

Removal of a Dental Implant Displaced into the Maxillary Sinus Following All-on-Four Protocol: A Case Report

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Abstract: Oral rehabilitation with dental implants has emerged as an effective alternative for patients with edentulism, offering improvements in masticatory function, aesthetics, and quality of life. The All-on-Four protocol is widely used for full-arch rehabilitation, employing four strategically positioned implants to support fixed prostheses while minimizing the need for bone grafts. However, complications can occur, especially in regions with unfavorable anatomical characteristics, such as the posterior maxilla, where low bone density and maxillary sinus pneumatization increase the risks. This article reports a clinical case of a 74-year-old male patient, without comorbidities, who presented with displacement of a dental implant into the right maxillary sinus, 30 days after the All-on-Four procedure. The displacement was confirmed by panoramic radiography. Surgical removal was planned using the Caldwell-Luc technique, performed under local anesthesia in an outpatient setting. After mucoperiosteal incision and flap elevation, an elliptical osteotomy was performed on the anterior wall of the maxillary sinus. The initial attempt to remove the implant by aspiration was unsuccessful, requiring enlargement of the bone window and the use of a Dietrich forceps for successful removal. Following extraction, a new implant was installed, and the maxillary sinus was obliterated. The procedure was successful, without complications, and the patient received appropriate postoperative instructions. The Caldwell-Luc technique proved to be effective and safe for the removal of displaced implants. This case highlights the importance of meticulous surgical planning, careful analysis of the maxillary anatomy, and adequate postoperative follow-up to prevent complications and ensure the success of oral rehabilitation with dental implants.

Keywords: Dental implants; Maxillary sinus; All-on-Four protocol; Caldwell-Luc technique.



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1. Introduction

Oral rehabilitation with dental implants has become one of the primary treatment options for edentulous patients, offering improvements in masticatory function, aesthetics, and quality of life. Among modern techniques, the All-on-Four protocol stands out by enabling full-arch rehabilitation with only four implants, minimizing the need for bone grafting and reducing overall treatment time [1]. However, despite technological and surgical advancements, complications may still occur, particularly in anatomically challenging regions such as the maxillary sinus. Implant displacement into the maxillary sinus is one such complication that, although relatively uncommon, can have significant consequences for the patient and pose considerable challenges for the dental surgeon [1,2].

The maxillary sinus is a complex anatomical structure whose proximity to the roots of the upper posterior teeth and the variable thickness of the sinus membrane (Schneiderian membrane) can directly impact the planning and execution of implant-related procedures [1,3]. Although the All-on-Four technique reduces the need for bone grafts, it is not without risks, especially in cases involving severe bone resorption or inadequate surgical planning [2,4]. Implant migration into the maxillary sinus can occur either during implant placement or postoperatively, most commonly associated with insufficient primary stability, perforation of the sinus membrane, or improper use of sinus lift techniques [5].

