

# Maxillary Sinusitis due to Dental Infection: A Case Series Study

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**Introduction:** Odontogenic infection is one of the most common causes of maxillary sinusitis which can lead to severe complications like cerebral abscess and orbital cellulitis. This study aims to evaluate the frequency of acute and chronic maxillary sinusitis by odontogenic source in 120 patients. **Materials and Methods:** One hundred and twenty patients (240 sinuses) were examined by clinical examinations and their sinuses were assessed for the extent of fluid or mucosal thickening in computed tomography (CT) images and water's views. A dental examination has been performed to detect dental involvement and periapical radiography has been obtained to confirm the findings. Combination treatments were performed on five patients with refractory odontogenic sinusitis. Chi-square analysis has been used to identify the correlation between the prevalence of odontogenic sinusitis, age, and gender. **Results:** Sinus involvement caused by dental origin has been found in 11.2% of the cases. Periapical involvement of maxillary first molar has been the most common cause of sinusitis with dental source (68%). The incidence of chronic apical periodontitis has been significantly higher than the other periapical infections (75% versus 25%). The signs and symptoms of sinusitis in all five cases were eliminated after the combination treatment after four months. **Conclusions:** Odontogenic sources especially chronic apical periodontitis may lead to inflammation of the maxillary sinus membrane which usually is ignored because of its silent progression.

**Keywords:** Maxillary Sinusitis; Odontogenic Infection; Chronic Apical Periodontitis

## Introduction

Maxillary sinusitis affects a lot of people all over the world and can lead to serious complications such as cerebral abscess and orbital cellulitis (1, 2). Odontogenic origin is suggested as an etiologic factor about (10-12%) for maxillary sinusitis cases which are resisted to medical treatment (3). Maxillary sinuses are the only sinuses which can be affected by odontogenic infections due to the anatomic proximity of posterior maxillary teeth roots (4). The dental infections including periodontal abscess, acute apical abscess, chronic apical periodontitis, and acute apical periodontitis are the most common odontogenic infection sources of acute and chronic maxillary sinusitis (5-7). Many otolaryngologists do not consider the importance of this effective cause on sinus membrane inflammation so leads to misdiagnosing the cause of sinusitis and providing

inappropriate treatments (8). Furthermore, maxillary sinusitis may be observed in various manners in different populations and age groups which indicate the importance of studying the prevalence and features of odontogenic maxillary sinusitis in different societies (9, 10). The prevalence of maxillary sinusitis by odontogenic infection in radiographic views has been evaluated by several reports (7, 8, 11). These investigations have proved that this prevalence can be different from which is reported in the literature (9). Lopatin *et al.*, (2002) evaluated the frequency of a dental source for chronic maxillary sinusitis. In their investigation, oroantral fistula has been identified as a significant source of maxillary sinusitis. They have concluded that cleaning the sinus antrum by endoscopy is an appropriate treatment plan for sinusitis with dental origin (5). Two studies by Bomeli *et al.*, and Connor *et al.*, investigated the odontogenic maxillary sinusitis caused by the dental restoration in computed tomograms. These studies show that the sinus membranes are more susceptible to be thickened as a reaction to dental infections (8, 12). According to the various reports of

odontogenic sinusitis in different populations (4, 8) and the importance of early diagnosis of this problem (3), this study aimed to evaluate the frequency of maxillary sinusitis of odontogenic origin in 120 Iranian patients. Since there was no such report and study in the literature, we tried to design an investigation to assess the effects of dental treatments and antibiotic therapy in treatment of refractory maxillary sinusitis.

This study aimed to evaluate the occurrence of odontogenic acute and chronic maxillary sinusitis by odontogenic origin and assess the dental treatment in treating odontogenic sinusitis.

## Materials and Methods

This study has been executed at Otolaryngology centers of Tehran, Iran. One hundred and twenty patients (58 females and 62 males) with the age range between 6 to 81 years, after the maxillary sinusitis diagnosis, have been included in the current study.

