

# IMPLANTS IN FOCUS

## PLANNING FOR IMPLANT RESTORATIONS

Replacing a missing maxillary central incisor with a dental implant can be the most demanding restoration in dentistry, so it's important to consider some of the key surgical and restorative elements. Benjamin Watkins explains



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**E**ndosseous dental implant restorations have proven to be highly predictable, and long-term success is common in complete and partially edentulous cases. Success is closely linked to meticulous planning and execution of therapy, and this is no less the case when aesthetics of the single, implant-supported restoration is contemplated. Contemporary aesthetic and functional demands require that the implant restoration be the primary determinant for implant placement. Restorative-driven implant placement must, therefore, result in implant restoration and peri-implant soft tissue contour that is harmonious with the adjacent natural teeth. The contours and form of the restoration must also guide the development of the definitive peri-implant soft tissue profiles to ensure compatibility with the adjacent natural teeth. None of these objectives are attainable if the implant site does not have adequate hard and soft tissue foundation to allow for ideal implant positioning.

As a result of post-extraction bone resorption, the implant site is often insufficient for ideal implant placement, and some form of augmentation is often necessary. When the alveolar bone in the implant site

is initially insufficient, procedures can be undertaken to augment deficient ridges prior to or even simultaneously performed with implant placement. Procedures to alter the peri-implant soft tissues can be utilised prior to, during or after implant placement. The decision process to use any of these techniques is based on an assessment of how best to create an acceptable peri-implant result with the least amount of surgical interventions.

Replacing missing teeth with implants in the aesthetic zone requires careful planning and diagnostic work-up, close collaboration between surgeon, restorative dentist and laboratory technician, and meticulous attention to each important stage of the treatment. This case report guides the reader through the placement of a single-tooth dental implant in the aesthetic zone of a partially edentulous patient and highlights key surgical and restorative principles to achieve predictable results.

Dr Ben Watkins will be co-presenting a seminar with Dr Pirooz Zia on 12 March 2011 at Seminars@38, London, entitled: Key Prosthetic Considerations For Restoring Anterior Single Tooth Implants.

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**CASE STUDY PART ONE**

A 45-year-old male presented with a missing maxillary right central incisor that was extracted approximately four weeks prior to his initial presentation to his oral surgeon. He was dissatisfied with the aesthetics of his current provisional tooth, and the fact that it was a food trap (Figure 1). The tooth was originally extracted due to non-restorable caries, and neither bone preservation nor bone augmentation was considered. The only restorative option he was given was a three-unit, fixed partial denture, as there wasn't enough bone for an implant. Upon clinical and radiographic examination, it was determined that the patient was deficient of hard and soft tissue, both in horizontal and vertical dimensions (Figures 2 and 3). The gingival margins of the adjacent teeth were not harmonious with the provisional tooth. However, it was noted that the interproximal peaks of bone of the adjacent teeth were completely intact and the patient had a thick gingival biotype.

Key preliminary indicators for aesthetic success were the fact that this patient had minimal loss of interproximal bone volume and a thick gingival morphotype. These are critical indicators for the surgical and restorative team to predict a favourable tissue

response to surgical intervention and to allow for full regeneration of the gingival embrasure areas at the completion of the final restoration.

**SURGICAL PHASE AND IMPLANT PLACEMENT**

The treatment plan called for the placement of a single-tooth, implant-supported restoration along with hard and soft tissue regeneration prior to implant placement. It was determined that a new anatomically correct fixed transitional tooth should be placed prior to site development. The primary goal of site development in this case was to augment the residual ridge horizontally to a minimum 6mm width. In order to accomplish that goal, the surgeon determined that an autogenous onlay bone graft harvested from the ramus and combined with particulate bone should be placed. The surgical procedure called for a palatal incision that extended medial away from the papilla to avoid embarrassing the interdental blood supply (Figure 4). This is a surgical technique referred to as a papilla-saving incision technique. The incision was then extended to create a full thickness flap to visualise the extent of the defect. At this time,



Figure 1: Initial bonded provisional restoration



Figure 2: Loss of vertical and horizontal tissue

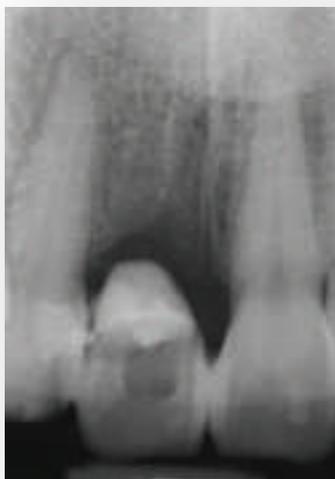


Figure 3: Normal interseptal bone level



Figure 4: Papilla saving incisions

**CASE STUDY** PART TWO



Figure 5: Stabilisation of onlay bone graft



Figure 6: GTR membrane application

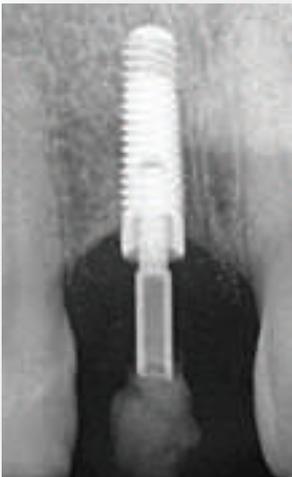


Figure 7: Radiograph verifying complete seating of the screw-retained provisional

