Abstract:

To achieve excellence when placing immediate implants, the diagnosis and planning of the case must be precise. There are 5 keys aspects to consider during the decision-making process, to help prevent blunders that can lead to difficult esthetic situations. The following are (I) the presence of a buccal plate, (II) primary stability, (III) implant design, (IV) filling of the gap between the buccal plate and the implant, and (V) tissue biotype.

Key words: immediate implants, buccal plate and immediate implants, aesthetic outcomes immediate implants

Introduction

Preserving soft and hard tissue once initiating an implant treatment is a crucial goal. The intention of placing immediate implants is to try to preserve tissue contour, dimension and also, decrease treatment time. Nevertheless, immediate implants require a precise case selection to achieve successful results. If conditions are not favourable, an alternative approach, like delayed placement, also has several advantages.

Moreover, appropriate surgical treatment, restorative procedures, and clinical experience are essential when performing immediate instalment of implants. Nevertheless, this technique has several advantages, like reducing treatment time, and number of interventions. Furthermore, it's a valuable and predictable option in terms of implant survival and hard and soft tissue remodelling. Thus, there are five key aspects to follow in placing an immediate implant in order to reach favourable outcomes, these are the five triangles (Figure 1): I the presence of a buccal plate; II primary stability where there is existing apical bone; III implant design; IV filling of the gap between the buccal plate and the implant or jumping distance; and V tissue biotype.

Clinical case

In 2011, a healthy 35 year old female was referred for implant evaluation for a failing upper left lateral incisor, where she previously had endodontic treatment and internal bleaching. The patient had major concerns about replacing the tooth, as it 'showed' when she smiled. She had good systemic health and no periodontal disease or gingival recession (Figure 2). Clinical evaluation, periapical radiographs and a CBCT were studied (Figure 3), and it was determined that she was a candidate for immediate implant placement, for she had no facial plate perforation or dehiscence. The procedure was explained to the patient, and she agreed to continue.

An atraumatic extraction was carried out under local anaesthesia, without elevating a flap, thus maintaining the buccal plate's periosteal blood supply. Sharp dissection of the supracrestal fibres was performed with a 15c scalpel blade, and the tooth was thereby extracted atraumatically. A fracture was visible along the extracted root (Figure 4), however, the walls of the alveolus demonstrated to be intact.

The socket was debrided, and an osteotomy was performed to place a tapered, platform-switched implant (3.4mm platform x 4mm diameter x 11.5mm Prevail T3, Biomet 3i) in a palatal position (Figure 5), to avoid dehiscence of the buccal plate. Since a gap was present between the implant and the labial plate, it was filled with small particle BioOss (Geistlich Pharma) (Figure 6). The mentioned xenograft was added not only into the gap, but also along the soft tissues, above the abutment interface, to ‘overbuild’ the soft tissue contour. Furthermore, because primary stability was achieved (35 Ncm), immediate provisionalisation was done in order to help protect the blood clot, graft particles, and soft tissue contours.

To carry out this procedure, a temporary abutment was screwed (Performance, Biomet 3i) and the crown

Figure 1.
of the patient’s extracted tooth was adapted to it. The crown was luted in place using flowable light-cured composite. It was then modified to have appropriate subgingival contours, by adding additional flowable composite extraorally, and then the provisional was cured and polished (Figure 7). Occlusion was checked to relieve the provisional from centric and lateral-protrusive contacts, and the patient was instructed to avoid chewing on the treated area for 3 months. The patient was prescribed with antibiotics one day prior to surgery, and following surgery, up to 7 days with the use of analgesics for 2–3 days.

After 6 months (Figure 8), impressions were taken and the patient’s lateral incisor was prosthetically rehabilitated. After 3 years, radiographic and clinical follow up demonstrated successful results, meeting aesthetic and functional requirements (Figure 9).

To carry out this procedure, the rule of the 5 triangles was followed. By using these guidelines, the clinician can obtain predictable, long-lasting aesthetic results.

