Multiple maxillofacial fractures in a patient undergoing orthodontic treatment: a case report

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Abstract

Severe maxillofacial injuries among patients receiving orthodontic treatment are very rare. When they occur, they can be life threatening with several complications which include neurologic deficits, malunion of fracture segments secondary to delay in reduction and immobilization of fracture segments and massive blood loss. Delay in treatment of such maxillofacial injuries in the presence of other life threatening injuries predisposes the patient to residual and minor malocclusion. The interdisciplinary management of injuries sustained by an orthodontic patient and the challenges associated with its management are highlighted in this report.
Reduction and immobilization was carried out under general anaesthesia using an arch bar in the mandibular arch. Direct bonded brackets in the maxillary arch with additional eyelet wires were used in the management of the fractures.
An acceptable reduction of bilateral parasympseal fractures was obtained with available intermaxillary fixation. There was some residual and minor malocclusion attributed to the delay in treatment and possibly the method used.
A multi-disciplinary team approach for the management of maxillofacial fractures in patients undergoing orthodontic treatment with fixed appliances is suggested. Orthodontic treatment with surgical involvement has been found to improve both facial aesthetics and occlusal function.

Key words: Maxillofacial, trauma, reduction, immobilization, orthodontic

Introduction

Injuries commonly reported in patients undergoing orthodontic treatment include those resulting from appliances worn; and are mostly not life threatening but may affect quality of life due to permanent disabilities resulting from such injuries[1-3]. These injuries are mostly of dental origin. However, severe maxillofacial injuries among patients receiving orthodontic treatment are very rare. When they occur, these traumatic maxillofacial injuries can be life threatening with complications. Complications that may occur include neurologic deficits, malunion of fracture segments secondary to delay in reduction and immobilization of fracture segments and massive blood loss[4].
Patients with multiple craniofacial fractures often suffer from stomatognathic problems after their primary treatment, because administering emergency care is the clinician's highest priority. It is therefore of paramount importance to prevent loss of life in the patients involved[5]. Optimal bone repositioning in the process of reduction and immobilization is sometimes difficult because bone fixation is delayed. Moreover, adequate radiographic examination is often unavailable; and an evaluation of the primary occlusion is difficult at the time the patient is seen in the emergency room. This delay usually results in malunion of the fracture segments. Stomatognathic problems encountered are that of chewing difficulties and derangement of the occlusion. Affected patients complain of impediments to masticatory functions caused by incomplete repositioning of the fracture segments after receiving first aid or tentative treatment for fractures of the jaw bones. This often leads to further orthodontic alignment and in some cases more complicated orthodontic treatment post surgically to correct the deformity of the dental arches as a result of malunion.
Several challenges are faced during management and can be overcome by collaboration with several specialties. It is also advocated that the orthodontists liaise with the Trauma Team at the earliest stage of management of trauma cases in these patients.
A case is reported of a rare life threatening and multiple severe maxillofacial injuries sustained by a patient currently undergoing orthodontic treatment with a view of highlighting the challenges associated with its management.

Case report

A 22- year- old female patient on fixed orthodontic appliance with fully bonded/banded upper and lower arches was involved in a road traffic accident (RTA). She was unconscious and was immediately taken to a hospital. On presentation at the initial hospital, she had a Glasgow Coma Scale (GCS) of 3/15 and was referred to Lagos University Teaching Hospital (LUTH), Lagos. On presentation at LUTH, she was immediately resuscitated and the GCS scored later rose to 7/15.

Clinically, she was diagnosed to have Transient Brain Injury. Radiological investigations were ordered and revealed that the patient had sustained a pelvic fracture, left zygomatic fracture and bilateral parasymphyseal fractures of the mandible **(Figures 1 and 2).** She was billed for surgery for reduction and immobilization of the displaced bilateral mandibular fractures and reduction of the left zygomatic fracture by the oral and maxillofacial surgeons. Referrals were made to orthopeadic surgeons for review of the pelvic fracture sustained by the patient.

