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Evaluation of the Success Rate of Endoscopic Sinus Surgery after Dental Implantation: A Systematic Review and Meta-analysis

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ABSTRACT

Background and aim: Sinusitis after dental implantation can cause peri-implantitis or incomplete removal of graft material. The present study aimed to evaluate the success rate of Endoscopic sinus surgery after dental implantation.

Material and methods: In this study, international databases such as PubMed, Scopus, Science Direct, ISI, Web of Knowledge, and Embase were reviewed to select articles related to the purpose of this study from January 2012 to July 2022. Effect size with 95% confidence interval (CI) with fixed effect modal and inverse-variance done. Stata/MP.V17 software was used for data analysis.

Results: In the initial review, the abstracts of 344 studies were reviewed, two authors reviewed the full text of 58 studies, and finally, nine studies were selected. The success rate of endoscopic sinus surgery was 97% (ES: 95% CI, 95% to 98%).

Conclusions: Endoscopic sinus surgery is a suitable treatment with a high success rate in treating sinusitis after dental implants based on the present meta-analysis. A multidisciplinary collaboration between otorhinolaryngology and oral surgeons seems to provide the best treatment option to achieve an acceptable success rate.

1. Introduction

Generally, implantology methods are used to rehabilitate patients with the edentulous upper jaw, and this treatment can lead to sinusitis.^[1] The prevalence rate of dental implants is increasing, so an annual increase of 14% in the United States has been reported.^[2] According to statistics and reports, with the increase in the prevalence of dental implants, there is an increase in patients with sinusitis following dental implants; It should be noted that the reported incidence rate is low.^[3] According to the findings of the studies, sinusitis after dental implantation can cause peri-implantitis or incomplete removal of graft material.^[4] According to studies, the most common treatment for sinusitis after dental implants is endoscopic sinus surgery.^[5, 6] Considering the importance of the subject and the lack of sufficient evidence in this field, in the present study, an attempt has been made to evaluate the success of the treatment. Therefore, the present study was conducted to evaluate the success rate of endoscopic sinus surgery after dental implantation.

2. Material and methods

The present study is a systematic review and meta-analysis based on PRISMA guidelines.^[7] In this study, international databases such as PubMed, Scopus, Science Direct, ISI, Web of Knowledge, and Embase were reviewed to select articles related to the purpose of this study from January 2012 to July 2022. Mesh keywords were used for searching in PubMed, and similar keywords were searched in other databases. In the current study, Table 1 shows the response to PICO; the Google Scholar search engine was also used.

MeSH terms keywords: (((((((("Dental Implantation"[Mesh]) OR ("Dental Implantation/adverse effects"[Mesh]) OR "Dental Implantation/methods"[Mesh]) OR "Dental Implantation/rehabilitation"[Mesh]) OR "Dental Implantation/statistics and numerical data"[Mesh]) OR "Dental Implantation/therapy"[Mesh])) OR ("Dental Implant-Abutment Design"[Mesh]) OR "Dental Prosthesis, Implant-Supported"[Mesh])) AND "Paranasal Sinuses"[Mesh]) AND ("Sinusitis"[Mesh]) OR "Maxillary Sinusitis"[Mesh])) OR ("Sinusitis/classification"[Mesh]) OR "Sinusitis/complications"[Mesh]) OR

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"Sinusitis/diagnosis"[Mesh] OR "Sinusitis/prevention and control"[Mesh] OR "Sinusitis/rehabilitation"[Mesh] OR "Sinusitis/statistics and numerical data"[Mesh] OR "Sinusitis/surgery"[Mesh] OR "Sinusitis/therapy"[Mesh]) OR ("Maxillary Sinusitis/anatomy and histology"[Mesh] OR "Maxillary Sinusitis/classification"[Mesh] OR "Maxillary Sinusitis/complications"[Mesh] OR "Maxillary Sinusitis/diagnosis"[Mesh]

OR "Maxillary Sinusitis/rehabilitation"[Mesh] OR "Maxillary Sinusitis/statistics and numerical data"[Mesh] OR "Maxillary Sinusitis/surgery"[Mesh] OR "Maxillary Sinusitis/therapy"[Mesh]) AND "surgery" [Subheading] AND "Contraceptive Effectiveness"[Mesh] OR "Contraceptive Effectiveness/statistics and numerical data"[Mesh].

