Case Report

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Orthognathic Surgery in a Patient With Clear Aligners and Veneers: Options for Interim Fixation and Early Elastic Physiotherapy—Case Report

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Abstract

When clear aligners and veneers are used preoperatively, placement of orthodontic brackets is not possible. The MatrixWAVE maxillomandibular fixation (MMF) screws are readily available in many operating rooms and can be used as an alternative interim fixation device. Screws from this system can be left in place for postoperative elastic physiotherapy. In this case report, MMF screws were left in place for muscle memory training and an aid to prevent relapse. The screws were well tolerated by the patient. Removal at 14 weeks resulted in small wounds, which healed quickly.

Keywords

interim fixation device, MMF screws, maxillomandibular fixation, clear aligners, veneers

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Introduction

Orthognathic surgery has been changing with increasing numbers of older patients seeking care. Frequently they seek an alternative to traditional orthodontic brackets.[1,2] Clear aligners were introduced in 2000 as Invisalign (Align Technology) by Boyd et al.[3] Invisalign has been available for almost 20 years.

Issues that arise during orthognathic surgery when using clear aligners include establishing interim maxillomandibular fixation (MMF) and elastic postoperative physiotherapy. MMF screws have been used safely during surgery for interim fixation with or without brackets on the teeth.[4,5] While MMF screws have been shown to be effective when used for interim fixation, longer term elastic use has been less successful.[6] West et al[6] in the treatment of fracture patients had a 25.5% failure rate overall with a 6% failure rate in the group that underwent open reduction. In general, when a patient is in clear aligners and is undergoing orthognathic surgery, brackets or islets must be bonded to the teeth to retain splints and for postoperative physiotherapy. However, when patients have veneers and crowns, cemented orthodontic appliances are more tenuous. Placement of arch bars or anything that may contact crowns or veneers risk dislodging them during placement.

An alternative that could be used during and after the surgery is orthodontic temporary anchorage devices (TADs). TADs are more commonly used for enhancing

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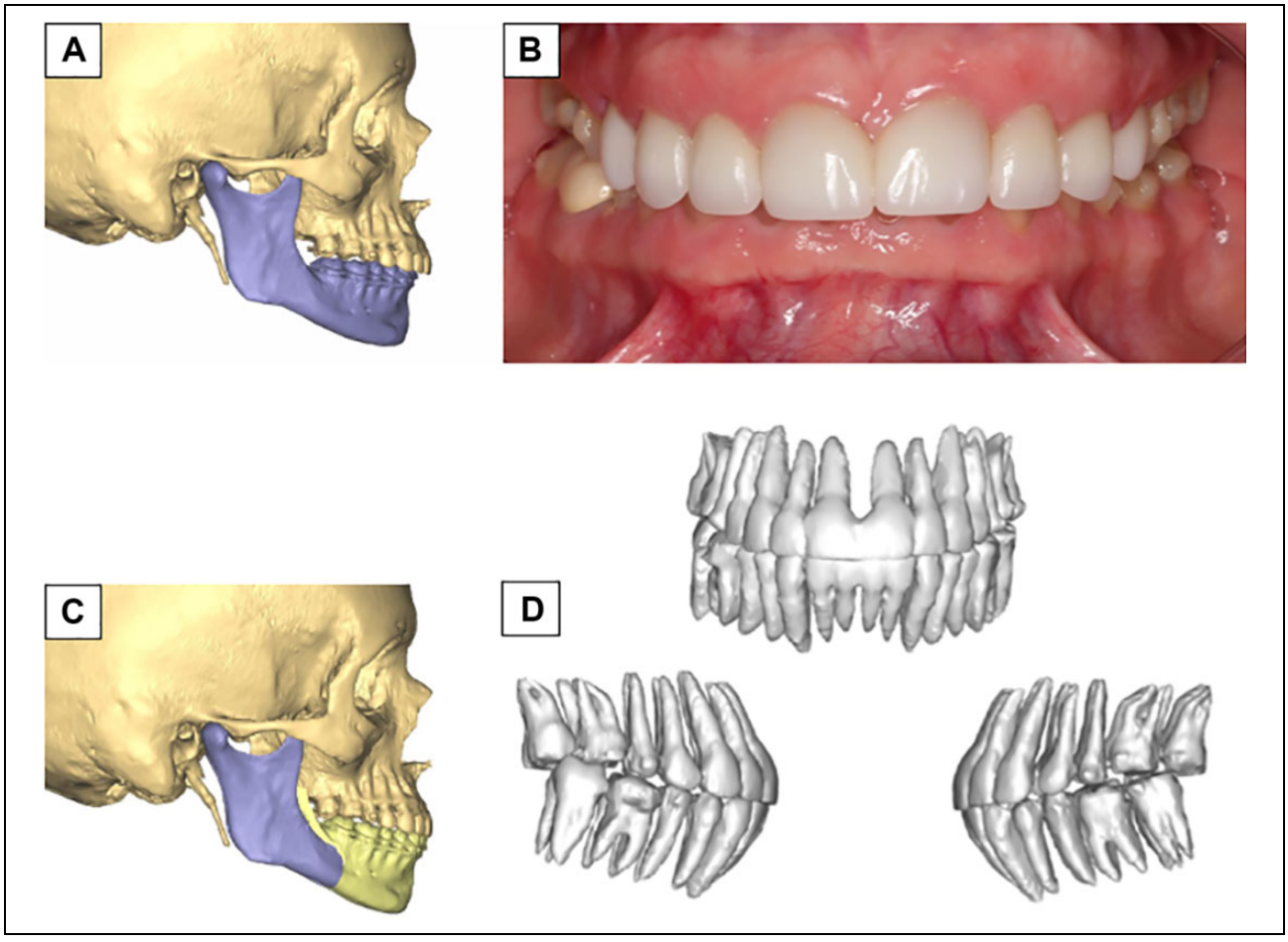

