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The prevalence association between the pattern of impacted third molars and their common hard tissues pathologies among the big Tripoli city population: A digital panoramic radiography retrospective study

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Abstract
Background: Third molar impaction is a prevalent condition that affects a substantial percentage of the global population, with a global prevalence ranging from 16.7% to 68.6%. 2. Nearly half of impacted third molars are associated with some form of pathology.
Aim: To ascertain the prevalence of third molars that have been impacted in the large Tripoli, Libyan population, in relation to the level of eruption, the angulation of impaction, their accompanying pathologies, and associated demographic data (sex and age of the patients).
Material and Methods: The 8860 digital panoramic radiographs (PRs) from the large Tripoli city population were obtained retrospectively for the current investigation. Using Microsoft Excel, the sampled PRs were assessed, and the information gathered was collated and examined (Microsoft Office 2013). The data was examined using the Chi-Square analysis technique.
Results: A total sample of 8860 digital panoramic radiograph, 2077 (23.4%) cases of impacted third molars to show at least one impacted third molar. The prevalence of impacted third molars was found significantly higher in the twenties and thirties age groups (35.1%).A total of 2077 digital PRS were diagnosed with impacted third molars out of which 642 (31%) were associated with pathologies.
Conclusion: This study's sample of impacted third molars demonstrated a low frequency in the large Tripoli population. Males are more prone than females to have an impaction. The most prevalent impaction patterns were mesioangular angulation, level C impaction, and class II impaction. The enlargement of the periodontal ligament space was one of the most frequent related hard tissue diseases.

Keywords: Prevalence, impacted third molars, hard tissue pathologies, digital panoramic radiography, big Tripoli population

Introduction
Third molar impaction is a common problem affecting a large proportion of the population throughout the world. According to clinical and radiographic evaluation, an impacted tooth is one that cannot or erupt into its normal functioning positions within the expected time. Therefore, tooth impaction is a pathologic situation and requires treatment. The third molars, often known as wisdom teeth, are the only teeth to erupt during adolescence or early adulthood, which is sometimes referred to as the "wise age," hence the name. However, these teeth usually appear between the ages of 17 and 21. Many local and systemic causes could contribute to the eruption's failure and eventual impaction. Crowding, the ectopic position of the tooth germ, extra teeth, soft tissue lesions, and bone lesions are other local causes whereas multiple systemic factors include cleidocranial dysplasia, endocrine deficiency, febrile disease, Down syndrome, Gardner's syndrome. Third molar impaction affects 16.7% to 68.6% of people. Some research claim that impacted third molars are more prevalent in women than in men, while another claims that whites have a much higher prevalence than blacks. However, there are regional differences in the frequency of impacted teeth as well as their location in the

upper and lower jaws. Race and ethnicity differences and their impacts on the epidemiological features of third molar impaction can be used to explain this variation. The third molars in the permanent human dentition have the highest impaction rates of all the teeth. Additionally, the mandible experiences third molar impacted cases more frequently than the maxilla [1]. To analyses the presence and impaction state of these teeth, several categorization methods are employed. Among these, Winter's classification takes the third molars' angles into account: mesioangular, distoangular, horizontal, vertical, buccal / lingual obliquity, and transverse. While the Pell and Gregory approach takes into account how far away from the occlusal plane the impacted third molars are. A tooth is categorised as an A tooth if the third molar is level with or above the occlusal surface of the neighboring second molar. It is categorised as a B tumour if it is located between the cervical line and the second molar's occlusal surface.

The third molar is at a C level when it is below the adjacent second molar's cervical line. Furthermore, Pell and Gregory's radiographic classification assessed the impacted teeth according to the relation of the third mandibular molar to the ramus of the mandible and second molar as follows: Class I(sufficient retromolar space), Class II(reduced retromolar space), and Class III(no retromolar space. According to extensive study, third molar impactions have been associated to a variety of illnesses, including cysts, The mandibular second molar has distal periodontal pockets, root resorption, and caries. Therefore, extraction of impacted third molars is intended to prevent the occurrence of these pathologies **(2)**. Panoramic radiographs are routinely done in dental practice because they are easy to interpret, cost-effective and are a useful aid to diagnose asymptomatic impactions and associated pathologies before they become symptomatic [2].

Materials and Methods

A sample of 8860 digital panoramic radiographs belonged to the patients who attended Dar Alfardous dental clinic in Tripoli-Libya during the period from January 2016 to December 2020.The PRs were retrieved from the archives of the radiology unit. To ascertain the distribution and frequency of impacted third molars, their levels of eruption, angulation, side, location, and associated pathosis, all of these retrospectively collected digital panoramic radiographs were carefully examined and evaluated by a single investigator in a dark room using an appropriate X-ray viewer. The impacted third molars were classified according to Winter, Pell, and Gregory classifications. Demographic data (patient sex and age) was recorded. The collected data were tabulated and analyzed using Microsoft Excel (Microsoft Office 2013). The collected data were analyzed using SPSS® 26 (IBM, USA) to describe the quantitative data, mean and standard deviation were used, and to describe the qualitative data, the cross-tabulation tables, bar and pie charts were used. The Chi-Square analysis test was used to assess the data that had been gathered. A p-value of 0.05 or less was regarded as significant. Data were anonymously gathered without any identification, in accordance with confidentiality. The Dar Alfardous clinic's board granted ethical approval.

