Successful full mouth fixed rehabilitation of a mutilated dentition is always a prosthodontic and surgical challenge. Accurate diagnosis, proper treatment planning, prudent choice of prosthetic materials and meticulous treatment execution are essential for a successful treatment outcome over a long period. The treatment of a partially edentulous oral cavity using a combination of immediate-loading and delayed-loading implant-supported porcelain-fused-to-metal and full-ceramic restorations is presented in this report.

Introduction

Prudent clinical judgement and careful balancing of the risks and benefits of various treatment options are essential for a predictable long-term treatment outcome for prosthodontic treatment. It is known that loss of the vertical dimension of occlusion (VDO) may pose significant clinical difficulties in prosthodontic treatment. The clinical procedures for the re-establishment of a new therapeutic vertical dimension of occlusion is seldom taught in undergraduate dental curricula. VDO is defined as the superior–inferior measurement between two points when the occluding elements are in contact. Various methods have been proposed for the clinical assessment of the VDO. Loss of the tooth structure does not necessarily equate to loss of the VDO, as the VDO may be maintained as a result of compensatory dental eruption. When the clinical loss of the VDO is small, accurate diagnosis can be difficult. In this case study, the management objective was to determine whether there was any need for the re-establishment of the VDO in the case of small loss and whether the proposed change in the VDO was clinically acceptable. When the loss of the VDO is small, any change in the VDO should be based on the amount of interocclusal space required to restore the dentition to proper form and function. A significant alteration of the VDO should be approached with care, and unnecessary, excessive changes of the VDO should be avoided. In general, a significant change of the VDO should be monitored over an extended period.

Improvements in macroscopic implant morphology and surface treatments have led to the reduction of healing time and the concept of immediate loading of implants. Early implant loading is a successful protocol in selected cases. Providing that sufficient bone volume is available, flagless surgical implant placement is predictable and patients experience minimal post-surgical discomfort.

The posterior maxilla presents a unique challenge to implant placement when minimal bone height remains inferior to the sinus floor. Pneumatisation of the maxillary sinus occurs after extraction of molars. In addition, the posterior maxilla has poorer bone quality, mainly Type IV bone.

Placement of implants in grafted bone sites has a high success rate of osseointegration. Several authors have reported an approximate 92 per cent success rate of implants after sinus augmentation. However, immediate implant loading under such conditions is generally avoided. The low failure rate may be attributed to the placement of implants of greater lengths in grafted bone sites.

This case study describes the team approach management of a mutilated dentition, using different types of composites.

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Fig. 1: Pre-treatment intra-oral frontal view, presenting with attrition, loss of posterior support, reduced VDO and compromised aesthetics.—Fig. 2: Pre-treatment intra-oral occlusal view of the maxilla, showing dental attrition and inadequately restored molars. The orthodontic arch wire was broken.—Fig. 3: Pre-treatment intra-oral occlusal view of the mandible, showing dental attrition and inadequately restored teeth. A few of the orthodontic brackets were debonded from the mandibular incisors.
**Clinical report**

A 58-year-old patient presented with multiple missing teeth. The patient desired the restoration of function and aesthetics. He was undergoing orthodontic treatment. He presented clinically with moderate dental attrition, defective restorations, loss of posterior support, discoloration, mild loss of the VDO and compromised aesthetics (Figs. 1–5). The pre-treatment radiograph showed adequate endodontic obturation, missing mandibular posterior teeth, over-eruption of maxillary posterior teeth and attrition of the incisors. The dentition was free from active dental caries and periodontal probing was within normal limits. The maxillary left molar region bone bed was determined to be inadequate for the placement of dental implants. The mandibular posterior bone bed was diagnosed as Type 2B with sufficient bone density for early implant-loading protocol (Fig. 4).

The overall fixed prosthodontic treatment plan included placement of endosseous implants in the mandibular posterior area for prosthodontic rehabilitation, using the early implant-loading protocol; placement of fixed restorations in the maxilla and mandible; simia lift with bone augmentation on the patient’s left side; and simultaneous bilateral placement of implants in the maxillary posterior area, using the conventional two-stage protocol. This was followed by the placement of implant-supported prostheses in the maxilla after a healing period of six months.