Figure 1. A, Preoperative 3D reconstructed CT model showing retrognathic short face due to mandibular deficiency. B, Photograph showing veneers on the patient's maxillary anterior teeth with 100% deep bite. C, Postoperative 3D reconstructed CT model showing correction of midface deficiency by bilateral sagittal split ramus osteotomy. D, Virtual treatment planning of final occlusion for planned mandibular orthognathic surgery. 3D indicates 3-dimensional; CT, computed tomography.

orthodontic movement of teeth. They are fixed to the bone allowing maximum anchorage and are subsequently removed after use.[7] Using orthodontic TADs for interim fixation and postoperative physiotherapy may be an option, however as a specialized orthodontic device, they are not normally available in most general hospitals.

Recently, the MatrixWAVE MMF system (DePuy Synthes) has become available for use in trauma patients. It is a bone-borne MMF fixation system consisting of an arch bar type wave-shaped appliance with self-drilling locking screws placed in the interdental region of maxilla and mandible.[6] The self-drilling locking screws sit above the wave plate serving as anchor points to the bone. The system is designed as a temporary stabilization of maxillo-mandibular fractures during intraoperative bone fixation and postop healing period up to 8 months. The screws from this system may be used independent of the MatrixWAVE MMF arch bar.

We therefore present the use of MatrixWAVE MMF screws in a manner similar to the use of orthodontics TADs in a clear aligner case undergoing a bilateral sagittal split advancement. The use of TADs-like device was necessary because the patient had extensive veneers and crowns on multiple teeth.

Diagnosis and Treatment Plan

A 48-year-old female with long history of temporomandibular pain was referred for evaluation and surgical treatment for her skeletal malocclusion. She had previous orthodontic treatment. Physical examination revealed a retrognathic short face due to her mandibular deficiency (Figure 1A). She had tenderness of temporalis muscle and clicking in both joints. Intraoral examination revealed a 100% deep bite with palatal impingement and a complete anterior scissor bite with significant overjet. She had veneers on her maxillary anterior teeth and crowns on others (Figure 1B). An in-depth discussion was held with her regarding options for temporary fixation during surgery and postoperative physiotherapy considering her veneers by both her orthodontist and surgeon.

