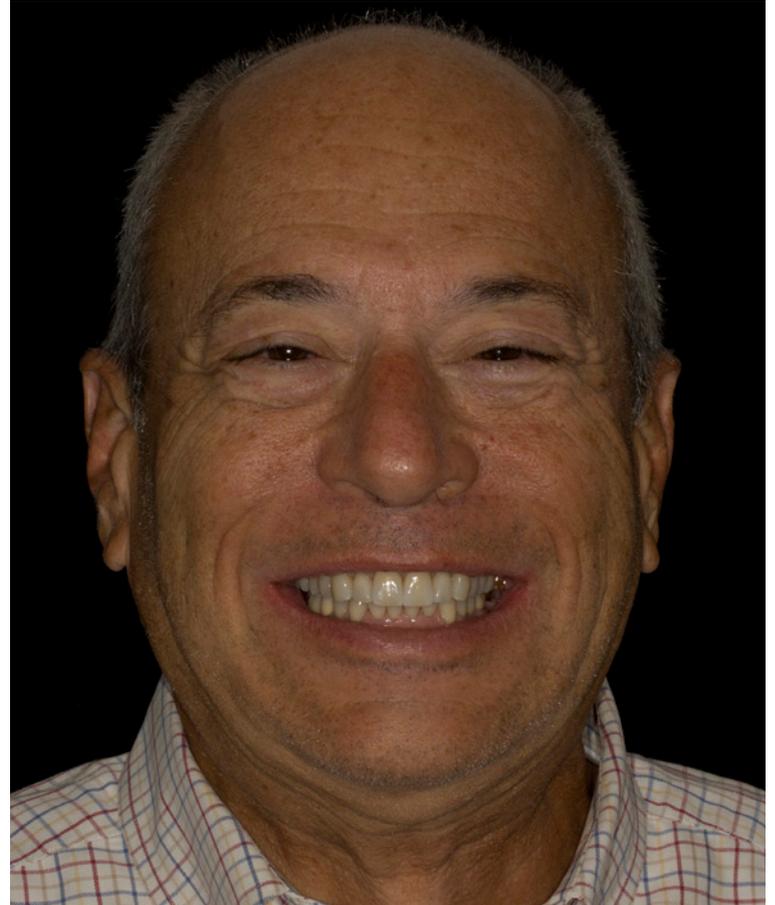


## Active Clinical Treatment • Case 73

*Treating Clinicians: Drs. Brian Vence, David Forbes, George Mandelaris, Alan Rosenfeld and Tadanori Tanaguchi, MDT*



Initial full-face view



Definitive full-face view

*Age at Initial Presentation: 60*

*Initial Presentation: October 2009*

*Active Treatment Completed: September 2012*

### Review of Treatment Goals

The patient, a 60-year-old male decided to seek restorative care after losing two teeth in a five-month period. He was concerned about his tooth loss, bruxism and sleep apnea. He also explained that he would like to simply maintain the current state of his teeth. He questioned the need for a comprehensive treatment plan that would include extensive restorative dentistry. However, he was open to exploring his options and learning about what various treatments would mean in terms of time, money and outcome.



Definitive restorations with teeth apart

### ***Phase I: Force Management and Co-Discovery***

The initial treatment phase incorporated a simple approach to force management. A maxillary stabilization splint was delivered and an occlusal equilibration was performed. As part of this first phase of treatment composite was used to restore the incisal edges of the anterior teeth. This allowed the exposed dentin to be covered and protected as well as the anterior guidance scheme to be optimized. The teeth were not restored back to ideal form at this stage due to space constraints secondary to compensatory supereruption as a result of the wear.

Anterior guidance that creates immediate posterior disclusion reduces muscle force. In addition, broad flat contacts on the incisal edges of the anterior teeth create a distribution of forces and minimize damage to the dentition. The clinicians were concerned that force management alone might not solve the initial issue of fracturing teeth since the patient also had sleep apnea and possibly an uncoordinated chewing cycle.

In the following six months, three additional teeth were lost. Tooth # 12 fractured while the patient was eating a hamburger and was extracted with socket preservation. In July of 2010 the crown on tooth # 30 came off. The tooth was un-restorable due to insufficient tooth structure and the decision was made to extract it and perform socket preservation. Three months later tooth # 5, which was originally scheduled for caries control and temporization, was removed as it was also deemed un-restorable.

The loss of additional teeth showed that the limited intervention of a splint and occlusal adjustment was not going to stabilize the patient's condition and led to a consultation to reassess the effectiveness of the planned treatment and discuss additional options.

