

Retrieval of Dental Implants from Maxillary Sinus- A Systematic Review

1. **Dr. Akshay Mishra**, Associate Professor, Department of Oral and Maxillofacial Surgery, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Wanadongri- Wadhamna Road, Hingna, Dist - Nagpur 441110, Maharashtra. Email id- akshaym21@gmail.com
2. **Dr Vikram V Khare**, Professor and Head, Oral Medicine and Radiology, Dr.DY Patil Vidyapeeth Pune
3. **Dr. Mohammed Ibrahim**, Assistant Professor, Department of Oral and Maxillofacial Surgery, College of dentistry, King Khalid University, Abha, Kingdom of Saudi Arabia, drmohammedibrahim79@gmail.com
4. **Dr. Monika Gahlawat**, Senior Lecturer, Department of OMFS, Maharaja Ganga Singh Dental College & Research Centre, 11 L.N.P, Hanumangarh Rd, Sri Ganganagar, Rajasthan 335002.
5. **Dr Navaljeet Kaur**, MDS, ORAL SURGERY, POWER HOUSE ROAD, BATHINDA 151001. navaljeetkaurmann@gmail.com
6. Mohamed Fadul A. Elagib, MD, MSc., BDS, Assistant Professor of Periodontics, Department of Periodontics and Community Dental Sciences, College of Dentistry, King Khalid University, Abha, Saudi Arabia

Corresponding Author: Dr. Akshay Mishra, Associate Professor, Department of Oral and Maxillofacial Surgery, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Wanadongri- Wadhamna Road, Hingna, Dist - Nagpur 441110, Maharashtra. Email id- akshaym21@gmail.com

Abstract

Introduction: Implant dislocation into the maxillary sinus often results from features specific to the posterior maxillary teeth, together with poor bone quality and inadequate remaining bone. This study reviews implants displaced into the maxillary sinus, the reasons and complications of dislocation, and how to retrieve them, according to when the dislocation occurs.

Materials and methods: The PubMed, Ovid (MEDLINE), and EMBASE databases were searched using the keywords “dislocation,” “implant,” “maxillary sinus,” and “removal/retrieval” for articles published between January 2000 and July 2013.

Results: 22 journal articles were chosen; these discussed 49 displaced implants. Most of the implants were displaced into the maxillary sinus during implantation, but caused in a low incidence of complications, such as maxillary sinusitis. The displaced implants were retrieved using the Caldwell-Luc approach or a transoral or transnasal endoscopic approach.

Conclusion: Implants displaced into the maxillary sinus have various reasons according to when they are displaced. As displaced implants can cause several complications, transnasal endoscopy is suggested to retrieve them; however, the implants should be examined thoroughly before

selecting the removal method.

Keywords: Retrieval, Dental Implants, Maxillary Sinus

Introduction

Implants are used extensively to restore maxillary posterior teeth, although this is a difficult task due to the poor bone quality of the maxilla, pneumatization of the maxillary sinus, and alveolar bone resorption in the edentulous area.¹ Significance is attached to the primary stability of maxillary implants, which can be displaced unintentionally into the maxillary sinus if there is inadequate primary stability during implantation or no osseointegration after implantation. Though some of these displaced implants are asymptomatic, many involve complications, such as migration into the paranasal sinus or causing maxillary sinusitis. Hence, it is desirable to retrieve most.² This study reviews implants displaced into the maxillary sinus to identify the reasons of dislocation, types of complication, and how to retrieve the implants, according to when they are displaced.

Materials and methods

The PubMed, Ovid (MEDLINE), and EMBASE databases were searched used the keywords “dislocation,” “implant,” “maxillary sinus,” and “removal” with the following search formula: {Subject 1 AND Subject 2 AND Subject 3 AND Subject 4} Subject 1: dislocation OR migration OR dislocation [Title] AND Subject 2: dental implant [Title] AND Subject 3: maxillary sinus [Title] AND Subject 4: removal OR retrieval [Title] Only articles published between January 2000 and July 2013 that described the number of displaced implants, when they were displaced after implantation, the presence of complications of dislocation and their removal, and how to retrieve the implants were reviewed. Articles were excluded that described teeth or foreign bodies, or implants displaced into the sphenoid sinus, ethmoid sinus, or brain, and not into the maxillary sinus. The selection was done by a single researcher.