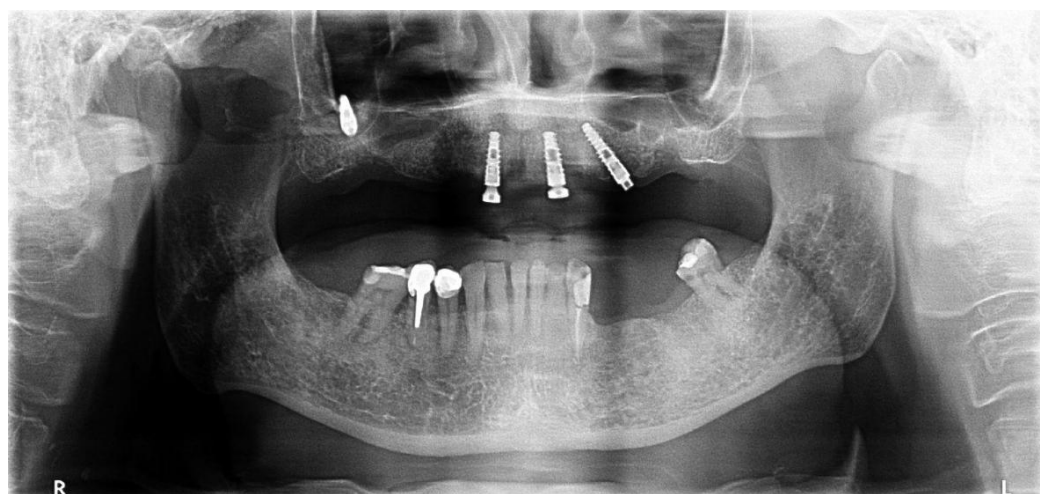
The literature describes several techniques for retrieving displaced implants, ranging from conventional surgical approaches to minimally invasive endoscopic procedures [4,5]. The choice of technique depends on factors such as the implant's location, the presence of symptoms, and the surgeon's expertise. Moreover, preventing such complications is critical and involves meticulous planning with three-dimensional imaging, such as cone-beam computed tomography (CBCT), alongside a comprehensive assessment of residual bone volume and sinus anatomy [5,6]. Therefore, this case report aims to describe the removal of a dental implant displaced into the maxillary sinus following the All-on-Four protocol, highlighting diagnostic challenges, surgical strategies, preventive measures, and clinical implications.

2. Case Report

A 74-year-old male patient presented for dental care complaining of the presence of a dental implant inside the maxillary sinus. He reported having undergone oral rehabilitation with implants using the All-on-Four protocol; however, 30 days after the procedure, one of the implants became displaced. During the anamnesis, it was identified that the patient was normosystemic, with no reported comorbidities. Clinical examination revealed that the distal long implant, responsible for anchoring the protocol, exhibited features inconsistent with an adequate late postoperative outcome.

Given this situation, a thorough evaluation was conducted to identify associated clinical signs, such as compromise of the prosthetic rehabilitation. To confirm the displacement of the implant into adjacent anatomical structures, a panoramic radiograph was requested, which revealed the presence of the implant inside the right maxillary sinus (Figure 1).

Figure 1: Panoramic radiograph showing the presence of the implant within the maxillary sinus.



The removal of the implant displaced into the maxillary sinus was planned using the Caldwell-Luc technique. The procedure was performed in an outpatient setting

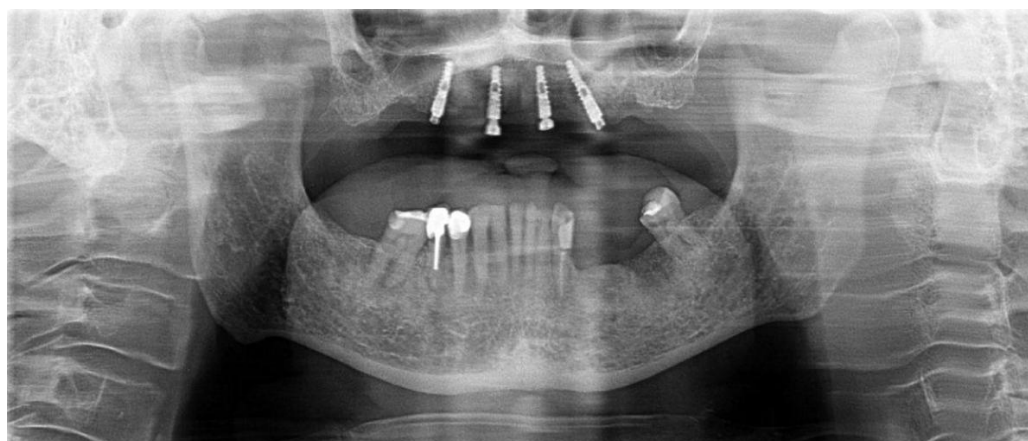
under local anesthesia. Initially, an incision was made followed by mucoperiosteal flap elevation, allowing exposure of the anterior wall of the maxillary sinus. In the same area, an elliptical osteotomy was performed. Through this access, an initial attempt was made to remove the implant using aspiration with a surgical suction device connected to a vacuum pump; however, this approach was unsuccessful. Given this difficulty, the surgeon decided to enlarge the bony window to improve access. With the aid of a Dietrich forceps, it was possible to successfully remove the implant from inside the maxillary sinus (Figure 2).