Table1. PICO strategy.

PICO Strategy	Description
P	Population: Patients treated for sinusitis after dental implantation
I	Intervention: Endoscopic sinus surgery
C	Comparison: other sinus surgery approaches
O	Outcome: success rate

Inclusion and exclusion criteria

Randomized controlled clinical trials (RCT), cohort studies, Case series and cross-sectional studies, patients with sinusitis following dental implants, Studies other than selected designs, and studies without full text were excluded from the study.

Reporting and extracting study data

Using a checklist that included the author's name, year of publication, type of study, number of patients, and the average age of patients, Surgical treatments and Postoperative medical treatments were extracted and reported in Table 2; Also, the data required for meta-analysis including success rate were extracted from the studies.

Evaluating the quality of studies

The current study evaluated the quality of studies using the National Heart, Lung, and Blood Institute (NHLBI) Study Quality Assessment Tools.^[8] The minimum score obtained from this tool is 80%; Scores less than 50 percent indicate low quality of study, scores 50 to 80 indicate good quality, and scores above 80 indicate high quality.

Data analysis

Stata/MP.V17 software was used for data analysis. The success rate was estimated with Effect size, a 95% confidence interval (CI), and a fixed effect modal and inverse-variance method. The level of heterogeneity was evaluated using the I2 index test (I2 < 50% = low levels, 50 < I2 < 75% = moderate and I2 > 75% = high levels).

3. Results

The search was conducted based on the mentioned keywords, and 283 studies were found in the introduced databases; After entering the studies into the EndNote.x8 software, duplicate studies were removed, and finally, the abstract of 256 studies was reviewed, and the studies that met the inclusion criteria were left out for the full-text review; at this stage, 225 studies were removed. The full text of 31 studies was carefully reviewed, and studies that had incomplete data, very low quality, or did not include the inclusion criteria and matched the exclusion criteria were excluded from the study (23 articles); finally, eight articles were selected, and their data were extracted for meta-analysis (Fig. 1)

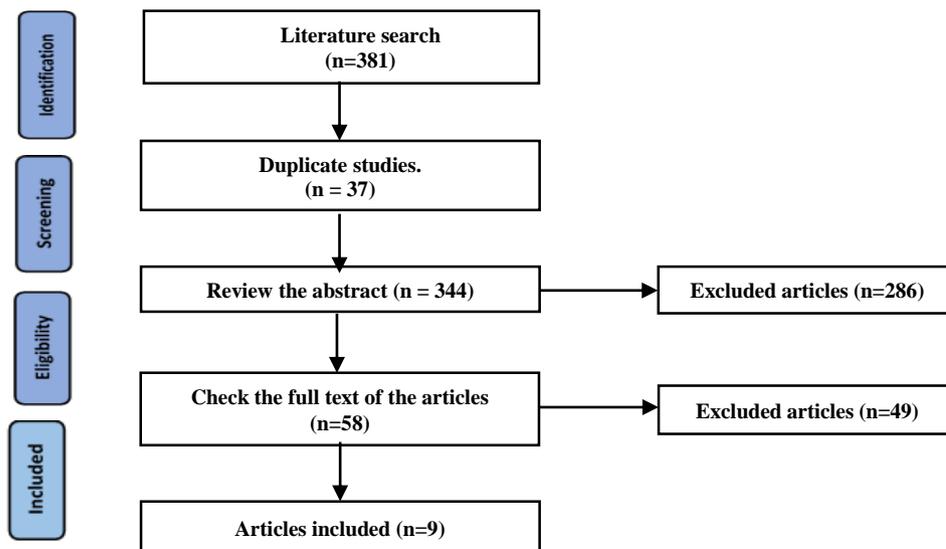


Fig. 1. PRISMA flowcharts.

