Full-Mouth Restoration of a Severely Decayed Dentition

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INTRODUCTION

Patients present to the dental office with a variety of needs both pressing and unique; some require a hygiene appointment and routine clinical examination, while others present with much greater challenges. In all cases, patients present with hope: that their teeth are cavity free, the nagging pain in one of their molars is a simple fix, a cosmetic concern can be corrected, or perhaps years of poor oral hygiene and the resulting decay can be repaired, allowing a fresh start with a healthy smile.

Such was the case with the full-mouth restorative case detailed below. The patient had presented to the author's office with extensive dental decay on both arches, the end result of years of neglect and poor oral hygiene, and was eager to save his teeth through extensive surgical and restorative therapies. Porcelain veneers were selected as the main restorative therapy, coupled with anterior periodontal crown lengthening on both arches, endodontics, and mandibular and maxillary posterior crowns, to bring his teeth back to good health, form, and function.[1-4]

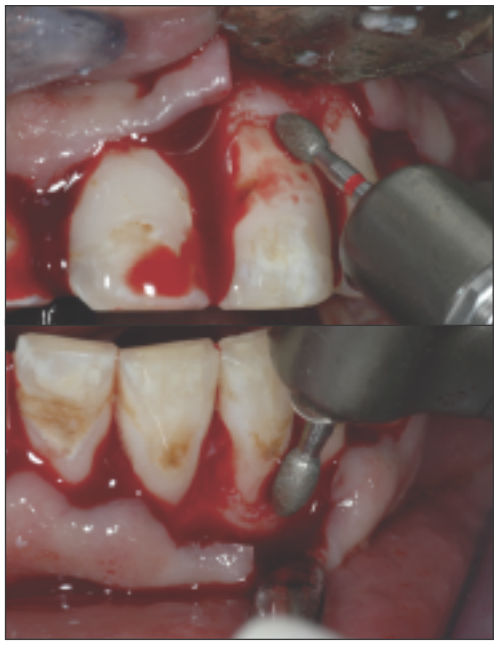
CASE REPORT

Diagnosis and Treatment Planning

A 24-year-old male in good health, accompanied by his parents, arrived at our office for a new patient interview and comprehensive examination. During a review of his medical history, the patient reported that he had been living on his own for the past 4 years and had severely neglected his teeth and oral health. Poor dental hygiene included a lack of regular tooth brushing and flossing as well as the regular daily consumption of soft drinks and candy. The patient was now practicing an improved, healthy lifestyle, and wished to restore his teeth before returning to college.

A comprehensive examination of the periodontium, teeth, existing restorations, occlusion, muscles of mastication, soft tissue, and temporomandibular joints (TMJs) was performed, revealing severe decay on most of his teeth (Figure 1). Impressions for study models were taken and poured in stone. A face-bow record and centric relation (CR) occlusal registration record were taken for mounting the study models.

Figure 1. Preoperative photo showing severe decay on most of the patient's teeth.



Figures 2 and 3. Periodontal crown lengthening surgery was performed on the maxillary and mandibular teeth.

Diagnostic photographs were taken of the patient's full-face smile, close-up smile, incisal edge position with lips in repose, retracted view of the anterior teeth in the closed and open position, right and left lateral views of the upper and lower teeth, and occlusal views of the upper and lower teeth taken in an occlusal mirror. The patient and his parents were given a consultation appointment a few days later.

During the consultation appointment, the patient's diagnostic photographs and radiographs were reviewed as well as photographs of other similar cases the author had restored. The patient's presenting dental condition was discussed, as were treatment options and the pros and cons of each option. Those options included the following: (1) extraction of some severely decayed teeth followed by restoration of the remaining teeth with a combination of removable appliances, crowns, bonded composite restorations and endodontics; (2) option one plus implants to replace the extracted teeth (versus removable appliances); or (3) saving and restoring all the teeth with a combination of periodontal crown lengthening surgery, endodontics, porcelain veneers and full crowns. The patient and his parents wished to save the teeth, if possible, and chose option 3.

The patient's presenting occlusion was excellent. There was no perceptible CR-centric occlusion (CO) slide or TMJ sounds. The patient could open his mouth 55 mm (incisal edge-to-incisal edge) without deviation of the mandible. He could easily move the mandible to the left and right of the midline 10+ mm. In addition, he did not exhibit any tenderness, tightness, or discomfort of the muscles of mastication.

