

Retrieval of a Dental Implant Displaced into the Maxillary Sinus During Full-Arch Rehabilitation: A Case Report

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Abstract

Background: Displacement of a dental implant into the maxillary sinus is an uncommon but clinically important complication of implant rehabilitation of the posterior maxilla. It arises from the unfavourable combination of poor bone quality, a reduced sub-antral bone height and progressive pneumatization of the sinus that characterise this region, and it may lead to chronic sinusitis, oroantral communication and further migration of the implant if it is not removed. This report describes the diagnosis and surgical retrieval of an implant displaced into the maxillary sinus in a patient undergoing full-arch implant rehabilitation.

Case presentation: A patient who had received multiple maxillary and mandibular implants for full-arch rehabilitation was found to have one implant displaced into the maxillary sinus. Panoramic radiography and cone-beam computed tomography (CBCT) localised the implant within the sinus cavity and confirmed the integrity of the surrounding sinus walls. Under local anaesthesia, a lateral bony window was prepared in the antero-lateral wall of the maxilla, the Schneiderian membrane was carefully reflected, and the implant was retrieved with fine forceps without additional trauma to the membrane. The window was managed and the mucoperiosteal flap repositioned and sutured. Healing was uneventful.

Conclusion: Displaced implants should be removed promptly to prevent sinonasal complications. Careful pre-operative three-dimensional imaging, a conservative intraoral lateral-window approach and meticulous handling of the Schneiderian membrane allow safe retrieval with minimal morbidity. Prevention through thorough radiographic planning and controlled surgical technique remains the most important consideration.

Keywords: Dental implant; Maxillary sinus; Implant displacement; Foreign body; Lateral window; Cone-beam computed tomography; Oroantral communication.

I. Introduction

Osseointegrated dental implants have become a predictable and widely used option for the rehabilitation of partially and completely edentulous patients, with high long-term survival when accepted success criteria are met [1,2]. Rehabilitation of the posterior maxilla, however, remains one of the more demanding clinical situations in implant dentistry. Following the loss of the posterior teeth, the alveolar ridge undergoes progressive three-dimensional resorption while the maxillary sinus continues to pneumatise, so that the sub-antral bone becomes low in height, poor in density (typically Lekholm and Zarb type III or IV) and covered by only a thin cortical plate [3]. These anatomical features reduce the volume of bone available for implant anchorage and increase the risk of intra-operative and post-operative complications in this region.

To overcome the deficient sub-antral bone, techniques such as lateral-window sinus floor augmentation and the transcrestal osteotome technique were developed and have been used for several decades [4,5,6,7]. Despite careful planning, a range of sinus-related complications may still occur, including membrane perforation, graft infection, sinusitis and displacement of the implant itself into the sinus cavity [8]. Migration of a dental implant into the maxillary sinus is a rare event, but its reported frequency is rising in parallel with the increasing number of implants placed and sinus procedures performed [9,10].

Displacement may occur during surgery, before prosthetic loading, or months to years after functional loading, and several mechanisms contribute according to the timing of the event: inadequate primary stability in poor-quality bone, an over-prepared osteotomy, excessive apical pressure, an altered intra-sinus and intra-oral pressure gradient, peri-implant bone loss and autoimmune-type foreign-body reactions have all been implicated [9,11,12,13,14]. Once within the sinus, an implant acts as a foreign body and may remain asymptomatic or provoke maxillary sinusitis, oroantral communication, ostiomeatal obstruction and, rarely, further migration to the ethmoid, sphenoid or nasal cavity [11,14,28]. For these reasons the prevailing recommendation is early removal, even in asymptomatic patients [10,11]. Four broad management strategies are described in the literature: functional endoscopic sinus surgery (FESS), an intraoral Caldwell-Luc approach, removal through the alveolar bone or the lateral sinus wall, and combinations of these techniques [11,15,20].

The present report describes the clinical and radiographic evaluation and the successful intraoral retrieval, through a lateral bony window, of a dental implant displaced into the maxillary sinus in a patient undergoing full-arch implant rehabilitation.

