The Influence of Mandibular Third Molar Position on Distal Caries in Mandibular Second Molar

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Abstract

Introduction: Distal caries of mandibular second molars has been documented to be associated almost exclusively with impacted third molars. The level of involvement of second molars in distal caries is influenced by the angulation of the occlusal surface of mandibular third molars and third molars depth. In spite of the importance of these factors on the occurrence of distal caries, their influence on prophylactic extraction decision of asymptomatic impacted molars for Iraqi population did not get enough attention.

Aim: of the study: To determine the influence of mandibular third molar impaction, as identified by panoramic radiograph, on distal caries incidence in second molar in Iraqi population.

Materials and Methods: Panoramic radiographs of impacted mandibular third molars prior to surgical extraction were retrieved from the database of Al-Karamah Secondary Dental Care Centre in the period 2004-2013. Demographic data were collected for all cases. Each panoramic radiograph was examined for the presence of distal caries of mandibular second molar and for the level of depth and degree of angulation of adjacent impacted mandibular third molar.

Results: One hundred forty-eight panoramic radiographs of 214 pre-surgically extracted impacted mandibular third molars were reviewed. Eighty-four (56.8%) of the cases were for males and sixty-four (43.2%) were for females. Chi-Square Test showed significant relationship between age group, impaction angulation, impaction depth and incidence of mandibular second molar distal caries. It also showed highly significant relationship between angulation and depth of impaction.

Conclusion: Horizontally impacted mandibular third molars close to the level of occlusion increases the chance of distal caries incidence in adjacent mandibular second molars. Close monitoring for such cases would be a suitable option. Further prospective studies should be conducted to study the influence of other factors on distal caries incidence.

Key words: impacted mandibular third molar, distal caries of mandibular second molar, panoramic radiography.

Introduction

Impaction of mandibular third molar is a common problem (Ozec et al., 2009), often associated with various complications. The complications identified in relation with impacted third molars are: dental caries, root resorption, periodontal problems, pericoronitis, infections, cysts, dental crowding and neoplastic lesions (Falci et al., 2012a; Fuster Torres et al., 2008; Juodzbalys and Daugela, 2013; RCS(Eng), 1997; Salehi and Danaie, 2008).

Accordingly, prophylactic extraction has been recommended (AAOMS, 2011; McArdle and Renton, 2005). However, the decision to extract asymptomatic impacted mandibular third molars as a preventive measure continue to be a debatable issue (Allen et al., 2009; Boughner, 2013; Fuster Torres et al., 2008; Mettes et al., 2012; Pitekova and Satko, 2009). Distal caries of mandibular second molar is a frequently noted complication of impacted mandibular third molar tooth. It has been found to be associated almost exclusively with impacted third molar teeth (Oderinu et al., 2012). The incidence of distal caries has been reported up to 42% (Allen et al., 2009; Ozec et al., 2009) . The level of involvement of second molar in distal caries has been found to be influenced by the depth of impacted third molar and the occlusal angulation between the impacted tooth and the occlusal surface of the second molar (Ahmed et al., 2011; Hupp, 2008).

In spite of the significance of
mandibular third molar position on the incidence of distal caries and its possible influence on prophylactic extraction decision, there is shortage of related data regarding Iraqi population.

Aim
To determine the influence of impacted mandibular third molar, as identified by panoramic radiograph, on distal caries incidence in second molar in Iraqi population.

Materials and Methods
This study has been approved by the Scientific Committee of College of Dentistry, Al-Mustansiria University. Panoramic radiographs of cases with impacted mandibular third molars were retrieved from the database of Al-Karamah Dental Centre for secondary care. These radiographs were taken using Planmeca machine (PM 2002 CC Proline Pan/Ceph) in the period between 2004 and 2013. The panoramic radiographs were reviewed to determine their eligibility for the study. Inclusion criteria were panoramic radiographs where both mandibular second and third molars are present. Exclusion criteria were panoramic radiographs with missed and/or filled mandibular second molars. Demographic data in addition to reasons for extraction were recorded.

Each panoramic radiograph was examined for the presence of radiolucency in the distal surface of mandibular second molar on the digital screen and for the determination of both: the angulation of impacted mandibular third molar according to Winter’s classification (Winter, 1926) and the depth of impaction according to Pell and Gregory’s classification (Pell and Gregory, 1993).

