The advent of CAD/CAM technology and the more widespread utilisation of implants in modern dentistry has led to an explosion of treatment solutions designed to address any situation encountered by the general dentist.

As patients have become more aware of the benefits of implant therapy, they have begun to demand more immediate restoration of their teeth. The provision of a fixed prosthesis has always been the goal in dentistry; however, the cost of such treatment is pricing the vast majority of patients out of the implant market. Immediate loading, avoiding conventional grafting techniques by placing implants at various angulations (All-on-4, Nobel Biocare; United Kingdom), has resulted in a significant uptake of treatment by edentulous patients and those with a failing dentition. This is mainly because a fixed bridge is provided and treatment times are reduced from months to hours, avoiding a conventional denture.

Most edentulous patients can tolerate a complete maxillary denture without problems. The vast majority of problems arise in the mandible, with few problems. The vast majority of patients out of the immediate loading market. Immedi ate loading, avoiding conventional grafting techniques, has resulted in implant companies and implant companies offering CAD/CAM-fabricated bars and frameworks. Thus, any impression making and cast technique. Studies have shown that 50–70% of all cases involving the SFI-Bar on two implants to restore an edentulous mandible. In addition, the major points from the indirect method will be outlined.

Case presentation

In 2006, a 60-year-old female patient initially presented, complaining of an ill-fitting lower denture. The patient had worn a conventional complete mandibular denture for over 20 years, opposing a metal-based maxillary removable partial denture. The patient had visited a dentist on several occasions to try to improve the situation. After several reline procedures, the patient decided to seek expert help. An OPG radiograph revealed a severely resorbed mandible that clinically presented as a classic horseshoe deficiency (Figs. 9a-c). Radiographic examination revealed there was adequate bone volume in the anterior region for the placement of dental implants. However, a fixed solution would only have provided bone grafting/composite bone grafting. An important factor negating the fixed solution was the size of the volume defect. The patient was not keen to have any more repositioning or complex bone grafting. Another important factor negating the fixed solution was the size of the volume defect. The patient would have been difficult both to correct and to maintain and would have produced a poor aesthetic result. The additional bulk of denture flanges allowed proper facial support.

After discussing all the relevant issues, the use of the SFI-Bar as a removable overdenture retained on two implants was the best and least expensive treatment option for the patient. The upper denture was not an issue for the patient, as it was restorative and stable. In order to limit costs, the upper denture was not replaced. A surgical guide was fabricated after the vertical dimension, aesthetic and phonetic parameters had been corrected in the wax denture try-in. Two 4.1 mm RN connection dental implants (Straumann, Basel, Switzerland) 8 mm in length were placed in sites 452 and 452 (Figs. 7a and 7b). These were allowed to integrate for three months, prior to fabrication of a bar-attachment-retained over-
denture. This denture functioned without surgical or prosthetic issues for a five-year period. Unfortunately, the patient revisited her dentist and complications arose after an attempted intra-oral finishing procedure. On examination, it was determined that the ball abutments were incorrect and needed to be replaced. The female housings needed to be replaced, as they were no longer seated properly on the ball abutments.

The patient was then given the option of having either another ball-abutment-retained overdenture or a bar-and-clip-retained overdenture instead. The patient opted for the bar and clip overdenture. The first step was to remove the damaged ball abutments and seat the appropriate implant adapters on each implant (Fig. 10). This assembly was then connected to the implant adapters and torqued into place. The universal nature of the ball joint allows the bar to be located in the horizontal plane in a truly stress-free alignment (Figs. 2a–c).

The implant adapters were chosen so that when the bar is seated it is parallel to the occlusal plane, with at least 1.0 mm clearance between the underside of the bar and the mucosal tissue (Fig. 7b). This allows for effective seal formation and, in turn, reduces the risk of tissue slippage around the bar when the denture is seated. From a surgical perspective, ridge reduction procedures may be required firstly to aid implant placement and secondly to ensure there is enough space to fabricate the final denture to be seated on the bar assembly. If multiple implants are used, adapters with a range of lengths should be used. Multiple ridge reductions are more difficult to place parallel to each other, but the bar points can accommodate up to 15° of inclination. All surgical and post-surgical complications are seen more commonly in bar and clip overdentures than stud-attachment overdentures. Clinically, the whole procedure took six minutes, from removing the bar all the way up to seating the bar assembly into place.

The bar-retained denture was then hollowed out so that it could be seated over the bar assembly and used as a provisional while the new definitive denture was being constructed. A custom trial bar was made to a border-moulded final impression with Impregum® (Fig. 10). After blocking out the bar assembly (Fig. 10), a wax occlusal rim was then used to determine the vertical dimension of the occlusion and obtain a CR record. This was followed by a full edentulous wax-up to ensure that all of the aesthetic, phonetic and occlusal parameters were correct. At this point, the denture was ready to be processed. The denture is processed in one of two ways:

In the chairside technique, the denture is processed and a window is cut in the denture, through which the dentist can pick up the female part (made from Edufor—0.6% per gold alloy), using self-curing acrylic resin in the patient’s mouth after seating the spacer and blocking out all undercutts (Fig. 10). The total width of the bar with the E clip seated is 4.5 mm (Fig. 11) and 5.6 mm with the T clip seated (Fig. 11a). This is relevant for treatment planning, as ridge reduction may be indicated to provide space for the denture.