Result

Digital PRs of 8860 patients were examined, and 2077 (23.4%) cases of impacted third molars were found in the entire study sample to show at least one impacted third molar (Fig 1).

The subjects' ages were divided into seven categories based on their chronological ages: 20, 20–29, 30-39, 40–49, 50–59, 60–69, and >70. Patients ranged in age from 17 to 75 years old, with a mean age of 41.7 years and a standard deviation of 13. Overall, it was discovered that the prevalence of impacted third molars was substantially higher in the twenties and thirties age groups than in any other age group (35.1% for each age group, P 0.001). Third molars that had been affected were reported to be least prevalent in both the age groups under 20 (1.3%) and over 70 (0.7%) (Table1).

Although the number of male subjects with impactions (797) is less than the number of female subjects with impactions (1280), the odds for males were significantly higher than the odds for females (OR = 1.16, 95% CI [1.05, 1.29]).

Out of 2077 digital PRs with third molars impaction, there was a higher prevalence of impacted mandibular third molars 1058 (50.9%) compared with impacted maxillary third molars 884 (42.6%) which was found to be statistically significant p=0.001. The presence of impacted third molars in both locations (mandible and Maxillae) 135 (6.5%) (Fig 2).

Among 2077 impacted third molars, both sides impacted third molars were most commonly encountered 836 (40.3%), followed by left impacted third molars 633 (30.5%) and right impacted third molars 608 (29.3%) which were found to be statistically There is no significant variance between impactations on the right and left sides of the mandible or maxillae (p>0.05). (Fig 3).

A total of 2077 digital PRs presented with third molar impactions had either unilateral or bilateral impactions. The number of unilaterally affected third molars was 1241 (59.7%), which was higher than the number of bilaterally impacted third molars, which were 836 (40.3%). However, there were 396 (44.8%) patients with impacted third molars, 488 (55.2%) respondents with unilaterally impacted third molars, and 884 (42.6%) subjects with impacted maxillary third molars. had bilateral impaction which was found to be significant *p*=0.002. While there were 1058 (50.9%) participants with impacted mandibular third molars, 709 (67%) of them had unilateral impactions and 349 (33%) had bilateral impactions, both of which were shown to be statistically very significant (p 0.001) in the study (table 2).

Regarding the analysis of impacted third molar angulation in the entire impaction cases, the mesioangular angulation was the most common pattern of impaction 639 (30.8%), followed by vertical 614 (29.6%), distoangular 445 (21.4%), horizontal 282 (13.6%), buccolingual 63 (3.0%) and inverted 34 (1.6%)(Fig4). Mesioangular impaction was the most frequent angulation in the mandibular arch, with a 452 (42.7%) prevalence rate, followed by horizontal (259 (24.5%), vertical 235 (22.2%), distoangular 55 (5.2%), inverted 31 (2.9%), and buccolingual 26 (2.5%). Distoangular 372 (42.1%), vertical 334 (37.8%), mesioangular 124 (14%), buccolingual 36 (4.1%), horizontal 16 (1.8%), and inverted 2 (0.2%) were the most common morphologies in the maxillary arch (Table 3).

Association between the age of the patients and impacted third molars angulation in both jaws. It was detected that the highest prevalence of Mesioangular impaction was among patients aged 30-39 years old. Furthermore, the association between age and angulation in the mandibular location only, the highest prevalence was found in mesioangular position 264 (40.8%) with an age group between 30-49 years old. It was statistically significant p<0.05(Fig 5a). While an association between age and angulation in the maxillary location only it was found that the highest prevalence was the distoangular position 165 (40.2%) with an age group between 30-49 years old followed by vertical angulation 154 (37.6%)

with the same age group. They were statistically significant p<0.05 (Fig 5b).

Based on Pell and Gregory's classification, the impaction levels were evaluated, and it was found that level C impaction 887 (42.2%) was the most prevalent, followed by level B 727 (35%) and level A473 (22.8%). Level C impactions were most prevalent in the maxillary arch (677 percent), while level A impactions were more prevalent in the mandibular arch (453 percent) (Table 4). In the mandible and maxilla, Level C and distoangular tooth placements were where impacted third molars were most common, according to the distribution of third molars by level of impaction and angulation (Fig 6).

According to the study, Class II retromolar space was the most common ramus relationship in third molars that were mandibular impacted, occurring in 1197 cases (57.6%), followed by Class I 500 cases (24.1%) and Class III 380 cases (18.3%). The retromolar space seems to be much smaller in female participants (class II and III), which was statistically significant at P 0.05. There was a significant correlation between the available retromolar spaces (class II and III) and female subjects. (Table 5).

A total of 2077 digital PRS were diagnosed with impacted third molars out of which 642(31%) were associated with pathologies while 1435 (69.1%) subjects had no pathology. 8.5% of maxillary third molars with impacted teeth and 48% of mandibular third molars with impacted teeth had associated hard tissue diseases. Widening of periodontal ligament space 281 (13.5%), carious lesions 207 (10%), bone resorption 143 (6.9%), cystic lesions 10 (0.05%), and granuloma 1 (0.0%) were the most prevalent associated hard tissue disorders (Fig 7).