Results

Twenty-two articles describing 49 displaced implants were found. The number of displaced implants, maxillary sinus floor elevation before implantation, when the implants were displaced into the maxillary sinus, complications of dislocation into the maxillary sinus, removal, and removal method are summarized in **Table 1**.

No significant difference was found in maxillary sinus floor elevation before implantation: 12 were preceded by the procedure; 10 were not; and the procedure was not mentioned for the remaining 27. Of the 34 implants with a description of when they were displaced, 12 were displaced during implantation and most were displaced less than 1 year after implantation. In contrast, Galindo-Moreno et al⁸ examined dislocation before and after loading and reported that more implants were displaced after loading than before loading (10 vs 5). Most of the implants (34 of 49) had no complication caused by their dislocation. However, 37 implants were retrieved: 29 using the Caldwell-Luc approach, 4 using transnasal endoscopy, and 3 using transoral endoscopy. Twelve implants were not retrieved due to the absence of symptoms, patient refusal, or dislocation into the digestive system.

Discussion

Implant longer than the remaining bone could be displaced into the maxillary sinus. Since then, implants displaced into the maxillary sinus have been reported regularly, despite the drastic increase in implant research and their successful implantation. The reasons of implant dislocation can be classified according to when the implant is displaced into the maxillary sinus; it is most often displaced during the operation. Varol et al²⁴ and Chappuis et al³ listed some reasons of dislocation during surgery, together with an unskilled surgeon, poor primary implant stability, unsuccessful bone regeneration following previous maxillary sinus floor elevation, and implantation without pneumatized sinus floor elevation or without treatment of perforation caused by implant drilling. In particular, poor primary stability reasons implant micro-movement, which prevents clot formation and revascularization and makes new bone formation difficult.

Poor implant fixation can prevent osseointegration, resulting in late implant dislocation.^{25–27} Most implants are displaced immediately after they are placed, or before or during a second operation. Flanagan⁴ indicated that within the first 2 weeks after implantation, bone regenerates actively around the implant, resulting in poorer implant fixation than during implantation and displacing the implant into the maxillary sinus. Galindo et al⁷ described the reasons of implant dislocation within 2 months after implantation and in the late phase: implant dislocation that occurs between 2 weeks and 2 months after placement is caused by incorrect surgical techniques, constant bone destruction due to an existing alveolar bone infection, or osteoporosis or osteopenia.^{9,28} In the articles reviewed, only 7 of 49 implants were displaced 1 year after they were placed or after they were loaded.

Regev et al²⁹ attributed implant dislocation after loading or in the late phase to changes in intrasinus or nasal pressure, inflammatory reactions around the implants, and incorrect distribution of the occlusal forces. Many articles reported that changes in intrasinus or nasal pressure could cause suction forces, which could then displace the implant into the maxillary sinus and that the dislocation was more likely to occur when the maxillary sinus was perforated. The second cause of dislocation, periimplantitis, destroys the bone around the implant and leads to unsuccessful osseointegration.^{7,28} Incorrect masticatory forces exert destructive forces on the bone around the implant, particularly a prosthesis with an over-sized cantilever, malocclusion caused by poor retention of the prosthesis, and the implant loading less than 3 weeks after placement make displaced into the maxillary sinus more likely.^{7,29}

Although many articles describe an association between inadequate height of the maxillary alveolar bone and implant dislocation,^{8,14,19} the height of the alveolar bone is a risk factor for implant dislocation, but the risk is not directly proportional based on the abovementioned reasons. Delayed implantation, which requires maxillary sinus floor elevation before implantation, is also likely to cause implant dislocation. Biglioli and Chiapasco² reported that 33% of 36 implants displaced into the maxillary sinus involved maxillary sinus floor elevation before implantation, whereas Galindo-Moreno et al⁸ reported this in 53.3% of the displaced implants.

The osteotome approach led to greater dislocation than the lateral approach due to the poor primary fixation caused by the difference in diameter between the final osteotome and placed implant. In the articles reviewed, 9 of 49 implants had maxillary sinusitis, excluding simple

maxillary sinus mucosal swelling. The displaced implants could cause maxillary sinus mucosal swelling, narrow the ostium, or reduce ciliary movements, consequently preventing or interrupting mucociliary clearance.^{6,30,31} A study of the tissues from the retrieved implant threads observed mucous-serous gland proliferation, pseudocyst formation, and inflammatory cell infiltration, along with degenerative changes in the maxillary sinus mucosa. Another article reported that the displaced implants themselves could cause aspergillosis or cancer.^{16,32,33}

