Bridge design, part 14: Immediate extraction, placement and loading for a single tooth implant as an alternative to anterior bridgework

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In the fourteenth part of his series, Paul Tipton looks at alternatives to anterior bridgework

In the anterior region, the successful replacement of a single tooth with an implant-supported restoration is one of the most difficult treatment options due to numerous functional and biological requisites. Such prosthesis should also satisfy the increasing aesthetic demands of a patient who expects the definitive restoration to mimic the natural dentition and their supporting gingival tissue. Especially in the mid-line, both central incisors should be identical with the same gingival architecture and levels. This latest article in the series highlights the importance of the multi-disciplinary approach incorporating prosthodonist, ceramist, orthodontist and implant surgeon to provide a highly predictable aesthetic restorative approach to the single tooth implant in the aesthetic zone as a replacement for a failing post-crown.

TREATMENT PLANNING

Morgano (1996) has recommended that – should an ideal post-crown preparation not be possible – extraction and replacement with an implant-supported restoration may be a more prudent treatment option. The length of the post should not be compromised and a minimum of 4-5mm of apical gutta percha should be maintained if a cast post and core is used (Mattison, 1984). This situation may be changing with the recent introduction of the carbon fibre adhesive post. The crown should extend apical to the core to provide a minimum ferule of 2mm (Rosen, 1996). In situations where the ideal post-crown is not possible, then as Morgano has recommended, extraction and replacement with a restoration giving greater longevity may be a preferable situation.

This in itself means that the referring GDP refers the patient early when a root fracture is suspected, rather than obvious, so that the precious labial plate of bone is maintained. Late referral often when the root has fractured completely and there may be infection present usually means a two or three-stage approach to implant placement with soft and hard tissue surgical procedures, often required to augment the area and provide the correct gingival architecture.

BRIDGEWORK

The addition of resin-bonded prostheses and implant restorations to traditional bridgework has dramatically expanded treatment alternatives for the replacement of a missing single tooth. Choice of the most appropriate restoration for each patient demands an objective comparison of these treatment modalities. Restoration of function and aesthetics must be balanced with objectives of predictable longevity, minimal biological consequence and effective cost. Conventional bridgework as described in the earlier parts of this series are aesthetically predictable but have obvious shortcomings that limit their aesthetic potential, relating primarily to preparation of the adjacent teeth that may adversely affect the long-term prognosis of the abutment teeth. Resin-bonded bridgework is, however, functionally and predictably inconsistent (Priest, 1996) but may be an ideal interim restoration for young patients whose teeth and tissues have not fully matured.

Single tooth implants now have an excellent success rate and prognosis (Henry, 1996), but pre-surgical treatment planning, especially in the anterior region is essential for success. Jansen (1995) has described some of the major concerns regarding a predictable aesthetic outcome with anterior single tooth implants. These include detailed analysis of the smile line and peridontium. Olsson and Lindhe (1991) described two types of 'periodontal biotypes': the thin, scalloped type and the thick, fibrous type. Each one differs in its bony housing and architecture, tooth shape and its response to trauma. A further concern is whether to delay implant placement after extraction to allow for healing or to extract the tooth and place the implant at the same time (Lazzara, 1991).