Due to the associated brain injury sustained by the patient, reduction and immobilization of the fracture segments was not done until about 9 days after she has fully recovered from the brain injury. This resulted in the malunion of the fracture segments.

Figure 1a, b and c. Pretreatment facial and intraoral photographs

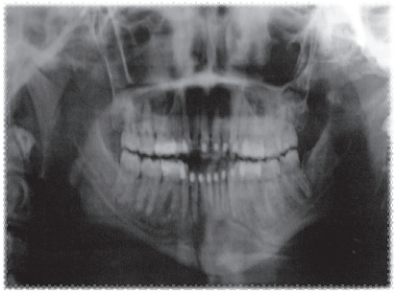

Figure 2. Panoramic radiographs revealing the bilateral mandibular fractures

The oral and maxillofacial surgeons planned to use an arch bar for the fixation of the jaw fractures and so requested for the removal of the lower arch wire and orthodontic appliances (brackets and molar bands). The removal of the orthodontic appliances was carried out under inhalational anaesthesia to prevent undue pain for the patient. Propofol (2.5mg/kg, 10mg/mL) was administered for induction of anaesthesia; after which all the attachments were removed before the patient was intubated **(Figure 3).** The malunited fracture segments were refractured, reduced and fixed using arch bars. In the upper jaw, the rectangular wire was not rigid enough to be used for fixation. Therefore [3] three eyelet wires were added and used in the upper arch for maxillo-mandibular fixation **(Figure 4).** The left zygomatic complex fracture was managed conservatively due to no disturbance of function. Maxillomandibular fixation was carried out and maintained for 6 weeks.

Figure 3. Intraoral pictures after orthodontic appliances have been removed from the mandibular arch.

Figure 4. Intraoral pictures after fracture segments were reduced and immobilized using lower arch bar and 3 accessory eyelet wires in the maxillary arch.

Following removal of the wires and arch bar used in immobilization, the patient was reviewed at the Orthodontic Unit of LUTH. There was an obvious post-surgical malocclusion attributed to the delay in treatment and possibly the method used which resulted in disturbance of dental occlusion and difficulty in mastication. On examination at the orthodontic unit, she was seen to have facial asymmetry with a slight deviation (about 2mm) of the mandible to the right. The occlusal relationship was poor, and she presented with a unilateral anterior open bite of about 2.5mm which extended from tooth 11 to tooth 13. There was a reduction in the overjet of about 1.0 mm on the left and an openbite on the right. Overbite was similarly reduced.

Mandibular crowding was recorded as moderate (space deficiency of >3mm). Teeth 31 and 32 were supra erupted and there was gingival recession of teeth 32 and 33 with more than half the root length of tooth 33 exposed. There was grade II mobility of teeth 31 and 32.

Treatment Objectives

After the accident, the patient's primary complaint was occlusal dysfunction. Therefore, the following objectives were established:

- Alignment and leveling of the teeth to obtain favourable interdigitation,
- Correction of overjet and overbite,
- Closure of the unilateral anterior open bite,
- Correction the mandibular midline deviation and
- Improvement facial asymmetry.

Treatment Progress

Treatment began by alignment and levelling of the arches. Treatment of the mandibular arch was complicated by inadequate space to unravel the crowding and correct the midline shift coupled with the grade II mobility of teeth 31 and 32.

Treatment Results

The anterior open bite was eliminated, and the overjet and overbite were corrected (overjet of 2.0 mm and overbite of 2.0 mm were obtained). A satisfactory occlusal relationship was also obtained. However, the deviation of the mandibular midline remained unchanged. There was no limitation of mandibular movement **(Figure 5).** Her treatment progressed satisfactorily.

