Bridge design, part twelve: short span bridgework on implants

By Paul Tipton BDS, MSc, DGDP (UK)

Carrying on from the last two parts of his series, Paul Tipton continues to look at bridgework in relation to implants - this time in a case report involving a patient who had lost teeth in a road accident

Tooth loss - especially in the anterior region - can be devastating in the psychological and aesthetic problems that it causes. Should soft and hard (bony) tissue also be lost then there is a limit to the amount of soft and hard tissue that the oral surgeon can replace by bone grafting due to the inelastic nature of the scarred mucosa. In response to this some technicians have gained the ability to reproduce the aesthetics of the soft tissue by the use of pink porcelain (Figure 1). The original method of replacing the missing tissues was with a screw retained bridgework (Figures 2 to 7). The problems of screw retention are well known, however (Misch, 1995), and more recently these large frameworks have been cemented over custom-made abutments for a more passive, more aesthetic and stronger bridge (Figures 8 to 11). As the demands for aesthetics have increased, so have the techniques improved. Some of the problems with the previous methods of achieving maximum aesthetics were the limited number of firings available to the dental technician to produce aesthetic pink and tooth colours, and the long-term maintenance should porcelain fracture.

This paper shows a method of using custom-made abutments, a pink porcelain sub-frame with metal tooth preparations and individual crowns, cemented onto the sub-frame to achieve maximum aesthetics and long term maintenance.

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Figure 1: Pink porcelain full arch ridge

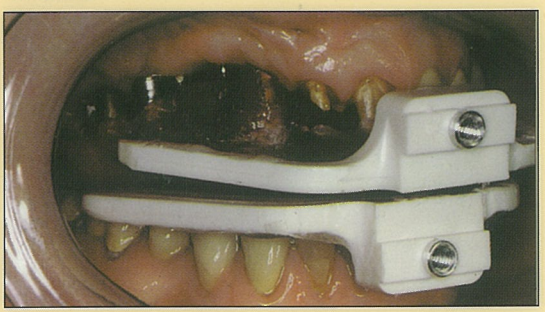
TRAUMA

A common occurrence of a road traffic accident can be the loss of teeth and alveolus due to an impact with a steering wheel or other in-car fittings. Such an accident occurred to a 16-year-old female resulting in the loss of her four maxillary anterior teeth (Figure 12). Prior to referral to St Ann's Dental Clinic for reconstruction of the anterior maxilla, her referring dentist made a partial chrome cobalt denture replacing the missing soft and hard tissue and also the four maxillary teeth. The patient was extremely happy with the overall cosmetic appearance of the provisional removable prosthesis but required a long-term fixed restoration.

The treatment plan for this patient was to graft the anterior maxilla from the illiac crest in the form of a J graft, adding not only labial bulk but also vertical height to the ridge, followed by placement of four 'Bränemark' implants (Nobel-Biocare) and definitive splinted crownwork.

Figure 2: Patient missing canine and premolar teeth wearing provisionals

Figure 3: Pantographic clutches, screwed with Estheticore abutments



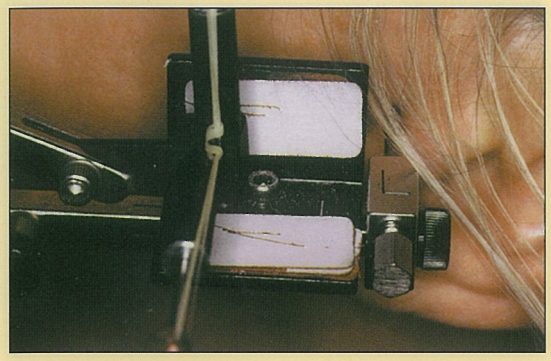


Figure 4: Pantographic tracings

Figure 6: Close up of screw retained bridge (side view)