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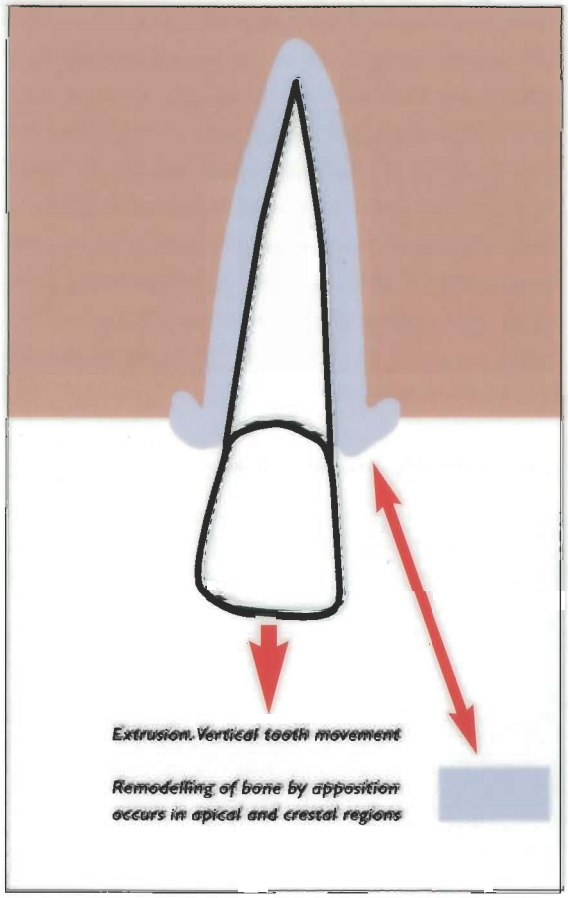
Delaying placement allows the clinician to predict where the soft tissue will ultimately reside. With immediate replacement, assuming the socket defect is isolated to the extracted tooth, an additional surgical procedure is eliminated. Salama & Salama (1993) have described a method of enhancement of the hard and soft tissue by orthodontics prior to immediate extraction, placement and loading of an implant. This paper describes the treatment of such a case.

PROSTHETICS

The success of an implant rehabilitation in the aesthetic zone is generally determined by a variety of factors that includes the quality of the restoration, the performance and reliability of the implant system components, harmonious and early soft tissue integration and the aesthetics of the prosthetic restoration (Touati, 1995). When placing a single tooth restoration in the anterior region, the aesthetic criteria represent the fundamental aspect of success since the prosthesis will be compared to the adjacent dentition and supporting tissues.

The concept of prosthetically driven implantology implies that the entire therapeutic process is guided by the visualisation of the optimal aesthetic restoration (Garber, 1995). The soft tissues that surround an implant are not identical to those that surround a natural tooth as the peri-implant connected tissues has an abundance of collagen but lacks cells. These collagen fibres are generally anchored to the marginal bone and are parallel to the surface of the implant (Listgarten, 1991). Connective tissue height is more important at the implant head level, and has been determined to be approximately 1.8mm, so that the total height of the peri-implant tissue requires augmentation of approximately 4mm (Ericsson, 1995). In order to establish adequate attachment around the implant, a specific soft tissue height must be achieved. If this height is not established, bone resorption occurs as a biologic response to maintain the proper level of attachment (Sanavi, 1998).

Figure 1: Diagram of expected orthodontic movement



ORTHODONTICS

In order to gain the correct bony and connective tissue support around an immediate extraction, placement and loaded implant, orthodontic extrusion of the tooth before extraction has been recommended by Salama. Orthodontic extrusion has been referred to as the 'slow eruption of teeth' which indicates that by utilising light eruptive forces, the entire attachment apparatus can be shifted coronally in unison with the tooth (Lindhe, 1983) (Figure 1). The gingival margin should maintain the same relationship with the mobilised tooth prior to and following extrusion. This is termed 'site development' and the aim is to orthodontically extrude the tooth to be extracted and replaced by the implant so that there is an excess of bone surrounding the tooth before extraction. Bone loss of 1mm is expected during the extraction, placement and healing stage, and if this extra tissue is not gained then gingival margin levels between central incisors may be different. Orthodontics, however, may not be possible if infection is present in and around the tooth that is to be replaced.

CASE STUDY

This young barrister was referred to St Ann's Dental Clinic by his practitioner in Derbyshire for treatment for a failing post crown on the upper left central incisor (Figure 2). Upon

Figure 2: Failing post-crown on upper left central incisor

Figure 3: Previous crown removed and tooth re-prepared

Figure 4: Provisional crown fitted onto the remaining tooth

recent recementation of the post-crown, an incomplete vertical fracture line was in evidence. If this had been left then ultimately this fracture line would become complete and infection would follow. This infection can rapidly lead to loss the labial plate of bone and non-ideal implant placement. In line with previous studies on immediate extraction and replacement with an immediately loaded implant, approximately 1mm of bone loss and soft tissue loss can be expected. Therefore, in order to eliminate this as a potential for an unaesthetic final result, orthodontics was employed to extrude the post crowned central incisor and stabilise this prior to extraction and implant placement.

