Practical implantology, part seven

IN THE FINAL PART OF HIS SERIES, SIMON ALLUM LOOKS AT FIXED BRIDGEWORK FOR EDENTULOUS ARCHES

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EDENTULOUS ARCHES AS FOUNDATIONS FOR ORAL RECONSTRUCTION

The removal of all the remaining natural teeth commonly results in unfavourable and ongoing skeletal changes both within and between the dental arches.

In the lower jaw, loss of bone height above the inferior dental canal may restrict the immediately available fixture sites to the anterior (inter-foraminal) region. If necessary, more complex surgical reconstruction techniques can be considered to allow fixture placement in the posterior mandible. However, the utilisation of support via fixtures in the anterior mandible alone is a commonly chosen treatment modality that often offers the possibility of fixed bridges with distally cantilevered extensions (Figures 1 & 2).

The edentulous maxilla is generally a less-reliable foundation on which to consider full arch reconstructions. Bone quality may be more variable, often poorer. A preliminary DPT commonly reveals restricted bone height distal to canine sites due to enlarged (pneumatised) maxillary sinuses. In addition, in many long-standing edentulous cases the premaxilla is compromised due to loss in bone height and width. The use of onlay grafts and sinus lifting procedures (as appropriate) can supplement deficiencies in maxillary bone volume.

Unfavourable inter-arch relationships are often noted in edentulous patients due to an undersized maxillary arch - the product of buccal maxillary bone loss. In these circumstances, good aesthetic and occlusal management is often difficult or impossible unless a removable prosthetic solution is chosen.

Removable appliances offer the possibility of labial and buccal flanges which can improve facial soft-tissue support as well as providing bases for harmonious mandibular/maxillary arch diameters (see part six of this series).

PROSTHETIC PRECISION

Unlike natural teeth,

Figure 1: The working model for a fixed mandibular bridge with abutments on four inter-foraminal fixtures

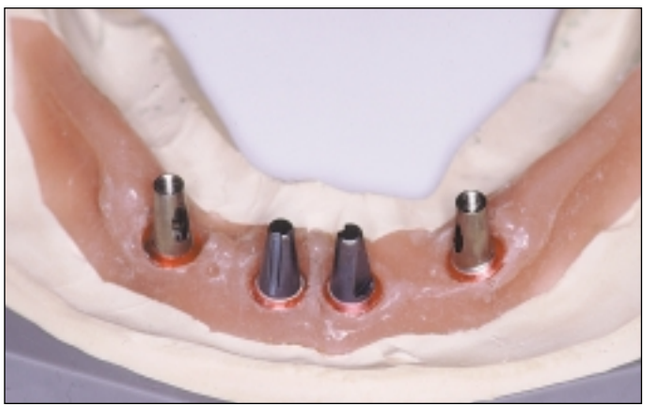

Figure 2: An example of a reduced arch bridge fabricated in porcelain on gold alloy. Despite being edentulous for over 30 years this patient had not previously been able to tolerate any lower prosthesis

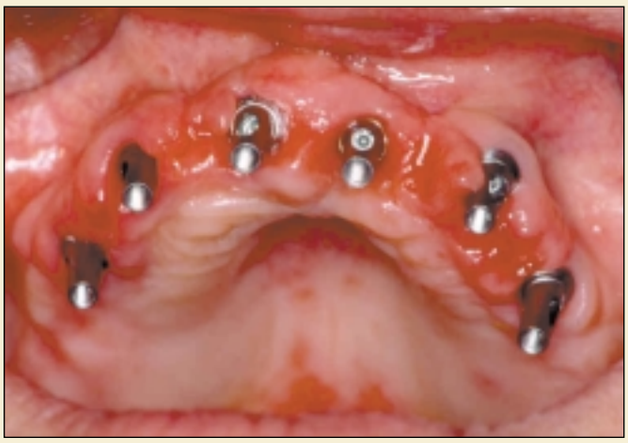

Figure 3: An example of a fixed maxillary reconstruction in progress at the clinic. Six fixtures have been placed to carry a ten-unit fixed bridge