The printed copy of the radiograph was used to measure the angle between mandibular occlusal plane and occlusal surface of the mandibular third molar using a tracing paper. The angles between the two tracing lines were categorized into four types of impaction as follows: $<0^\circ$ for disto-angular impaction, $0-30^\circ$ for vertical impaction, $31-60^\circ$ for mesio-angular impaction, and $61-90^\circ$ for horizontal impaction (Figure 1).

Figure 1: Tracing paper measurement for the occlusal angle of impacted mandibular third molar.
These measurements were performed using a half circle protractor marked in degrees (180°). The depth of impaction was classified into three levels: A, B and C. In level “A” the occlusal plane of the impacted tooth is within the same level as the adjacent tooth while in level “B” the occlusal plane of the impacted tooth is between the occlusal plane and the cervical line of the adjacent tooth and in level “C” the occlusal plane of the impacted tooth is apical to the cervical line of the adjacent tooth (Figure 2).

![Figure 2: Panoramic x-ray showing the depth of impaction of mandibular third molar (Pell & Gregory classification). A: the occlusal plane of the impacted tooth is at the same level as the adjacent tooth; B: the occlusal plane of the impacted tooth is between the occlusal plane and the cervical line of the adjacent tooth; C: the occlusal plane of the impacted tooth is apical to the cervical line of the adjacent tooth.](image)

The studied predictors were: age groups (17-24, 25-32 and 32-54), impaction angle between the occlusal plane and occlusal surface of mandibular third molar, and impaction depth.

Statistical analyses used were descriptive statistics and Chi-Square Test. The Chi-Square Test was used to determine correlation between each study variable and incidence of mandibular second molar distal caries.

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 20. P value < 0.05 was considered in this study to detect statistically significant relation between study variables.

**Results**

Panoramic radiographs for 148 patients with 214 pre-surgically extracted impacted mandibular third molars were reviewed. Sixty-six patients had bilateral impactions. The reasons for surgical extraction of lower third molars were: pericornitis, periodontitis, mandibular second molar caries, orthodontic referral and for prophylactic reasons.

Radiographic evidence of distal caries found in 40 cases (18.7%) whereas 174 cases (81.3%) were free from distal caries. Eighty-four of the cases were for males (56.8%) and 64 were for females (43.2%). Chi-Square Test showed no statistically significant relationship (p>0.05) between patients’ gender and incidence of distal caries as appeared in the radiographs.

Right sided impaction was found in 112 cases (52.3%) leaving 102 cases (47.7%) with left sided impaction. No statistical significant relationship (p>0.05) was found between the side of impaction and incidence of distal caries.

The age range was 17-54 years (Mean= 24.5, SD= ±5.8). As shown in Table 1, about two thirds of the study sample lies within the age range 17-24 years, whereas the age group above 32 years old represents the smallest number of included cases. The age groups 25-32
and above 32 years showed the highest number of distal caries in both males and females with similar percentages. The statistical relationship between age group and distal caries incidence was highly significant (p<0.01, df=2). As demonstrated in Table 1, apart from the distal angulation, the number of cases becomes less with the increase of impaction angulation. Vertical impactions were the highest incidence (33.2%) whilst the disto-angular impactions were the lowest incidence of impaction (8.9%). Level B impaction depth was recorded as the highest number of cases (49.1%), followed by level A (39.2%), then level C (11.8%). There was highly significant relationship between tooth angulation and its impaction depth (p<0.01, df=6) Most of the cases in each category were clear from distal caries in all study variables (58.5%-93%). The highest percentages of cases with distal caries, however, were found in association with both level A and horizontal impactions. Apart from the distal angulation, the percentage of mandibular second molar distal caries increases with the increase of occlusal angle of impaction. The incidence of caries was the highest in horizontal impaction (38.9%), followed by mesio-angular (17.1%), then vertical impaction (7%). Only two cases with disto-angular impaction were found associated with distal caries in mandibular second molar. This relationship between impaction angulation and distal caries incidence was statistically confirmed (P<0.001, df=2).

Table 1  incidence of distal caries according to age groups, Winter’s Classification and Pell and Gregory Classification.
The data in Table 1 show that the lesser the depth of mandibular third molar the more the incidence of distal caries. The statistical relationship between tooth occlusal level and distal caries incidence was statistically significant (p <0.01, df=2).

