FIXATION OF ZYGOMATIC COMPLEX FRACTURES WITH A BIODEGRADABLE COPOLYMER OSTEOSYNTHESIS SYSTEM: A CLINICAL STUDY

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ABSTRACT

Development of fixation devices has progressed greatly over the past twenty years. The advent of biodegradable bone plates and screws system has almost solved the problems of stress shielding, removal surgery and corrosion when plates are left-in-situ. In the present study, twelve adult patients of zygomatic complex fractures were treated to evaluate the efficacy of biodegradable self reinforced PLA copolymer (70L: 30DL) osteosynthesis system. The self reinforced PLA copolymer plates were easily bendable with plate bending pliers, at room temperature and maintained the desired position without requiring a heating device. Intraoperatively, there was no problem encountered during adaptation of the bone plates. None of the plates broke during bending. The number of screws with perfect fit and intact screw head were 81(96.4%) out of 84 screws (100%). Post-operatively, one patient reported of fluid collection at the osteosynthesis site, which eventually subsided after aspiration with a sterile needle and no further collection was observed. Not a single plate was removed. Thus, it can be concluded that biodegradable self reinforced PLA copolymer osteosynthesis system exhibit good handling properties, adequate strength, negligible complication, and good results in the management of zygomatic complex fractures.

KEYWORDS: zygomatic complex, Resorbable plates, Fracture, osteosynthesis, Biodegradable

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INTRODUCTION

Zygoma or malar complex is a key component of structural facial esthetics since it forms the central support of the cheek and is a strong buttress of the lateral portion of the middle third of the facial skeleton. In addition, by making up the anterior lateral floor, it is one of the principal supports to the orbit. Because the zygomatic bone is located in very prominent and exposed location, it is highly susceptible to fracture in facial trauma. Fractures of zygomatic complex commonly result from direct impact to the bone which causes fractures at one or more of its processes. So zygomatic complex fractures can be defined as any injury which disrupts the five articulations of the zygoma with the adjacent craniofacial skeleton: the zygomaticofrontal suture, zygomaticosphenoid suture, infraorbital rim, zygomaticomaxillary buttress, zygomatic arch and. The treatment of zygomatic fractures must restore the complex multidimensional relationship of the zygoma to the surrounding craniofacial skeleton. The universal principle of fracture management is reduction and immobilization. Reduction of malar fractures usually hastens the recovery of the facial anaesthesia and corrects the sharp bony edges which may be tender and take long time to remould. Techniques for repair of zygomatic complex injuries have undergone a significant evolution over the past century. Closed reduction without adequate fixation resulted in many reports of postoperative instability. These results and observations eventually led to an emphasis on open reduction and internal fixation of zygomatic complex fracture. There are various methods of stabilization of fractures of zygomatic complex which were used in last century are external pin fixation, antral support by means of pack or a balloon and wire osteosynthesis. Each method has its own advantages and disadvantages. Now the rigid fixations by means of plates are commonly accepted technique for the treatment of zygomatic fractures. The internal fixation of facial bones with metallic plates and screws are reliable method of achieving osteosynthesis, while, at the same time these metal implants have certain real or theoretical disadvantages, which are
1. Potential risk of stress protection-induced osteopenia in the cortex directly underlying the plates.
2. Thermal sensitivity making it susceptibility to environmental temperature changes.
3. Potential of back scattering caused by metallic implants during radiotherapy.
4. It produces artifacts in CT and MRI.
5. Carcinogenic potential of certain metallic implants (Chromium, Nickel) reported in animals.
6. Possible interference with craniofacial growth in children.