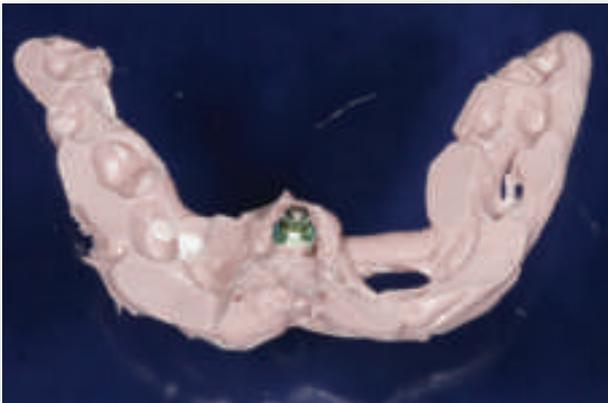


Figure 8: Surgical index



Figure 9: Surgical index with implant analog

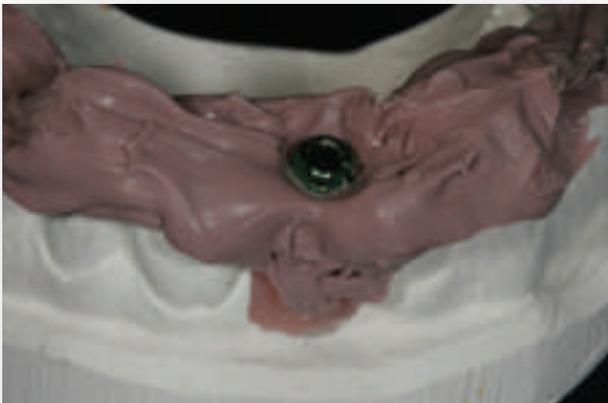


Figure 10: Surgical index seated on the pre-existing stone cast

**CASE STUDY** PART THREE

a cone beam computerised tomography (CBCT) radiograph would have helped the planning process, but it was not requested.

The use of ridged fixation screws are critical to make sure that the graft is stable at the time of placement, as micro-motion of the block graft impedes the biologic fusion to the recipient site and will cause failure of the graft (Figure 5). Particulate bone was used to fill the negative space between the block graft and the host site, as well as to create proper bone and gingival contour.

A resorbable membrane was placed prior to flap closure and was used to exclude soft tissue cells until the graft matures (Figure 6). Additional releasing incisions were performed to achieve a tensionless closure of the flap. Typically, autogenous bone grafts require four months of healing time; however, the use of other types of bone augmentation materials may require more protracted healing periods. In this case, a four-month healing period was observed prior to implant placement.

Surgical guides are used to assure precise positioning of the implant body during implant placement. They can be derived from either a diagnostic wax-up or from

CT guided planning software. Either way the desired goal of a surgical guide is to predictably and efficiently project an ideal trajectory for the implant in reference to the final restoration. The surgical guide should be utilised in all anterior implant cases. Next, the proper sized implant should be selected based on the dimensions of the edentulous site and the adjacent bone peaks. The types of options available when considering the placement of an implant include standard or wide; tapered or cylindrical; standard or switched platform, and immediate or delayed implant placement. Whichever type of implant design is selected, the use of a surgical guide is strongly recommended.

In this case, the use of a standard sized implant was adequate given certain considerations. The surgeon selected a standard diameter internal connection implant (4.1 mm x 13.0 mm Zimmer, Tapered Screw-Vent Implant). Because of the height and width of the residual ridge and the width of the implant, the surgeon placed the implant 4mm apical to the facial CEJ of the adjacent central incisor. This position afforded enough restorative space to create the proper emergence profile of the abutment/crown complex.



