



## Firearm Injury on Face: Literature Review and Case Report

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**Received:** December 16, 2017; **Published:** March 21, 2018

### Abstract

With the increase in urban violence, physical aggression with the use of firearms has gradually increased in the main urban centers, becoming a public health problem worldwide, which brings high costs in the treatment of these patients. Generally, when they hit the face, the projectiles can cause comminuted fractures and large tissue avulsions. Thorough knowledge of the anatomy of the maxillofacial region, surgical techniques and drug treatment is necessary to have clinical success in the treatment of these injuries. A brief review of the literature and a case report of a 35-year-old male patient, who entered the emergency department in buccomaxillofacial surgery and trauma, victim of assault with a firearm projectile in the right preauricular region. The projectile was housed in the posterior maxilla region. At the radiographic examination, the patient had no signs of fracture in the bones of the face. The projectile was removed under general anesthesia. Given the complexity of the facial anatomy and the severity of these lesions, the maxillofacial surgeon should be aware of the possible therapeutic possibilities for a correct conduct and subsequent outcome of the case.

**Keywords:** Face Fractures; Gunshot Wounds; Facial Injuries; Ballistics Forensic

### Introduction

Firearm projectiles (PAF) are built for specific purposes, varying in size and shape. They can be classified into simple projectiles, consisting of a bullet, or multiple projectiles, composed of lead grains. Depending on the energy released at the moment of impact can cause small injuries to large tissue avulsions [1].

Firearm-related injuries (FAF) are prevalent in large urban centers and constitute a global public health problem, generating large expenditures for society and contributing to increased morbidity and mortality. They can have aesthetic, functional and psychological consequences [2].

Lesions caused by PAF typically have an entrance orifice, resulting from the penetration of the projectile, and sometimes the exit orifice, when the kinetic energy is sufficient for the projectile to pass through the body. In the maxillofacial region, the mandible is the most affected site, the mandibular body region being the most affected, causing comminuted fractures [3,4]. The male sex is more susceptible to this type of injury and adults, mean age of 28.9 years, are more affected [5,6].

Some care should be taken in patients with this type of lesion, such as hemorrhage control, airway safety, identification of other lesions, and definitive repair of deformities caused by impact, which are essential for successful treatment. The anatomical complexity of the facial skeleton is a challenge for the treatment and requires that it be well planned, resulting in satisfactory end results [2].

This article aims to report a clinical case of a patient victim of gunshot wound in the maxillofacial region, which was minimally destructive, as well as to perform a literature review about the subject.

### Literature Review

In Brazil the main cause of the buccomaxillofacial trauma was car accidents. However, nowadays, with the increase of urban violence, it is observed that the rates of injuries caused by firearm projectiles (PAF) have increased considerably. These injuries constitute a serious public health problem and bring enormous expenses to the health services, given the longtime of hospitalization of the victims of these injuries [7-9].

The weapons based on the explosive properties of gunpowder date from the middle of century XIII and the small arms carried by a man appeared in Century XIV. Today firearms are available in various shapes and sizes. Handguns such as pistols and revolvers can fire low and high speed projectiles; while the rifles are larger, with the same firing properties. Shotguns are mostly charged with lead balls of variable size and shape. Weapons, in general, are classified according to the diameter of the barrel in calibers or inches [10].

PAF injuries present a higher prevalence in males, between 20 and 39 years, which implies socioeconomic problems, since it is a productive age group. The mandible is the most affected bone, the mandibular body region being the most affected. The maxilla,

according to the bone most affected in the facial framework, when affected, presents great destruction, being a bone less dense. Clinical and radiographic evaluation should be judicious in view of the proximity to vital structures such as the brain, eyes, nerves and vessels [5,6].

Lesions caused by PAF are classified as piercing-sharps and have high destructive power to body tissues. When they reach the maxillofacial region they can cause extensive fractures and lacerations in soft tissue. Injuries caused by firearms (FAF) present an entrance orifice, resulting from the projectile penetration into the body, and sometimes, depending on the kinetic energy (EC), the exit orifice. The entrance orifice usually has a circular or oval aspect, with slightly irregular borders. The exit orifice is characterized by irregular wounds, with everted borders and is only present in the transfixing wounds [5,11].

Neurosurgical, and often ophthalmological, evaluation should be performed before buccomaxillofacial interventions are instituted. The treatment is divided into initial, intermediate and final phases. In these phases, resuscitatory efforts are performed, with the main objective being to ensure the life of the patient, in addition, it is of paramount importance the clearing of the airways, by cleaning the oropharynx and intubation by means of tracheostomy or cricothyroidectomy, if necessary. Control of bleeding should also be performed to prevent hypovolemic shock. Prescription of antibiotics is recommended because of the contaminated nature of the wound by the projectile. Debridement of bone parts without periosteal coverage should be performed [3,12].

### Case Report

Patient, 35 years old, male, arrived at the service of buccomaxillofacial surgery and traumatology, victim of assault, affected by PAF in the right preauricular region. In the clinical evaluation, no neurological implications were detected, so the patient was referred to the buccomaxillofacial surgery and traumatology department.

