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Research Paper

Trauma

Relationship between facial nerve damage and transbuccal trocar placement: an anatomical cohort study

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Abstract. The surgical treatment of ramus and mandibular angle fractures is typically performed by intraoral and transbuccal approaches. As these approaches may result in nerve damage, this anatomical study was performed to establish the relationship between the transbuccal trocar position and the likelihood of inducing facial nerve damage. Twenty dissections of the parotid regions were performed after a simulation of surgical approaches aimed at addressing mandibular condylar and angle fractures. Two trocar tubes, ramic and angular, were inserted and left in position throughout the dissection. This procedure allowed the qualitative relationship between the various tube positions and facial nerve damage to be analyzed. The potential risk of contact between the ramic trocar and the facial nerve branches was 90%, while the angular trocar was in contact in 45% of cases. There was no contact with the trunk, cervicofacial division, or temporofacial division of the facial nerve. The contacts occurred at the level of secondary division branches, particularly pronounced for superior and inferior buccal branches, despite the absence of macroscopically visible trauma. Based on these findings, it is proposed that trocars should be used in procedures aimed at addressing subcondylar or angle fractures of the mandible.

Key words: facial nerve; trocar; osteosynthesis; mandibular fracture.

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The surgical treatment of mandibular ramus and angle fractures has benefitted from the development of miniaturized osteosynthesis materials.[1,2] In the mid-1990s, such fractures were typically addressed by vestibular incision with a percutaneous transbuccal access.[3] Significant developments in endoscopic technology that have taken place since 2000 have enabled the treatment of mandibular condyle fractures as well.[4,5] These novel surgical approaches have resulted in reduced facial scarring, while also mitigating the risk of facial nerve injury that may arise when adopting standard open approaches.[6] However, despite the fact that the transbuccal access can result in facial nerve lesions, only a few anatomical studies on the risk of facial nerve injury during this surgical approach have been performed to date.

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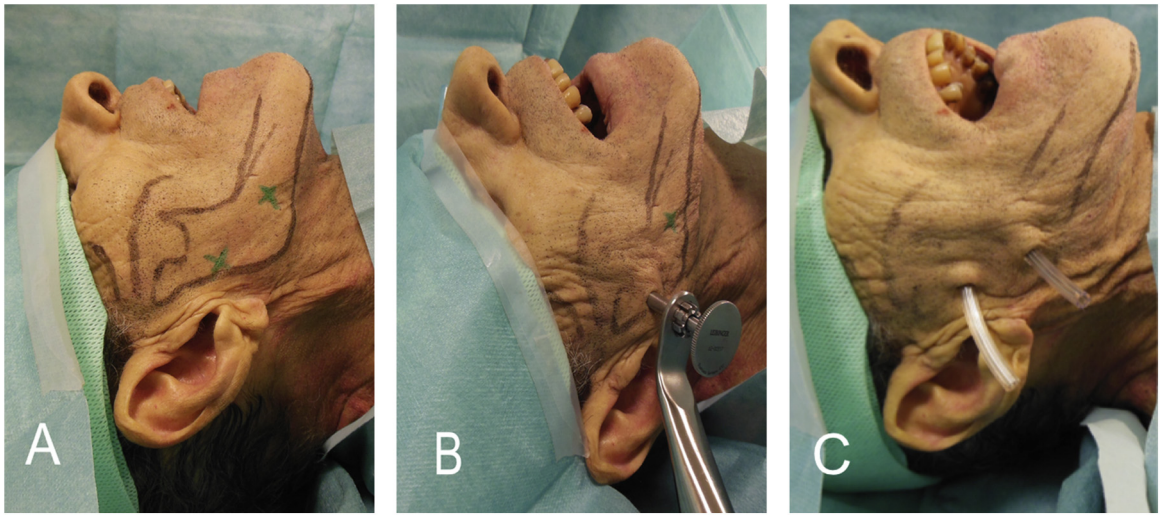

Fig. 1. Simulation of the process of ramic and angular percutaneous osteosynthesis. (A) Percutaneous sites, comprising the proximal (ramic) and distal (angular) tube positions. (B) Focusing the transbuccal viewfinder and foam trocar on subcondylar and angle fractures with oral visual control. (C) The proximal ramic tube and the distal angular tube simulate the channel operators of the transbuccal viewfinder.

