

Maxillary Sinusitis After Deep Sinus Lift Procedure: A Systematic Review

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ABSTRACT

Maxillary sinus augmentation techniques are most widely performed and high clinical success procedure that enable dental implant placement in the posterior maxilla. Maxillary sinusitis is a noteworthy post-operative complication in sinus lift procedure that may influence the implant outcome. This systematic review focus to assess the clinical presentation and intervention of pre-operative and post operative maxillary sinus linked with maxillary sinus lift procedure. The studies undertaken in this systematic review was published between 2008 and 2025. 1518 implants were placed in augmented maxillary sinus. The occurrence of post operative maxillary sinusitis markedly different across studies ranging from 0.9% to 13%. The included studies are retrospective multicenter cohort investigations, retrospective and prospective cohort studies, retrospective case-control clinical studies, case series, a single prospective clinical study, and case reports. Six studies identified no post-operative clinical symptoms, whereas eight studies reported complications including post-operative infection, wound dehiscence, and Oro-antral fistula. Most of the complications in the selected cases were successfully treated through medical and surgical intervention. Untreated pre-operative chronic sinusitis was consistently identified as the single, most important predictor of post-operative infection or implant failure, both at a rate of 6.6%. Late onset post-operative maxillary sinusitis was rare (4%), it was closely associated with a history of maxillary sinus disease and pathology, but not associated with intra operative variables. Predominantly the incidence of maxillary sinusitis

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following maxillary sinus augmentation is variable but primarily influenced by pre – operative sinus disease and pathology. Comprehensive maxillary sinus pre operative assessment should be thoroughly done followed by appropriate management is important to decrease post operative complications and ensure favorable long term implant outcome.

Keywords: Maxillary sinus augmentation, Maxillary sinusitis, Complications, Dental Implants, Systematic review.

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INTRODUCTION

Pneumatization of maxillary sinus and residual ridge resorption causing decreased vertical bone level commonly restored by implant supported rehabilitation. In several studies it was observed that undiagnosed and untreated chronic maxillary sinusitis before sinus augmentation surgery significantly increases the risk of postoperative infection and implant failure following lateral sinus augmentation procedures. Other factors that may influence treatment outcome is systematic conditions such as diabetes, and intraoperative complications [1]. Individuals with pre-existing sinus inflammation and pathologies should be advised about the risk of postoperative complications [8]. Careful assessment of anatomical structures and patient-related factors is essential to minimize potential intraoperative and postoperative complications [2]. Proper examination of maxillary sinus and alveolar bone in maxillary posterior region is necessary before proceeding with implant rehabilitation [4]. Unlike conventional crestal sinus lifting, endoscopy – assisted crestal sinus elevation proves better predictability during Schneiderian membrane elevation [5]. Perioperative sinus membrane perforation during maxillary sinus lift grafting provides high incidence of maxillary sinusitis and infection as a post - operative complication [9]. Multidisciplinary approach with an otolaryngologist should be practised for better outcome. This will ensure that the patient's health will not be at risk during the implant surgery or the follow up [12].

METHODOLOGY

Registration

This study followed the PRISMA 2020 Statement guidelines [19]. PROSPERO database (International Prospective Register of Systematic Reviews) under the registration number CRD420261281720.

No amendments were made to the protocol after registration.

RESEARCH QUESTION:

What is the incidence of maxillary sinusitis in patients undergoing deep sinus lift procedures?

PICO

Population

Patient with atrophic maxilla / maxillary bone resorption / sinus pneumatization/ edentulous maxillary posterior

Intervention

Schneiderian membrane elevation/ maxillary sinus augmentation / maxillary sinus lift

Comparison

Maxillary sinusitis in case of dental implant placement without sinus lifts procedure.

Outcome

Primary

Incidence of post-operative maxillary sinusitis after maxillary sinus augmentation.

Secondary

Possibility of Oro-antral fistula, maxillary sinus perforation, epistaxis, sinus pathologies, implant loss, wound dehiscence after maxillary sinus augmentation.

