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Accidental Displacement of a Dental Implant into the Maxillary Sinus Managed by Caldwell–Luc Procedure: A Case Report

Godvine, Laxmi Shravya, Sarah Fatima*, Rithvika Gunda, Ramakrishna Yathavakilla, Alam Bhavya Chowdary, Yeshaswini Jasti, Abhineeth Kumar, Anagha Devulapalli, Mokshitha Varma, Fazeelah Fatima, Amatul Hafsa, Anuja Aich

Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, India

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***Corresponding author:** Sarah Fatima, Panineeya Mahavidyalaya Institute of Dental Sciences and Research Centre, India

ABSTRACT

Displacement of dental implants into the maxillary sinus is a rare but clinically significant complication associated with implant placement in the posterior maxilla. The posterior maxillary region often presents anatomical challenges due to reduced alveolar bone height, poor bone quality, and sinus pneumatization following tooth loss. Inadequate preoperative assessment, insufficient primary implant stability, or improper surgical technique may increase the risk of implant migration into the sinus cavity. Although some displaced implants may remain asymptomatic initially, they can potentially lead to complications such as maxillary sinusitis, mucosal irritation, infection, and obstruction of the sinus ostium if left untreated. Therefore, early diagnosis and prompt surgical retrieval are essential to prevent further morbidity and restore normal sinus function.

Various surgical approaches have been described for the removal of displaced implants from the maxillary sinus, including functional endoscopic sinus surgery and the Caldwell–Luc approach. The Caldwell–Luc technique remains a reliable and effective method, particularly when direct access to the sinus floor is required. This case report presents a middle-aged female patient with displacement of a dental implant into the maxillary sinus following implant placement in the posterior maxilla. The displaced implant was successfully retrieved using the Caldwell–Luc approach with favourable postoperative outcomes. This case highlights the importance of thorough preoperative planning, accurate surgical technique, and early intervention in managing implant-related complications involving the maxillary sinus.

Keywords: Dental implant displacement; Maxillary sinus; Caldwell–Luc procedure; Implant complications; Sinus surgery; Case report

INTRODUCTION

Dental implant rehabilitation in the posterior maxilla presents considerable anatomical and technical challenges. Following tooth loss, progressive pneumatization of the maxillary sinus and resorption of the alveolar ridge frequently result in reduced residual bone height and compromised bone quality [1-3]. These anatomical limitations often make implant placement in this region more complex and may affect primary implant stability. Although dental implants generally demonstrate high long-term success rates, the posterior maxilla remains a region where complications are more likely to occur due to its unique anatomical characteristics [4,5].

One of the uncommon but clinically significant complications associated with implant placement in this region is the displacement or migration of a dental implant into the maxillary sinus. This complication may occur intraoperatively or during the early postoperative period and is often associated with factors such as inadequate primary stability, excessive preparation of the osteotomy site, perforation of the sinus floor, or uncontrolled insertion forces during implant placement [6-8]. Poor bone density, improper treatment planning, or failure to adequately evaluate the sinus anatomy may further increase the risk of implant displacement.

Once displaced, the implant acts as a foreign body within the maxillary sinus and may interfere with normal mucociliary function. The presence of a foreign body within the sinus cavity can lead to several complications, including mucosal irritation, acute or chronic maxillary sinusitis, infection, and obstruction of the natural sinus ostium [9-12]. Although some patients may initially remain asymptomatic, delayed diagnosis can result in progressive sinus pathology and increased morbidity. Therefore, early detection and timely surgical retrieval of the displaced implant are essential to restore normal sinus function and prevent long-term complications.

Radiographic evaluation plays a pivotal role in diagnosis and surgical planning. Conventional radiographs may provide preliminary information; however, cone-beam computed tomography (CBCT) is considered the imaging modality of choice as it allows accurate three-dimensional assessment of the sinus anatomy and precise localization of the displaced implant [13-15]. This information is critical in determining the most appropriate surgical approach for retrieval.

Several surgical techniques have been described for the removal of implants displaced into the maxillary sinus. These include minimally invasive transnasal endoscopic techniques as well as intraoral approaches such as the Caldwell–Luc procedure [16-18]. Endoscopic sinus surgery offers advantages such as reduced surgical morbidity and preservation of sinus mucosa. However, the Caldwell–Luc approach continues to remain a reliable and widely accepted technique, particularly when direct visualization and access to the sinus floor are required [19-21].

The Caldwell–Luc procedure involves creating a bony window in the anterior wall of the maxillary sinus through an intraoral approach, allowing direct visualization of the sinus cavity and facilitating safe removal of displaced implants or other foreign bodies [22-24]. Despite advancements in endoscopic techniques, this method continues to provide predictable surgical outcomes when performed with proper case selection and meticulous surgical technique [25-27].

The present case report describes the successful retrieval of a dental implant displaced into the maxillary sinus using the Caldwell–Luc approach in a middle-aged female patient. This report highlights the importance of early

diagnosis, appropriate surgical planning, and careful execution of surgical procedures in the effective management of implant displacement into the maxillary sinus.

