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IMMEDIATE DENTOALVEOLAR RESTORATION (PAGES 10 AND 11)

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Publication date: 18 December 2017

A new perspective for immediate implant placement in compromised sockets

The purpose of this article is to present a step-by-step protocol for immediate dentoalveolar restoration (IDR). This technique (first put forward by Dr Martins Da Rosa^{3, 4}) offers a new approach for immediate implant placement and immediate provisionalisation following the extraction of a maxillary incisor in a compromised socket with severe damage to the buccal plate.

IDR aims to restore the bone defect while maintaining the gingival architecture and allowing implant placement and immediate loading in a single surgical procedure using a hybrid connective tissue and bone graft from the maxillary tuberosity. This article will also explore how IDR may benefit from the implementation of new technologies.

Introduction

Immediate implant placement in a fresh extraction socket has been well described. The protocol has shown very high success rates (similar to those placed in healed sites²) and is now considered highly predictable. However, the procedure can be extremely challenging in many clinical situations and is often rated either advanced or complex^{5, 6}.

The purpose of contemporary aesthetic dentistry is to achieve an inconspicuous reconstruction or replacement of missing teeth in a biomimetic fashion. The architecture of the reconstructed hard and soft tissues should therefore mimic nature as far as possible. Nevertheless, the reasons for tooth extraction and immediate implant placement – such as endodontic failure, advanced periodontal disease, trauma and root fracture – are frequently associated with severe alveolar bone resorption and soft tissue loss⁴. In cases involving extensive bone loss, immediate provisionalisation is contra-indicated because of the high aesthetic risk⁷.

Several procedures have been proposed to re-establish the compromised gingival and alveolar bone architecture, such as forced orthodontic eruption^{8, 9}, guided bone regeneration (GBR)^{10, 11}, and bone-block grafts with or without sub-epithelial connective tissue grafts^{12, 13}. All of these treatments can be used to treat bone defects before, during, or after tooth extraction, and in two or three surgical stages. Conversely, the possibility of reconstruction using grafting procedures and immediate restoration in a single operation has not been supported by several clinical studies¹⁴.

The IDR technique was developed to address extreme cases like those described above in a single surgery including: extraction of a failing tooth; implant placement; and provisionalisation using a bone reconstruction of the missing buccal plate without having to raise a flap. This technique introduced the use of a cortico-cancellous bone graft harvested from the maxillary tuberosity to restore buccal bone defects at the time of implant placement. Several treatments of cases involving minimal-to-severe bone loss in post-extraction sites have been reported¹⁴. In what follows, we will describe two clinical cases which we treated with IDR.

Case 1

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The first case involves a 49-year-old woman who was complaining about her central right maxillary incisor. The clinical examination showed a failing tooth 11. The tooth exhibited degree III mobility; localised periodontitis; pocket probing depth from 8 to 11mm; bleeding on probing; and suppuration (Figure 1). A CBCT cross-section revealed total loss of the buccal plate combined with a moderate defect in the palatal side (Figure 2).

Unfortunately, the extraction had to be performed, and it was decided that, five days prior to surgery, a prophylactic regimen of antibiotics (amoxicillin 1g twice a day) be prescribed as infection/abscess was present (as described in the original protocol).

Local anaesthesia (primacaine, adrenalin 1/100,000) was first administered. Then an intra-sulcular incision around the tooth being extracted was made using the Viper Microblade® (MJK instruments, Marseille, France) (Figure 3). The tooth was extracted without any structural damage, and the integrity of the remaining bone wall was preserved. A micro-curette was then used to remove the granulation tissue and the remaining periodontal connective tissue from the extracted socket.



Figure 1: Initial situation.

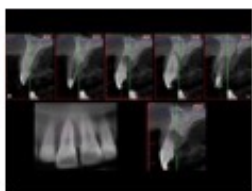


Figure 2: Pre-operative CBCT.



Figure 3: Viper blade in intrasulcular position.