(Table 6) showed the frequency and distribution of hard tissue pathologies among different age groups. The most common cases of hard tissue pathologies were observed in the age groups 20-29 years old 257 (35.2%), 30-39 years old 249 (34.1%) then 40-49 years old 99 (26%) respectively and the distribution among these groups were statistically different *p*<0.001.

The association between hard tissue pathologies and angular position of impacted third molars, it was found that widening of periodontal ligament space lesions was highly frequent to mesioangular position142 (47%) in impacted third molars with a statistically significant difference of P < 0.001 (Fig 8).

The association between hard tissue pathologies and levels of impacted third molars was found to be carious lesions 126 (38.1%) was most common with level A which was statistically significant p < 0.001 (Fig 9).

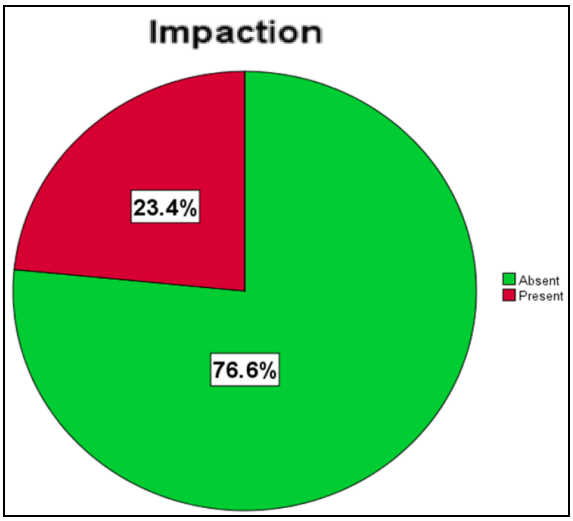

Fig 1: Pie chart representing the prevalence rate of impacted third molars in the entire study sample

Table 1: Frequency and Percentage of impacted third molars according to the age groups

Age groups	Frequency	Percent
<20	28	1.3
20-29	730	35.1
30-39	729	35.1
40-49	382	18.4
50-59	146	7.0
60-69	48	2.3
>70	14	0.7
Total	2077	100.0

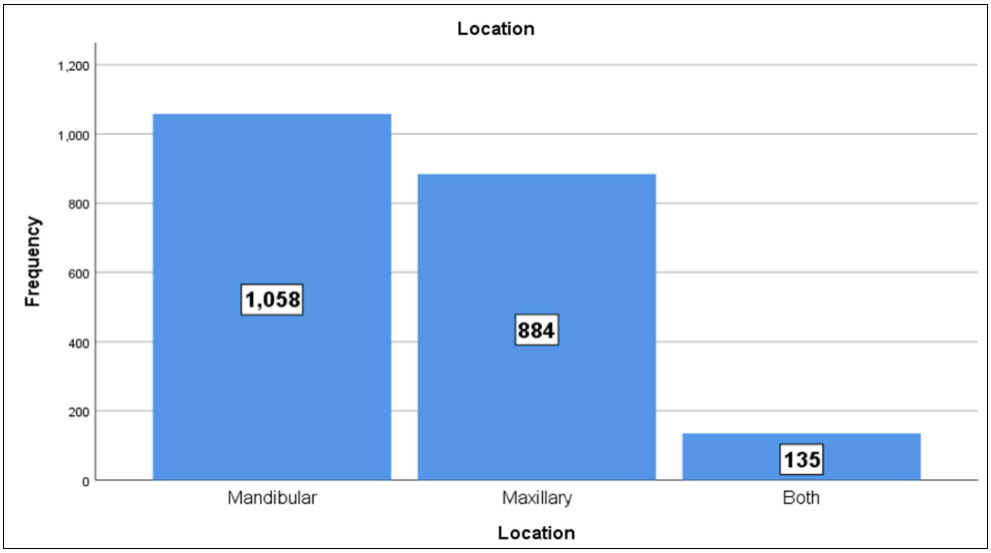

Fig 2: Bar graph shows distribution and frequencies of impacted third molars by location

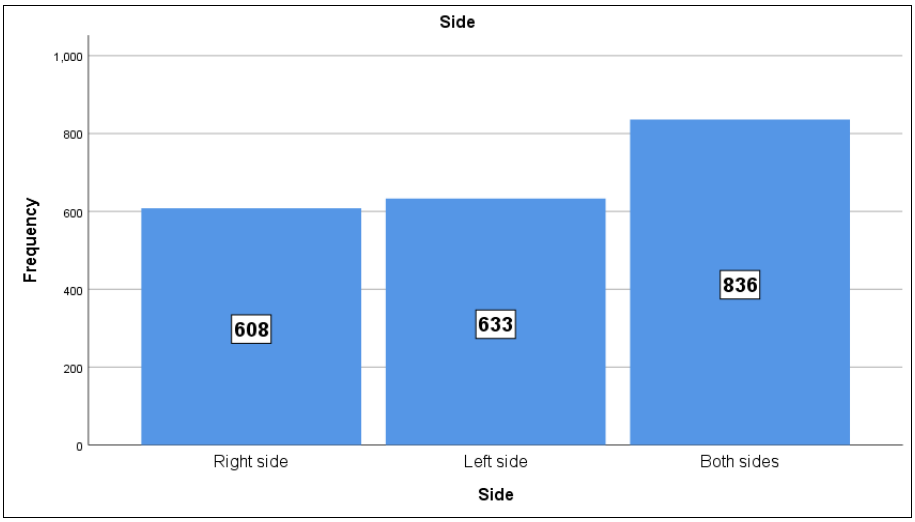

Fig 3: Distribution and frequencies of impacted third molars by side (right, left, both sides)

