Technique Considerations for Maxillomandibular Fixation: Universal SMARTLock Hybrid MMF

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INTRODUCTION

Maxillomandibular Fixation (MMF) is a fundamental component in the management of facial trauma, reconstruction and orthognathic surgery. This is done to ensure the interrelationship of the dental occlusion, which is necessary in the reduction of traumatic or surgically induced segments of the mandible and maxilla. MMF is used intraoperatively to aid in Open Reduction Internal Fixation (ORIF), in the closed treatment of fractures, and during orthognathic procedures.

Currently, the most widely applied technique for MMF is the use of Erich Arch Bars (EABs). While considered the "gold standard" in the treatment of facial trauma, the application comes with significant drawbacks as presented in the literature; namely, extended application time and the risk of disease transmission via sharps injuries due to interdental wiring (1-6).

An alternative technique such as the use of MMF screws is another commonly used option. While providing benefits of speed, safety, and versatility, common drawbacks related to MMF screws include a high rate of screw loosening or displacement over time which can compromise the stability of the maxillomandibular treatment (7-9). Soft-tissue overgrowth of the screw heads which can compromise the interface with wire loops or elastics is a common occurrence, which also makes the removal of hardware a challenge (10-11).

The advent of a novel MMF concept such as the Universal SMARTLock Hybrid MMF system (Stryker Craniomaxillofacial – Kalamazoo, MI) was designed to obviate some of the challenges of existing MMF techniques, while introducing a rigid fixation construct that can be applied without a cumbersome process. While the advantageous time of placement has been well documented, a common occurrence associated with the concept is in relation to mucosal overgrowth of the plate and screw construct (12-13). The following is an overview of our experience to provide both anatomical and intra-operative considerations when applying the Hybrid MMF system.

CONSIDERATIONS

The HMMF System has a few key points of consideration in order to properly execute successful MMF.

During placemnt, one must understand and identify the inherent anatomical boundries present with each patient; specificly, tooth roots, inferior alveolar nerves and maxillary sinuses. These anatomical structures should be avoided and may affect the number and/or location of screws that can be placed.

Another point of emphasis is the potential for soft tissue overgrowth and hyperplastic tissue encompassing the implants. This typically occurs when the HMMF system is placed too far into the vestibule (Figure 1A and 1B). Should tissue overgrowth occur with a properly placed HMMF implant, management is conservative with proper hygiene. If tissue overgrowth is present, a small incision over the screw may be required in order to retrieve and remove it.

Figure 1: Soft tissue overgrowth of the device due to placement too superior in the maxilla (A) and too inferior in the mandible (B).

Next, challenges may arise with comminuted fractures. While this is not a contraindication to the use of HMMF, comminuted or multiple fractures of the mandible may require sectioning the HMMF bars to fixate in various segments or with the addition of an MMF screw. We have also used this technique in subjects with an altered occlusion (Figure 2).

Figure 2: Example of a combination use of Hybrid MMF and MMF screws in a subject with an altered bite.

Finally, limited native occlusion can provide challenges in overall stability; however, this is also the case in any other MMF technique.

TECHNIQUES

1. It is important to consider the patient specific anatomy via radiographic imaging for the best treatment strategy.

2. Identify the vertical location of locking screw placement at the mucogingival junction to minimize potential soft tissue overgrowth. Upon eventual fixation of the entire system, the lugs of the arch bars should be aligned with the clinical crown of the tooth (Figure 3).

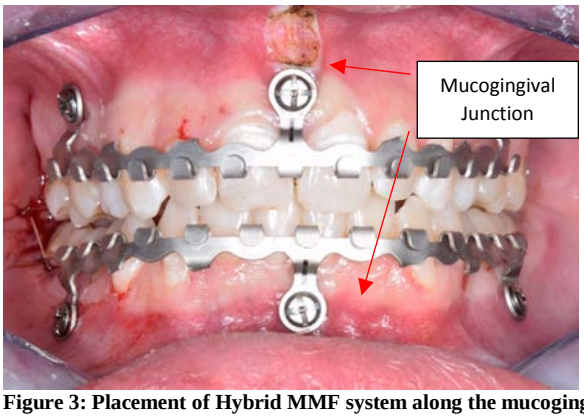

Figure 3: Placement of Hybrid MMF system along the mucogingival junction.