Discussion

Atraumatic extraction is essential when wanting to place an immediate implant. Attempting this is recommended to provide the best healing conditions for the socket. It must be mentioned that, despite all efforts, trauma to the bundle bone of the socket cannot be avoided, since extracting a tooth implies severing the collagen fibres and blood vessels of the periodontal ligament. There are several techniques described to carry out an extraction atraumatically; Blus et al. state that with piezosurgery, extractions are less traumatic than with forceps, especially in caried teeth or brittle roots. Cosyn et al. perform their atraumatic extractions with periotomes with minimal mucoperiostial flap.

Extracting a tooth with or without elevating a flap, is a surgical aspect that must be considered. Covani et al. affirm that elevating a flap may cause alveolar bone resorption in the exposed area, whereas a flapless technique reduces patient discomfort, alveolar crest dimensional alterations, and better quality of the soft tissue around post-extraction sites. This reduces surgical trauma, and preserves the integrity of the vascular supply, because the periosteum is maintained.

Once the tooth is extracted, the stages of alveolar healing initiate. There are diverse numbers of proposed classifications of sockets after tooth extractions. Many of these can aid the clinician in the decision-making process in order to determine if their case is favourable for immediate implant placement or not. The proposed 5 keys to consider are important to take into account prior to tooth extraction, and what considerations to have during and after implant placement. This can guide the clinician to choose favourable cases and avoid complications.
I. Buccal Plate

The buccal bone is a critical aspect, and the first triangle, one has to take into account, in order to prevent esthetic complications. Grunder et al. suggests that the presence of a 2mm buccal plate is crucial to avoid soft tissue recession, and an inter-implant distance of 3mm should always be present in order to allow papilla formation. If the case requires installing an implant adjacent to a tooth, they state that a distance of 1.5 mm should be maintained to preserve bone tissue and fiber attachment and therefore, the loss of the interproximal papilla. Kois et al. also postulates that the implant position will dictate the emergence profile of the final restoration.

Choquet et al. states that papilla level is mostly related to the bone level adjacent to teeth, and more specifically to the bone crest. They determine that when a distance of 5mm or less between the contact point to the bony crest exists, the regeneration of papillae will be accomplished. Furthermore, palatal- placed implants provide more space to allow for the growth of horizontal soft tissue, that can later be manipulated in order to create a more adequate soft tissue profile.

Moreover, when there is lack of mesio-distal space, Vela et al. study the concept of platform switching: a discrepancy between the diameter of the implant platform and the abutment. They were able to determine that these implants can be as close as 1mm to teeth, and still maintain the interproximal bone peak. On the other hand, there is a minimum distance that implants should be separated in order to maintain a bone peak. With the use of the platform switching, implants can be placed as close as 1.5-3mm to each other, and still, obtain a greater coronal bone-to-implant contact, thus preserving the interproximal bone peak.

Following these parameters can help prevent perilous situations, especially when dealing with cases in the esthetic zone. Thus, when implant placement is to be done, there are two important aspects to consider, primary stability and the gap, the two following triangles.

II. Primary Stability

Placing an immediate implant is a delicate procedure, which requires not only the presence of the buccal plate, but also of sufficient bone apical to the extracted tooth’s alveolus. An approximate 2-4 mm of bone apical to the alveolus is necessary in order to have a greater possibility of obtaining a stable anchor, and thus obtain stability. This can be enhanced by the type of implant used, which is of a tapered design.

III. Implant Design

Different implant designs influence the biomechanics of the environment where an immediate implant is placed. As mentioned before, achieving primary stability at implant placement is essential when planning an immediate load technique. To enhance primary stability self-tapping implants were developed, which compress the alveolar bone as the implant is inserted.

Therefore, the overall design of an implant is ideally one that ensures good primary stability even when placed into bone of reduced quality and quantity.

As we analyzed before, when explaining the importance of the 3D position, a critical aspect is to place the implant palatally. Once the implant is successfully placed, there will be a gap present between the implant and the buccal plate. Filling this gap with biomaterial, is the fourth triangle.