PROVISIONALS

The upper left central incisor crown was removed and the residual post and tooth re-prepared (Figure 3) for a provisional acrylic crown (Figure 4). Orthodontics was then completed to bring the teeth and gingival margin down by approximately 1-2mm (Figures 5 & 6). This took approximately six weeks and the tooth was splinted to the adjacent teeth for a further six weeks prior to the tooth being extracted, atraumatically by the use of periotomes.

IMPLANT TREATMENT

A stepped 'Frialit 2' implant (General Medical) was placed immediately into the extraction socket, hugging the palatal wall, making sure not to put any pressure on the thin labial plate which could lead to fracture of this very delicate bone (Figure 7). Once the implant had been inserted to the correct apico-incisal position and it was deemed stable, a plastic temporary abutment was screwed into the implant (Figure 8) and the previous provisional crown placed over the top (Figure 9). This restoration was to last approximately six months, until the definitive restorative phase.

OCCLUSION

During this stage, it is important that the implant is not overloaded, and therefore the provisional needs to be taken out of occlusion. This can be easily achieved by reshaping the palatal aspect so that there is no intercuspal holding contact and no protrusive guidance on the provisional. However, in order to stop the lower teeth from over-erupting and seeking a further intercuspal contact with the provisional, the lower incisors that would normally contact the provisional were bonded together on a lingual aspect with orthodontic wire. In this way, it was not possible for there to be any intercuspal contact or lateral or protrusive contact on the provisional crown, thus ensuring minimal stress on the implant. The patient was placed on a soft diet for the first four weeks and post-operative healing was uneventful.

Figure 5: Orthodontic brackets and wire placed

Figure 6: Completed orthodontic movement

Figure 7: Implant placement immediately after tooth extraction

Figure 8: Provisional abutment placed

Figure 9: Provisional crown refitted over the new abutment

Figure 10: Provisional crown and abutment removed after six months

During this stage, bleaching was completed so that the new definitive crown could be colour matched to the new lighter shade.

RESTORATIVE PHASE

Some six months after placement the provisional crown was removed (Figure 10), together with the plastic temporary abutment, and impressions taken for the definitive abutment and crown (Figures 11 & 12). A custom-made gold abutment was produced (Figure 13) and torqued down to 32cm prior to a porcelain-fused-to-yellow gold crown 'Duceragold' (Degussa) being fabricated (Figure 14) and fitted. This crown had a light inter-cuspal holding contact, but not protrusive or lateral guidance placed on it. Once fitted, the orthodontic wire and the bonding was removed from the lower incisors.

CONCLUSIONS

The final end result shows aesthetic harmony of both central incisors with soft tissue levels the same as prior to the extraction and placement of the implant (Figures 15 & 16). This predictable success rate is only possible with a multidisciplinary approach involving prosthodontist, implant surgeon, dental technician and orthodontist, and by early referral from the GDP prior to infection. Late referral by the practitioner usually results in a staged, delayed implant protocol and unpredictability in terms of maintaining aesthetics and patient compliance. The final part of the series deals

Figure 11: Frialit 2 impression coping placed

Figure 12: Impression pick-up cap in place on the coping

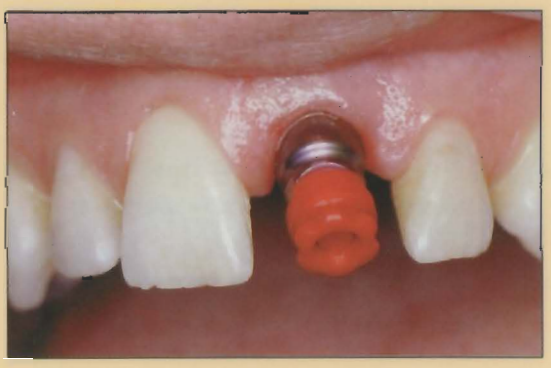


Figure 13: Final custom-made gold abutment in situ

Figure 14: Final crown cemented with temp bond

Figure 15: Close-up pre-operative view

Figure 16: Close-up post-operative view – note no change in the gingival margin position

with the brand new concept of CAD/CAM all-ceramic bridgework as a future option.

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