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Posterior immediate maxillary implants placement and peri-implant FGG – a case report

Natychmiastowe wszczepianie implantów w bocznym odcinku szczęki z przeszczepem FGG – opis przypadku

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Summary

The clinical report describes an immediate implant placement after atraumatic extraction of a maxillary first molar procedure, mentioning specific requirements to achieve this surgical step.

The tooth was extracted with minimum trauma to adjacent tissues, then a flap was raised to immediately place an implant in the site of the removed molar. Three months after extraction, a peri-implant keratinized gingiva augmentation was indicated to ameliorate the implant function and guarantee its long-term health.

During a two-year –follow-up, no clinical or radiographic complications were exhibited. A minimized bone reduction was observed around the implant and osseointegration was satisfactory.

The maxillary molar replacement with an immediate implant is a reliable treatment option offering the advantages of a reduced bone loss, shorter treatment duration and a facilitated procedure. However, this remains a meticulous intervention where particular guidelines should be respected. Further intervention may be needed as soft tissue grafting to enhance the result.

Streszczenie

W raporcie klinicznym opisano natychmiastowe wszczepienie implantu po atraumatycznej ekstrakcji pierwszego zęba trzonowego szczęki, omawiając specyficzne wymagania dotyczące przeprowadzenia tego zabiegu.

Ząb został usunięty z minimalnym urazem tkanek sąsiednich, a następnie uniesiono płat, aby natychmiast umieścić implant w miejscu usuniętego zęba trzonowego. Trzy miesiące po ekstrakcji zalecono augmentację dziąsła zrogowaciałego wokół implantu w celu poprawy funkcji implantu i zagwarantowania jego długotrwałego funkcjonowania.

W ciągu dwóch lat obserwacji nie zaobserwowano żadnych powikłań klinicznych ani radiologicznych. Zaobserwowano minimalną redukcję kości wokół implantu i zadowalającą osteointegrację.

Wymiana zęba trzonowego szczęki za pomocą natychmiastowego implantu jest rzetelną opcją leczenia, oferującą korzyści w postaci mniejszej utraty kości, skróconego czasu leczenia i ułatwionego zabiegu. Pozostaje jednak zabiegiem wymagającym precyzji, w którym należy przestrzegać określonych wytycznych. Może wymagać dalszej interwencji, jak przeszczep tkanek miękkich, w celu poprawy wyniku leczenia.

Introduction

It is known that the mean number of lost teeth increases with age. Elderly patients aged 60 years and over may have lost several teeth and need prosthetic rehabilitation.[1] According to literature, the loss percentage of maxillary molars ranges from 7.3% to 14.7% among a 40- to 60-year-old population.[2]

The replacement of lost teeth is one of the chief objectives in fixed prosthodontics. To prosthetically manage one or several maxillary molar losses, different treatment options are available. From the least to the most invasive ones, restorations range from implant-supported prostheses to fixed partial dentures, involving the preparation of teeth bordering the edentulous ridge. To respect minimally invasive imperatives, implants are selected. However, it is a long-lasting procedure, with various interventions and prolonged healing periods.

After tooth extraction, three to six months are required for bone healing to be able to place the implant. However, recent studies have demonstrated that considerable bone loss in both vertical (35%) and horizontal (65%) directions occurs during these first six months of healing, besides adjacent teeth drifting. The bone resorption continues in a steady way up to twelve months after tooth extraction. This makes the prosthetic treatment more challenging.[3]

To shorten the waiting period for implant placement, alternatives focused on three main approaches: immediate loading, modifying the implant surface for faster healing, or immediate implantation.[4]

Immediate implants were first introduced by Schulte and Heimke in 1976. A clinical report and histological studies were also conducted to confirm the reliability of this procedure.[5]

Since its introduction, the immediate implant approach has been extensively considered. Available data show that it is a successful procedure with several benefits; however, a good case selection is required, and meticulous clinical steps should be followed.[1] A study published by Figazzotto in the "Journal of Periodontology" in 2008, where a total of 391 rough-surface implants were placed in 386 patients at the time of maxillary molar extraction. A follow-up of up to 75 months with a mean of 40.3 months was conducted. As a result, a cumulative survival rate of 99.5% was noted.[6] A literature review published in 2015 reported a survival rate of 90% of immediate implants placed in maxillary molar sites, which is similar to delayed implants.[7] The survival rate, according to a more recent systematic review published in 2020, is 96.6% after one year follow-up, and the success rate was 93.3%.