Table 2
caries incidence in each impaction category (angulation and depth of impaction)

<table>
<thead>
<tr>
<th>Impaction Type</th>
<th>No. of cases</th>
<th>Caries incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level A</td>
<td>37</td>
<td>17 (45.9%)</td>
</tr>
<tr>
<td>Level B</td>
<td>10</td>
<td>2 (20%)</td>
</tr>
<tr>
<td>Level C</td>
<td>7</td>
<td>2 (28.6%)</td>
</tr>
<tr>
<td>Mesio-angular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level A</td>
<td>15</td>
<td>6 (40%)</td>
</tr>
<tr>
<td>Level B</td>
<td>39</td>
<td>6 (15.4%)</td>
</tr>
<tr>
<td>Level C</td>
<td>16</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Vertical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level A</td>
<td>28</td>
<td>2 (7.1%)</td>
</tr>
<tr>
<td>Level B</td>
<td>41</td>
<td>3 (7.7%)</td>
</tr>
<tr>
<td>Level C</td>
<td>2</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Disto-angular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level A</td>
<td>4</td>
<td>1 (25%)</td>
</tr>
<tr>
<td>Level B</td>
<td>14</td>
<td>1 (7.1%)</td>
</tr>
</tbody>
</table>

Table 2 details the caries incidence in each impaction category according to Winter and Pell and Gregory’s classifications. The lesser is the impaction depth in each angulation type, the more caries incidence is noticed. Caries incidence was mostly associated with level “A” horizontal (45.9%) and mesio-angular (40%) impactions. Disto-angular impaction showed the least incidence of distal caries.

Discussion

The focus of the current study is to determine the value of mandibular third molar position, as identified in panoramic radiograph, in distal caries incidence in mandibular second molar in the Iraqi population. This may inform the clinician’s decision for prophylactic extraction of asymptomatic mandibular third molars. The ability to predict the incidence of impacted mandibular third molars complications has been the subject of continuous argument (Costa et al., 2013; RCS(Eng), 1997). It has been suggested that the reason for such opinion conflict is related to the flaws in some of the published studies, such as inadequate sample size, insufficient monitoring time or methodological errors (Costa et al., 2013). Despite the fact that over the last two decades there was no sufficient evidence to support either extraction or retention options for asymptomatic impacted mandibular third molar (Allen et al., 2009; NHS, 1998; Steed, 2014), it is generally agreed that asymptomatic mandibular third molar with the potential risk for developing complications needs to be extracted. However, there is no consensus about what should be considered the high risk factors (Mc Ardle and Renton, 2005; Network, 1999; NICE, 2000). Surgical decision, as far as distal caries incidence concerned, is no exception (BDA, 2013). The incidence of mandibular second molar distal caries associated with adjacent impacted third molar was reported in the literature to range from 0.5% to 42.5% (Sandhu and Kaur, 2008; Sheikh et al., 2012). Distal caries incidence in this study sample falls within this range and is comparable to what has been reported by Ozec et al. (2009) study (20%). Patients’ age, as this study suggests, has significant influence over mandibular second molar caries incidence. This is expected because increased patient’s age can give more chance for bacteria to cause dental caries. Almendros-Marques et al. (2006) reported that younger age group (16-30 years) was associated generally with more mandibular third molar complications. The authors, however, found no statistically significant relationship between age and impaction complications, which disagree with the finding of the current study. This disagreement may be attributed to the wider age range for “young group” in Almendros-Marques et al. study, which could influence statistical analysis Results.
Patients’ gender in this retrospective sample was found to have no influence on the incidence of distal caries. Similarly, Almendros-Marques et al. (2006) found that gender has no influence on mandibular third molar complications.