At the extraoral examination, a perforated-contusional lesion was observed in the right pre-auricular region with irregular borders, characteristic of the projectile orifice (Figure 1). At the intraoral examination, there was an increase in volume on the palate, precisely between teeth 15 and 13 (Figure 2). Waters and Postero-Anterior radiographs of the skull were requested. When analyzed, they showed radiopacity compatible with a firearm projectile, in the posterior region of the maxilla and in close relation with the maxillary sinus, without signs of complete fracture (Figure 3).

The patient underwent surgery under general anesthesia and nasotracheal intubation. Surgical access was performed, with incision extending from elements 21 to 16, by the palatine region, with total mucoperiosteal detachment, for total exposure of the projectile (Figure 4). Cleaning was carried out with abundant irrigation with saline solution. Next, a conservative debridement was performed for the removal of the projectile and removal of non-viable teeth and tissues. Finally, the wound was closed (Figure 5).



**Figure 1:** Puncture-contusional lesion, with irregular borders, compatible with the projectile inlet, in the right pre-auricular region.



**Figure 2:** Volume increase in the palate region between teeth 15 and 13, indicating possible location of the projectile.



**Figure 3:** Waters radiograph showing a prominent radiopacity compatible with firearm projectile, in posterior region of maxilla and intima relationship with the maxillary sinus. Signs of fracture are not observed.



**Figure 4:** Surgical access. Incision extending from teeth 21 to 16, through the palatal region, with total mucoperiosteal displacement. Total projectile exposure is observed.



**Figure 5:** Suturing of the palate region after removal of the projectile.

The PAF was carefully removed, along with bone fragments from the posterior wall of the maxillary sinus with a Seldin's lift (Figure 6). Suture was performed at the projectile's orifice. The patient progressed well and was discharged the next day. It was prescribed antibiotic, for 7 days, anti-inflammatory and analgesic.



**Figure 6:** Bone fragments of the posterior wall of the maxillary sinus and projectile removed.

### Discussion

Over the years, facial injuries were mostly caused by automobile accidents. However, at present, the number of reports of trauma by firearm projectiles in hospital services has gradually increased, as in the present case. This is mainly due to the increase in urban violence and the ease of arms procurement [2,14].

The level of tissue injury caused by projectiles depends on the kinetic energy they acquire at the time of firing. Factors such as elasticity and vascularization of the affected tissue, composition and shape of the projectile are also linked to the degree of injury of the affected tissues [15]. Such factors are important for the diagnosis of the severity of the lesions and help guide the treatment.

The entrance orifices present as circular or oval lesions with irregular borders, being concentric or eccentric, depending on the penetration of the projectile, as well as in the case in question, where the orifice penetrated the preauricular region. The observation of these holes is valid, since they can reveal the direction of penetration of the projectile, being able to suggest the region that reached [11]. The exit holes are not always present, as they are often not transfixed, that is, they are housed in organs or tissues, in which case the projectile was housed in the posterior maxilla region.

Most epidemiological studies prove that the prevalent age range for this type of lesion is between 20 and 39 years and the male sex is the most affected. This information corroborates the

reported case, in which the patient was male and was 35 years old, this can be explained, since men are more exposed to violence, including through drug use [5,6,17].

The mandible is the most affected bone in the facial region, the mandibular body being the most affected region. In a retrospective study, Pereira, *et al.* [16] analyzed 501 patients, pointing out that in the firing of handguns, a comminuted fracture occurred in all cases. In addition, in this study, it was also observed that the hospitalization time was 8.3 days, on average. These data are different from that observed in the aforementioned case, since the patient did not show signs of complete fracture, and after 1 day of the surgical intervention, the patient was discharged, which is an exception, considering the destructive character of the firearms.

After stabilization of all vital signs of the patient, treatment of facial lesions should be performed as soon as possible, taking into account the risk of contamination by the projectile. The treatment of choice recommended by most authors consists of cleaning the wound by means of copious irrigation with saline solution, conservative debridement for the removal of the projectile, removal of unworkable teeth and tissues, and closure of the wound. In these cases, the fractures receive closed reduction through the Erich bar and rigid maxillomandibular block. In more complex cases, an open reduction is done with reconstruction plaques, and a second surgical time is made for bone reconstruction, if necessary [17]. In the case described, such intervention was not necessary, since the lesion was minimally destructive without signs and symptoms of fracture.

Drug therapy with antibiotics is an important step in the treatment of these lesions. Wolf, *et al.* [18] demonstrated in a microbiological experiment the existence of bacterial proliferation after identifying the presence of *Staphylococcus aureus* in sterile gellatins after experimental shots. Montamedi, *et al.* [12] concluded that critical levels of bacterial proliferation can be found in injured tissues at approximately 6 hours after firing. The patient usually uses intravenous antibiotics, from admission to the emergency room, to hospital discharge. It is important that he continue antibiotic coverage for at least 1 week orally.

## Conclusion

Fractures caused by PAF require caution in their treatment, since injuries are destructive and can lead to death. The oral and maxillofacial surgeon should be attentive to this situation, from the completion of a rigorous anamnesis, to the correct therapeutic behavior to minimize the risks of infection. In addition, the professional should have a good knowledge of the facial anatomy and surgical techniques employed in these cases, in order to obtain good results for the patient, without affecting their quality of life.

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## Volume 2 Issue 4 April 2018

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