### ***Phase II: Interim Treatment***

Discussing care with a patient can be challenging when minimal intervention does not achieve their desired expectations. Of course discussing care with a patient when optimal care does not achieve desired expectations is even more difficult. Clinicians who clarify the challenges, treatment options and attainable outcomes prior to treatment are more likely to set realistic expectations and obtain a satisfying experience at the end of care. Predicting potential challenges during the phases of treatment allows the patient to assist in discovering solutions with the interdisciplinary team.

A consultation was scheduled to review the comprehensive treatment plan with all the key people involved in the patient's care. This included the entire interdisciplin-

ary team as well as the patient's wife and everyone was asked to bring their schedules so a treatment sequence could be determined and scheduled. At this meeting a comprehensive treatment plan was developed that would regain space to restore natural coronal tooth morphology, optimize facial aesthetics and harmonize stomatognathic function.

### ***Phase III: Provisionalization & Periodontal Surgery***

There were several goals for this pre-orthodontic restorative phase. The vertical dimension needed to be opened, crown lengthening would reposition the bone and gingiva and the process of returning the anterior teeth to a more normal width-to-length ratio would begin. Diagnostic casts were mounted in a fully seated condylar position in centric relation to determine the minimum increase in vertical dimension necessary to re-establish posterior tooth morphology.

Increases in vertical dimension cause changes in horizontal and vertical overlap of the anterior teeth (overbite and overjet) as the mandible rotates down and back. These changes can uncover an Angle Class II malocclusion being masked by the worn dentition. Minimal increase in vertical dimension was chosen to reduce the discrepancy of the maxillary and mandibular incisors and realize an anterior protected articulation in a fully seated condylar position.

Silicone matrices were fabricated from the diagnostic wax-up for use as reduction guides and provisional matrices for the posterior teeth. The clinicians decided to use restoration of the teeth as the primary modality for opening the vertical dimension. The maxillary posterior teeth were prepared, making sure that a minimum prep height of 3 mm was obtained and following the guidelines for ideal preparation for full coverage restorations, including allowing 2 mm of occlusal thickness for restorative materials. The teeth were provisionalized with bis-acrylic temporary material. A week later all of the mandibular posterior teeth were prepared and placed in provisional restorations. The provisionals established the new vertical dimension, normal posterior tooth morphology and a harmonized occlusal scheme. The biologic width was purposely violated with the plan that the patient was being sent to the surgeon after four weeks of epithelial healing for definitive crown lengthening to re-establish a normal biologic width.

The margins of the posterior provisionals were used as a reference to reposition the bone and gingiva during crown lengthening. A minimum of 2 mm of occlusal thickness was needed for the final posterior restorations.



A minimum vertical preparation height of 3 mm (measured from the occlusal table of the preparation) was also necessary for retention. These two measurements determined the placement of the margin. The periodontium was placed relative to this margin to allow a distance of 2.5-3 mm for biologic attachment and sulcus formation. Posterior interproximal radicular space was re-established with biologic root shaping. The interproximal root space could have also been gained with orthodontics. Biologic root shaping was selected because full-coverage posterior restorations were being utilized and anchorage was necessary to move the anterior teeth utilizing surgically facilitated orthodontic therapy (SFOT). After the osseous crest and root proximity was established implants were placed in sites #'s 5, 12, 18, 20 & 30 based on a restoratively-driven treatment plan.

#### ***Phase IV: Surgically Facilitative Orthodontic Therapy (SFOT)***

As anterior teeth wear they can undergo compensatory supereruption. When this happens, the anterior incisal edges and gingival margins are no longer aesthetically positioned. In addition, the wear and super-eruption alters the anterior occlusal relationships—changing overbite, overjet and guidance patterns. The ideal placement of the teeth, incisal edges and gingival margins are based on ideal tooth proportions, facial aesthetics and craniomandibular function. The tooth root or implant needs to be in the ideal position to achieve all three goals and have ideal interproximal root proximity or bone.

Craniomandibular function, for this interdisciplinary team, means harmonious neuromuscular function, phonetics, a fully seated condylar position and an anterior protected occlusion. The idea is similar to restoratively-driven implant placement, but carried one step further to include the roots of the teeth. Building bone for ideal implant position relative to the final restoration is well accepted. SFOT is basically the same concept for dentoalveolar bone as it relates to the roots of teeth.

Restoring the anterior teeth to their proper width, length and position can be complicated. Tooth movement was initiated prior to SFOT by the orthodontist to gain some space for transitional bonding. Composite was added to the teeth, not to restore ideal tooth form, but to allow for optimal bracket placement. During the course of treatment following the SFOT surgery and additional orthodontic tooth movement, the composite was optimized to create ideal tooth proportion on both maxillary and mandibular anterior teeth once adequate space had been created.

