Bridge design, part thirteen: full arch bridgework on immediately placed and loaded implants using the 'All-in-One' bridge - a new method

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In the thirteenth part of his series, Paul Tipton continues to look at bridgework in relation to implants

The transitional removable prosthesis is a frequent barrier to patient acceptance of implant treatment. Whether it is a partial or a complete denture, patients often resist the idea of wearing a removable prosthesis as the concept of such a prosthesis may be psychologically traumatic to many patients.

Patients undergoing implant treatment often wear either a removable prosthesis or no prosthesis at all when abutment support is lacking in the non-aesthetic zone. While most edentulous patients are more tolerant of additional months of denture therapy, patients who have been rendered recently edentulous may experience difficulty adapting. Postoperative changes during the healing period can lead to discomfort and often necessitate frequent denture relines which the newly edentulous patient cannot tolerate.

ORIGINAL PROTOCOL

The abundance of longitudinal studies, supporting the utilisation of dental implants for the completely and partially edentulous patient, exemplifies the successful results obtained by the application of a standardised surgical and prosthodontic protocol. One disadvantage of such a protocol is that, following the placement of the implant in bone, a healing period of at least three to four months for the mandible and four to six months for the maxilla must take place prior to the initiation of the prosthodontic rehabilitation and the placement of the final prosthesis (Adel, 1981). During this time the implant has been covered up under the soft tissue. This technique has been termed the two-stage approach.

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ONE STAGE APPROACH

Several studies have demonstrated that good clinical results may be achieved with a one-stage approach. Using a split-mouth technique, Ericsson (1994) placed one and two-stage Branemark implants into completely edentulous mandibles and reported no short-term loss of implants for either method of placement. Bernard (1995) placed two one-stage implants each in the mandibles of five patients for tissue bar-supported dentures, with similar results. Busser (1997) showed over a 90% success rate involving over 2,000 non submerged implants over an eight-year period.

As these studies indicate, one-stage implants osseointegrate predictably and function well when loaded in completely edentulous mandibular reconstructions. One-stage implant procedures also offer the advantages of fewer patient surgeries, less time between abutment placement and final prosthetic restoration, and, potentially reduced patient expense (Becker, 1997).

IMMEDIATE LOADING

Schnitman et al (1997) described a technique that avoids the need for a removable denture during this interim phase of therapy.

The immediate loading protocol they discussed allows the patient to wear an interim fixed partial denture without compromising the long-term success of the overall reconstruction. He reported ten year follow up results of which all ten prostheses supported by implants placed in immediate function at the time of implant placement were successful. Of the 28 implants placed in immediate function, four eventually failed including three prior to six months, and one at 18 months post-implantation. All failures of immediately loaded implants were distal to the incisor regions.

According to Schnitman, the failures were probably the result of inadequate implant length using 7mm for the posterior implants and poor bone quality in the posterior mandible. The ten-year life table analysis of survival for immediately loaded implants was 84.7%.

Salama (1995) has also reported cases in which titanium root-form implants were immediately loaded and success-

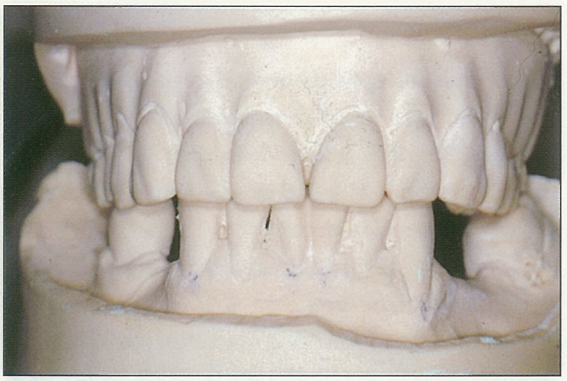


Figure 3: Mounted study casts

forms signed before the procedure began. Several changes to the initial protocol (Tipton, 2000) were put into operation during this procedure, which included the use of intermediary abutments (Multi-Unit abutments from NobelBiocare) and the fabrication of the final bridge in only two visits using the 'All-in-One' titanium framework technique (NobelBiocare).

