

## Case Report

# Penetration of a wooden wedge into the infratemporal space: a case report

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**Abstract:** Penetrating wounds to the deep maxillofacial space by foreign bodies are rare but potentially life-threatening. The purpose of this article was to discuss the features and management of this emergency in caring of a 60-year-old man, victim of a work-related accident, penetration by a 1.5×1×10 cm<sup>3</sup> wooden wedge into the infratemporal space of the left side. Removal of the wooden wedge was performed after the patient's general condition became stable. The location of the foreign body and its proximity to the vital structures were established by an enhanced spiral computed tomography scan and 3D reconstruction of the patient's anatomy. The Weber-Ferguson incision was applied in such case for the first time and achieved good surgical access and adequate exposure, which facilitated precise foreign body removal and prevented complications like hemorrhage or infection. As a result, the foreign body was removed and no severe complications occurred. In conclusion we summary some key points solving the often intractable problem of penetration in the deep maxillofacial spaces by a foreign body.

**Keywords:** Maxillofacial injury, penetrating wound, foreign body, oral surgical procedures

## Introduction

The rising incidence of road traffic accidents, work-related injuries and violent attacks has made maxillofacial trauma an increasing common medical emergency [1]. Maxillofacial trauma often involves a foreign body. While superficial foreign bodies can usually be easily located and removed, those penetrating into the deep maxillofacial tissue spaces present common and serious complications [2]. Their surgical removal is usually complicated by the risk of hemorrhage from the dense vasculature of the maxillofacial region [3]. Furthermore, the foreign body is a significant infection risk to the deep maxillofacial spaces which, because of the continuity of these spaces with those in the cranial cavity, can spread rapidly to cause serious intracranial infection [4]. In addition to the medical complications of such penetrations of the deep maxillofacial space, there are some crucial and controversial issues that must be solved relating to the operative approach and pre- and post-operation treatment [5, 6]. Thus, the treatment of deep foreign body penetration

of a deep maxillofacial space remains a great challenge to surgeons.

In this article, we present a case of a patient suffering a work-related maxillofacial trauma involving a wooden wedge penetrating deeply into the infratemporal space. Especially, we describe and discuss proper surgical treatment in this case and summarize some key points of treatment involved in this type of injury.

## Case report

A 60-year-old man presented to West China Hospital of Stomatology, Sichuan University with an unusual wooden foreign body penetrating into the left maxillofacial region. The patient was a carpenter with an unremarkable medical history, and was hurt by a wooden wedge ricocheting into him at high speed while cutting wood. He immediately felt a pain and bled, but no coma or vomiting occurred.

The patient remained conscious and had no difficulty in breathing or evidence of shock. A 1.5×1×10 cm<sup>3</sup> wooden wedge, rectangular in

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**Figure 1.** Photograph of the wooden wedge penetrating into the left mid-maxillofacial region, with ~1 cm visibly exposed on the face (white arrow). There was little mobility in the wedge.

cross-section, was found penetrating into the infraorbital region with 1 cm of its length remaining exposed and little mobility (**Figure 1**). Clinical examination also revealed a left-face hematoma but no active bleeding and no evidence of facial palsy.

The patient had bedside electrocardiogram monitoring and immediate intravenous infusion of Lactated Ringer's Solution. We later administered tetanus antitoxin and prophylactic antibiotics to the patient. After ensuring that his general condition was stable, we arranged for the patient to undergo an enhanced spiral computed tomography (CT) scan. This scan revealed the foreign body penetrating through the maxilla, coming to rest in the infratemporal space (**Figure 2A-C**). We also produced a 3D reconstruction of the patient's anatomy to visualize the relationship between the foreign body and the local nerves and blood vessels, which showed that the foreign body was in very close proximity to several great vessels, including the maxillary artery, internal jugular vein and common carotid artery (**Figure 2E, 2F**). We also noted that the wooden wedge was heavily splintered, and postulated that these splinters could shred the vessels during surgical removal and lead to severe hemorrhage. We thus prepared 800 ml of human red cell suspensions in case of emergency. Surgical removal of the foreign body and debridement of the traumatized area was performed under general anesthesia. A Weber-Ferguson incision was made and a lip-cheek flap was elevated (**Figure 3A**). The maxilla and wooden wedge were clearly exposed (**Figure 3B**). We then used a round bur to

remove bone around the wooden wedge and provide a path of removal for extraction of the 10 cm-long foreign body (**Figure 3C**). Fortunately, there was no severe hemorrhage during or after this procedure. After thorough removal of any residual wood and bone fragments, the cavity was rinsed with povidone-iodine solution and physiological saline solution, then filled with a 60 cm-long iodoform gauze, which was later extracted via the left floor of the nose. The flap was tightly sutured in layers (**Figure 4**).

