

# Radiographic assessment of impacted teeth and associated pathosis prevalence

## Pattern of occurrence at different ages in Saudi male in Western Saudi Arabia

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### ABSTRACT

**الأهداف:** تقييم مدى انتشار انحشار الأسنان، والعوامل المسببة لذلك بين السعوديين في المدينة المنورة بالمملكة العربية السعودية وذلك اعتماداً على صور الأشعة البانورامية الرقمية.

**الطريقة:** أُجريت هذه الدراسة في عيادات تشخيص الفم، كلية الأسنان، جامعة طيبة، المدينة المنورة، المملكة العربية السعودية وذلك خلال الفترة من ديسمبر 2013م إلى فبراير 2015م. وقد شملت الدراسة 359 ذكراً ممن أتوا إلى العيادات، وتم تقييم حالاتهم باستخدام الأشعة البانورامية. وبعدها قمنا بدراسة هذه الصور الإشعاعية من أجل تحليل مدى انتشار وأنماط انحشار الأسنان الطواحن، والأنياب، بالإضافة إلى تحديد العوامل المسببة لذلك.

**النتائج:** أشارت نتائج الدراسة إلى ظهور انحشار الأسنان بين 124 مريضاً من أصل 359 مشاركاً تضمنتهم الدراسة. وكانت الطواحن الثالثة بالفك السفلي هي أكثر الأسنان المنحشرة انتشاراً حيث كان 77.6% منها لديها الدرجة الثانية من نمط الانحشار. وفيما يخص أنياب الفك العلوي التي ظهر عليها الانحشار فقد كان 75% منها إنسية الزاوية. ومن بين 66% من الطواحن الثالثة للفك العلوي التي ظهر عليها الانحشار فقد كان 63.6% من الدرجة الثالثة. بالإضافة إلى ذلك فقد عانى 5.8% من المرضى السعوديين من انحشار 3 أو أكثر من الأسنان، وعانى 13.1% من انحشار سنين، فيما عانى 15.6% من انحشار سن واحد فقط. ولقد اتضحت العوامل المسببة لانحشار الأسنان لدى 18.2% من طواحن الفك العلوي الثالثة، ولدى 31.5% من طواحن الفك السفلي الثالثة. ولقد وجدنا انخفاض حدوث انحشار الأسنان مع التقدم في السن.

**الخاتمة:** أظهرت الدراسة بأن انتشار انحشار الأسنان الطواحن الثالثة لدى المرضى السعوديين قد كانت مشابهة لتلك الموجودة في الأعراق الأخرى. ولقد كان عدد أسنان العقل المفقودة تزداد مع التقدم في العمر. وعلى الرغم من أن نسبة الحالات المرضية المرتبطة بالأسنان المنحشرة كانت منخفضة إلى حد كبير، فمن الضروري القيام بفحص دوري للأسنان للحفاظ على الأسنان المنحشرة التي لم تؤدي إلى أعراض في صحة جيدة.

**Objectives:** To assess the prevalence of both impaction and associated pathosis in a Saudi population in Al-Madinah, Saudi Arabia based on digital panoramic radiographs.

**Methods:** This study was carried out from December 2013 to February 2015. Panoramic radiographs of 359

male patients attending the Oral Diagnosis Clinics, Faculty of Dentistry, Taibah University, Al-Madinah, Saudi Arabia were reviewed. All images were evaluated to determine the prevalence and pattern of impacted third molars and canines, and associated pathosis.

**Results:** Among 359 panoramic radiographs examined, 124 patients had impacted teeth. The impacted mandibular third molars were the most prevalent impacted teeth, 77.6% had class II pattern of impaction. Among the impacted maxillary canines, 75% were mesioangular and among 66 impacted maxillary third molars, 63.6% had class C. Our study showed that 5.8% of Saudi patients had 3 or more impacted teeth, 13.1% had 2 impacted teeth, and 15.6% had one impacted tooth. Associated pathosis was found in 18.2% among impacted maxillary third molars, and 31.5% among impacted mandibular third molars. The incidence of impaction decreases with age.