Ideally the osteosynthesis material must be biocompatible, causing a minimal tissue reaction and provide sufficient stability to enable the consolidation of fractures, without interfering the bone healing and bone strength adversely. It should be easy to handle, not interfere with postoperative imaging techniques (CT or MRI) or postoperative radiotherapy and vanish naturally when it is no longer needed. The new biodegradable material made of self reinforced polylactic acid (PLA) with copolymer composition of 70% L-Lactic acid and 30% D-Lactic acid which are fulfilling almost all the above requirements. Moreover, several research groups have shown that these materials can adequately fix fractures in craniofacial skeleton and they gradually lose their strength, enabling the underlying bony tissue to take up the stress. The secondary procedures for implant removal may cause discomfort and pain are not needed. In the present study, zygomatic complex fractures were treated by stable internal fixation, using self reinforced PLA bone plates and screw system through extraoral and/or intraoral approach.

MATERIALS AND METHODS

Subjects for the present study were selected from amongst the patients who reported to the outpatient department of Oral and Maxillofacial Surgery, Punjab Government Dental College and Hospital, Amritsar. Twelve adult patients of zygomatic complex fracture were selected at
random irrespective of sex, caste, religion, socioeconomic status and nature of injury. Diagnosis of the fracture of zygomatic complex was made on the basis of detailed history, clinical examination and radiological examination. Routine laboratory investigations were carried out before undertaking the surgery to evaluate the systemic condition in these patients. All the patients were admitted to the hospital at least 24 hours prior to surgery. The whole procedure was carried out under local anaesthesia after proper premedication.

Surgical armamentarium
In addition to the standard instruments used for the reduction of the fracture, the following instruments were used.
1. Plate bending pliers
2. Micromotor hand piece
3. Universal driver handle
4. Drill bits (1.5 mm diameter)
5. Bone tap (2.0 mm diameter)
6. Screw driver blade
7. Plate cutting scissor
8. Depth gauge
9. PLA bone plates
   Dimensions: Thickness 1.2 mm
   Width 5.5 mm
   Screw hole diameter 2.0 mm
10. PLA monocortical screws
    Dimensions: Thread diameter 2.0 mm
         Length of screw 6.0 mm

Surgical procedure
Before performing surgery, premedication (Inj. Pentazocine 30mg and Inj. Glycopyrolate 0.2 mg intramuscularly) was given to the patients. The surgery was performed under local anaesthesia (using 2% Lignocaine with adrenaline 1:200000). Site of operation was scrubbed with 5% povidine-iodine solution. Patient was draped, using sterile sheets exposing the area to be operated upon. Different incisions used for surgical access were

Extraorally
- Temporal incision (Gillies approach)
- Lateral eye brow incision
- Crow foot incision

Intraorally
- Linear buccal vestibular incision

Extraoral (Gillies approach)
The region overlying the temporal fossa was shaved. A cotton pellet was placed in the external auditory canal to prevent blood from entering during surgery. The bifurcation of the superficial temporal artery was identified. Under local anaesthesia an incision about 2.5 cm long is made above and parallel to the anterior branch of temporal artery at an angle of 45° to zygomatic arch. The incision is carried down through skin and subcutaneous tissue until the white glistening surface of the temporal fascia is visualized. When the fascia has been correctly identified, it is incised and periosteal elevator inserted between the temporalis fascia and temporalis muscle and is swept anteriorly and posteriorly as it is advanced inferiorly. So that the deep surface of temporalis fascia is freed from the temporalis muscle. The periosteal elevator is advanced inferiorly until the medial surface of the zygomatic arch and temporal surface of the zygomatic body is identified. Then the periosteal elevator is withdrawn and Taylor Monks' pattern zygomatic elevator is inserted into the previously created space. Firm upward and outward force was applied to elevate the bone into its proper position. The wound was irrigated with a mild antiseptic solution and closed layerwise with 3-0 catgut and 3-0 silk sutures after obtaining complete hemostasis. Antiseptic dressing was given.

Copolymer osteosynthesis
After reduction by Gillies approach, the zygomatic complex fracture was fixed by extraoral and/or intraoral approach.

