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Shrapnel-Induced Mandibular Hypomobility

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Shrapnel-Induced Mandibular Hypomobility

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Mandibular hypomobility can develop from direct injury to, or as a result of disorders affecting, the supporting structures of the temporomandibular joint. This can be subdivided into intra-articular and extra-articular processes. Ankylosis is commonly associated with trauma (31% to 98%), followed by infections (10% to 49%) and systemic disease (10%).[1] Temporomandibular joint ankylosis is an intra-articular process characterized by fibrous, fibro-osseous, or osseous obliteration of the joint space.[2] Pseudoankylosis involves extracapsular causes of restricted jaw motion that include, but are not limited to, coronoid-zygomatic fusion, coronoid hypertrophy, and muscular fibrosis.[2] Shrapnel injuries can be as devastating as high-velocity gunshot wounds, with functional and esthetic consequences, depending on the velocity, size, shape, and jagged edges of the fragments.[3,4] Traumatic life support measures are paramount during the immediate postinjury setting. The airway and hemodynamic status must be maintained, because the oxygen-carrying capacity is essential for wound healing and the prevention of infection.[3,4] A secure airway controlled with an endotracheal tube or tracheostomy needs early consideration because bleeding and edema can result in airway compromise.[3,4] The securing of the airway should be followed by a comprehensive examination of the patient to reveal additional injuries.

Report of a Case

The oral and maxillofacial surgery service was consulted by the orthopedic surgery department to evaluate a 23-year-old male US Army specialist from the 82nd Airborne Division (Fort Bragg, NC). He had sustained multiple facial and extremity shrapnel injuries while serving in Iraq during Operation Iraqi Freedom. On October 26, 2003, as Ramadan was beginning, his high-mobility multipurpose wheeled vehicle (HUMV) was destroyed by a roadside-improvised explosive device. He was 1 of 2 survivors of the 4 manning the vehicle. He was flown by medical evacuation helicopter to the 28th Combat Surgical Hospital in Baghdad, Iraq. His treatment included hemostasis, debridement of wounds, and closure of the facial lacerations. He arrived at Womack Army Medical Center on November 13, 2003, for definitive surgical care.

Clinically, the patient exhibited a 3-cm entrance stellate scar on the left side of his face.

Remarkably, no facial nerve palsy or trigeminal nerve paresthesia was present. Pain on maximal opening was recorded as 4 to 6 of 10 on a visual analog scale. However, he exhibited trauma-related mandibular hypomobility with a maximal interincisal opening of 12 mm. The lateral excursions were measured as 6 mm to the left and 3 mm to the right. Other injuries included large avulsive lacerations to the left forearm, hand, and right ankle. Computed tomography and plain film radiography revealed multiple, tiny, scattered shrapnel fragments, with a larger 2.0 × 1.5-cm shrapnel fragment located along the medial surface of the left condyle and comminution of the left coronoid process (Figs 1, 2).

On the basis of these imaging and clinical examination findings, it was concluded that the large shrapnel fragment at the left condyle was impinging on the condylar range of motion, because it was wedged anterior and medial to the condyle and temporal bone. Owing to the proximity of the fragment to the maxillary artery and pterygoid plexus and the reported history of brisk bleeding from the site at resuscitation, it was determined that wide access was necessary for potential management of hemorrhage. An extraoral approach, with a vertical ramus osteotomy for access, was planned.

The patient was taken to the operating room for combined oral and maxillofacial surgery and orthopedic surgery procedures, with awake fiberoptic intubation and general anesthesia. The examination under general anesthesia revealed no improvement of the maximal incisal opening (MIO) of 12 mm. A left submandibular approach was used, with exposure of the lateral mandibular cortex and conservation of the periosteal blood supply. Rigid internal fixation,

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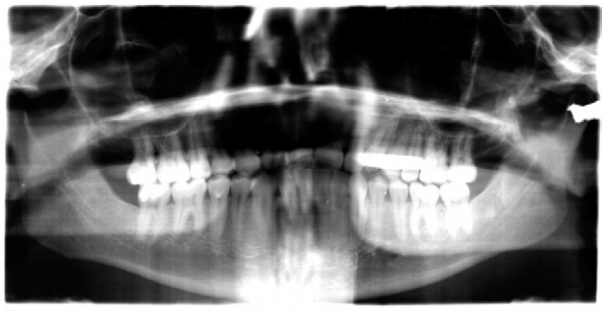

FIGURE 1. Preoperative panoramic radiograph showing 2.0 × 1.5-cm shrapnel fragment located at medial surface of left condyle and obliteration of left coronoid process.