This study showed that the horizontal impaction was associated with the highest incidence of distal caries in comparison with the mesio-angular impaction which concurs with Falci et al. (2012b). This study, also, showed that the greater the occlusal angle the higher the chance of distal caries incidence. This is probably due to more chance of food impaction (Ahmed et al., 2011; Motamedi and Kavandi, 2013). However, the available evidence mandates especial consideration for mesio-angular rather than horizontal impaction (NICE, 2000). Many studies found that mesio-angular impaction was associated with the highest incidence of distal caries (Allen et al., 2009; Ozec et al., 2009; Sheikh et al., 2012). In their clinical and radiographic study on Turkish population, Ozec et al. (2009) reported that 47% of cases with distal caries of second molars were associated with mesio-angular impacted third molars (31-70 degrees). The authors, therefore, suggested prophylactic removal of asymptomatic partially erupted mandibular third molar with 30-90 degree angulation to prevent distal caries development (Ozec et al., 2009). Sheikh et al. (2012) also recommended prophylactic removal or close monitoring for asymptomatic mesio-angular impacted third molar because half of these cases in their study were associated with distal caries of adjacent second molars.

In this study, level B impaction depth was the highest incidence of impaction, which agrees with other studies (Almendros-Marques et al., 2006; Mehdizadeh et al., 2014) followed by level A. This study showed that the highest occlusal level of mandibular third molar (level A impaction depth) is associated with a greater chance of distal caries in adjacent second molar. The highest the level of impacted teeth means more exposure of the tooth crown to the oral environment. This provides bacteria with better access increasing the possibility of causing caries in the distal surface of second molar (Almendros-Marques et al., 2006; Hupp, 2008). The deeply impacted third molar, however, may also provide access to bacteria leading to bacterial accumulation around the distal surface of second molar, even with no obvious communication between the impacted tooth and the oral cavity (BDA, 2013; Hupp, 2008).

The highest incidence of distal caries was found in level “A” horizontal impaction followed by level “A” mesio-angular impaction. This concurs with the finding of Polat et al. (2008) study. Accordingly, it can be argued that level “A” horizontally impacted mandibular third molars require particular attention.

The number of cases with distal caries incidence in all study variables, however, was less than the cases without distal caries. This implies that tooth position alone might not be the only influential predictor for distal caries incidence. Other factors, such as individual susceptibility to caries and improper oral hygiene maintenance may play more important role (Falci et al., 2012b).

Recently, numerous published studies from different parts of the world are involved in the debate around the issue of prophylactic extraction decision of asymptomatic impacted third molar (Allen et al., 2009; BDA, 2013; Costa et al., 2013; McArdle and Renton, 2005; Steed, 2014). However, the predictive value of mandibular third molar position on distal caries incidence, in Iraqi population, did not get similar attention. As far as Iraqi studies are concerned, the only published Iraqi study on extraction of impacted mandibular third molar showed that prophylactic extraction is not uncommon practice (Al-Bahrani et al., 2012).

Despite the fact that symptom free impacted mandibular third molar is not necessarily risk free, it should be remembered that the decision to remove an asymptomatic mandibular third molar for predictable complication is usually weighted against expected surgical difficulties, postoperative complications and surgery cost (Godfrey, 1999; Mettes et al., 2012; Steed, 2014). Accordingly, prophylactic removal of impacted tooth is not a straightforward decision (AAOMS, 2011; Friedman, 2007). It needs to be considered after thorough clinical and radiographic examination.

In addition, the decision should not ignore the patient’s opinion when the tooth is asymptomatic. Mettes et al. (2012) on the basis of absence of strong evidence for prophylactic removal of symptom free impacted third molar, suggest that this decision is influenced by patients informed agreement in addition to surgeon’s experience.

To the best of study authors’ knowledge, this is the first study conducted in Iraq trying to determine, on the basis of radiography, the value of impacted third molar position using this number of cases. The study, however, had some limitations. First, the panoramic radiographs may not be the best investigative tool to detect proximal carious lesions (Kambarouglu et al., 2012). This study limitation is understood within the context of retrospective studies in general. In retrospective studies the authors have no control over the data. Second, the radiographic assessment was performed by a singular examiner with possible related bias. Third, the
sole reliance on radiographic findings alone may not provide a strong base for prophylactic extraction decision. Nevertheless, the impacted tooth position, as this study suggest, may have a role in developing distal caries of adjacent tooth and should be taken in consideration before making a decision to extract or retain an asymptomatic impacted tooth.

Conclusion
Horizontally impacted mandibular third molar close to the level of occlusion increases the chance of distal caries incidence in mandibular second molar. Close monitoring for such cases would be a suitable option. Further prospective studies should be conducted to evaluate the influence of other factors on distal caries incidence.

Conflict of interests:
No conflict of interest in this study.

References


Network SIG (1999). Management of Unerupted and Impacted