Maxillary and mandibular diagnostic casts were made of Type IV dental stone (Silky-Rock, Whip Mix). The casts were mounted on a semi-adjustable articulator (Hanau, Wide-view, Teledyne Water-pik). Diagnostic wax-up was carried out to restore the anterior teeth to proper form. The resulting diagnostic wax-up indicated that an increase of 1.0 mm in vertical dimension at the incisal pin level was required to restore the patient’s anterior teeth to proper form. Such level of change of the VDO had no practical need for prolonged provisionalisation before definitive prosthodontic treatment. The patient’s maxillary right second and third molars required a reduction of 2.5 mm gingivo-incisal height, in order to re-establish a proper occlusal plane. All the natural teeth in the maxillary and mandibular arches required full coverage restorations. The maxillary right second and third molars were restored with an amalgam post-and-core foundation prior to full coverage restoration preparation. An adequate pre-existing composite resin core retained by a prefabricated post with sufficient ferrule was noted in the mandibular left second premolar.

On the day of teeth preparation, all teeth were prepared to receive full crown restorations. In order to establish anterior guidance, the treatment indicated that the restoration of the anterior teeth should be completed before or at the same time as the implant-supported restorations. The anterior teeth were prepared in the usual manner for complete coverage crown restorations.

**Influence of surface properties on osseo-integration**

A biomechanical and histological study in the rabbit

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The overall objective of the present study was to compare shear strengths at the bone-implant interface between the SLActive implants and the TiUnite implants. The second objective was to compare the bone-to-implant contact between the two different surfaces. The hypothesis of the study was that SLActive implants would promote a superior osseo-integration to the TiUnite implants, as evaluated by biomechanical and histological means.

Thirty rabbits with a minimum age of four months were chosen for the study. Two test implants (Standard Plus, 0.8 mm, RN, SLActive, 8 mm) and two control implants (Re-Place Select Taper, 0.8 mm, TiUnite, 10 mm, corresponding to 8.5 mm Ti-Unite) were inserted in the tibia, and one test and one control implant were inserted in the femur. The left and right side were randomised for test and control implants. Ten rabbits per time point were evaluated after ten days, three weeks, six weeks and six weeks after implant placement. At ten days of healing, the SLActive implants yielded higher mean shear-strength values than the TiUnite implants without statistical significance. At three weeks and six weeks of healing, the SLActive implants yielded higher mean shear-strength values than the TiUnite implants (Fig. 1) with statistical significance.

The histomorphometrical investigation for the second objective of the study is still in progress. Thus far, this study strongly suggests that the interface shear strength of titanium implants is significantly influenced by their surface characteristics. The SLActive surface demonstrated higher shear strength with statistical significance in the tibia of rabbits compared with the TiUnite surface at three and six weeks after implant placement.
Margins of the tooth preparations were kept supra-gingival, and no gingival displacement procedures on the prepared teeth were necessary. Upon completion of the crown preparations, six endosseous implants (Nobel-Replace, Nobel Biocare) were placed by the periodontist in the posterior mandible using a flapless surgical protocol. All implants were placed with 45 Ncm insertion torque (Fig. 5). No surgical template was used during the surgical phase; the prosthodontist was present during the implant surgery to ensure implant placement was prosthetically acceptable.

Pick-up type implant impressions (NobelReplace, Nobel Biocare) were attached to the newly placed mandibular implants. High-viscosity vinyl polysiloxane material (Aquasil Ultra Heavy, DENTSPLY DeTrey) was carefully injected onto all tooth preparations and the implant impression copings. A stock polystyrone tray loaded with putty material (Aquasil Putty, DENTSPLY DeTrey) was seated over the entire dental arch to make the definitive mandibular impres-

sion. The maxillary definitive impression was made in the usual manner. A centric relation record was made with a vinyl polysiloxane material (Regisil PR, DENTSPLY DeTrey). The development of the definitive crown restorations was carried out as usual on the definitive casts. Except for the maxillary right molars, all maxillary and mandibular crowns supported by natural teeth were restored with Cercon (Degudent) full-ceramic crowns. Prefabricated abutments (NobelReplace, Nobel Biocare) were custom milled with a six-degree taper in the dental laboratory to facilitate the development of the restorations. Splinted, cement-retained, implant-supported mandibular restorations with porcelain occlusal surfaces were made of porcelain fused to metal material.