Extraoral approach
Depending on the site of fracture incision was marked in the lateral eyebrow area or parallel to the natural skin creases. The solution of 2% lignocaine with adrenaline (1: 200000) was infiltrated in this region. After the onset anaesthesia, an incision of about 1.5 cm in length was given directed downwards at the same angle as the emerging hair. Blunt
dissection through the underlying muscle fibres were carried out down to the bone and the periosteum was then incised and stripped away. In case of crow’s foot incision, the incision was made in the skin creases (crow’s foot wrinkles) around the outer aspect of eye. Then layerwise dissection was done to expose the fracture line. The 2.0 mm self reinforced PLA copolymer plate was selected as per requirement and bent to conform with the bone contour at room temperature without heating at higher temperature. The plate was adapted passively against the bone surface and was held in position with the help of suitable instrument. By selecting a drill bit of diameter 1.5 mm, first screw hole was drilled with the help of micromotor hand piece, at right angle to the bone surface using normal saline as a coolant. Then drilled hole was tapped in perpendicular fashion with the help of 2.0 mm bone tap. The tapped hole was irrigated with normal saline to remove bone debris. The PLA screws of 6mm length and 2mm diameter were used to fix the plate. The first screw was inserted in the hole using screw driver blade and universal driver handle. The second hole was drilled on the other side of the fracture bone line and then it was tapped and second screw was inserted in position. The remaining screws were placed in position in a similar manner. Extraoral fixation was followed by intraoral fixation to maintain the aseptic protocol. The wound was irrigated with a mild antiseptic solution and closed layerwise with 3-0 catgut and 4-0 silk/4-0 prolene sutures after obtaining complete hemostasis. Dressing of the wound was done.

**Intraoral approach**

A linear vestibular incision was made in the upper buccal sulcus opposite the first molar tooth and deepened on to the tuberosity of the maxilla. The mucoperiosteal flap was reflected and zygomatic buttress was exposed. The fracture line was located and a 2 mm self reinforced PLA copolymer plate was adapted on the fracture site and was kept in position with the help of an instrument. A hole was drilled (1.5 mm diameter) and tapped (2.0 mm diameter). A 2 mm self-reinforced PLA copolymer screw of 6mm length was used to fix the plate. Similarly other holes were drilled and the screws were tightened. The wound was irrigated with mild antiseptic solution and closed layerwise using 3-0 catgut and 3-0 silk sutures after achieving adequate hemostasis.

**Figure 1**

Preoperative radiograph showing fracture right zygomatic complex
Figure 2
*Photograph showing fracture at right F-Z region*

Figure 3
*Photograph showing fixed fractured segments at F-Z region with bioresorbable plates*
Figure 4
Photograph showing fixed fractured segments at ZMB region with bioresorbable plates

Figure 5
Postoperative radiograph
Postoperative treatment
A course of medications which consisted of Inj. Cefotaxime 1 gm 12 hourly, Inj. Gentamicin 80mg 8 hourly, analgesics and multivitamines preparations started prior to the surgery and were continued for 5 days postoperatively. All the patients were encouraged to maintain good oral hygiene. Patients were put on a liquid diet for 24 hours postoperatively. Sutures were removed on the 7th postoperative day. All the patients were followed up for a period of six months postoperatively regarding restoration of function, stability of the system used, complications if any and the patients acceptance in terms of esthetics and function.

RESULTS
The present study was undertaken on twelve adult patients with Zygomatic complex fractures of face who reported to the Department of Oral and Maxillofacial Surgery, Punjab Govt. Dental College and Hospital, Amritsar. Patients were selected irrespective of sex, caste, religion, socio-economic status and nature of injury. All the patients were treated by stable internal fixation using PLA bone plates and screws. The observations made during this study were presented in tabulated form.

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>AGEWISE DISTRIBUTION OF THE PATIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group (years)</td>
<td>No. of patients</td>
</tr>
<tr>
<td>21-30</td>
<td>6</td>
</tr>
<tr>
<td>31-40</td>
<td>2</td>
</tr>
<tr>
<td>41-50</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

The age of patients included in this study ranged from 21 to 50 years. From the above data, it is obvious that maximum number of fractures of the zygomatic complex recorded were in the age group of 21-30 years (50%). The mean age being 33.7 years. There was no case in the age group of 0 to 20 years and above 50 years of age.