The patient attended at the clinic all day. In the morning the patient was scheduled to have his lower teeth removed and implants placed, and in the afternoon his provisional bridge fitted.

Mounted study casts were taken (Figure 3) for the fabrication of two sets of dentures (one transparent, one tooth-coloured) which rested on the one remaining molar tooth on the left hand side, and retromolar pad on the opposite side so as to accurately position this in the mouth once the anterior teeth had been removed (Figures 4 to 7). The second denture was fabricated in transparent acrylic (Figures 8 & 9) for use as a surgical guide. Both were reinforced with wire. A wide channel was cut out in the middle to allow the surgeon correct implant placement and for the prosthodontist to pick up the metal cylinders later when making the

Figure 4: Lower cast

Figure 5: Lower cast with teeth removed anteriorly

Figure 6: Lower tooth-coloured denture

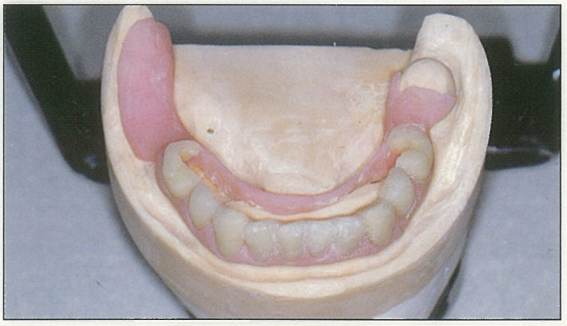


Figure 7: Lower denture in correct occlusion with upper denture

Figure 8: Transparent surgical stent on model

Figure 9: Transparent surgical stent – close up

fully utilised to support provisional fixed restorations in the maxilla and the mandible. These were followed from 37 to 40 months after implant placement and immediate loading. All implants osseointegrated and were restored with a fixed prosthesis.

CURRENT PROTOCOL

The level of predictability and high success of current implant therapy have provided cause to re-evaluate both the surgical and prosthetic protocol that have been proposed. A number of studies have reported that immediate loading of implants with a provisional prosthesis after stage 1 surgery can result in a high success rate. Tarnow (1997) assessed the same concept, utilising a larger number of implants with cross-arch stabilisation, and using implants in the posterior region of the mandible and maxilla. Except in two cases reported by Salama (1995), posterior mandibular placement has been avoided in most studies because poor bone quality in this region was expected to result in high failure rates. In Tarnow's study, the same procedure was performed in the maxillary arch, which was attempted in only one of the aforementioned studies on immediate loading papers. The results of this study indicate no difference in success rate between maxillary and mandibular arches.

Tarnow's case reports, along with the others documented, may provide cause to re-evaluate the essential principles of the Branemark protocol for osseointegration. A submerged, non-loaded period of three to six months has certainly been proven to be a successful course of treatment. However, osseointegration can clearly be attained in selected immediately loaded situations as well. This in no way implies that submergence is no longer necessary - these results simply suggest that it is not essential in certain situations.

GUIDELINES FOR IMMEDIATE LOADING

- Comprehensive informal patient consent must be attained
- Immediate loading should be ideally attempted in edentulous arches only to create cross-arch stability
- Implants should be at least 10mm long
- A diagnostic wax up should be used for template and provisional restoration fabrication
- Reinforced metal should be used on the lingual aspect of the provisional restoration
- A screw retained provisional restoration should be used where possible for the full arch and the single implant situation
- If cemented, the provisional restoration should not be removed during the four to six month healing period
- All implants should have good initial stability at stage 1 surgery
- The widest possible anterior-posterior distribution of implants should be utilised to provide resistance to rotational forces
- Cantilevers should be avoided or non-functional in the provisional restorations
- An occlusal scheme that provides axial loading and minimises horizontal or off axial loading is required
- An occlusal splint should be considered to minimise the effects of parafunctional habits.

The following case report illustrates this technique.