Search Strategy

The below mentioned terminologies were searched: (“MAXILLARY ALVEOLAR ATROPHY” OR “MAXILLARY RIDGE RESORPTION”) AND (“SINUS FLOOR ELEVATION” OR “SINUS LIFT” OR “MAXILLARY SINUS AUGMENTATION”) AND (“MAXILLARY SINUSITIS” OR “ANTRAL SINUSITIS” OR “INFECTED MAXILLARY SINUS”). Initial electronic search was done in December 2025 and the last update was undertaken in March 2026 in PubMed/ Medline, Ovid database. Maxillary sinus augmentation and implant linked journals were manually sorted. The list of journals is listed in the Supplementary materials.

Inclusion And Exclusion Criteria:

Inclusion Criteria

Human clinical studies on maxillary sinus augmentation in maxillary posterior region which provides information either maxillary sinusitis or other complications during the sinus augmentation procedure.

Exclusion Criteria

Narrative Review, Systematic Review, Meta-analyses, Animal Study, In vitro, Cadaveric studies, Editorials, Expert opinions, Conference abstracts without full data, studies reporting cases with Sinus lift procedures performed for non-implant-related indications (e.g., trauma, tumors, congenital defects), odontogenic or non-iatrogenic sinusitis unrelated to sinus lift, Dental implant placement without sinus augmentation, Alveolar ridge augmentation or bone grafting not involving the maxillary sinus, cases rehabilitated with mini-implants, zygomatic implants.

Study Selection

The identified records were then uploaded to reference software with the removal of duplication. Seven authors independently screened titles and abstracts for relevance. Any disagreements were resolved by discussion, and consensus was reached in all instances.

Definitions

Maxillary Sinusitis: It is defined as inflammation of the maxillary sinus mucosa caused by bacterial, viral, fungal, or non-infectious factors, presenting with facial pain or pressure, nasal obstruction, purulent nasal discharge, and radiographic evidence of sinus involvement.

Sinus Lift: It is a pre-prosthetic surgical procedure performed to increase vertical bone height in the posterior maxilla by elevating the Schneiderian membrane and placing bone graft material between the lifted membrane and the sinus floor, thereby creating sufficient bone volume for dental implant placement. Reported complications after maxillary sinus augmentation were evaluated through clinically as well as radiographically. Post sinus augmentation complications that are observed in patients are maxillary sinusitis, nasal bleeding, headache, pain or tenderness in the sinus area. These clinical findings reflect varying degrees of sinus involvement and highlight the impact of post-operative complications on patient comfort and functional outcomes.

Data Extraction

Information such as study design, year of publication, geographic location, clinic / hospital name, patient's

demographics details were incorporated in data extraction. Maxillary sinusitis and other complications, implants placed, follow up durations are also collected. When necessary, study authors were contacted to obtain incomplete or missing data.

Data Synthesis

Quantitative meta-analysis was overlooked due to heterogeneity in study design, sample size, follow up duration and outcome. Therefore, the findings were synthesized using a qualitative descriptive approach, summarizing the incidence of sinusitis and other reported complications across the included studies.

Risk Of Bias Assessment

Two Reviewers independently evaluated included studies used Newcastle – Ottawa scale for observational studies. Any disagreements between reviewers were resolved through discussion and consensus. The scale evaluates studies based on selection of participants, comparability of study groups, and ascertainment of outcomes.

Assessment of Reporting Bias

Formal assessment of reporting bias was not conducted because the included studies varied substantially in design and outcome reporting. Additionally, the limited number of studies addressing specific outcomes made statistical assessment of publication bias inappropriate.

Certainty of Evidence

A formal certainty-of-evidence assessment was not performed. The overall strength of evidence was interpreted based on study design, methodological quality, and consistency of findings across the included studies.