### Otolaryngology examination

The history of the present illness has been taken, and clinical examinations have been performed for all the patients, nasal endoscopy has been carried out during the clinical examinations and computed tomography scanning (CT scans) or Water's radiograph has been obtained as it is necessary for diagnosis. Diagnostic criteria of acute maxillary sinusitis include:

- Pain during the anterior wall of maxillary sinuses percussion
- Pus in the middle meatus
- Systemic symptoms such as fever
- Air fluid level in CT scan or Water's radiograph

Diagnostic criteria of chronic maxillary sinusitis include:

- Purulent rhinorrhea
- Postnasal discharge (PND)
- Tension headaches
- Thickening of sinus membrane in CT scan

All examinations have been executed by an otolaryngologist.

### Dental examination

The patients with acute or chronic sinusitis and unilateral sinus opacification have been selected for dental examinations by two general dentists and an oral medicine specialist. These patients have been examined by clinical examination, and periapical radiographs have been obtained from the affected teeth. Diagnostic criteria of odontogenic infections include:

- History of dental pain

- Signs like gingival swelling, sinus tracts, or periodontal packet
- Percussion tenderness of the affected tooth
- No response to thermal tests
- Poor or no response to electrical pulp test (EPT)
- Periradicular radiolucencies on periapical radiographs

To find the relationship between age and the frequency of odontogenic maxillary sinusitis, the patients have been divided into five age groups:

- I.Mixed dentition period (6 to 12 years)
- II.Teenage (13 to 19 years)
- III.Adulthood (third and fourth decades)
- IV.Old adults (fifth and sixth decades)
- V.Elderly (over 60 years)

In the second part of the research, the combination of dental and otolaryngology treatments was used for treating the patients with the accurate diagnosis of odontogenic sinusitis. Six patients needed immediate surgical procedures on their sinuses and were excluded from the present study. Five patients with a history of previous unsuccessful otolaryngology treatments were selected for this part of the research. These patients underwent dental treatments including root canal therapy or surgical treatments (apicoectomy or extraction) before starting the otolaryngology remedies. Cefixime was the antibiotic agent choice after dental treatments. Improvement or removing the mentioned signs and symptoms and radiographic findings were considered as cured maxillary sinusitis.

### Ethical considerations

Participants were informed about the purpose and design of the investigation and signed an appropriate informed consent form. The research protocol was approved by the Ethics Committee in Research of Shahid Beheshti Medical University with an ethical code of IR.SBMU.DRC.REC.1389.089.

### Statistical analysis

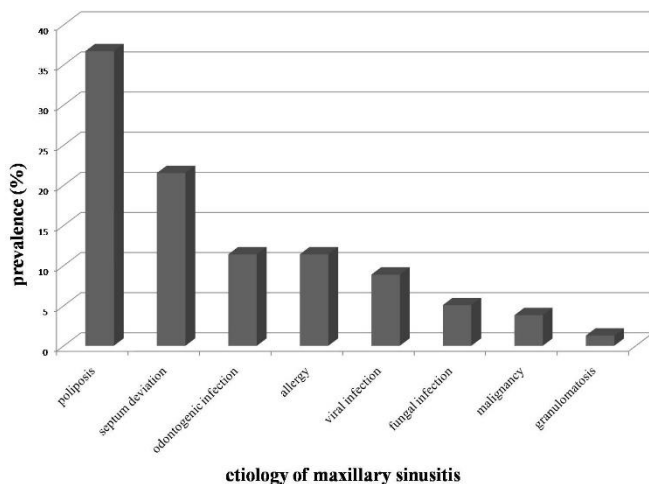
All calculations have been processed using Statistical Package for Social Science statistical software (version 20; SPSS Inc.). Descriptive statistics including tables and graphs have been applied to show the information. Chi-square test has been used to determine the significant differences between the frequency of teeth and odontogenic infection. Phi-Cramer value has been used to determine the influence of gender on the prevalence of the evaluated problem. To compare the significance of categorical findings with respect to age groups, Spearman's rho



has been used. A *P* value of less than 0.05 has been considered statistically significant.