Figure 5. Clinical intraoral picture after alignment and correction was achieved

Discussion

The relationship between the specialties of orthodontics and oral and maxillofacial surgery is one of the closest in the field of dentistry[6]. Several methods are currently available for mandibular fracture treatment, though the search for the ideal method for treatment has however continued over the years. Oral and maxillofacial surgeons must learn and master several techniques for mandibular fracture treatment. An adequate knowledge of anatomy, multiple closed reduction techniques, and the physiology of fracture healing must be adequately understood and technically mastered by the oral and maxillofacial surgical team for the present and future of mandibular fracture management[7]. The present case was treated using maxilla-mandibular fixation (closed reduction technique with arch bars and wires). Despite the known drawbacks of maxilla-mandibular technique many reports have attested to the satisfactory results obtained using this technique[8].A recent systematic review on open and closed reductions of mandibular fractures using retrospective studies has raised doubts regarding the superiority of open reduction and internal fixation compared to closed reduction and intermaxillary splinting[9].

In the reported case, though there were bilateral fractures of the mandible at the parasymplyseal region only arch bar maxillomandibular fixation was used in the treatment. It was reported however that maxillomandibular fixation (MMF)/orthodontic direct bonded brackets DBB can serve as the single treatment method with satisfactory results in patients with favorable, less complicated mandible fractures[10]. Maxillomandibular fixation/direct bonded brackets (MMF/DBB) is an economical, safe technique that minimizes blood-borne-pathogen risk to the operative team, eliminates periodontal injury, facilitates postoperative dental hygiene, and is painless to apply and remove[10]. Angle was the first to show the practical application of orthodontic appliances in the fixation of jaw fractures[11].

The oral and maxillofacial team who collaborated with the management of this case instructed to have the direct bonded brackets removed because of the complicated nature of the fractures and opted to use arch bars for the fixation of the fracture. In this case, it was impossible to use the DBB only because the fracture was grossly displaced. In cases necessitating open reduction and internal fixation (ORIF), MMF/DBB can be performed preoperatively to align fracture segments and reestablish occlusion. This facilitates placement of osteosynthesis plates and reduces ORIF operative time[7].

Facial skeleton fractures should be reduced as early as possible to restore optimal function and minimize skeletal and soft-tissue deformity. In this case there was a delay of about 9 days because of comorbidity, which resulted in malunion of the fracture segments. It was reported that such an unsatisfactory outcome from delayed treatment because of comorbidity could be reconstructed with conventional orthognathic surgical procedure[12]. The patient had to undergo another round of orthodontic treatment in the lower arch alone for a shorter time after the arch bars and wires used for immobilization were removed. This was to correct the post-surgical malocclusion[12, 14], which was attributed to the delay in treatment and possibly due to the used method for immobilization of fractures. Disturbance of dental occlusion and difficulty in mastication were the complications in the case reported.

Maxillo-facial injuries in patients undergoing orthodontic treatment with fixed or removable appliances may present with some challenges and complications. Therefore, these challenges should be borne in mind when such patients present to both oral and maxillofacial surgeons and orthodontists. These challenges and complications include aspiration of the components of the orthodontic appliance (metal brackets, ligature wires and elastic modules) and direct injury to the soft tissue by the appliance (loose ends of the orthodontic wires and other sharp accessories) as well as breakage and loss of these appliances. Plain chest x-ray should be ordered if any of the components of these appliances cannot be accounted for.

DBB can be adapted as a maxilla-mandibular fixation technique in cases where there is gross displacement of the fractured segments as seen in the present case report. DBB may not be useful as a maxillo-mandibular fixation technique, and the surgeon may be faced with a choice between closed reduction and ORIF.

Conclusion

A multi-disciplinary team approach for the management of maxillofacial fractures in patients undergoing orthodontic treatment with fixed appliances is presented. Delay in treatment of maxillofacial injuries in the presence of other life threatening injuries predisposed the patient to residual and minor malocclusion which was corrected thereafter. Orthodontists, as well as oral and maxillofacial surgeons should participate in every stage of the treatment of jaw fractures involving this category of patients. Orthodontic treatment has been found to play an important role in the occlusal rehabilitation of a patient with traumatic maxillofacial fractures, providing improved occlusal function and facial aesthetics. It is recommended that

orthodontists join the facial trauma team at the earliest stage of management. The orthodontists should also be in attendance at surgical operations to determine the most stable occlusion, making possible more detailed occlusal reconstruction.

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