Prevalence of impacted teeth among a sample of Yemeni population and their association with sex and age.

Prevalencia de dientes impactados entre una muestra de población yemení y su asociación con el sexo y la edad.

Jameel Mohammed Helmi.[1]
Amen Abdulkarem Hagar.[1]
Khaled Ahmed Al- Jawfi.[1]
Abulwahab Al- dilami.[1]
Mohammed Ali Al –Wesabi.[1]

Affiliations: [1]University of Sciences and Technology, Yemen.

Corresponding author: Mohammed Ali Al- wesabi. Department of Biological and Preventive Sciences, College of Dentistry, University of Sciences and Technology, Yemen. Phone: (00697) 774643364. E-mail: M.alwesabi@ust.edu

Abstract: Aim: the aim of the study was to assess the prevalence of impacted teeth and its association with sex and age among a sample of the Yemeni population. Materials and Methods: A cross sectional study design was employed. The study included 999 radiographical records of patients who had panoramic X- rays previously done. All radiographs were assessed for the number and type of impacted teeth, pathology-associated impaction, sex, age and location (mandible and/or maxilla). The collected data was analyzed using SPSS®version21 software. Results: The study sample comprised digital panoramic radiographs of Yemeni patients aged 17 to 54 years (mean 26.6 years). The present study found 542 patients (54.3%) presented with at least one impacted tooth. The 17 to 25 years age group of the study sample had the highest prevalence of tooth impaction (28.6%). Only 10 (1.0%) case presented pathologies associated with the impacted teeth. There was a significant difference in the number of male 203 (20.3%) and female 339 (33.9%) patients with impacted teeth (p=0.031). Impacted teeth occurred slightly more often in the mandible (42.8%) compared to the maxilla (42.4%). Conclusion: The prevalence of impacted teeth among a sample of Yemeni population was high. Third molars and canines were the most common impacted teeth. The prevalence of impacted teeth in females was higher than in males and it was higher in the mandible than in the maxilla, with the younger patients with a higher prevalence of impaction.

Keywords: Impacted tooth; third molar; panoramic radiography; prevalence; cross-sectional studies; Yemen.

Resumen: Objetivo: el objetivo del estudio fue evaluar la prevalencia de dientes impactados y su asociación con el sexo y la edad en una muestra de la población yemení. Material y Métodos: se empleó un diseño de estudio transversal. El estudio incluyó 999 registros radiográficos de pacientes con radiografías panorámicas realizadas previamente. Todas las radiografías fueron evaluadas en relación al número y tipo de dientes impactados, patología asociada a la impactación, sexo, edad y ubicación (mandíbula y/o maxilar). Los datos recopilados se analizaron utilizando el software SPSS® version 21. Resultados: La muestra del estudio comprendió radiografías panorámicas digitales de pacientes yemeníes entre 17 a 54 años (media 26,6 años). El presente estudio encontró que 542 pacientes (54,3%) presentaron al menos un diente impactado. El grupo de edad de 17 a 25 años de la muestra de estudio tuvo la mayor prevalencia de impactación dental (28,6%). Solo 10 casos (1,0%) presentaron patologías asociadas a los dientes impactados. Hubo una diferencia significativa en el número de pacientes masculinos 203 (20.3%) y femeninos 339 (33.9%) con dientes impactados (p=0.031). Los dientes impactados ocurrieron con un poco más de frecuencia en la mandíbula (42.8%) en comparación con el maxilar (42.4%). Conclusión: La prevalencia de dientes impactados entre una muestra de población yemení fue alta. Los terceros molares y caninos fueron los dientes más comúnmente impactados. La prevalencia de dientes impactados en las mujeres fue mayor que en los hombres y fue mayor en la mandíbula que en el maxilar, y los pacientes más jóvenes mostraron una mayor prevalencia de impactación.

Palabras Clave: Diente impactado; tercer molar; radiografía panorámica; prevalencia; estudios transversales; Yemen.

INTRODUCTION.