The socket walls were probed in the apicocoronal and mesiodistal directions to assess the degree of bone damage and to confirm the anatomical shape of the defect (Figure 4). The implant was then placed in a suitable 3D position with a flapless procedure (Figure 5). The implant platform was placed 3mm apical to the cemento-enamel junction (CEJ) of the contralateral tooth. The implant was anchored to the palatal wall to provide enough space for buccal hard and soft tissue reconstruction (Figure 6). Implant position is a primary factor for achieving hard and soft tissue stability in IDR (as in any other technique).

Regardless of which tooth is replaced, a gap of approximately 3mm between the buccal implant surface and the outer buccal bone wall is required.

At this stage, a provisional crown was made. In this case we chose to use the extracted tooth, by removing the root and creating a 3mm (approx.) hole through its crown. The temporary abutment, made out of titanium, was tried to ensure it could be well seated on the implant connection without occlusal interference. A composite opaque resin (Ivoclar Vivadent) was then used to offset the shade of the metal beneath (Figure 7). The appearance of the temporary crown was optimised with light-polymerising composite resin (Tetric EvoCeram, Ivoclar Vivadent).



Figure 4: Probe assessment of bone defect.



Figure 5: Implant placement.



Figure 6: Palatal implant positioning with vestibular gap.



Figure 7: Provisional and temporary abutment adjustment.

The ideal emergence profile was worked out to obtain a concave contour for the trans-gingival part of the provisional crown (Figure 8). This provided space for better accommodation of the soft tissue and promoted a thicker and more stable gingival margin. Then, in order to harvest a connective tissue graft, the donor site was injected with anaesthetic from the base of the vestibule to the palatal portion of the maxillary tuberosity.

An initial mucoperiosteal incision was made at the maxillary tuberosity following the distal contour of the last molar. The flap was then divided starting at the buccal line angle, and directing the blade to the most posterior portion (Figure 10). Next, the bone was cut with a straight chisel (Schwert IDR Kit) along the relaxing incisions to define the bone fracture line (Figure 11). First, the chisel was placed perpendicular to the bone structure on the incision line; second, its angulation was adjusted to reach an axis parallel to the outer surface. It was gradually moved deeper, as far as the distal limit of the relaxing incisions, to obtain a uniform bone graft (Figure 12). Finally, the bone was fractured, taking care to maintain an epithelial pedicle to ensure better nutrition for the flap that would cover the donor site (Figure 13).



Figure 8: Provisional crown.



Figure 9: Insertion of the bone graft harvested from tuberosity.



Figure 10: Tuberosity access (courtesy M. Fadaneli).



Figure 11: Special chisels.



Figure 12: Using chisels for bone harvest from tuberosity (courtesy M. Fadaneli).



The bone graft was modelled to the anatomy of the defect as quickly as possible; the finer the adaptation the better (Figure 14). The bone portion of the graft must coincide with the implant platform. Its stability was improved with the use of additional cancellous bone harvested from the same donor site with a curved chisel. This allowed us to fill the gap between the graft and the exposed implant thread. This particulate bone was inserted and gently compacted between the medular part of the bone graft and the surface of the implant, with small increments and delicate compaction. The provisional crown was then screwed into place.

The three-week postoperative view showed a re-established bone and gingival architecture (Figure 15). A CBCT scan was taken to confirm the correct bone/graft integration and highlight any need for potential remodelling.

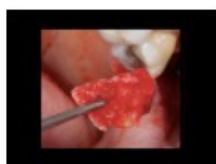


Figure 13: Bone harvesting (courtesy M. Fadaneli).



Figure 14: Post-operative situation: day 0.



Figure 15: Post-operative healing at three weeks.

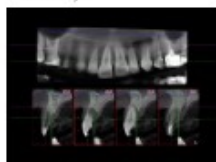
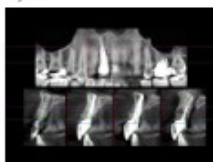


Figure 16: Comparative CBCT before and after treatment.



After six months, the final restoration was placed. The clinical situation exhibited no changes in the hard and soft tissue level, and showed healthy peri-implant soft tissue (Figures 17, 18).



Figure 17: Provisional situation six months post-operation.



Figure 18: Occlusal view of trans-mucosal healing.



Figure 19: Emergence profile.