Figure 4: Mirror view of one section of the fixed bridge under construction. A cementable design has been chosen in this instance. The work is at a biscuit bake stage - ready for porcelain try-in

Figure 5: Palatal view of the finished bridge in situ. Note the 'post-ceramic' soldered joint at the midline

Figure 6: The buccal aspect of the case. The occlusion is against natural teeth and implants, and needs to be carefully balanced in both centric occlusion (ICP) and in excursive movements

osseointegrated fixtures cannot compensate for minor inaccuracies in prosthetic fit or occlusion via small orthodontic adjustments within supporting bone. Therefore, it has long been recognised that superstructures must be constructed to seat as accurately as possible onto supporting implant fixtures. Inaccurate superstructures which set up constant stresses between implants can be associated with problems of bone loss and failure of osseointegration.

A number of prosthetic techniques have therefore been developed to enhance the prospect of an optimum ('passive') fit. During the following process of considering some of the various fixed bridge options on implants, it is important to note how the issue of achieving a passively fitting prosthesis is addressed.

SCREW-RETAINED VS. CEMENTABLE BRIDGES

Both screw-retained bridges and cementable prostheses are in common use in implantology - different operators have their own preferences for different situations. Screw-retained work offers the important advantage of being easily 'retrievable' in the event of a restorative or other problem. Large constructions, which feature porcelain components can run the risk of ceramic fracture, and where this type of construction is screw-retained, the prosthesis can be removed for repair with relative ease. Conversely, the presence of access holes for retaining screws may be unsightly and may perhaps leave ceramic work inherently weaker and more prone to porcelain fracture.

Cementable constructions are often said to be more common in the UK than many other parts of the world. A cement lute spacer may help compensate for minor inaccuracies in superstructure fit.

Drawbacks of cementable designs include the possibility of excess cement lodging undetected below abutments. Excess subgingival cement is a potential source of soft tissue irritation and peri-implant problems. In addition, the removal of cemented bridges for repair or maintenance can prove extremely difficult, even where temporary cements have been used.

BRANEMARK NOVUM

Branemark Novum has

Figure 7: The final aesthetic outcome of the completed case

received extensive media exposure, and the 'same day teeth concept' which Novum has promoted has captured the imagination of the public and much of the profession.

The Novum concept is to allow completion of treatment within a single day with immediate placement of the permanent restoration. It is claimed that overall costs as well as treatment times can be reduced in this way.

During the year 2000, Professor Branemark himself appeared on BBC1's Watchdog Healthcheck programme to launch the product in the UK. The national newspapers reported Novum as a new breakthrough in dental therapy set to revolutionise the treatment of edentulous patients and forecasting the advent of affordable full-arch implantology for the edentulous masses. It is important to realise that a number of similar techniques involving 'immediate loading' have been described with various implant systems, but these been less widely advertised and differ fundamentally from Novum in that they involve the initial placement of an interim prosthesis prior to the construction of a definitive custom-made bridge or beam. Where other factors are favourable, splinted fixtures can show potential for osseointegration even in the presence of limited loading.

Novum's initially published data (six months to three year results) appeared to show success rates comparable to more traditional protocols for mandibular implant supported prostheses (150 fixtures placed in 50 patients - three fixtures lost). The procedure is said to be contra-indicated in severe class II jaw relationships and in extreme V-shaped mandibles. There are minimum requirements for bony height and width and for an adequate vertical dimension able to accommodate the prosthetic components.

Three dedicated Novum fixtures must be precisely seated in the inter-foraminal region, allowing the connection of a prefabricated milled titanium primary bar. Small discrepancies in fixture alignment are compensated for during the process of connecting the bar by using a system of compression screws and washers.