The displaced implants can cause complications affecting the organs neighboring the maxillary sinus. Implants displaced into the maxillary sinus migrated into the ethmoid sinus, orbital floor, sphenoid sinus, or even the cranial fossa.^{34–36} The maxillary sinus infection can cause orbital cellulitis and damage the optic nerve,^{37,38} resulting in meningitis or brain abscess in some cases.^{39,40} In the articles reviewed, most of the displaced implants were retrieved, unless no symptoms of maxillary sinusitis were found, it was difficult to retrieve the implant, the patient refused removal, or there was no need to retrieve it because it had been sucked into the maxillary sinus and migrated into the digestive system.^{11,20}

Although some reported that the displaced implants were asymptomatic for up to 8 years after they were displaced into the maxillary sinus,²¹ removal is necessary because they can cause late sinusitis due to the foreign body reactions years after they are displaced.^{16,18} Many articles recommend removing the displaced implants endoscopically because excessive tears of the maxillary sinus mucosa are less likely and it is less invasive than the Caldwell-Luc approach, reducing injuries or bleeding in the mucosa, facilitating recovery, and preserving mucociliary function. Implants markedly displaced in the anteromedial direction are retrieved more easily via endoscopy than with an intraoral approach with surgery of the paranasal sinus.^{22,41,42}

It is necessary to retrieve an implant that has caused sinusitis, and the vitality of the sinus is determined by the patency of the maxillary ostium. When there are symptoms and signs related to the sinus, transnasal endoscopy can be used to widen the narrowed or blocked ostium and to retrieve foreign bodies and treat the hyperplastic, hypertrophic, infected mucosa simultaneously through functional endoscopic sinus surgery (FESS).^{14,41,42} This method can be performed under local anesthesia. However, when surgical forceps cannot easily approach a displaced implant due to its location and angle, transnasal endoscopy is also difficult.^{43–48}

The Caldwell-Luc approach was selected to retrieve the displaced implants in most cases. This approach enables a very wide view and is useful for removing objects that cannot be retrieved endoscopically because of their size or excessive dislocation.²² If implant dislocation has caused an oroantral fistula, an intraoral approach, such as the Caldwell-Luc approach, is essential to close it.⁴⁹ If there are no symptoms of maxillary infection, maxillary sinus floor elevation and bone grafting can be performed immediately after removing the implant; Ucer¹⁸ stitched up the perforated maxillary sinus mucosa and grafted Bio-Oss (Geistlich Pharma, Wolhusen, Switzerland) after removing a displaced implant.

An antrostomy can also be used when there is maxillary sinusitis; it is difficult to achieve mucociliary clearance, and the removal of the implant through the Caldwell-Luc approach alone is rarely considered a good solution.⁶ Gonzalez-Garcia et al⁴² noted that the Caldwell-Luc operation and transoral endoscopy could be used when there was no need to treat the ostium and the paranasal sinus was not affected. Cutler et al⁵⁰ reported that the Caldwell-Luc approach could be used when endoscopy was unsuccessful or when there was refractory chronic sinusitis.

Endoscopy is suggested together with an oral approach if there is an oroantral fistula.

Chiapasco et al⁴⁹ reported that 5 of 13 patients affected by sinusitis had ostium obstruction and used an oral approach combined with FESS. However, they also noted that an oral approach alone could be useful when there was an oroantral fistula or sinusitis but no effect on the ostium. There were some complications, together with recurrence of maxillary sinusitis, whatever method was used to retrieve the implant. In summary, although transnasal endoscopy is most often suggested when there is ostium obstruction or when the paranasal sinus needs to be treated, the Caldwell-Luc approach can be used alone or in combination with the endoscopy if there is an oroantral fistula. Endoscopy can be used when there is maxillary sinusitis; however, it is necessary to conduct a full preoperative evaluation before selecting a method (Table 2).

Conclusion

Implant dislocation into the maxillary sinus common and has different reasons, according to when it occurs. The displaced implants may cause complications in the maxillary sinus, paranasal sinus, or neighboring organs. Hence, it is desirable to retrieve them rather than to use conservative treatment, even when there are no symptoms. Endoscopy can be used to retrieve such implants; however, it is necessary to conduct a full preoperative evaluation of their location and size, the osteomeatal complex, and the paranasal sinus before selecting the treatment method.