CASE REPORT

This gentleman was referred into the clinic by a colleague from North Manchester with several remaining loose lower teeth and a full upper denture (Figures 1 & 2). The patient was unwilling to undergo conventional implant treatment which would have involved removal of his teeth and construction of a provisional acrylic full lower denture prior to implant placement three months later. The recent literature on immediate loading was again discussed and consent

Figure 1: Patient wearing full upper denture

Figure 2: Close-up of remaining lower teeth

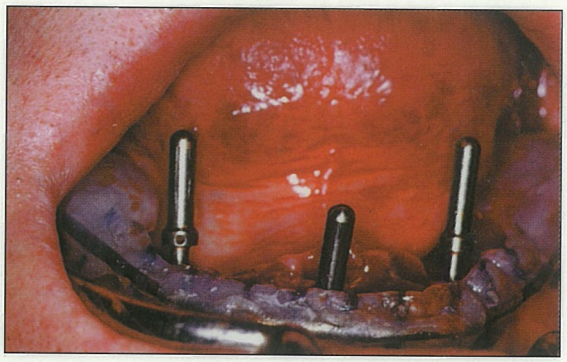


Figure 10: Implants being place using transparent surgical guide

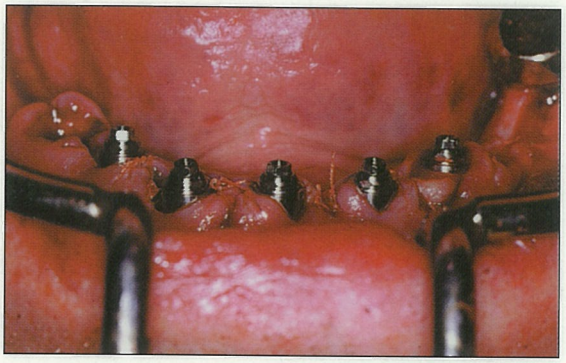


Figure 11: Multi-Unit abutments placed on the implants

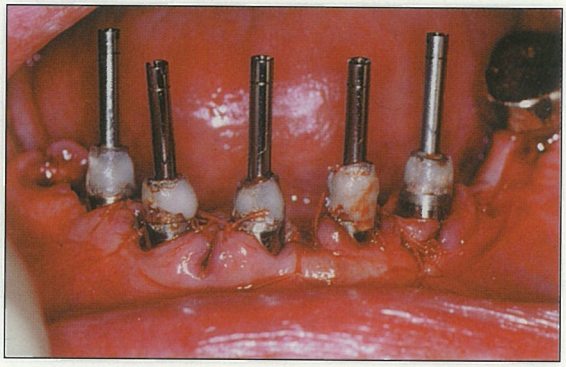


Figure 12: Metal cylinders, silicoated placed onto abutments

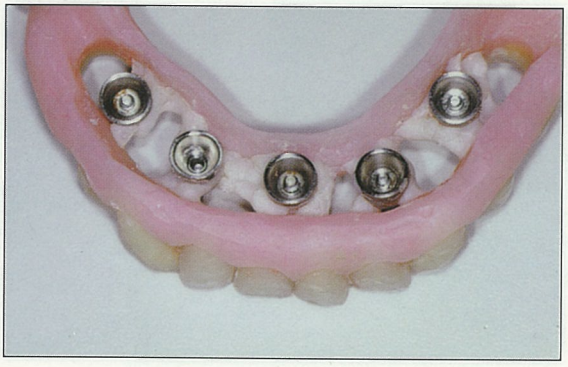


Figure 13: Denture and metal cylinders unscrewed

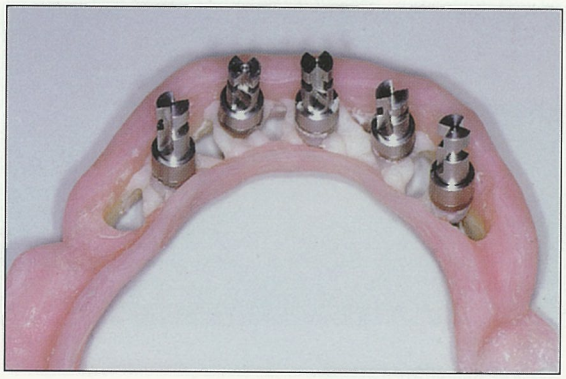


Figure 14: Abutment analogues placed onto the cylinders

bridge.

