic factors may include nutritional deficiencies, endocrine diseases, syndromes, and specific infections. Genetic factors may also play a role in tooth impaction [10,11].

Tooth impaction can cause malocclusions, which can affect tooth movement, functional occlusion, and an esthetic smile [8,12]. Late diagnosis of tooth impaction can lead to damage to the maxillomandibular complex due to the forces exerted by the impacted tooth on other teeth, leading to crowding [13,14]. Careful examination, diagnosis, and follow-up of patients with impacted teeth are recommended to avoid such complications [15]. Imaging studies, like panoramic imaging, are useful tools for identifying and diagnosing impacted teeth. Most factors related to decision-making on whether or not to extract impacted teeth can be determined during a preoperative radiographic examination [16–18].

Methods

A cross-sectional retrospective study was conducted using panoramic radiographic images obtained from the Dental Centre at the Faculty of Dentistry, Libyan International Medical University (LIMU), between May 2021 and February 2023. Ethical approval was granted under Certificate Reference No. DEN-2023-00092. The initial sample comprised 1,553 cases, which were subjected to specific inclusion and exclusion criteria. Eligible participants were Libyan nationals aged at least two years beyond the average age of tooth eruption. Exclusion criteria included patients with evidence of maxillofacial fractures, space-occupying lesions (unless associated with impacted teeth), hereditary diseases or syndromes, mixed dentition, radiographic errors, and edentulism.

To maintain confidentiality, demographic data—specifically age and gender—were recorded using a coded checklist. Panoramic images were evaluated by two observers: a trained dentist (first observer) and a dental and maxillofacial radiologist (second observer), under standardized conditions including a dimly lit room, identical workstation computer units, and the same display monitor. All panoramic images were acquired using a single Digital Panoramic System (Vatech · Rayence · Vatech MCIS · Ewoosoft · Woorien · Vatech eng), located at 13, Samsung 1-ro 2-gil, Hwaseong-si, Gyeonggi-do, Korea. Image acquisition was performed using two exposure settings: 60 kVp, 4 mA, 18 s, and 66 kVp, 8 mA, 18 s. Evaluations were conducted on an HP LP2475W LCD TFT Monitor using the EasyDent V4 Viewer software (version 4.1.5.10,

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To assess reliability, 15% of the images were randomly selected for analysis of both inter-observer repeatability and intra-observer consistency. The prevalence of impacted teeth was analyzed according to age, gender, and dental arch type, and results were expressed as frequencies and percentages. All quantitative data were presented as mean (μ) and standard deviation (SD). Statistical analysis was performed using SPSS software, version 28, with significance set at $p < 0.05$.

Results

The study examined a substantial number of panoramic images, a total number 1553, to investigate impacted teeth. Of these, 1113 images (556 males and 557 females) met the inclusion criteria, ensuring a robust dataset for analysis. The statistical analysis utilised the Chi-square test, a method commonly employed to assess the association between categorical variables. With a significance level set at 5%, the study aimed to identify meaningful relationships within the data.
The inter-observer repeatability and intra-observer reliability between the first and second observers were calculated for 15% of the randomly selected images. The Cronbach's Alpha score of 0.882 suggests that the analysed items have high internal consistency. An alpha value of 0.882 is considered excellent, which means the items on the scale are highly correlated and measure the same underlying concept. This high value indicates that the scale is a reliable measure and can be trusted for further analysis.
The descriptive stats showed that 610 patients, or 54.8% of the sample (Table 1), had at least one impacted tooth, indicating a significant prevalence in the study group. Of these patients, 309 (27.8%) had impacted teeth in the upper arch and 301 (27%) in the lower arch, showing a fairly even distribution between the two arches. Furthermore, the study detailed the specific impacted tooth locations, with the upper left teeth being the most affected (162 patients, 14.6%). Additionally, the lower left (154 patients, 13.8%) and both upper and lower right (147 patients, 13.2%) teeth were frequently impacted, offering valuable insights into the spatial distribution of impacted teeth within the sample (Figure 1).

