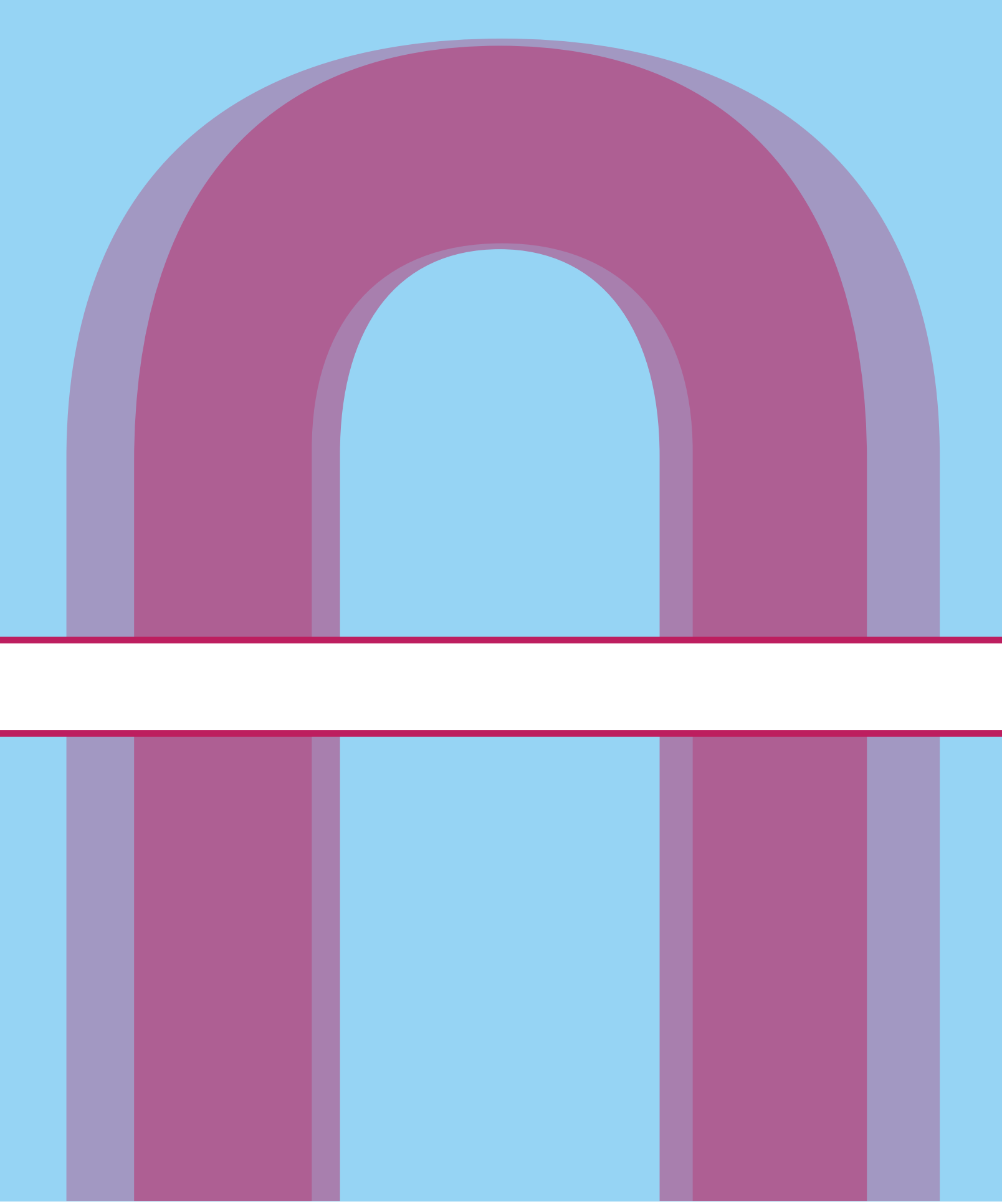

TREATMENT of a Class III Malocclusion

Utilizing an Implant-Supported, Fixed Removable Milled Bar Overdenture

Jeff H. Bynum, DDS

Key Words: implant, milled bar, overdenture, orthognathic surgery

Abstract

Orthognathic surgery is often recommended for the adult patient presenting with a skeletal malocclusion and a desire to restore the teeth to a more ideal esthetic and functional relationship. For the patient who also presents with a compromised existing dentition requiring removal of all or multiple teeth within the arch, it may be possible to manage the skeletal malocclusion with the use of dental implants and a milled bar overdenture. This case discusses the treatment of a Class III malocclusion and a compromised maxillary dentition with implant therapy and a milled bar overdenture to achieve the appropriate esthetic and functional parameters and effectively eliminate the need for orthognathic surgery. Diagnosis, treatment planning, surgery, and prosthetic work are addressed.

Introduction

The Angle Class III skeletal malocclusion is a skeletal growth abnormality characterized by mandibular prognathism, maxillary retrognathia, or a combination of both.[1,2] Originally, Class III malocclusions were primarily attributed to an overdevelopment of the mandible; however, cephalometric analysis indicates that maxillary retrognathia is responsible for up to 60% of cases. These patients often clinically exhibit a concave facial profile, retrusive nasomaxillary area, and prominent lower third of the face. The maxillary arch is often narrower than the mandibular arch, and the overjet and overbite can range from reduced to reverse.[3]

Much of the literature focuses upon orthodontia, appliance therapy, and other non-surgical therapies for the adolescent.[4] For the adult, orthognathic surgery typically is recommended. The type of surgical treatment depends upon the etiology of the malocclusion and may include sagittal split osteotomies, segmental osteotomies, Leforte I osteotomies, or some combination of the aforementioned.[5]

For the adult Class III malocclusion patient who presents with other dental compromises and associated risks, management of the malocclusion is possible with implant therapy and a milled bar overdenture.[6,7] Without the use of implants to create stability and retention, placing denture teeth beyond the limits dictated by the patient's anatomy can create instability of the prosthesis.[8] The appropriately fabricated milled bar can effectively create an artificial crest of the ridge, allowing the denture teeth to be placed beyond the traditional anatomic landmarks. The prosthesis can then be fabricated in a more esthetic and functional position for the Class III malocclusion patient without subjecting the patient to orthognathic surgery.