**Conclusion:** The prevalence and pattern of impacted third molars among Saudis are almost similar to other racial populations. The number of missing wisdom increases with age. Although the percentage of pathosis associated with impaction was considerably low, it is essential to carry you regular oral examinations to preserve asymptomatic impacted teeth in good health.

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As eruption is a complex process, therefore tooth retardation or failure of eruption may arise, so failure of permanent teeth eruption and subsequent impaction is a common dental anomaly.<sup>1</sup> Previous literature reported that teeth impaction is a usual incident and many factors affect its prevalence including aging and eruption time.<sup>2</sup> Genetic and environmental factors play a role in developmental disturbances. The incidence of impacted teeth is contradictory in different populations and ethnic groups.<sup>3</sup> Complications associated with impaction may range from simple problems to serious life threatening problems. Hyperplastic follicular space, subsequent dentigerous cyst or odontogenic keratocyst are the most common simple problems with impaction.<sup>4,5</sup> Serious complications involve malignant transformation of cystic wall into squamous cell carcinoma or mucoepidermoid carcinoma. Consequently, life threatening conditions maybe a chain of simple problem such as impaction, which if solved from the beginning would cost less, and would be simple to solve.<sup>6</sup> Panoramic radiography is a simple tomographic technique that introduces the panoramic view of the maxillofacial region.<sup>7</sup> Radiographic examinations are either digital imaging or conventional. Digital imaging has many advantages versus conventional, such as reduction of radiation exposure, feasibility of image manipulation and analysis, which improves sensitivity and diminishes errors.<sup>8</sup> The United States guidelines state that the panoramic radiograph is one of the screening images for Adolescent with Permanent Dentition and Adult, Dentate or Partially Edentulous.<sup>9</sup> During our daily oral examinations, we notice poor patient awareness of oral health and its implications in Saudi Arabia. Additionally, there is no present data on the prevalence of impacted teeth, and associated pathologies in the Saudi population in Al-Madinah, Saudi Arabia. The aim of the present study was to determine the prevalence and pattern of occurrence of impacted teeth at different ages based on digital panoramic radiograph. In addition, to report the radiographic features of associated pathologies in a Saudi male population, in order to correlate between impaction and associated pathosis

**Methods.** This study was a retrospective observational study, which was implemented in the clinics of the College of Dentistry, Taibah University, Al-Madinah Al-Munawarrah, Saudi Arabia from December 2013 to February 2015. We included all male patients of Saudi nationality with an age range from 20-40 years; high quality digital panoramic radiographs were acquired for

all patients. Patients were divided into 2 groups, the first group from 20-30 years, and the second group from 30-40 years. After assessment of the patient records, patients who displayed one or more of the following pathological situations were excluded from the study. Any conditions that may affect normal growth of permanent dentition as diseases or trauma of the jaw, also any syndromes or hereditary diseases, such as craniosynostosis, Down's syndrome, or cleidocranial dysostosis. Digital panoramic radiographs were acquired by Care Stream CS9000, select 3D Extraoral Digital Imaging System (SM749, Rochester NY, USA). All patients panoramic radiograph were archived using Care Stream R4 (Special filing system software) Clinical and Practice Management database. All patients' panoramic radiographs were examined carefully by 2 skilled Oral and Maxillofacial radiologists with experience of 8 and 12 years in order to detect impacted teeth and associated pathosis.