<table>
<thead>
<tr>
<th>TABLE II</th>
<th>SEXWISE DISTRIBUTION OF THE PATIENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>No. of patients</td>
</tr>
<tr>
<td>Male</td>
<td>9</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

It is evident from the Table II that male patients predominated as regards the incidence of fractures of zygomatic complex. The frequencies of male patients were found to be 75% whereas female patients were 25%.

<table>
<thead>
<tr>
<th>TABLE III</th>
<th>ETIOLOGY OF FRACTURES OF ZYGOMATIC COMPLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>No. of patients</td>
</tr>
<tr>
<td>Road traffic accident</td>
<td>9</td>
</tr>
<tr>
<td>Physical assault</td>
<td>1</td>
</tr>
<tr>
<td>Fall</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

Road traffic accidents were responsible for majority of the fractures i.e. nine out of twelve patients. In two patients fracture occurred due to fall (16.67%) and in one patient due to physical assault (8.33%).

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In this study, 66.67% of cases treated in the period between 5 to 7 days. Remaining 33.33% of cases treated in the period of 2-4 days. The mean day between the trauma and Surgery was 5.41 days.

**TABLE V**

**MAJOR SYMPTOMS ASSOCIATED WITH ZYGOMATIC COMPLEX FRACTURE**

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>No. of patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression of malar region</td>
<td>11</td>
<td>91.67%</td>
</tr>
<tr>
<td>Restricted mouth opening</td>
<td>4</td>
<td>33.33%</td>
</tr>
<tr>
<td>Infraorbital nerve involvement</td>
<td>6</td>
<td>50.00%</td>
</tr>
<tr>
<td>Ptosis</td>
<td>1</td>
<td>8.33%</td>
</tr>
<tr>
<td>Enophthalmos</td>
<td>1</td>
<td>8.33%</td>
</tr>
<tr>
<td>Diplopia</td>
<td>1</td>
<td>8.33%</td>
</tr>
</tbody>
</table>

In this study, depression of malar region was present in eleven cases after trauma due to fracture displacement. This deformity was corrected by reducing the fractured zygomatic bone into its correct position, thus improving the esthetics. Post-traumatic restricted mouth opening was present in 4 cases and it was clinically inferred at the time of diagnosis as displaced zygomatic bone impinging on the coronoid process which interfering with the mandibular movements. This problem was solved by lifting the fractured segments into its right position which indirectly relieved the mechanical interference of coronoid process with fractured zygomatic bone. Thus improving function. In this study, post-traumatic anaesthesia of infraorbital nerve was present in six cases which was clinically inferred as compression of the nerve by fractured fragments with in the area of infraorbital foramen. Anaesthesia was relieved in all patients at 3rd month follow up which found to be due to infraorbital nerve relieved from compression by reduction of fractured fragments into its correct position. In one case ipsilateral ptosis of upper eyelid was present associated with fixed, dilated pupil. It was diagnosed as 3rd cranial nerve (oculomotor) palsy and a patient was referred to ophthalmologist for opinion. Patient was kept under observation and was put on conservative management. In this study, post-traumatic enophthalmos was present in one case, which was clinically inferred as an increase in bony orbital volume by displacement of lateral orbital wall and it was corrected by reduction of fractured segments into its correct position. Post traumatic diplopia was present in one case which was corrected postoperatively with in 3 days. It was found to be due to temporary muscle edema interfering with the action of extraocular muscles. After subsidence of the edema the muscle movements become normalised.

**TABLE VI (a)**

**MATERIAL RELATED FAILURES**

<table>
<thead>
<tr>
<th>Total no. of plates used</th>
<th>No. of plate fracture</th>
<th>Percentage of failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The total number of plates used in this study was 23. There was no plate fracture occurred during manipulation.
TABLE VI (b)  
MATERIAL RELATED FAILURES

<table>
<thead>
<tr>
<th>Total no. of screws used</th>
<th>No. of screw head fracture</th>
<th>Percentage of failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>84</td>
<td>3</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

The total numbers of screws used in this study were 84. The number of screw head fracture occurred while tightening the screws were 3 (3.6%). These screws had been drilled out and new screws were replaced.