Having fitted the primary beam, centric relation and the vertical dimension are recorded, and a laboratory beam analogue is then mounted against a model of the opposing arch. The acrylic 'bridge' can then be waxed up incorporating denture teeth, and transferred onto the primary beam in the mouth.

In a private practice setting, this treatment protocol is difficult to organise unless appropriate laboratory facilities are available nearby or preferably on-site. Working time schedules are tight with limited scope for correction of errors or unforeseen problems if the same-day treatment objectives are to be met.

Whilst the logistics of such a treatment protocol are difficult to organise, there are other reasons why many operators do not favour this 'flat-pack' approach to dental reconstruction, feeling that it is the patient who is made to fit the product.

The 'same day' allure is undoubtedly a strong selling point, but it is important to realise that the finished restoration is very different to a fully custom-made

prostheses where the focus of treatment centres purely on the achievement of the best-possible clinical outcome, with overall treatment time more of a secondary consideration.

MILLED TITANIUM FRAMEWORKS

Nobel Biocare's 'All-In-One' titanium frameworks feature Procera CAD/CAM technology - more familiar to GDPs for its use in the construction of ceramic crowns. In a similar way, the Procera technique can be employed to manufacture a crown coping or bridge framework.

This product has been promoted especially for use in the provision of implant supported full-arch bridges. The initial phase of construction involves the making of a framework master in acrylic using temporary components.

Subsequent to a satisfactory try-in, the working model and the master framework are then sent to the production unit in Sweden for laser scanning. The finished titanium framework is sculptured from a single block of homogenous titanium alloy using digital CAD/CAM data and returned to the commissioning laboratory two days later. The framework can be fabricated as cementable or screw-retained prosthesis.

Having produced an accurate full arch framework, the next challenge is to construct the aesthetic overlay without introducing internal stresses into the finished bridge. Bonding porcelain to a complete metal arch poses huge technical challenges - not least because of the conflicting thermal expansion properties of metals and ceramics. Many would argue that this problem is insurmountable. In addition, bonding to titanium poses its own special difficulties. Although new titanium bonding procedures and porcelains are now being introduced to the market, some operators prefer to prescribe the use of laboratory composites such as Gardia and Belle-Glass to help overcome these issues, while others prescribe acrylic work and high grade denture teeth.

At the present time, Procera bridgework is unfortunately only available for use with Nobel Biocare implants (Branemark and SterriOss), but there seems to be a general feeling amongst surgeons and technicians that the system is likely to become more generic, and that CAD/CAM frameworks could well become a more extensively used treatment option in the future.

PORCELAIN BONDED TO CAST PRECIOUS METAL ALLOY

Constructions in 'traditional' materials are popular and successful providing they are constructed with care. Key issues largely resolve around the prospect of achieving a good aesthetic outcome, with precision fit and well-balanced occlusion.

Accuracy of fit with reduction of stress within the metal framework can be improved by casting the metalwork in sections. Whilst the dental arch can be reconstructed with a series of smaller short-span bridges, the production of a large single span bridge may offer the prospect of distributing loading of fixtures during function, as well as offering cross-arch support against non-axial loading. In order to minimise internal stress within the final metal-ceramic structure, porcelain can be bonded onto the sectional metal framework, and completed sections can then be soldered together to produce the final prosthesis (Figures 4 & 5).

Some authors have also described the use of spark erosion during the manufacture of these restorations. Short-circuit impulses are arched between the master model implant analogues and the metallic superstructure removing metal particles from the tightest-fitting surfaces of the retainers and enhancing the passive fit of the finished product.

CONCLUSION

The key to successful implant therapy lies, to a great extent in the planning stages. The patient needs to understand the proposed treatment outcome as does the operating surgeon. Pre-operative appointments, including the construction of wax try-ins, mock-ups, and surgical stents must be correctly employed to ensure the correct number, distribution and alignment of supporting implant fixtures. ID

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