This clinical essay presents an Angle Class III skeletal malocclusion case treated with implant therapy and a milled bar overdenture in lieu of orthognathic surgery, with marked functional and esthetic results.

Figure 1: The patient was not pleased with his existing bridgework.

Figure 2: Interpretation of cephalometric data revealing a retrognathic maxilla.

Case Report

A 68-year-old male presented for comprehensive examination and treatment **(Fig 1)**. His medical history consisted of controlled Type II diabetes and no known drug allergies, current medications, or contraindications for dental treatment. His dental history revealed tooth loss associated with caries. He presented with a failing maxillary fixed partial denture spanning from #8 to #16. He reported discomfort in the area of #13 while chewing hard, sticky foods.

The patient was also concerned with the appearance of his teeth. He had never been pleased with the appearance of his existing bridgework. Orthognathic surgery had been recommended by previous dentists to correct the skeletal malocclusion and improve esthetic outcomes. Interpretation of cephalometric data revealed a retrognathic maxilla (Nasion-A point to Frankfort Horizontal plane angle (Na-FH of 82° and ANB <1°) **(Fig 2)**.

Diagnostic Opinion

Periodontal

A clinical and radiographic examination revealed American Academy of Periodontology (AAP) Type III classification with bone 2 to 4 mm from the cemento-enamel junction **(Fig 3)**.

A mucous retention cyst was noted in his right maxillary sinus and evaluated by an ear/nose/throat physician specialist. No treatment was indicated for this finding. Periodontal findings included slight bleeding on probing and probing depths less than or equal to 3.0 mm.

Risk: Moderate[9,10]
Prognosis: Fair[9,10]

Biomechanics

The patient had a history of restorative dentistry and missing teeth due to biomechanical compromises. He presented with active carious lesions on two teeth (#6 and #13) supporting the long-span bridge (#8-#16). Tooth #8 also appeared to have

Figure 3: Preoperative radiograph showing AAP Type III.

internal resorption. The mandibular teeth exhibited no active caries but had several questionable restorations and areas of structural compromises **(Fig 4)**.