Literature reviews on the topic stress that the immediate placement of implants in fresh sockets can help reduce dimensional bone alterations that would occur in the first three to six months after extraction, can optimize the position of the implant since it is guided with the extracted tooth axis, and enhance the soft tissue architecture since they remain supported with the preserved bone. It is also worth mentioning the important psychological advantage of this technique, allowing the patient to have his extracted tooth immediately replaced.[4] An extra advantage for the particular maxillary posterior region is that implant insertion can occur before the pneumatization phenomenon occurs. The pneumatization is a physiological increase in sinus volume due to teeth loosening.[8]

Case presentation

A 65-year-old female patient presented at our department with a chief complaint of fractured maxillary posterior teeth. The teeth constituted the support of a four-unit partial fixed denture (FPD), performed ten years previously and lost three months earlier. The patient complained of chewing difficulties, since her right lower

Fig. 1. Intra-oral view at the first session.

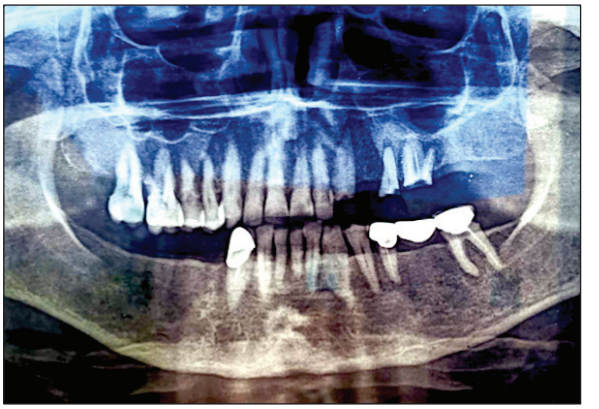

Fig. 2. Pre-operative panoramic radiograph.

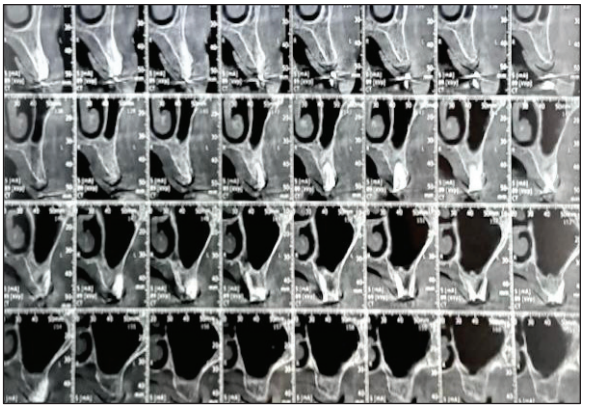

Fig. 3. Pre-operative CBCT showing the coronal sections.

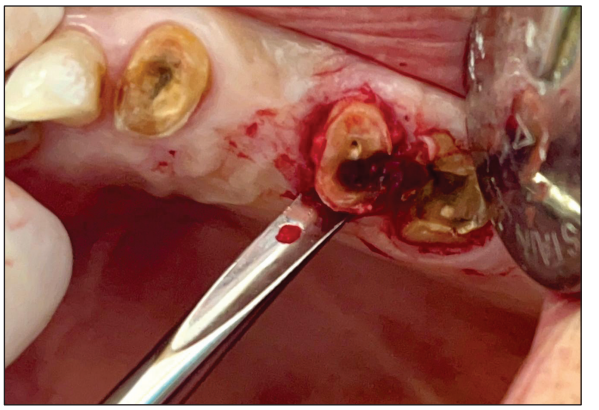

Fig. 4. Atraumatic extraction of tooth 25.

mandibular site was also edentulous. The patient was medically fit to undergo surgery.

The clinical examination (Fig. 1) showed satisfactory oral hygiene. The following were noted : the presence of a fractured tooth 23, an edentulous site of tooth 24, which had been extracted 10 years earlier and root stumps of teeth 25 and 26. A three-unit FPD was found in the opposing 35-36 and 37 sites.

Radiographic examination (Fig. 2) showed that tooth 23 was not root canal treated but had a satisfactory radiographic crown-to-root ratio (RC/RR < 1). Teeth 25 and 26 were endodontically treated albeit inadequately, and periapical images related to both teeth.