Table 2: Association of location with presence of unilateral or bilateral impacted third molars

Location	No. &%	Unilateral or bilateral impaction		Total
		Unilateral	Bilateral	
Mandibular	Count	709	349	1058
	% Within Location	67.0%	33.0%	100.0%
Maxillary	Count	488	396	884
	% Within Location	55.2%	44.8%	100.0%
Both	Count	44	91	135
	% Within Location	32.6%	67.4%	100.0%
Total	Count	1241	836	2077
	% Within Location	59.7%	40.3%	100.0%

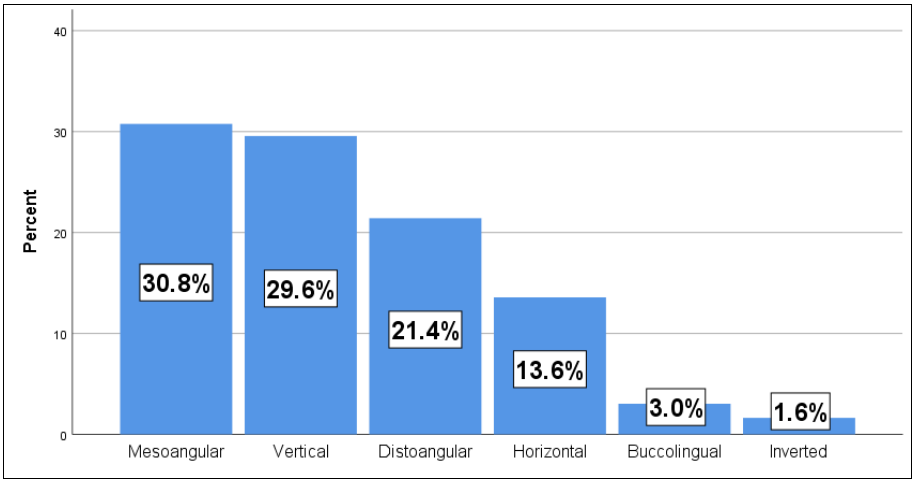

Fig 4: Bar graph shows the percentage distribution of impacted third molar angulation in entire study sample

Table 3: Frequency and percentage of impacted third molar by angulation according to their location

Location	Angulation	Frequency	Percent
Mandibular	Mesioangular	452	42.7
	Distoangular	55	5.2
	Vertical	235	22.2
	Horizontal	259	24.5
	Buccolingual	26	2.5
	Inverted	31	2.9
	Total	1058	100.0
Maxillary	Mesioangular	124	14.0
	Distoangular	372	42.1
	Vertical	334	37.8
	Horizontal	16	1.8
	Buccolingual	36	4.1
	Inverted	2	0.2
	Total	884	100.0
Both	Mesioangular	63	46.7

	Distoangular	18	13.3
	Vertical	45	33.3
	Horizontal	7	5.2
	Buccolingual	1	0.7
	Inverted	1	0.7
	Total	135	100.0