Tooth eruption is a complex, localized, and programmed sequence involving bone remodeling at a specific timing.[1] Dental anomalies including impaction, supernumerary teeth, and alterations in size and structure of teeth are of great concern and it is a major challenge for both dental practitioners and patients.[2] This is because of the potential complications and possible risks to function and desired esthetics and may be even associated with psychological effects.[3]

Tooth impaction is its failing to erupt in order to reach the occlusal plan even after completion of two-thirds of its root, so it is covered by mucoperiosteum and bone because of abnormalities such as malposition, lack of space, odontoma, excessive soft tissue, endocrine diseases, or due to obstruction by another tooth.[4,5]

Furthermore, impacted teeth are often associated with pericoronitis, periodontitis, cysts, neoplasm, root resorption of the adjacent tooth and can cause detrimental effects on adjacent teeth. Also, it weakens the body of the mandible at an angle increasing the susceptibility to fracture and vague orofacial pain and neuralgias.[6]

Many patients are not aware about the presence of impacted teeth and it is usually detected during routine examinations. Therefore, early detection and proper mana-gement is important to avoid possible complications.[7]

The prevalence of impacted teeth has been studied in different communities, and it can provide important pathologic and genetic profile information.[8] Many factors affect its prevalence including the age of the sample, den-tal eruption sequence, and the radiographic criteria for eruption and impaction.[6]

Third molar impactions are classified according to the angulation of the impacted teeth. Winter's classification is used to categorize the type of impacted teeth angulation with the reference to the angle formed between the intersected longitudinal axes of the second and third molars.[9]

According to the American Association of Oral and Maxillofacial Surgeons, since the majority of the impacted teeth are at the risk of these complications their removal should be considered as early as possible.[10]

Although orthopantomograms (OPG) and periapical radiographs are utilized to determine the presence of tooth impaction, previous studies reported that periapical radiographs are only better than OPG in determining the number of roots. However, the OPG is the radiograph of choice when the patient has associated trismus.[11]

So the aim of the study was to assess the prevalence of impacted teeth and their association with sex and age among a sample of Yemeni population.

MATERIALS AND METHODS.

The study utilized a cross sectional design. Because of the difficulty of achieving a rational sample size by primary data from patients and the availability and accessibility of the radiographic records, the data of the study was collected from the radiographical records of the patients who had a panoramic X- ray previously taken during the period from 1st November 2016 to 1st of August 2018.

Records from three private radiographic centers in Sana'a city were gathered. A case sheet was designed for data recording and radiograph interpretation. All panoramic radiographs were included in the study sample irrespective of patients age or sex. After assessment of the patients records, patients who displayed a pathological situation, any conditions that may affect normal growth of permanent dentition as diseases or trauma of the jaw, and any syndromes or hereditary diseases, such as craniosynostosis, were excluded from the study.

The sample of this study included 999 subjects. Teeth were considered as impacted when they remained below the jaw for a minimum of two years after the respective expected mean age of tooth eruption. All radiographs were determined for the number and type of impacted teeth, pathology associated impaction, sex, age and location (mandible and/or maxilla). The third molar impaction angulation was scored based on Winter`s classification.

The data from the examination sheet was collected and scored. The collected data was analyzed using SPSS® version 21 software (SPSS Inc. Chicago, IL). Descriptive, bivariate, and multivariate analysis was the performed. A *p*-value less than 0.05 was considered as significant.

The Ethics Committee of the Faculty of Medicine, University of Science and Technology, Sana'a, Yemen, has approved the study (MECA NO. EAC/UST133).

Table 1. The prevalence of impacted teeth according to sex and age among the study sample.