Characteristics

Nine studies have been included in the present article. Male and female patients were 340 and 396, respectively; a total of 736 patients were examined; Data on Patients' treatment is reported in Table 2.

Bias assessment

According to NHLBI tools, two and seven studies have high and good quality, respectively Table 2.

Table 2. Summary of demographic and clinical data of studies selected.

No	Study. Years	Study Design	Number of Patients		Mean of Age (Years)	Surgical Treatment	Postoperative Treatment	Quality of Studies
			Male	Female				
1	Gâta et al., 2021 ^[9]	Retrospective	38	38	53	Endoscopic sinus surgery and dental treatment	NR	High
2	Molteni et al., 2020 ^[4]	Retrospective case series	212	268	52	Endoscopic sinus surgery with dental implant removal	Oral levo 500 mg, SNI, topical antibiotic creams, and local steroids	High
3	Saibene et al., 2019 ^[10]	Prospective	13	23	57	Endoscopic sinus surgery with dental implant removal	Oral levo 500 mg, Cef axetil 500 mg, SNI and TNO	Good
4	Jiam et al., 2017 ^[11]	Case series	5	4	65	Endoscopic sinus surgery to all sinuses without dental implant removal	NR	Good
5	Fadda et al., 2016 ^[12]	Case series	6	11	56	Endoscopic sinus surgery with dental implant removal	Amc 1, Levo 500 mg, SNI	Good
6	Jong et al., 2016 ^[13]	Case series	7	7	54	Endoscopic sinus surgery with dental implant removal	NR	Good
7	Kim et al., 2016 ^[14]	Prospective	12	7	54	Endoscopic sinus surgery to all sinuses without dental implant removal	NR	Good
8	Felisati et al., 2013 ^[15]	Case series	41	24	54	Endoscopic sinus surgery with dental implant removal	Oral levo 500 mg, Cef axetil 500 mg, SNI and TNO	Good
9	Chiapasco et al., 2013 ^[16]	Prospective	6	14	50	Endoscopic sinus surgery with dental implant removal	CH-M, SNI, TMO	Good

CH-M: chlorhexidine mouthwash; SNI: saline nasal irrigations; TMO: topical mupirocin ointment; levo: levofloxacin; Cef: Cefuroxime; TNO: topical nasal niaouli oil; amc: Amoxicillin-clavulanate.

Success rate

Success rate in patients undergoing endoscopic sinus surgery following dental implantation was 97% (ES: 95% CI, 95% to 98%) ($I^2=38.78\%$; $P=0.11$; low heterogeneity) (Fig. 2). In Chiapasco et al. 2013 (16) study, Fadda et al. 2016 (12) study, and Jiam et al., 2017 (11) study, respectively, 4, 20, and 9

patients with available microbial cultures were reported. Fig. 3 shows a funnel plot for graphical diagnostics of small study effects and detecting bias or systematic heterogeneity. Galbraith plot for heterogeneity analysis showed that there was no inconsistency across studies (Fig. 4).