Figure 11: Fabrication of temporary abutment on the soft-tissue cast



Figure 12: Preparation of screw-retained provisional restoration: facial view

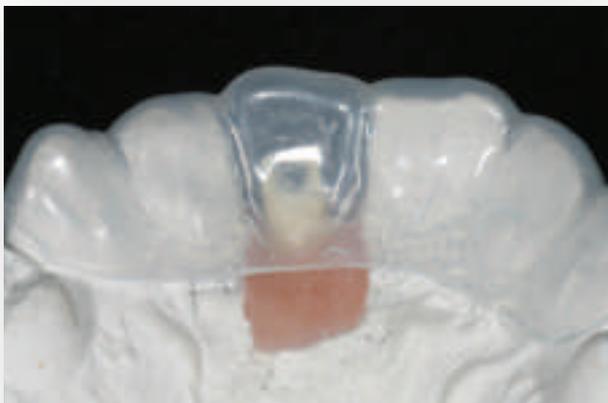


Figure 13: Preparation of screw-retained provisional restoration: lingual view



Figure 14: Provisional contours mimic the tooth replaced

**CASE STUDY** PART FOUR



Figure 15: Provisional that supports soft tissue contour



Figure 16: Excellent papilla form at final impression



Figure 17: Composite retention is assisted by sandblasting the post



Figure 18: Impression post seated prior to customisation



Figure 19: Creation of a custom impression post and accurate soft tissue cast



Figure 20: Closed-tray final impression

## CASE STUDY PART FIVE

Poor aesthetic results due to improper emergence profile are almost always a function of incorrect implant positioning and can be easily avoided with the use of an anatomically correct surgical guide and the close communication between the implant surgeon and restorative doctor. In this case a guide was utilised and the surgeon elected to follow a submerged implant technique. After three months of healing, the implant was exposed. The labial soft tissue was enhanced by a palatal incision designed to mobilize excess gingival tissue to the facial aspect of the site. The immature facial and

interproximal soft tissue is best supported by a screw-retained provisional restoration placed at the time of implant uncover (Figure 7). This step is most easily accomplished by indexing the position of the fixture at uncover and fabricating a laboratory processed fixed provisional restoration (Figures 8–10).

### RESTORATIVE PHASE

The creation of a provisional restoration is facilitated by retrofitting an implant analog



Figure 21: Initial appearance of final impression

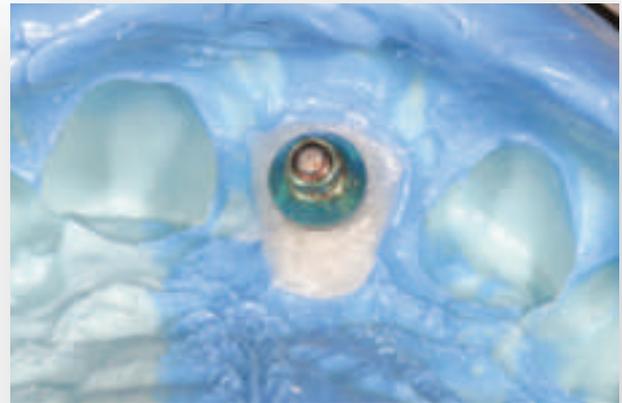


Figure 22: Custom impression post seated in the final impression

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into a preexisting stone cast to be delivered immediately or within 48 hours after implant uncover. It is critical that the subgingival and interproximal contour of the provisional restoration closely mimics that of the natural tooth being replaced. Detailed attention to subgingival contour of the provisional will help guide gingival maturation and help to assure complete fill of the embrasure spaces. Incorrect contouring in this area has the potential to promote the creation of negative interproximal unaesthetic dark areas (often referred to as 'black triangles'). In this case, the incisal edge of the

provisional was shortened to avoid occlusal contact during the healing period (Figures 11–15).

At three months post-implant placement the gingival sulcus showed excellent triangular shape and papilla form (Figure 16). To accurately record the shape of the periimplant soft tissue, flowable composite was directly syringed around the impression coping and light-cured. An implant level impression was made via a closed-tray technique. Steps were taken to confirm the shade of the