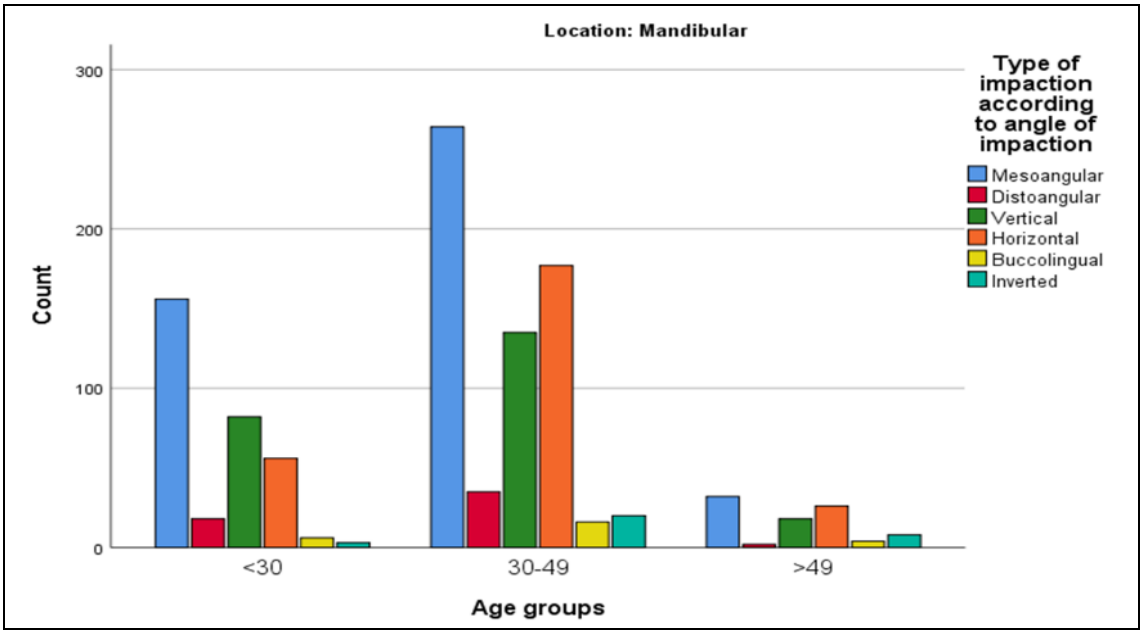

Fig 5a: Bar graphs shows association between angulation and age in mandibular ach

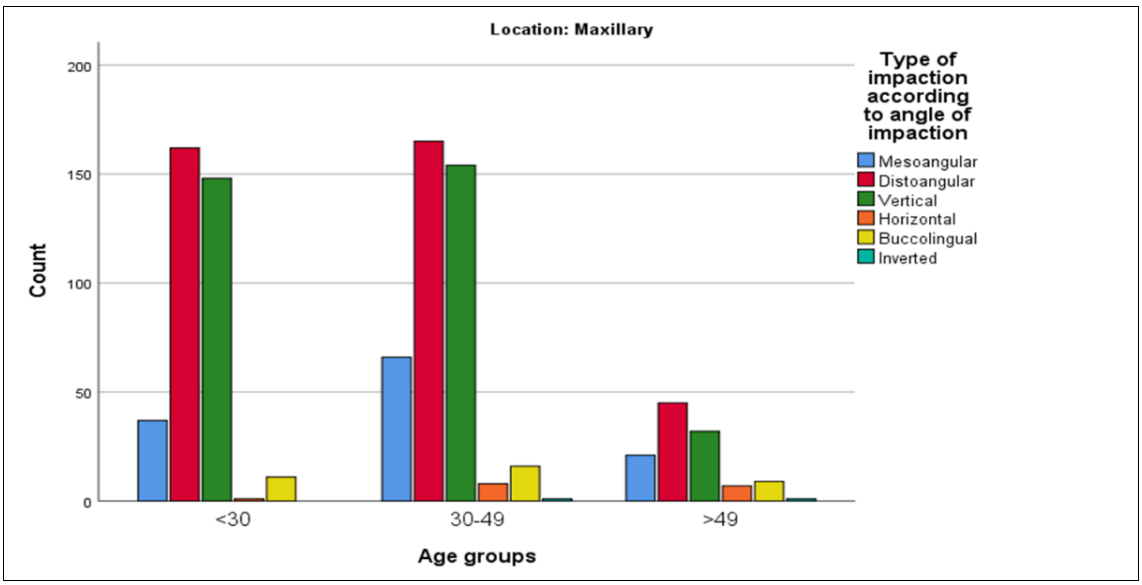

Fig 5b: Bar graphs shows association between angulation and age in maxillary arch

Table 4: Frequency and percentage of impacted third molars by level according to their location

Location			Frequency	Percent
Mandibular	Valid	A	453	42.8
		B	447	42.2
		C	158	14.9
		Total	1058	100.0
Maxillary	Valid	A	4	0.5
		B	203	23.0
		C	677	76.6
		Total	884	100.0
Both	Valid	A	16	11.9
		B	77	57.0
		C	42	31.1
		Total	135	100.0

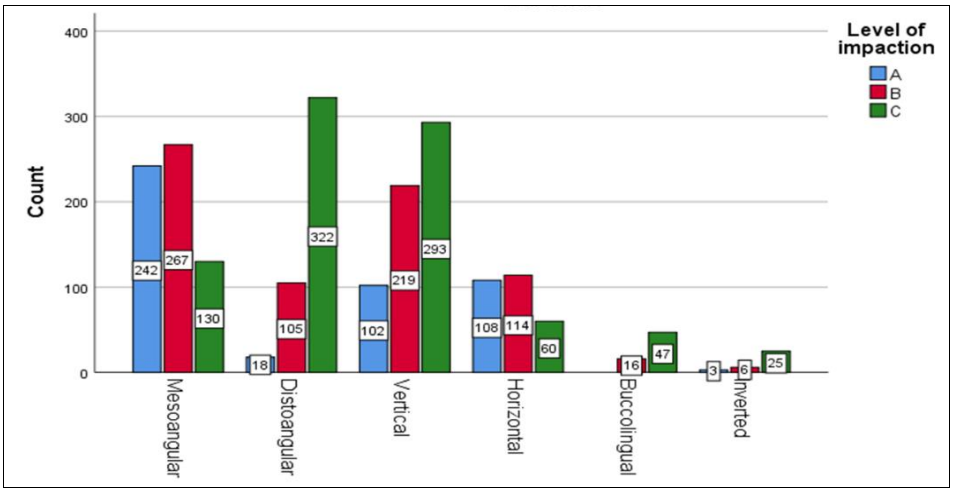

Fig 6: Bar graphs shows the distribution and Frequencies of impacted third molars by angulation and level of impactions.