Multiple structurally compromised teeth were noted. Tooth #13 exhibited irreversible pulpal pathology and #4 showed signs of pulpal pathology. Class II mobility was noted on the abutments supporting the maxillary fixed partial denture. The three abutment teeth supporting the fixed partial denture showed evidence of cement fatigue and resultant recurrent caries **(Fig 5)**.

Risk: High
Prognosis: Poor to hopeless

Function

Bilateral mandibular tori were noted and posed no contraindication for treatment **(Fig 6)**.

Although the patient reported difficulty in chewing hard, sticky foods, this difficulty was attributed to the discomfort associated with the active apical pathology. Some attrition was noted on the mandibular anterior teeth. The wear on the anterior teeth was attributed to the end-to-end anterior occlusal scheme previously established in an attempt to manage the Class III malocclusion.

The extremely long-span bridge showed no evidence of fracture or chipped porcelain and had been in function for more than 20 years. The right lateral view demonstrates the skeletal Class

Figure 4: Several questionable restorations and areas of biomechanical compromises.

Figure 5: Maxillary arch displaying several notable concerns.

Figure 6: Bilateral mandibular tori were noted.

III malocclusion **(Fig 7)**. The patient stated that the wear seen on the lower incisors had not noticeably changed in the past five years. The functional system was not displaying signs of active breakdown, leading to a diagnosis of acceptable function.

Risk: Low
Prognosis: Good

Dentofacial

The patient displayed no maxillary teeth with the lips in repose. Only 1 to 2 mm of each visible tooth was displayed in a full smile. Lip mobility was only 3 mm and less than average **(Fig 8)**. Asymmetries of the gingival architecture were not evident without retraction. The patient expressed a desire to display more tooth structure when speaking and smiling.

Risk: Low
Prognosis: Good

Treatment

The patient had previously been given a treatment plan of a mandibular bilateral sagittal split osteotomy to reduce his "prognathic mandible." Cephalometric analysis showed a retrognathic maxilla. Both surgical and restorative options were explored and discussed as a way of treating the retrognathic maxilla. The patient chose to reject the orthognathic surgery because: (1) even with an improved skeletal relationship, he would still require implant therapy to replace missing teeth; and (2) it was felt that his esthetic objectives could be met utilizing the implants. The implant option would minimize the number of surgical procedures and the consequent healing time and sequellae. It was decided to proceed with maxillary implants and a milled bar overdenture. This option appropriately managed the patient's risk factors and susceptibility for disease and fulfilled the treatment goals, which were as follows:

- Decrease the high biomechanic risk by eliminating periapical infection and caries.

These patients often clinically exhibit a concave facial profile, retrusive naso-maxillary area, and prominent lower third of the face.

Figure 7: Skeletal Class III malocclusion.

Figure 8: Less-than-average tooth visibility and lip mobility.

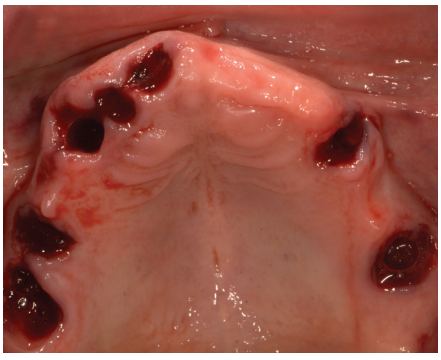

Figure 9: All of the remaining maxillary teeth were carefully extracted.

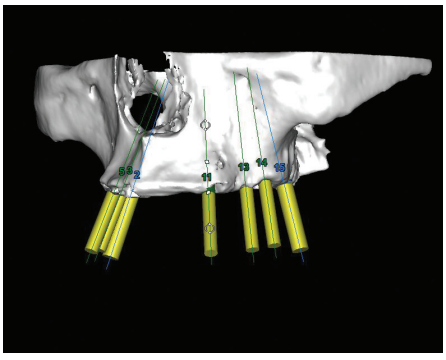

Figure 10: A 3-D implant treatment plan was established.