The anterior teeth were removed and implants placed immediately using several extraction sockets and the transparent acrylic guide (Figure 10). The positioning of the implants was verified by the use of the surgical guide (transparent denture), which as described previously fitted onto the remaining molar tooth and the opposite retromolar pad. The guide was also in occlusion when the patient closed together, verifying the proposed final tooth position of the restoration, and the surgeon's implant positioning to support the restoration.

Five Branemark (NobelBiocare) implants were placed and 'Multi-Unit' abutments (NobelBiocare) were placed on top of the implants and torqued down to 20Ncm prior to suturing (Figure 11). Metal cylinders silicoated previously in acrylic by the technician were placed onto the 'Multi-Unit' abutments (Figure 12) and hand-tightened.

The tooth-coloured denture was then tried over the top of the metal cylinders to ensure that it could seat correctly on the molar tooth and retro-molar pad, and then attached to them by the use of tooth coloured acrylic. Whilst the acrylic was setting the patient was closed into RCP to maintain the correct occlusion. Once the acrylic had set the denture was unscrewed (Figure 13) and given to the technician who placed abutment analogues into the metal cylinders (Figure 14) prior to casting a master model (Figure 15 & 16). The one remaining molar tooth was then removed.

On the model the dental technician placed more acrylic and wire between the denture and the metal cylinders (Figure 17) and reshaped the denture to form a provisional bridge (Figures 18 & 19) and the new provisional bridge was then polished, fitted back onto the 'Multi-Unit' abutments and torqued down to 10Ncm.

The occlusion was then accurately adjusted so that RCP was the same as ICP, with even shallow anterior guidance and no contact on the cantilever sections.

The patient was dismissed and reviewed at seven days for suture removal, and monthly up to three months (Figure 20), where healing was uneventful.

In order to reduce the time taken to make the final bridge the 'All in One' technique (NobelBiocare) was used. The undersurface of the patient's provisional acrylic bridge

Figure 15: Denture used to cast a new master model

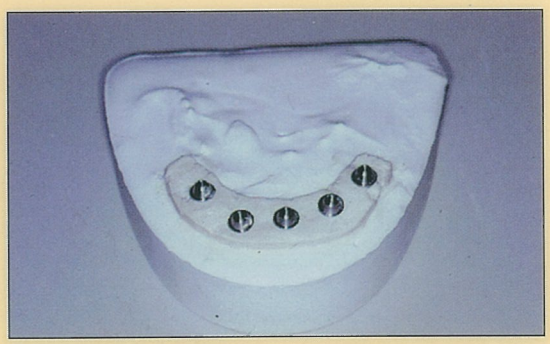


Figure 16: New master model

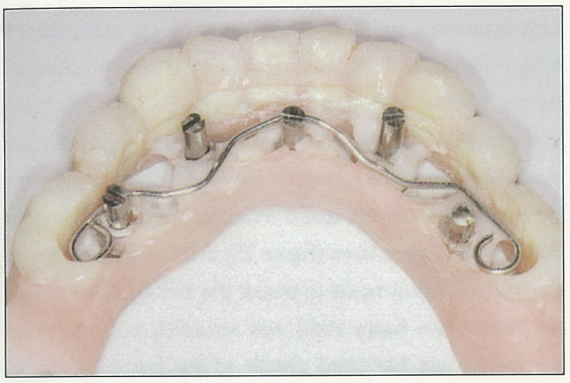


Figure 17: Wire reinforced denture prior to conversion

Figure 18: New provisional bridge – labial view

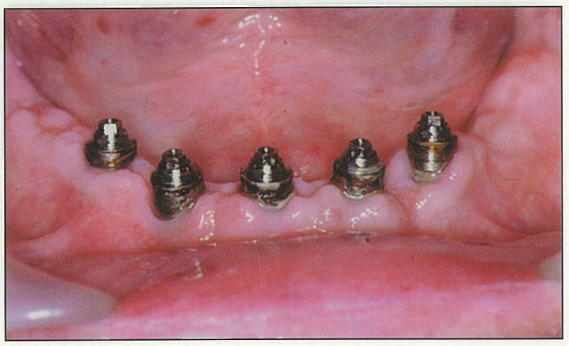
Figure 19: Lingual view

was painted with adhesive, and impression material syringed underneath, so as to gain an impression of the soft tissue under the bridge, after the initial shrinkage (as a result of surgery) had occurred (Figure 21). The patient's bridge was then removed with the corresponding 'Multi-Unit' abutments (Figure 22). Implants analogues were attached to the Multi-