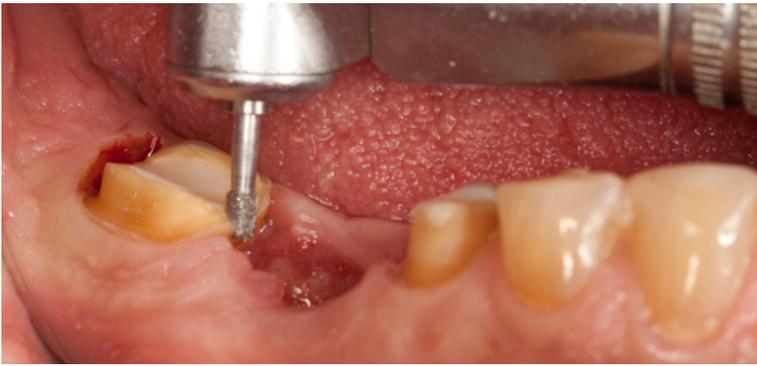
Corticotomies and dentoalveolar decortication were

performed. Particulate bone allograft (BioHorizons® MinerOss®, Birmingham, AL) was placed with CollaTape® (Zimmer Dental, Carlsbad, CA) wound dressing for graft stabilization. The focus was on positioning the roots in an optimal axial position for natural coronal tooth form, aesthetics and function. An interpositional connective tissue graft was also placed at tooth # 12 as the marginal peri-implant tissue was judged to be somewhat thin. Morbidity for this procedure is similar to a patient undergoing an aesthetic crown exposure procedure. The ideal root position was realized in approximately six weeks and retained for six months. Three months of this retention was during provisionalization in the next phase.

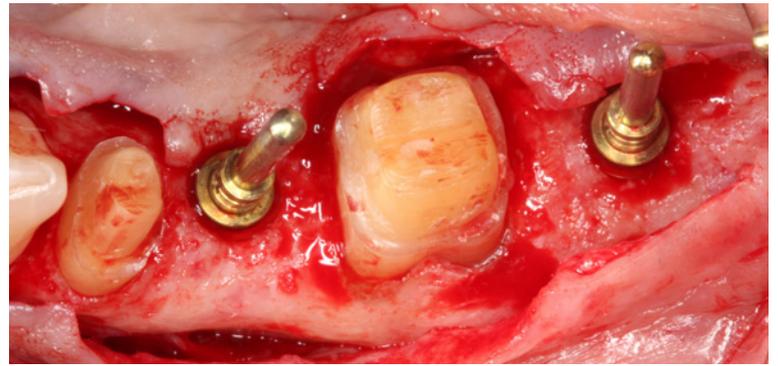
This interdisciplinary team believes in expanding the oral cavity to make more room for the tongue and avoid encroaching on the airway and exacerbating sleep-disordered breathing. A study by Braut<sup>1</sup> showed the thickness of facial bone around maxillary anterior teeth evaluated by cone beam computed tomography was less than 1 mm in 90 percent of the 492 patients in their study. Traditionally, the orthodontic walls/boundary conditions of dentoalveolar bone limits ideal root position, as we do not want dehiscences as a result of root movement. SFOT allows the orthodontist to change the dentoalveolar parameters. While each case is unique, the experience of this interdisciplinary team has demonstrated that dentoalveolar parameters can be changed by about 3 mm without orthognathic surgery. Prosthetically, SFOT is preferred to morphing the anterior teeth by enlarging the cingulums of the maxillary teeth or thickening the incisal facial dimensions of the mandibular incisors to achieve an anterior protected occlusion. Fabricating unnatural tooth forms to create anterior tooth contact in intercuspal position and excursions may appear correct in a static view of the occlusion (MI=FSCP), however, it oftentimes creates problems in dynamic situations such as phonetics.

