Digital planning for full mouth reconstruction

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With greater public awareness about cosmetic dental reconstructions, dentists are often challenged with greater demands from the patient. This increased demand for aesthetic restorative treatment challenges the dentist, the laboratory technician and dental manufacturers to develop techniques and materials to satisfy the discerning patient. Utilising digital planning, modern materials and effective techniques, the restorative team can succeed in restoring a smile to proper form, function, and health. The case presented in this article demonstrates the significance of a systematic approach to planning, preparation and material selection in full mouth reconstruction of a patient’s dentition.

Case presentation

A man in his late 30s was referred to my practice by his dental provider because he was dissatisfied with the appearance of his smile. The patient commented that he felt that his existing teeth and restorations were unattractive because of recurrent decay, wear and colour (Figs. 1 & 2). Most importantly, he mentioned that he was suffering from tension headaches, grinding and a limited range of function.

Initial diagnostic evaluation at the first appointment consisted of a series of digital images with study casts, a centric relation bite record, a face bow transfer and a full mouth set of X-rays. In the maxillary arch, the patient had several teeth that had worn composite restorations as well as abfractions with cervical decay. Tooth #5 had an existing crown on an implant. In the lower arch, several existing composite restorations had wear as well as decay on the facial cervical areas. Although there were no restorations present in the anterior mandibular teeth, there was severe wear in the incisal edges due to possible grinding, parafunction and end-to-end bite.

Planning

After reviewing the clinical findings as well as the mounted models, the patient was diagnosed with a restricted envelope of function and decreased vertical dimension from continuous wear. To develop a treatment plan and determine if the vertical dimension could be increased, a diagnostic 3-D White Wax-Up (Arrowhead Dental Lab) was fabricated (Fig. 3). With this service, the dental provider also receives a Preparation Guide as well as a Temporisation Fabrication Template.
The vertical dimension was increased by 1.5 mm. Based on information gathered from the initial consult and digital images, it was determined that the maxillary centrals could be lengthened by 1.3 mm to improve aesthetics and function. The canines would also be lengthened to restore canine guidance in lateral excursions. In regards to his lower anterior teeth, the goal was to correct the length to width ratio and create a less worn appearance. Since tooth #31 was already missing and tooth #2 already had a root canal, core and crown restoration, it was decided to not remove this restoration since it did not oppose a lower tooth and it was not visible when the patient smiled. The final treatment plan would consist of crown restorations, placing composite cores where needed from teeth #3–15 in the upper arch and teeth #18–30 in the lower arch. The material of choice for these crown restorations would be Zenostar (Wieland, Ivoclar Vivadent). According to the manufacturer, this translucent zirconia material combines excellent flexural strength with the aesthetics of natural tooth shades. Zenostar is especially suitable for making monolithic restorations but can also be used as anaesthetic framework material.

Preparation
When informed consent was obtained from the patient, treatment was initiated. After anaesthetic was administered, any existing crown restorations were removed and the teeth cored with composite if any old amalgam cores were present or there was any indication of recurrent decay remaining in the tooth using a Midwest MultiPrep Carbide Bur (DENTSPLY). Adhese Universal bonding agent (Ivoclar Vivadent) was applied following the manufacturer’s protocol and cured using the Demi Ultra (Kerr) curing light. Using Multicore Flow Light (Ivoclar Vivadent), build-ups were accomplished on any teeth requiring cores. A Clear Reduction Guide (Arrowhead Dental Lab) provided with the 3-D White Wax-Up was used to insure adequate reduction for the definitive restorations. In other words, the Clear Reduction Guide allows the dental provider the ability to work quickly and comfortably knowing exactly how much to prepare each tooth for the best result. Using a coarse grit chamfer diamond bur 856 (Axis), the entire dentition was prepared for Zenostar crowns starting from teeth #3–15 and then teeth #18–30. Once these teeth were prepared, a sequential bite was obtained using Blu-Mousse VPS (Parkell) bite registration material. A stump shade (Ivoclar Vivadent) was selected for shade matching of the preparations to assist the laboratory technician in creating natural looking restorations. Utilising Expasyl (Kerr) we not only controlled haemorrhaging, but also achieved gingival retraction. After approximately two minutes in the sulcus, the Expasyl was rinsed off thoroughly with copious amounts of water. A full arch impression was taken using Instant Custom C&B Trays (Goodfit). Made of a proprietary material (PMMA — polymethyl methacrylate) that becomes adjustable when heated in boiling water, these trays provided a quick, efficient way of capturing a dimensionally accurate impression with uniform thickness of impression material. Once molded and customised to the patient’s maxilla and mandible, full arch impressions were taken using a heavy and light polyvinylsiloxane impression material (Take One Advance, Kerr). After the impressions were completed, a bite relations jig fabricated on the 3-D White Wax-Up models from Arrowhead Dental Lab was tried in the mouth. Light body impression material (Take One Advance, Kerr) was placed into the relations jig and seated into the patient’s mouth on to the prepared teeth (Fig. 5). The patient was asked to bite into the relations jig until he reached the vertical stops and the material set. Instructions for the size, shape, and colour of the final restorations was forwarded to the dental laboratory (Arrowhead Dental Lab) as well as the 3-D White Wax-Up models.