In order to fill this gap in the existing body of knowledge, this anatomical study evaluated the consequences of positioning the transbuccal trocar foam viewfinder in the vicinity of the facial nerve, according to the surgical simulation protocol.

Materials and methods

This anatomical study was performed between January 2011 and March 2013 in the anatomy department of the study institution in Toulouse, France. All appropriate consents were obtained prior to commencing the study. As a part of this investigation, 20 parotid regions were dissected in 13 embalmed adult cadaveric heads that had been donated to the anatomy department. The study sample comprised seven females and six males aged 64–85 years at the time of death. None of the cadavers had any clinical evidence of previous mandibular fracture or surgery. All methods for securing human tissue were humane and complied with the tenets of the Declaration of Helsinki.

Subcondylar and angle fractures were simulated on the same hemi-mandible. While many classifications systems are presently in use, subcondylar fractures are commonly defined as extracapsular fractures that pass through the anatomical neck of the articular process or diagonally downwards and backwards from the mandibular notch towards the posterior edge of the ramus. In contrast, angle fractures involve a triangular region bounded by the anterior border of the masseter muscle and an oblique line extending from the lower third molar region to the postero-inferior attachment of the masseter muscle.

In this work, two osteosynthesis approaches were simulated. The oral access commenced with a lower vestibular incision followed by a sub-periosteal detachment from the angle to the mandibular condyle. In addition, two percutaneous buccal access points in front of each fracture were created via two punctures (6 mm in diameter), through which the transbuccal equipment was inserted. The equipment comprised a transbuccal viewfinder (channel operator), cheek retractor, and foam trocar.

To facilitate the dissection, the transbuccal viewfinder (6 mm in diameter) was subsequently substituted by two semi-rigid silicone tubes of the same diameter (6 mm), which were left in place during the dissection—a proximal (ramic) tube and a distal (angular) tube, positioned at opposing angles, as shown in Fig. 1.

The dissection of the facial nerve was conducted as a superficial parotidectomy. The pre-auricular incision was performed from the base of the helix to the mandibular angle.

A skin flap was created by making an incision that extended towards the light of the zygoma and the basal border of the mandible. This allowed the trunk of the facial nerve to be identified and placed on a vessel loop. Next, the cervicofacial division (CFD) and its secondary division branches—three buccal branches (lower deep, superior, and inferior), the marginal mandibular branch, and the cervical branch—were dissected. This was followed by a dissection of the temporofacial division (TFD) and its secondary division branches (temporal and zygomatic branch), without releasing them from the deep plane, following the superficial parotidectomy approach (Fig. 2).

Once this procedure was completed, contacts between the tubes and the facial

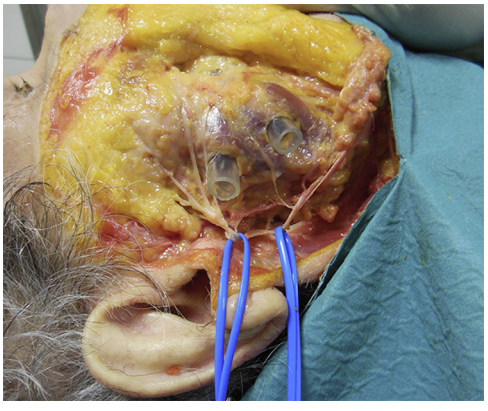

Fig. 2. Dissection of the right facial nerve (dissection No. 19), comprising a right superficial parotidectomy, followed by the identification of the facial nerve trunk and a dissection of the cervicofacial and temporofacial divisions.