Complications and Management of Implants Migrated into the Maxillary Sinus

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The article describes complications following dental implant dislocation into the maxillary sinus and their management and attempts to elucidate the reasons for these complications and their prevention. This retrospective study presents 55 cases of dental implant migration into the maxillary sinus. Patients were 30 men and 25 women with average age of 58 years. Oroantral communication was found in 46 cases, primarily in cases without prior bone augmentation, in patients aged older than 60 years (mean), and medically compromised patients (ASA > 1). The dislocated implant and the infected tissue were removed from the sinus in most cases by Caldwell-luc intervention. The oroantral communication was closed by local and regional flaps. In most of the cases, the oroantral communication was closed by a single intervention. The conclusion was that oroantral communication and maxillary sinusitis are common findings following dental implant migration and dislocation into the maxillary sinus. The risk factors for these complications were dental implantation in the posterior maxilla without sufficient alveolar bone, implantation without prior maxillary sinus augmentation, and older and medically compromised patients. Successful closure of the communication is usually performed with local or regional flaps. Int J Periodontics Restorative Dent 2018;38:e112–e118. doi: 10.11607/prd.3328

Dental implants in posterior edentulous areas for oral rehabilitation have been widely investigated. Maxillary posterior edentulous alveolar ridges may be not suitable for implant placement and are often a challenge for the oral surgeon due to alveolar ridge resorption and maxillary sinus pneumatization. The use of short implants and maxillary sinus floor elevation are well-documented and successful procedures to overcome these problems.1–7 In some cases, complications such as implant displacement or migration may occur due to inadequate bone height, the presence of type IV alveolar bone, or massive bone resorption due to infection.8 Implant migration into the sinus is not always followed by signs and symptoms of infection, but it can be associated with oroantral communication and/or infection that may involve the maxillary sinus and the paranasal sinuses. The displaced foreign bodies should be removed as soon as possible to prevent such complications.9–15

Two main treatment modalities have been proposed for the removal of displaced implants in the sinuses and treatment of associated infectious complications: a Caldwell-luc operation in which an intraoral approach with the creation of a bony window in the anterior-lateral wall of the maxillary sinus is performed5,9,12–15,16; or a transnasal
approach with functional endoscopic sinus surgery (FESS).2–11,15,17 FESS uses a transnasal approach through the ostium in the middle meatus to enter the maxillary sinus and other paranasal sinuses. It allows removal of displaced implants or other foreign bodies, treatment of paranasal sinusitis, and reestablishment of adequate patency of the natural maxillary ostium with a minimally invasive procedure. However, it cannot close oroantral communications without an additional intervention.

The introral approach makes possible removal of the implants and closure of the oroantral communications with local flaps, such as a buccal, palatal, or buccal fat pad flap.18–22 Its disadvantages are that it does not allow efficient treatment of an obstructed maxillary sinus ostium and the eventual sinusitis of paranasal sinuses.

Cooperation between oral surgeons and otolaryngologists might be the best way to treat these clinical situations. Most of the relevant publications describe case reports or very limited case series8–10,12–15 that do not allow evaluation of the best treatment modality.

The aim of this study was to evaluate circumstances leading to dental implant dislocation into the maxillary sinus and to investigate the complications and their management to elucidate their causes and aid in their prevention.

Materials and Methods

A retrospective study was conducted on consecutive cases sent to departments of oral and maxillofacial surgery in three medical centers between 2000 and 2013 that presented with dental implant dislocation into the maxillary sinus. Information regarding the referring dentist and demographic data regarding age, sex, and health status according to the American Society of Anesthesiologists (ASA)23 were recorded. A normal healthy patient was designated as ASA I, while a patient with a mild systemic disease was categorized as ASA II. Clinical data recorded after the development of the complication and the course of treatment were retrieved from patient files. Bone height measurements were performed according to the radiographic data by a special ruler provided for each radiograph by the institution that performed the x-ray. Information regarding the details before implant dislocation and the type of bone graft and torque insertion were not provided by the referring dentist.