CASE PRESENTATION

A 50-year-old female patient presented to the department with the chief complaint of a sensation of heaviness in the upper right posterior tooth region for the past 20 days. The patient reported that the symptoms began shortly after undergoing dental implant placement in the same region at a private dental clinic. She complained of mild pain and discomfort in the right posterior maxillary region, associated with a sensation of heaviness over the right cheek and intermittent nasal stuffiness on the same side. There was no associated history of fever, purulent nasal discharge, or significant facial swelling.

Intraoral examination revealed implant-supported prosthetic rehabilitation in multiple regions of the maxillary arch. Dental implants were present in relation to 25, 26, and 27, which appeared clinically stable. In the right maxillary quadrant, implants had been placed in relation to 14, 15, and 16; however, one of the implants was suspected to have migrated following placement.

In the mandibular arch, tooth 46 was missing, and a fixed partial denture was present with a pontic in relation to 46 supported by abutments 45 and 47. Tooth 37 had previously undergone root canal treatment and was restored with a full-coverage crown. No signs of acute infection or purulent discharge were observed intraorally.

Radiographic Evaluation

A cone-beam computed tomography (CBCT) scan was performed for detailed evaluation of the implant position and sinus condition. The CBCT images demonstrated a radiopaque dental implant displaced into the right maxillary sinus cavity, located superior to the sinus floor in the posterior maxillary region. The implant appeared to be lying freely within the sinus cavity, suggesting displacement following implant placement in the right posterior maxilla.

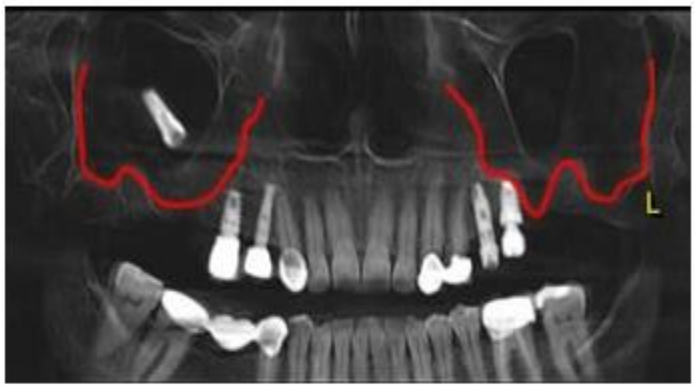

Figure 1: OPG of the patient showing the implant in the right maxillary sinus.

The displaced implant measured approximately 10– 11 mm in length, consistent with a standard dental implant fixture. The scan also revealed significant pneumatization of the right maxillary sinus with reduced residual alveolar bone height in the posterior maxilla, which likely contributed to inadequate primary stability and subsequent migration of the implant into the sinus cavity. Approximately 3-4 mm was observed along the sinus lining adjacent

to the displaced implant, indicating localized inflammatory changes. No obvious fluid level or extensive sinus pathology was noted.

Mild mucosal thickening of the Schneiderian membrane measuring.

Figure 2: CBCT views showing the implant position in the maxillary sinus on the right side.

The CBCT examination also confirmed the presence of implants in relation to 25, 26, and 27, which appeared to be appropriately positioned within the alveolar bone with no evidence of peri-implant radiolucency or peri-implant bone loss.

Based on the clinical and radiographic findings, a diagnosis of implant displacement into the right maxillary sinus was established, and surgical retrieval using the Caldwell–Luc approach was planned.

Surgical Procedure

The patient was prepared for surgery following standard preoperative protocols, including comprehensive clinical evaluation and routine investigations. Written informed consent was obtained before the procedure. The surgery was performed under local anaesthesia using 2% lignocaine with adrenaline (1:80,000) to achieve adequate anaesthesia and haemostasis.

Figure 3: Removal of the implant through the bony window created during the Caldwell–Luc procedure.

A crevicular incision was made in the maxillary posterior region extending from the canine to the molar area, along with a vertical releasing incision to improve surgical access. A full-thickness mucoperiosteal flap was carefully elevated to expose the anterior wall of the maxilla.

A bony window was created in the anterior wall of the right maxillary sinus in the region between the premolars using a round bur under continuous saline irrigation to prevent thermal injury and ensure controlled bone removal. This provided adequate visualization and access to the sinus cavity.

Following the creation of the window, the sinus membrane was gently elevated, allowing entry into the sinus cavity. The displaced implant was visualized within the right maxillary sinus and retrieved using sinus forceps. The sinus cavity was thoroughly irrigated with sterile saline to remove debris and reduce the risk of postoperative infection.

After confirming complete removal of the implant and inspection of the sinus lining, the mucoperiosteal flap was repositioned and sutured using interrupted sutures to achieve primary closure.

