Development of Sinusitis After Sinus Floor Elevation Surgery: A Systematic Review

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ABSTRACT  
Background: Maxillary sinusitis can arise after sinus floor elevation surgery and should be treated immediately to prevent further complications which included dental implants failure, graft lost, and oro-antral fistula. This is the first systematic review to assess the incidence, causes, and treatment of sinusitis after sinus lift surgery.  
Materials and methods: An electronic search included MEDLINE (PubMed) data base site was carried out for articles involving development of sinusitis after sinus lift surgery from September 1997 up to April, 8, 2017. The search was done and reviewed by two independent authors.  
Results: The total results of electronic search were (182) abstracts and articles, the extracted articles which involved development of sinusitis after sinus lift surgery were (25) studies. Of the 25 articles only (8) articles fit the inclusion criteria. Maxillary sinusitis was calculated for all selected studies and it was ranged from 2.12% to 12.7% with average of 5.4 %.  
Conclusion: Maxillary sinusitis could be developed after sinus lift surgery with average of 5.4 % and the patients with previous maxillary sinus disease showed to be at increased risk of sinusitis after sinus lift surgery.  
Keywords: Sinusitis after sinon lift; sinus lift complication; systematic review. (Received: 26/7/2017; Accepted: 23/8/2017)  

INTRODUCTION  
One of the major postoperative complications after sinus floor elevation surgery is sinusitis. The post-surgical sinusitis etiology can arise from two origins; either from earlier chronic infection of the maxillary sinus which is triggered by post-surgical inflammatory changes or from communication with bacteria of oral cavity via perforation of Schneiderian membrane (1). It is very important to treat sinusitis after maxillary sinus lift surgery as soon as possible because the infection may spread to other paranasal sinuses. In addition to that sinus infection may cause oro-antral fistula, loss of graft material and failure of dental implants (2-6).  
The aims of this study were to present the results of the previous studies which involved development of sinusitis after sinus lift surgery and to assess the incidence of the maxillary sinusitis after sinus floor elevation surgery.  

MATERIALS AND METHODS  
An electronic search was carried out in MEDLINE (PubMed) data base site for articles published in the literature from September 1997 up to April, 8, 2017 and limited to studies on human trials. The following keywords were used in the search: sinusitis after sinus lift, sinus lift infection, sinus lift complication and sinusitis after sinus floor elevation surgery.  

The search process is demonstrated in diagram 1.  

Inclusion criteria:  
1. Researches involving RCT (randomized clinical trials, prospective and retrospective studies.  
2. Studies involving sinusitis development after sinus lift surgery.  
3. Studies with at least 6 months of follow-up after sinus lift surgery.  
4. Studies on humans only.  
5. Articles in English language only.  
6. Healthy patients with no systemic diseases that may influence on the maxillary sinus health.  

Exclusion criteria:  
1- Case reports and case series with less than 10 patients.  
2- Studies published in other languages than English.  
3- Experimental studies (on animals).  
4- Studies involving complications after sinus lift other than maxillary sinusitis.  
5- Studies with less than 6 months follow-up period.  
6- Patient with systemic diseases that may had an effect on maxillary sinus health.  

Selection of studies  
Titles and abstracts of the articles were examined initially by two independent reviewers (authors) for the chance of inclusion in this systematic review.
RESULTS
The total results of electronic search were 182 abstracts and articles. The reviewed abstracts were 130, the extracted articles which involved development of sinusitis after sinus lift surgery were 25 studies. Of the 25 articles 17 studies were excluded and only 8 articles which fit the inclusion criteria were involved in this research. The characteristic data for each study was summarized in table 1. The average of sinusitis was calculated for all studies and it was 5.4 %.

Seventeen articles were excluded from this research because of the following points:
1- Five articles were excluded because they were case reports.
2- One study excluded because it was involving various types of localized lateral alveolar ridge and/or sinus floor augmentation procedures performed before implant placement.
3- Seven articles were excluded because of missing data and not standardized criteria.
4- Three articles were excluded because they written in German language.
5- One article was excluded because the sinusitis complication was not related only to sinus lift surgery but to other causes like odontogenic causes.

DISCUSSION
Development of sinusitis after sinus lift surgery among the selected studies in this research ranged from 2.12% to 12.7% (10,14).

Causes of sinusitis (according to the authors in the selected studies) were as follow:
1- Sinusitis due to sinus membrane perforation as mentioned in two studies (10,14).