II. Case Report

Preoperative assessment

A patient undergoing full-arch implant-supported rehabilitation of both jaws was noted to have one implant displaced into the maxillary sinus. The patient underwent a comprehensive clinical and radiographic evaluation. A panoramic radiograph and cone-beam computed tomography (CBCT) were obtained to determine the exact location and orientation of the displaced implant, to assess the condition of the maxillary sinus, and to evaluate the relationship of the implant with the sinus walls and adjacent anatomical structures. The panoramic view showed the standing maxillary and mandibular implants together with a radiopaque implant projected within the maxillary sinus (Fig. 1). CBCT confirmed the implant lying free within the sinus cavity and allowed assessment of its precise position, the thickness and continuity of the sinus walls, and the antral floor (Figs 2 and 3). Three-dimensional surface-rendered reconstructions were used to plan the position of the lateral bony window (Fig. 4). The presence or absence of sinus pathology, such as mucosal thickening, fluid accumulation or established sinusitis, was assessed, and the patency of the ostiomeatal complex was noted. A thorough medical and dental history was recorded and routine pre-operative investigations were reviewed before surgery was planned.

Surgical procedure

After the procedure had been explained and written informed consent obtained, surgery was performed under local anaesthesia. Following antiseptic preparation and infiltration of a local anaesthetic solution, a mucoperiosteal flap was elevated in the posterior maxillary region to obtain surgical access to the antero-lateral wall of the maxillary sinus. A lateral bony window was created in the lateral wall of the maxilla at the level corresponding to the displaced implant, taking care to avoid injury to the underlying Schneiderian membrane (Fig. 5).

The sinus membrane was carefully elevated and reflected to expose the displaced implant. Once identified, the implant was engaged and retrieved using fine surgical instruments [e.g., sinus curette and forceps/hemostat, or a dedicated implant-retrieval instrument—specify the actual instrument used] (Fig. 6). It was removed without causing further trauma to the sinus membrane, and the sinus cavity was inspected for any residual foreign material or pathological tissue. The retrieved implant was examined and preserved (Fig. 7).

Following retrieval, the surgical site was thoroughly irrigated with sterile saline. The integrity of the Schneiderian membrane was reassessed, and any perforation, where present, was managed appropriately [specify whether a collagen membrane, oxidised regenerated cellulose or other material was used]. The bony window was repositioned or otherwise managed according to the surgical technique used, and the mucoperiosteal flap was repositioned and secured with [suture material] interrupted sutures to achieve tension-free primary closure.

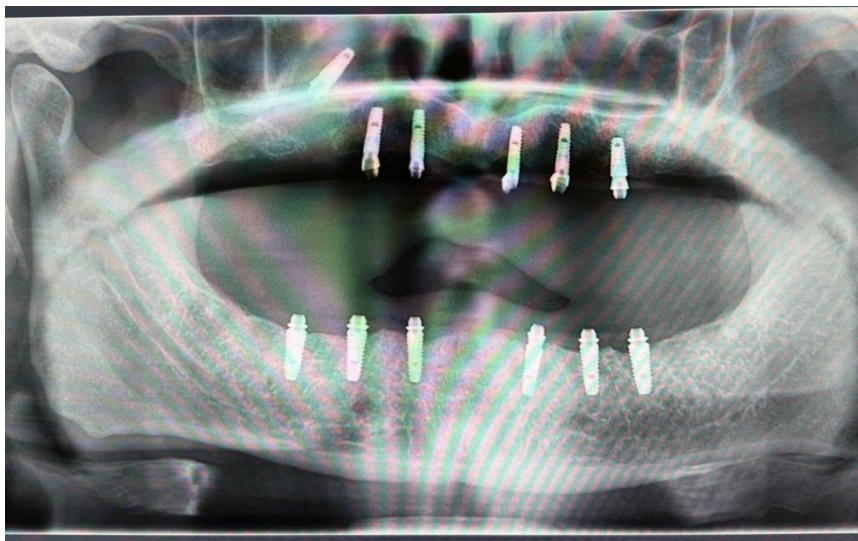


Figure 1. Panoramic radiograph showing the full-arch implant rehabilitation of the maxilla and mandible, with a radiopaque implant projected within the maxillary sinus above the standing maxillary implants.