Variable		n	%
Impacted teeth	Yes	542	54.3
	No	457	45.7
Sex	Male	405	40.5
	Female	594	59.5
Age Group (years)	17-25	462	46.2
	26-35	387	38.7
	36-54	150	15.0

Table 2. The prevalence of impacted teeth regarding age among the study sample.

| Age group (years)	Impacted teeth		p-value
	Yes %	No%	
17 - 25	286 (28.6)	176 (17.6)	
26 - 35	191 (19.1)	196 (19.6)	0.001
36 - 54	65 (6.5)	85 (8.5)	
Mean and SD±	26.6±6.8		

Table 3. The prevalence of impacted third molar according to location and sex among the sample study.

|	Impacted Lower Third Molar				Impacted Upper Third Molar			
	Yes		No		Yes		No	
	Count	%	Count	%	Count	%	Count	%
Male	148	14.8	257	25.7	109	10.9	296	29.6
Female	224	22.4	370	37.0	194	19.4	400	40.0
p-value	0.708				0.052			

Table 3. The prevalence of impacted third molar according to location and sex among the sample study.

Variable		Male		Female		p-value
		Count	%	Count	%	
Impacted Lower Canine	Yes	10	1.0	18	1.8	0.708
	No	395	39.5	576	57.6	
Impacted Upper Canine	Yes	30	3.0	84	8.4	0.001
	No	375	37.5	510	51.0	
Impacted Lower Premolars	Yes	11	1.1	17	1.7	0.891
	No	394	39.4	577	57.7	
Impacted Upper Premolar	Yes	1	0.1	4	0.4	0.348
	No	404	40.4	590	59.0	
Impacted Upper Lateral Incisor	Yes	0	0.0	0	0.0	Not computed
	No	405	40.5	594	59.4	
Impacted Upper Central Incisor	Yes	0	0.0	2	0.2	0.242
	No	405	40.5	592	59.2	

Figure 1. Number and distribution of impaction according to tooth type.
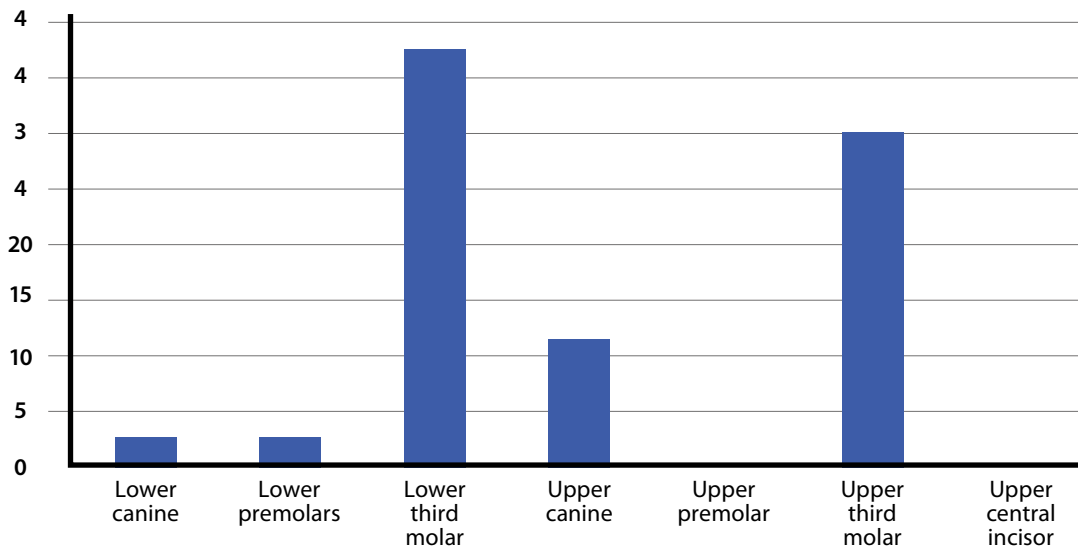
Figure 2. Distribution (%) of third molar impaction by angulations.
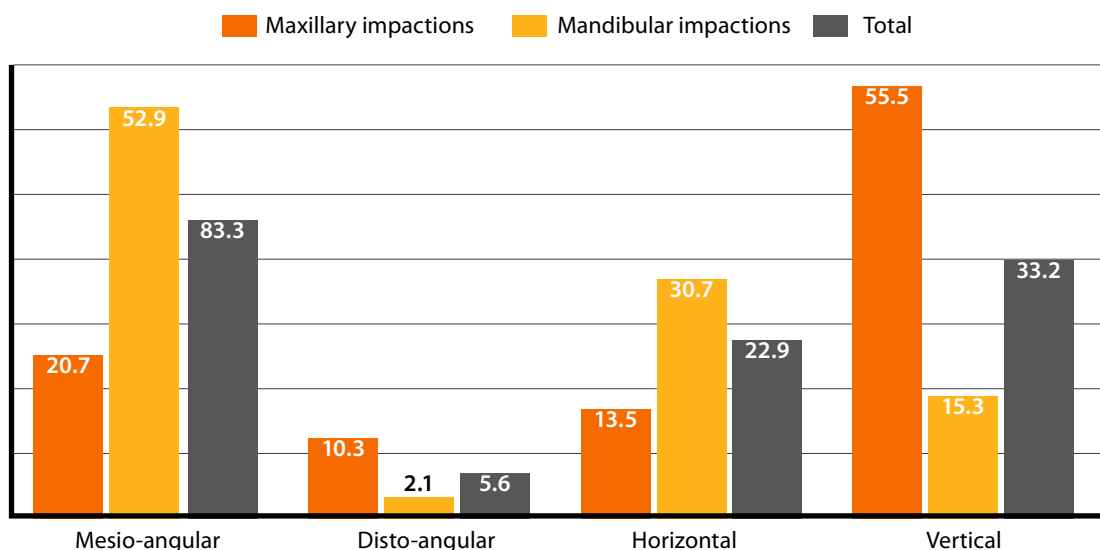
RESULTS.