## Results

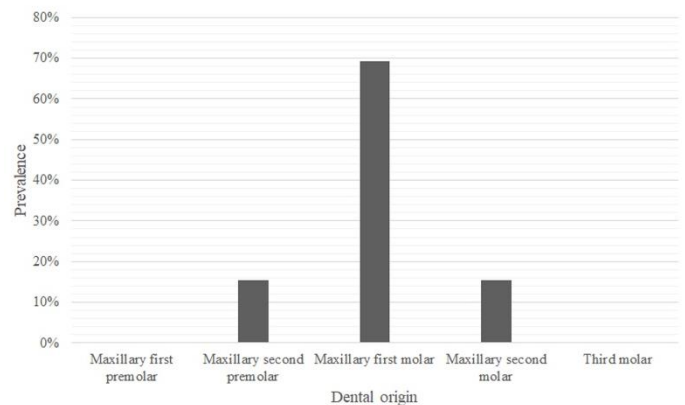
One hundred and twenty patients (58 females and 62 males) with an age range between 6 to 81 years (mean age of  $36.2 \pm 1.8$ ) have been included in the present study. Otolaryngology and dental examinations proved that 11.2% of the maxillary sinusitis cases were affected by odontogenic origin. This study indicates that odontogenic infection is the third common cause of maxillary sinusitis among the 8 detected etiologies (Figure 1).



**Figure 1.** The prevalence of different etiologic factors of maxillary sinusitis

Chi-square test represents that odontogenic infection is significantly less common than polypsis and deviated nasal septum (*P* value < 0.01 for both tests). Although odontogenic maxillary sinusitis has been more common in men than women (54.5% versus 45.5%), there is no significant difference. The most affected tooth in the evaluated patients has been the first maxillary molar (Figure 2). Phi-Cramer value indicates that the prevalence of the first maxillary molars is significantly higher than the other posterior teeth in sinusitis of dental sources (*P* < 0.01).

Chronic apical periodontitis has been detected more than other dental infections as a cause of maxillary sinusitis. The frequency of this problem is significantly higher than the other dental involvements (*P* < 0.01).



**Figure 2.** The prevalence of tooth involvement in odontogenic maxillary sinusitis

To determine the relationship between age and prevalence of odontogenic maxillary sinusitis, the patients have been evaluated in different age groups. The most frequency belongs to the age group of the third and fourth decades (adulthood) (Table 1). Statistical analysis proves that the prevalence of odontogenic sinusitis in this age group is significantly higher than in other groups (*P* < 0.01).

Then the CT images of the patients were assessed for evaluating the opacity of maxillary sinuses. The results are shown in Figure 3. In 60% of the odontogenic sinusitis cases the mucosal thickening was progressed more than two-third of the sinuses which was significantly higher than other conditions i.e., less than two-third opacity (*P* < 0.05).

The findings of the second part of the project are shown in Table 2. This study showed that the signs and symptoms of sinusitis in all five cases were eliminated after the combination treatment after four months (Figure 3).

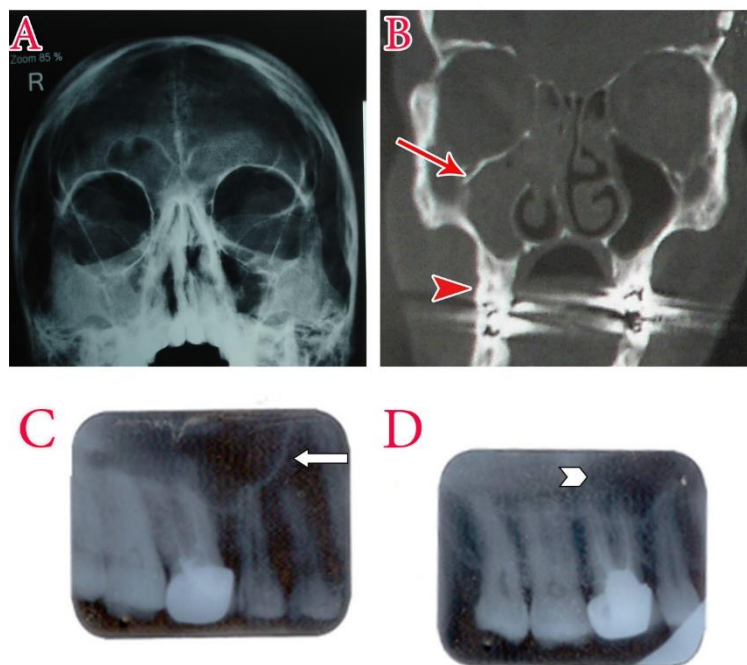
## Discussion

The maxillary sinus is an important issue in dentistry because of its proximity to upper posterior teeth especially the maxillary first molar (13). The prevalence of maxillary sinusitis with dental sources has been evaluated in different studies (2, 3, 8). This study showed that the prevalence of odontogenic maxillary sinusitis in this Iranian group is about 11.2%. This finding is similar to the findings of the other studies (2, 3), although this prevalence is greater in some other researches (8- 16).