On the day of restoration delivery, the mandibular implant abutments were torqued down to 52 Ncm. The abutment screw holes were sealed with gutta-percha (Mynol, Block Drug Company). All the definitive crowns were cemented in resin-modified glass ionomer luting agent (RelyX Unicem, ESPE; Figs. 8 & 9). The insertion of crowns was followed by implant placement in the maxillary arch.

In the presence of the prosthodontist, three endosseous implants (NobelReplace, Nobel Biocare) were placed by the periodontist in the right posterior maxillary implant-supported area.

The development of the definitive crown restorations was carried out as usual on the definitive casts. Except for the maxillary right molars, all maxillary and mandibular crowns supported by natural teeth were restored with Cercon (Degudent) full-ceramic crowns. Prefabricated abutments (NobelReplace, Nobel Biocare) were custom milled with a six-degree taper in the dental laboratory to facilitate the development of the restorations. Splinted, cement-retained, implant-supported mandibular restorations with porcelain occlusal surfaces were made of porcelain fused to metal material.

The patient desired a high level of aesthetics; full-ceramic restorations were chosen for the anterior teeth. As the minimum core thickness for this full-ceramic system is 0.4 mm, this enabled conservation of tooth structure while achieving excellent aesthetics. Traditional porcelain-fused-to-metal anterior crown restorations require the placement of labial crown margins within the gingival sulcus, in order to mask the transition between the root surface and the porcelain-fused-to-metal restoration. By prescribing full-ceramic restorations, intra-sulcular placement of crown margins on the labial surface becomes less important from an aesthetic standpoint.

Porcelain-fused-to-metal anterior crowns. The cervical contour of the anterior teeth was free of caries, teeth preparation margins were made at the gingival level and gingival retraction procedures were eliminated. As gingival retraction cord packing was not required, mechanical trauma to the gingival tissues was reduced and significantly less clinical time was required. This is particularly beneficial for individuals with thin gingival biotypes.

Porcelain-fused-to-metal restorations were used in the posterior teeth because of the high level of aesthetics, full-ceramic restorations were chosen for the anterior teeth. As the minimum core thickness for this full-ceramic system is 0.4 mm, this enabled conservation of tooth structure while achieving excellent aesthetics.

Conclusion

The surgical phase; the prosthodontist was present during the implant surgery to ensure implant placement was prosthetically acceptable.

Pick-up type implant impressions (NobelReplace, Nobel Biocare) were attached to the newly placed mandibular implants. High-viscosity vinyl polysiloxane material (Aquasil Ultra Heavy, DENTSPLY DeTrey) was carefully injected onto all tooth preparations and the implant impression copings. A stock polystyrone tray loaded with putty material (Aquasil Putty, DENTSPLY DeTrey) was seated over the entire dental arch to make the definitive mandibular impression. After a six-month healing period, the left maxillary implants were exposed. A definitive maxillary impression was made as usual. The fabrication of the definitive porcelain-fused-to-metal implant-supported restorations was carried out in the usual manner on the definitive casts. Splinted, cement-retained, porcelain-fused-to-metal restorations with porcelain occlusal surfaces were prescribed for the implant-supported maxillary posterior crowns. The maxillary implant-supported restorations were inserted in the same manner described earlier using resin-modified glass-ionomer luting agent (RelyX Unicem, ESPE; Figs. 8 & 9).

Discussion

Various newer implant clinical protocols and conventional two-stage delayed-loading implant protocols have a high level of clinical predictability. In this report, a flapless implant procedure, single-stage implant placement, sinus lift augmentation, and early implant loading and delayed implant-loading techniques were applied.

The treatment required a small increase in the VDO. It was therefore necessary to make impressions that registered all tooth preparations simultaneously.

Panoramic radiograph after insertion of the crowns. Additional implants were placed in the maxillary posterior areas.

Conclusion

The clinical management of an aesthetically demanding, complex functional prosthodontic rehabilitation is a clinical challenge. Various restorative materials were used for this treatment. A combination of full-ceramic restorations and porcelain-fused-to-metal restorations with porcelain occlusal surfaces enhances the overall aesthetic outcome, as well as functional predictability. Various surgical and implant-loading protocols were used, to ensure optimal results.

Editorial note: A complete list of references is available from the publisher.

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