Consent forms were reviewed and signed, and an appointment was made for a thorough teeth cleaning and oral hygiene instruction. The patient was very cooperative and thrilled that his teeth could be saved. Prior to his examination and consultation appointment, he and his parents had been certain that many teeth were going to be lost. Following the oral hygiene appointment, the patient was scheduled for an all-morning sedation appointment to begin the surgical portion of his treatment plan.

Clinical Treatment

At the first appointment, periodontal crown lengthening surgery was performed on the maxillary and mandibular anterior teeth (Figures 2 and 3). The objective of the surgery was to move the gingival line 1.0 to 2.0 mm apical to the decay on the teeth. This was done so that the caries could be predictably removed and restorative margins placed on healthy tooth structure. Additionally, this surgery would re-establish a new biologic width position, allowing harmony with the forthcoming restorative margins.

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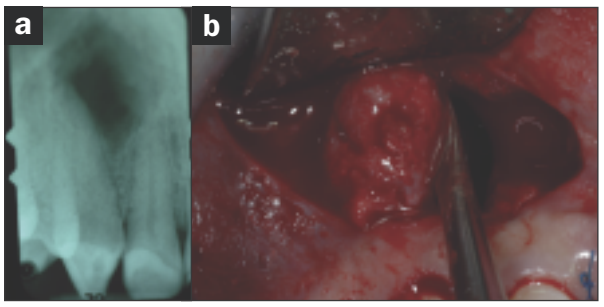

Figures 4a and 4b. During the clinical examination, a globulomaxillary cyst was discovered between the roots of the maxillary right cuspid and lateral incisor. It was surgically removed and sent for evaluation.

Figure 5. Following crown lengthening surgery, sutures were placed to secure the gingival flap; they were removed 2 weeks later.

Figure 6. Gingival tissues were allowed to heal for 3 months before beginning the restorative phase of treatment. Healing progressed without incident.

Patients present to the dental office with a variety of needs both pressing and unique; some require a hygiene appointment....

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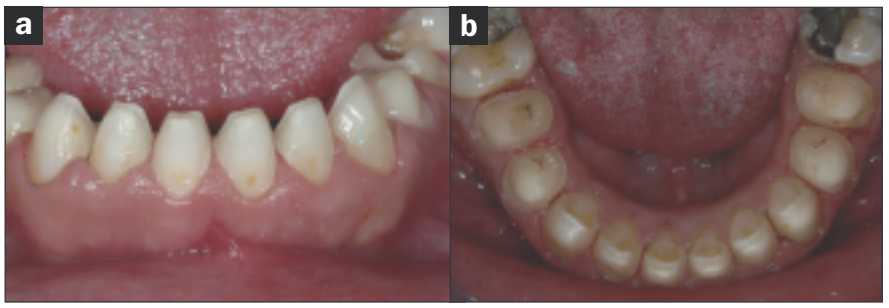
It is important in periodontal crown lengthening surgery that both alveolar bone and gingival tissue are *proportionally* removed. If only gingivectomy is performed, the gingival tissue will regrow approximately 2 to 3 mm coronal to the alveolar crest and re-establish the original biologic width and gingival line position. If 2.0 mm of gingival height is to be removed (gingivectomy), a gingival flap must be reflected following gingivectomy and the alveolar crest must then be reduced apically (ostectomy) the same 2.0 mm so there are 3.0 mm between the newly recontoured alveolar crest line and the newly established gingival line. This measurement allows a healthy biologic width to be re-established apical to the desired gingival line, which is now also apical to the decay on the teeth. Also note that only the facial half of each papillae is reflected, leaving the palatal/lingual half of each papillae in place, to prevent potential formation of an interproximal "black triangle." (Technique by Dr. Pat Allen, Dallas Tex.)