**Table 1.** Demographic data of the odontogenic sinusitis cases

Order	Gender	Age	Etiology	Involved side	Caused tooth	Sinusitis status
1	Female	29	Chronic apical periodontitis	Left	Maxillary first molar	Chronic
2	Female	6	Acute apical abscess	Left	Maxillary first molar	Acute
3	Female	21	Chronic apical periodontitis	Left	Maxillary second molar	Acute
4	Female	51	Chronic apical periodontitis	right	Maxillary first molar	Chronic
5	Male	39	Chronic apical periodontitis	Left	Maxillary first molar	Chronic
6	Female	26	Chronic apical periodontitis	Left	Maxillary second premolar	Chronic
7	Male	31	Chronic apical periodontitis	Right	Maxillary first molar	Chronic
8	Female	31	Chronic apical periodontitis	Left	Maxillary second premolar	Chronic
9	Female	36	Chronic apical periodontitis	Left	Maxillary first molar	Chronic
10	Male	44	Chronic apical periodontitis	Right	Maxillary first molar	Acute
11	Male	51	Acute apical periodontitis	Right	Maxillary second molar	Acute



**Figure 3.** A) Water view of a patient with odontogenic sinusitis. The fullness of right maxillary sinus is detectable in the radiograph. B) Coronal section of the CT scan of the same patient. C) The fullness of right maxillary sinus (arrow) due to the infected molar (arrow). D) The periapical infection is removing due to root canal retreatment after four months (arrow head). The signs and symptoms of maxillary sinusitis were also improved.



**Table 2.** Successful rate of combination therapy in patients

No.	Gender	Age	Dental problem	Previous treatment	New treatment plan	Treatment duration (weeks)	Findings
1	Female	31	Acute apical abscess of right first maxillary molar	Previous unsuccessful antibiotic therapy	Root canal therapy + surgical procedure + antibiotic therapy with cefixime	16	Healing of periapical infection and removing the signs and symptoms of sinus involvement
2	Female	26	Chronic apical periodontitis of right second maxillary premolar	Previous unsuccessful surgery	Tooth extraction + surgical procedure + antibiotic therapy with cefixime	14	Removed signs and symptoms of sinusitis
3	Male	39	Acute apical periodontitis of left first maxillary molar	Previous unsuccessful antibiotic therapy	Root canal therapy + antibiotic therapy with cefixime	12	Improvement of sinusitis signs and symptoms
4	Male	31	Acute apical periodontitis of left first maxillary molar	Previous unsuccessful antibiotic therapy	Root canal therapy + antibiotic therapy with cefixime	16	Improvement of sinusitis signs and symptoms
5	Male	36	Acute apical periodontitis of left first maxillary molar	Previous unsuccessful antibiotic therapy	Tooth extraction + antibiotic therapy with cefixime	12	Improvement of sinusitis signs and symptoms

In other studies, the diagnosis of sinusitis due to dental infection or a periapical involvement was based on radiographs such as the panoramic view or CT scans (8, 9, 17) whilst this study has been performed based on patient examination. It is obvious that radiography is an additional technique for the diagnosis of dental problems, and it cannot be sufficient for the examination of the periapical problems on their own. Furthermore, the simultaneous occurrence of an odontogenic infection and sinus involvement cannot be an absolute finding for the detection of maxillary sinusitis of odontogenic infection. So, in this study, patients with maxillary sinus involvement have been examined to detect the teeth with periapical problems, and periapical radiographs have been obtained from the infected teeth as an auxiliary method to confirm the diagnosis. The closeness of the

posterior teeth roots of the upper jaw to the inferior border of the maxillary sinuses and the determining radiolucencies near the sinus border are two important criteria to conclude the correlation between dental infection and sinusitis (18, 19) which have been considered in this study.

