Evaluation of Risk Factors for Oroantral Communication During the Extraction of Third Upper Molar

Ocena czynników ryzyka połączenia ustno-zatokowego podczas ekstrakcji trzecich górnych zębów trzonowych

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Abstract

Background. Oroantral communication (OAC) is a common complication of tooth extraction, including the removal of upper third molar (UTM). Orthopantomograms (OPG) may be used to assess the position of UTM and to detect patients at high risk for OAC.

Objectives. The aim of this study was to use OPG to identify patients at risk of OAC after the extraction of UTM.

Material and Methods. Patients who underwent UTM extraction were divided into two groups. The study group consisted of 13 patients with OAC. The control group comprised of 50 subjects without OAC. Subsequently, OPG of all participants, taken before extraction, were analyzed retrospectively by SCANORA software version 5.1. The analysis included following variables: position of teeth 18 and 28 (according to Archer Third Molar Classification), distance between the apex of the maxillary third molar and the floor of the maxillary sinus, position of UTM in relation to the cemento-enamel junction of the adjacent second molar.

Results. In the study group, 92.1% of teeth 18 and 28 were in direct contact with the floor of the maxillary sinus. The type “d” of tooth impaction, according to Archer Third Molar Classification, significantly increased the risk of OAC (OR = 14.7; CI (95%) = 1.4–156.2; p = 0.03). However, in the study group type “3a” was detected more frequently (15.9%).

Conclusions. The type “d” of tooth impaction, according to Archer Third Molar Classification has a significant impact on the occurrence of OAC during extraction of UTM (Dent. Med. Probl. 2015, 52, 1, 17–21).

Key words: radiography, upper molars, oral sinus communications.

The development of the maxillary sinus, located bilaterally in the corpus of maxilla, begins in the fetal period. The growth of the maxillary sinus ends with the eruption of the third molar. The maxillary sinus shape alterations may lead to the formation of recess. Alveolar recesses are usually situated between the two laminae dura of the alveolar process. Less frequently, recesses are located between the roots of the teeth, intraradicular and interdental septa. The presence of alveolar recess may cause a protrusion of the lateral teeth roots into the lumen of the maxillary sinus. Protruding roots may be covered only by a thin layer of mucousa as a consequence of the bone lamina atrophy [1–3].

The incidence of OAC after the extraction of canines, premolars and molars ranges from 0.31 to 4% [4] (0.8% after the extraction of third molars) [5]. This complication occurs most commonly after surgical extraction of second premolar, first molar and second molar of the maxilla [6], probably due to the proximity of apices of
these teeth to the floor of maxillary sinus [7]. Radiographs, such as OPG may be used to visualize the patient’s teeth, temporomandibular joint and maxillary sinus. Assessment of the teeth position could be used to estimate the risk of OAC.

Therefore, the aim of this retrospective study was to identify risk factors for the occurrence of OAC during the extraction of UTM.

**Material and Methods**

We reviewed medical records of patients who underwent the extraction of UTM in the Department of Dental Surgery between January 2002 and December 2012. From among 1749 removals of UTM (882 on the right side and 867 on the left side), 152 were complicated by OAC. Inclusion criteria for the study group were as follows: occurrence of OAC during the extraction of UTM, availability of pre-extraction OPG in the SCANORA software and complete medical documentation. Cases not fulfilling these criteria were excluded from the study. Only 13 patients fulfilled these requirements. The control group consisted of 50 randomly selected patients without OAC after UTM extraction. However, only subjects in whom pre-extraction OPG had been taken, were included into the control group.

OAC was identified by careful socket examination using a blunt sinus probe (without pressure to avoid opening the sinus) and by the examination of patient during nose blowing.

The obtained X-ray image was analyzed according to the following parameters:

1. Position of UTM according to Archer Third Molar Classification (Fig. 1) [8].
2. Distance between the apex of UTM and the floor of the maxillary sinus.
3. Position of UTM in relation to the cemento-enamel junction of the adjacent second molar.
4. Depth of impaction in relation to the adjacent second molar (the distance between the most coronal points of UTM and the adjacent second molar in vertical plane.