The study sample comprised 999 digital panoramic radiographs of Yemeni patients aged 17 to 54 years (mean, 26.6 years) were examined. They were assessed for the presence of impaction and the location of impacted teeth. Out of all patients, 40.5% were male and 59.5% were female. The majority of the patients were in the age group 17-25 years, followed by 26-35 years. The present study found that, 542 patients (54.3%) presented with at least one impacted tooth with a 1.2:1 ratio of patients having impaction to those who did not; 594 of patients (59.5%) was female with a ratio of male to female patient

of 1:1.4. The prevalence of impacted teeth, gender and age groups. (Table 1).

The 17 to 25 years age group had the highest prevalence of tooth impaction (28.6%), but this prevalence decreased with increasing age. (Table 2)

Impacted third molars were found in 453 patients (45.3%), with only 33 patients with impacted premolars. Out of the 999 examined cases, there were only 10 (1.0%) with pathologies associated to the impacted teeth. There was a significant difference in the number of male 203 (20.3%) and female 339 (33.9%) patients with impacted teeth (p=0.031). Impacted teeth occurred

slightly more often in the mandible (42.8%) compared to the maxilla (42.4%).

The present study showed that there were significant age differences among the age groups of the study sample (26.6±6.8) and its significant association with impaction of teeth (*p*=0.001). Binomial regression analysis showed that the odds of having impaction in females was 1.32 compared to males [CI; (1.021.70), *p*=0.031]. The highest percentage of impaction was lower third molar followed by upper third molar, whereas the lowest prevalence was for upper central incisor. There were no cases of impacted first and second molars nor of impacted lateral incisors. However, there were two cases of impacted upper central incisors (0.2%). (Figure 1)

There was a non-significant association between impaction of the lower third molar and sex, and the percentage of impaction of lower third molars was higher among female compared to male patients. Upper third molar impaction was significantly associated with the sex of patient with the prevalence of impaction of upper third molar among female patents was higher than that of their male counterparts. From all the teeth included in this study, other than third molars, the only significant association with sex was the impaction of upper canines, other teeth were not significantly associated with sex. (Table 3)

Mesio-angular impaction was the most common angulation (38.3%), whereas the disto-angular angulation of impacted third molars was the least common (5.6%). Impacted lower third molars was most commonly mesio-angular (52.9 %) followed by horizontal impaction (30.7 %). Vertical impaction was the most common among the maxillary third molar impactions (55.5%). (Figure 2)

DISCUSSION.