On the other hand, odontogenic infection is an initiative factor for unilateral sinus involvement (20, 21). This study represents that there are definite etiologic factors for bilateral sinusitis while there has been no initiative factor for half of the unilateral sinus involvements. Oral examination of these patients showed the presence of dental and periapical involvement. So, the odontogenic infection has been considered as an etiologic factor in these patients.

Bomeli *et al.*, tried to determine the frequency of a causative





dental infection in the patients with radiographic evidence of maxillary sinus fluid. It has been concluded that oroantral fistula and the combination of periodontal diseases like periapical abscess have been identified as significant sources of maxillary sinusitis (8). In other studies, the diagnosis of sinusitis due to dental infection or a periapical involvement was based on radiographs such as the panoramic view or CT scans (8, 9, 17) whilst this study has been performed based on patient examination. It is obvious that radiography is an additional technique for the diagnosis of dental problems, and it cannot be sufficient for the examination of the periapical problems on their own. Furthermore, the simultaneous occurrence of an odontogenic infection and sinus involvement cannot be an absolute finding for the detection of maxillary sinusitis of odontogenic infection. So, in this study, patients with maxillary sinus involvement have been examined to detect the teeth with periapical problems, and periapical radiographs have been obtained from the infected teeth as an auxiliary method to confirm the diagnosis. The closeness of the posterior teeth roots of the upper jaw to the inferior border of the maxillary sinuses and the determining radiolucencies near the sinus border are two important criteria to conclude the correlation between dental infection and sinusitis (18, 19) which have been considered in this study.

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Bomeli *et al.*, tried to determine the frequency of a causative dental infection in the patients with radiographic evidence of maxillary sinus fluid. It has been concluded that oroantral fistula and the combination of periodontal diseases like periapical abscess have been identified as significant sources of maxillary sinusitis (8). The present study showed that chronic periapical periodontitis is the most frequent reason for odontogenic maxillary sinusitis. Bacterial infections spread to the periapical region due to not attending the early treatment and cause periapical granuloma and cysts. Patients usually are not aware of their teeth problem because of the asymptomatic nature of these infections. In this situation, the periapical disease may spread to the borders of maxillary sinuses.

In conclusion, it is important to know the dental history of patients. The history of tooth pain in the past and no pain in the present is an important alarm to consider the periapical involvement of maxillary teeth to prevent the extension of dental infection to maxillary sinuses.

The main concept of the present investigation was to bold the importance of history taking. This study proved that some of the odontogenic sinusitis may be misdiagnosed and undergo the wrong treatments. It is obvious that initial treatment of maxillary sinusitis with unrecognized etiology can lead to failure (22). Patient referral to a dentist to rule out the dental source in refractory maxillary sinusitis or sinusitis cases with unrecognized etiology may be helpful in the treatment of these patients. After detection of the main cause of maxillary sinusitis, an appropriate approach should be selected (23). First and second molars (24) are close to maxillary sinuses and dental management alone may be adequate to resolve OMS at first, followed by subsequent surgical approaches including FESS or CLP (25). The second part of the current study showed that dental treatment may be necessary before otolaryngology remedies in treating the maxillary sinusitis which is resistant to routine antimicrobial therapies. These findings prove that antimicrobial therapy may not be sufficient in treating sinusitis with dental sources on its own. In fact, medication therapy without dental treatments would be irrational when an infected canal is in the proximity of a sinus border. Choosing an appropriate antimicrobial agent in the treatment of odontogenic sinusitis is another important issue that should be considered by physicians. In all the cases of the present study cefexime was the antibiotic agent choice that was effective in them.

However, there are few cases included in the present study, current investigation can brighten this sight that dental treatments are preceded to otolaryngology remedies when odontogenic infections are the main cause of sinusitis and more researches is recommended to perform based on this concept.

## Conclusion

Chronic apical periodontitis may be an important factor of maxillary sinusitis and leads to extensive sinus membrane thickening. High prevalence of maxillary sinusitis with dental sources especially in adulthood necessitates certain attendance of dentists and otolaryngologist and they should be aware of its silent nature because early diagnosis of this problem can prevent



serious complications of maxillary sinusitis such as a cerebral abscess.

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Conflict of Interest: 'None declared'.

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