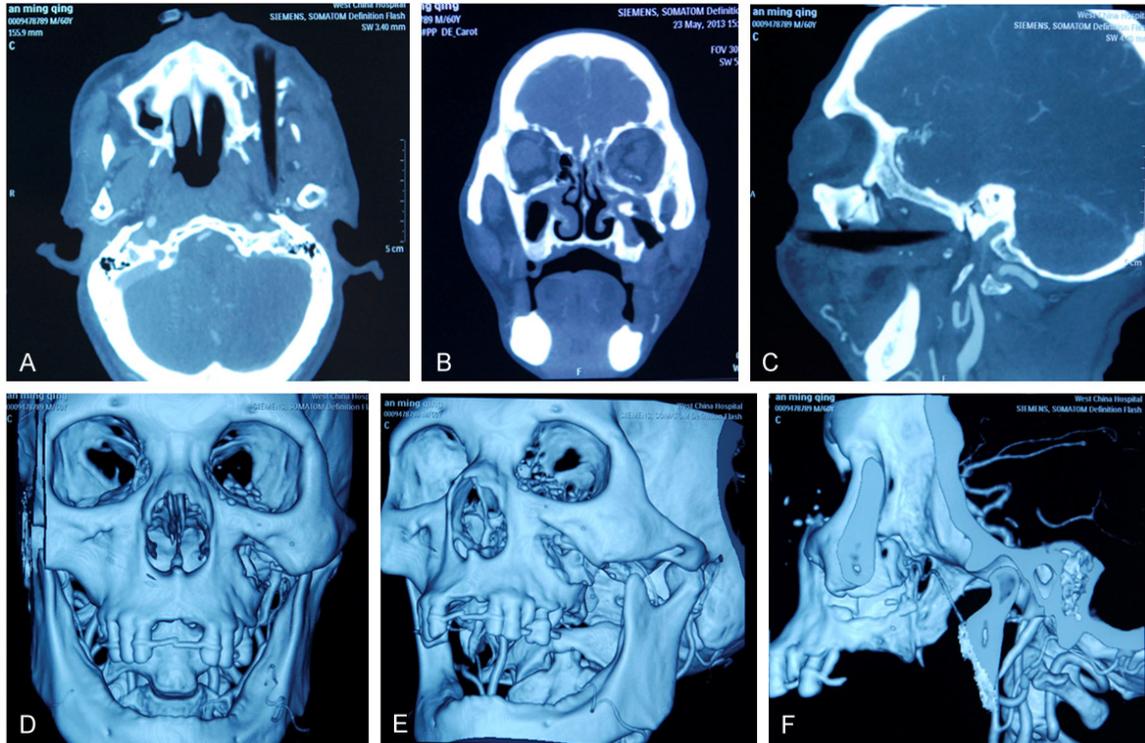
To prevent bacterial infection, the patient was treated with antibiotics (0.75 g cefuroxime every 8 h and 0.5 g ornidazole every 12 h, for 3 days), and dexamethasone in decreasing doses for 3 days (20 mg in 1<sup>st</sup> day, 15 mg in 2<sup>nd</sup> day, 10 mg in 3<sup>rd</sup> day). Dressings were changed every other day. Postoperative instructions were given, including the need for a soft diet and meticulous oral hygiene. Ten days later, the patient returned for suture removal, at which point the wound was already healing with no signs of infection. Long term follow-up revealed the wound eventually healed completely without any complications and the patient got totally recovery.

### Discussion

Major penetration of a foreign body into the deep maxillofacial space is a rare occurrence. Initial management should focus on stabilizing the patient's general medical condition through life support measures. Only when the patient is medically stable and not in shock should any attempt be made to remove the foreign body [7, 8]. However, the preferred treatment strategy for removal of foreign body penetration into the deep maxillofacial space remains a subject of debate.

There is no dispute on the idea that preoperative foreign body location is absolutely necessary. Because blind removal of foreign bodies without accurate localization of the foreign body or visualization of the local anatomical structures can cause serious damage to these structures and the failure of removal [9]. But as medical technologies develop, more and more assistant examination are available for this purpose, including radiographs, CT, MRI scans, ultrasound, metal detector and 3D image-guided device [9-11], which brings difficulties in

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**Figure 2.** Preoperative location of the foreign body by enhanced spiral computed tomography and 3D reconstruction. A-C. CT images showing the wooden wedge penetrating through the maxilla, terminating in the infratemporal space. D-F. Three-dimensional reconstruction from CT images showing the proximity of the foreign body to the maxillary artery.