After thorough analysis of clinical and radiographic data, it was decided that tooth 23 was restorable after endodontic treatment, unlike teeth 25 and 26, which had to be extracted and then replaced.

The treatment options were:

- Extract teeth 25 and 26, then replace them with a removable partial denture (RPD),
- Extract teeth 25 and 26 and replace them with implant-supported fixed restorations after six months of bone healing,
- Extract teeth 25 and 26 and replace them with implant-supported fixed restorations, with immediate implant placement.

After a detailed discussion of the risks, benefits, and costs of each treatment option, the patient opted for implant-supported fixed restorations.

A CBCT was then ordered to evaluate the available bone volume.

The CBCT (Fig. 3) shows type 3 bone

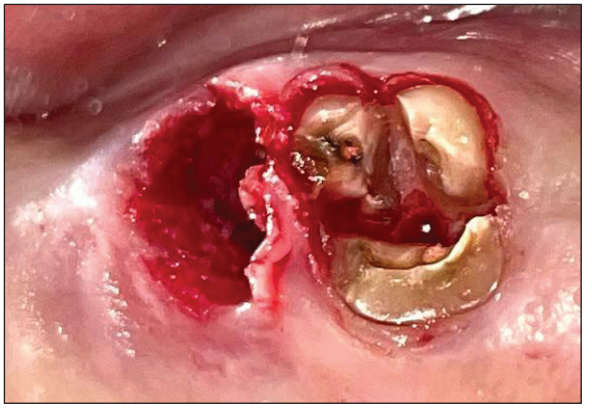

Fig. 5. The sectioning of roots of tooth 26.

according to Lekholm and Zarb classification, sufficient bone volume in the mesio-distal and bucco-lingual directions, an intact and thick buccal cortical at the sites of teeth 24 and 25, and a bone height of more than 3 mm beyond the teeth apices ensuring primary stability.

This situation was favourable for an immediate placement of implants after the extraction of teeth 25 and 26. A delayed implant was also planned in the site of tooth 24 (already extracted).

The patient was informed that the immediate implant placement procedure depends on the extraction conditions ; if a problem were encountered during this protocol like buccal cortical fracture, root ankylosis or difficulties to meticulous site disinfection, the delayed approach would be proposed.

The extraction procedure

Amoxicillin (500 mg every 8 hours) was prescribed, beginning 24 hours prior to surgery and maintained for seven days. A 0.2% chlorhexidine solution was also given to the patient as a mouthwash for oral disinfection.

The extraction of teeth 25 and 26 was performed atraumatically, using an elevator to luxate teeth without socket enlargement. When a significant mobility was achieved, force was used to remove the root in a rotational movement (Fig. 4). As for tooth 26, the three roots were sectioned and removed separately to keep the inter-radicular septum (IRS) intact and avoid the buccal bony plate fracture (Fig. 5).

Once the tooth was removed, the socket was then meticulously debrided with curettes and irrigated with sterile saline to remove the granulation tissue.

At the time of implant placement, tooth 23 was undergoing endodontic treatment, planned for completion after the surgical phase.

The implant placement

Then, a full-thickness flap was raised (Fig. 6), and osteotomy preparation commenced. A dentium superline internal hex implant (3.6*10 mm) was placed at the site of 24. A larger diameter Dentium superline internal hex implant (4.5*10 mm) was placed in the socket of the 25, and oriented toward the palatal plate, 1 mm subcrestally.

Fig. 6. A full-thickness flap is raised.

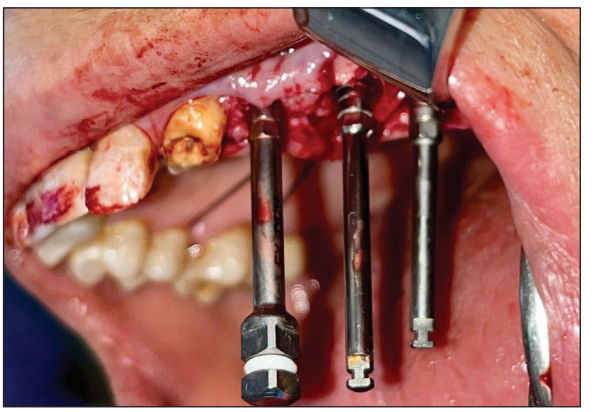

Fig. 7. The parallelism check.