TABLE VII  
POST-OPERATIVE COMPLICATIONS

<table>
<thead>
<tr>
<th>Complications</th>
<th>No. of patients</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid collection at frontozygomatic region</td>
<td>1</td>
<td>8.33</td>
</tr>
<tr>
<td>Restricted mouth opening</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Persistent swelling</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Wound dehiscence</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Infection</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mal union/asymmetry</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Out of twelve patients, one patient reported with fluid collection at the frontozygomatic region where PLA bone plate fixation was done one month back. It was aspirated with sterile 18 gauge syringe needle and sent for culture and sensitivity, but no growth was detected. After aspiration, the swelling was reduced and no further collection was observed. No other patient reported for any kind of persistent swelling (other than post-operative edema) or post-operative infection and wound dehiscence. Not a single plate was removed. There was no clinically visible pigmentation in the surrounding tissues. It was observed during the course of this study that fixation of zygomatic complex fracture with the biodegradable PLA plating system achieved satisfactory restoration of form, function and esthetics.

DISCUSSION

Just as the development of metal bone plates and screws revolutionized the conduct of oral and maxillofacial surgery, the development of biodegradable plates and screws are now poised on a similar frontier. Although biodegradable bone plates and screws have been used for more than a decade the reliable composition, strength, duration, presence of an inflammatory response and proper design have been problematic. The new self reinforced polylactide polymers are currently available for use in the craniofacial skeleton and these polymers have overcome many of the shortcomings of earlier materials. Combining adequate strength and rigidity with bioresorption has appeal for both patients and health care providers. By eliminating the permanency of bone plates and screws there is less risk of infection and other long-term problems associated with metal in the body. Moreover, concerns about compatibility with future imaging needs, interference with radiation therapy, migration of the material, growth restriction, long term palpability and thermal sensitivity have been reduced (Turvey et al, 2002). In the present study, twelve cases of zygomatic complex fractures were treated by internal fixation using 2.0 mm PLA bone plates and screws of 2 mm diameter and 6.0 mm length. Fractures were reduced by extraoral Gillies technique. The advantages of this technique are negligible scar, the field is free from important nerves which might be injured during the operation (Gillies et al, 1927). Extraoral and/or intraoral approach was used to expose the fractured fragments under local anaesthesia. Extraorally fracture was exposed at frontozygomatic suture region through lateral eyebrow incision. It gives simple and rapid access to the frontozygomatic area. Since the incision is made almost entirely within...
the confines of the eyebrow, the scar is usually imperceptible. Intraorally, incision was made in upper buccal sulcus region, approximately 3-5 mm superior to the mucogingival junction to expose the zygomatic buttress region. Ellis et al (1996) used same approach for access to zygomaticomaxillary buttress. Biodegradable bone plates made of self reinforced copolymer L-lactic acid and D-lactic acid (70 L: 30 DL) were used to fix the reduced fractured fragments. The PLA plates were easily bendable at room temperature. The plates were adapted passively against the bone surfaces and was held in position against reduced segments. By using a drill bit diameter of 1.5mm, screw hole was drilled with the help of micromotor handpiece, at right angle to the bone surface. Then a drilled hole was tapped in perpendicular fashion using 2 mm bone tap. The PLA screws of 6mm length and 2mm diameter were used to fix the plate. Suresh et al (2004) stated that self reinforced polymers have increased initial mechanical strength, modulus and toughness than regular copolymers. In this study we have used self reinforced copolymers. The present study was carried out on adult patients between the age group of 21 to 50 years. The mean age being 33.7 years. There was predominance of males in this study, male female ratio being 9:3. This observation is in accordance with the findings of Kailund (1971) who also observed that the male patients were more prone to trauma