#### ***Phase V: Definitive Restorative Treatment***

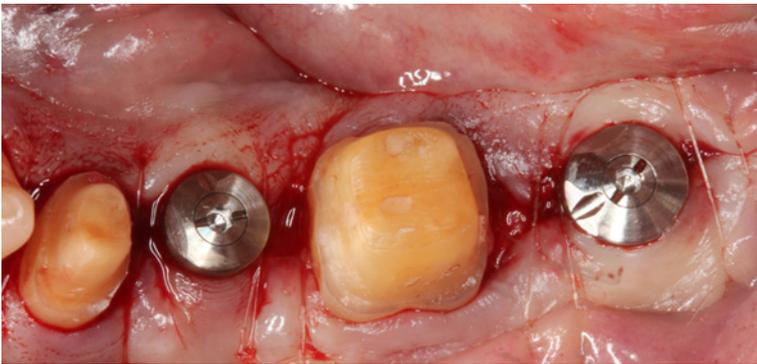
Three months after the orthodontics was completed new impressions and records were taken. A new diagnostic wax-up was completed to refine tooth morphology, aesthetics and function. The original provisional restorations were removed and the posterior tooth preparations were refined based on silicone matrices fabricated from the new diagnostic wax-up. The anterior teeth were prepared for full-coverage restorations on both arches. Provisional restorations were fabricated to serve as a prototype of the final aesthetics, function and soft tissue grooming. The new provisionals stayed in place for three months as a trial period.



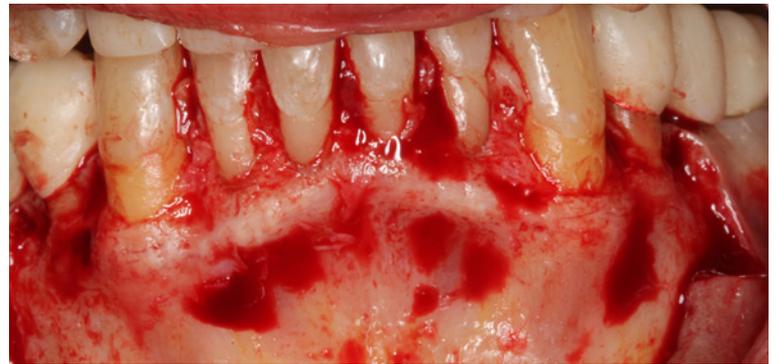
Ideal tooth preparation with 3 mm height



Implant placement in site #'s 18 & 20 with osseous recontouring



Apically repositioned gingiva



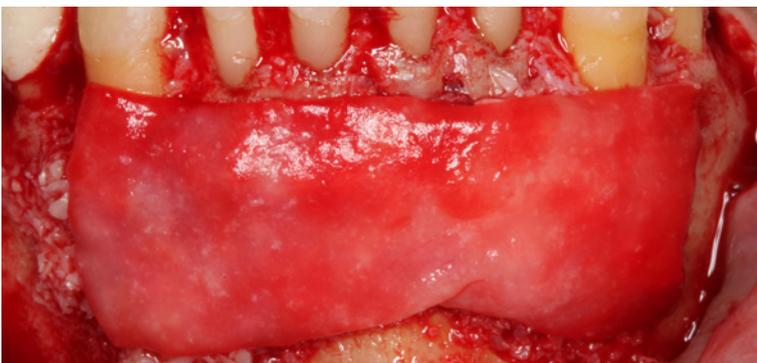
Cortical plate exposure



Cortical plate sectioned vertically



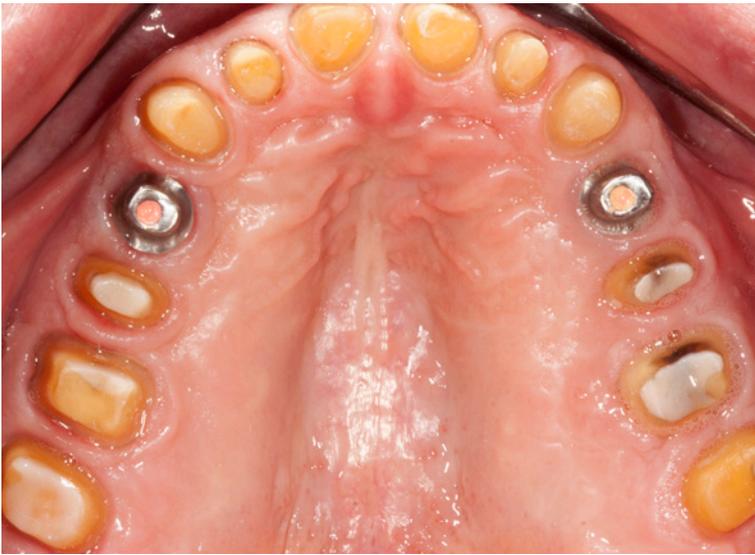
Bone graft material placed



Placement of membrane



Post suturing



Maxillary occlusal view of tooth preparations



Mandibular occlusal view of tooth preparations



Definitive maxillary occlusal view



Definitive mandibular occlusal view

The three-month trial period coincided with the last three months of retention. Therefore, to facilitate inter-occlusal record making and retain the teeth in the new position, the provisionals were splinted from second molar to canine in all posterior areas as well as the four incisors in both arches. This segmentation of the provisional made gathering bite records during the restorative phase simple and predictable. The posterior segments on each arch could be removed—leaving the anterior segments in place. The anterior provisional served to hold the new vertical dimension and as an anterior bite stop, or lucia jig—ensuring condylar seating. Silicone could then be used to capture a bite record of the posterior preps on each arch against the opposing provisionals. The clinicians also

captured a prep-against-prep bite record to allow cross mounting of provisional and prep models to be used by the technician.