Table 5: A significant association between available retromolar spaces (class II and III) and females' subjects

Gender	No. & %	Retromolar space			Total
		Class I (Sufficient space)	Class II (Reduced space)	Class III (No space)	
Male	Count	228	445	124	797
	% within Gender	28.6%	55.8%	15.6%	100.0%
Female	Count	272	752	256	1280
	% within Gender	21.3%	58.8%	20.0%	100.0%
Total	Count	500	1197	380	2077
	% within Gender	24.1%	57.6%	18.3%	100.0%

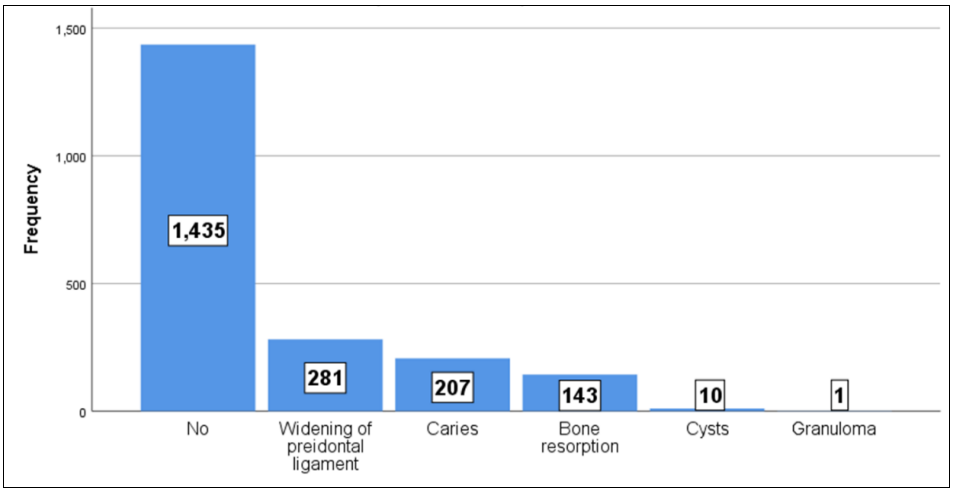

Fig 7: Bar graphs shows the frequency of the most common hard tissue pathosis in the subjects with third molar impaction

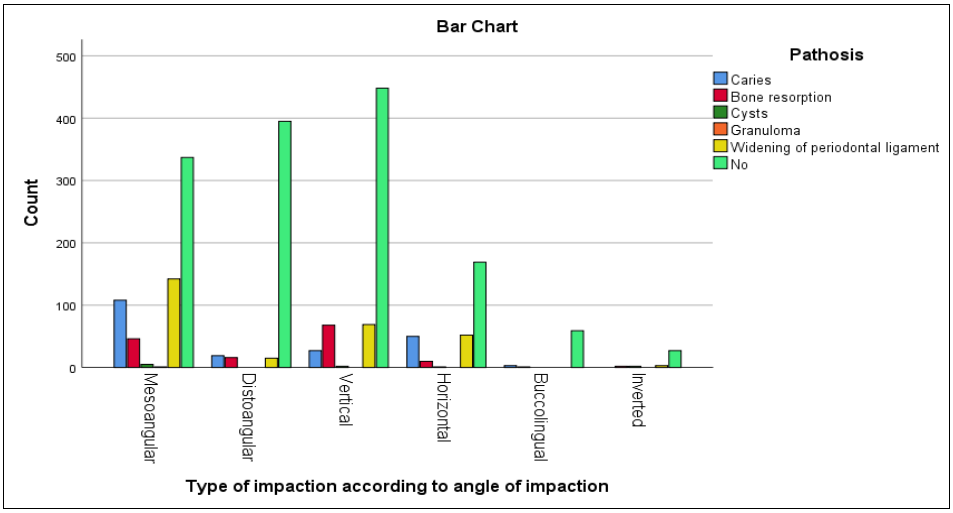

Fig 8: Bar graphs represents association between hard tissue pathosis and angulation of third molar impaction

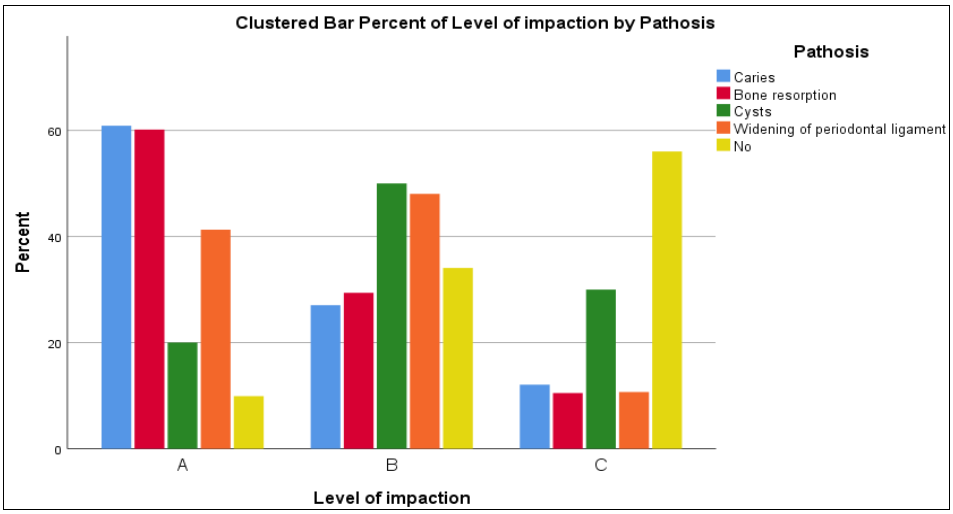

Fig 9: Bar graphs shows association between hard tissue pathosis and level of third molar impaction