Table 1. The distribution of the most common impactions among study participants according to arch, region, and side.

Positive		
Side	**N**	**Percent (%)**
Upper Right	147	13.2
Upper Left	162	14.6
Lower Left	154	13.8
Lower Right	147	13.2

It was observed that there is a slightly higher prevalence of impacted teeth among females (52.5%) when compared to males (47.5%). However, the correlation analysis conducted showed that gender did not yield significant results, except for the upper right arch ($p = 0.017$), where the third molar had the most tooth impaction with 144 cases. This suggests that gender may not be a substantial factor in tooth impaction within the study population (Tables 2 and 3).

Table 2: Chi-Square Test of Independence for Gender and Upper Right and Left Impactions.

Gender		**Upper Right**			**Upper Left**		
		Positive	χ^2	***P_value***	***Positive***	$_{\chi}2$	***P_ value***
Female	n	87	5.658	0.017	90	2.303	0.129
	%	59.20			55.60		
Male	n	60			72		
	%	40.80			44.40		
The statistical significance threshold was set at p< 0.05.							

Table 3: Chi-Square Test of Independence for Gender and Lower Right and Left Impactions.

Gender		**Lower Right**			**Lower Left**		
		Positive	χ^2	***P_value***	***Positive***	$_{\chi}^2$	***P_ value***
Female	n	72	0.077	0.782	71	1.11	0.292
	%	49.00			46.10		
Male	n	75			83		
	%	51.00			53.90		
The statistical significance threshold was set at p< 0.05.							

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Age emerged as a significant variable, with patients aged less than 30 years exhibiting the highest occurrence of impacted teeth, demonstrating a statistically significant association ($p < 0.05$). Conversely, no significant differences were noted among age groups 30–40, 41–50, and those over 50 years. This emphasises the influence of age, particularly in younger individuals, on the prevalence of impacted teeth, as presented by Chi-square tests of independence for age and impact for the upper right, upper left, lower right, and lower left arches (Tables 4, 5, and 6).

Table 4. Age of patients' distribution of the most common impactions among study participants.

Age	Frequency	Percent
Less than 30	386	34.70
30 - 40	316	28.40
41 - 50	212	19.00
More than 50	199	17.90
Total	1113	100.00

Table 5. Chi-Square Test of Independence for Age and Upper Right and Left Impactions.

Age		Upper Right			Upper Left		
		Positive	x^2	P_value	Positive	χ^2	P_ value
Less than 30	N	68	22.259	0.00*	82	31.799	0.00*
	%	46.30			50.60		
30-40	N	49			47		
	%	33.30			29.00		
41-50	N	20			24		
	%	13.60			14.80		
More than 50	N	10			9		
	%	6.80			5.60		
The statistical significance threshold was set at p< 0.05; *p-value statistically significant.							

Table 6: Chi-Square Test of Independence for Age and Lower Right and Left Impactions.

Age		Lower Right			Lower Left		
		Positive	x^2	P_value	Positive		P_ value
Less than 30	N	78	33.102	0.00*	79	29.026	0.00*
	%	53.10			51.30		
30-40	N	42			45		
	%	28.60			29.20		
41-50	N	17			15		
	%	11.60			9.70		
More than 50	N	10			15		
	%	6.80			9.70		
The statistical significance threshold was set at p< 0.05; *p-value statistically significant.							

The frequency of panoramic images with at least one impacted tooth was estimated to be 610 images (Figure 1). However, there were images with more than one impacted tooth. That is why the frequency of the impacted teeth is 620* (Table 7).

Table 7: The frequency and percentage of teeth impactions.