References

1. Cawood JJ, Howell RA. A classification of the edentulous jaws. *Int J Oral Maxillofac Surg.* 1988;17:232–236.
2. Biglioli F, Chiapasco M. An easy access to retrieve dental implants displaced into the maxillary sinus: The bony window technique. *Clin Oral Implants Res.* 2013;25:1344–1351.
3. Chappuis V, Suter VG, Bornstein MM. Dislocation of a dental implant into the maxillary sinus: Report of an unusual complication when performing staged sinus floor elevation procedures. *Int J Periodon Rest Dent.* 2009;29:81–87.
4. Flanagan D. A method to retrieve a displaced dental implant from the maxillary sinus. *J Oral Implantol.* 2009;35:70–74.
5. Fusari P, Doto M, Chiapasco M. Removal of a dental implant displaced into the maxillary sinus by means of the bone lid technique. *Case Rep Dent.* 2013;2013: 260707.
6. Raghoobar GM, Vissink A. Treatment for an endosseous implant migrated into the maxillary sinus not causing maxillary sinusitis: Case report. *Int J Oral Maxillofac Implants.* 2003;18:745–749.
7. Galindo P, Sánchez-Fernández E, Avila G, et al. Migration of implants into the maxillary sinus: Two clinical cases. *Int J Oral Maxillofac Implants.* 2005;20:291–295.
8. Galindo-Moreno P, Padial-Molina M, Avila G, et al. Complications associated with implant migration into the maxillary sinus cavity. *Clin Oral Implants Res.* 2012;23:1152–1160.
9. Iida S, Tanaka N, Kogo M, et al. Migration of a dental implant into the maxillary sinus. A case report. *Int J Oral Maxillofac Surg.* 2000;29:358–359.
10. Kitamura A. Removal of a migrated dental implant from a maxillary sinus by transnasal endoscopy. *Br J Oral Maxillofac Surg.* 2007;45:410–411.
11. Kluppel LE, Santos SE, Olate S, et al. Implant migration into maxillary sinus: Description of two asymptomatic cases. *Oral Maxillofac Surg.* 2010;14:63–66.
12. Lubbe DE, Aniruth S, Peck T, et al. Endoscopic transnasal removal of migrated dental

implants. *Br Dent J.* 2008;204:435–436.

13. Nakamura N, Mitsuyasu T, Ohishi M. Endoscopic removal of a dental implant displaced into the maxillary sinus: Technical note. *Int J Oral Maxillofac Surg.* 2004; 33:195–197.
14. Ramotar H, Jaberoo MC, Koo Ng NK, et al. Image-guided, endoscopic removal of migrated titanium dental implants from maxillary sinus: Two cases. *J Laryngol Otol.* 2010;124:433–436.
15. Ridaura-Ruiz L, Figueiredo R, Guinot-Moya R, et al. Accidental dislocation of dental implants into the maxillary sinus: A report of nine cases. *Clin Implant Dent Relat Res.* 2009;11:e38–e45.
16. Scarano A, Perrotti V, Carinci F, et al. Removal of a migrated dental implant from the maxillary sinus after 7 years: A case report. *Oral Maxillofac Surg.* 2011; 15:239–243.
17. Tilaveridis I, Lazaridou M, Dimitrakopoulos I, et al. Dislocation of three dental implants into the maxillary sinus in two patients. Report of two cases. *Oral Maxillofac Surg.* 2012;16:311–314.
18. Ucer TC. A modified transantral endoscopic technique for the removal of a displaced dental implant from the maxillary sinus followed by simultaneous sinus grafting. *Int J Oral Maxillofac Implants.* 2009;24:947–951.
19. Galindo-Moreno P, Padiál-Molina M, Sánchez-Fernández E, et al. Dental implant migration in grafted maxillary sinus. *Implant Dent.* 2011;20:400–405.
20. Borgonovo A, Fabbri A, Boninsegna R, et al. Dislocation of a dental implant into the maxillary sinus: Case series. *Minerva Stomatol.* 2010;59: 45–54
21. Guler N, Delilbasi C. Ectopic dental implants in the maxillary sinus. *Quintessence Int.* 2007;38:e238–e239.
22. El Charkawi HG, El Askary AS, Ragab A. Endoscopic removal of an implant from the maxillary sinus: A case report. *Implant Dent.* 2005;14:30–35.
23. Adell R, Lekholm U, Rockler B, et al. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. *Int J Oral Surg.* 1981;10:387–416.
24. Varol A, Türker N, Göker K, et al. Endoscopic retrieval of dental implants from the maxillary sinus. *Int J Oral Maxillofac Implants.* 2006;21:801–804.
25. Brunski JB. In vivo bone response to biomechanical loading at the bone/dental-implant interface. *Adv Dent Res.* 1999;13:99–119.
26. Gerstenfeld LC, Cullinane DM, Barnes GL, et al. Fracture healing as a post-natal developmental process: Molecular, spatial, and temporal aspects of its regulation. *J Cell Biochem.* 2003; 88:873–884.
27. Davies JE. Mechanisms of endosseous integration. *Int J Prosthodont.* 1998;11:391–401.
28. Quiney RE, Brimble E, Hodge M. Maxillary sinusitis from dental osseointegrated implants. *J Laryngol Otol.* 1990; 104:333–334.
29. Regev E, Smith RA, Perrott DH, et al. Maxillary sinus complications related to endosseous implants. *Int J Oral Maxillofac Implants.* 1995;10:451–461.
30. Scorticati MC, Raina G, Federico M. Cluster-like headache associated to a foreign body in the maxillary sinus. *Neurology.* 2002;59:643–644.
31. Sugiura N, Ochi K, Komatsuzaki Y. Endoscopic extraction of a foreign body from the maxillary sinus. *Otolaryngol Head Neck Surg.* 2004;130:279–280.
32. Legent F, Billet J, Beauvillain C, et al. The role of dental canal fillings in the development of *Aspergillus* sinusitis. A report of 85 cases. *Arch Otorhinolaryngol.* 1989;246:318–320.
33. De Foer C, Fossion E, Vaillant JM. Sinus aspergillosis. *J Craniomaxillofac Surg.* 1990;18:33–40.

