A Solution to Immediate Implant Placement in the External Root Resorption Case

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The quest for a "true" immediate tooth replacement in dentistry has long plagued the clinician in everyday practice. The advent of osseointegration in the early eighties and its expansion into the realm of the single site tooth replacement began to change the way both dentists and the public contemplated the possible loss of a tooth. Traditionally, when considering implant replacement of nonsalvageable teeth the approach was to extract the tooth, wait two to six months for socket healing, insert the implant fixture at a subsequent surgery, allow for healing and osseointegration, and then try to reconstitute the soft tissue profile with perioplastic procedures and gingival modeling around a healing abutment or provisional restoration. This effective but arduous drawn out process was considerably expedited by a philosophy first proposed by Shulte in the 1970's whereby an implant was placed concurrent with tooth removal and allowed to integrate prior to loading. However, even in relatively ideal situations such as traumatic injuries, root perforations, root fractures, etc. it still resulted in a period of time where the actual restorative aspect of the procedure was delayed many months.

It is the authors' contention that these traditional philosophies while predictable may be vastly modified to expedite the process and incorporate immediate tooth replacement in its entirety - that is root removal, replacement with an appropriately designed fixture and loading a provisional restoration all in the same day. But, for this to be a clinical reality the potential site must be prognostically evaluated prior to tooth removal. The diagnostic criteria for the predictable and successful implementation of this innovative immediate implant placement protocol is especially critical. This phase involves assessing the following:

1. The gingival soft tissue profiles

2. The three dimensional osseous topography

3. The tooth form.

The Soft Tissue Profile

The soft tissue is evaluated as being either of the thin scalloped or thick flat periodontal biotype, bearing in mind that the thin scalloped form is inevitably more difficult and usually requires

secondary soft tissue procedures for optimal esthetic results. The individual implant/restorative recipient site comprises two distinct soft tissue aspects - (i.) papillae on either side of the restoration, connected by (ii.) the rise and fall of the free gingival margin arching apically. Each of these aspects needs to be prognostically evaluated for any soft tissue deformity but perhaps more importantly for the presence and position of the underlying supporting osseous structure. Periodontal probing in the interproximal region should not exceed 4.5 millimeters from the tip of the papilla or contact point of the respective teeth. This will allow for the presence of a papilla following implant placement. The osseous crest on the direct labial should ideally be at a depth of 3 millimeters from the height of contour of the free gingival margin. The parabolic form of this underlying osseous structure appears to replicate the form of the gingival restorative recipient site, which in turn seems to mimic the rise and fall of the cemento enamel junction, i.e. they parallel one another.

The Tooth Form

The silhouette form of teeth is classically described in removal prosthodontic literature as ranging from square through elliptical to triangular. It would appear that in all implant supported restorative endeavors that squarer tooth form is very often required to compensate for the loss of a portion of the interdental papilla. This being the case (again particularly in the thin scalloped perioduntum), the tooth form of the replaced tooth may necessitate a change to an squarer form; which will in turn require direct composite bonding, porcelain veneers or crowns on the adjacent contralateral tooth.

Extraction/Tooth Removal

The key to the process of immediate tooth replacement is to not compromise the potential site, during the process of tooth removal. The extraction should be done atraumatically as possible without inducing loss of osseous support by taking precautions to retain the essential form of the soft tissue profiles. Problems arise when the compromised tooth is severely fractured showing little or no coronal structure beyond the height of the gingiva and the authors have found it optimal to remove a tooth using the FRIALIT®-2 Periotome (FRIADENT GmbH, Mannheim, Germany -- FRIADENT North America, Irvine, California). This instrument is a cross between a mini-elevator and a scalpel, which is inserted into a periodontal lingual space between the tooth and the osseous, gently severing the periodontal ligament fibers. If it is not readily inserted a small trough may be made with a carbide finishing bur (E.T. 12 Brasseler USA, Savannah, Georgia) to start the process. The FRIALIT®-2 Periotome is moved around the root in an oscillating motion progressing apically separating the periodontal ligament fibers until the root can literally be lifted out of the socket. This should leave the osseous scaffold totally unaffected and still supporting the crucial elements of the gingival profile ready for incisionless implant placement thru the socket access and rapid restoration with no esthetic compromise.
At times the Class I site is not amenable to a use of a FRIALIT®-2 Periotome due to the process of external root resorption. The radiographic lamina dura or the periodontal ligament space is no longer present due to the nondiscriminatory osteoclastic cell activity and the FRIALIT®-2 Periotome cannot be worked down along side the root. It is specifically for these types of cases, that the authors would suggest the following approach to immediate tooth replacement.

