Skin reference point for the zygomatic branch of the facial nerve innervating the orbicularis oculi muscle (anatomical study)

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Abstract

Purpose Direct access to the zygomatic branch of the facial nerve in the parotid is less invasive and more selective than first dissecting the nerve trunk and then finding the branches. The aim of this study was to confirm the point of reference on the skin which would give direct access to the zygomatic branch for the orbicularis oculi muscle. The skin reference point studied was on the intertragic notch/external canthus line, 2.5 cm in front of the intertragic notch.

Methods Ten fresh cadavers, and thus 20 sides of faces were dissected. The zygomatic branch of the facial nerve innervating the orbicularis oculi muscle was accessed directly. The dissection was extended to temporofacial and cervicofacial branches and then to the trunk of the facial nerve by a retrograde path in the parotid.

Results Twenty dissections of the parotid area confirmed the validity of the anatomical reference point of the zygomatic branch for the orbicularis oculi muscle considered.

Conclusions The simplicity and reliability of this landmark is important in clinical practice and has numerous potential applications in surgery for rehabilitation of facial paralysis associated with VII healthy and VII affected neurorrhaphies, in facial paresis for superneuromizations and in traumatology.

Keywords Facial nerve · Facial palsy · Landmarks · Anatomy · Parotid

Introduction

Knowledge of the key landmarks of the facial nerve and its branches is essential for a safe and effective surgery in the region of the parotid gland. In current practice, wide range of landmarks are used to identify the facial nerve, but there is much debate in the literature about the safety and reliability of each of these landmarks. In fact, reference points for direct access to the zygomatic branch originating from the temporo facial branch pose problems. Anatomical studies were performed to characterize precisely their location with respect to bone and soft-tissue landmarks. Several points have been described, but their recognition and clinical application are difficult and have not led to the development of a direct surgical approach [3, 4, 6, 9, 13]. There are no accurate data in the anatomical literature concerning zygomatic branch cutaneous landmarks. However, direct surgical access to the terminal branches of the facial nerve (VII) in the parotid is less invasive and more selective than access by first dissection of the trunk and then the branches. Fausto Viterbo [15] has shown the advantages for terminal branches of direct access over first accessing the trunk of VII. End-to-side nerve grafting has several potential advantages for the treatment of patients with facial nerve palsy. The ideal situation would involve direct cross-face nerve grafts from an healthy facial nerve to the corresponding nerve branches in the paralysed hemi-face, without loss of function in the donor nerve. An animal study demonstrated that end-to-side neurorrhaphy used to reinnervate the paralysed orbicularis oculi muscle can produce facial reanimation in a clinically relevant large-animal model [12].
Our clinical experiment and four preliminary dissections of the facial nerve and its branches enabled us to predict a cutaneous reference point giving direct access to the zygomatic branch of the facial nerve in the parotid innervating the orbicularis oculi muscle. This skin landmark was constant on the intertragic notch/external canthus line, 2.5 cm in front of the intertragic notch in the four cadaver hemifaces. The aim of this study was to confirm this point and to establish an accurate and reliable reference point giving direct access to the zygomatic branch innervating the orbicularis oculi muscle for safe and effective surgical intervention in the region of the parotid gland.

Materials and methods

Ten fresh non-frozen adult cadavers, that is 20 hemi-faces, were dissected to study the zygomatic branch of the VII. Specimens with a history of cervico-facial surgery or facial trauma were excluded from the study. The age and the sex of the cadavers were unknown.

The anatomical skin reference point described and hence studied was on the intertragic notch/external canthus line, 2.5 cm in front of the intertragic notch (Fig. 1).

First, the skin reference point was drawn on each hemi-face (Fig. 2). The skin had been removed. The Superficial Muscular Aponeurotic System (SMAS) in continuity with the platysma had been lifted to show the parotid gland surrounded by the parotid fascia or deep facial fascia, this is the first plane of dissection. For practical reasons, the reference points were reproduced on the parotid fascia or deep facial fascia. To help with the dissection, the parotid regions were first infiltrated with physiological serum (±10 cc) (Fig. 3). The parotid fascia was incised with scissors over a length of 1.5 cm. The dissection continued with the search for the zygomatic branch accessed directly by only decision and not on the section of the parotid gland. The scissors were oriented parallel to the nerve branches (Fig. 4). The nerve branch identified was displayed prominently (Fig. 5).