Figure 20: Three months post-insertion showing corsodyl staining

Figure 21: Impression of undersurface of the provisional bridge

Figure 22: Multi-unit abutments prior to removal



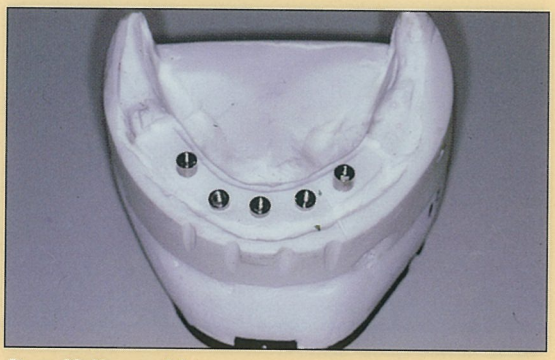


Figure 23: New model

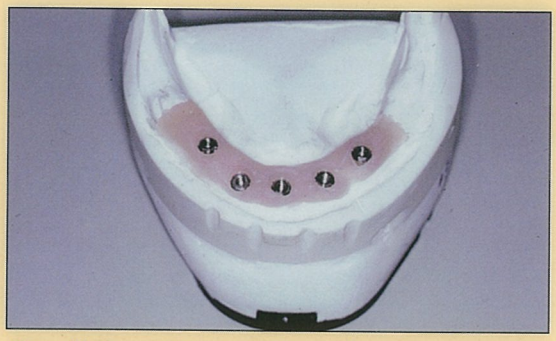


Figure 24: New model and soft tissue replicated from impression of undersurface of provisional bridge

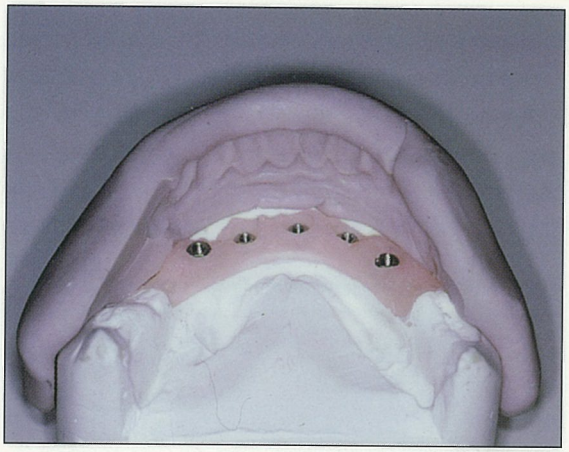


Figure 25: Putty matrix showing position of original provisional bridge

Unit abutments and a new soft tissue model cast into the bridge (Figures 23 & 24). Healing abutments were placed after removal of the Multi-Unit abutments to prevent soft tissue overgrowth. A facebow transfer of the patient's upper denture in situ was employed to mount the lower bridge against the denture in the correct spatial relationship in the articulator. Putty matrices were taken (Figure 25) of the original bridge on the new soft tissue model to ensure the existing shape (which the patient was happy with) was accurately copied. A wax framework was fabricated directly to the fixture head analogues to support the shape of the original bridge using the putty matrices to ensure there was sufficient space for acrylic placement (Figures 26 to 29). The framework was removed and scanned prior to the titanium framework being made. An 'All-in-One' titanium CAD/CAM bridge structure was then fabricated from the scan onto which acrylic was bonded to