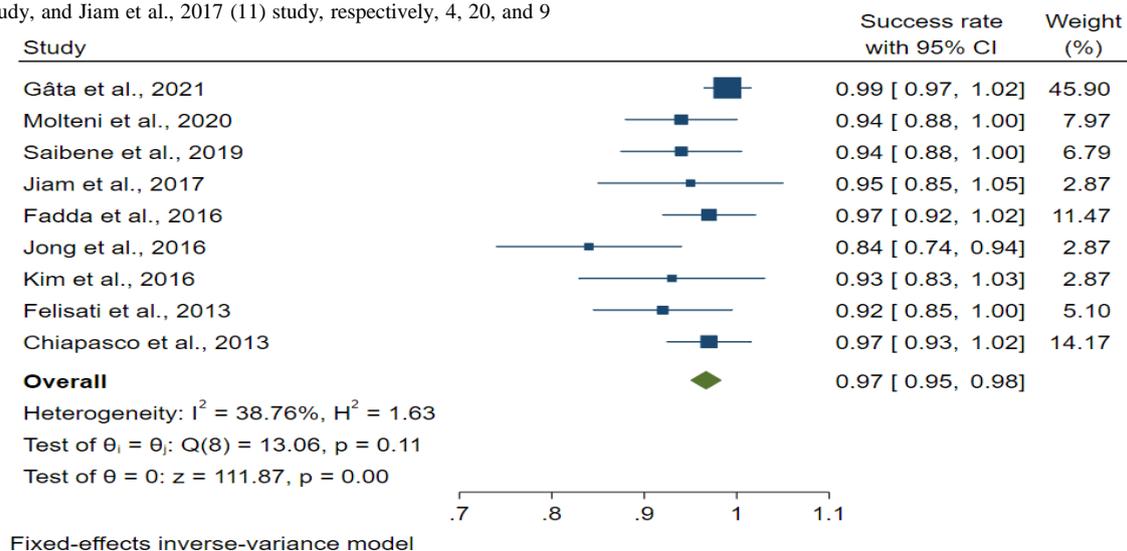


Fig. 2. The Forest plot showed the endoscopic sinus surgery success rate following dental implantation.

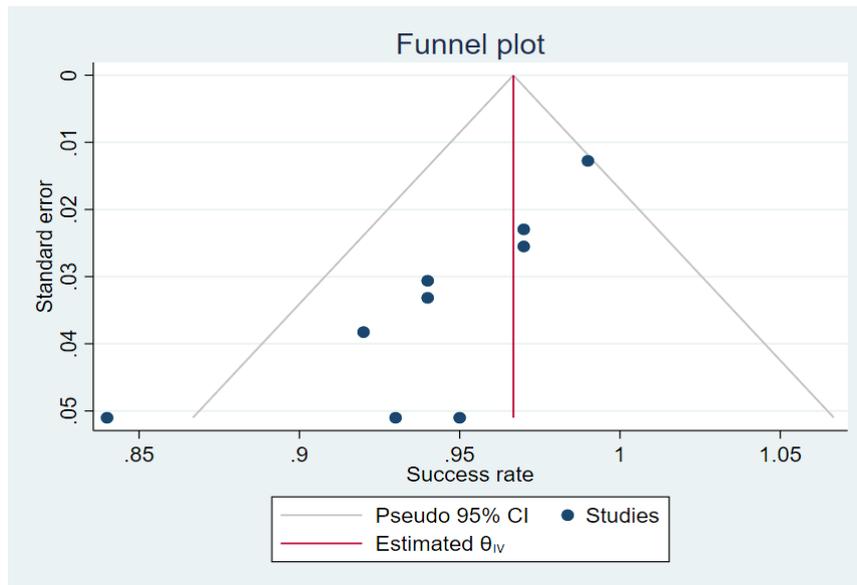


Fig. 3. The funnel plot showed the treatment effect against a measure of study precision.

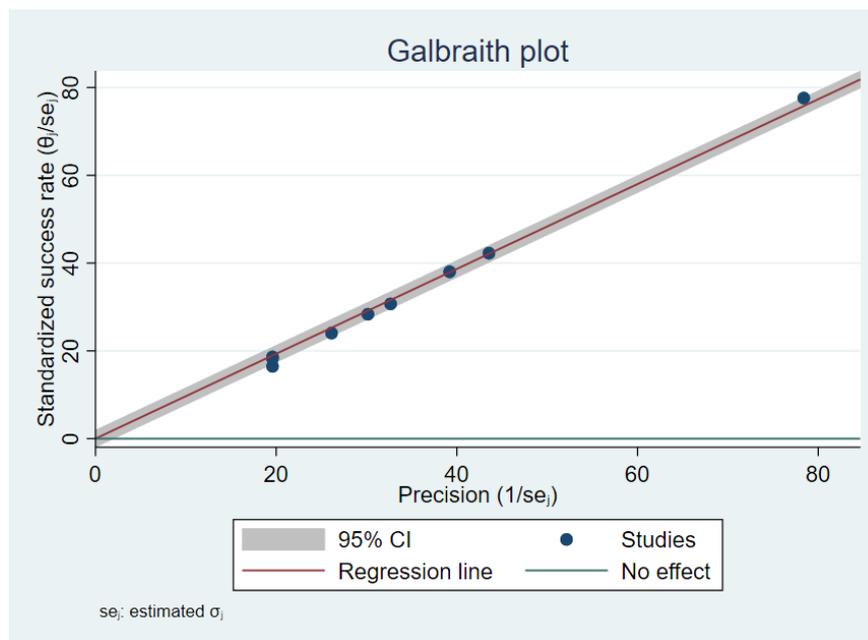


Fig. 4. Galbraith plot for assessing heterogeneity.