Effect Measures

The outcomes of interest were primarily reported as incidence rates and proportions of post-operative maxillary sinusitis following sinus lift procedures. When applicable, descriptive statistics were used to summarize the frequency of sinusitis and other complications across the included studies

RESULT

1011 articles (67 PUBMED, 936 Ovid search), 8 articles manually selected in the initial search result. 59 articles were assessed for eligibility. Post data extraction 16 articles were left. Hand searches were performed on International Journal of Implant Dentistry, Journal of Periodontology, Journal of Oral and Maxillofacial

Surgery, Journal of International Oral Health ,11th Edition of the Scientific Days of the National Institute for Infectious Diseases and the bibliographies of all relevant papers and review articles.

Description of the Studies

Out of 16 included studies, 12 reported on cases in which maxillary sinusitis occurred post maxillary sinus lift in the posterior maxilla and 2 studies reported on cases in which there was chronic maxillary sinusitis in maxillary sinus lift in the posterior maxilla.

Pre - operative maxillary sinusitis:

Articles included in this category were published between 2010 and 2017. Two of the studies were retrospective cohort studies.

Incomplete investigation and undiagnosed pre - operative chronic sinusitis will lead to untreated maxillary sinus disease, which holds a potential risk factor for post - operative infection and pathologies which may lead to implant loss following lateral sinus augmentation. Although other patient- and procedure-related factors also contributed to implant survival, chronic sinusitis was the primary predictor. It is important to note that accurate pre-operative sinus evaluation and treatment are necessary to prevent irreversible complications from sinus lift surgery.

Pre-operative chronic sinusitis was a major predisposing factor for post-operative infection and the late outcome of implant loss, occurring at a rate of 6.6% during lateral sinus augmentation surgeries compared to the surgical factors, emphasizing the importance of the pre-operative sinus assessment [1].

Late post-operative complications after sinus augmentation were uncommon, with chronic sinusitis diagnosed in 4% of cases during 12–80 months of follow-up. The risk was associated with the history of chronic maxillary sinusitis and thick sinus mucosa. There was no correlation shown in relation with intra - operative membrane perforation and bleeding. [8]

Post - operative maxillary sinusitis

The study involves aggregating various medical reports published in a particular time frame (2008- 2025). All including 5 retrospective cohort studies, 1 retrospective case control clinical studies, 1 prospective clinical cohort studies, 2 retrospective case series and case report

1518 implantations were done in maxillary posterior. Maxillary sinusitis occurrence in post maxillary sinus augmentations was 8.35% [2], 1.78% [3], 100% [7], 5.57% [9], 13% [10], 4.25% [11], 4.3% [12], 100% [13], 0.9% [15], 100% [16].

In the above-mentioned studies, 6 studies [2],[3],[4],[5],[6],[14] were there with no post operative symptoms in the patients whereas 8 studies [7][9][10][11][12][13][15][16] shows post - operative infection such as wound dehiscence, Oro - antral fistula. Most of the symptomatic cases of post operative infection was treated with medical and surgical intervention.

Other post- operative complications in sinus augmentation:

There are multiple other complications post sinus lift procedure like Epistaxis [3][14], Wound dehiscence [2][10], Schneiderian membrane perforation [2][5][9][10][15], Peri-implantitis [6], Oro-antral Fistula [15][16], Benign paroxysmal positional vertigo [15].

Risk of Bias Results

The methodological quality of the included studies was evaluated using the Newcastle–Ottawa Scale. Most studies demonstrated abate methodology. Mainly due to retrospective design and insubstantial follow up duration. Some studies also presented potential risk of bias related to incomplete outcome reporting and variability in diagnostic criteria for sinusitis.

Heterogeneity Explanation

The population, study design, diagnostic criteria and surgical intervention in included studies of this systematic review is considerably diversified. This heterogeneity limited the possibility of conducting a quantitative result synthesis.

Sensitivity Analysis

Sensitivity analyses could not be conducted due to availability of data which were inadequate for quantitative comparison.