Figure 2: A. Caldwell-Luc access. B. Implant removal procedure. C. Removed implant.



During the same procedure, a new implant with larger dimensions (3.8 x 15 mm) was placed in the previously compromised region. Subsequently, maxillary sinus obliteration was performed using the buccal fat pad (Bichat's fat pad) through its mobilization and traction, followed by flap repositioning and suturing. The procedure was completed without complications, and the patient received appropriate postoperative instructions, with scheduled follow-up to monitor the success of the rehabilitation (Figure 3).

Figure 3: Postoperative panoramic radiograph showing the newly placed implant.



3. Discussion

Osseointegration of dental implants has been a milestone in the evolution of oral rehabilitation, providing significant improvements in the quality of life for patients with partial or total edentulism. Although dental implant techniques show high success rates, the posterior maxilla remains a challenging region due to unfavorable anatomical features such as reduced bone quantity, low bone density, and maxillary sinus pneumatization [5,6]. These conditions often complicate implant placement without the need for regenerative procedures, such as sinus lift or bone grafting [5]. Furthermore, complications related to implant placement, including accidental migration into the maxillary sinus, can still occur, particularly in cases of significant pneumatization or insufficient primary stability [6,7]. Bone scarcity, combined with

potential surgical inexperience, may increase the risk of this type of displacement, which, although infrequent, is considered a serious event that can lead to sinus infections, pain, discomfort, and compromised rehabilitation outcomes [5].

The removal of dental implants displaced into the maxillary sinus can be performed using different surgical approaches, with the Caldwell-Luc technique being one of the most effective. This method allows direct access to the sinus cavity via an intraoral approach, minimizing the morbidity associated with external facial incisions [6,7]. In the present case, removal was successfully performed after enlarging the bony window and using specific forceps, which facilitated the extraction of the implant lodged in the posterior region of the maxillary sinus.

The placement of a new implant was carefully planned, taking into account the integrity of the remaining alveolar bone and the need for secure anchorage. The use of longer implants was the chosen strategy, particularly in scenarios of pronounced pneumatization or bone resorption [5,6]. Postoperative radiographs confirmed the correct positioning of the new implant and the stability achieved. Success in cases like this highlights the importance of precise planning, detailed anatomical assessment, and the use of regenerative techniques when necessary. Continuous postoperative follow-up is essential to monitor osseointegration and prevent complications that could compromise the final outcome. With the proper application of surgical techniques such as Caldwell-Luc, combined with the correct selection of implants, it is possible to achieve excellent results even in complex situations involving the maxillary sinus [5,6].

The All-on-Four concept, developed by Nobel Biocare, was designed to overcome anatomical limitations of the edentulous mandible, allowing full-arch rehabilitation with only four implants. Two of these implants are posteriorly tilted, enabling the installation of full prostheses with up to two cantilevered teeth in the distal region, thus avoiding more complex surgical techniques [8]. This clinical case exemplifies the importance of accurate diagnosis and the appropriate choice of therapeutic approaches to resolve complications such as implant migration into the maxillary sinus. The combination of thorough assessment, meticulous planning, and the use of specialized surgical techniques is essential to ensure patient safety and the success of the rehabilitation.

4. Conclusion

Although implant displacement occurs unexpectedly, the dental surgeon must be prepared to manage this complication. In this context, it is recommended that the implant be removed from the maxillary sinus as soon as possible, preferably before the onset of associated symptoms. Therefore, it can be concluded that the Caldwell-Luc technique proved to be effective for the removal of the displaced implant, ensuring success in both the rehabilitation process and the patient's postoperative follow-up.

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Conflicts of Interest: None.

Supplementary Materials: None.

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