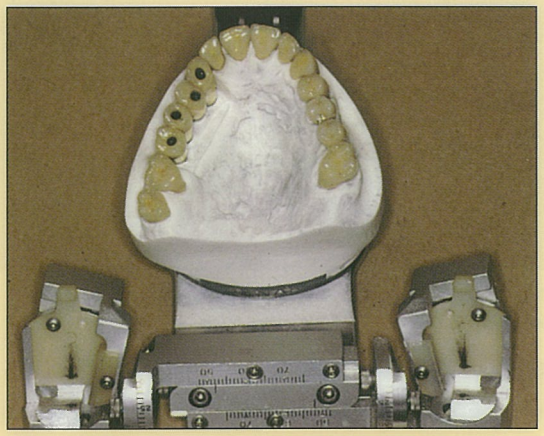


Figure 5: Full arch reconstruction mounted on fully adjustable articulator

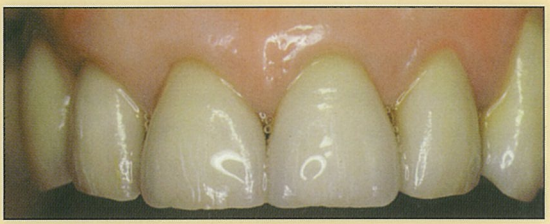


Figure 7: Final reconstruction (anterior view)

DIAGNOSTIC PHASE

The initial prosthetic treatment planning involved a diagnostic wax up to the same shape and form of the provisional denture (Figure 13). The position of the denture teeth was then copied in a clear acrylic stent which was tooth-borne and served the purpose of transferring to the implant surgeon the amount of bone bulk required to support the final prosthesis. Touati (1997) has described this as the 'double guidance concept' (Figure 14). One of the many problems involved with grafting of the anterior maxilla is that the amount of bone bulk that can be placed is limited by the ability of the soft tissue to stretch over the bone graft and the depth of the labial sulcus. It is also imperative that during the healing phase the graft is not loaded by any removable prosthesis. An interim fixed prosthesis was therefore required.

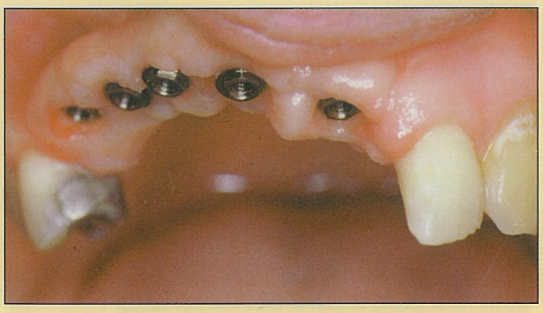


Figure 8: Patient lost teeth due to accident with horse

Figure 10: Porcelain-fused-to-metal bridge cemented over custom abutments

Figure 9: Procera titanium custom-made abutments in place

Figure 11: Final smile

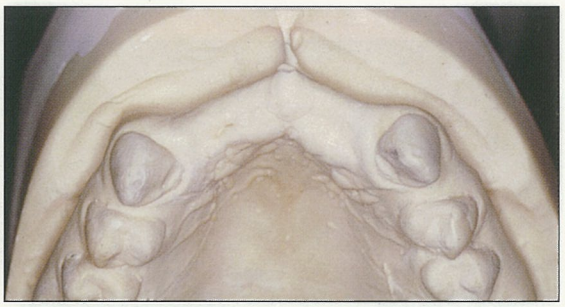


Figure 12: Model of edentulous anterior ridge as a result of car accident

ROCHETTE BRIDGE

A Rochette bridge was fabricated for when the graft was completed (Figure 15) as the patient could not wear a removable partial denture. The patient's original denture was again the template for the tooth position and shape and utilising pink porcelain to establish the correct lip contour and aesthetics for the anterior tooth pontics in the 'golden proportion' as described by Levin (1981). This was cemented with 'Bis-Fil' chemical cured composite (Optident) for ease of removal and replacement when required (Figure 16). Following graft placement the fitting surface of the bridge pontics was reshaped to allow for the excess graft material placed onto the edentulous ridge and to ensure no pressure on the graft when the bridge was refitted. Implant placement followed six months later and four 'Bränemark' implants (Nobel-Biocare) were placed including two regular platform implants for the central incisors and two narrow platform implants for the lateral incisors (Figure 17) and the Rochette bridge recemented (Figure 18).