34. Haben CM, Balys R, Frenkiel S. Dental implant migration into the ethmoid sinus. *J Otolaryngol.* 2003;32:342–344.
35. Felisati G, Lozza P, Chiapasco M, et al. Endoscopic removal of an unusual foreign body in the sphenoid sinus: An oral implant. *Clin Oral Implants Res.* 2007;18: 776–780.
36. Cascone P, Ungari C, Filiaci F, et al. A dental implant in the anterior cranial fossae. *Int J Oral Maxillofac Surg.* 2010; 39:92–93.
37. Clary RA, Cunningham MJ, Eavey RD. Orbital complications of acute sinusitis: Comparison of computed tomography scan and surgical findings. *Ann Otol Rhinol Laryngol.* 1992;101:598–600.
38. Velasco e Cruz AA, Demarco RC, Valera FC, et al. Orbital complications of acute rhinosinusitis: A new classification. *Braz J Otorhinolaryngol.* 2007;73:684– 688.
39. Gallagher RM, Gross CW, Phillips CD. Suppurative intracranial complications of sinusitis. *Laryngoscope.* 1998;108: 1635–1642.
40. Kastner J, Taudy M, Lisy J, et al. Orbital and intracranial complications after acute rhinosinusitis. *Rhinology.* 2010;48: 457–461.
41. Kitamura A, Zeredo JL. Migrated maxillary implant retrieved via semilunar hiatus by transnasal endoscope. *Implant Dent.* 2010;19:16–20.
42. González-García A, GonzálezGarcía J, Diniz-Freitas M, et al. Accidental dislocation and migration of endosseous implants into adjacent craniofacial structures: A review and update. *Med Oral Patol Oral Cir Bucal.* 2012;17:e769–e774.
43. Sandler NA, Carrau RL, Ochs MW, et al. The use of maxillary sinus endoscopy in the diagnosis of orbital floor fractures. *J Oral Maxillofac Surg.* 1999;57:399–403.
44. Catalano PJ, Strouch M. The minimally invasive sinus technique: Theory and practice. *Otolaryngol Clin North Am.* 2004;37:401–409.
45. Chiu AG, Kennedy DW. Disadvantages of minimal techniques for surgical management of chronic rhinosinusitis. *Curr Opin Otolaryngol Head Neck Surg.* 2004; 12:38–42.
46. Närkiö-Mäkelä M, Qvarnberg Y. Endoscopic sinus surgery or CaldwellLuc operation in the treatment of chronic and recurrent maxillary sinusitis. *Acta Otolaryngol Suppl.* 1997;529:177–180.
47. Penttilä MA, Rautiainen ME, Pukander JS, et al. Endoscopic versus Caldwell-Luc approach in chronic maxillary sinusitis: Comparison of symptoms at one-year follow-up. *Rhinology.* 1994;32: 161–165.
48. Schaefer SD, Manning S, Close LG. Endoscopic paranasal sinus surgery: Indications and considerations. *Laryngoscope.* 1989;99:1–5.
49. Chiapasco M, Felisati G, Maccari A, et al. The management of complications following dislocation of oral implants in the paranasal sinuses: A multicenter clinical report and proposed treatment protocols. *Int J Oral Maxillofac Surg.* 2009;38: 1273–1278.
50. Cutler JL, Duncavage JA, Matheny K, et al. Results of Caldwell-Luc after failed endoscopic middle meatus antrostomy in patients with chronic sinusitis. *Laryngoscope.* 2003;113:2148–2150.