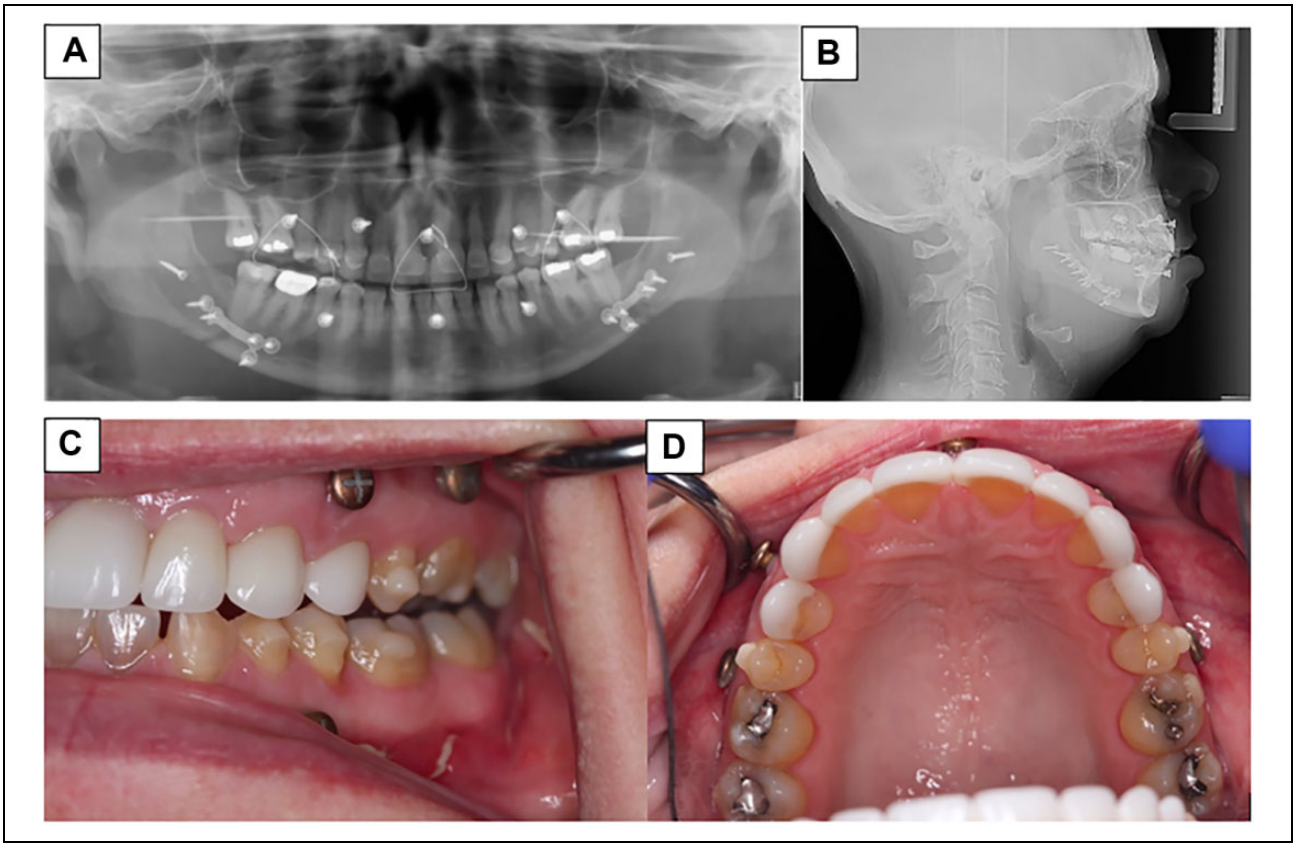

Figure 2. Postoperative orthopantomogram (A) showing MatrixWAVE MMF screw and wires in place, and postoperative lateral cephalogram (B) and postoperative photographs (C and D) showing MatrixWAVE MMF screws in place. MMF indicates maxillomandibular fixation.

After thorough clinical and radiographic evaluation, a bilateral sagittal split ramus osteotomy (BSSO) was performed to advance the mandible and increase her facial height (Figure 1C). Immediately prior to her surgery, her teeth were scanned for construction of the next clear aligner trays and for virtual treatment planning of final occlusion for planned mandibular orthognathic surgery (Figure 1D).

At the time of surgery, self-drilling screws from the MatrixWAVE MMF system were placed as TADs for anchorage of interim fixation splints and postoperative early elastics (Figure 2A and B). Placement of the screws was guided by mechanical requirements, clinical examination, radiographic examination (Panorex), and virtual planning of proposed occlusion. The screw has a 1.85 outer diameter with a 0.75 mm bone thread pitch. Overall screw length (tip of bone threads to top of head) is 12.3 mm for 8 mm length screw. The screw anchorage area from the bone surface to the top of screw head is 2.3 mm.