Postoperative Follow-Up

Postoperative instructions were provided, including avoidance of nose blowing, maintenance of oral hygiene, and adherence to prescribed medications, including antibiotics, analgesics, and nasal decongestants. The patient was followed up periodically, and healing was uneventful with complete resolution of symptoms.

Postoperative radiographic evaluation confirmed complete removal of the displaced implant and restoration of normal sinus anatomy without residual foreign body.

DISCUSSION

Implant displacement into the maxillary sinus is an uncommon but well-documented complication associated with implant placement in the posterior maxilla. The posterior maxillary region presents several anatomical challenges, including reduced bone density, limited residual alveolar bone height, and progressive pneumatization of the maxillary sinus following tooth loss. These factors may compromise primary implant stability and increase the risk of implant migration into the sinus cavity during or after implant placement [1,4,6].

In addition to anatomical limitations, surgical and prosthetic factors may also contribute to implant displacement. Over-preparation of the osteotomy site, excessive insertion torque, inadequate assessment of bone quality, and failure to recognize sinus floor proximity are frequently reported contributing factors [2,3,7]. In the present case, CBCT examination demonstrated significant sinus pneumatization and reduced posterior maxillary bone height, which likely contributed to inadequate primary stability and subsequent implant migration.

Once displaced into the maxillary sinus, a dental implant behaves as a foreign body and may interfere with normal mucociliary clearance. The presence of foreign materials within the sinus cavity may lead to mucosal inflammation, obstruction of the sinus ostium, and development of acute or chronic maxillary sinusitis [9-11]. Although some patients may remain asymptomatic initially, delayed management can lead to progressive sinus pathology. For this reason, early diagnosis and timely surgical retrieval of displaced implants are strongly recommended.

Radiographic imaging plays a crucial role in identifying the location of the displaced implant and planning appropriate surgical management. Conventional radiographs may provide preliminary information; however, cone-beam computed tomography (CBCT) offers superior three-dimensional visualization of the maxillary sinus and

surrounding anatomical structures. CBCT allows accurate localization of the implant, assessment of sinus pathology, and evaluation of residual alveolar bone, thereby facilitating precise surgical planning [13-15].

Several surgical techniques have been described for the retrieval of implants displaced into the maxillary sinus. These include transnasal endoscopic sinus surgery, transoral approaches, and the classical Caldwell–Luc procedure [16-18]. Endoscopic approaches have gained popularity due to their minimally invasive nature and ability to preserve sinus physiology. However, they require specialized equipment and expertise and may not always provide adequate access to the sinus floor. The Caldwell–Luc approach, first described in the late nineteenth century, remains a reliable and widely used technique for accessing the maxillary sinus [22-24]. This procedure involves creating a bony window in the anterior wall of the maxillary sinus through an intraoral approach, allowing direct visualization and removal of foreign bodies. The technique provides excellent surgical access and facilitates complete removal of displaced implants, particularly when they are located in the inferior or posterior sinus region.

Despite the advantages of newer endoscopic techniques, several authors have reported successful retrieval of displaced implants using the Caldwell–Luc approach with predictable outcomes [19-21]. Nevertheless, potential complications such as postoperative discomfort, infraorbital nerve disturbance, or sinus membrane injury have been reported if the procedure is not performed carefully [25-27]. Therefore, careful surgical planning and meticulous technique are essential to minimize complications.

Preventive strategies play a critical role in reducing the incidence of implant displacement into the maxillary sinus. Thorough preoperative evaluation of the posterior maxilla using CBCT imaging, assessment of bone quality and sinus anatomy, and appropriate treatment planning are essential steps before implant placement. When residual bone height is insufficient, procedures such as sinus floor elevation or bone grafting should be considered to achieve adequate implant stability [28-33]. The present case highlights the importance of early recognition and prompt surgical intervention when implant displacement into the maxillary sinus occurs. Successful retrieval using the Caldwell– Luc approach resulted in resolution of symptoms and uneventful postoperative healing. Early diagnosis and appropriate management remain key factors in preventing long-term sinus complications and ensuring favourable clinical outcomes [34-40].

CONCLUSION

Displacement of dental implants into the maxillary sinus represents a rare but clinically significant complication associated with implant placement in the posterior maxilla. Early diagnosis through appropriate radiographic evaluation, particularly CBCT imaging, is essential for accurate localization and treatment planning.

Although minimally invasive endoscopic techniques are increasingly used, the Caldwell–Luc procedure remains a dependable and effective surgical approach for the retrieval of displaced implants, particularly when direct access and visualization of the sinus cavity are required. Careful surgical planning, timely intervention, and meticulous surgical technique are critical to ensure successful outcomes and prevent sinus-related complications.

ETHICAL STATEMENT

This study was conducted in accordance with the ethical standards of clinical research. Patient confidentiality and anonymity have been strictly maintained throughout the preparation of this case report.

PATIENT CONSENT

Written informed consent was obtained from the patient for publication of the clinical details and radiographic images associated with this case report.

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