Classification of impacted mandibular third molar level, position, and depth determined by panoramic radiograph according to the following classification: A) Pell and Gregory radiographic classification with respect to mandibular ramus into: Class I, Class II, and Class III;<sup>10</sup> B) Pell and Gregory radiographic classification for the occlusal plane: Class A, Class B, and Class C;<sup>10</sup> and C) based on winter's classification: mesio-angular, disto-angular, horizontal, vertical, buccal/lingual obliquity, and transverse.<sup>11</sup> Classification of impacted maxillary third molar: Class A, Class B and Class C, and sinus approximation/no sinus approximation.<sup>12</sup> Classification of impacted maxillary and mandibular canine level: A) Archer's classification of impacted maxillary canines: Class I, Class II, Class III, Class IVm and Class V;<sup>13</sup> B) Classification of impacted mandibular canines was classified into: mesioangular, distoangular, vertical, or horizontal Field and Ackerman Classification 1935;<sup>14</sup> C) depth of the impactions were classified into: Level A, Level B, and Level C. Classification of associated pathologies with the impacted teeth included: 1. Caries of the impacted or adjacent teeth. 2. Widening of periodontal ligament space of the adjacent tooth. 3. Loss of lamina dura of adjacent teeth. 4. Root resorption of the adjacent tooth. 5. An increase in the follicular space around the impacted tooth. 6. Cyst formation or tumor associated with the impacted teeth or adjacent teeth.

**Ethical consideration.** This study was approved by the Taibah University College of Dentistry Research Ethics Committee; a waiver of informed consent was approved for this retrospective study. Confidentiality of data was ensured by the commitment of the principal

investigator, and by using codes for all study subjects included in this study.

**Statistical analysis.** All the data were coded, collected, and tabulated. Statistical analysis was performed by Microsoft Office 2013 (Excel) and IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp, Armonk, NY, USA). The significant level was set at  $p \leq 0.05$ . Descriptive analysis was performed using simple frequencies and percentage. Data was presented as count and percentage. Chi square test was used for inferential statistics to compare between the groups.

**Results.** Maxillary and mandibular third molars and canines from 359 panoramic radiographs were examined, of the 1436 jaw quadrants were inspected for impaction, only 212 missing canines and/ or third molars were found. Of the total 359 patients, 124 (34.5%) patients had impacted teeth and 235 (65.5%) patients had no impaction. One impacted tooth was detected in 56 patients (15.6%), 2 impacted teeth were detected in 47 patients (13.1%), 3 impacted teeth were detected in 12 patients (3.3%), and 4 impacted teeth were detected in 9 patients (2.5%). According to statistical analysis of our study, we found that the impacted mandibular third molars were the most prevalent impacted tooth. There were 98 patients (27.3%) that had impacted mandibular third molars, about 53 of them had unilateral impaction, and 45 had bilateral impaction. The total number of impacted mandibular third molars was 143. The second most prevalent impacted tooth was the maxillary third molar. There were 48 (13.4%) patients with impacted maxillary third molars, around 30 of them had unilateral and 18 had bilateral impaction, with a total of 66 impacted maxillary third molars. Six patients had impacted maxillary, and 2 patients had impacted mandibular canines. Among the impacted maxillary canines, 75% were mesioangular and the remaining were vertical with the majority of them having level B, and only 2 canines were associated with an increase in the follicular space around them. There were 2 impacted mandibular canines, which were distoangular, level B with one of them associated with pathosis. Among 66 impacted maxillary third molars, 63.6% had class C followed by class A then class B. Sinus approximation was noted in 71.2% of impacted maxillary third molars. The greater proportion had vertical angulations followed by oblique then mesioangular and horizontal. Associated pathosis was found in 18.2%, which varied from either loss of lamina dura of adjacent teeth or an increase in the follicular space around them (Table 1). Among

143 impacted mandibular third molars, 77.6% had class II followed by class I then class III. While 44.8% had position A, 44.8% had position B, and 15% had position C. The majority of impacted mandibular third molars had vertical angulation followed by horizontal, mesioangular, oblique, and the least prevalent was distoangular. Associated pathosis was represented in 31.5% (Table 2). The most common associated pathosis with impacted mandibular third molar was loss of lamina dura of adjacent teeth followed by widening of the periodontal ligament space of the impacted or the adjacent tooth, especially at the left side then caries of the impacted or adjacent teeth followed by increase in the follicular space around the impacted tooth. Cyst or tumor formation was not associated with any impacted third molar. Out of 124 patients with impaction,

**Table 1** - The frequency and percentage of impacted maxillary third molar according to its crown position, level and angle.