- Improve and enhance the smile by increasing tooth display in repose and full smile.
- Create a prosthesis that allows for long-term esthetics, stability, cleansability, function, and repairability.

All of the remaining maxillary teeth were carefully extracted using periotomes, luxators, and proximators **(Fig 9)**.[11] Site optimization techniques were utilized in all sites where the buccal plate thickness was less than or equal to 1 mm.[12,13] A human cortical and cancellous mineralized allograft (MinerOss, BioHorizons IPH; Birmingham, AL) was delivered into the extraction sockets, and an absorbable collagen wound dressing (CollaPlug, Zimmer Dental; Carlsbad, CA) was sutured over each site.

A three-dimensional (3-D) cone beam-computed tomography image was obtained (i-CAT, Imaging Sciences Int.; Hatfield, PA), and 3-D implant treatment planning was utilized (Simplant, Materialise Dental; Glen Burnie, MD) to accurately plan the proper placement of the implants to facilitate the desired prosthesis **(Fig 10)**. A temporary treatment denture was fabricated and worn by the patient during the post-extraction, three-month healing period.

After adequate healing, implants were placed according to the preoperative plan (BioHorizons Maestro, BioHorizons) **(Fig 11)**. The implants were allowed to heal for three months, after which time an open-tray impression was made and all appropriate diagnostic information was relayed to the laboratory (RE Bourke; Redmond, WA).

A wax rim was fabricated to establish the desired position of the maxillary incisal plane, horizontal and vertical positions of the anterior teeth, and maxillary posterior occlusal plane **(Fig 12)**. The canines were positioned level with the lip in repose.[14] The development of the maxillary occlusal plane was established based upon esthetics and dentofacial parameters.[15,16] Orthodontic therapy would be performed to align the mandibular teeth to coordinate

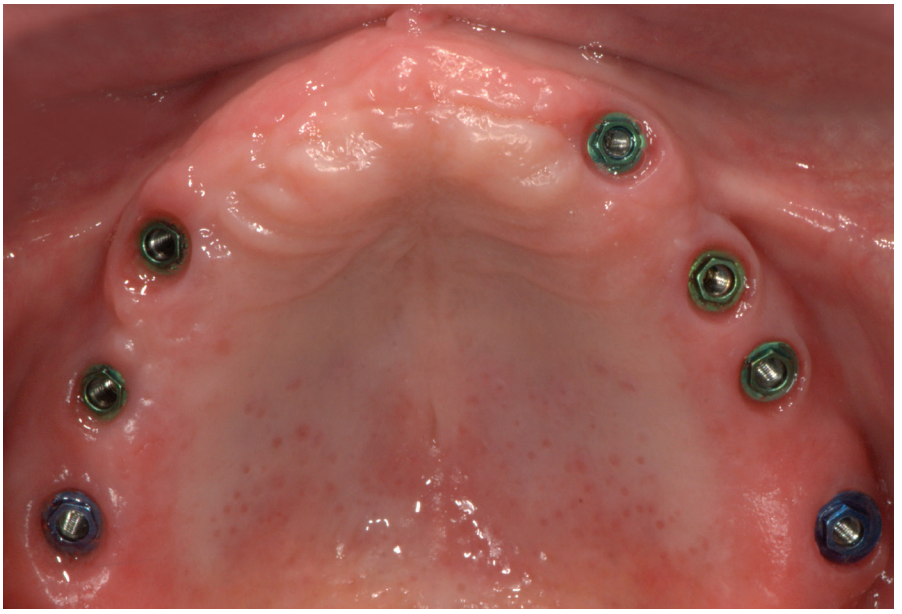

Figure 11: Implants were placed after satisfactory healing.

Figure 12: A wax rim was fabricated to establish the desired position.

Figure 13: The rim was previewed with a full smile.

functionally with the facially generated maxillary occlusal plane.

The wax rim can be previewed with a full smile **(Fig 13)**. Establishing the maxillary incisal plane relative to the canines positioned level with the maxillary lip in repose increases the amount of teeth displayed with a full smile for this patient. The patient's low lip line affords the opportunity to move the vertical position of the maxillary teeth down in the face and increase the amount of maxillary tooth display.