Secondly, the dissection was extended to the temporo-facial branches and as far as the trunk of the VII by a retrograde approach, laying back the superficial lobe of the parotid gland to test the validity of our dissection (because we could not use a nerve stimulator in anatomy). The dissection finished downstream from the reference point (Fig. 6).

Results

The zygomatic branch for the orbicularis oculi muscle was found in all our 20 dissections using the skin reference point described \((n = 20)\). The temporo-facial branch of the facial nerve was always seen coursing over the masseter muscle and dividing into two principle branches:temporal branch superiorly and zygomatic branch inferiorly. In two cases, the zygomatic branch was anastomosed with the buccal branch of the facial nerve. The distribution was everytime symmetrical in the ten cadavers.

The average depth of the branches in the parotid was 4.8 ± 0.3 mm (taking into account the serum infiltration).

Discussion

We confirmed the anatomical reference point that we had predicted. The skin reference point was on the intertragic
notch/external canthus line, 2.5 cm in front of the intertragic notch in 20 dissections. Direct access to the zygomatic branch innervating the orbicularis oculi muscle was straight-forward using the skin reference point described. This reference point had been predicted during the clinical experiment and the four preliminary dissections of the facial nerve and its branches. However the data are not published. In this study, the results are comparable to the results of the preceding work.

The simplicity and reliability of this landmark is important in clinical practice and has numerous potential applications, even though the dissection of the nerve trunk followed by tracing of its branches remains the reference method [2]. In fact, accurate identification and precise location of facial nerve are imperative for safe and effective surgical intervention in the region of the parotid gland. This anatomical cutaneous landmark serves to caution the surgeons as the region is approached and aids in the performance of safe surgery. Classic descriptions of the trunk and temporofacial division indicate that their courses can be predicted based on bone or retromandibular vein or soft-tissue landmarks relative to the auricule, the lateral aspect of the eyebrow and possibly the temporal hairline [2, 14]. Errors of localization can be explained by the variability of the different anatomical landmarks. A cutaneous landmark is not absolutely sure but it allows an easy identification, does not require complex dissection and is less prone to anatomical variations. However, there are no accurate data in the anatomical literature concerning zygomatic branch cutaneous landmarks.

The zygomatic branch is particularly vulnerable during surgical procedures on the upper and midface and also in traumatology. In cases of facial palsy from deep wounds or serious ragged bites in the mediojugal region, it is
necessary to ensure the integrity of adjacent organs and in particular of the facial nerve. If a nerve branch is sectioned at the back of the anterior edge of the masseter, immediate surgical repair is required. Nerve suture is facilitated by skin reference point which enable an accurate positioning of a branch without dissecting the trunk.

This anatomical reference point can have several applications in rehabilitation surgery of facial palsy [7]. The orbital region can be revived by neurorraphy between healthy VII and affected VII. The skin reference point technique enables the positioning of a nerve graft by termino-lateral connection [5, 10, 11, 16] between the healthy side of the zygomatic branch and the zygomatic branch of the paralysed side [12]. Nerve connection by transfacial nerve graft of a revascularized and reinnervated free muscle transfer is also possible [8].

The use of anatomical skin reference points is also important in the management of facial paresis, especially in the superneurotizations described by Frey [1].

This study identified a reliable skin reference point for the zygomatic branch, innervating the orbicularis oculi muscle. This landmark is on the intertragic notch/external canthus line, 2.5 cm in front of the intertragic notch. This location technique can easily be reproduced, does not require a complex dissection and also ensures minimum risk of injury to the facial nerve in clinical practice.

Conflict of interest All authors, their immediate family, and any research foundation with which they are affiliated did not receive any financial payments or other benefits from any commercial entity, related to the subject of this article.

References