Figure 15: Edentulous ridge grafted from illiac crest

Figure 17: Four Branemark implants inserted into the graft

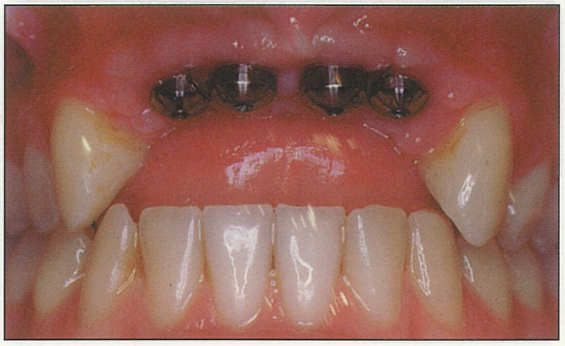


Figure 13: Diagnostic wax up

PROVISIONAL RESTORATION

Following a six month osseointegration phase and in order to gain full maturation of the soft tissue prior to the definitive restoration, a provisional acrylic bridge as described by Zinner (1994) was fabricated and screwed into the implants (Figure 19). Should the definitive restoration be made too early then soft tissue recession around the implant

Figure 14: Surgical stent in situ

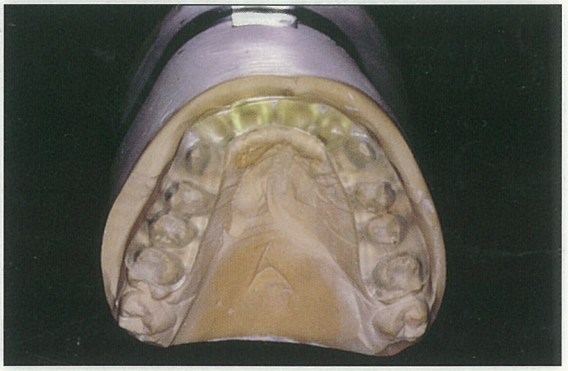


Figure 16: Adjusted Rochette bridge in situ on top of the graft

Figure 18: Rochette bridge recemented over bridge

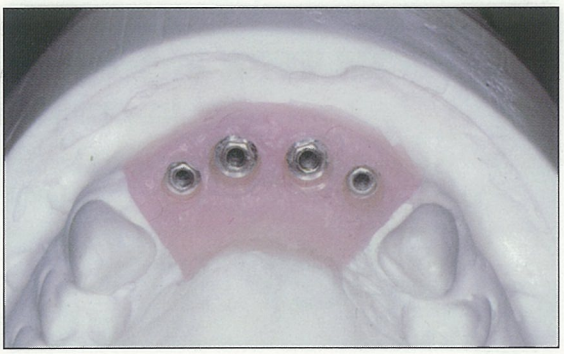
abutments can lead to a disappointing aesthetic result. During this stage soft tissue can also be shaped prior to the definitive porcelain-fused-to-metal restoration being fabricated. After a further six months wearing the provisional bridge and gaining soft tissue maturation, impressions were taken using pick up copings (Carr, 1991) for the definitive restoration (Figure 20) and a soft tissue model constructed (Figure 21). Four 'Procera' cad/cam milled titanium abutments (Nobel-Biocare) were produced to allow better soft tissue adaptation, as the abutments are titanium, rather than precious metal. Titanium encourages hemi-desmosomal attachment of the soft tissue to it, producing a soft tissue seal better than for precious metal or gold. These 'Procera' abutments also contain an internal anti-rotation device so that each individually shaped abutment can be torqued down to 32 Newton/cm^2 using internal counter torque, to avoid overstressing the bone implant interface (Jividen 2000).

PINK PORCELAIN FRAMEWORK

A pink porcelain fused to metal framework was then constructed to replace the missing soft tissue where it had been impossible to place enough bone graft because of the limited ability of the soft tissue to stretch over it. This framework had individual tooth preparations waxed and cast as part of it. Four individual porcelain-fused-to-metal crowns were then fabricated to be adhesively cemented on top of the metallic tooth preparation by the technician after try in procedures (Figures 23 & 24). The crowns and metal preparations were sandblasted and silicated prior to being cemented with 'Panavia' cement (Morita). This ensured a more accurate fit as the metal distortion upon casting as described by Schiffleger (1985) and upon porcelain application as described by Bridger (1981) can be avoided and a better final aesthetic result as the crowns provided a more natural interproximal shape and colour. This also allowed the patient to floss in between her crowns, making the restoration feel more like the natural dentition.

Figure 19: Provisional bridge screwed into the implants

Figure 21: Soft tissue model



MAINTENANCE

The restoration built in this way also allows greater long-term maintenance. Should at any time part of a porcelain crown fracture the individual crown can be removed and impressions of the technician-made tooth preparation taken. A provisional crown can then be constructed whilst the technician remakes a new crown in the traditional way. This crown can then be recemented onto the metal tooth preparation as previously described by an adhesive cement. The traditional one-piece restoration is more vulnerable to porcelain fracture, and less aesthetic than the sectional restoration.