Figure 17: Provisional situation six months post-operation.

Figure 18: Occlusal view of transmucosal healing.

Figure 19: Emergence profile.

The emergence profile looked natural, and the mesial and distal papillae were totally preserved (Figure 19). An impression was taken using a custom impression coping to achieve an exact registration of the healed tissue (Hinds) (Figure 20). A ceramic crown and titanium-zirconia abutment with an angulated screw channel (ASC Abutment, Nobel Biocare) was placed (Lab Integrale Prothèse France) (Figure 21).

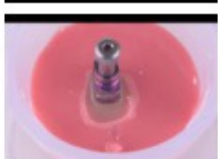


Figure 20: Impression with custom impression coping.

Harmonious integration of the prosthesis was accomplished; it looked natural and aesthetic. The pink and white aesthetic score was high, and the buccal convexity of the bone wall was similar to the adjacent tooth (Figures 22, 23). The one-year follow-up showed a stable situation.



Figure 21: Screw-retained restoration with ASC abutment (Nobel Biocare).

Figure 22: Occlusal view of the buccal wall with final restoration.

Figure 23: Final restoration, one year post-operation.

Case 2

The second case involves a 46-year-old patient with a root fracture on tooth 22. Initial examination showed discrete inflammation but no suppuration. A thick biotype was identified (Figure 24). From the CBCT examination, a buccal bone defect measuring around 7mm was discovered. Fortunately, this case was rated class 1 according to the root classification described by J. Kan. It was therefore decided to perform immediate dentoalveolar restoration (Figure 25).

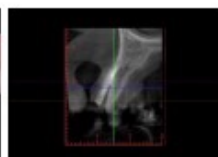


Figure 24: Case 2: initial situation.

Figure 25: CBCT.

Even if we practise classic techniques with success for many years, the inherent lack of accuracy, repeatability and simplicity naturally leads us to guided surgery. Indeed, many studies have shown the advantages of guided surgery, provided that certain criteria are met. In this case, our aim was to use a quicker, safer and more accurate alternative to free-hand positioning^{17, 18}. A 3D printed guide (MGUIDE, MIS implant) was used.

The 3D implant position was guided by the desired prosthetic outcome. The guide was then generated (Figure 26). This type of guide has a very large number of supports to ensure an optimal stability while being very open. The guide was printed and tags were positioned on occlusal, vestibular and palatal areas. Hence it felt securely fixed when placed in the mouth. This allowed the surgeon to keep the sensation of a routine surgery and ensure greater comfort (Figure 27).

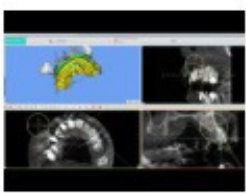


Figure 26: Implant planning.

Figure 27: Printed guide (Mguide, MIS).

The final implant position as well as the provisional crown and the definitive zirconia abutment (Figure 28) were decided and designed. According to the literature, the best way for maximum attachment and biocompatibility to be achieved is to place the final abutment on the day of surgery, without removing it^{19, 20} (Figure 29). The lab (MLAB, MIS) delivered a Ti-Base with a bonded zirconia abutment and milled provisional crown (Figure 30), with an ideal concave emergence profile (Figure 29).

After anaesthesia, an intra-sulcular incision around the tooth being extracted was made, using the Viper Microblade® (MJK instruments) (Figure 31). To perform an atraumatic extraction of the root, the Benex system (Dexter instruments) was used. It looks like a corkscrew. This instrument allowed us to extract the tooth without damaging soft and hard tissues (Figure 32).

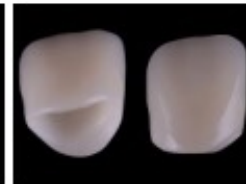
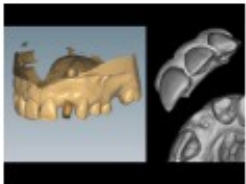


Figure 28: STL files and digital prosthetic project (Mlab, MIS).

Figure 29: Ti-Base, zirconia abutment and provisional crown.