Case Report

This patient presented with a Frialit (FRIADENT GmbH, Mannheim, Germany -- FRIADENT North America, Irvine, California) implant placed and restored in the position of the upper left central incisor (Fig. 1). Some time later, radiographs reveal that the adjacent right central incisor is

showing similar signs of external root resorption with the potential to fracture during function. (Fig. 2; Fig. 3) It is decided to preemptively intervene on tooth #8 and replace it with an implant. The problem that presents is the extraction of the root undergoing external resorption without compromise to the site. Any surgical approach will inevitably result in loss of some of the osseous support, the soft tissue form and necessitate extended healing periods and numerous surgical procedures in an attempt to utilize the incisionless approach, with only two clinical appointments. The authors elected to approach the process somewhat differently. To this end the coronal aspect of the right central incisor, is horizontally sectioned off at the level of the gingival margin (Fig. 4)

Figure 1

Larger View

Facial view of two central incisor restorations, one tooth supported and one implant supported.

Figure 2

Larger View

Radiograph showing left maxillary central implant supported restoration and crowned right central incisor showing signs of external root resorption.

Figure 3

Larger View

The two crowns -- one implant supported and the other tooth supported over the maxillary central incisors.

Figure 4

Larger View

Incisal view following crown removal of remaining root clearly showing the gutta percha within the root canal.

It is into this root canal that a 2 millimeter implant twist drill is inserted removing the gutta percha following the original path of the root canal (Fig. 5). The twist drill is extended beyond the apex to maximize the use of the native bone between the apex of the root and the base of the nose to ensure primary stabilization. Following the use of the 2 millimeter twist, the 3 millimeter twist drill is used to further enlarge the canal circumferentially once again extending to the same depth. Considering the tapering form of an anterior tooth and the need not to remove bone beyond the lateral aspect of the root, the next drilling sequence requires a drill that similarly decreases in diameter apically. The 3 millimeter twist drill is therefore followed by a stepped tapered decreasing diameter drill (FRIADENT GmbH, Mannheim, Germany) inserted into the expanded canal via the root face. This 4.5 millimeter twist is rotated with light pressure and copious irrigation slowly expanding the size of the canal and removing root structure to the predetermined depth (Fig. 6). Once the drill is extended to its full depth of 13 millimeters (Fig. 7), it is now backed out and replaced with a 5.5 twist drill (Fig. 8). To preserve the topography of the soft tissue and the underlying osseous structure the twist drills should never to exceed the mesiodistal width of the root. The mesiodistal measurement at the coronal aspect of tooth #8 is 6.2 millimeters and so as not to impinge on the interproximal bone a 5.5millimeter twist drill is the largest that will be used. The root is entirely ground away along the area undergoing root resorption by angling the drill along the mesial aspect, leaving a thin sliver of root on the distal and around interproximally as it extends into the buccal and lingual aspects. Following the use of the 5.5 red-stepped drill, it is evident that the entire root along the mesial aspect has been removed into sound bleeding bone. So as not to run the risk of compromising the dimension available between the two implants, and\or the implant and the adjacent teeth, a 5.5 millimeter fixture will be selected as a 6.5 will compromise the interproximal support.

Figure 5

Larger View

2 millimeter twist drill inserted into root canal space and extended beyond the apex.

Figure 6

Larger View

A 4.5 millimeter twist drill is inserted into the root face to expand the internal configuration of

Figure 7

Larger View

The 4.5 millimeter blue twist drill inserted to its full length of 13 millimeters.