To the best of our knowledge, this study is the first attempt of investigating the prevalence of the impacted teeth in a sample of population living in Sana'a city, the capital of Yemen. Furthermore, despite one study for impaction of canines, and to the extent of the researchers' knowledge, no studies have been conducted nor published conducted by other institutions in our country, aiming to assess the prevalence of any impacted teeth in a single study.

As expected, the selection method for radiograph employed in this study was similar to that employed in other studies. However, the sample size chosen in this study was considerably larger than that of most other studies mentioned in the medical literature.[12]

Orthopantomograms are one of the most important diagnostic tool for most of dental specialties. Traumatic dental and jaw injuries, presence of cysts and tumors in facial, maxillary, and mandibular areas, and dental anomalies of number, size and shape, are examples of alterations that can be conveniently observed on a panoramic radiograph.

Although this study may not represent the Sana'a population as a whole, the results are useful for primary health workers because the patients studied represent the range of dental patients referred from most of dental centers and hospitals to the radiographic center.

The prevalence of impacted teeth in the study population was 54.3%, a relatively high prevalence compared with studies involving a wider age range of patients, including patients younger than 17 years.[12,13]

The present investigation found impaction to be significantly more prevalent among females (54.4%) compared to males (30.9%), this finding is in disagreement with El-Khateeb *et al.,*[14] who found that the incidence of impacted teeth did not differ significantly between males and females among Saudi subjects.

The prevalence rate of third molar impaction in the present study was high (45.3%) 453/999 when compared to the previous studies conducted in Saudi Arabia and other countries.[15,16] Where as other studies reported a relatively higher prevalence rate (77.1%) of impacted third molars compared to our study.[17] These studies reported frequencies of 65.6% in the United States of America, 68.6% in Singapore, and 77.1% in Saudi Arabia.

This difference may be due to the fact that genetic and racial differences are two important factors in tooth impaction. Although a study conducted in Nigeria 18 found that the prevalence of third molar impaction in countries with high standards of living ranges from 9.5 to 25%; the preva-lence rate in this study is close to what was reported in a study that examined 999 OPG of a Singapore Chinese population (68.6%).[19]

In the present study, it was found that out of 999 cases investigated there were only ten cases (1.0%) of impacted teeth with associated pathologies. This finding was much lower than that found by El-Khateeb *et al.,*[14]

who reported that the associated pathologies were found in 18.2% of impacted maxillary third molars, and 31.5% impacted mandibular third molars. The age group 17 to 25 years had the highest prevalence of third molar tooth impaction (28.6%) and this decreased with increasing age. Similar to the results of other studies and as widely stated in the literature.[20]

Although the overall impaction of all teeth had a different distribution between males and females and this difference was statistically significant (*p*=0.031), the results of the present study showed a difference in the prevalence of impaction of third molars between male and female patients, but this difference was non-significant. This finding of our study was similar to the studies reporting gender predilection in terms of the third molar impactions.[21] Whereas this finding disagreed with Syed *et al.,*[22] regarding a Saudi population in which males had a higher incidence of third molar impaction compared to females.

Different developmental growth profile patterns in males and females might explain the higher prevalence of third molar impaction in females. Besides, the growth of the jaw in females usually stops at the time when the third molars just start to erupt. However, in males, the growth of the jaw continues during the period of third molar eruption, which provides adequate space for the eruption of the third molar.

Third molar impaction was more prevalent in the lower arch more than in the upper arch irrespective of the age group, in the present study the ratio of third molar impaction was 1:1.22 for the upper arch to the lower arch. This tooth might be the most common tooth to need to be extracted since it is commonly associated with pathology and diseases. McArdle et al investigating lower third molars with 10.11 panoramic radiographs[23] reported that from the examined teeth 49%, 27%, 14%, 5%, and 2% was associated with pericoronitis, caries and related diseases, mandibular second molar decay, periodontal disease, and dentigerous odontogenic cysts, respectively. The most common angulation in the mandible was mesioangular (52.9%), which is in agreement with findings of Quek *et al.,*[19] and Hashemipour *et al.*[9]

However another study conducted by Bataineh *et al.,*[24] reported that vertical impaction was the most common

angulation impaction in the mandible. Different methods to classify the angulation were used in these studies, hence this could be the reason behind the differences found. The current study showed that the most common angulation in the maxilla was vertical (55.5%) which is in agreement with other authors, but Kruger *et al.,*[20] observed that mesioangular impaction was the most common among maxillary third molar impactions.