To avoid excessive movement of the plate during implantation, cut the plate to size with the dedicated plate cutter, insert the midline screw first, then insert the most posterior screws to avoid torqueing of the plate when inserting any remaining screws. The dedicated plate spacer is to be used behind the plate during screw insertion to avoid excessive pressure on the gingiva during screw tightening and activation of the locking mechanism to the plate (Figure 4).

The Hybrid MMF plates are available in a larger "gold" or a smaller "silver" color. In our experience, the silver plate has provided a more accurate fit for most patients based on the height, width and projection of the implant compared to most patients' anatomy.

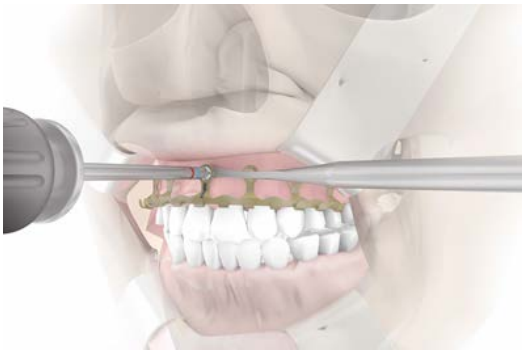

Figure 4: Use of the plate spacer during screw insertion.

3. Select the desirerable horizontal locations of screws in between tooth roots to avoid dental injury (Figure 5). It has been shown that manual insertion of MMF screws in contact with tooth roots does not create permanent damage to the root or dental complications (11). However, care should be taken, via pre-operative radiographic imaging and tactile feel intra-operatively, to avoid direct screw insertion through critical structures.

Figure 5: Placement of screw positioning in between dental roots and bar placement over the clinical crown.

The dedicated plate bender should be used to manipulate the arms in between the arch bar and the screw hole (Figure 6). Avoid grasping and bending the screw hole itself to alter the arm position. Bending the screw hole can alter the ability of the screw to engage the plate which can affect the locking mechanism of the construct.

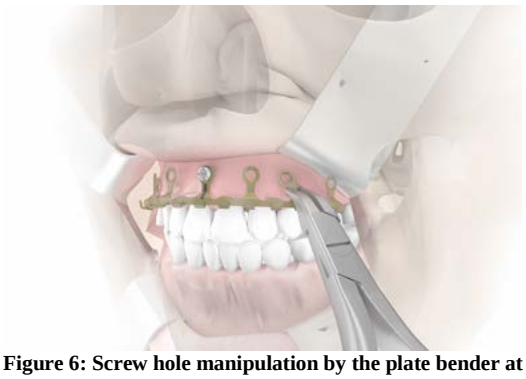

Figure 6: Screw hole manipulation by the plate bender at the arm.

4. Removal of the unused screw arms can assist the patient with hygiene and limit the areas of potential soft tissue overgrowth. Also, manipulation of the frenum and soft tissue may further reduce irritation and/or overgrowth due to contact with the implant (Figure 7).

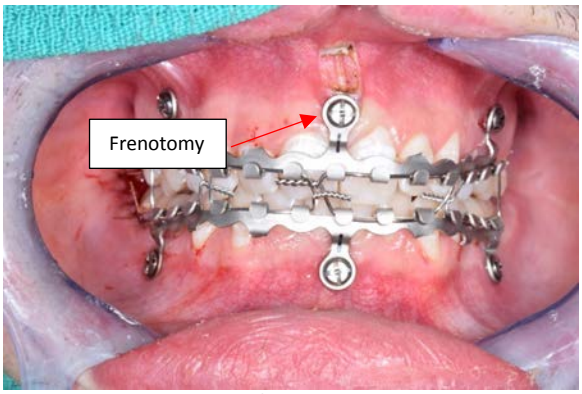

Figure 7: Frenotomy and soft tissue manipulation with removal of unused screw arms.