Inclusion criteria were as follows:

- Complete medical and radiographic data regarding the treated patients after the complication
- Patients presenting with dental implants in the maxillary sinus
- Patients with or without oroantral communication
- Complication treated by a specialist in oral and maxillofacial surgery
- Follow-up of at least 1 year in the department that provided treatment

The following exclusion criteria were applied:

- Patients who presented with other foreign bodies than implants or bone graft in the maxillary sinus
- Patients who refused treatment
- Patients without follow-up

The study was approved by the ethical committees of the medical centers and the university. Data were analyzed statistically by t test, chi-square test, Fisher exact test, and Spearman correlation using SPSS for Windows.

Results

A total of 55 patients were included in the study, 30 men and 25 women. All of them presented with dental implant dislocation into the maxillary sinus. The age range was 36 to 84 years (average 58 ± 9 years). Health status was ASA I in 33 patients and ASA II in 22 patients (mainly stable cardiovascular problems and controlled diabetes). An oroantral communication developed in 46 patients. In 27 patients, only a panoramic radiograph was performed to localize the dislocated implant. In 8 patients, a computed tomography (CT) scan was performed, and in 20 patients, both types of imaging were performed (Fig 1).

In most of the cases (72%), implant migration into the maxillary sinus occurred during the surgery and by 2 months postsurgery. Most of the cases treated by general practitioners occurred with the implant
insertion. In patients treated by oral and maxillofacial surgeons, the implant dislocated during the healing period (1 to 6 months after implantation) following sinus augmentation by the lateral approach.

Table 1 Symptoms Following Implant Dislocation/Migration into the Sinus

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Frequency (no. of patients)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oroantral communication</td>
<td>37</td>
</tr>
<tr>
<td>Sinusitis</td>
<td>38</td>
</tr>
<tr>
<td>Postnasal drip</td>
<td>27</td>
</tr>
<tr>
<td>Nasal obstruction</td>
<td>13</td>
</tr>
<tr>
<td>Headache</td>
<td>9</td>
</tr>
</tbody>
</table>

Baseline Clinical and Radiographic Details for Treatment of the Complication

In all cases, implant dislocation was found in type 4 bone, which is characteristic of the posterior maxilla. In 16 of the cases the sinus floor was very thin (0 to 8 mm vertical bone height) without prior bone augmentation or sinus augmentation, and in 2 cases a crestal approach sinus augmentation was used (6 to 8 mm residual bone height). Implant dislocation was found in 37 cases of lateral window sinus augmentation (0 to 5 mm vertical bone height). It was assumed that the placed implants were stable in the available bone, with a satisfactory torque of insertion for the treating dentist. All implants were submerged under the oral mucosa.

The signs and symptoms presented by the patients with implant dislocation into the maxillary sinus included sinusitis (67%), oroantral fistula (OAF) and communication (83%), postnasal drip (49%), nasal obstruction (23%), and pain (16%) (Table 1).
The time that elapsed between the implant dislocation and/or OAF formation and the repair procedure (implant removal and closure of OAF) was 1 to 6 months in 32 patients and 6 to 12 months in 23 patients.

Operative Treatment

In 52 cases (94%), the implant was removed through a Caldwell-luc approach, 1 implant was rejected spontaneously through the nose, 1 was removed by FESS, and 1 by a combination of FESS and Caldwell-luc. The Caldwell-luc approach facilitated the removal of all the infected tissue, including the affected bone graft from the sinus.

In 46 of 55 cases, an oroantral fistula developed and had to be surgically closed by local flaps (buccal and/or palatal flaps with or without buccal pad of fat flap) (Table 2 and Figs 2 and 3). In some cases, more than two surgeries were needed to close the oroantral communication: 32 patients (69.5%) had one operation, 5 patients (11%) had two operations, and 9 patients (19.5%) had 3 operations. The number of closure attempts of the OAF, the number of hospitalization days, and the need for general anesthesia were higher in the medically complex (ASA II) patients (Table 3).