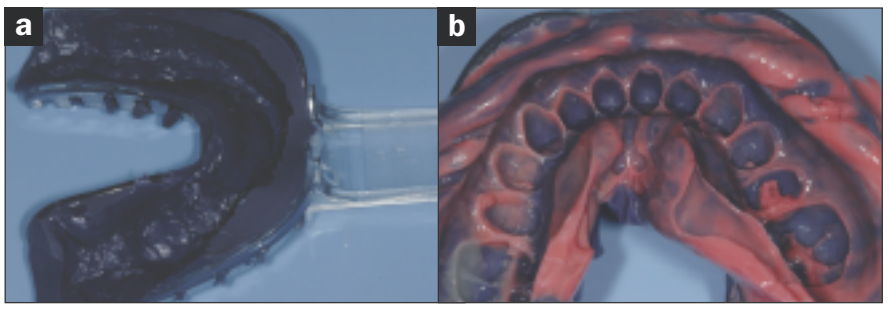
At the comprehensive examination appointment, a previously undiagnosed globulomaxillary cyst was discovered between the roots of the maxillary right cuspid and lateral incisor. This is just one example of the importance of a comprehensive examination on all new patients. The cyst was surgically removed and sent for pathologic evaluation (Figures 4a and 4b). As expected, the pathologic evaluation confirmed the diagnosis of a globulomaxillary cyst.

A 5-O Prolene interrupted suture (Ethicon, a Johnson & Johnson Company) was placed to secure the gingival flap following crown-lengthening surgery (Figure 5), and was removed 2 weeks later. The tissue was healing well and was allowed to continue healing for 3 months prior to dental restoration (Figure 6). During that time, the patient was advised to rinse

Figure 7. Study models were poured in stone, mounted on a semi-adjustable articulator, and waxed-up to ideal tooth dimensions.



Figures 8a and 8b. Mandibular anterior teeth were prepared for porcelain veneers, and bicuspids were prepared for all-ceramic crowns.



Figures 9a and 9b. A polyether impression of the lower arch was taken with a custom tray.

for one minute at bedtime with Crest 3D White Multi-Care Whitening Rinse (Procter & Gamble). This solution contains hydrogen peroxide and may be diluted if too strong. Rinsing was to be followed by flossing and brushing (especially at the gumline) with a Sonicare ultrasonic toothbrush (Philips Oral Healthcare); and then a one-minute rinse with chlorhexidine gluconate (PerioGard [Colgate Palmolive]). Each morning the patient rinsed with mouthwash for one minute, brushed with the Sonicare toothbrush, and then rinsed for one minute with PerioGard.

Following 3 months of periodontal healing, impressions of the teeth were taken along with a face-bow record. Occlusal registration records were not necessary for mounting, since there was no perceptible CR-CO slide and the patient contacted simultaneously in centric relation occlusion (CRO) on the right and left cuspids through first molars. The study models were poured in stone, which were then mounted on a semi-adjustable articulator (Hanau articulator) with the arbitrary face-bow and waxed up to ideal tooth dimensions. The waxed-up models would be used to fabricate the matrix for provisional restorations (Figure 7). The patient was scheduled for an all-morning appointment (with sedation planned) to begin the restorative process.

The mandibular anterior teeth were prepared for porcelain veneers, and the first and second mandibular bicuspids were prepared for all-porcelain crowns (Figures 8a and 8b). Following retraction cord placement in the gingival sulci of the bicuspid teeth (the gingival tissue surrounding the mandibular anterior teeth was too fragile and the gingival sulci too tiny for retraction cord placement), a polyether impression (3M Impregum Penta Soft Custom Tray and Impregum Garant Soft Impression [3M ESPE]) with custom tray (Figures 9a and 9b) was taken of the mandibular teeth; followed by a second reversible hydrocolloid impression (Van R Dental Products). The author utilizes this second impression as a backup, just in case there was some unseen inaccuracy with the polyether impression. The model from the reversible hydrocolloid impression can also be used as a solid model for perfecting the interproximal contacts of the restorations. In that utilization, the gingival quarter of the stone teeth are first cut back with an acrylic bur.

Provisional restorations were fabricated with bis-acrylic provisional material (Luxatemp [DMG America]) using a vinyl polysiloxane (VPS) (or a vacuum-formed) matrix fabricated from the wax-up model. Note that if a vacuum-formed matrix is utilized, as in this case, the wax-up model must first be impressed and poured in stone prior to fabrication of the matrix; otherwise, heat will melt the wax. The mandibular anterior and bicuspid provisional restorations were adjusted to fit the prepared teeth, but they were not cemented at this time.