4. Discussion

The present study investigated the success rate of endoscopic sinus surgery after dental implantation. The present meta-analysis showed that the success rate of endoscopic sinus surgery after dental implants is 97% (ES: 95% CI, 95% to 98%) and is considered a very suitable treatment method. In the present study, an attempt was made to examine the studies conducted in the last ten years in order to provide sufficient evidence; the reason for choosing studies in the last ten years is to check the results of newer and more recent studies. Most of the selected studies were conducted as case series; also, diagnostic methods were not reported in the studies, and the definition of the disease was not clearly defined. However, the study methodology was of high to good quality. In some studies, peri-implantitis or implant dislocation (implant complication) were investigated, and in some studies, it

has been reported that sinusitis occurs after implant placement. According to the results of the present study, endoscopic sinus surgery is a suitable treatment method for sinus infections; however, the choice of treatment approach depends on the surgeon's priority, attitude, and preference. No antibiotic-requiring failures were observed in studies where postoperative antibiotic therapy was not explicitly planned.^[5] The microbiological information in the studies was not comprehensive, and it is impossible to examine their relationship with treatment outcomes. According to the results of some studies, it is accepted that non-osseous fixtures should be carefully evaluated during the initial treatment because they can be a focal point of infection.^[17] Surgeons must choose the treatment according to the patient, and addressing the dental cause is very important for treating sinusitis. It has also been proven that cooperation between dental care providers/maxillofacial

surgeons and otolaryngologists is highly important and can improve the treatment process. Studies have shown that the precise amount of endoscopic sinus surgery is very important in speeding up recovery after closing chronic orofacial fistulas.^[9] Some studies have reported a gradual increase in the incidence of sinusitis as a complication of dental implants and, for some authors.^[14] Endoscopic sinus surgery seems to be the most appropriate treatment for sinus inflammation. In addition, endoscopic sinus surgery allows the management of other sinuses and the treatment of anatomical changes that can impair normal sinus clearance and drainage. Therefore, acute inflammation can be removed in one surgical step, its exacerbation can be prevented, and sinus function can be improved.^[14] The selected studies did not report information about the health status of the sinuses before implantation, so it cannot be said that the condition of the sinuses can cause aggravation after implantation or that it has nothing to do with it; this issue can be a potential bias and affect the results of the study. The current study also has limitations, including the sample size of most of the studies being very small, so more studies with a higher sample size are needed to provide better results and stronger evidence. Some patients were treated with drug therapy, which can be very effective in the study results, and this case should be further investigated in future studies. The success rate for transplantation and implant implantation in the future in patients who were treated has not been investigated, which requires rejection studies in this field because these patients need to be re-implant after treatment or choose other methods.

5. Conclusion

Based on the present meta-analysis, endoscopic sinus surgery is a suitable treatment with a high success rate in treating sinusitis after dental implants. A multidisciplinary collaboration between otorhinolaryngology and oral surgeons seems to provide the best treatment option to achieve an acceptable success rate. Since antibiotic treatments have been used in some of the selected studies and the use of these treatments in sinusitis after tooth implantation does not have sufficient and official scientific validity, this case must be considered, and more on this in future studies. The category should be paid. It is suggested that in future studies, in addition to increasing the sample size, the follow-up period and precise definitions of sinusitis after tooth implantation should be provided so that the results can be compared and the consensus of the results can be better and stronger evidence can be provided.

Conflict of Interest

The authors declared that there is no conflict of interest.

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