Table 6: The frequency and percentage of hard tissue pathologies among different age group

Age groups	Pathosis	Frequency	Percent
<20	Caries	1	3.6
	Bone resorption	2	7.1
	Cysts	1	3.6
	No	17	60.7
	Widening of periodontal ligament	7	25.0
	Total	28	100.0
20-29	Caries	40	5.5
	Bone resorption	54	7.4
	Cysts	3	0.4
	No	473	64.8
	Widening of periodontal ligament	160	21.9
	Total	730	100.0
30-39	Caries	99	13.6
	Bone resorption	55	7.5
	Cysts	5	0.7
	No	480	65.8
	Widening of periodontal ligament	90	12.3
	Total	729	100.0
40-49	Caries	49	12.8
	Bone resorption	27	7.1
	Granuloma	1	0.3
	No	283	74.1
	Widening of periodontal ligament	22	5.8
	Total	382	100.0
50-59	Caries	16	11.0
	Bone resorption	2	1.4
	Cysts	1	0.7
	No	126	86.3
	Widening of periodontal ligament	1	0.7
	Total	146	100.0
60-69	Caries	2	4.2
	Bone resorption	3	6.3
	No	42	87.5
	Widening of periodontal ligament	1	2.1
	Total	48	100.0
>70	No	14	100.0

Discussion

The purpose of this study was to assess the prevalence of impacted third molars in a sample of the Libyan population, as well as their associated hard tissue diseases, impaction patterns, and relevant demographic data. However, this is the first study to estimate the incidence of third molar impaction in Libya's city of Tripoli. Impaction of permanent teeth is a common phenomenon with mandibular and maxillary third molar being the most frequently impacted of all and many factors influence its prevalence including ageing and eruption time. In the present study, the prevalence rate of impacted third molars was (23.4%). This value is lower than the range reported in many previous studies in different populations and regions of the world with a significant difference has been observed. A reviewed study conducted by Samira *et al.* [3] on 1,000 orthopantomogram (OPGs) in Oman, who found that the prevalence rate (54.3%) with impacted maxillary and mandibular third molars was also lower in the study reported

by other studied who found that the prevalence of impacted third molars among 1900 Yemeni citizens was (39%), as well as lower in the OPGs retrospective study conducted by M Hatem *et al*. in a sample of Benghazi population who found that (70%) prevalence rate of impacted third molars. **(4)** On the other hand, the prevalence rate of our study (23%) was higher than the reported studies by Sarica *et al*. (2019) [5] who found that the prevalence of impacted third molar was (16%) and (10%) respectively. The possibility of dietary influence on the physique, role of genetic factors or a combination of genetic and dietary factors have been proposed to affect the low prevalence of impacted third molars. Usually, the roots are expected to be completely formed with an open apex by the age of 18 years and by the age of 24 years. Nevertheless, at the age of 20, one can tell whether a third molar is going through a typical eruption process or if it will stay impacted in the jaw. The age of patients in our study ranged from 17-75 years old with a mean age of 41.7 years. However, our findings showed that the prevalence of impacted third molars was found significantly higher in the twenties and thirties age groups (35.1% equally for each age group). This finding was in agreement with Hashemipour (2013) [6] who conducted a study on 1020 OPG of the patients and found that more than half were in the third decade of their lives, also in agreement with Al-Dajani (2017) [7], who stated that individuals between the ages of 20 and 39 were more likely to have impacted third molars and in disagreement with Abbas (2021) [8] who found that the age group 20-29 was the most prevalent for impaction but decreased in the age group 30-39 with a significant difference between the two age groups. These variations might be attributed to the age groups included in our studies being less than 20 years old as well as the large sample of the population.

The female preponderance of impacted third molars has been reported by previous studies. However, other studies reported no gender difference and male preponderance. In this presented study the number of female subjects is more than the number of male subjects in the entire study sample but the odds ratio for males was significantly higher than the odds ratio for females (OR = 1.16, 95% CI [1.05, 1.29]) This means that the impaction is 1.16 times more common in males than in females. This finding was consistent with Msagati (2013) [9], who discovered that slightly more males than females were affected by impacted teeth, with a male to female ratio of 1.2:1, and inconsistent with Ishwarkumar (2019) [10], who discovered that females had a higher prevalence of impacted third molar teeth (54.5%). It was also inconsistent with Alfadil and Almajed (2020) [11] who discovered that the distribution of impaction between the two genders was almost equalHowever, the higher rate of female patients reported with impacted third molars may be due to a great interest in oral health and cosmetic aspect among women.