Figure 26: Wax framework – on soft tissue model

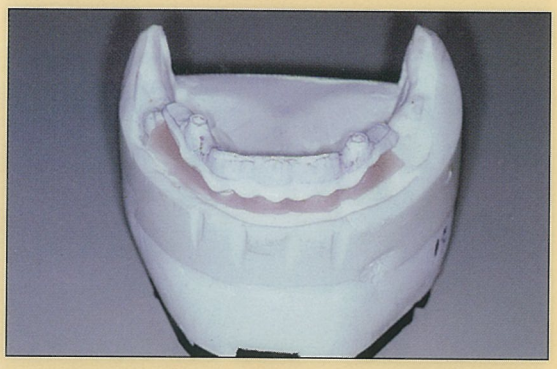


Figure 28: Wax framework – lingual view

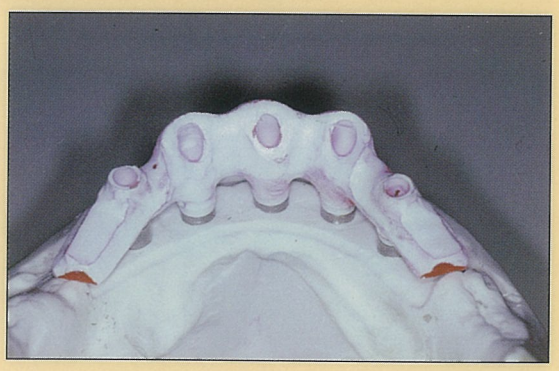


Figure 27: Wax framework – screwed onto the implant analogues

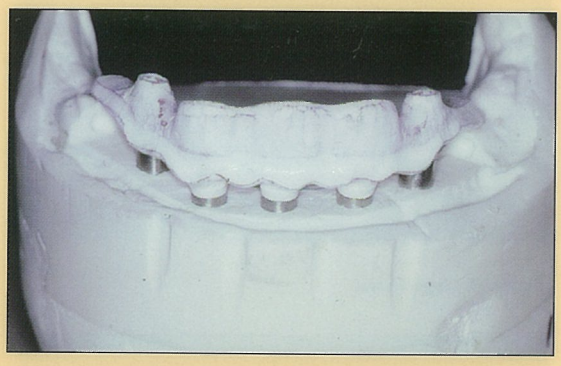
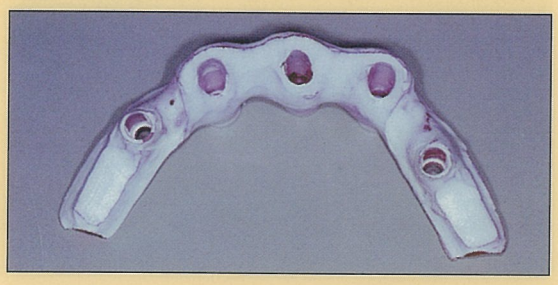


Figure 29: Wax framework – occlusal view



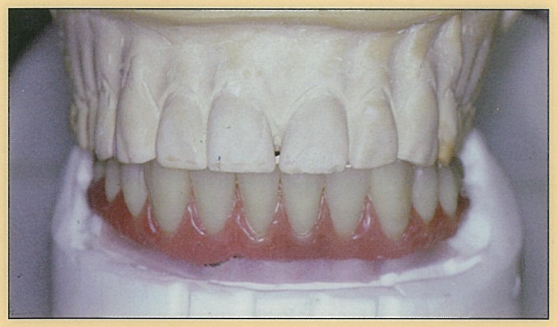


Figure 30: Acrylic/titanium bridge against upper model of denture

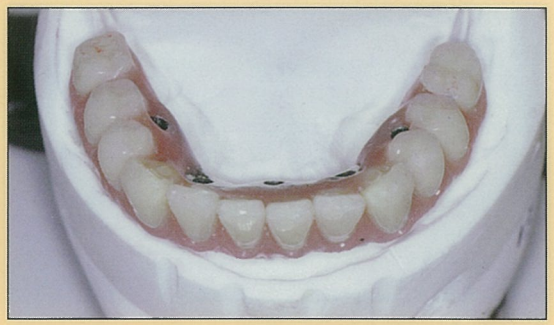


Figure 31: Occlusal view of acrylic/titanium bridge on the model

Figure 32: Bridge returned to technician prior to polishing and staining

Figure 33: Lingual view

form the final restoration (Figures 30 & 31).

At the second appointment, the bridge was tried in and adjusted before being returned to the technician (Figures 32 & 33) for staining and polishing (Figures 34 & 35) before fitting in the mouth (Figures 36 & 37). With this method the bridge can be accurately copied, milled and fitted within only two appointments saving considerable time and costs for the dentist and patient.