Figure 8

Larger View

The 5.5 millimeter staggered stepped twist drill is inserted into the root face slightly toward

the canal toward the peripheral root structure and sound bone.

the mesial to remove the undifferentiated osseous root, which is undergoing root resorption along the mesial aspect.

To remove the remaining root structure that still shows the presence of a lamina dura and no active root resorption a FRIALIT®-2 Periotome is now gently inserted in the distal interproximal ligament space and oscillated back and forth working around the circumference of the root, apically. As the peirodontal ligament fibers are separated, the root remnant is gently moved towards the center of the extraction site and although extremely friable it is readily removed in one piece, with no compromise to the site (Fig. 9). The remaining root once the periodontal ligament fibers are separated is readily elevated out vertically on the side of the FRIALIT®-2 Periotome (Fig. 10).

Figure 9

Larger View

The tip of the FRIALIT®-2 Periotome is gently inserted into the distal aspect of the remaining portion of the root. It is evident that the mesial aspect and part of the buccal and lingual has already been removed by the drilling process.

Figure 10

Larger View

The remaining root surface is gently elevated coronally on the FRIALIT®-2 Periotome.

Implant Insertion

Following site preparation the osseous site is evaluated for any perforation, dehiscence, fenestration or compromise. This is done using a periodontal probe extending to the full length of the osteotomy (Fig. 11). An appropriately sized implant is inserted and torqued down into position. If it is decided to temporize this fixture immediately the following guidelines should be met.

1. No compromise to the osseous during tooth removal with an adequate quantity and quality of bone.

2. No compromise of the overlying soft tissue gingival profiles - i.e., the restorative gingival interface

3. A wide diameter stepped tapered implant that decreases in size in the apical portion. The wide diameter will obliterate the socket negating the need for a membrane or guided bone regeneration. The staggered decreasing apical size will prevent perforating within the concavity of the labial plate of bone.

4. The use of an implant at least 13 millimeters in length.

5. A grit-blasted acid etched FRIOS® surface to the implant to maximize osseous contact during early integration.

6. A screw type implant to optimize primary stability during the early phase of healing negating any micromovement of the fixture and resultant failure to integrate (Fig. 12).

The implant is tapped down in position to engage the lateral walls of the osteotomy site and then rotated into position using a torque driver. If it is to be loaded immediately, measurements in the range of 40 Newton centimeters should ideally be recorded (Fig. 13). The head of the fixture is definitively evaluated for optimal positioning utilizing a periodontal probe developing a 3 millimeter depth measured from the facial free gingival margin (Fig. 14). The interproximal measurements should not exceed 4.5 millimeters from the tip of the papilla to the height of the interproximal peaks of bone on the adjacent teeth. Once the implant is in an optimal position, an impression is made utilizing an incisal acrylic jig or vinyl poly siloxane material, incorporating a registration of the soft tissue form so as to proceed to the final restoration at the next visit.

Figure 11

Larger View

Occlusal view showing preparation of the site, with no compromise of the osseous or the soft tissue and showing the stepped tapered decreasing diameter osteotomy within the bony housing.

Figure 12

Larger View

A stepped tapered screw shaped S.L.A. surface FRIADENT implant prior to placing in the implant site.

Figure 13

Larger View

Utilizing a torque driver to tighten down and correctly position the head of the wide bodied fixture.

Figure 14

Larger View

Periodontal probe demonstrates the head of the fixture at 3 millimeters from the height of contour of free gingival margin.

