# BIORESORBABLE PLATES IN MANAGEMENT OF MANDIBULAR ANGLE FRACTURE

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## ABSTRACT

Rigid internal fixation of the jaw bones is a routine procedure for the management of facial fractures. Titanium plates and screws are routinely used for this purpose. The limitations of this system have led to the development of plates manufactured from bioresorbable materials which, in some cases, omits the necessity for the second surgery. However, concerns remain about the stability of fixation and the length of time required for their degradation and the possibility of foreign body reactions. The following case report tries to evaluate the treatment of mandibular angle fracture via a single biodegradable plate and address complication such as malocclusion, infection, soft tissue dehiscence and nonunion in these patients.

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## INTRODUCTION

Oral and maxillofacial surgery has evolved in the last two centuries from surgeons using Barton Bandages on mandibular fractures, to sophisticated internal fixation implants and devices that have allowed early mobilization and pain free functional movements. Most of the focus in modern faciomaxillary and orthopedic implant development is on developing devices that are stronger, more acceptable to the body, cheaper and durable. In the past few decades a lot of research has been done with significant improvement in the development of bio absorbable osteosynthetic devices. Biodegradable implants have allowed a paradigm shift away from bionic (mechanical replacement) engineering to true biologic solution to reconstructive problems. Although successful applications of biodegradable systems on various sites of craniofacial anatomy and pediatric patients are well known, fixation of weight bearing bones such as mandible with resorbable plates remains controversial (1). There are few studies on using biodegradable fixation materials for mandibular fractures. These systems were reported to be reliable for mandibular fractures and fixation procedures following orthognathic osteotomies of both maxilla and mandible (2,3). As intraoperative problem in fixation of a mandibular fracture with biodegradable plates has been reported, we believe that further investigations should be done on this subject. With the above perspective a case where mandibular angle fracture was reconstructed by means of resorbable plate screw systems in our hospital is presented.

## CASE REPORT

A 30 year old female patient, who had a motor vehicle accident four days back reported to our unit with chief complaint of pain and swelling in the left lower back and right lower front region of the jaw. Maxillofacial examination and radiological evaluation revealed right parasymphysis fracture and left angle fracture of the mandible (Fig.1). Open reduction and internal fixation with stainless steel and Bioresorbable plates was planned for parasymphysis and angle fracture respectively. Submandibular incision was given extra orally to reach fracture site in parasymphysis region (Fig.2). Following reduction of the displaced fracture, 2.5 mm stainless plates were used for fixation in accordance with Champy's principle of osteosynthetic (Fig.3). Further, another submandibular incision (Fig.4) was given to expose the fracture site in angle region followed by reduction and fixation with single 2.0 mm Bioresorbable plate and screws (Fig.5). Resorbable plates were adapted to the fracture site by immersing them into hot water bath for 3 minutes.

Wound closure was achieved layer by layer with the help of 4-0 vicryl and 3-0 mersilk respectively. Postoperatively healing was uneventful and occlusion stable, slight wound dehiscence was noted in the parasymphysis region which healed with secondary intention. No infection or swelling was noted in the angle region. Post operative radiograph taken after 45 days showed bone healing (Fig.6)