Fig. 8. The surrounding gaps filled with BioOss.

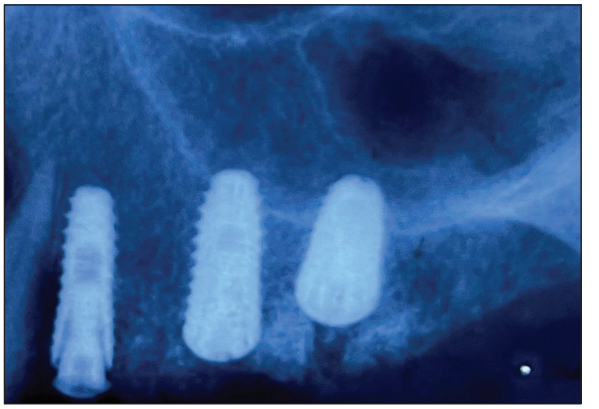

Fig. 9. Post-surgical periapical radiograph.

At the site of 26, a Dentium superline internal hex implant (5*8 mm) was placed in the center of the IRS, 3 mm away from the adjacent implant and & mm subcrestally.

After every drilling, the parallelism between the implants was checked with parallel pins (Fig. 7).

All the implants placed showed good primary stability with an insertion torque of 25 N/cm.

The cover screws were placed, and the gaps surrounding the implants #25, #26 in the socket were filled with 0.5 g of BioOss (Fig. 8).

The last step was to close the wound, using horizontal mattress sutures, then interrupted sutures were placed to coat the flap edges. A post-surgical radiograph was taken (Fig. 9), and post-operative instructions were given to the patient. Four months later, the patient was recalled to check the osseointegration and place the healing abutments.

After healing, it was noticed that the fixed gingival tissue around teeth 25 and 26 was reduced (Fig. 10).

Therefore, a free gingival graft (FGG) was indicated to increase the width and thickness of the gingiva in this area.

A splint was first applied prior to the surgical procedure to protect the donor site on the hard palate from which the graft was collected. After that, measurements of the buccal peri-implant site were taken, and a template was made according to these measurements.

Fig. 10. The gingival tissue around teeth 25 and 26 was reduced.

A total thickness flap was raised in the receptor site (Fig. 11). The donor site was prepared with an incision in the region of the hard palate corresponding to the pattern already prepared (Fig. 12). The graft was removed and then inserted into the receptor site. Horizontal and simple mattress sutures were then made to coapt the edges (Fig. 13).

A month later, the patient was recalled. Both the receptor and donor sites showed good tissue healing and satisfactory emergence profiles.

The prosthetic procedure

Fifteen days later, after gingival healing (Fig. 14), the prosthetic procedure was started. A modified pick-up impression was performed. Dental floss was placed to splint the three impression copings. An auto-polymerizing

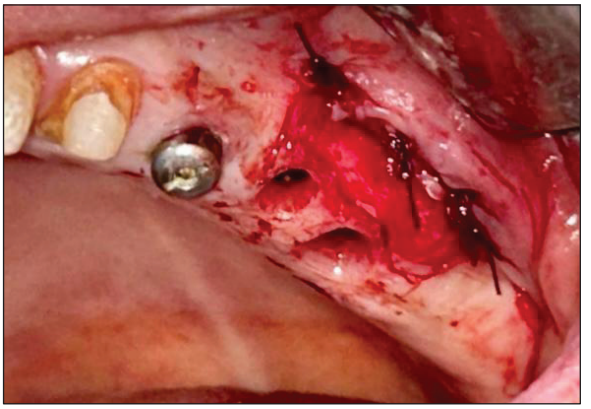

Fig. 11. A total thickness flap was raised in the receptor site.

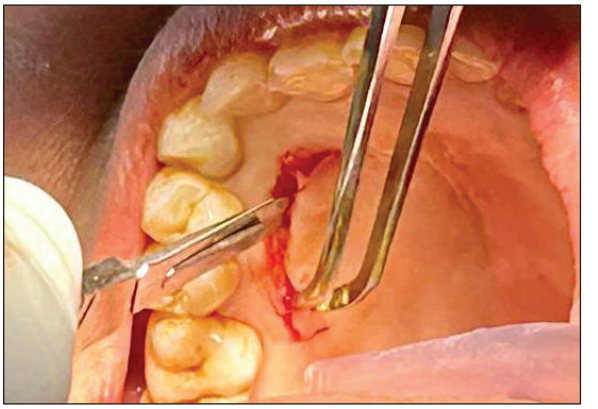

Fig. 12. Preparation of the donor site.