Pattern of impaction	Frequency	%
Class A	18	(27.3)
Class B	6	(9.1)
Class C	42	(63.6)
Mesio-angular	7	(10.6)
Disto-angular	2	(3.0)
Horizontal	7	(10.6)
Vertical	29	(43.9)
Buccal/lingual	10	(15.2)
Sinus	47	(71.2)
No sinus	19	(28.8)
No pathosis	54	(81.8)
Presence of pathosis	12	(18.2)

**Table 2** - The frequency and percentage of impacted mandibular third molars according to position, angle and level of the crowns.

Pattern of impaction	Frequency	%
Class I	25	(17.5)
Class II	111	(77.6)
Class III	7	(4.9)
Class A	64	(44.8)
Class B	64	(44.8)
Class C	15	(10.5)
Mesio-angular	41	(28.7)
Disto-angular	2	(1.4)
Horizontal	43	(30.1)
Vertical	53	(37.1)
Buccal/lingual	4	(2.8)
No pathosis	98	(68.5)
Presence of pathosis	45	(31.5)

63% had impacted mandibular third molar, 31% had impacted maxillary third molar. While only 1% of patients with impaction had impacted mandibular canine, 4.6% of patients had impacted maxillary canine, and 2.3% of patients with impaction had impacted maxillary supernumerary. Regarding the variation of impaction prevalence at different age groups. Our results indicated that there was a significant difference between the 2 age groups. The 20-30 age group had the highest prevalence of impaction, but it decreased in the 30-40 age group. The percentage of one impacted tooth was 67.9%, 76.6% for 2 impacted teeth, 91.7%

**Table 3 -** Prevalence of impacted teeth according to different age groups in a study in Saudi Arabia.

Impaction	Age 20-30	Age 30-40 Count (%)	Total	P-value
0.00	96 (40.9)	139 (59.1)	235 (100.0)	
1.00	38 (67.9)	18 (32.1)	56 (100.0)	
2.00	36 (76.6)	11 (23.4)	47 (100.0)	<0.001
3.00	11 (91.7)	1 (8.3)	12 (100.0)	
4.00	8 (88.9)	1 (11.1)	9 (100.0)	

**Table 4 -** Patterns of retention of third molars by age in a study in Saudi Arabia.

Variables	Unilateral impaction n (%)	Bilateral impaction n (%)
<i>Maxillary third molars</i>		
20-30 years	20 (66.7)	15 (83.3)
30-40 years	10 (33.3)	3 (16.7)
<i>Mandibular third molars</i>		
20-30 years	39 (73.6)	41 (91.1)
30-40 years	14 (26.4)	4 (8.9)

for 3 impacted teeth, and 88.9% for 4 impacted teeth was in age group of 20-30 (Table 3). Our results showed that there was an insignificant difference between the 2 age groups regarding unilateral or bilateral distribution of impacted maxillary canines and mandibular canines. Our results also showed that there was a significant difference between the 2 age groups regarding unilateral or bilateral distribution of impacted maxillary and mandibular wisdom teeth. As our results showed that 66.7% of unilateral maxillary wisdom impaction was in the age range from 20-30 compared with 33.3% in age range from 30-40. Moreover, bilateral maxillary wisdom impaction was 83.3% in age range from 20-30 compared with 16.7% in age range from 30-40. In addition, the results of the present study showed that unilateral mandibular wisdom impaction was 73.6% in the age group 20-30 compared with 26.4% in age group 30-40. Furthermore, bilateral mandibular wisdom impaction was 91.1% in the age range from 20-30 compared with 8.9% in the age range from 30-40 (Table 4). Additionally, our results displayed insignificant differences between the 2 age groups regards different classification of impacted canine and maxillary third molars. However, there was a significant difference between mandibular wisdom ramus relationship classifications between the 2 age groups. For instance, class I was 76% for the age group of 20-30, compared with 24% for the age group of 30-40. Class II was 89.2% for the age group of 20-30, compared with 10.8% for age group of 30-40 (Table 5).