Following the retention phase and approval of the provisional by the clinician and patient, impressions of the approved provisional restorations were captured. A SAM® facebow was taken of the upper provisional and mounted on a semi-adjustable articulator. The mounted provisional models were used to produce a custom incisal guide table. Composite was added to the table of the articulator and the models were then worked through all of the excursive movements while matching the wear facets the patient created in the bis-acrylic. The custom incisal guide table then allowed all of the functional parameters to be

transferred to the final restorations. Aesthetic information was transferred with a silicone index of the cross-mounted diagnostic provisional to identify the incisal edge position and tooth widths of the maxillary teeth on the articulator.

The final prep impressions were taken after the trial period was complete when the soft tissue was epithelialized and the emergence form had developed with the provisional contours. A two-cord technique was executed using a compression and reflection cord around the natural teeth. Custom impression copings were fabricated for the implant restorations. Full arch maxillary and mandibular vinyl polysiloxane impressions were fabricated to record the undistorted preparation, emergence profile and a 360-degree circumferential intra-sulcular impression.

The laboratory poured up the casts three times for dies, sectioned casts and a soft tissue cast. The soft tissue cast was cross-mounted as described above. Custom GC titanium abutments were fabricated for site #'s 5, 12, 18, 20 & 30. Lithium Disilicate (e.max®, Ivoclar Vivadent, Amherst, NY) restorations were fabricated for the anterior teeth and PFM and gold were utilized for the posterior teeth. The restorations were tried-in to verify aesthetics and occlusion. The patient signed an aesthetic and try-in agreement form and the restorations were seated definitively. A maxillary stabilization splint was fabricated and the patient's CPAP was titrated by his sleep physician.

### Commentary

From a dental professional's point of view, this patient presented with minimal expectations. Some dental professionals might call it a low dental IQ. However, this particular patient actually had a high understanding of his condition and what dentistry could provide. His initial interests and goals did not include committing to the process of completing significant dentistry and paying the associated fees. The issue the patient and the doctors had to contend with was loss of teeth due to fracture.

Many patients need to discover what they want in terms of dental health. Unless they have been motivated externally, internal motivation requires exploration and discovery. This is the *behavioral side* of dental care. The discovery process is equally important for the doctor. Are any of us convinced we can promise every individual to keep their teeth for a lifetime even with the most sophisticated of treatments?

With this in mind, a comprehensive treatment plan was segmented into phases that allowed for trial therapy and reassessment. Treatment plans segmented into phases allow for assessment, alterations or cessation of

treatment. After the first phase of treatment, another consultation was scheduled to evaluate the state of treatment. During the process the patient re-evaluated his goals and interests based both on the information we shared with him and what he had learned based on his experiences during early treatment. The patient developed new goals that included comprehensive treatment.

One of the challenges for many patients is the expense of this type of care. On the clinical side, it is challenging to maintain provisional restorations during the course of treatment. There are approaches that would allow cases like this one to be phased over time and limit the number of provisionals by using composite overlays on the posterior to open the vertical dimension. There are also alternate techniques that would have allowed the occlusal contacts to be established, but would have required creating tooth forms that were unnatural. This clinical team believes SFOT is a superior choice to maintain natural tooth contours. It provides the ability to favorably influence the dentoalveolar bone conditions and allow otherwise unattainable root positioning to be accomplished for more ideal outcomes.

### Reference

1. Braut V, Bornstein MM, Belser U, Buser D; Thickness of the anterior maxillary facial bone wall—a retrospective radiographic study using cone beam computed tomography.; *Int J Periodontics Restorative Dent.* 2011 Apr;31(2):125-31.

*Dr. Brian Vence is in the private practice of restorative dentistry, West Dundee, IL.*

*Dr. David Forbes is in the private practice of orthodontics, West Dundee, IL.*

*Dr. George Mandelaris is in the private practice of periodontics, Park Ridge, IL.*

*Dr. Alan Rosenfeld is in the private practice of periodontics, Park Ridge, IL.*

*Tandanori Tanaguchi, MDT is a dental technologist, Fountain Valley, CA.*