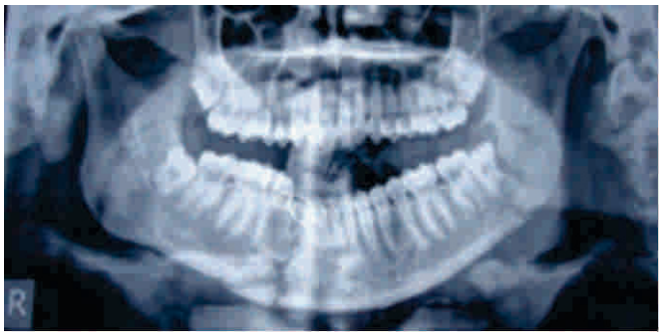

**Fig.1**

**Fig.2**

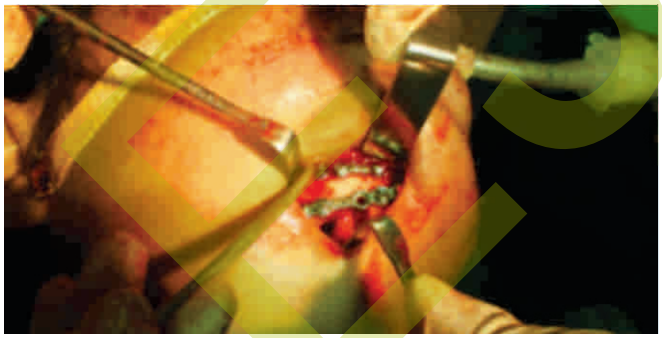

**Fig.3**

**Fig.4**

**Fig.5**

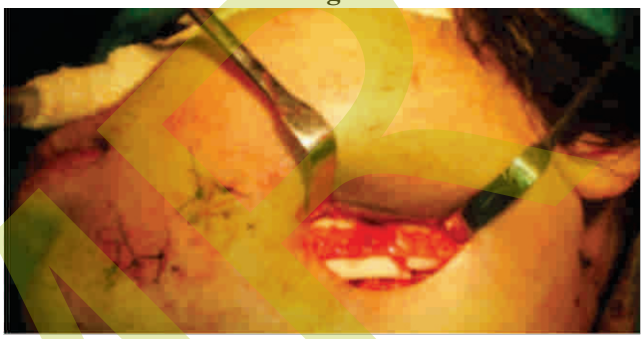

**Fig.6**

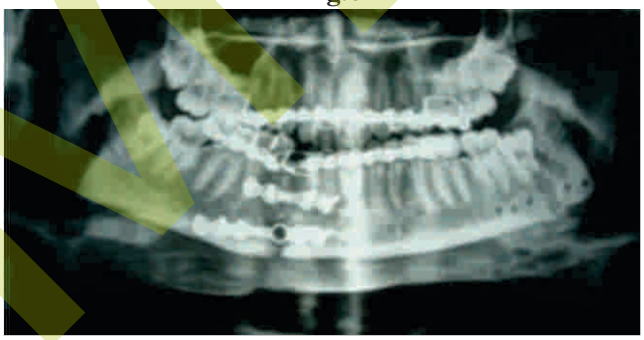

**Fig.7**

## DISCUSSION

Since the 1980s, fixation devices have been developed to achieve adequate strength and rigidity, as well as biocompatibility, with maximum bone healing at the fracture interface. Bone plating systems manufactured from titanium are currently used extensively for the fixation of facial fractures. Such bone plates are biocompatible and provide strength, but several postoperative problems persist with these systems, including visibility or palpability, hard ware loosening with resulting extrusion(4), temperature sensitivity(5),screw migration and maxillary sinusitis(6),bone atrophy or osteopenia caused by stress shielding and corrosion(7,8),interference with radiographic imaging and radiation therapy(9),allergic reactions(10), intracranial migration in cranio-orbital surgery(11,12), and the possibility of causing growth restrictions of the craniofacial skeleton in pediatric patients (13). The general recommendation by the AO/ASIF group is that the metallic fracture fixation

devices be removed either routinely in all patients or as a selective removal in symptomatic patients. In an effort to address these issues, a new class of materials, bioresorbable polymers has been developed for use in rigid internal fixation. As the field of Bioresorbable material has matured many devices have become available to the maxillofacial surgeon, including pins, screws, suture anchors, and osteosynthetic plates. The resorbable polymer plate is designed to retain sufficient rigidity until skeletal healing has taken place. The device than undergoes resorption, thereby achieving the advantages of titanium plate fixation without the associated long term problems. The concept of the use of bioresorbable devices is far from novel. It was originally suggested by Galen in 150 AD. Biodegradable devices have been in common use in orthopedic surgery for several years, as has bioresorbable suture material. In theory, an ideal bioresorbable material has the following characteristics: rigid fixation in the initial phase of healing with sufficient strength to meet biomechanical demands, resorption in a predictable fashion (still providing sufficient biomechanical strength during this process), elimination from the body without an adverse response, and, once eliminated from the body, lack of a delayed immune or other reaction (14).Since the advent and progress of technology for the manufacture of bioresorbable material, several biopolymers have been used. The biopolymer used in this instance is manufactured from poly-*l*-lactic acid (PLLA) and polyglycolic (PGA) acid at a ratio of 82:18 (15). It exhibits intermediate absorption characteristics with complete absorption between 6 months and 1 year (14). The use of PGA polymers alone significantly shortens the rate of resorption(14), while pure PLLA polymers are resorbed slowly, often taking several years to be completely resorbed (14). There still exist some operative constraints with the use of the PLLA-PGA plates. Initially, at least, operative time is prolonged. The heat packs used to mould the plates typically are functional for only about 1520 min (15). Careful attention is required to install the screws at precisely perpendicular angles to the plane of the bone to achieve adequate immobile fixation.

## CONCLUSION

We think, however, that the advantages that are offered by the biodegradable devices far outweigh the disadvantages. Operative time is significantly reduced with continued experience. Treatment method of mandibular angle fractures has been comprehensively studied in the literature. The inferior biomechanical properties of polymeric implants previously limited their clinical application to the fixation of low load fractures. The biomechanical characteristics of resorbable implants were improved by fiber reinforced composite texture. These self re enforced biodegradable plates and screws promise suitable rigidity and adequate stability for fracture fixation in even high load fracture site like the mandible.

## CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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