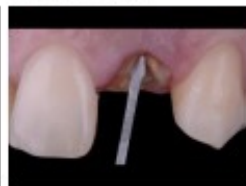


Figure 30: Natural emergence profile.

Figure 31: Viper blade in intra-sulcular position before extraction.

Figure 32: Root extraction with Benex system.

After the extraction, the defect was probed to evaluate its anatomy. In this case it reached a depth of around 6mm and width of 4mm (Figure 33). The guide was used with a 2mm pilot drill, and at the time of placement it confirmed correct positioning (Figure 34). We decided to use the IDR technique²¹. The technique was performed as described in Case 1 (Figure 35).

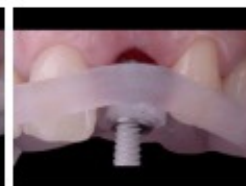


Figure 33: Probe assessment of bone defect.

Figure 34: Drill sequence and implant placement through the guide.



Figure 35: Modelling and insertion of the bone harvested from tuberosity.

Following implant placement and graft stabilisation, the final zirconia abutment was screwed on (Figure 36). A minor adjustment of the emergence profile of the temporary crown was made to enhance its compatibility with the site. A micro-concavity was created, and a sequence of polishing burs was applied. A hole was created through the crown to facilitate removal of excess cement (Figure 37). An ideal emergence profile, similar to the natural tooth, was achieved (Figure 38).



Figure 36: Final zirconia abutment.

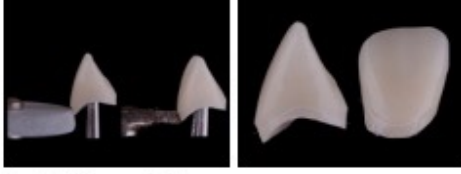


Figure 37: Enhancement of the emergence profile.



Figure 38: Natural emergence profile.

Immediate and ten-day postoperative assessments showed how effective this less traumatic approach could be, compared to conventional immediate implant placement combined with bone and soft tissue grafts (Figure 39). Two months later, the situation has remained stable, so it is possible to move on to the next step of the treatment plan: to treat the natural teeth to rebuild a natural smile (Figure 40).



Figure 39.1: Soft tissue position, day 0.

Figure 39.2: Soft tissue position, day 10.

Figure 40: Three months post-operation.

Discussion

The protocol for immediate loading of implants following tooth extraction – in cases without any damage to the tissue – is well established in the literature^{22, 23}. Maintenance of the bone and gingival architecture; aesthetic restoration; and reduction of the treatment duration are key factors which have been identified in the technique^{24, 25}.

However, extensive damage to the buccal bone may jeopardise the outcome of immediate implant placement and immediate provisionalisation. Treatment alternatives in cases involving alveolar defects are widely documented^{10, 26, 27}. Bone-block grafts or GBR represent viable solutions before or after delayed implant placement. But in cases of tooth loss along with the loss of support structures, there is a higher risk of unsatisfactory aesthetic outcomes. Moreover, such treatments include multiple surgeries and extended healing periods.

The IDR technique can offer significant improvements to the expected aesthetic result and treatment duration. The goal of this technique is to perform a number of procedures during a single surgical stage: the extraction of a failing tooth; implant placement; alveolar reconstruction; and provisionalisation. Furthermore, no flap needs to be raised to preserve the gingival architecture. Some studies^{5, 28} have shown that papilla-sparing incisions could minimise interproximal bone loss. A buccal bone wall of sufficient dimensions is a prerequisite for aesthetic soft tissue contours on the facial aspect^{5, 28}.

A recent study found the IDR technique to be a viable option for treating a compromised extraction socket in the aesthetic zone during an immediate single implant placement²⁹. However, the maxillary tuberosity also presents disadvantages, two of which are limited quantity and access.

Conclusion

This technique may be considered a viable and predictable option for placing implants in the aesthetic zone. Immediate loading of the implant in damaged fresh sockets, in conjunction with a bone graft from the tuberosity may be performed in a single procedure, enabling patients to avoid multiple surgical procedures. Surgical time can be further reduced if new technologies are used, such as: guided surgery protocols; printed models; and CAD/CAM restorations made before the day of surgery.

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