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Removal and Immediate Replacement of Malpositioned Dental Implant in the Maxillary Anterior Region.

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Abstract

Though, Implant Surgery has reported a high success rate, failure can occur as a consequence of infection, impaired healing due to surgical trauma, excessive biomechanical stress, poor surgical technique, poor bone quality, traumatic loading conditions and improper positioning. It has been shown that 10% of all implants are malpositioned and have an inadequate prosthetic position. This causes technical and biological complications relating to occlusal forces, unfavorable aesthetic outcomes and inadequate oral hygiene maintenance and eventually implant failure.

Several techniques are employed for the removal of failed implants from reverse torque, block resection, trephine osteotomy, piezosurgery to the laser. The article discusses these popular techniques with an emphasis on the removal of an implant in the maxillary anterior region using the trephine technique.

Keywords *- dental implants, implant removal, implant failure, malpositioned dental implants.*

Introduction

Periodontitis, dental caries and trauma are the main causes for tooth loss. In the past decades, dental implants have become a great additional treatment option to replace missing teeth. An ideal prosthesis design may reduce the risk of technical and biological complications and allow for adequate oral hygiene maintenance. Moreover, an accurate restorative-driven implant placement offers important long-term advantages, allowing for favorable aesthetics and function as well as optimal occlusion and masticatory forces distribution. **[**1**]** Respective treatment concepts have reported high success rates of 97% and 75% over 10 years.

Although presenting high and acceptable survival rates **[**4**]**, failure can occur as a consequence of infection (peri-implantitis), impaired healing due to surgical trauma, excessive biomechanical stress or improper positioning. Other reasons for implant failures are poor surgical technique, poor bone quality and traumatic loading conditions.

This article will be dealing with a malpositioned implant. In addition, various techniques that have been described to remove a failed dental implant that include reverse torque, block resection, buccal bone osteotomy, trephine osteotomy, and piezosurgery will also be discussed. **[**5**]**

Surgical Malpositioned implants

A surgical malpositioned implant is an incorrectly positioned implant, that may be in location or inclination, which may impede an adequate prosthetic rehabilitation. Such problems are mainly caused by poor treatment planning or an inaccurate surgical execution. According to Becktor, Isaksson & Sennerby, approximately 10% of all implants show a prosthetically inadequate position. It means that such implants cannot even be adequately loaded.**[**6**]** As a result, several biomechanical problems due to a wrong occlusal force axis, an unacceptable aesthetic appearance, or difficulties in maintaining proper hygiene may occur.**[**7**]**

Therefore, this situation is nothing less than a failure of the implant and may require removal and replacement at a better position sometimes requiring an adjuvant procedure like soft tissue grafting or GBR. Having said that, let us discuss the various popular techniques for the removal of implants.

Techniques for Removal of Malpositioned Implants:

Trephine burs

They are widely considered as a standard approach and therefore still represent a very common method to remove implants. Most trephine burs are characterized by cylindrical blades. These burs exist in

different diameters and should be chosen being only a little broader than the actual implant diameter in order to remove as little as possible of the remaining bone. A cutting speed ranging between 1,200 and 1,500 rpm is recommended with maximal water cooling in order to avoid any overheating and thermal necrosis. It is important to assess the local anatomy before attempting to remove the implant with a trephine. If needed cone-beam radiology should be performed in high-risk anatomical areas. Certain complications that may arise such as fractures of the mandible and osteomyelitis have been described in case reports. **[**8**]**

Deeb et al. described a new approach in trephine bur removal which is the use of CAD/CAM generated surgical guides. It can be used for a guided explanation as well. The authors concluded that a 3D-guided process might allow a more accurate and less invasive surgery. **[**9**]**

Counter-torque ratchet technique (CTRT)

In the counter-torque ratchet technique, the ratchet is inserted into the implant and counter torqued in a counter-clockwise direction to remove the implant. It is reported to represent the least traumatic technique in order to remove failed implants. The application of this method allows keeping the surrounding bone undamaged.**[**10**]**