Figure 2. CBCT axial section demonstrating the displaced implant lying free within the maxillary sinus cavity and its relationship to the sinus walls.



Figure 3. CBCT cross-sectional view (with reference crosshairs) localising the displaced implant relative to the antral floor and the adjacent standing implants.

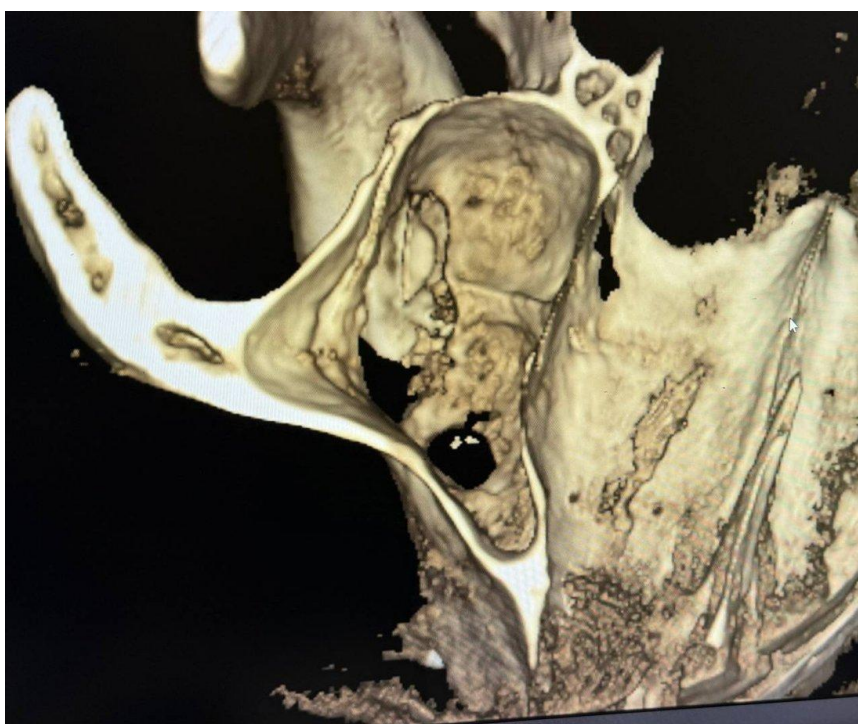


Figure 4. Three-dimensional volume-rendered CBCT reconstruction of the maxilla, showing the antral region and the bony window used to plan surgical access.

