A Simple Method for Percutaneous Reduction of Isolated Zygomatic Arch Fractures With a Dental Elevator: A Technical Note

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Abstract
Isolated zygomatic arch fractures are common fractures of the facial skeleton. Dislocation may result in facial disharmony and/or restricted mouth opening if not treated properly. Different methods of minimally invasive treatment of depressed fractures of the zygomatic arch have been described. Most of them are based on either a direct percutaneous approach with a malar hook, a temporal approach according to Gillies, or transorally according to Keen. For these methods, general anesthesia is often preferred. In this technical note, an alternative method of a percutaneous approach for reduction of a zygomatic arch fracture under local anesthesia is presented.

Keywords
isolated zygomatic arch fracture, reduction, percutaneous approach

Introduction
Zygomatic bone fractures are common fractures of the facial skeleton, often caused by traffic accidents, falls, assaults, and sport accidents.¹ Isolated zygomatic arch fractures account for 10% of all zygoma fractures, mostly caused by low-energy trauma mechanisms.² Due to its thin, long structure and position projecting outside of the facial skeleton the zygomatic arch is prone to fracture.³

Patients with an isolated zygomatic arch fracture may complain of limited mouth opening and/or limited painful sideway excursions of the mandible. This is caused by the impingement of the temporalis muscle and coronoid process of the mandible. Usually a visible depression in the projection of the zygomatic arch can be noted in the face and steps can be palpated on the fracture site, although both can be camouflaged due to soft tissue swelling.

Yamamoto et al classified isolated zygomatic arch fractures into 5 types according to the degree of displacement with and without loss of bone contact and the amount of fracture lines (type I: no displacement; type II: displacement with bone contact at all fracture lines; type III: displacement without bone contact at 1 fracture line; type IV: displacement without bone contact at 2 fracture lines; type V: comminution or displacement without bone contact at 3 or more fracture lines).⁴

Radiographic examination mostly shows a V-shaped fracture (type II). Most isolated zygomatic arch fractures are stable after elevation only and do not require fixation, as a result of the intact periosteal envelope, the thick temporalis fascia, tendons of the masseter muscle, and interfragmentary locking. In comminuted fractures, fractures with separation of the sides, and tears of the periosteum,
an instability of the arch after reduction should be antici-
pated. In these unstable zygomatic arch fractures an open
approach for reduction and fixation may be required.5

Several ways of minimally invasive treatment of a
depressed fracture of a zygomatic arch have been well
described in the literature. Most of them are based on either
a direct percutaneous approach with a malar hook, a tem-
poral approach according to Gillies, or transorally accord-
ing to Keen. For these methods, general anesthesia is often
preferred.

In this technical note, an alternative method of a percu-
taneous approach for reduction of a zygomatic arch frac-
ture, which can be performed under local anesthesia, is
presented.

**Technique**

A 39-year-old, healthy male patient attended our clinic
after being assaulted, complaining of pain, restricted mouth
opening and deformity of the left side of the face in the
zygomatic arch region. Clinical and radiographic examina-
tion showed an isolated left zygomatic arch fracture (type
II; Figure 1A). The patient was treated according to our
alternative method.

The fracture is palpated, marking the skin with three
dots of a marking pencil, representing the fracture nods/
steps. The middle dot represents the deepest point of dis-
location of the fracture (Figure 2A and B). In most cases,
this will be the root of the V-shaped fracture. It is important
to draw the dots before injecting the local anesthe-
sic as it can be difficult to palpate the fracture steps after the
injection. After disinfecting the skin, draping of the surgical
field, and administration of local anesthesia (articaine
hydrochloride 40 mg/mL, with 1:100,000 adrenaline), a
stab incision parallel to the tension lines of the skin is
placed with a no. 15 blade, 5-10 mm below the deepest
point of the fracture (Figure 2A [the middle dot]).

A curved haemostatic forceps (type mosquito) is then
used for blunt preparation of a pocket through subcuta-
aneous tissues and masseter muscle, undermining the dee-
pest point of the fracture (Figure 3). Through this pocket, a
curved dental elevator (Aesculap type DL376 R) (Figure 4)
is placed underneath the deepest depression of the fracture
of the zygomatic arch, and reduction of the fracture is
achieved by pulling the instrument laterally and ending this
movement in a sweeping motion below the whole arch,
reducing the fracture (Figure 5). The wound is closed with
a single Ethilon 5.0 suture. An immediate control
radiograph is made to check proper reduction, which showed good anatomical reduction (Figure 1B). The patient is instructed to use a soft diet for 2 weeks and to refrain from contact sports for 4 to 6 weeks. Two weeks after the treatment, the patient demonstrated good mouth opening (40 mm), no facial asymmetry was observed, and a small scar of the stab incision could hardly be detected.

Discussion

Several methods have been described to reduce isolated zygomatic arch fractures. Most of them are based on direct transcutaneous approach (with a malar hook, towel clip, or wire sutures), Gillies temporal approach, or intra-oral Keen approach. Different modifications of these approaches have been described in the literature, such as endoscopic-assisted surgery\(^7\) and the use of a Foley catheter for fracture reduction\(^7\) via the Gillies approach. Every method has its advantages and disadvantages. Using an endoscope requires additional training, additional costs, and longer time of surgery. Disadvantages of the percutaneous approach with a malar hook can be the risk of injury to the soft tissues and the frontal branch of the facial nerve due to poor placement of the malar hook.\(^8\) Wire suture technique described by Giudice et al\(^9\) is minimally invasive, has little to no risk of infection or neurovascular injury, and doesn’t require an experienced surgeon. Unfortunately, an excessive tension on the sutures can lead to necrosis of the skin and thus an obvious scar.

The presented alternative method is easy, safe, quick, and can be performed under local anesthesia, which makes it cost-effective. This technique can be applied to reduce the classical V-shaped fractures (type II according to Yamamoto et al) and fractures of the zygomatic arch with displacement without bone contact at 1 fracture line (type III according to Yamamoto et al\(^4\)). More comminuted fractures can also be reduced but may not be stable after reduction and may need fixation.

Using the thin, curved mosquito forceps for undermining the fracture reduces the soft tissue trauma and the chance of trauma to the facial nerve. In 2010, Mezitis et al described a technique involving only a curved mosquito forceps for reducing isolated zygomatic arch fractures.\(^10\) However, a slim hemostatic forceps can only transfer limited forces. Adding the use of a dental elevator, a more robust instrument with a handle, the necessary force can be applied during reduction of the fracture.

Besides a direct force can be applied to the arch with this technique, while with a Gillies or Keen approach, the instrument is inserted from a more distant site, resulting in a less favorable vector of the applied reduction force, unless a specific instrument like a Rowe zygomatic elevator is used. A disadvantage of the presented technique is the absence of direct visualization of the fracture site and the achieved reduction. Given that this technique can be performed under local anesthesia, the treatment result can be evaluated immediately with a radiograph, and corrected if unsatisfactory. This may be advantageous in settings without the possibility of intraoperative imaging. This advantage has to be weighed up against the possible discomfort of the treatment under local anesthesia. Another disadvantage could be the necessity to convert to open reduction and fixation when stability of the fracture cannot be achieved after reduction as it counts for any other closed reduction method.

In conclusion, this alternative method of percutaneous reduction of an isolated zygomatic arch fracture is a safe, quick, and simple technique which can be applied under local anesthesia.

Declaration of Conflicting Interests

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Informed Consent
A written informed consent for patient information and images was signed and provided by the patient.

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