Each OPG was analysed by SCANORA software version 5.1 (Soredex, Finland). Two observers separately evaluated 63 OPGs according to Archer Third Molar Classification. The observers also identified and manually selected the following landmarks:

1. Apex of UTM,
2. Floor of the maxillary sinus,
3. The most coronal point of UTM,
4. The most coronal point of the upper second molar,
5. Cementoenamel junction of the upper second molar.

**Statistical Analysis**

The obtained data was subjected to statistical analysis. Demographic variables were assessed with $\chi^2$ test with Yates correction and Mann-Whitney test. Logistic regression model was used to determine the risk factors of the occurrence of OAC after UTM extraction. $P$ values below 0.05 were considered significant. MedCalc software version 12.2.1.0 (MedCalc Software, Inc, Mariakerke, Belgium) was used for analyses.
Results

Statistical analysis revealed age difference between groups as median age was higher in the study group (32 vs 23 years). Table 1 presents the demographic characteristics of both groups.

Twenty-nine (46%) UTM extractions were performed on the right side of the maxilla and 34 (54%) on the left side. The frequency of OAC occurrence was similar on both sides of the maxilla: 7 (53.8%) after extraction of left UTM and 6 (46.2%) after extraction of right UTM.

In the control group, 40 procedures were performed by a dental surgery specialist (80%) and 10 by a resident (20%). In the study group, 10 extractions were performed by dental surgery specialists (76.9%) and 3 by a dentist (23.1%).

In the control group, 42 of UTMs were removed surgically (84%) and 8 were removed by a simple extraction (16%). In the study group all UTMs were removed surgically (100%). In 6 patients OAC was simply closed with sutures. In 7 cases a buccal flap was used to close OAC.

OPGs revealed that most of UTMs roots were in direct contact with the floor of the maxillary sinus or in the lumen of the maxillary sinus (92.1%). In the study group 2 (15.4%) teeth roots were located below the level of the sinus floor, 4 (30.8%) were in direct contact with the floor of the maxillary sinus and 7 (53.8%) were in the lumen of the maxillary sinus. In the control group 3 (6%) of UTMs roots were situated below the sinus floor, 21 (42%) reached the level of the sinus floor and 26 (52%) protruded into the maxillary sinus lumen.

The position of teeth 18 and 28 was also evaluated in relation to the cementoenamel junction of the adjacent second molar. In the study group 5 (38.5%) UTMs were located below the anatomical neck of the adjacent tooth (apical), 3 (23.1%) UTMs at the level of the neck, and 5 (38.5%) teeth above the neck (towards the tooth crown). In the control group 15 (30%) teeth were situated below the neck, 19 (38%) at the same level and 16 (32%) above the neck.

In both groups the type ‘3a’ of UTM impaction according to Archer Third Molar Classification occurred most frequently (in a total of 10 patients; 15.9%). According to the results of the statistics, only the ‘d’ position was a statistically significant risk factor of the occurrence of OAC after UTM extraction (OR = 14.7, CI (95%) = 1.4–156.2, p = 0.03). There were no significant differences in the prevalence of other teeth arrangements according to Archer Third Molar Classification (Table 2).

### Table 1. The demographic characteristics of the groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Study group</th>
<th>Control group</th>
<th>Total</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>13</td>
<td>50</td>
<td>63</td>
<td>–</td>
</tr>
<tr>
<td>Women</td>
<td>11 (84.6)</td>
<td>41 (82.0)</td>
<td>52 (82.5)</td>
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<tr>
<td>Men</td>
<td>2 (15.4)</td>
<td>9 (18.0)</td>
<td>11 (17.5)</td>
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</tr>
<tr>
<td>Median age</td>
<td>32</td>
<td>23</td>
<td>–</td>
<td>0.02</td>
</tr>
<tr>
<td>18 removed</td>
<td>7 (53.8)</td>
<td>23 (46.0)</td>
<td>30 (47.6)</td>
<td>0.8</td>
</tr>
<tr>
<td>28 removed</td>
<td>6 (46.2)</td>
<td>27 (54.0)</td>
<td>33 (52.4)</td>
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</tr>
</tbody>
</table>

Data is presented as median or number (percentage).