Provisionalization requires a temporary abutment (FRIALIT®-2 Pro Tect - FRIADENT GmbH, Mannheim, Germany -- FRIADENT North America, Irvine, California), which is inserted in position into the implant internal hex and screwed down tight (Fig. 15). A single shell crown or a clear vacu-form matrix is positioned over this with the long screw extending out of the lingual aspect. This screw may be lubricated to prevent binding to the temporary restorative material (Fig. 16). The soft tissue profiles can be maintained in their exact form by utilizing composite in the "soft tissue extraction site" - i.e the space between the head of the fixture or the osseous level and the height of the free gingival margin. The form of this tissue is predicated upon exerting lateral pressure on the two papillae to maintain their height and form, while replicating the degree of subgingival labial contour so as not to exacerbate the height or curvature of the free gingival margin. To this end composite is packed down around the FRIALIT®-2 Pro Tect abutment into the soft tissue "well until the form is optimal" and then cured so defining the subgingival form of the restoration (Fig. 17). The plastic abutment form is removed, trimmed and any voids in the subgingival portion of composite are filled with a flowable (Fig. 18) (Aelite Flow, Bisco, Schaumburg, Illinois) composite.

Once there is a smooth contiguous form the entire restoration is coated with a clear sealant (PalaSeal, Heraeus Kulzer, Inc., South Bend, Indiana) and screwed into position alongside the adjacent implant supported restorations. The methyl-methacrulate supra-gingival coronal tooth form is added to this using a vacuform matrix or shell tooth, allowed to cure and join, and then the entire restoration unscrewed. The occlusion is developed so as to negate any guidance contact on this implant supported restoration and to have no contact during maximal intercuspation (Fig. 19 A, B, and C). The obvious benefit of this incisionless approach is that the clinician can go to final restoration at the next visit (having taken impressions during implant placement) knowing full well that the soft tissue profile will be very much the same as it is in the temporization phase. It also avoids the inevitable compromise to the osseous and soft tissue aspects of the implant site associated with the surgical approach to tooth removal in the root resorption case.

Figure 15

Larger View

A FRIALIT®-2 Pro Tect abutment located within the internal hex and screwed down tight onto the head of the fixture.

Figure 16

Larger View

The FRIALIT®-2 Pro Tect abutment in position showing lingual access for the screw and optimal positioning of the implant.

Figure 17

Larger View

The composite or subgingival portion of the restoration responsible for soft tissue configuration is made by tucking or packing composite into the well created by the supraosseous soft tissue, and light curing once it is of optimal form.

Figure 18

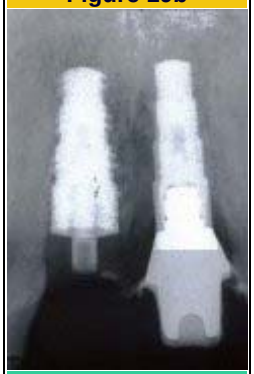
Larger View

The subgingival portion is removed and any voids filled in and trimmed.

Figure 19a

Larger View

Figure 19b



Larger View

Figure 19c

Larger View

Two implant supported restorations. The mature one on tooth #9, the left central incisor, showing a Press Fit Frialit implant with a custom abutment and an all ceramic crown. Tooth #8 has a FRIALIT®-2 Pro Tect (FRIADENT GmbH, Mannheim, Germany -- FRIADENT North America, Irvine, California) supported combination acrylic composite temporary restoration.

Conclusion

In selected cases with the uncompromised osseous topography and when using the correctly shaped implant with the correct surface, immediate tooth replacement for even the root undergoing external root resorption has at last become a true everyday clinical reality. It requires different tapered armamentarium as opposed to a cylindrical form implant (FRIADENT staggered stepped implant), which allows the clinician to obliterate the top of the extraction socket negating

the need for a membrane and primary closure of the site. The stepped decreased diameter in the apical region precludes perforating the subnasal concavity of the labial surface. The concept of incisionless implant placement allows the clinician to maintain the key inherent forms of the restorative gingival interface -- maximizing esthetics. In addition, it allows the critical preservation of the labial facial bone by not stripping the periostium and maintaining the crucial vascular supply. If the length of the implant fixture is optimized utilizing the primary native bone beyond the apex of the root towards the base of the nose, primary stability can be obtained and healing with full osseointegration, no soft tissue seam, and immediate provisional restoration is viable. This approach expedites the process exponentially making it possible to go from tooth removal with implant placement and temporization at one visit to insertion of the final restoration some six to eight weeks later, even in the problematic case of external root resorption.