in his study of fracture of zygoma. In this study, road traffic accidents were found to be responsible for majority of the fractures i.e. nine (75%) out of twelve patient (100%). In two patients (16.67%) fracture occurred due to fall and in one patient (8.33%) due to physical assault. These findings coincide with the findings of the Kailund (1971) and Raju (1971). In this study, post-traumatic anaesthesia of infraorbital nerve was present in six cases (50%) which were clinically inferred as compression of nerve by fractured fragments within the area of infraorbital foramen. Anaesthesia was relieved in all patients at 3rd month follow up period which found to be due to infraorbital nerve relieved from compression by means of reduction of fractured fragments into its correct position. Kailund (1971) reported infra-orbital nerve dysfunction in nearly 50% of cases following fractures of the zygoma. Peter Jungell et al (1987) noted paresthesia of the infra-orbital nerve in 56 cases (82%) out of 68 cases (100%) of fractures of zygomatic complex. They treated 50 cases out of 68 cases and found that 21 patients (42%) showed some degree of persisting sensory disturbance inspite of operative treatment. De Man et al (1988) reported the presence of sensory disturbance of infra-orbital nerve in 219 (80.2%) out of 273 patients of isolated zygomatic fractures. In their study 38 (100%) patients underwent interosseous wire fixation and they noted that 19 patients (50%) showed a persistent reduced sensitivity. They treated 68 (100%) patients with miniplate osteosynthesis and found that 15 (22.1%) patients showed persistent sensory disturbances. They stated that use of miniplates in unstable fractures of malar complex result in stable fixation and greater chance of regeneration of infra-orbital nerve than stabilisation of zygoma with wire sutures. Taicher et al (1993) reported sensory disturbances of infra-orbital nerve in 153 (83.6%) patients after zygomatic complex fractures and observed that there is higher recovery rate of infra-orbital nerve with miniplate osteosynthesis than with other methods of treatment. In the present study, post-traumatic diplopia was present in one case (8.33%) which was corrected postoperatively within three days. The possible cause could have been temporary muscle edema interfering with the action of extra-ocular muscles. After subsidence of the edema the muscle movements become normalized. Carr et al (1997) reported that diplopia was present in 4 (16%) cases of orbitozygomatic complex fracture pre-operatively and in 1 (4%) case post-operatively out of 25 (100%) patients. In this study, post traumatic restricted mouth opening was present in four cases (33.33%) and it was clinically inferred at the time of diagnosis as displaced zygomatic bone impinging on the coronoid process interfered with the mandibular movements. This problem was solved by lifting the fractured segments into its right position, which indirectly relieved
the mechanical interference of coronoid process with the fractured zygomatic bone. Thus improving function. Carr et al (1997)\textsuperscript{16} reported restricted mouth opening in 13 (17\%) cases of orbitozygomatic complex fractures. In this study, depression of malar region was present in eleven cases (91.67\%) after trauma due to fracture displacement. This deformity was corrected by reducing the fractured zygomatic bone into its correct position, thus improving the esthetics. Bos et al (1987)\textsuperscript{17} reported the presence of changed cheek contour in all ten cases (100\%) of zygomatic fractures which was corrected in all patients (100\%) post-operatively. Kailund (1971)\textsuperscript{10} reported malar depression in 38 (61\%) cases of fractures of zygoma out of 62 cases (100\%). He treated 36 patients, out of which he achieved good results in 16 patients (44.4\%) and improved results in 4 patients (11\%). In this study, one case (8.3\%) was reported with ipsilateral ptosis of upper eyelid associated with fixed, dilated pupil. The possible cause could have been 3\textsuperscript{rd} cranial nerve (oculomotor) palsy and the patient was referred to ophthalmologist for opinion. Patient was kept under observation and was put on conservative management. Williams (1994)\textsuperscript{18} stated that ptosis due to nerve paresis required no immediate treatment but should be left for about 6 months, as spontaneous recovery ensues in many instances. Peter Ward Booth et al (1999)\textsuperscript{19} stated that traumatic nerve paresis (3\textsuperscript{rd} nerve) usually resolves slowly, although spontaneous resolution is rare after 6 months. In this study, post traumatic