<table>
<thead>
<tr>
<th>Correlations Between Patient Health Status and Sinusitis Symptoms</th>
<th>Healthy (n)</th>
<th>Medically complex (n)</th>
<th>Mean age (y)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>No sinusitis symptoms</td>
<td>15 (45%)*</td>
<td>2 (9%)</td>
<td>53</td>
</tr>
<tr>
<td>Acute sinusitis symptoms</td>
<td>8</td>
<td>10 (45%)*</td>
<td>62</td>
</tr>
<tr>
<td>Chronic sinusitis symptoms</td>
<td>10</td>
<td>10 (45%)</td>
<td>57</td>
</tr>
<tr>
<td>Without oroantral communication</td>
<td>12</td>
<td>6</td>
<td>53***</td>
</tr>
<tr>
<td>With oroantral communication</td>
<td>21</td>
<td>16</td>
<td>60***</td>
</tr>
</tbody>
</table>

*P = .016. **P = .063. ***P = .0023.

Postoperative Details

In 37 patients, no complications arose following implant removal from the maxillary sinus. The remaining 18 patients developed sinusitis...
and/or OAF and required reoperation and closure of the fistula.

The surgical intervention for implant removal and OAF closure were performed under general anesthesia in 33 patients, under local anesthesia in 18 patients, and under intravenous sedation in 4 patients.

Regarding need for hospitalization, 15 patients with a mean age of 62 years needed 3 to 7 days of hospitalization. Most of these patients had stable diseases (ASA II). The rest of the patients required 0 to 1 day of hospitalization and were included in the ASA 1 group, with a mean age of 55 years.

**Correlations**

No correlation was found between prior bone augmentation (sinus lift) and dental implant dislocation into the maxillary sinus.

A high negative correlation was found between prior bone augmentation and OAF formation \( (P = .061) \). OAF formation was also correlated with higher age \( (P = .023) \). Only the older patients (aged > 60 years) presented oroantral communication, while younger patients (aged up to 53 years) did not present OAF following implant dislocation.

**Correlation to Sinusitis**

A high correlation was found between the health status ASA II and sinusitis after implant dislocation into the maxillary sinus \( (P = .016) \). ASA I patients did not develop any signs of sinusitis following implant dislocation \( (P = .063) \).

A trend of sinusitis following implant dislocation was correlated to higher age. Acute sinusitis was found in the oldest group (average 60 years), while chronic sinusitis was found in the younger patients (average 57 years). The youngest group (average 54 years) did not demonstrate any signs of sinusitis \( (P = .063) \).

Headaches were reported three times more often by women than by men \( (P = .033) \).

**Discussion**

Implant displacement/migration into the maxillary sinus and related infectious complications are probably underreported. Dental implantation has become a widespread procedure and is performed by many dentists and oral surgeons. As the frequency of surgical procedures for implant placement in the posterior maxilla is rapidly increasing, the number of such complications will likely increase.

According to the present study, implant migration occurred in cases of bone deficiency and lack of available vital bone for implant osseointegration, either at implant placement or during the following 6 months postoperatively. The analysis showed no correlation to prior bone augmentation, and the authors believe this was due to a mistake on the part of the clinician placing the implant. A recent study analyzed 24 implants displaced into the sinus in 21 patients due to incorrect treatment planning or a poorly performed surgical procedure and recommended removal of the displaced implant to avoid sinus pathology.24

Once an implant has migrated or dislocated into the maxillary sinus, the chronic infection and foreign body reaction may lead to the formation of an oroantral communication, which is sometimes the first sign of implant dislocation. The implant should be removed, the maxillary sinus should be cleaned of all the inflamed tissue, and the oroantral communications should be closed by local flaps.25 In the present study, Caldwell-luc operations were performed in most cases with a very high success rate (96%). The oroantral communications were

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**Table 3 Patient Distribution According to Postoperative Clinical Details and Health Status**