APPLICATIONS AND VERSATILITY

Hybrid MMF has been a versatile tool for various oral and facial surgeries. Ulitmately the goal of this system is to simplify the execution of MMF for short and long-term situations.

MMF is a key component in facial trauma surgery by reestablishing occlusion for not only ORIF procedures, but also for closed management of mandibular fractures. MMF can facilitate reconstructive procedures like orthognathic surgery and TMJ alloplastic joint replacement procedures. This system also provides an option for bracketless orthodontics and orthognathic surgery.

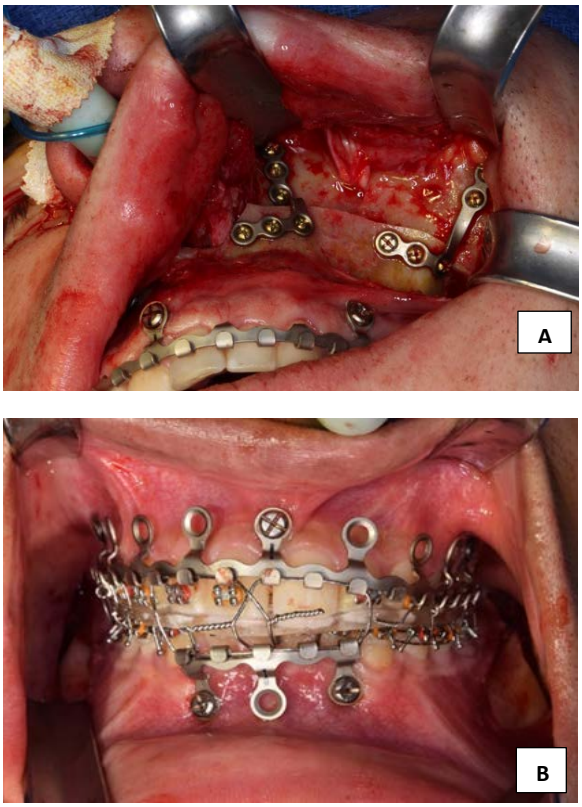

Figure 8: Examples of Hybrid MMF usage during orthognathic procedures without traditional orthodontic appliance (A) and a combination use with orthodontic appliances (B).

The basic HMMF set allows for additional instrumentation and user selected configurations. The author of this paper prefers to set up the Hybrid MMF tray as depicted (Figure 9). This allows for a contained sterilized and portable tray for the application of MMF in various settings and multiple techniques.

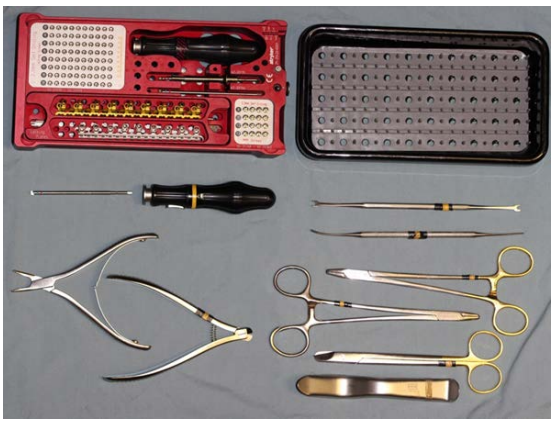

Figure 9: Hybrid MMF tray

SUMMARY

In conclusion, the Universal SMARTLock Hybrid MMF System is a game-changing advance in the setting of oral and maxillofacial surgery. While providing a number of conceptual benefits to the surgeon and patient, the user must be aware of a number of aspects related to the successful application of the device.

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