The milled bar was fabricated by the laboratory with bilateral attachments cast into the milled bar framework (MK1 Dental-Attachment GmbH; Zetel, Germany) to allow the overdenture to be fixed in place during function **(Fig 14)**. The security of the combination of the attachments with the milled bar allowed the teeth to be positioned in a position dictated by esthetic and functional parameters. Passive placement of the milled bar on the implants was assured with a try in, and the esthetics of the denture were verified prior to final processing.

The bar was delivered with a passive fit, and the screws were torqued to the manufacturer's recommendation of 30 Ncm. The bar was extended well over the crest, allowing the teeth to be positioned beyond the traditional bony landmarks. This enabled an increase in tooth display without compromising the stability of the denture **(Fig 15)**.

The intaglio surface of the denture was milled to allow for a precise and secure fit over the bar, and the attachments were easily engaged by the patient. This allowed for a fixed overdenture prosthesis that had the ability to be removed for cleaning purposes **(Fig 16)**. During the planning stages of implant placement, accommodation for the space requirements of the attachments as well as preparation for visual shielding of the access hole used to engage retention were considered.

The simple placement of a key into the access opening for the attachment will disengage the frictionless, positive

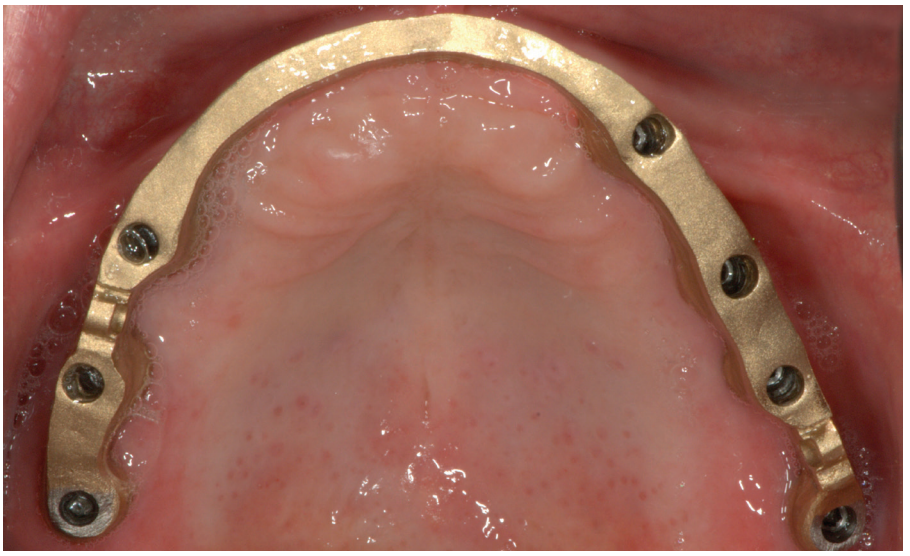

Figure 14: A milled bar was fabricated and placed.

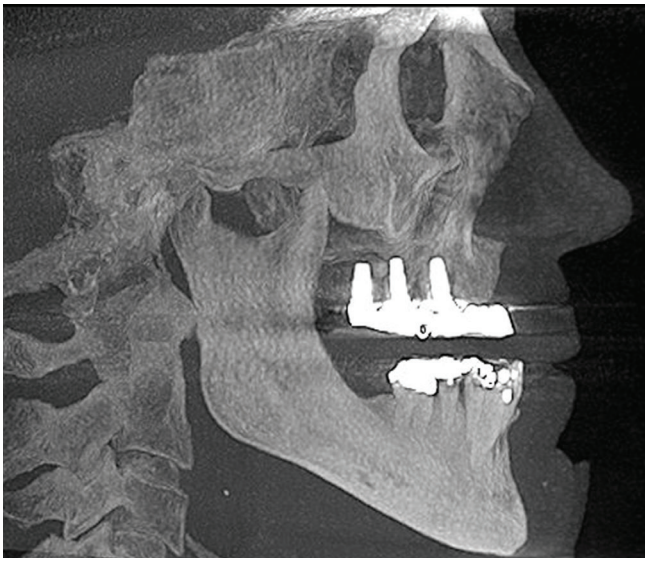

Figure 15: Radiograph showing the bar with a passive fit and labial position relative to the crest of the ridge.