<table>
<thead>
<tr>
<th>Postoperative period</th>
<th>ASA I</th>
<th>ASA II</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attempts at OAF closure &lt; 1 ( (n) )</td>
<td>8</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Attempts at OAF closure ≥ 1</td>
<td>13</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Hospitalization days &lt; 1</td>
<td>28</td>
<td>13</td>
<td>41</td>
</tr>
<tr>
<td>Hospitalization days ≥ 1</td>
<td>3</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Local anesthesia</td>
<td>14</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Sedation</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>General anesthesia</td>
<td>15</td>
<td>16</td>
<td>31</td>
</tr>
</tbody>
</table>
closed by local flaps. Removal of the dislocated implant and closure of the oroantral communication should be performed as soon as possible to preserve the patency of the maxillary sinus and prevent the spread of infection to paranasal sinuses or other vital sites.26–28

The present analysis concentrated on the treatment of patients who presented with implants migrated or dislocated into the maxillary sinus. In 46 of the 55 cases, an oroantral fistula was created. The case analyses showed that implant dislocation took place during the operation itself as well as during the healing period. According to the available data, the reasons for this complication were sparse and loose bone in the posterior maxilla, lack of vital available bone adequate for osseointegration, lack of appropriate planning or training of the performer, and local and systemic factors.

Penetration of the anatomical barrier between the maxillary sinus and the oral cavity may lead to OAF. OAF was found more frequently in cases without prior sinus augmentation and in cases of concomitant sinus augmentation and dental implantation. Lack of bone and lack of osseointegration due to insufficient quantity of vital bone may lead to implant dislocation, sinus infection, and OAF formation. Preimplantation bone augmentation and a staged procedure with bone grafting at the first stage and dental implantation at the second stage may prevent this outcome by increasing the amount of bone designed to serve as a barrier and prevent OAF formation.

Dental implant dislocation such as maxillary sinusitis and oroantral fistula were highly presented in older patients (average age 59 years) and ASA II patients in comparison to younger patients (average age 53 years) and healthy patients (ASA I). This older group of patients also needed more than one surgery attempt for OAF closure and a longer period of hospitalization following implant removal. These patients should be treated carefully, and local factors should be considered to prevent this complication.

The need for a long period of hospitalization was found in 27% of the patients, most of them ASA II. It may be assumed that the reason for this was the Caldwell-luc operation and that FESS would enable a shorter hospitalization.

In this study, headache was reported primarily by women. In a previous study,29 it was found that women developed more maxillary sinusitis following sinus augmentation and complained more often of headaches. It is possible that women have greater self-awareness and a greater tendency report changes in their situation than men. Anatomical differences in the sinus and nervous system between men and women may also explain this difference and should be investigated.

Implant removal from the sinus was performed mostly through Caldwell-luc operation, with a high success rate. Caldwell-luc enables removal of the implant and all the inflamed tissue thanks to a direct visual approach. This approach is also recommended in cases of oroantral communication that require local and regional flap closure. FESS is an alternative method for removal of foreign bodies from the sinus, but it was rarely applied in this study. In case of dislocated implant into the sinus and oroantral fistula, a cooperation between otolaryngology for implant removal by FESS and oral and maxillofacial surgeons for closure of oroantral fistula will be praiseworthy.

Conclusions

Dental implant dislocation into the maxillary sinus creates symptoms of sinusitis and oroantral fistula in most cases. The risk for complication is sparse and loose bone in the posterior maxilla and lack of available vital bone. Implant migration should be prevented by placing implants in areas with sufficient available vital bone. This approach should enable new osteogenesis through bone augmentation prior to implant placement. The risk of OAF formation increases in cases without previous bone augmentation and in older, medically complex patients. Signs of sinusitis were mainly presented in older patients (> 57 years) and patients with ASA > 1. Headache is more pronounced in women than in men. Once an implant is dislocated into the sinus, it should be removed and the oroantral communication should be closed by local flaps. A longer recovery period is needed for older and medically compromised patients presenting this complication.
Acknowledgments

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References