IV. “Fill in the Gap”

After an extraction, it has been postulated that there is a horizontal resorption of bone dimension that amounts to 56% . Furthermore, when an implant is inserted immediately after a full-thickness flap extraction, there will be a void created between the buccal wall and the implant. The mentioned space, is suggested to be filled with a biomaterial for many reasons described by Araújo et al. They state that filling the gap with deproteinized bone mineral has beneficial outcomes: (i) hard tissue healing process is modified, (ii) additional hard tissue is present at the re entrance of the socket after a period of bone healing, (iii) soft tissue recession is prevented, and there is an (iv) improvement of the marginal bone-to-implant contact.

Therefore, the placement of xenogenic material in the void between the buccal wall and the implant surface, compensates for the hard tissue lost after a tooth is extracted. A preoperative CBCT can be very helpful in terms of measuring the buccal plate, and can provide more information prior to the extraction of the tooth.

Thus, this is done in order to maintain hard tissue contour, but preserving the volume in soft tissue is also of crucial importance, especially in the esthetic zone. This is the fifth triangle, biotype.

V. Biotype

Kois et al. analyzed 5 factors that influence periimplant esthetics. They stated prior to tooth extraction, it is important predict the complexity of the case by considering the initial tooth position in the three planes of space. The type of periodontum can provide the clinician with useful information to determine the intricacy of the case. The presence of a highly scalloped gingiva, translates into a larger discrepancy between facial and interproximal bone, leading to an increased risk of recession.

Furthermore, the patient’s biotype, is also of crucial importance, being more favorable, if it’s thick rather than thin. Of equal significance is the location of interproximal bone before extraction, which will prevent the loss of the interproximal osseous position and thus, the overall soft tissue architecture.
In terms of soft tissue, the clinician also has to consider that soft tissue will also go through the process of remodeling following implant placement.27 There are two ways described in the literature to compensate this remodeling. The first one being with a soft tissue graft from the palate. Grunder studied the changes that occur in the crestal ridge at the time of extraction, and how it varies if a soft tissue graft is placed or not. It was proved that the average horizontal resorption of labial tissue dimension was 1.063 mm in the control group.28 All patients that received a soft tissue graft, had no soft tissue dimension changes in the test group. The explanation for this, is that implants were placed without raising a full thickness flap, using a split flap technique, thus not compromising blood supply. Therefore, augmenting soft tissue at the time of implant insertion is a satisfactory treatment to prevent the expected loss of labial soft tissue.27

Another technique is described by Capelli et al., where they demonstrated that in cases where the buccal plate is less than 4mm wide, they would graft internally. In other words, they would place biomaterial between the soft tissue and the buccal plate to maintain the ridge contour, and thus, “overbuilding” the buccal aspect.1

Immediate implants require a complicated and precise soft tissue management.29 Moreover, De Rouck et al. demonstrate that using single immediate implants with instant provisionalization, can help optimize esthetics. It was concluded that this can limit the amount of midfacial soft tissue loss, being this area the most critical in aesthetic implant dentistry.30 Nevertheless, if primary stability is not achieved, or the patient’s case does not fit the ideal requirements for immediate provisionalization, this should not be done, and therefore, a different type of treatment should be considered.29

Conclusion:

1. Following the 5 diagnostic keys, I the presence of a buccal plate; II primary stability; III implant design; IV filling of the gap between the buccal plate and the implant; and V tissue biotype, can help reach a more precise diagnosis and case selection in order to obtain optimum results.

2. Performing an atraumatic extraction can prevent a more pronounced bone loss.

3. When positioning the implant in an ideal 3D position, the void should always be grafted with biomaterial.

4. It is recommended to compensate soft tissue remodelling, by means of overbuilding buccally with biomaterial or by a soft tissue graft.

5. When possible, using Provisional crowns in immediately placed implants can help maintain soft tissue contours.

6. Implant design is recommended to be self-tapered, so it can favour reaching primary stability.

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