Since the patient lived in another state, it was determined that the mandibular and maxillary anterior and bicuspid teeth would be prepared, impressed, and provisionalized at the same appointment. Normally, only the mandibular anterior and bicuspid teeth would have been prepared and impressed at the first restorative appointment; the maxillary anterior and bicuspid teeth would have been prepared and restored at the next appointment, when the mandibular anterior and bicuspid final restorations were returned from the laboratory team and seated.

The maxillary anterior teeth and bicuspids were prepared for porce-

lain veneers (Figures 10a and 10b). Impressions were taken and provisional restorations fabricated exactly like those of the mandibular anterior teeth and bicuspids, with the exception that the retraction cord (1n [Van R Dental Products]) was placed in the facial sulci of the maxillary anterior teeth as well as the bicuspids prior to impression taking.

An arbitrary face-bow record was taken as well as a VPS occlusal registration record (JET BLUE BITE Fast Set [Coltène]) of the prepared teeth. The provisional restorations were trimmed and polished, and then tried on the teeth; care was taken to ensure correct incisal planes, occlusion, and well-adapted gingival margins.

Quality full-face photographs were taken of the prepared maxillary and mandibular teeth with the teeth slightly parted and lip retractors in place (Figures 10c and 10d). These photos allow the dental laboratory technician to observe the maxillary and mandibular incisal planes of the prepared teeth compared to the pupillary line (representing a horizontal plane). This also allows the technician to confirm that the face-bow mounting is correct.

The bis-acrylic provisional restorations were luted to the teeth as follows:

A dot of 38% phosphoric acid gel (3M ESPE) was placed for 15 seconds on each tooth prepared for a veneer, then rinsed. Unfilled resin (Scotchbond Universal Adhesive [3M ESPE]) was then copiously applied to the teeth prepared for veneers and also to the inside (tooth-side) of the provisional veneer restorations. Next, temporary crown and bridge cement (Fynal [DENTSPLY Caulk]) was placed in the mandibular bicuspid crown provisional restorations. The 10 maxillary and 10 mandibular connected provisional restorations were then placed firmly on the prepared teeth. As the anterior provisional restorations were held firmly in place with the thumb and pointer finger of one hand, the excess unfilled resin was blown from the teeth onto a 2 x 2 gauze using an air syringe. Two curing lights were used to cure each anterior veneer provisional restoration for 20 seconds simultaneously on both the facial and lingual surfaces. Following initial set, the excess temporary cement was removed from the mandibular bicuspid provisional crown restorations.

Full-face photos of the maxillary and mandibular provisional restorations were taken with the lips retracted and the incisal edges slightly parted, as well as with the patient smiling and with “lips in repose,” showing the incisal edge position in relation to the slightly parted lips (Figures 11a to 11c). These views allow the laborato-

ry team to observe the seated provisional restorations in relation to the pupillary line, gingival line, and lips.

Quality alginate impressions (Identic Alginate [DUX Dental]) were taken of the provisional restorations and poured in stone, and a face-bow record was taken of the provisionals. The laboratory team can use the mounted models of the provisionals for a custom incisal guide table or VPS matrix guide for the final restorations.

The final restorations (feldspathic porcelain veneers and all-ceramic crowns [Tanaka Dental Laboratory]) were fabricated by our lab team and returned to our office. The maxillary and mandibular provisional restorations were removed, and the prepared teeth were polished with plain pumice and water. The remaining "dot" of retained unfilled resin, where the original "dot" of acid etch was placed on the facial surface of each veneer-prepared tooth, was removed with a 5379-023 football-shaped diamond (Brasseler USA). The final restorations were tried-in, and any necessary (very minor) interproximal adjustments were made. Note that these adjustments generally should not be necessary if accurate impressions and provisional restorations have been made. If significant interproximal adjustments are required, and excellent prepared teeth impressions and provisional restorations were made, then inaccurate laboratory die/model systems are usually the problem.

The importance of following oral hygiene instructions and keeping all scheduled appointments should also be emphasized.