DISCUSSION

The aim of the current review was to assess the complications following of maxillary sinus augmentation during the placement of dental implants in the posterior maxilla. Maxillary sinus lift technique are reported to be a reliable means of creating vertical bone height in the posterior maxilla in order to place an implant. However, successful results are strongly affected by the preoperative status of maxillary sinus. Pre-existing inflammatory disease of the maxillary sinus may substantially increase the chances of postoperative infection, graft complication and eventual implant failure. Considering that implant placement in sinus pathology must be carefully planned, thorough pre-operative radiographic and clinical evaluation, together

with appropriate management of sinus pathology, is essential as well as close interdisciplinary follow-up, minimizing the risk of complications in normal cases, and assuring the long-term survival of the implants [1]. Transient changes in sinus mucosa post sinus augmentation may be observed. However, there is an increased risk of postoperative sinusitis and implant related complications with the presence of chronic sinus disease [4].

Pre-existing pathologies affecting the maxillary sinuses and particularly mucosal thickening and sinusitis are linked to post-operative complications. Underlying maxillary sinus disease can surge the risk of pathologies, sinus augmentation can cause transient radiographic changes. These results point to the tremendous importance of thorough preoperative evaluation of sinus health. [5].

Complications like Schneiderian membrane perforation are observed and may potentially put at risk of post operative sinus pathology [2],[5],[9],[10],[15]. Epistaxis may occur as a consequence of injury to the vascular network of the lateral sinus wall or Schneiderian membrane [3],[14]. Wound dehiscence may potentially compromise the grafted area, hinder healing and potentially increase the risk of infection [2],[10]. Peri-implantitis has been documented as a late complication, usually in relation to compromised osseointegration or chronic inflammatory conditions [6]. Oro-antral fistula development, although rare, establishes a pathological connection between the oral cavity and the maxillary sinus [15],[16].

Benign paroxysmal positional vertigo has also been documented, especially after osteotome-assisted sinus lift procedures, potentially related to vestibular system disruption caused by surgical vibrations [15].

In order to avoid any post-operative problem, a thorough pre-operative evaluation of the posterior maxillary area, ruling out any unfavorable anatomic condition and/or existence of an asymptomatic pathologic paranasal sinusitis, remains the only key point. In cases in which a complication occurs, the surgical protocols presented by the authors might be a rational treatment proposal [14].

Moreover, the implants were placed by different surgical teams, since different studies were conducted, which might also have a negative effect on the survival rate because of the variation in the technique, skill, and/or judgment of the surgeons. Moreover, the fact that most studies are retrospective leads to errors that are shown by the gaps in information. Also, most studies have short duration of follow up.

There is a presence of methodological limitation in the results of the review. Since, the search strategy was limited to selected electronic databases, and there is a

possibility to miss any relevant studies being indexed in other databases. Moreover, heterogeneity in the reported outcome may have been caused by difference between included studies in the diagnostic criteria, surgical techniques and follow up duration.

CONCLUSIONS

This systematic review shows that maxillary sinusitis is conspicuous complication in relation with maxillary sinus augmentation. The evidence suggests that contributing factors for the development of maxillary sinusitis as a post operative complication in maxillary sinus augmentation are sinus membrane perforation, pre-existing sinus pathology, poor surgical technique, and post-operative infection.

Untreated sinusitis can affect the maturation of the graft and lead to the failure of implant. Proper medical and surgical intervention can successfully treat maxillary sinusitis.

In conclusion, pre-operative radiographic evaluation, surgical expertise, and post-operative care are critical in reducing the risk of complications associated with the paranasal sinuses.

However, the current conclusions are compromised by the variability in the design of the studies, the criteria for diagnosing, and the follow-up period. Future studies with careful planning and a standard approach are required to gain better understanding of the true incidence and importance of maxillary sinusitis post deep sinus lift procedures.