Figure 23: Implant replica connected to custom impression post



Figure 24: Master cast with removable soft tissue

CONT

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## CASE STUDY PART SIX



Figure 25: Final shade verification

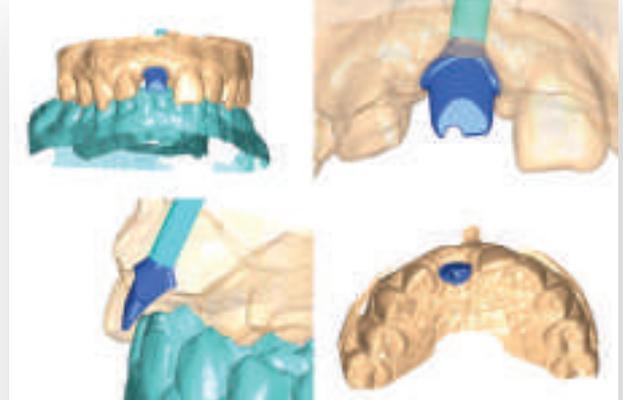


Figure 26: Digital file of CAD/CAM abutment prior to milling



Figure 27: Visualisation of precise final zirconia abutment and crown contours

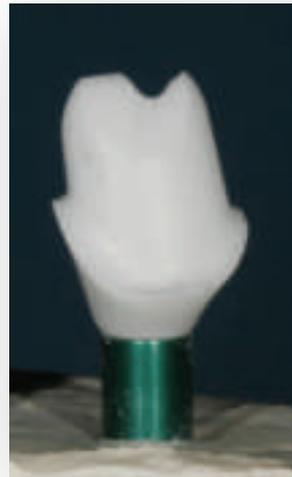


Figure 28: Final CAD/CAM zirconia abutment: facial view



Figure 29: Final CAD/CAM zirconia abutment: lingual view



Figure 30: Margin placed 0.5-1.0 mm subgingival



Figure 31: Lingual gingival contours mimic adjacent tooth



Figure 32: Crown contours mirror the adjacent tooth



Figure 33: Mature peri-implant tissue at abutment and crown delivery



Figure 34: Custom abutment placement with proper restorative margins



Figure 35: Final crown at delivery



Figure 36: Complete restoration of the ridge width

**CASE STUDY** PART FOUR



Figure 37: Three-year follow-up

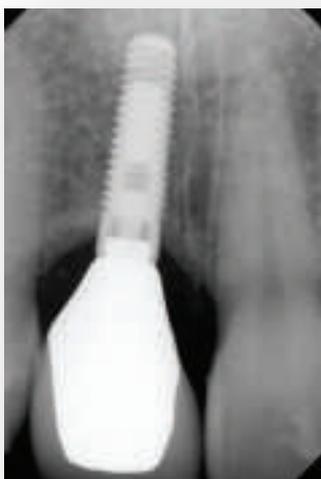


Figure 38: Stable bony peaks at three-year follow-up

adjacent teeth. An implant soft tissue master cast was poured and transferred to an appropriate articulating device (Figures 17–25).

To avoid the risk of a greying effect to the peri-implant labial soft tissue caused by a titanium abutment, a custom CAD/CAM zirconia abutment was designed and milled. Custom CAD/CAM abutments allow the clinician to evaluate margin placement and abutment design prior to final milling of the abutment (Figures 26–29). Accurate margin placement can be designed with confidence because the tissue was allowed to mature in the provisional stage for a minimum of three months. A zirconia crown was selected as the definitive restoration because of its potential for superior optical properties and similarity to the abutment material. By examining the soft tissue cast with the final crown in place, we can begin to appreciate the gingival harmony created by the abutment and the crown prior to delivery (Figures 30–32).

At the time of abutment and crown delivery, we can see the type of result that was predicted: maintenance of a thick gingival biotype and harmonious gingival margins with complete fill of the papilla. The abutment was torqued according to the manufacturer's instructions; the access opening was filled by condensing a polytetrafluoroethylene (PTFE) material into the access opening and subsequently sealed with composite resin, and cemented with composite resin cement (Figures 33–36). The patient was seen for follow-up at one week, one month, three months and at three-month recall appointments after this with the restorative doctor for regular hygiene appointments.

**CLINICAL OVERVIEW**

Several steps and considerations are needed when engaging in the restoration of a missing, maxillary central incisor. This type of result achieved in the case study can only be achieved through proper site development, proper implant placement, and the use of an anatomically correct provisional along with patience to allow for stable healing.

In summary, this case demonstrated many keys to obtaining aesthetic success with maxillary anterior dental implants. The first and possibly one of the most important steps is a diagnostic work-up that reflects end-point thinking. Since the anticipation of the loss of hard and soft tissue is concurrent with the extraction of teeth, clinicians should get into the habit of considering augmenting those deficiencies in different ways before, during or after implant placement.

The use of an anatomically correct surgical guide is mandatory in every anterior implant case. Choosing carefully, a sized and positioned implant is critical in achieving an aesthetic result. The use of a precisely designed provisional restoration that will last an appropriate length of time is important in the development of the soft tissue topography. The selection of the abutment and crown medium should mimic nature. Correct positioning of the implant is the most important factor to achieving aesthetic success with dental implants in the anterior maxilla.

All of the key considerations mentioned are down to the clinician, however, one limiting factor that isn't under the clinician's control is the variation in the patient's level of physiologic healing. Clinicians must therefore respect the variation each individual presents and focus on detailed work-ups and precise clinical execution to achieve an acceptable outcome.

*I would like to thank Dr Ryan Kazemi for his collaboration and dedication to achieving this excellent clinical outcome and for preparing the case study.*