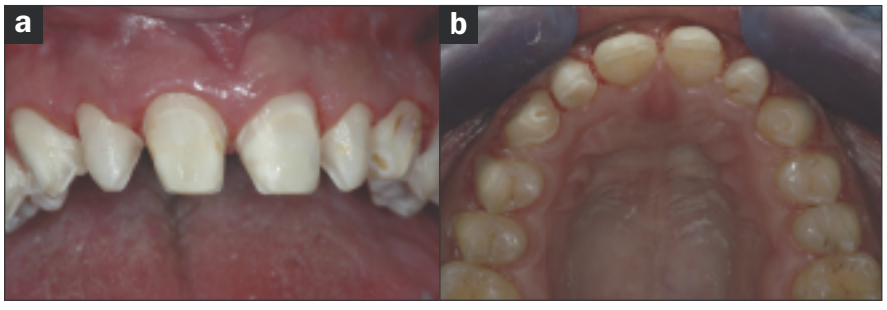
The mandibular anterior veneer prepared teeth were first etched with 38% phosphoric acid for 15 seconds (dentin) to 30 seconds (enamel), then rinsed thoroughly with water for 15 seconds. The porcelain veneers were previously etched with 8% hydrofluoric acid in the laboratory, then placed in an ultrasonic cleaner for several minutes to remove any caked powder that was created from the etching process. Following try-in, the 6 mandibular anterior veneers were wiped with isopropyl alcohol on a small cotton ball, then dried with aspirator air. The room lights in the operatory were turned off so that only the operatory light, turned downward toward the patient's feet and set on low intensity, was on for minimum illumination.

Unfilled resin primer/adhesive (3M Adper Scotchbond Multi-Purpose Adhesive [3M ESPE]) was placed in each mandibular veneer as well as on the facial surface of each veneer prepared tooth. The excess liquid was blown off with an air syringe to remove the acetone carrier. Filled veneer luting resin (RelyX shade B0.5 [3M ESPE]) was next placed in the veneer restorations, which were then placed on the prepared teeth. All 6 veneers were placed at once, without curing. Placement of all 6 veneers at once is not a problem and is done so that the interproximal contacts of the veneers are ideal and do not "swim" microscopically, as often happens when adjacent veneers are placed and cured individually.

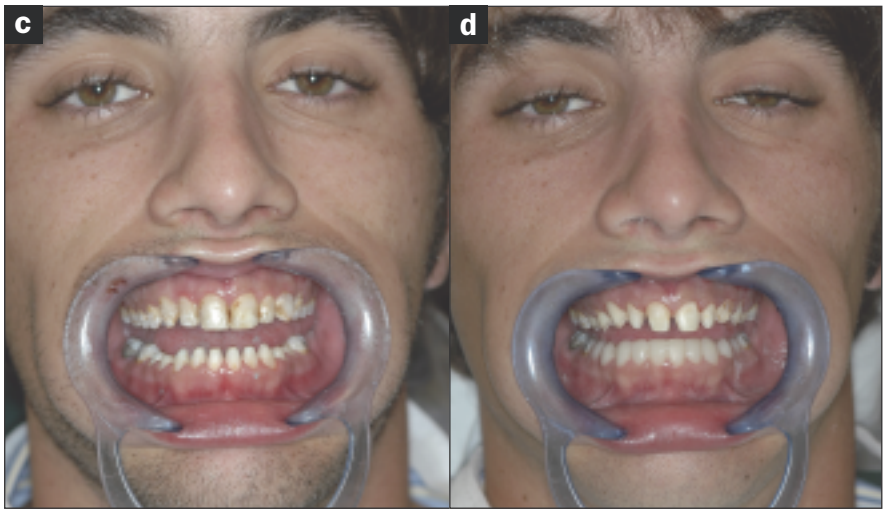
Once the veneers were in place on the teeth, a curing light was activated and moved fluidly from the lingual surface of the mandibular left cuspid to the lingual of the lower right cuspid. This initial cure was only for about 3 seconds total for the 6 veneers. Next, the same curing light was placed on the facial surface of the mandibular left cuspid veneer, activated, and then moved fluidly across the facial surfaces of all the mandibular anterior veneers, ending at the right cuspid. This initial cure was also done for no more than 3 seconds. This minimum cure creates an initial "set" of the veneer luting composite.