Provisionalisation
A provisional restoration, which would aid in determining the best size, shape, colour and po-
In the context of digital planning, a decision was made for the definitive restorations, which were created from a Siltec (Ivoclar Vivadent) impression of the 3-D White Wax-Up provided by the dental lab. Using a B1 shade of Structur 3 (VOCO America) as a temporary material, the Siltec mold was quickly filled and placed on the patient's prepared dentition. Within minutes, the provisionals were fabricated and effortlessly trimmed with trimming burs and discs (Axis). Once the teeth were desensitised with Systemp desensitiser (Ivoclar Vivadent) and dried, the provisionals were temporarily cemented using Temp Bond Clear (Kerr). The patient was taught about their care and use in eating, speaking and biting. A few weeks later, the patient returned for evaluation of aesthetics, phonetics, and bite. Already, he exhibited excitement and confidence with his provisional restorations, commenting that all his coworkers noticed he looked younger and happier. Most importantly, the patient said he no longer experienced discomfort in his TMJ and that his bite never felt better. Since no adjustment or modification of the temporary was needed, the dental lab was instructed to replicate the 3-D White Wax-Up when fabricating the definitive restorations.

**Laboratory considerations**

The 3-D White Wax-Ups, colour photographs, impressions and bite relations were forwarded to the dental lab (Arrowhead Dental Lab). A scan of the 3-D White Wax-Ups was used to select an appropriate arch form, tooth size and occlusion from the library of teeth available in the 3Shape software (Figs. 6 & 7). Using 3Shape Communicate, images of the proposed reconstruction were forwarded to my office by email. Any minor adjustments in tooth shape and contour were communicated with the technical advisor to achieve the most ideal aesthetics. Once approved, the provider and patient, the milling process was begun (Fig. 8).

**Cementation**

The patient returned three weeks after the postoperative appointment for removal of his provisionals and placement of the definitive restorations. Once appropriately anaesthetised, the provisionals were removed with the Pneumatic Crown Remover (DentCorp, NJ). Any remaining temporary cement was removed and the teeth further cleaned with chlorohexidine 2% (Consepsis, Ultradent Products, Inc.). The ZenoStar (Ivoclar Vivadent) crown restorations were tried in to verify marginal fit, contour and accuracy. The patient was handed a mirror to examine the appearance of these restorations. Once satisfied, he approved them for final cementation. As the restorations were removed from the patient's mouth, they were cleaned with Ivoclean (Ivoclar Vivadent), a universal cleaning paste indicated for cleaning of prosthetic restoration surfaces that have been contaminated during intraoral try-in. The active ingredient is sodium hydroxide which is for extraoral use only. Once shaken, the material was applied to the restorations and then thoroughly rinsed, enhancing the bond strength between the indirect restoration and adhesive cement. The preparations were washed and dried; a single component, light cured adhesive, Adhese Universal (Ivoclar Vivadent), was applied to the teeth using the VivaPen (Ivoclar Vivadent) dispenser. In this particular case, Adhese Universal (Ivoclar Vivadent) was used with...
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the self-etch technique although it can also be used with the selective-etch or etch-rinse techniques. Care was taken to insure there was no pooling of the adhesive before curing it for ten seconds with the curing light. The crown restorations were seated utilising a neutral shade of dual-curing adhesive resin cement, Variolink Esthetic DC (Ivoclar Vivadent), starting from the midline and working out distally to prevent any canting of the restorations. The restorations were secured until final polymerisation was achieved. According to the manufacturer, some of the advantages of this cement are excellent shade stability, lifelike fluorescence, easy clean up, and Fig. 8 increased radiopacity. The occlusion was checked and verified with the T-Scan (Tekscan) to make sure that all the proper points of contact were in their ideal positions to ensure longevity of the reconstruction. The patient no longer experienced pain and was very pleased with his new enhanced ‘whiter’ smile (Figs. 9 & 10). In addition, he commented on how effectively and efficiently our staff worked together in delivering his treatment.

**Conclusion**

In conclusion, having a systematic method for treatment planning, material selection, tooth preparation and cementation, the dental provider will be able to address the needs of the patient more effectively and efficiently. Because of this and more, the final outcome will be much more predictable aesthetically and functionally.

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