



## THE USE OF RESORBABLE PLATES IN FIXATION OF MIDFACE AND MANDIBULAR BONE. A CLINICAL STUDY

Khalid. M. El-Sayed\*and Hesham Khalil\*\*

### **ABSTRACT**

Resorbable plates were used in 15 patients for fixation of maxillofacial skeleton either after trauma or orthognathic surgery. The technique was applied in 8 cases in the midface and in 7 cases in the mandible. Fixation of the plates was done with resorbable screws activated through ultrasound appartus. Application was easy in some areas and difficult or impossible to use in other areas. Postoperatively, the fixed bone remained stable enough to allow complete healing with no major complications.

### **INTRODUCTION**

Internal fixation of maxillofacial skeleton is now the standard method of treatment of facial fractures or bone fixation after orthognathic surgery. Metallic plates and screws have become the routine method of stabilizing the craniofacial skeleton. They are reliable and have a low incidence of complications. Disadvantages of metal fixation, however, include unacceptable palpability, exposure intraorally, passive migration, and distortion of future magnetic resonance images (MRI) and computed tomograms (CT). Titanium particulate matter may be shed

into the adjacent tissues and has also been found in regional lymph nodes. Furthermore, it needs a second operation to remove.<sup>(1)</sup>

It is ideal to have bioresorbable material that only supports the bony fragments during healing and resorbs fully once healing is completed. The resulting metabolites should not cause any local or systemic disorders. LactoSorb is a copolymer of poly-L-lactic and polyglycolic acid, in a ratio of 82:18%. The copolymer is structured to provide adequate strength for 6–8 weeks and to allow a resorption time of 9–15 months. It is metabolized

\* Professor, Department of Oral & Maxillofacial Surgery, College of Dentistry, King Saud University, Saudi Arabia. Professor Department of Oral & Maxillofacial Surgery, Faculty of Dental Medicine, Al-Azhar University, Cairo, Egypt.

\*\* Assisant Professor, Department of Oral & Maxillofacial Surgery, College of Dentistry, King Saud University, Saudi Arabia.

in the citric acid cycle and eventually excreted by the lungs as carbon dioxide and water.<sup>(2)</sup>

Various polymers have been investigated including polylactic acid (PLA) and polyglycolic acid (PGA). Biodegradable fracture-fixation devices have been used in the maxillofacial region by many authors with varying degree of success and complication. Nieminen et al. 2004<sup>(3)</sup> tested the tissue reactions and mechanical strength of a novel biodegradable craniomaxillofacial plating system, Inion CPStrade mark, in the course of degradation. Plates and screws composed of L: -lactide, D: -lactide and trimethylene carbonate. They concluded that, the plates and screws examined maintain adequate strength for the healing period of a bone fracture or osteotomy, producing no harmful foreign body reactions.

The use of resorbable plates is more or less accepted in the maxilla and midface. On contrary, its use in the mandible is controversy. Recently, some articles have been published addressing the use of resorbable plates in the treatment of mandible fracture or after osteotomy.<sup>(4, 5, 6)</sup>

## PATIENTS AND METHODS

The study consisted of two parts. The first part was concerned with the use of resorbable plates in the midface in 8 cases. The second part consisted of 7 patients with mandibular fracture treated with resorbable plates.

In both groups, the material used and the technique were the same. Resorbable plates and resorbable screws were used for bone fixation. Sonic Weld ultrasound\* was used for the screw application. The plates were heated in water bath for a few minutes to be malleable and then adapted to the fractured bone segment until it became hard. The plates were fixed in the underlying bone by

resorbable screws supplied by the same company. First, a drill hole was made then the screw was applied and activated with Sonic Weld ultrasound\* that softened the screw to go in the drilled hole and to melt with the plate. In the mandible, two plates were used in each fracture line (Fig1), while in the maxilla four plates were used, two in each side. In patients with orbital fractures, two plates were used



Fig.(1) Operative photograph of symphyseal fracture treated with resorbable plate and resorb X screws in adult patient.