Clinical Significance

Providing an acceptable prognosis and patient centered outcome in sinus augmented implant rehabilitations is significant challenging part if there are complications. Maxillary sinusitis is a pertinent complication which negatively impact the treatment. Current evidence suggests that undiagnosed and untreated pre – operative chronic sinusitis is the dominating factor for post operative complications related to maxillary sinus disease and implant failure. If diagnosed early it can be properly treated. For optimize long term implant outcome it is significantly crucial to evaluate presence of pre – operative maxillary sinus pathology followed by appropriate treatment of the pathology and timely follow up should be done by the doctor.

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Data Availability Statement: All the data generated from this review is included in this manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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SUPPLEMENTARY MATERIAL

Maxillary Sinusitis in Deep Sinus Lift Procedure: A Systematic Review.

- A. List of journals included in the manual (hand) searching
- B. Table 1. Keywords
- C. PRISMA 2020 flow chart for a new systematic review
- D. Table 2. Detailed data of the included studies
- E. List of excluded articles
- F. Complications mentioned in articles
- G. Table 3 PRISMA 2020 Checklist

A. List of journals included in the manual (hand) searching
 European Journal of Dentistry, The International Journal of Oral & Maxillofacial Implants, Journal of Maxillofacial Surgery, Journal of Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology, Journal of BMC Infectious Diseases, Journal of Head & Face Medicine, Clinical Oral Implants Research, , Journal of Clinical Periodontology, Journal of Oral Implantology, Journal of Periodontology, Current Problems in Surgery, Journal of Clinical Medicine, International Journal of Implant Dentistry, Journal of International Oral Health, Journal of Clinical Oral Implants Research.