Figure 16: The removable fixed overdenture prosthesis.

locking axle from the housing **(Fig 17)**. Once both sides are disengaged, the denture becomes easily removable for repair and cleaning. Upon being placed back in the mouth and seated over the bar, the axle is easily engaged with the patient's finger or thumb and sits flush with the denture base.

Orthodontics on the mandibular arch was used to level the mandibular occlusal plane and establish a functional intra-arch relationship **(Fig 18)**. The functional and esthetic parameters, determined by the dento-facial analysis and esthetic parameters, remained constant on the maxilla. The active phase of mandibular orthodontia was completed in approximately 10 months, and the patient is actively maintaining this relationship by wearing a clear, hard plastic retainer.

The postoperative close-up full smile shows a more desirable amount of tooth display **(Fig 19)**. The patient was pleased with the enhanced esthetics, stability of the restoration, and alleviation of pain. He was also pleased that the results were achieved without the need to advance the maxilla via orthognathic surgery.

Summary

The patient's postoperative full smile two weeks post-treatment demonstrated a marked improvement in facial esthetics **(Fig 20)**. Patients with skeletal malocclusions have compound challenges when attempting to improve dentofacial parameters. Orthognathic surgery has traditionally been utilized to correct skeletal malocclusions in an attempt to achieve more idealized results. In the case of a compromised dentition, adding implant therapy and a milled bar overdenture made it possible to move the crest of the ridge to a position that allowed for placement of the maxillary teeth in a more desirable esthetic and functional position. This patient was able to avoid the risks associated with orthognathic surgery, reduce and manage his susceptibility for disease, and achieve a restoration that fulfilled his goals for improved esthetics and functional longevity.

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Figure 17: Placement of a key to enable disengagement of prosthesis for removal.

Figure 18: Orthodontics used to level occlusal plane and establish function.

Figure 19: Postoperative full smile showing more tooth display.

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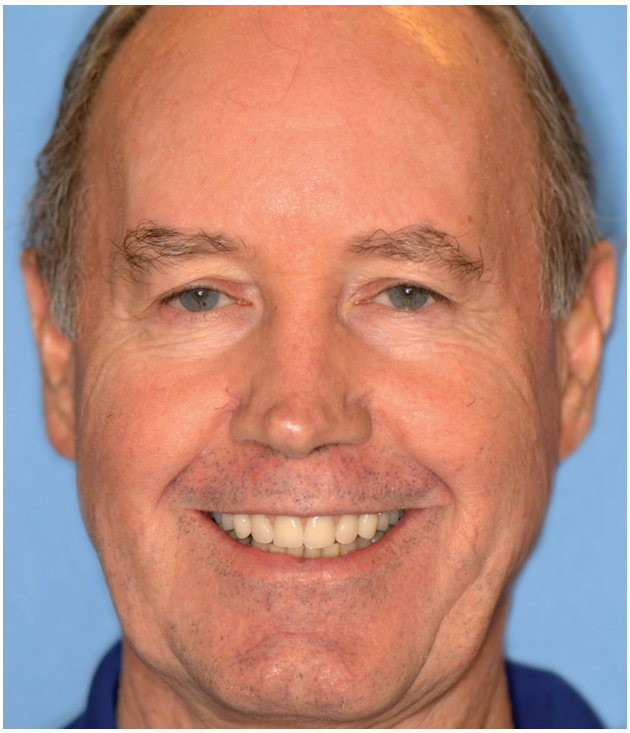

Figure 20: The patient's two-week postoperative full smile, showing an improvement in facial esthetics.

This patient was able to avoid the risks associated with orthognathic surgery.

Dr. Bynum is a clinical instructor at the Kois Center, Seattle, Washington; and at the Ickert Teaching Centre, Langley, British Columbia, Canada. He maintains a private practice in Valrico, Florida.

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