**Figure 3.** Surgical removal of the foreign body and debridement of the traumatized area was performed. A. Image shows the Weber-Ferguson incision marked with methylene blue. B. The left maxilla and wooden wedge were fully exposed following Weber-Ferguson incision and elevation of a lip-cheek flap. C. The wooden wedge (~10 cm total length) was removed.

choosing. For clearly visible large foreign body the traditional radiographs, CT or MRI scans could provide reliable position information, and invisible and tiny foreign bodies could be located by a metal detector or 3D image-guided device. Here, the wooden wedge was clearly visible protruding from the face, and we chose CT scanning and 3D reconstruction as a means of localization to assist in preoperative analy-

sis. The success of the operation testified to the pivotal role played by this CT analysis and 3D reconstruction in locating the foreign body and facilitating the planning of its safe removal.

After establishing the location of the foreign body and its proximity to the vital structures, selecting an appropriate operative approach

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**Figure 4.** The remaining cavity was filled with ~60 cm of iodoform gauze, which was subsequently extracted through the left floor of the nose. The flap was tightly sutured in layers. The patient returned for suture removal ten days later. The wound healed completely with no infection complications.

becomes another crucial part of surgical planning [12]. For such a case, controversies on operative approach mainly focus on whether rejecting or utilizing the original wound as operation approach. Surgeons who approve extending the original wound as operation approach think that the injury should not be artificially aggravated. On the contrary, surgeons who support selecting an appropriate operative approach think we should take more factors into consideration, like size and type of lesion, surrounding anatomies, extends of trauma, the location of foreign body and the possible complications. In this case, the wooden wedge had penetrated into the infratemporal space, which contains the maxillary artery, internal jugular vein, common carotid artery and the maxillary and mandibular nerves. Owing to the close relationship between the wooden wedge and the great vessels, and given the splinters on the wedge, it seemed likely that hemorrhage from the great vessels could occur, which would have been potentially life-threatening. In addition, the deep and irregular wound and lots of splinters and dirt on the wedge made it harder for surgeons to debride completely. Incompletely debridement could result in severe infection even other measures like provision of appropriate antibiotics were taken [13]. Thus, an additional incision was absolutely essential to provide total exposure of the wound region and better surgical access, not only for hemostasis but also for complete debridement to prevent infection [4, 14].

The Weber-Ferguson incision was first described by Gensoul in 1827 and was devel-

oped by Weber and Ferguson afterwards. Now it has been routinely applied in unmodified, modified or extended forms in maxillectomy procedures [15, 16]. The Weber-Ferguson incision has many advantages. Firstly, it could get excellent access to the maxilla, especially to the lateral aspect of maxilla and infratemporal space. Secondly, the position of incision was designed through philtrum, nasolabial fold and palpebral fissures which could make the incision scar more invisible after operation [17]. When we made the surgical planning, we analyzed the original wound and possible intraoperative complications as we discussed above. Because a large part of the wooden wedge penetrated deeply into the left maxilla and infratemporal space and original wound was too limited, expanding the original wound was necessary to remove the foreign body. Considering the potential difficult of hemostasis in infratemporal space, the good access to the infratemporal became very important. The Weber-Ferguson incision exactly meets such a requirement. Meanwhile, the position of incision is so concealed that the operation scar could be more invisible than that of other incisions. And the success removal of foreign body via the Weber-Ferguson incision prove that such kind of operative approach could be useful and safety for removal of foreign body penetration into the deep maxillofacial space in mid-face area and prevent severe complications.

Penetration of the deep maxillofacial space by a foreign body is rare but life-threatening. Taking right treatment strategy could avoid much trouble during treatment. A number of key points of treatment strategy could be concluded from this case:

Protection of the patient's airway, circulation and consciousness is of utmost importance and is a precondition of surgery.

Once the patient is stable, the foreign body should be removed as soon as possible.

The location and relationship between the foreign body and vital anatomies should be confirmed via radiological examination before operation.

The operation strategy should be meticulously planned, which should follow the principles of benefiting complete removal of foreign body

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and debridement and avoiding the complications to the maximum extent.

### Disclosure of conflict of interest

None.

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