The third molar impaction is higher in the mandible than in the maxilla. In our study the prevalence of impacted mandibular third molars were significantly higher than impacted maxillary third molars. This conclusion was in line with Abbas (2010) [8] who conducted a study on 665 OPG and found the impacted mandibular third molars were the most prevalent impacted tooth as well as with In contrast to Dachi and Howell (1961), who discovered that the incidence of impacted third molars was much higher in the maxilla than the mandible, Al-Dajani (2017) [7] showed that the frequency of impacted third molars was significantly higher in the mandible than the maxilla. In both arches, bilateral impaction was more frequent than unilateral impaction. The results of the present study showed that the percentage of unilateral impacted third molars was 59.7%, while bilateral impacted third molars were 40.3%. This finding was in disagreement with Samira (2014) [3]. These variations may be attributed to the large size of our study sample. There were 884 (42.6%) patients with impacted maxillary third molars, with approximately 488 having unilateral impaction and 396 having bilateral impaction. There were also 1058 (50.9%) patients with impacted mandibular third molars, with approximately 709 having unilateral and 349 having bilateral impaction. These results were in line with Sara's (2015) [12] findings that unilateral impactions were more frequent than bilateral impactions in both jaws, but they were at odds with Dachi and Howell's (1961) findings that bilateral and unilateral impactions were approximately equally common in both arches.

Winter classified the impacted teeth according to their inclination into mesioangular, horizontal, distoangular, vertical, and inverted. In our study the distoangular pattern was the most common angle in the maxillary arch this finding was inconsistent with Ishwarkumar (2019) [10] Whilst, the mesioangular pattern was the most common angle in the mandibular arch which was consistent with consistent with Prodhan (2021) [13] who was found that the mesioangular pattern of angulation was most prevalent in their studies and inconsistent with Ishwarkumar (2019) [10] who reported that the vertical pattern was high in number also. However, there was a significant correlation between the age group 30 - 60 years with both mesioangular patterns in the mandibular arch and distoangular patterns in the maxillary arch.

The level of impaction is very important as it gives the idea of the depth and position of the impacted tooth. In our study, the distribution of third molar impaction by level according to Pell & Gregory's classification the most common impaction level was level C which was in agreement with Alfadil and Almajed (2020) [11] who found The C level impaction depth was most prevalent in both jaws and in disagreement with Alhadi (2019) [14] who reported that level B was the most common level of impacted third molars in both jaws. Level C was the most common level in the maxillary arch. Level A was more prevalent in the mandibular arch which was inconsistent with Ishwarkumar (2019) [10].

The lack of availability of retromolar space results in the failure of the eruption of mandibular third molars. In our study, we found a significant correlation between available retromolar spaces and female subjects which means that the retromolar space was significantly smaller in females. This result was similar to many previous studies which may be attributed to the length of the dental arch in females being generally smaller than in males thus inadequate space is therefore available for their eruption. Nevertheless, retromolar space is not the only indication that the third molar will be impacted or erupted.

Nearly all cases of impacted teeth were accompanied by a hard tissue lesion such as caries, periapical lesion, or a lesion that extends into the jaw. In our study, widening of periodontal ligament space was found to be the most common associated hard tissue pathologies (13.5%) followed by the carious lesion (10%). This result was in contrast to many previous studies which reported that the carious lesion and periodontal disease were the most prevalent hard tissues pathosis and consistent with Abbas (2020) [8] who reported that loss of lamina dura was found to be the most common pathology.

Between the ages of 20 and 29, a greater incidence rate of hard tissue diseases related to impacted third molars was noted. Additionally, there was a strong correlation between tooth angular location and diseases, which most frequently occurred in the mesioangular position. This finding has been supported by many previous studies.

In the presented study level A was the most common depth significantly associated with the second molar distal carious lesion. This result was supported by the finding of Haddad (2021) [15] and inconsistent with Marques *et al*. (2017) [16] who observed that these carious lesions were mainly identified in impacted teeth with level B.

Conclusion

Understanding of prevalence and position patterns of impacted third molars is helpful in early diagnosis since these teeth are often associated with pathological conditions including widening of periodontal ligament space, carious lesion, root resorption, cystic lesions or granuloma. Impacted third molars among this study sample revealed a low prevalence in the big Tripoli population.

There is an association between age groups and type of impaction because the distribution of impacted third molars among all age groups is not equal.

The odds ratio for gender male to female confirms that males are 1.16 more likely to have an impaction than females.

We can confirm that when impaction is present in both jaws, it most likely will be present on both sides (bilaterally) and when impaction is present only in one jaw maxilla or mandible, it is most likely will be present on one side (Unilaterally) regardless of whether it is left or right.

We can observe clearly that the mesioangular impaction was the most common mandibular impaction while the distoangular and vertical impactions were more common in the maxillary jaw in all age groups.

We can see clearly that the majority of all types of impaction were not associated with hard tissue pathologies (no pathologies). The most prevalent kind of impaction, however, was mesioangular, which was connected to the hard tissue diseases expansion of periodontal ligament space and carious lesion. In the maxilla, the distoangular angulation and level C impaction were the most prevalent, whilst in the mandible, the mesioangular, level A and Class II impaction patterns were the most frequent. Furthermore, mesioangular angulation, level C impaction and Class II impaction patterns in the entire impaction cases were the most frequent in the big Tripoli population.

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