S. No.	Impacted Tooth	Frequency	Percent
1	13: Upper right canine	7	0.6
2	23: Upper left canine	13	1.2
3	33: Lower left canine	6	0.5
4	43: Lower right canine	4	0.4
5	18: Upper right 3rd molar	144	12.9
6	28: Upper left 3rd molar	153	13.7
7	38: Lower left 3rd molar	149	13.4
8	48: Lower right 3rd molar	144	12.9
	Total	620*	54.8

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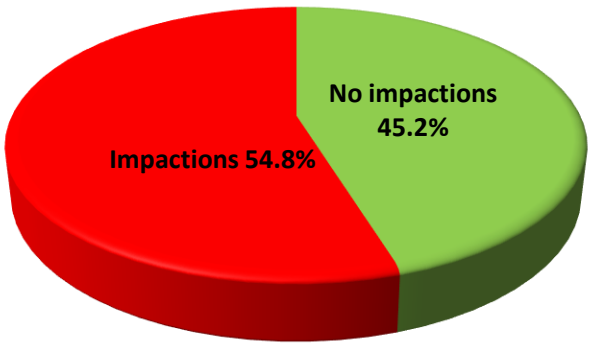

Figure 1. The percentage of panoramic images with impacted teeth and images with no impacted teeth.

Discussion

This retrospective study of panoramic images showed a prevalence of almost 55% impacted teeth, as the images had at least one impacted tooth, in patients attending the LIMU Dental Centre in Benghazi-Libya. The proportion of the impacted teeth in the current study was fairly close to the prevalence of the impacted teeth (33.7/%) estimated in a study conducted by Kazmina et al. (2015) in Iran [19]; both studies agreed that the third molar was the most prevalent impacted tooth, followed by the canines [19]. A recent study by Alamari et al. (2020) showed that the prevalence of impacted teeth was low (13.2%) in patients in the Eastern Province of Saudi Arabia [20]. That is because the third molars were excluded from the sample in that study, justifying the reason for the inconsistency with the present study. This lower pattern of tooth impaction prevalence is similar to that of Chu et al. (2003) in Hong Kong (28%) [7], to Ahlquist et al. (1991) in a sample of Swedish women [3], to Aitasalo et al. (1972) in Finland with the prevalence of (14%) of impacted teeth [2], to Fardi et al. (2011) with (13.7%) impacted teeth among a Greek population [6], and lastly to Patil and Maheshwari (2014), who reported that (16.8%) of the patients were diagnosed with impacted teeth in North India [12]. On the contrary, Arabion et al. (2017) reported that (44%) of the cases had at least one impacted tooth in the Central Part of Iran, and that proportion is the closest to the present study [21].

The variations in the prevalence of impacted teeth in different studies can be attributed to the criteria used to define impaction, as well as the recruitment of different age groups and sample sizes. To our knowledge, the current study is the first to provide information regarding the prevalence of different types of tooth impaction in Libya. However, there were a few limitations in this study. It is possible that a larger sample size in the present study could affect the prevalence of impacted teeth, especially since more than 50% of the impacted teeth were detected in the age group of less than 30. This reflects that a considerable proportion of this young population was dentally aware and pursued dental care in the LIMU Dental Centre. However, this large number of patients could influence the prevalence figures in the current study. It is very well known that a random sample selection is more accurate to represent a certain population; however, a representative sample of the population was a challenge, as exposing a randomly selected study participant to radiation is unethical, unjustified, and expensive. Therefore, caution should be exercised in this regard, and accordingly, limitations may appear.

Conclusion

In this study, it can be concluded that the maxillary third molar was the most impacted tooth, followed by the maxillary canine. The study underscored the impact of age (specifically, being less than 30 years old) and tooth location as primary factors influencing the occurrence of impacted teeth, while gender did not demonstrate a substantial association with tooth impaction within the study cohort. These findings contribute to a deeper understanding of the epidemiology and factors contributing to impacted teeth, potentially informing future clinical approaches and patient care strategies.

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Conflict of interest. None declared.

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