Very few studies have been carried out regarding impacted premolars. It has been concluded from the results of another study, that premolar impaction is rare, with the prevalence ranging from 2.1-2.7%.[25]

The results of the present study were higher with a prevalence of 3.3%. The present study indicated that the mandibular premolars were more frequently impacted than maxillary premolars. This is in agreement with the findings of another study regarding that mandibular premolars remained impacted more frequently.[26]

This results may emphasize that, during the follow up of the patients with impacted teeth, not to rush to surgical removal, with their putative related complications and harmful effects of the patients, unless there is a treatment need from an aesthetic or functional perspective.

In the present study, canine impaction represented 14.2% of the overall investigated sample. When comparing lower jaw with upper jaw canine impaction, lower jaw canine impaction was present in 2.8% of the sample whereas the upper jaw impacted canines comprised 11.4% of the sample. These findings are in the line with the results of a previous report,[27] which also showed that canine impaction is more prevalent in the maxilla than the mandible. According to the literature, the prevalence of maxillary canine impaction ranges between 0.8 and 2.8% among different populations. On the other hand, mandibular canine impaction is relatively rare.[28]

The ratio of maxillary to mandibular impaction was about 1:1.10. The maxillary impacted canines was 8.4% in females and 3.0% was in males showing a significant sex predilection. Sex distribution of impacted canines in the present study was relatively in agreement with that of two studies, one of which is a recent study among a Saudi population.[29]

In a previous study among Sana'a population regarding canine impaction; 3.55% of subjects were determined to

have canine impactions, this percentage is much lower than that we found in this study (14.2%).[30] Furthermore in the present study maxillary impacted canines was very much higher than mandibular (11.4% compared to 2.8%), these results are much higher that of previous study in which 3.18% subjects presented maxillary canine impactions, and 0.15% subjects presented mandibular canine impactions. As in the present investigation, the same authors also found that the prevalence of impacted maxillary canine was significantly higher in females than in males. This difference in the results of the same population might be due to the difference in sample size and sampling methods and the source of the OPG records, since Al-Motareb *et al.,*[30] study data was from records of 453 patients who attended their outpatient orthodontic clinic for evaluation of malocclusions.

Whereas our study data source was a radiographic center to which the cases were referred from multiple and different dental practitioners and different specialties. The maxillary central incisor is rarely reported as an impacted tooth and there are very few studies assessed their prevalence. The present study found that the prevalence of impacted central incisors among the study sample was 0.2%.

Compared to Nepalese and Malaysian patients, in which the prevalence was 1.8% and 2.4% respectively, it was lower in our study, which may be due to selecting the sample from orthodontic and the current study emphasizes the rarity of its occurrence. There were various etiological factors for the impaction of maxillary central incisors. One of the most common reasons was the presence of supernumerary teeth in the midline causing obstruction on the path of eruption.[31]

The study of a Nepalian population also further compared the occurrence of impacted maxillary central incisors between males and females, which was 1.9% and 1.6% respectively in their population. Whereas the current study found that there was no male cases of impacted central incisors (0.0%) compared to 0.2% in females, gender differences of maxillary central incisor impaction was not statistically significant in this study and other studies.

According to a recent review, prophylactic extraction of asymptomatic third molars occurs in a disorderly manner without clearly defined criteria. Although the American Association of Oral and Maxillofacial Surgeons recommends extraction of all four third molars in adolescence to minimize complications such as severe pain, hypoglossal nerve palsy and infection, there are no randomized controlled studies to compare the long-term outcome of early removal *versus* retention of pathology-free third molars.[32]

Future studies are required to evaluate the etiology behind this relatively high frequency of third molar impaction especially in the nationwide. The present study, like most of the similar previous works about third molar impaction, used a hospital based sample, which lacks randomization.