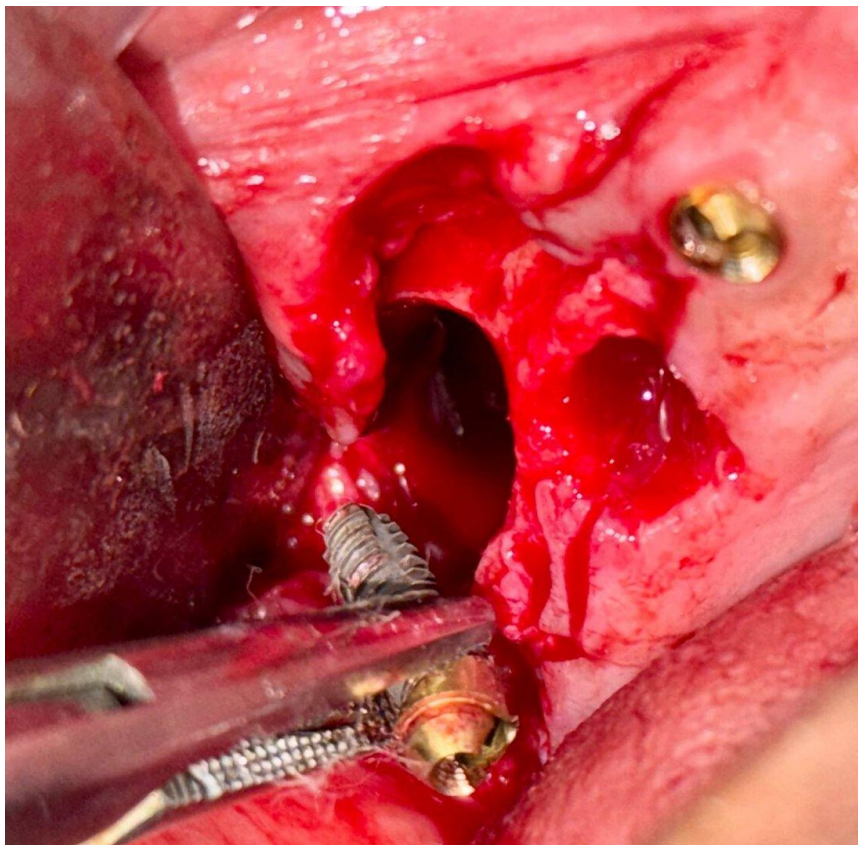


Figure 5. Intra-operative view of the posterior maxilla after flap elevation, showing the lateral bony window prepared in the antero-lateral sinus wall and the adjacent healing abutments.

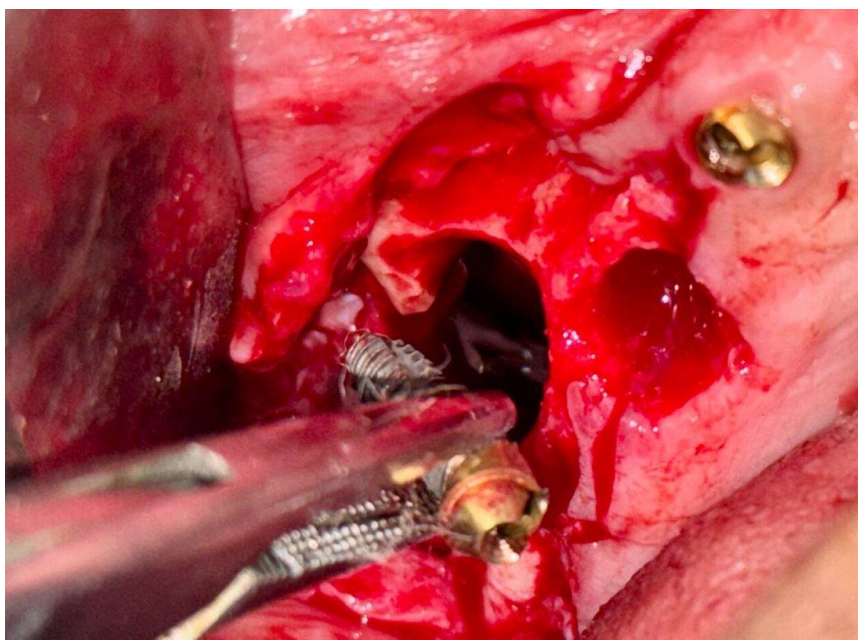


Figure 6. Intra-operative view showing engagement and retrieval of the displaced implant from within the sinus using fine forceps, with care taken to protect the Schneiderian membrane.



Figure 7. The retrieved dental implant on gauze after removal from the maxillary sinus.

Postoperative management

Post-operative instructions were provided, including avoidance of nose blowing, sneezing with the mouth closed, use of a straw, vigorous physical activity and any other manoeuvre that could raise intra-nasal or intra-sinus pressure during the healing period. The patient was prescribed [antibiotics, analgesics and nasal decongestant/saline irrigation—mention only those actually prescribed]. The patient was reviewed post-operatively for assessment of wound healing, infection, oroantral communication and sinus-related symptoms. Follow-up radiographic examination [if performed] confirmed successful retrieval of the displaced implant and satisfactory healing, with no evidence of retained foreign material or persistent sinus pathology.

III. Discussion

Displacement of a dental implant into the maxillary sinus is an infrequent complication, but recent systematic reviews confirm that it is reported with increasing frequency. In a PRISMA-based review of 321 patients across a 31-year period, the upper first molar site was most often involved, displacement occurred mainly within the first six months after placement, and the majority of patients eventually became symptomatic—most commonly with maxillary sinusitis and/or oroantral communication ^[10]. An earlier systematic review similarly attributed the complication to the specific features of the posterior maxilla, namely poor bone quality and insufficient residual bone height ^[9]. These findings support the decision, taken in the present case, to remove the implant promptly once its intra-sinus position was confirmed.