In the laboratory method, the denture is completed with the female part T integrated into the denture. The dentist then chooses the level of retention required by selecting the appropriate plastic inserts and seating them in part T (Fig. 11b). The plastic inserts are designed to compensate for transfers inaccuracies during the impression, master cast fabrication and post-processing stages. The presence of a laboratory technician is recommended for the chairside technique. A spacer is placed on the tube bar prior to seating the E clip to ensure vertical residence. The spacer ensures a slight gap between the E clip and the tube bar so that when the patient bites down, the E clip does not overload or distort the bar as the denture beds into the supporting mucosa. All undercuts around the bar assembly, especially between the bar clip and tissues, were blocked out with a silicone material (Fig. 10). A window was then cut into the lingual aspect of the denture to expose the E clip (Fig. 11a). A small bead of cold-cure acrylic resin was then placed on the E clip, covering the retentive element of the clip. The E clip was then attached to the denture with small increments of resin (Fig. 11b). The resin was allowed to cure fully before the denture and the E clip was removed from the mouth. The remainder of the void was then filled with cold-cure resin and allowed to cure outside the mouth (Figs. 11c & d). Ideally, this process should take place in a pressure pot.

A transfer jig that fits into the E clip and is effectively a tube bar replica can be utilised if a large volume of acrylic has been used to house the E clip. The transfer jig seated in the E clip is inserted into a patty of fast-set plaster, similar to a denture-repair scenario. Once the stone has set, the denture is placed in a pressure pot with warm water and the self-curing resin is allowed to polymerise. Once the acrylic has fully cured, it is separated from the stone base and the transfer jig and all excess acrylic is trimmed. At least 50 per cent of the lamellae of the E clip must be clear of resin. Only the superior part of the E clip with the attachment portion and shoulder section is locked into acrylic (Fig. 11c). The lamellae must be free to flex over the tube bar during insertion and removal of the denture. If the resin is in direct contact with the lamellae, the denture may not seat, as the E clip cannot flex. Finally, the definitive prosthesis was seated (Figs. 11a & b).

The level of retention of the E clip was adjusted using the activation and retraction tools provided in the restorative kit. The occlusion was checked and adjusted after verifying that the denture had been properly seated, using pressure-indicating paste. The bar assembly is required to retain the denture in the two-implant scenario. Support is derived from the conventional hard- and soft-tissue load, bearing areas like the residual ridge and the buccal shelf. The patient was then instructed on appropriate care of the implants and the prosthesis, and a routine recall and maintenance programme was instituted.

Discussion

It is imperative that the blockout procedure around the bar assembly is correct. Otherwise acrylic will enter an unsterile area and cure, thus locking the denture to the bar assembly. As a consequence, there would be no option but to cut the denture from the bar to free it. This will not only ruin the denture, but may also damage the bar—a very costly and time-consuming mistake. The E clip is designed for use with the two-implant bar and should be picked up with a self-curing resin as explained. The T clip is for a laboratory-processed denture on four or more implants, as the plastic inserts correct any processing errors. It must not be used in a two-implant situation.

Several studies have shown that conventional bar- and clip-retained overdentures transfer significant stress to the supporting peri-implant tissues (mainly bone).

The key to the SFI-Bar system is that the bar is assembled in the patient’s mouth without the use of soldering, laser welding or conventional bonding techniques, thus reducing stress transmission to bone and hence around the implants. Studies have demonstrated that any laboratory-based technique that requires a master cast made from a dental impression will result in a bar that is not truly passive. As a result, several authors have suggested that the only way to achieve a passive fit would be to assemble the framework intra-orally and then bond the bridge pontic in place.

No laboratory time is required to fabricate the bar and there are no costly implant components or gold-alloy charges. Clinically, there is no need for the bar sections to be sol-dered in an attempt to achieve passive fit—a step that may need re-peeling—as with the conventional method.

There are no soldered or laser-welded joints; the bar assembly has no inherent weak points that may fracture or corrode. The bar is assembled in situ; the dentist who also attaches the E clip intra-orally.

The reduced number of clinical ap-pointments, laboratory time and component costs result in reduced treatment costs for the patient. In the case presented, for example, the bar assembly was completed in only six minutes. This is approximately 20–30% less time it takes for a polyester impression material (like Impregum) to set!

Conclusion

The SFI Bar is relatively inexpensive compared with conventional gold castings and CAD/CAM techniques. The overall cost of the prosthesis and treatment time are significantly reduced compared with conventional and CAD/CAM tech-niques. Precision-milled compo-nents provide an improved quality of fit. The physical and mechanical properties of the component mate-rials can be controlled accurately, which is not the case with con-ventional casting methods. The SFI-Bar can be used with any implants to create a full-arch bar if needed, while the SFI-Bar system produces a prosthesis that is passive as well as a bar that is stress-free. The passive-fit bar assembly can result in greatly reduced stress transmission to the supporting implants. Studies have demonstrated that this is also a viable treatment option for immediate-loading situations in the mandible, provided that the implants achieved insertion torques exceeding 50 Ncm approx.

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