Two different CTRT modalities have been described so far: The first option requires an intact implant connection in order to loosen the fixture. Hereby, a fitting abutment or engaging extraction tool is placed in or on the implant. The removal is done through an anti-clockwise torque. **[**11**]**

The second option is the reverse screw technique (RST), which finds its application mainly in the removal of fractured and damaged implants. In the latter, a screw is driven anti-clockwise into the damaged implant to get a grip. Afterward, counter-torque-wise force is applied to remove the unit as a whole. Force is applied until the resistance drops, and the implant can be easily unscrewed without force. **[**10**]** If the counter-torque exceeded the 200 Ncm limit, trephine bur was used to cut into the first 3–4 mm of implant-bone contact. The implant explanation was then continued with the torque wrench. It is seen that an implant with an internal connection is easier to be removed than implants with external connections. **[**12**]**

Piezosurgery

As compared with trephine burs, this method allows for a less traumatic surgical approach for the removal of the failed implants. The devices operate at frequencies ranging from 24.000 to 29.500 Hz, which apparently allows for precise and selective cutting to conserve sensitive structures.**[**13**]**

The principle of piezosurgery is to destroy the implant-bone interface by ultrasonic waves. The osteotomy is performed as close as possible to the implant surface to remove only the minimum required amount of bone. The method was mostly described in combination with fractured and malpositioned implants. An improved postoperative bone healing with this method in comparison to trephine bur surgery has been observed.[10]

Laser surgery

Smith & Rose described the removal of a single dental implant using an Er,Cr: YSGG-laser. The laser generates pulsed photons, which when absorbed by water leads to micro explosions and destruction on the surrounding target tissue The procedure was described as similar to piezo-surgical interventions because circumferential destruction of the bone-implant interface by the laser device is achieved. The procedure is less invasive and hence gives clean cuts, less bone destruction, less thermal necrosis and optimal hemostatic control.[14] The only disadvantage of laser surgery is that it is time-consuming as compared to trephine burs which is more than two times faster (17.2 vs. 44.1 s).[15]

Electrosurgery

The idea behind this approach is to cause a distinct thermo-necrosis at the bone-implant interface in order to be able to remove the implant at a low counterclockwise torque after Osseo disintegration and therefore be as mechanically atraumatic as possible. Osteonecrosis due to thermal reasons is a condition that results in local bone death by loss of blood supply and primary or secondary death of bone cells. [16] Cunliffe & Barclay, applied an ultra-high frequency monopolar electrosurgery unit for 15 s in a malpositioned implant. One week later, the implant could be removed with a counter torque ratchet at 30 N.[17]

Main disadvantage is this technique is the development of mucosal and extended osteonecrosis. Temperatures above 56°C to 70°C are considered harmful to bone tissues, mainly also because of the transformation of alkaline phosphatase.[18]A recent study reported 47°C as a critical temperature for the development of thermal osteonecrosis in bone. Osteonecrosis due to thermal reasons is a condition that results in local bone death by loss of blood supply and death of bone cells.[16]

Case Report

A 35-year-old male came to the Department of Dental Surgery at Fortis Memorial Research Institute, Gurugram, India for prosthetic rehabilitation of his previously placed implants in the maxillary anterior region. On examination, perforation of the mucoperiosteum with exposure of the implant cover screw

and the implant threads were seen, probing depth of 2mm seen in tooth # 11and 3mm seen in tooth # 2. However, there was no sign of any active infection. Further, a cone beam CT scan was performed which showed abnormal angulation and labial bone loss in both #11,21.

According to Kim et al, given the premise of sufficient bone quantity and quality in the absence of infection after explanation, a new implant can be placed in the same session.

However, the primary stability of the replacement implant has to be carefully considered. Furthermore, according to literature, there is no evidence, which might pinpoint any statistical difference in outcomes when comparing immediate or late performed "reimplantation".**[**20**]** Further, the successor implant should be chosen with a rough surface and in a relatively large size in order to gain adequate primary stability, implants with rough surfaces and wider diameters may be advantageous for the overall survival and success rate. The defect should be subjected to grafting wherever necessary. **[**20**]**

Thus, considering the above studies it was decided to remove the implants and simultaneous reimplantation of a larger implant with bone grafting and PRF membrane.