The excess luting composite was now easily "chipped" away from the veneers with the backside of a sharp-tipped scaler, followed by interproximal flossing with waxed dental floss. It is critical not to remove any excess luting composite before it is initially set. If excess luting composite is removed in the flowable stage, "suck-back" will occur under the veneer margin, leading to microvoids in the tooth-veneer microgap. These microvoids can lead to marginal decay, sensitivity, and staining.

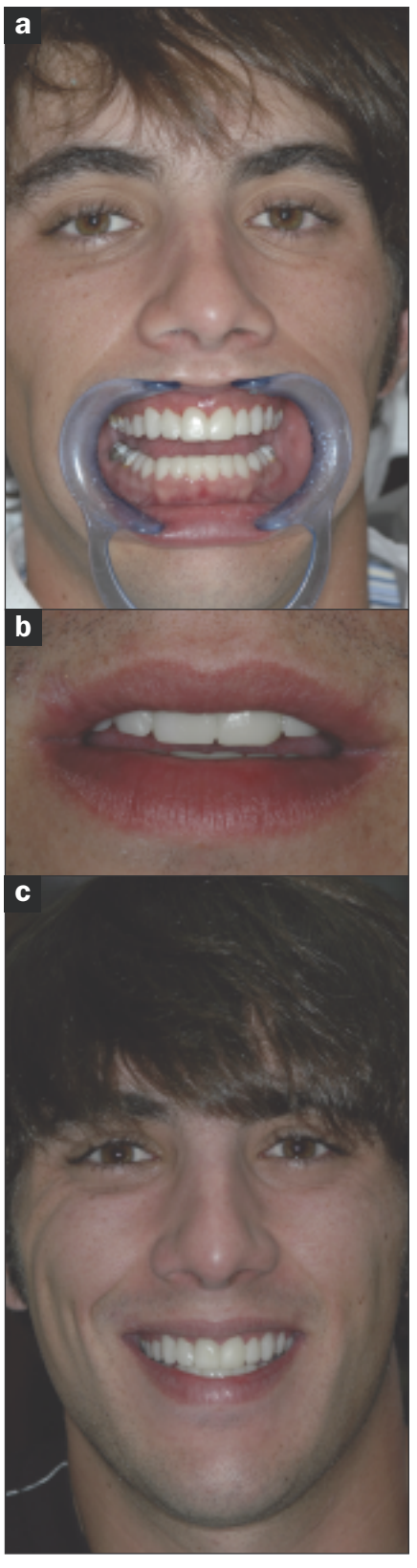
Once the excess veneer luting material was removed, the bicuspid all-porcelain crowns were tried on the teeth, interproximal adjustments were made if necessary, the crowns and teeth were cleaned, and the crowns were cemented in place with RelyX Unicem (3M ESPE) resin cement. Vaseline was placed on the interproximal contacts prior to cementation to facilitate easy interproximal cement removal. Again, except for interproximal contacts, excess cement should not be removed until initial set takes place; the excess cement is then easily chipped away. Waxed floss should be popped through the interproximal contacts as soon as the crowns are seated to be sure the contact does not become blocked with set cement.



Figures 10a and 10b. The patient's maxillary anteriors and bicuspids were prepared to receive porcelain veneers.



Figures 10c and 10d. Full-face photos of the prepared teeth allowed the laboratory team to observe the patient's incisal planes.



Figures 11a to 11c. Full-face photos of the provisionalized teeth allowed the laboratory technicians to observe the seated restorations in relation to the pupillary line, gingival line, and lips.

Figure 12. A hard acrylic centric relation occlusion flat plane maxillary nightguard was fabricated to protect the patient's restorations.

Figures 13a to 13e. Final photos of the patient with the completed restorative care.

The maxillary anterior veneers were seated in the same sequence. Following maxillary and mandibular anterior veneer seating, initial curing, and excess luting composite removal, each veneer was cured 60 seconds with a curing light (Demetron [Kerr]) on both the facial and lingual surfaces. Two lights were used simultaneously so the total curing time for 16 veneers (10 upper, 6 lower) was 16 minutes.

Final luting cement removal was accomplished with dental floss and scalers. If required, the margins may be further polished with ultra fine diamond burs then 33-fluted carbide burs (Brasseler USA Fluted Carbide Bur No. H246LUF.31.012) with a light touch and high water volume, followed by rubber wheels and diamond polishing paste in a prophy cup.