Previously if there was a porcelain fracture then this often meant a complete remake as it is impossible to add onto porcelain when it has been in the patient's mouth for any length of time, because of porcelain contamination with saliva. Should porcelain addition be tried then there is a high probability of catastrophic fracture of the porcelain in the furnace.

Figure 20: Impression copings attached to head of the implants

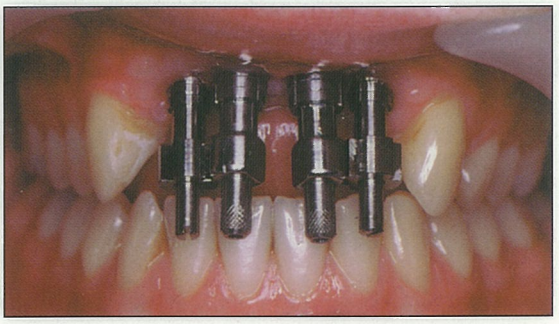


Figure 22: Custom made 'Procera' titanium abutments

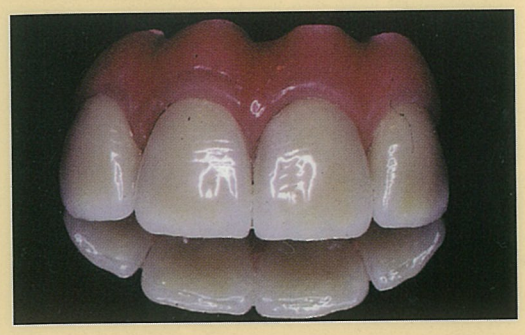


Figure 23: Pink porcelain-fused-to-metal framework with four individual crowns attached (labial view)

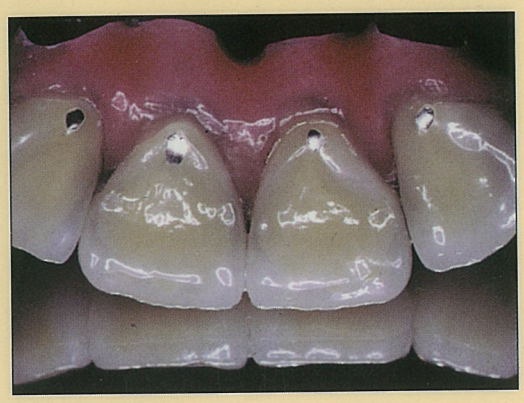


Figure 24: Lingual view

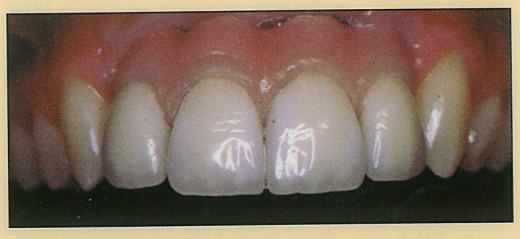


Figure 25: Bridge cemented over custom-made abutments

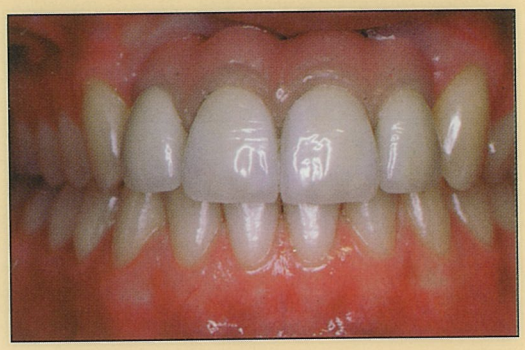


Figure 26: Close up view in ICP

Figure 27: Final smile

CONCLUSIONS

The final restoration (Figures 25 to 27) shows correct form, function and aesthetics based on the preoperative provisional denture and diagnostic wax up and fulfils all the requirements of a fixed final aesthetic reconstruction. The end result is only achievable by thorough treatment planning starting with the diagnostic wax up so that the end result can be visualised, and excellent team work between prosthodontist, technician and implant surgeon.

The next article in this series will concentrate on immediately loading implants with full arch bridgework.

ACKNOWLEDGEMENTS

I would like to thank Mr Keith Jones for his surgical work on this case and Mr Martin Fletcher and Mr John Wibberley for their technical support. ■

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