More precise studies are necessary to evaluate the impaction of third molars in a randomized sample representative of Yemen population. The present study has several limitations such as difficulty in tracing all the dental records notes and OPG. There were also incomplete data in some dental records. Also, more studies are required to evaluate the pattern of third molars in other regions of Yemen.

CONCLUSION.

The prevalence of impacted teeth among a sample of Yemeni population was high. Third molars and canines were the most commonly impacted teeth. The prevalence of impacted teeth in females was higher than males and in was higher in the mandible than the maxilla, with younger patients with a higher prevalence of impaction. Occurrence of associated pathologies with impacted teeth were very rare.

REFERENCES.

1.   Manoj S, Vipindas A, Yadav S, Rawat SK, Prem L. Rare Patterns of Impacted Mandibular Teeth: A Case Series. 2015.

2.   Stecker SS, Beiraghi S, Hodges JS, Peterson VS, Myers SL. Prevalence of dental anomalies in a Southeast Asian population in the Minneapolis/Saint Paul metropolitan area. Northwest dentistry. 2006;86(5):25-8.

3.   Tuna EB, Kurklu E, Gencay K, Ak G. Clinical and radiological evaluation of inverse impaction of supernumerary teeth. Medicina oral, patologia oral y cirugia bucal. 2013;18(4):e613.

4.   Arriola-Guillén LE, Rodríguez-Cárdenas YA, Ruíz-Mora GA. Skeletal and dentoalveolar bilateral dimensions in unilateral palatally impacted canine using cone beam computed tomography. Prog Orthod. 2017;18(1):7.

5.   Isola G, Cicciù M, Fiorillo L, Matarese G. Association between odontoma and impacted teeth. J Craniofac Surg. 2017;28(3):755-8.

6.   Al-Dajani M, Abouonq AO, Almohammadi TA, Alruwaili MK, Alswilem RO, Alzoubi IA. A Cohort Study of the Patterns of Third Molar Impaction in Panoramic Radiographs in Saudi Population. Open Dent J. 2017;11(1).

7.   Pakravan AH, Nabizadeh MM, Nafarzadeh S, Jafari S, Shiva A, Bamdadian T. Evaluation of impact teeth prevalence and related pathologic lesions in patients in Northern part of Iran (2014-2016). J contemp med sci. 2018;4(1).

8.   Santosh P, Bharati D, Sumita K, Farzan R. Prevalence of dental anomalies in Indian population. 2013.

9.   Hashemipour MA, Tahmasbi-Arashlow M, Fahimi-Hanzaei F. Incidence of impacted mandibular and maxillary third molars: a radiographic study in a Southeast Iran population. Medicina oral, patologia oral y cirugia bucal. 2013;18(1):e140.

10.   Assael LA. Indications for elective therapeutic third molar removal: the evidence is in. WB Saunders; 2005.

11.   Priya PV, Nasyam FA, Ramprasad M, Penumatsa NV, Akifuddin S. Correlating the clinical assessment of impacted mandibular third molars with panoramic radiograph and intraoral periapical radiograph. J Int Soc Prev Community Dent. 2016;6(Suppl 3):S219.

12.   Ezoddini-Ardakani F, Sarikhani-Khorrami K, Shafiee-Rad E, Safaei A, Davodi L. Evaluation the Prevalence of Impacted Teeth in Patients Referred to Department of Oral and Maxillofacial Radiology of Yazd Dental School in years 1392-1394. SSU_Journals. 2016;24(8):659-66.

13.   Keris EY, Bozkaya S, Öztürk M, Güngör K. Prevalence and characteristics of impacted permanent molars in a Turkish subpopulation. JOMR. 2016;4(3):45.