DISCUSSION

The procedures have evolved since the first cases (Tipton, 2000) so that a more accurately fitting provisional bridge can be produced more quickly by the technician by using implant analogues on a master model prior to forming the provisional bridge. This reduces polymerisation shrinkage of the bridge. 'Multi-Unit' abutments are now used to ensure that the level at which the prosthodontist works is above the soft tissue which is more comfortable for the patient and easier for the prosthodontist to reposition the bridge, although when fabricating the final restoration no intermediate abutments are required.

Finally, with the new 'All-in-One' titanium framework, because there are no casting inaccuracies as it is milled from a homogenous piece of titanium, the number of appointments can be reduced as the metal framework is guaranteed to fit. The technique also allows for movement of the implants after initial insertion to fit the provisional bridge during the integration stage, thus making the provisional completely pas-

Figure 34: Final adjusted bridge, polished and stained – labial view

Figure 35: Lingual view

Figure 36: Close-up view in the mouth

Figure 37: Bridge in occlusion with patient's upper denture

sive fitting once the implants have integrated. The technician then casts a new model into the provisional bridge with the 'Multi-Unit' abutment and implant analogue attached, and from this new model a framework is waxed and milled from a solid homogenous titanium block to produce a truly passive fitting bridge. Acrylic or porcelain can then be fabricated onto the framework and built into matrices taken from the original provisional bridge to accurately reproduce the same shape and form of the original.

This technique also allows for micro-movement of the implants from within the preparation site at the time of implant insertion to fit within the provisional bridge once it is screwed into place thus making the provisional bridge completely passive fitting once the implants have integrated in their new stable position in the implant preparation site.

CONCLUSIONS

Tarnow's one to five year results in ten consecutive patients suggest that threaded implants can be placed into immediate function to support a provisional fixed prosthesis in edentulous arches during a four-to-six month healing period, in both mandibular and maxillary arches. A delayed loading protocol still remains the treatment of choice; however, for a particular population, immediate loading of multiple implants splinted across the arch may prove to be a valuable adjunct to therapy.

Recently, the 'Same Day Teeth' concept has been launched by NobelBiocare after development and clinical evaluation by Branemark et al (1999). The results reported by Branemark and co-workers confirm that it is possible to routinely provide the patient with a permanent, fixed mandibular prosthesis on the 'Same Day Teeth' – a concept that has also been evaluated by colleagues in multi-centre clinical trials (Branemark, 2000).

The next part of this series will concentrate on immediately place and loaded single tooth implants as an alternative to fixed bridgework.

ACKNOWLEDGEMENTS

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REFERENCES

Adel R et al (1981). A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. *Int J Oral Surg* **10:** 387

Becker W et al (1997). One step surgical placement of Branemark implants: a prospective multi-centre clinical study. *JOMI* **12:** 454

Bernard JP et al (1995). Osseointegration of Branemark fixtures using a single-step operating technique. *Clin Oral Imp Res* **6:** 122

Branemark PI et al (1999). Branemark Novum: a new treatment concept for rehabilitation of the edentulous mandible. Preliminary results from a prospective clinical follow-up study. *Clin Impl Dent* **1:** 2

Busser F et al (1997). Long-term evaluation of non-submerged ITI implants. *Clin Oral Imp Res* **8:** 161

Ericsson I et al (1994). Clinical and radiographical features of submerged and non-submerged titanium implants. *Clin Oral Impl Res* **5:** 185

Salama H et al (1995). Immediate loading of bilaterally splinted titanium root form implants in fixed prosthodontics – a technique re-examined: two case reports. *Int J Periodont Res Dent* **15:** 345

Schnitman P (1997). Ten-year results for Branemark implants immediately loaded with fixed prostheses at implant placement. *JOMI* **12:** 495

Tarnow D et al (1997). Immediate loading of threaded implants at stage 1 surgery in edentulous arches. Ten consecutive case reports with one to five year data. *JOMI* **12:** 319

Tipton P (2000). Immediate loading for dental implants. *Dental Practice* May: 6