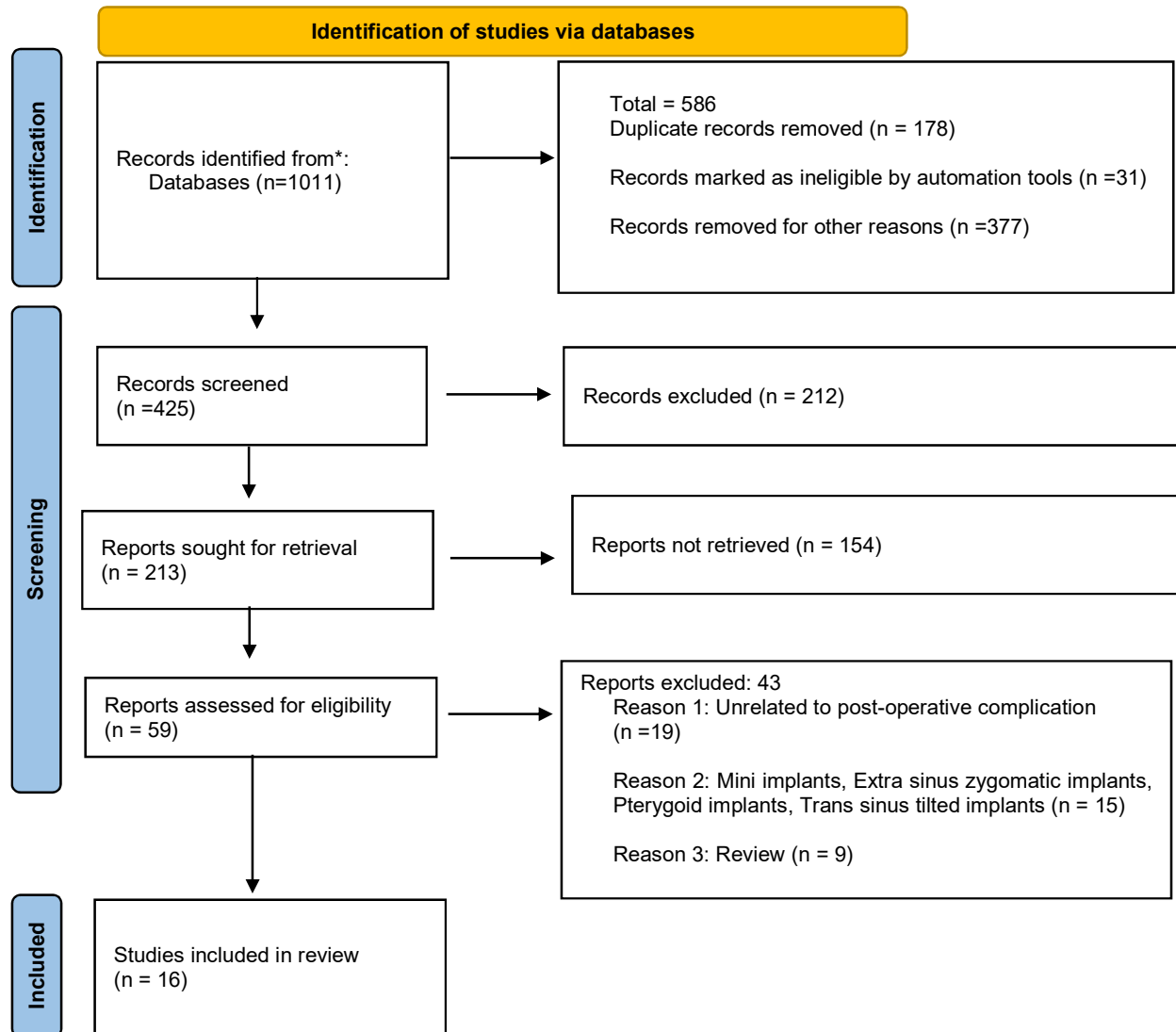
B. Table 1. KEYWORDS

CONCEPT 1	CONCEPT 2	CONCEPT 3
1. RESORBED MAXILLA	1. SINUS LIFT	1. MAXILLARY SINUSITIS
2. MAXILLARY RIDGE RESORPTION	2. MAXILLARY SINUS AUGMENTATION	2. ANTRAL SINUSITIS
3. SEVERELY RESORBED MAXILLA	3. SINUS FLOOR AUGMENTATION	3. ANTRITIS
4. MAXILLARY ALVEOLAR ATROPHY	4. SINUS FLOOR ELEVATION	4. MAXILLARY ANTRUM INFLAMMATION
5. ATROPHIED MAXILLA	5. MAXILLARY SINUS FLOOR AUGMENTATION	5. INFECTED MAXILLARY SINUS
6. DEFICIENT MAXILLARY RIDGE	6. SUB ANTRAL SINUS LIFT	6. ANTRAL MUCOSITIS
7. COMPROMISED MAXILLARY RIDGE	7. CRESTAL SINUS AUGMENTATION	7. ANTRAL PATHOLOGY
8. REDUCED MAXILLARY BONE VOLUME	8. LATERAL WINDOW SINUS AUGMENTATION	8. MAXILLARY SINUS INFLAMMATORY PATHOLOGY
9. MAXILLARY BONE LOSS	9. TRANSCRESTAL SINUS FLOOR ELEVATION	
10. MAXILLARY RESIDUAL RIDGE RESORPTION	10. OSTEOTOME MEDIATED SINUS ELEVATION	
11. KNIFE EDGE MAXILLARY RIDGE	11. ELEVATION OF SCHNEIDERIAN MEMBRANE	
12. ADVANCED MAXILLARY RIDGE ATROPHY	12. MAXILLARY SINUS GRAFTING	
13. SEVERELY DEFICIENT MAXILLA	13. MAXILLARY SINUS PNEUMATIZATION	
14. MAXILLARY CRESTAL BONE DEFICIENCY	14. INFERIOR DISPLACEMENT OF MAXILLARY SINUS	
	15. MAXILLARY SINUS EXPANSION	
	16. MAXILLARY SINUS ENLARGEMENT	
	17. SINUS FLOOR DESCENT	

15. VERTICAL AND / OR HORIZONTAL BONE DEFICIENCY	18. INCREASED SINUS VOLUME	
16. ATROPHIC EDENTULOUS MAXILLA	19. INFERIOR SINUS EXTENSION	