Figure 1

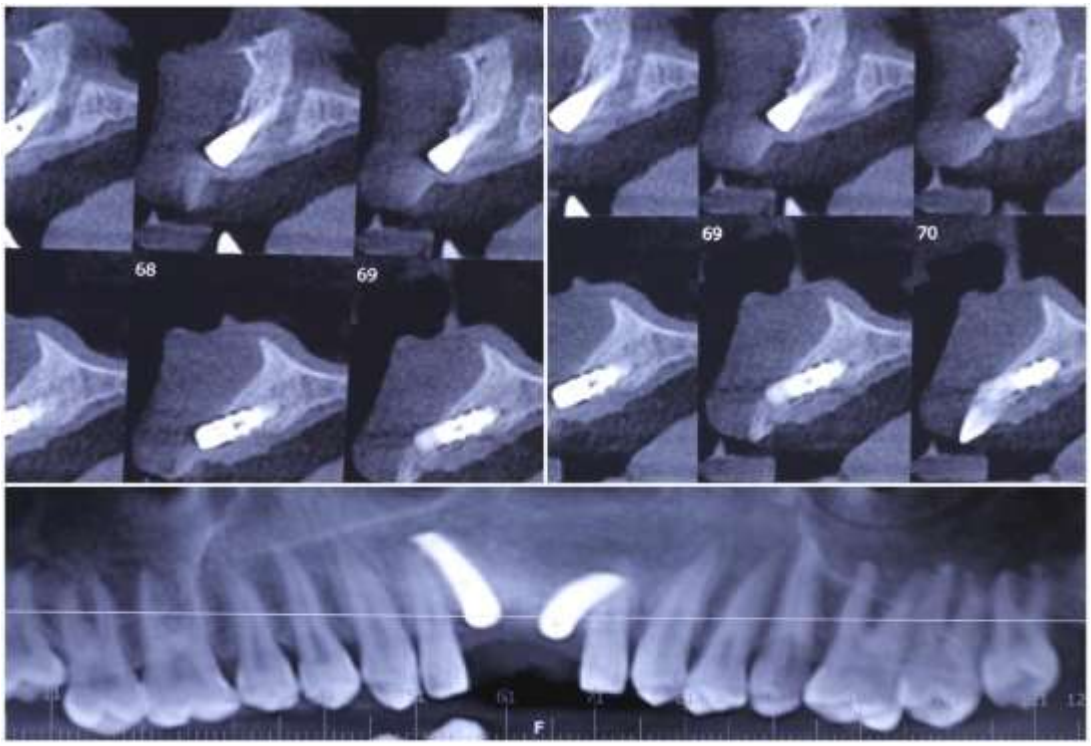

Figure 2

Figure 3

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Figure 8

Figure 9

Figure 10

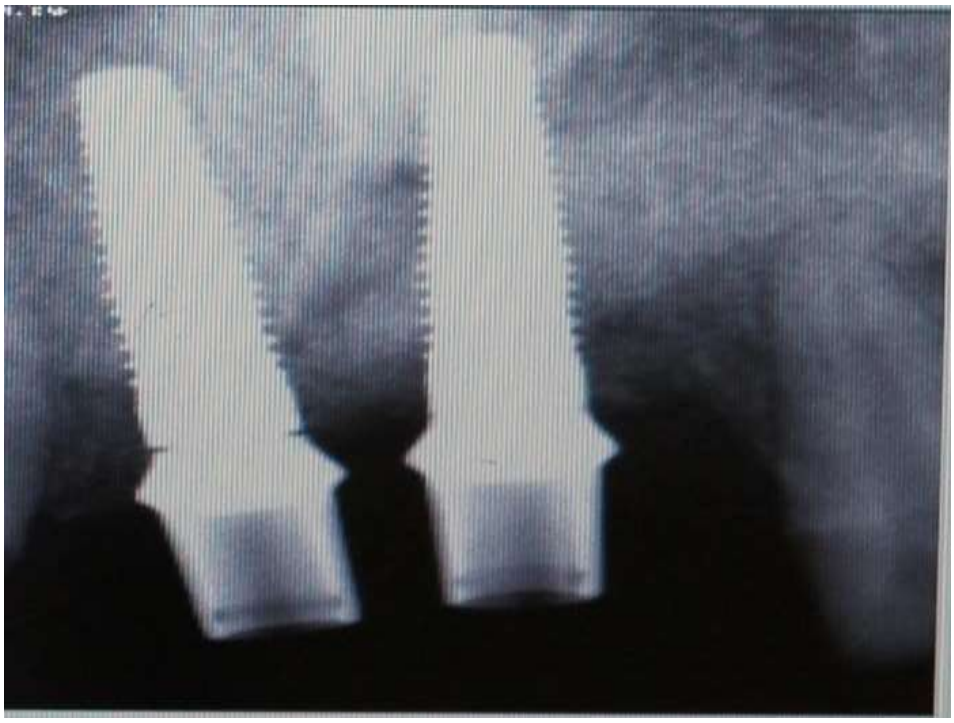

Figure 11

Figure 12

Surgical Procedure

Under local anesthesia, crestal incision along with two oblique vertical releasing incisions placed, carefully a trapezoid mucoperiosteal flap was raised up to the anterior nasal spine. A trephine with a slightly larger diameter than the implant was used to drill under corpus irrigation up to ¾ depth of the implant length. Thereafter, a Coupland elevator was used to luxate and elevate the failed implant. It should be noted that minimum force is used at the time of elevation to prevent damage to the surrounding bone. The bone was curetted, irrigated, and disinfected with 0.2% chlorhexidine gluconate.

New Implant site Osteotomy was done at the desired angle and depth, implants were placed with good primary stability and a final torque of 40Ncm was achieved. Periosteal scoring was done to facilitate tension-free closure of the flap.

An alloplastic bone substitute granule mixed with PRP is placed on the labial aspect of the implant to cover the bone defect and to increase the labial bone volume. Following meticulous placement and packing, the bone graft was covered by a PRF membrane. The flap was closed using 5-0 Prolene and 4-0 undyed Vicryl sutures achieving a tension-free closure. A pressure dressing was placed, the patient was put on a course of antibiotics and NSAID.

One month after the surgery, good soft tissue healing was seen. Nonresorbable sutures were removed and the patient was recalled after 5 months for second-stage surgery.

Six months X-ray shows the good bone formation and osseointegration of the implants; second stage surgery was performed and prosthetic rehabilitation using zirconia crowns was done.

Discussion

