

Maxillomandibular Fixation

Nina Lewis - Team Leader
Ashley Phillips- Team Leader
Joe Ferris- Communications
Sara Karle - BWIG
Emily Maslonkowski - BSAC

Client: Jeremy Warner, MD
Plastic Surgery, UW Medical School

Advisor: William Murphy
Assistant Professor, Department of Biomedical Engineering

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Abstract: The goal of this project is to create a new technique for fixating a fractured mandible that will be easier and faster to apply than the current method of 'maxillomandibular fixation' (MMF). The decision was made to use a design that incorporated aspects of orthodontic braces designed specifically to hold the lower jaw tight against the upper jaw. The device will accomplish this by the use brackets and a power chain attached to a total of 16 molars, and rubber bands strung from the upper jaw to the lower jaw. The patient will wear the device for 4 to 6 weeks or until completion of the healing process.

Problem Definition:

Currently, the most common technique of fixating the jaw after a facial fracture is called maxillomandibular fixation (MMF), which requires wiring the mouth shut with the use of arch bars and wires. It has been proposed to us to design a device which will mimic the function of maxillomandibular fixation, but be easier and faster to apply while maintaining an adequate cost of application. Our design needs to securely hold the lower jaw tight to the upper jaw, but also needs to have an emergency quick release system. The device should also be safe for the patient during application and for the 4-6 weeks of healing.

Motivation:

The first writings about mandible fractures were recorded in the Edwin Smith Papyrus which dates back to 1650 B.C. However, at that time there was no technique available for the treatment of mandible fractures. Individuals with such injuries thus went untreated and commonly faced subsequent complications, often leading to death. Hippocrates was the first to attempt treatment of mandible fractures by using bandages to immobilize the fractured jaw. Occasionally he used gold circumdental wires in the stabilization process as well. A textbook written in Salerno, Italy was the first to mention the importance of correct occlusion when treating mandible fractures. The first person to come up with the theory of maxillomandibular fixation was Guglielmo Salicetti, in 1492, introducing the method in which one would "tie the teeth of the uninjured jaw to the teeth of the injured jaw." Since this time, many other people have slightly altered Salicetti's technique, though the original principle remains.

The current technique of MMF is not only outdated, but also tedious and time consuming. The application of the fixation device takes an average of 40 minutes, though the exact time varies depending on the difficulty the surgeon experiences in threading the circumdental wires about the teeth. A picture of this procedure can be seen in Figure 1. The small wires are often hard to manipulate when inserted in the correct position above or below the arch bar. Thus, our client is interested in developing a new device for the treatment of mandible fractures which will use the same principle of fixation, but be quicker and simpler to apply.

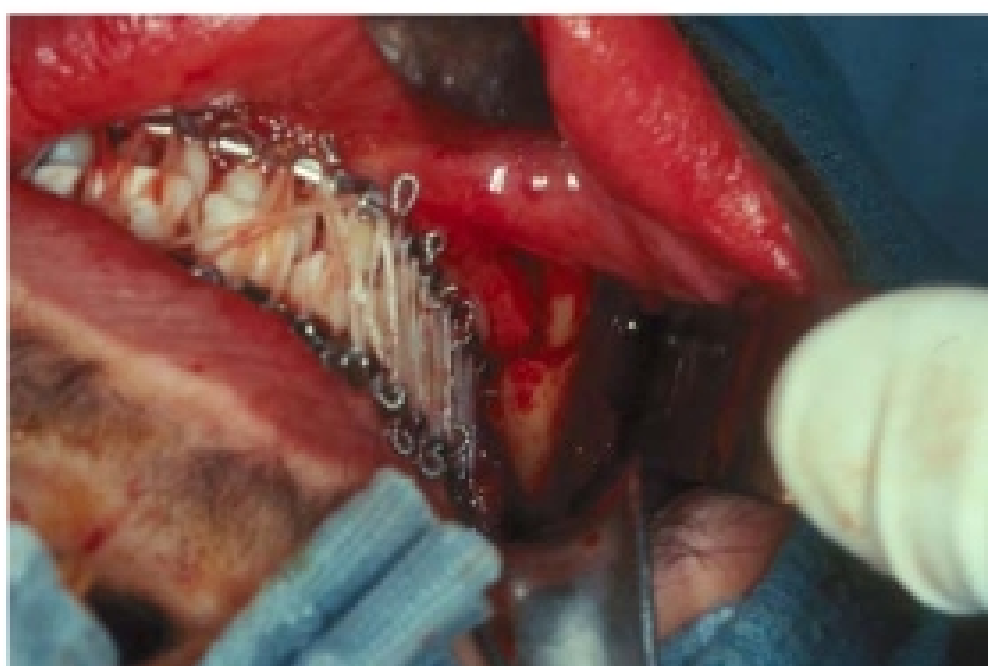


Figure 1. Picture of the current MMF technique

Client Requirements:

While the client has provided our group with the freedom to be creative in designing a new MMF technique, he has also provided multiple design constraints in order to ensure safety to the patient. Our device must be of an appropriate size and weight as to provide minimal discomfort to the patient. Forces must not be exerted on front teeth as they are easily moved out of alignment. The device must also be cost and time effective when compared to the current technique that costs \$175 and takes an