The occlusion was adjusted so that there were no premature contacts on the anterior teeth, and contacts were bilateral and simultaneous on the cuspid and bicuspid teeth when the condyles were seated in CR position (CRO). The incisal edges of the veneers were perfected with a fine, flame-shaped diamond (Brasseler USA Diamond Bur No. 8862.31.012). The patient sat up straight in the operatory chair for this process so that the pupillary line was parallel to the floor (the "alert feeding position"). Final polish was done with rubber polishing wheels (Shofu) and diamond paste (Mirage Diamond Paste) in a prophy cup.

The maxillary and mandibular molar teeth were next prepared for full crowns at the same appointment, impressed, and provisionalized. Once received from the lab, the final molar crowns were cemented, similar to the cementation procedure for the lower bicuspid all-porcelain crowns.

Final occlusal equilibration to CRO was performed. The anterior occlusion was again checked with the patient sitting upright in the alert feeding position to ensure there were no premature contacts on the anterior teeth. A flat plane, hard acrylic CRO maxillary nightguard was fabricated and delivered to the patient (Figure 12).[5] Maxillary and mandibular night guards may be fabricated and worn simultaneously for maximum restoration protection.

The patient was given the following postoperative instructions: (1) At bedtime, rinse vigorously with mouthwash (may be diluted) for one minute followed by dental flossing and brushing with a Sonicare toothbrush; (2) Each morning, rinse with mouthwash followed by brushing; (3) Wear the nightguard each night; (4) Limit sticky sweets, soft drinks, mints, and cough drops; (5) Do not bite or chew hard foods (especially with the anterior teeth) and do not bite anything harder than a sandwich with the anterior teeth; (6) Cut pizza, corn on the cob, apples, etc, into bites and chew these only with the posterior teeth. While studies show that well-constructed porcelain veneers are as strong as natural teeth and can be a good long-term restorative solution,[1-4] shear forces on maxillary anterior teeth, as well as on the porcelain veneers, can cause fracture due to the facial (outward) direction of biting forces.

The patient's final photos after restorative care are shown in Figures 13a to 13e.

DISCUSSION

When a treatment plan is complex and calls for multiple procedures, it is especially important that patients be fully informed from the outset regarding treatment options, duration of treatment, cost of therapy, maintenance of restorations, principles of overall dental health, and their responsibility for maintaining the restorations. The importance of following oral hygiene instructions and keeping all scheduled appointments should also be emphasized. The patient must understand some appointments will often be several hours long. Missed appointments can be costly for the dental practice. Sedation is another important consideration with longer appointments, especially when surgery is involved.

The dental and medical health histories should be carefully reviewed for potential contradictions to therapy and the patient advised accordingly. Examples of potential contradictions to full-mouth reconstruction might be extreme bruxism or periodontal disease. If these conditions exist preoperatively, it is imperative serious conversations take place with the patient regarding possible restoration breakage and tooth loss.

With any restorative treatment, and especially extensive treatment, consideration must be given to longevity of the restorations and responsibility of repair should it be necessary. The possibility always exists that the patient will relapse into the detrimental habits that resulted in one's initial presentation for therapy. The younger the patient is at presentation, the greater the possibility that some or all of the restorations will eventually need to be repaired or redone. Even if the restoration is performed well, there is tremendous stress on dental restorations in the mouth. Just like automobile upkeep, periodic restorative repairs should be expected.

IN SUMMARY

An outline of the sequence of treatment for this full-mouth reconstruction was as follows:

- A patient presented to the author's office in need of a full-mouth restoration, and brought with him the hope that his teeth, and his smile, could be saved.
- Endodontic procedures, periodontal surgery, occlusal equilibration into CRO;
- Study models mounted on a semi-adjustable articulator with an arbitrary face-bow for wax-up to ideal teeth anatomy and position;
- Restoration of the lower anterior teeth, then the upper anterior teeth, establishing appropriate anterior guidance;
- Restoration of the mandibular and maxillary posterior teeth;
- Placement of a hard acrylic, CRO nightguard.[5]

With careful treatment planning involving periodontal crown lengthening surgery, endodontics, porcelain veneers, and crowns, the patient's teeth were systematically and successfully restored.✦

ACKNOWLEDGMENT

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