Fig. 13. Simple mattress sutures were performed.

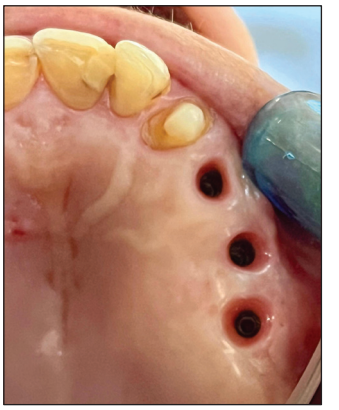

Fig. 14. Gingival healing.

Fig. 15. Definitive metal ceramic crowns were placed.

acrylic resin (Duralay) was placed by little amount to cover the dental floss between the three copings, without interference with the gingiva.

One week later, definitive metal ceramic crowns were placed (Fig. 15).

Discussion

When a missing tooth needs to be replaced with an implant-supported restoration, different treatment protocols can be used. One of the most important parameters to consider is the timing of implant placement according to the tooth extraction. In 2004, Hammerle proposed a classification system concerning the time of placement based on post-extraction morphological, histological, and dimensional changes, including four categories:

1. Immediate extraction/implant placement: The implant is placed on the same day as the extraction.
2. Early implant placement with healing of soft tissue:
   The implant is placed four to eight weeks

after extraction to allow the supra-alveolar soft tissue to heal.

3. Early implant placement with partial bone healing:
   The implant is placed twelve to sixteen weeks post-extraction, enabling initial bone healing.
4. Delayed implantation protocol:
   The implant is placed at six months or later after extraction to achieve complete bone healing.[9]

According to literature, the survival rate for immediately, early, delayed, or late placed implants is similar, amounting to approximately 95%. Even though shortening the surgical procedure with immediate or early implants can have psychological advantages for patients, added to anatomical advantages related to less bone resorption after teeth extraction, this protocol is challenging and has rigorous indications.[9]

Therefore, a good case selection should be made. In this clinical case, since the patient was elderly, the authors opted for immediate implants in order to reduce the duration of the treatment and minimize the surgical interventions.

As for the site, the clinical and radiographic examinations showed good bone and soft tissue quality to support implants. Most researchers concluded that the ideal extraction site for immediate implant placement was one with slight or no bone loss around the tooth, with no severe buccal or circumferential bone defect or wall loss. It is also recommended to have at least 3 mm of bone beyond the teeth apices and no less than 10 mm of bone height to guarantee the primary stability of the implant.[4]

Regarding the periapical lesions associated with both teeth, they were asymptomatic and chronic. Based on clinical observations, Novaes and Novaes reported that periapical lesions might not contraindicate the immediate implant placement if the socket was debrided and disinfected effectively. Implants immediately placed in sites with chronic periapical lesions can still achieve a successful outcome like uninfected sites.[1]

A systematic review published in 2010 by Jonathan Waasdorp and Cyril Evian, stressed that implants could be immediately placed into sites with periapical infections. However, these sites must be thoroughly debrided prior to placement. Then, a guided bone regeneration should be performed to fill the bone–implant gap and/or socket deficiencies.[10]

Another systematic review and meta-analysis conducted by Haida Chen et al. in 2018 showed that immediate implant placement into infected sites and non-infected sites in the aesthetic zone had similar survival rates (97.6% vs 98.4%), also no statistically significant differences were found in bone level changes or in gingiva level changes.[1]

It should be mentioned that several anatomical parameters should be considered during clinical examination or following teeth extraction to make sure the immediate implant placement is indicated: the first parameter is the alveolar bone height (ABH), which can be measured on CBCT. The ABH classification is:

- Grade A: ABH>8.0 mm; sufficient to contain the fixture in the vertical dimension,
- Grade B: 6.0 mm≤ABH≤8.0 mm; may or may not require socket lifting,
- Grade C: ABH<6.0 mm; insufficient ABH, socket lifting is mandatory. (Guidance and rationale for the immediate implant placement in the maxillary molar)

In this clinical case, 13 mm of bone height was measured. A sinus elevation can also be indicated if the ABH is insufficient.[11]

The second parameter is the IRS anatomy, which is first defined on CBCT, then clinically checked after tooth extraction. The IRS classification according to its anatomy is as follows:

- Type I: The interradicular septum can support and integrate well with the implant.