The aetiology of displacement varies with its timing. Intra-operative displacement is usually related to inadequate primary stability in low-density bone, an osteotomy prepared beyond the sinus floor, or excessive apical force during insertion. Displacement occurring after placement but before loading has been linked to disturbance of the pressure balance between the sinus and the oral cavity, to peri-implant osteolysis, and to nasal-blowing or other pressure changes; late displacement of an osseointegrated implant, although rare, has been reported many years after insertion and is generally associated with progressive peri-implant bone loss ^[9,11,12,13,16,17,18]. In a patient undergoing full-arch rehabilitation, as here, multiple posterior maxillary implants are placed into pneumatized, atrophic bone, which increases the cumulative probability that one implant lacks adequate anchorage and is displaced.

Accurate three-dimensional localisation is essential before any attempt at removal. Whereas panoramic and Waters' views can suggest the diagnosis, CBCT is now regarded as the imaging modality of choice because it defines the exact position of the implant within the sinus, the status of the sinus walls and floor, the condition of the mucosa and the patency of the ostiomeatal complex, all with relatively low radiation exposure ^[10,15]. In the present case CBCT and surface-rendered reconstructions guided the location and dimensions of the lateral window and reduced the risk of unnecessary bone removal.

Four principal techniques are used to retrieve implants displaced into the maxillary sinus: functional endoscopic sinus surgery, the intraoral Caldwell-Luc approach, removal through the alveolar crest or a lateral antrostomy, and combinations of these methods ^[11,15]. In the large systematic review by Seigneur and colleagues,

the lateral approach (38.1%) was the most frequently used, followed by the Caldwell-Luc approach (27.2%) and endoscopic nasal surgery (23.1%) [10]. Endoscopic and trans-nasal techniques, sometimes assisted by dedicated retrieval devices or image guidance, are minimally invasive, preserve the integrity of the antral walls and are particularly valuable when the implant lies close to the ostium or has migrated to other sinuses [19,20,21,23]. Multidisciplinary protocols combining oral and ENT expertise have been proposed to match the technique to the clinical situation and to address any concurrent sinonasal disease [11,25,26].

The lateral-window approach used in this case is well established, gives direct visual access to the implant, allows immediate inspection and irrigation of the sinus, and can be performed intraorally under local anaesthesia. It is especially suitable when the implant lies on or near the sinus floor and when access to the same region is required for subsequent grafting or implant placement [12,13,22,29]. Compared with the classic Caldwell-Luc technique, a conservative lateral antrostomy that preserves and repositions the bony window on a mucosal or periosteal pedicle can reduce post-operative morbidity while still achieving reliable removal [24]. Careful elevation of the Schneiderian membrane is critical; where a perforation occurs it should be repaired with a resorbable collagen membrane or equivalent to prevent oroantral communication and to protect any planned graft.

Prevention remains more important than treatment. Thorough pre-operative radiographic analysis, respect for the residual bone height, appropriate site preparation, achievement of adequate primary stability, and—where the sub-antral bone is deficient—staged or simultaneous sinus augmentation reduce the likelihood of displacement [7,9,10]. When displacement does occur, the consensus of the literature is that early removal, even in the absence of symptoms, minimises the risk of sinusitis, oroantral communication and further migration and gives the best long-term outcome [10,11]. The uneventful course in the present case is consistent with these principles and reinforces the value of prompt diagnosis with CBCT and conservative surgical retrieval.

IV. Conclusion

Displacement of a dental implant into the maxillary sinus is a rare but significant complication of posterior maxillary rehabilitation that should be diagnosed and treated without delay. Precise localisation with CBCT, a conservative intraoral lateral-window approach and meticulous handling of the Schneiderian membrane allowed safe retrieval of the displaced implant with minimal morbidity in this patient undergoing full-arch rehabilitation. Meticulous pre-operative planning and controlled surgical technique remain the most effective means of preventing this complication.

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