### Table 2. The frequency of upper third molar positions according to Archer Third Molar Classification

<table>
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<tr>
<th>Position</th>
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<th>CG</th>
<th>SG</th>
<th>CG</th>
<th>SG</th>
<th>CG</th>
<th>SG</th>
<th>CG</th>
<th>Total</th>
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</thead>
<tbody>
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<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>1</td>
<td>4</td>
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<tr>
<td></td>
<td>(7.7)</td>
<td>(4.0)</td>
<td>(7.7)</td>
<td>(2.0)</td>
<td>(15.4)</td>
<td>(2.0)</td>
<td>(16.0)</td>
<td>(7.7)</td>
<td>(26.0)</td>
</tr>
<tr>
<td>b</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10.0)</td>
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<td>(6.0)</td>
<td>(7.7)</td>
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<td>(12.0)</td>
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<td>(7.7)</td>
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<tr>
<td>c</td>
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<td>4</td>
<td>0</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>2</td>
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<tr>
<td></td>
<td>(7.7)</td>
<td>(8.0)</td>
<td></td>
<td>(16.0)</td>
<td>(15.4)</td>
<td>(7.7)</td>
<td>(10.0)</td>
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<td>(15.4)</td>
</tr>
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<td>1</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
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<td></td>
<td>(15.4)</td>
<td>(2.0)</td>
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<td></td>
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<td>(23.1)</td>
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<td>(2.0)</td>
</tr>
<tr>
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<td>1</td>
<td>12</td>
<td>5</td>
<td>19</td>
<td>1</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>(30.8)</td>
<td>(26.0)</td>
<td>(7.7)</td>
<td>(24.0)</td>
<td>(38.5)</td>
<td>(38.0)</td>
<td>(7.7)</td>
<td>(15.4)</td>
<td>(38.0)</td>
</tr>
</tbody>
</table>

Data is presented as number (percentage).
CG – control group.
SG – study group.
**Discussion**

This study indicates a higher risk of OAC during the extraction of UTM in position “d” according to Archer Third Molar Classification. Similar results were obtained by A.A.T. Lim et al. [9]. We also observed the lack of a link between the radiological picture of roots location in relation to the maxillary sinus floor (OR = 1.0, CI (95%) = 0.3–3.4, p = 1.0) and the incidence of OAC. As OAC requires specialist treatment due to the increased risk of acute or chronic sinusitis [10], patients with apparent OAC risk factors on OPG should be referred to a dental surgeon. Whilst OAC < 2 mm may spontaneously heal within 48 h after extraction, OAC > 3–4 mm is not expected to resolve without intervention and requires surgical treatment [11]. Moreover, without proper management persistent OAC may transform into oroantral fistula [10]. Contrary to previous research, our study indicates that OPG may be a useful tool for predicting the possibility of OAC occurrence [9]. Angled periapical radiographies allow for the precise assessment of the tooth roots anatomy [12]. The study conducted by Ridao-Sacie et al. [13] showed that, compared with OPG, periapical radiographs offer a superior view of teeth; however, with the exception of a visualization of the maxillary second and third molars. These are more visible on OPG. However, due to higher reliability, computed tomography (CT) is considered superior to OPG and periapical radiographs for predicting the occurrence of OAC [14]. CT offers greater measurement accuracy and precision in the assessment of the anatomical position of UTM. Hence, CT may be useful in both, diagnosis and therapy of OAC [15].

Effective dose and dose to the main organs of the head and neck for multi-slice computed tomography (MSCT) are higher than for cone-beam computed tomography (CBCT). For visualizing teeth and bone, CBCT image quality is equivalent to the image quality of MSCT; however, MSCT is superior to CBCT in the assessment of soft tissues. Beam-hardening artifacts due to dental-care material and implants are weaker at CBCT than at MSCT [16]. Compared with panoramic radiography, the effective radiation doses of CBCT are significantly higher. The effective doses of CBCT are different in adults and children and dependent on equipment type and exposure parameters [17]. Panoramic radiography has sufficient diagnostic accuracy in dental caries, periodontal diseases, and other lesions. As the effective dose of panoramic radiography is lower compared with CBCT, MSCT and traditional full-mouth periapical radiography [16–18], OPG is an appropriate method for detecting the risk factors of OAC.

Although the position of UTM seems to influence the incidence of OAC after UTM removal, further studies on a larger group of patients are warranted to confirm these observations.

**References**


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