CONCLUSION
According to this research, sinusitis can developed after sinus lift surgery with average of 5.4 %. Patients with previous maxillary sinus diseases appeared to be at increased risk of sinusitis development after sinus lift surgery.

REFERENCES


Table 1: Summary of the percentage, causes, and treatment of maxillary sinusitis after sinus lift surgery in the selected studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>N of patients</th>
<th>Types of sinus lift procedure</th>
<th>N of sinus Augmentation</th>
<th>N of sinusitis and ratio</th>
<th>Diagnosis of sinusitis</th>
<th>Total N of membrane perforations</th>
<th>Causes of sinusitis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timmenga et al (7)</td>
<td>1997</td>
<td>45</td>
<td>NM</td>
<td>85</td>
<td>Autogenous bone grafts</td>
<td>N:2 R:4.4%</td>
<td>*Questionnaire examination</td>
<td>N: 29</td>
<td>Patients with a predisposition for this condition</td>
</tr>
<tr>
<td>Cannizzaro et al (8)</td>
<td>2013</td>
<td>40</td>
<td>lateral and crestal approach</td>
<td>NM</td>
<td>Organic bovine &amp; autogenous bone</td>
<td>N:1 R: 2.5%</td>
<td>NM</td>
<td>N:52</td>
<td>Assumed long implant 10-16mm</td>
</tr>
<tr>
<td>Vazquez Moreno et al (9)</td>
<td>2014</td>
<td>127</td>
<td>NM</td>
<td>202</td>
<td>NM</td>
<td>N:6 R:4.7%</td>
<td>NM</td>
<td>N:52</td>
<td>No relation to Postoperative complications</td>
</tr>
<tr>
<td>Nolan et al (10)</td>
<td>2014</td>
<td>208</td>
<td>NM</td>
<td>359</td>
<td>R: 12.7%</td>
<td>NM</td>
<td>N:150</td>
<td>Sinus membrane perforation</td>
<td>Antibiotics</td>
</tr>
<tr>
<td>Kayabasoglu et al (11)</td>
<td>2014</td>
<td>94</td>
<td>Lateral approach</td>
<td>(145) 51 bilateral 43 unilateral</td>
<td>Cortico-cancellous mineralized allograft bone</td>
<td>N:4 R:4.2%</td>
<td>*Questionnaire *Satisfaction *radiographic examination, and nasal endoscopic examination</td>
<td>N: 8 No one developed sinusitis</td>
<td>*Patients who suffer from chronic sinusitis *large amount of graft</td>
</tr>
<tr>
<td>Schwarz Linda et al (12)</td>
<td>2015</td>
<td>300</td>
<td>Lateral approach</td>
<td>407</td>
<td>A mixture of autologous bone and deproteinized bovine bone substitute (Bio-Oss)</td>
<td>N:34 R:8.4%</td>
<td>Clinical symptoms and patient compliance</td>
<td>N: 35 11 of them developed sinusitis</td>
<td>* Sinus membrane perforation * Smoking *Sinus elevation width</td>
</tr>
<tr>
<td>Chirilă et al (13)</td>
<td>2016</td>
<td>116</td>
<td>Lateral window technique</td>
<td>151</td>
<td>*Xenograft *Allograft *Xenograft and allograft mix *Alloplastic *Xenograft and alloplastic mix</td>
<td>N:5 R:4.3%</td>
<td>“The clinical signs of infection: headache, locoregional pain, cacosmia, inflammation of the oral buccal mucosa and rhinorrhea or unilateral nasal discharge”.</td>
<td>NM</td>
<td>Patients developed infections received *xenografts (3 cases) *xenograft + allograft mix (1 case) *alloplastic grafts (1 case)</td>
</tr>
<tr>
<td>Sakkas et al (14)</td>
<td>2016</td>
<td>99</td>
<td>Lateral wall approach</td>
<td>105</td>
<td>Autogenous bone</td>
<td>N:2 R:2.12%</td>
<td>(Clinical signs of infection) headache nasal congestion, pain on the operated facial site, fever or redness</td>
<td>N: 11 No one developed sinusitis</td>
<td>Sinusitis developed in patient with no membrane perforation and with no history of maxillary sinus diseases</td>
</tr>
</tbody>
</table>

Abbreviations: N: Number; NM: Not mentioned; R: ratio.