Bone grafting is not mandatory.

- Type II: The interradicular septum support for the implant is available but weak; bone grafting is required for primary stability of the implant fixture.
- Type III: The interradicular septum bone is absent to provide primary stability within the socket, and fixture stabilization only depends on the socket wall. In this type, a wide implant diameter can replace most of the extraction socket.[12]

The patient presented Type II IRS bone, which explains the need for bone grafting as mentioned in the surgical protocol.

Factors such as teeth ankylosis, buccal bony plate fracture, or socket enlargement during the tooth extraction or IRS fracture can make the immediate implant placement unpredictable.[4] Therefore, many difficulties should be managed during the surgical procedure.

The key parameter for a predictable outcome of an immediately placed implant in the maxillary molar region is an atraumatic extraction, based on root section, slight mesio-distal movements and, in some cases, a raised flap to easily control the buccal plate during extraction.[1]

The position of the implant is dictated by aesthetic and functional requirements in all three spatial dimensions

Mesio-distally

The implant should be positioned at a distance of between 1.5 and 2 mm from the adjacent teeth and at least 3 mm from the adjacent implant.

Bucco-lingually

The placement of the implant is frequently shifted towards the palatal side in the maxilla due to the frequently very thin buccal plate and the necessity to preserve a minimum of 2 mm of bone barrier on the buccal side.

For multi-rooted teeth, insertion into the interradicular bone or positioning into the palatal alveolar socket is also possible (if we have Type III IRS).

Corono-apically

In general, immediate implants should be placed 1 mm subcrestally to account for vertical bone height resorption (approximately 0.5–1.0 mm).

If the buccal or lingual plates of bone are thin, the implants should be placed at a more subcrestal position, given the potential for an increased degree of bone resorption.

As a general rule, platforms of immediate implants should be placed at a depth of 2 to 3 mm below the gingival margin.[13]

After implant placement, a gap between the surface of the implant and the interior of the bone walls is often observed. In the treatment of intact sockets, the size of the gap requires special attention. Studies have reported that the size of the gap can vary. It has been reported that if the gap is 1.25 mm mid-facial and/or 2.25 mm on the mesial, distal, and mid-lingual, a bone graft, membrane, or combination of both may be needed.[1]

Several studies have suggested that when the gap is greater than 2 mm, a bone graft, membrane, or combination of both may be needed to facilitate bone healing. Smaller distances could heal spontaneously.

Bovine bone matrix and collagen membrane are the most common grafting materials.

In the clinical outcomes of the International Team of Implantology consensus, an extensive review provided strong evidence that bone augmentation following immediate placement reduces horizontal resorption on the facial bone; however, these augmentation procedures appear not to influence vertical resorption on the facial bone.[14,15]

At the end of surgery, a tension-free primary wound closure is achieved with resorbable or non-resorbable suture material to maintain the

grafted buccal bone convexity. For this, the flap must be released with an incision of the periosteum.[12]

In this case report, an FGG was needed to enhance the soft tissue thickness around the implants in the sites of teeth 25 and 26. Free gingival graft is a successful and predictable technique. This procedure can be performed previous to implant placement, during the second stage surgery for implants, or after placement of the final prosthesis (free gingival graft to increase keratinized mucosa after placing of mandibular fixed implant-supported prosthesis).[16] A prospective controlled randomized clinical study published in 2016 concluded that there was a significant gain in keratinized mucosa in the FGG group compared to controls at six, twelve and eighteen months.[17]

Conclusion

Even if most of the studies or conducted systematic reviews report a survival rate of immediately placed implants similar to the conventional delayed ones, it has to be stressed that this approach has several requirements that should be well considered. Added to the challenging surgical protocol and unpredictable feasibility of this technique, according to eventual difficulties that can be encountered during the procedure. Therefore, practitioners should practise good case selection, perform a meticulous clinical and radiographic examination, and be prepared for unpredictable conditions like necessity of bone or soft tissue graft or sinus elevation in the maxillary molar region.

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