**Discussion.** It is of great importance to investigate the oral cavity beyond what is directly noticeable during clinical examination in order to establish an accurate diagnosis. Adjunctive use of imaging examination delivers valuable information to this scenario.<sup>15</sup> In order

**Table 5 -** The variation of third molars impaction patterns among different age groups in a study in Saudi Arabia.

Variables	Maxillary		Mandibular	
	20-30 years	30-40 years	20-30 years	30-40 years
	n (%)			
Class A	15 (83.3)	3 (16.7)	57 (89.1)	7 (10.9)
Class B	5 (83.3)	1 (16.7)	53 (82.8)	11 (17.2)
Class C	30 (71.4)	12 (28.6)	11 (73.3)	4 (26.7)
Mesio-angular	4 (57.1)	3 (42.9)	33 (80.5)	8 (19.5)
Disto-angular	1 (50.0)	1 (50.0)	2 (100.0)	0 (0.0)
Horizontal	6 (85.7)	1 (14.3)	35 (81.4)	8 (18.6)
Vertical	20 (69.0)	9 (31.0)	47 (88.7)	6 (11.3)
Buccal/lingual obliquity	10 (100.0)	0 (0.0)	4 (100.0)	0 (0.0)
No pathosis	38 (70.4)	16 (29.6)	76 (77.6)	22 (22.4)
Presence of pathosis	12 (100.0)	0 (0.0)	45 (100.0)	0 (0.0)

to achieve effective treatment and allow preventive measurements of impacted or supernumerary teeth, earlier detection is necessary.<sup>16</sup>

Our study showed that 5.8% of Saudi patients with impacted teeth have 3 or more impacted teeth, 13.1% have 2 impacted teeth, and 15.6% have only one impacted tooth. These results agree with Fardi et al<sup>1</sup> who detected at least one impacted tooth in 170 (13.7%) of Greek patients. Our study found that the impacted mandibular third molars were the most prevalent impacted teeth in our male sample in Al-Madinah, and this was in accordance with Othman et al<sup>17</sup> who found the same distribution among Malaysians. The second most prevalent impacted tooth was the maxillary third molar (13.4%) followed by the maxillary (1.7%) and mandibular canines (0.6%). This was in agreement with Al-Faleh<sup>18</sup> who stated that the most frequently involved teeth in descending order were the mandibular and maxillary third molar, the maxillary canines, the mandibular and maxillary second premolar, and maxillary central incisors, among Pakistani patients. There was a similar distribution of teeth impaction among a Brazilian subpopulation and among Tanzanian patients.<sup>15,19</sup> This impaction distribution in our study was in disagreement with previous study<sup>1</sup> in North Greek population, where the most frequent impacted teeth were maxillary canine followed by mandibular second premolar, and the least frequent were the third molars.

Our study found that 27.3% of 359 patients had impacted mandibular third molars, and this was in concurrence with Chu et al<sup>20</sup> who conducted a retrospective study among a Hong Kong Chinese population, and reported a 28.3% prevalence of impacted third molars. Tang et al<sup>21</sup> also reported a similar prevalence rate of 27.8% among a Hong Kong population. On the contrary, a previous study by Aydin et al<sup>22</sup> reported an impacted canines incidence of 3.58%. In addition, Zahrani's study<sup>23</sup> of 4,898 Saudi patients with age range 13 years or older, indicated that 3.6% had at least one impacted cuspid. Rózsa et al<sup>24</sup> analyzed 1,858 children, and their results revealed 101 cases of impacted cuspids. The different results from these studies may arise from racial differences and differences in the methodology of the study. As reported previously,<sup>25</sup> the rarity of impacted canines in the mandible was confirmed. Indeed, most of the impacted canines were located in the maxilla, which had also been established as the predominant location by others.<sup>26</sup> Conversely, Fardi et al<sup>1</sup> reported that among 225 impacted teeth, the most frequently affected teeth were the canines (59.6%), followed by premolars (19.1%),

and supernumerary teeth (15.1%), while the incidence of impacted molars was substantially lower (6.2%). We reported that 53% of impacted mandibular third molars had vertical angulation, followed by horizontal, mesioangular, and oblique, and the least prevalent was distoangular. This was in disagreement with Bokhari et al<sup>27</sup> who stated that among the impacted mandibular third molars, most of the patients had mesio-angular impaction (50.75%), and only 1.4% of the patients had distoangular impaction.