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consisting of 2 Synthes 2.3-mm, 4-hole titanium miniplates (Synthes, Paoli, PA) (Fig 3), was adapted to the ramus, and screw holes were drilled before creation of the osteotomy to ensure precise repositioning of the osteotomized segments.[6] A vertical ramus osteotomy was performed, and the proximal segment was distracted laterally and rotated superiorly to expose the medial ramus soft tissues.[5-7] Optimal direct access to the foreign body was achieved. The shrapnel was carefully removed without incident, and hemostasis was maintained (Fig 4).

An MIO of 50 mm was achieved with brisement (ie, forceful manipulation of the jaw before the patient emerged from anesthesia).[2] This was reproducible with finger pressure. No maxillomandibular fixation was deemed necessary. The patient recovered uneventfully without experiencing inferior alveolar or facial nerve injury or occlusal discrepancies.

FIGURE 2. Axial computed tomography scan showing prominent portion of shrapnel along path of entrance located anterior to left ramus.

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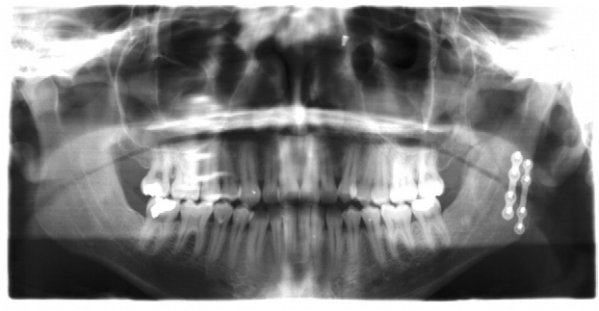

FIGURE 3. Postoperative panoramic radiograph showing 2 Synthes 4-hole miniplates and shrapnel removed.

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Postoperative physical therapy to maintain the maximal opening included immediate use of tongue depressors and the Therabite Jaw Motion Rehabilitation System (Therabite, Bryn Mawr, PA). The Therabite is a patient-driven device that provides intermittent passive motion and stretch exercises (Fig 5). Initially, the patient was given a stack of tongue blades and instructed to insert additional blades 5 to 7 times daily for at least 1 minute each time. Initially, he had difficulty using the tongue blades because of a postoperative splint on his left hand and forearm and required assistance to perform his physical therapy (MIO) range of motion exercises. After the Therabite was acquired, he was able to perform the range of motion exercises without difficulty. His postoperative course was uneventful, with a gradual MIO increase from 20 to 32 mm. The lateral excursions improved slightly to 11 mm to left and 3 mm to right postoperatively. He was without pain on mastication and scored 4 of 10 on the visual analog scale during MIO.

Four months later, a repeat brisement procedure was performed immediately after induction of anesthesia for revision orthopedic surgery. An MIO of 48 mm was attained. At his last follow-up visit, the patient was able to open actively to 36 mm without masticatory pain or dysfunction.

FIGURE 4. Shrapnel fragment (2.0 × 1.5 cm) removed and positioned next to Purple Heart medal with US quarter for size representation.

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FIGURE 5. Patient using Therabite Jaw Motion Rehabilitation System.

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Discussion

This technique, as previously described by Larsen and Smead,[6] provides excellent exposure to the tissues that lie medially between the angle of the mandible and the skull base, making it an ideal choice for this situation. The use of rigid internal fixation with adaptation of the miniplates before creation of the osteotomy was easily performed and made the need for maxillomandibular fixation unnecessary. This approach has little risk of inferior alveolar nerve injury, intraoral contamination, or changes in the occlusal relationship.

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