C. Prisma 2020 Flow Chart For A New Systematic Review

PRISMA 2020 FLOW CHART FOR A NEW SYSTEMATIC REVIEW



D. Table 2. Detailed data of the included studies.

STUDY	YEAR	STUDY DESIGN	COUNTRY	PATIENTS AGE (MEAN) (YEARS)	COMPLICATION
KOZUMA	2017	Retrospective observational study	Kyushu University Hospital, Fukuoka, Japan	58.3	Sinusitis
SCHWARZ	2015	Retrospective observational (cohort) study	Division of Oral Surgery, Medical University of Vienna(Austria)	56	Sinusitis Wound dehiscence Membrane perforation
NOOH	2013	Prospective cohort study	College of Dentistry, King Saud University, Riyadh, Kingdom of Saudi Arabia	52	Epistaxis Sinusitis
GOLLER BULUT	2025	Retrospective observational study	Department of Dentomaxillofacial Radiology, Faculty of Dentistry, Bolu Abant Izzet Baysal University, Bolu, Turkey.	49.59 ± 10.51	Maxillary sinus pathology
ELIAN	2025	Prospective clinical study	Faculty of Dentistry, Al-Azhar University (Assuit Branch), Egypt	46.2 ± 8.0	Schneiderian membrane perforation
STACCHI	2020	Multicenter cross-sectional study	Four centers in Italy (private clinics): Gorizia, Cassano allo Ionio, Genova, Milano, Italy	60.9 ± 11.6	Peri- Implantitis
ALKAN	2008	Case report	Turkey – Erciyes University and Ondokuz Mayıs University	52	Acute maxillary sinusitis
MANOR	2010	Retrospective cohort study	Tel-Aviv University, Kaplan Medical Center, Sapir Medical Center, Israel	55 ± 9.08	Acute sinusitis Chronic sinusitis
NOLAN	2014	Retrospective cohort study	Montefiore Medical Center, Bronx, New York, USA	56.25	Schneiderian membrane perforation Sinusitis
GUERRERO	2015	Retrospective observational study	Bogotá D.C., Colombia	55	Schneiderian membrane perforation Maxillary sinusitis Intraoperative hemorrhage Wound dehiscence

Maxillary Sinusitis After Deep Sinus Lift Procedure: A Systematic Review

KAYABASOGLU	2014	Retrospective case-control study	Ev Private Dentistry Clinic, Turkey	29–71 (in males) 33–64 (in females)	Sinusitis
CHIRILA	2016	Retrospective observational study	Three medical centers, Bucharest, Romania	45.5 ± 10.1 years	Acute Maxillary Sinusitis
KIM	2010	Case Report	Chosun University, Gwangju, Republic of Korea.	≈ 59.5	Maxillary sinusitis
CHIAPASCO	2009	Single retrospective clinical study	San Paolo Hospital – University of Milan; Istituto Stomatologico Italiano, Milan, Italy	53.9	Sinusitis Oro-antral communication
CLAUDIO	2022	single retrospective multicenter study	Seven private clinical centers, Italy (Gorizia; Terranegra di Legnago (VR); Sassuolo (MO); Cassano allo Ionio (CS); Arco (TN); Torino; Rome)	58.3 ± 11.5	Acute Sinusitis Schneiderian Membrane Perforation Oro- antral fistula Benign Paroxysmal Positional Vertigo Implant Displacement into Sinus
ANAVI	2008	Retrospective case series	Department of Oral and Maxillofacial Surgery, Rabin Medical Center – Beilinson Campus, Tel Aviv University, Israel	63	Sinusitis Implants displaced into sinus Oroantral fistula