enophthalmos was present in one case (8.3\%), which was clinically inferred as an increase in bony orbital volume by displacement of lateral orbital wall and it was corrected by reduction of fractured segments into its correct position. Fonseca et al (1997)\textsuperscript{20} stated that zygomatic fractures are associated with enophthalmos in approximately 5\% of cases prior to treatment. In the present study, total numbers of plates used were twenty three. None of the plates broke during bending. These findings coincide with the findings of Haers et al (1998)\textsuperscript{22}, they fixed forty plates in the maxilla and reported that none of the plates broke during bending for adaptation, which involved making wave forms, angles, torsions and combinations of these. The total number of screws used in this study were 84 (100\%). The number of screw head fracture occurred while tightening the screw were 3 (3.6\%). The number of screws with perfect fit and intact screw head were 81 (96.4\%). Haers et al (1998)\textsuperscript{23} stated that relocation could be avoided because new holes could be drilled through broken screws and extra holes could be drilled in the plates in situ, which is not possible with metal plates and risks of causing plate fracture in resorbable systems requiring heating devices for manipulation. In this study, one patient reported post-operatively after 1 month of fluid collection at the frontozygomatic region where PLA bone plate fixation was done. It was aspirated with sterile 18-gauge needle and sent for culture and sensitivity. But no growth was detected. After aspiration, the swelling reduced and no further collection was observed. Rozema et al (1991)\textsuperscript{24} reported almost similar finding, they fixed 305 screws (100\%) and they reported perfect fit with screw head intact in 275 screws (90.2\%). In none of cases was it necessary to relocate a plate because of problem with screws, in contrast to metal plates and screws. Haers et al (1998)\textsuperscript{23} stated that relocation could be avoided because new holes could be drilled through broken screws and extra holes could be drilled in the plates in situ, which is not possible with metal plates and risks of causing plate fracture in resorbable systems requiring heating devices for manipulation. In the present study, one patient reported post-operatively after 1 month of fluid collection at the frontozygomatic region where PLA bone plate fixation was done. It was aspirated with sterile 18-gauge needle and sent for culture and sensitivity. But no growth was detected. After aspiration, the swelling reduced and no further collection was observed. Rozema et al (1991)\textsuperscript{24} reported late tissue responses to PLLA plates and screws used in 4 patients out of 10 patients in zygomatic fractures post operatively, in the form of mild intermittent swelling in implant area. Bostman et al (1990)\textsuperscript{25} reported fluctuant swelling at the implantation site of biodegradable copolymer. They stated that surgical drainage (by needle aspiration or by incision) yielded sterile exudate containing liquid remnants of degrading implants. They found that such minor procedures were sufficient to allow the reaction to settle. The reason for the origin of swelling may be the combination of factors such as the disintegration of the PLLA material into small particles, and an increased osmotic pressure.
caused by these fragments and compared to bone low resistance of the subcutaneous tissue. No other patient reported for any kind of persistent swelling (other than post-operative edema) or post-operative infection and wound dehiscence. Not a single plate was removed. Suuronen et al (1999) treated more than 200 patients with biodegradable plates successfully and stated that use of biodegradable fixation can be considered routine and it will be definitely state of art at the beginning of the new millenium. Ritta Suuronen et al (2000) stated that “Today, most maxillofacial fractures and osteotomies may be adequately fixed with bioabsorbable materials”. Kris et al (2001) stated that PLA plating system has advantages over metal systems which includes increased ease of plate contouring, the ability to adjust the plate and bone fragments in situ, radiolucency of the material, absence of persistent foreign body and lack of temperature intolerance.

CONCLUSION

Thus, as a result of clinical experience it can be inferred that the use of self reinforced copolymer PDLLA biodegradable bone plates and screw system in the management of zygomatic complex fractures gives excellent results in terms of function, esthetics and acceptability.

REFERENCES