Despite the high quality of endosseous titanium implants and high success rate, failures too sometimes occur. It could be due to infection (peri-implantitis), impaired healing due to surgical trauma, [21] excessive biomechanical stress, [22] or improper positioning[6]. Other attributes to implant failures are poor surgical technique, poor bone quality and traumatic loading conditions.

If removal of the implant is the only solution, before removal, clinicians need to assess the patient's intra-oral condition, the proximity of the oral structures, the level of the surgeon's skill and experience. The detailed treatment plan for delayed or immediate reinstallation should be discussed with the patient. It is critical to provide predictable explanation methods with minimum damage for the patients, which may directly influence the subsequent re-treatment, healing time and the final prosthetic restoration.

The choice of the implant explantation technique mainly depends on two aspects: the neighboring tooth/implant proximity and the cortical bone thickness around the failing implant. [23]. In this case, the implants were away from the adjacent teeth, and they were fully Osseointegrated in the surrounding bone. The author uses the trephine technique as it is faster than the other techniques. [15] The alveolar bone loss around the treatment site can be minimized by using the trephine bur that has a similar or slightly larger diameter to the fixture. It is to be noted that GBR should be considered in the fixture removal sockets in order to allow reimplantation later or at the same time depending on the presence or absence of infection. Also, alveolar bone drilling must be conducted under saline irrigation with care in order to minimize surrounding alveolar bone damage. Primary stability is critical at the time of immediate reimplantation for the success of the implant, an insufficient primary stability causes poor healing related to the early loss of the implant. [24]

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