E. List of excluded articles

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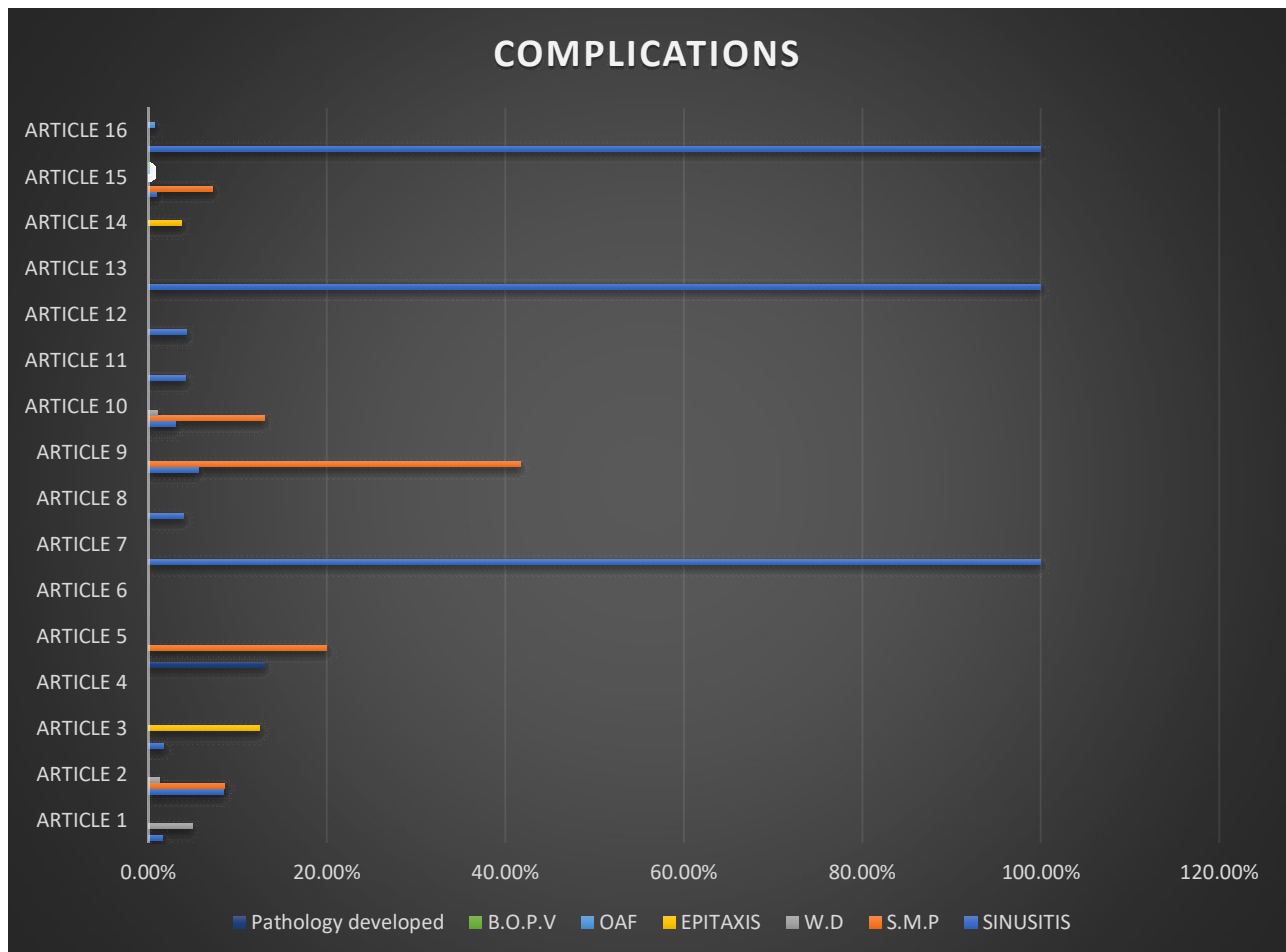
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F. Complications Mentioned in Article



B.O.P.V = Benign paroxysmal positional vertigo

OAF = Oro-antral Fistula

W.D = Wound dehiscence

S.M.P = Schneiderian membrane perforation