14.   El-Khateeb SM, Arnout EA, Hifnawy T. Radiographic assessment of impacted teeth and associated pathosis prevalence: Pattern of occurrence at different ages in Saudi male in Western Saudi Arabia. Saudi Med J. 2015;36(8):973.

15.   Raheem AA, Alhamdani F, Kamal B. The influence of mandibular third molar position on distal caries in mandibular second molar. J Oral Dent Res. 2015;23(2463):1-8.

16.   Syed KB, Alshahrani FS, Alabsi WS, Alqahtani ZA, Hameed MS, Mustafa AB, Alam T. Prevalence of Distal Caries in Mandibular Second Molar Due to Impacted Third Molar. J

Clin Diagn Res. 2017;11(3):ZC28-30

17.   Bayoumi A, Baabdullah R, Bokhari A, Nadershah M. The Prevalence Rate of Third Molar Impaction among Jeddah Population. Int J Dent Oral Health. 2016;2(4).

18.   Olasoji H, Odusanya S. Comparative study of third molar impaction in rural and urban areas of southwestern nigeria. Trop Dent J. 2000:25-8.

19.   Quek S, Tay C, Tay K, Toh S, Lim K. Pattern of third molar impaction in a Singapore Chinese population: a retrospective radiographic survey. International journal of oral and maxillofacial surgery. 2003;32(5):548-52.

20.   Kruger E, Thomson WM, Konthasinghe P. Third molar outcomes from age 18 to 26: findings from a population-based New Zealand longitudinal study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod;2001;92(2):150-5.

21.   Kathariya MD, Nikam AP, Chopra K, Patil NN, Raheja H, Kathariya R. Prevalence of dental anomalies among school going children in India. JIOH. 2013;5(5):10.

22.   Syed KB, Zaheer KB, Ibrahim M, Bagi MA, Assiri MA. Prevalence of impacted molar teeth among Saudi population in Asir region, Saudi Arabia–a retrospective study of 3 years. Journal of international oral health: JIOH. 2013;5(1):43.

23.   McArdle L, Andiappan M, Khan I, Jones J, McDonald F. Diseases associated with mandibular third molar teeth. Br Dent J. 2018;224(6):434.

24.   Bataineh AB, Albashaireh ZS, Hazza'a AM. The surgical removal of mandibular third molars: a study in decision making. Quintessence Int. 2002;33:613–7.

25.   Wedl J, Danias S, Schmelzle R, Friedrich R. Eruption times of permanent teeth in children and young adolescents in Athens (Greece). Clin Oral Investig. 2005;9(2):131-4.

26.   Mustafa A. Prevalence of Impacted Pre-Molar Teeth in College of Dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia. JIOH. 2015;7(6):1.

27.   Al-Zoubi H, Alharbi AA, Ferguson DJ, Zafar MS. Frequency of impacted teeth and categorization of impacted canines: A retrospective radiographic study using orthopantomograms. Eur J Dent 2017;11(1):117.

28.   Fardi A, Kondylidou-Sidira A, Bachour Z, Parisis N, Tsirlis A. Incidence of impacted and supernumerary teeth-a radiographic study in a North Greek population. Med Oral Patol Oral Cir Bucal. 2011;16(1):e56-61.

29.   Alhammadi M-S, Asiri H-A, Almashraqi A-A. Incidence, severity and orthodontic treatment difficulty index of impacted canines in Saudi population. J Clin Exp Dent. 2018;10(4):e327.

30.   Al-Motareb FL, Al-Labani MA, Al-Zubair NM, Dhaifullah E. Prevalence of impacted canine among Yemen population in Sana'a city. Int. J Dent Res. 2017;5(2):148-51.

31.   Kafle D, Shrestha S, Acharya N, Agarwal A. Prevalence of Maxillary Central Incisor Impaction and Supernumerary Teeth among Nepalese Orthodontic Patients. OJN. 2016;5(2):14-6.

32.   Lee CT, Zhang S, Leung YY, Li SK, Tsang CC, Chu C-H. Patients' satisfaction and prevalence of complications on surgical extraction of third molar. Patient Prefer Adherence 2015;9:257.