While our study declared that the greater proportion of impacted maxillary third molar had vertical angulations followed by oblique then mesioangular and horizontal. This was in harmony with Bokhari et al,<sup>27</sup> where the vertical impaction was the most common type in the maxillary arch (52%), and horizontal impaction was the least prevalent one (1.5%). Conversely, Jung and Cho<sup>28</sup> found that horizontal impaction was most frequent in mandibular third molars. Our study observed that the most prevalent associated pathosis with impaction was loss of lamina dura of adjacent teeth, followed by widening of the periodontal ligament space of the impacted or the adjacent tooth, then caries of the impacted or adjacent teeth, followed by increase in the follicular space around the impacted tooth. This was in dissimilarity with Jung and Cho<sup>28</sup> who affirmed that the most frequently observed pathology was caries (5.4% of mandibular third molars). Cyst or tumor formation was not associated with any impacted third molar in the present study. Jung and Cho<sup>28</sup> also claimed that cysts rarely developed with impaction. This prevalence was similar to that of a previous study by Polat et al,<sup>29</sup> but lower than in other studies such as Punwutikorn et al,<sup>30</sup> and Al-Khateeb and Bataineh.<sup>31</sup> We reported that there was significant difference between the 20 to 30 age group and the 30 to 40 age group. The 20-30 age group had the highest prevalence of impaction, but it decrease in the 30-40 age group. This result agrees with Gunduz et al<sup>32</sup> who conducted their research on Turkish patients. Jung and Cho<sup>28</sup> also found that older patients had fewer third molars. Supporting our results, a similar study was carried out among a Saudi population in the Asir region; they concluded that the highest incidence of tooth impaction was found in the age group of 20-25 years.<sup>27</sup> The higher impaction prevalence in the younger age group could be explained by the increased number of missing investigated wisdom teeth for the above 30 age group, than the age group of less than 30 years. For example, among 388 investigated for impacted maxillary wisdom molar, 98 teeth were missed. Surprisingly only 28 missed teeth at age 20-29 and 70 missed teeth at age 30 and above.

The results of the present study showed that the percentage of unilateral mandibular wisdom impaction was 73.6%, while bilateral mandibular wisdom impaction was 91.1% in age group 20-30. Unlike the results found by Eshghpour et al,<sup>33</sup> who performed a study on 489 Iranian male patients with a mean age of participants of  $25.44 \pm 6.12$ . A total of 154 (31.49%) had bilateral impacted mandibular third molars, and 109 (22.29%) patients had unilateral impaction. These variations in results may be due to racial differences or due to variation of sample.<sup>33</sup> Our results displayed a significant difference between mandibular wisdom ramus relationship classification between the 2 age groups. For instance, class II showed the highest percent of occurrence at 89.2% for the 20-30 age group, followed by class I at 76% for the same age group. This was reinforced by Eshghpour et al,<sup>33</sup> who stated that class II was significantly prevalent followed by class I and class III.

**Study limitations.** Although the incidence of impacted teeth does not differ significantly between genders, the limitation of the present study was that it was conducted only in male patients. This was because the female x-ray department in the Taibah University Dental Clinics was not open at the time the research was carried out.

In conclusion, the prevalence and pattern of impacted third molars among Saudi subjects are almost similar to other racial populations. The incidence of impaction decreases with age and the number of missing wisdom teeth increases with age. Although the percentage of associated pathosis is considerably low, it is essential to carry out regular oral examinations to preserve asymptomatic impacted teeth in good health.

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