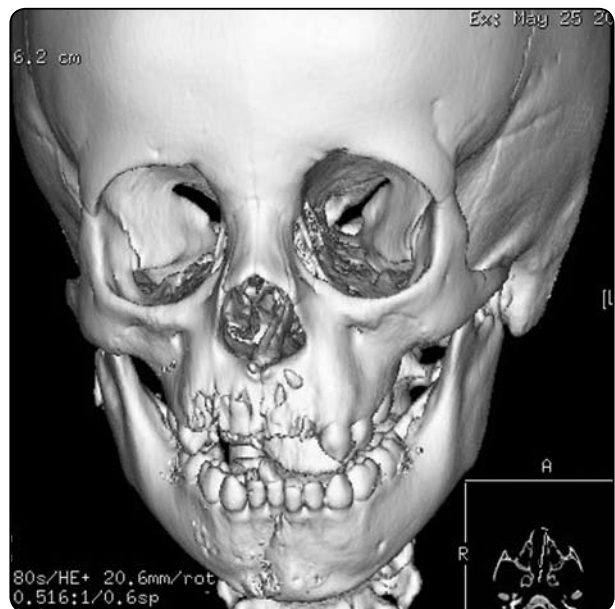


Fig.(2) One week post-operative 3 D CT of 5 years old child treated with resorbable plate. The plate is radiolucent.

\* (Martin Medizin-Technik Company, Tuttlingen, Germany)

for fixation, one at the infra-orbital rim and another one at the supra-orbital rim.

Postoperative orthopantomogram and CT were taken the second day of surgery. 6 months and one year postoperatively, panoramic and Water's view (in midface fracture) were taken. Postoperatively, the patients were followed clinically for one year. Stability of the fixed bone, soft tissue healing, development of infection, change of occlusion or any adverse reaction were recorded.

## RESULTS

In group I (midface & maxilla), the age distribution ranged from 17 to 35 years. Of the treated patients, 5 were males and 3 females. Of the 8 treated patients in this group, 5 patients had traumatic fracture (two Le Fort I, two orbital, one combined Le Fort I and zygomaticoorbital fracture). Three further patients were treated with orthognathic surgery in the form of Le fort I osteotomy.

In the second group (mandible), 7 patients had been treated with their age ranged from 3 to 40 years. All patients presented with mandibular fracture due to trauma with no orthognathic cases in this group. Four patients were children under the age of 12 years, while the rest were adults. Sex distribution was 4 females and 3 males. Two of the pediatric patients had symphyisial and two had parasymphyisial fractures. Of the three adult patients, two had symphyisial fracture while the other one was presented with body fracture.

During surgery there was no difficulty in plates' application or screw fixation in either the maxilla or the mandible. On the other hand, the application of the plate, the adaptation and fixation in the orbital region was more difficult. The fixation of the plate to the supra-orbital rim was very easy. We could not apply the plate in the posterior region of the mandible as the rode used for screw activation was

short and could not be applied through transbuccal approach.

Soft tissue healing was uneventful with no case of wound dehiscence or allergic reaction. The occlusion established at the time of surgery did not change over the whole postoperative period. X-ray follow up did not show the plates. We could only observe the fracture line healing, which was stable with no mobility. Bone healing was complete one year postoperative.

## DISCUSSION

Biodegradable osteosynthesis materials are becoming more common, but the use of biodegradable screws has a number of limiting factors: poor mechanical stability, difficult handling properties, and time-consuming fixation. The tapping of threads takes a long time and limits easy handling, in particular for small diameter screws, and the insertion is limited by the relation of the axis of the screw to the osteosynthesis plate.<sup>(6,7,8)</sup>

The aim of the development of ultrasound-aided pin fixation was to create a new way of linking the osteosynthesis plate and the bone. A specially designed pin is inserted in the drill hole using ultrasound, which fixes the surface of the pin into the trabecular bone structure using a melting (welding) process. At the same time, the pin and the osteosynthesis plate weld together. Because they are welded, the pins can be inserted even if there is a difference in axis between the pin and the osteosynthesis plate. Critical torque forces on screws are avoided, and there is no need for thread tapping. These advantages lead to improved handling and shortened osteosynthesis times. That we did found in our study except that the application was difficult in areas with little exposure as the infra-orbital rim. This difficulty was not related to screw fixation but rather to the adaption of the softened plate to an

irregular small bone. This disadvantage is present in all resorbable plates.<sup>(9)</sup>

Healing with resorbable plates is excellent and the material is biocompatible.<sup>(10)</sup> The stability of the fixed bone remains for enough period to prevent any occlusal disturbance after surgery which has been reported by some investigators. There is general argument to the rational use of the resorbable plates in the maxilla and children.<sup>(4,6)</sup> On the other hand, there is some doubt about its use in the treatment of fracture mandible in adults. Our experience is positive with no major post-operative complications. Although the number of our patients in this study is limited, it was enough to endorse its use in a larger group of patients under close observation.

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