Table 1: Survey of 49 Implants Displaced Into the Maxillary Sinus in 22 Journal Articles

Authors	No. of Implants	Previous Sinus Lift	Time From Placement to Dislocation	Sinus Complication	Removal	Method of Removal
Chappuis et al ³	1	Yes	Immediately	Swelling	Yes	Transnasal E
Flanagan ⁴	1	?	Immediately	No	Yes	CL
Fusari et al ⁵	1	?	Immediately	No	Yes	CL
Raghoobar and Vissink ⁶	1	No	5 mo	No	Yes	CL SL
Galindo et al ⁷	1	?	4 y	No	No	
	1	?	6 mo	No	No	
Galindo-Moreno et al ⁸	1	Yes	Before loading	No	Yes	CL
	1	Yes	Before loading	Swelling	Yes	CL
	4	Yes	Afterloading	No	Yes	CL
	2	Yes	Afterloading	No	No	
	3	No	Beforeloading	Sinusitis	Yes	CL
	3	No	After loading	No	No	
	1	No	After loading	No	Yes	CL
lida et al ⁹	1	?	10 y	No	Yes	CL
Kitamura ¹⁰	1	?	3 y	Sinusitis	Yes	Transnasal E
Kluppel et al ¹¹	1	?	6 mo	No	Yes	CL A + SL
Lubbe et al ¹²	1	No	3 wk	Facial pain	Yes	CL
Nakamura et al ¹³	1	?	Immediately	No	Yes	Transoral E
Ramotar et al ¹⁴	1	?	Immediately	No	Yes	Transnasal E
	1	?	Immediately	Sinusitis	Yes	Transnasal E
Ridaura-Ruiz et al ¹⁵	3	?	4 mo	No	Yes	CL
	1	?	4 mo	No	Yes	CL SL
	1	?	6 mo	No	Yes	CL
	1	?	6 mo	Sinusitis	Yes	Crestal approach
	1	?	6 mo	No	No	

	1	?	8 mo	Sinusitis	Yes	CL
	1	?	10 mo	Sinusitis	No	
Scarano et al ¹⁶	1	?	4 mo	Sinusitis	Yes	CL
Tilaveridis et al ¹⁷	1	?	Immediately	No	Yes	CL
	1	?	8 mo	No	Yes	CL
Ucer ¹⁸	1	?	8 wk	No	Yes	Transoral E + SL
Galindo-Moreno et al ¹⁹	1	Yes	13 mo	No	No	
	1	Yes	7mo	No	Yes	CL
Borgonovo et al ²⁰	1	No	6mo	Swelling	Yes	CL + A
	1	Yes	3 mo	Sinusitis	Yes	CL
	1	?	Immediately	No	No	
Guler and Delilbasi ²¹	1	?	Immediately	No	Yes	CL
	1	?	8y	No	No	
El Charkawi et al ²²	1	?	Immediately	Sinusitis	Yes	Transoral E

A indicates antrostomy; **CL**, Caldwell-Luc approach; **E**, endoscopy; **SL**, sinus lift with bone graft; **Swelling**, swelling of Schneiderian membrane

Table 2: Suggested Method of Removal of Implants Displaced Into the Maxillary Sinus

Complications				
Oroantral Fistula	Ostium Obstruction	Sinusitis	Paranasal Sinus Affected	Suggested Method of removal
-	+	+	+	Transnasal endoscopy
-	-	+	-	Transoral endoscopy
+	-	±	-	Caldwell-Luc approach

+” indicates yes; -, no or complications of little importance