Five MMF screws were placed in the maxilla and 3 screws in the mandible at the junction of attached and unattached tissue and a BSSO was performed in usual manner (Figure 2C and D). In the maxilla, a total of 4 screws were placed bilaterally between the molar and second bicuspid, medial to the cuspid, and 1 additional screw was placed in the midline. On the mandible, 2 screws were placed between the first molar and second bicuspid bilaterally and 1 screw in the symphyseal region. The splint was wired to the MatrixWAVE MMF screws during fixation of mandibular segments. Segments were fixed using miniplates with monocortical screws and a bicortical positional screw. After fixation of the segments and the closure of wound, vertical elastics were placed on screws bilaterally as well as one in the midline. The splint remained in place.

Postop Evaluations

Postoperative radiographic revealed a well-secured mandible with MatrixWAVE MMF screws in place. Condyles were seated in the fossa with well-aligned inferior border of mandible. Postoperative elastics were placed in a class 2 fashion. The splint was removed 3 weeks after surgery, and the next aligner trays were inserted. Occlusion was stable and repeatable, and dental midlines were coincident with skeletal midline.

Orthodontic Treatment Progress

Presurgical orthodontic treatment including but not limited to arch alignment, leveling, and arch form coordination using the clear aligners was completed. In preparation for

the finishing orthodontic requirements and being aware of opening limitations after surgery, a new scan was secured so that additional aligners could be fabricated in the corrected anteroposterior position and delivered after surgery.

Following surgery, the patient presented with good oral hygiene which was much superior to the usual findings with fixed appliances. Two weeks following surgery, she was able to open sufficiently to obtain a new bite registration to be used with the previously secured intraoral scan.

Post-surgery, the patient tolerated the MMF screws and clear aligners very well. New aligners were designed and delivered approximately 5 weeks after surgery. With the new aligners in place, it was possible to use standard elastics. The MMF screws were removed after 3.5 months after surgery.

Discussion

The popularity of clear aligners among patients and orthodontist is undeniably growing significantly.[8] With more and more patients asking for clear aligners as an alternative to orthodontic appliances, surgeons and orthodontist will have to adapt when these patients need surgery. When clear aligners are used in a surgical patient, then alternative methods must be sought to establish intermaxillary fixation at surgery and during physiotherapy in the postoperative period. Maxillomandibular screws (MMF) have been shown to be effective and safe when placed for interim fixation.[4,5] Attishia et al[4] showed that when they were used there was a decrease in incidence of bracket failure during surgery. The 2.0 mm stainless steel MMF screw is sturdy but has been shown to fail by loosening when used for long periods of time.[6] While loosening of TADs is also possible, they can usually be replaced in the office easier than the stainless steel MMF screws. Due to its size, stainless steel screws are usually placed apically to the teeth and therefore not as user-friendly for postoperative elastic use. Cornelius and Ehrenfeld[9] showed tooth root damage when MMF screws were placed too close to the teeth. The newer 1.85 mm titanium MatrixWAVE MMF screw (DePuy Synthes) was introduced as an alternative to the stainless steel screw and was designed to be used in conjunction with an arch bar type of system. When used off label, it can serve a similar role to the larger screw. Due to its narrow size, it can be used much like a TAD between teeth and is readily available in many operating rooms. Because it has 2.3 mm top that sits above the bone, it can be used to attach splints and postoperative elastics. Conventional orthodontic TADs may also be used but require prior approval before being brought into most hospitals and placed in the operating room.

When clear aligners are used preoperatively, a number of different options are available when the patient goes to surgery.[10] These include brackets or islets that can be attached to the teeth. When placement of brackets is not possible, the MatrixWAVE MMF screw is a reasonable alternative. They are available in many operating rooms and can be left in place for postoperative elastic physiotherapy. Arch bars are always an option but are not the first choice in an elective osteotomy case. In this case report, they were well tolerated when left in place for 14 weeks. It was felt that they would be needed this long for muscle memory training and an aid to prevent relapse. When they were removed, all 8 were firm. The small wounds healed quickly.

Conclusions

Complex malocclusions can be treated using clear aligners even those requiring orthognathic surgery. Placement of titanium MatrixWAVE 1.85 mm screws at the time of surgery as a substitute for interim fixation is a useful alternative when the use of brackets is not possible. The TADs can be used for postoperative elastics as needed. Coordination between the orthodontist and surgeon is important not only in the setup but also in early postoperative visits concerning when to place the next clear aligner trays. Finally, long-term occlusal adjustments can occur in the usual manner and normal retention protocol should be utilized.

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