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Research Paper

Facial nerve trunk variations with surgical implications: A cadaveric study

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ABSTRACT

Purpose: : Anterograde identification of facial nerve trunk (FNT) identification is paramount, because FNT injury causes substantial morbidity. This study reexamines controversial landmarks and considers the importance of gender and dentition in landmark choice.
Methods: Distances from key landmarks to FNT were measured and compared by side, gender and dentition (92 specimens). Landmarks included posterior belly of digastric muscle (PBM), tragal pointer (TP), mastoid process (MP), external acoustic meatus (EAM) and transverse process of axis (TPA).
Results: Two-sample T tests showing longer distances from: MP/TPA to FNT in men than in women (14.8 ± 2.2 mm vs. 13.5 ± 1.6 mm, P = 0.004; 37.6 ± 4.4 mm vs. 32.7 ± 4.2 mm, P = 0.001); EAM to FNT on occlusal sides than on the counterparts (14.2 ± 1.8 mm vs. 16.0 ± 3.8 mm, P = 0.020). One-sample T tests showing longer distances from: TP to FNT on right than on left side (21.4 ± 2.7 vs. 19.9 ± 2.9, P = 0.006); MP to FNT on the less dentulous maxillae than on the counterpart (14.4 ± 2.1 vs. 13.0 ± 1.6, P = 0.027); PBM/EAM to FNT on the less dentulous mandible than on the counterpart (9.8 ± 1.6 vs. 7.8 ± 2.5, P = 0.039; 16.4 ± 3.0 vs. 14.1 ± 1.5, P = 0.020).
Conclusion: Surgeons should be aware that distances of MP, PBM and EAM, to FNT, are lengthened in less dentulous patients, especially when maxilla and mandibles are non-occlusive. Overall, soft landmarks are less reliable than osseous landmarks.

1. Introduction

Penetration of the parotid gland near the facial nerve has always raised concerns among surgeons because facial nerve injury is an important cause of morbidity associated with parotid gland surgery. The conventional approach is anterograde parotidectomy, in which the main trunk of the facial nerve (facial nerve trunk, FNT) is identified and meticulous anatomical dissection is subsequently performed to resect the tumor. Therefore, an appreciation of the relevant anatomy associated with the FNT is of significant importance in clinical practice.

There has been a long-term debate over the reliability of osseous and soft tissue landmarks in identification of the FNT. These landmarks can be chosen because they are easily palpable either preoperatively or during the course of surgery [e.g. mastoid process (MP), external acoustic meatus (EAM), styloid process, tragal pointer (TP) and transverse process of the axis (TPA)], or they represent soft or hard tissue landmarks that would be encountered during the course of the surgery [e.g. the posterior belly of the digastric muscle (PBM), tympanomastoid suture] [1–3].

In the present study, we evaluated anatomical areas that have been controversial in the literature, taking into account factors that have not been fully evaluated in previous studies. Specifically, the effect of dentition on the reliability of the above-mentioned landmarks was assessed. We also reevaluated the reliability of osseous versus soft tissue landmarks and highlighted differences between the two sexes.

2. Methods

Of the total eighty-one half-head cadaver specimens which were collected, twenty-eight half-heads were pairs from the same head. Approval for the research was obtained from the University of New South Wales Human Research and Ethics Committee (HREC09372).

The selection criteria for the landmarks were as follows: the structure has not been fully evaluated in previous studies, has been associated with controversy in the literature, and can be easily identified. Consequently, the chosen landmarks in this study were the PBM, TP, MP, EAM, and TPA.

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Table 1
Description of each landmark used in this study.

Landmark	Description
Posterior belly of the digastric muscle	From the facial nerve main trunk origin to the most superior aspect of the posterior belly of the digastric muscle closest to the mastoid process
Tragal pointer	From the facial nerve main trunk origin to the midpoint of the tragal pointer
Mastoid process	From the facial nerve main trunk origin to the inferior–anterior point of the mastoid process
External acoustic meatus	From the facial nerve main trunk origin to the antero-inferior aspect of the junction between the bony and cartilaginous ear canal
Transverse process of axis	From the facial nerve main trunk origin to the superior border of the transverse process of the axis

The distance from each of these landmarks to the FNT was compared between the two sexes, between the right and left sides of the same cadaver specimens, between the more and less dentulous sides of the maxillae and mandibles of the same cadaver specimens, and between the sides of cadaver specimens with occlusal maxillae and mandibles and the sides with non-occlusal maxillae and mandibles. Table 1, Figs. 1 and 2 illustrate the details of these distances. If more than one maxillary premolar or molar tooth was lined up with the corresponding mandibular tooth, the specimen was defined as having an occlusal maxilla and mandible.

Data were collected using prosected specimens from the University of New South Wales and the University of Sydney, where standard prosections and dissections are routinely performed. Measurements were performed three times using the same digital micrometer (Mitutoyo Digimatic Caliper; Mitutoyo Corp., Kawasaki, Japan), and the average was calculated. The head of each specimen was extended to 120° as shown in Fig. 3. Statistical analyses were performed using SPSS 20.0 (IBM Corp., Armonk, NY, USA) (Table 2).

3. Results

The distance from the EAM to the FNT was significantly longer on the sides of specimens with non-occlusal maxillae and mandibles than on the sides with occlusal maxillae and mandibles (difference in mean, –1.8; P = 0.018) (Table 3).

For sex-related variations, Table 4 reveals that the distances from two osseous landmarks (the MP and TPA) to the FNT were significantly longer in male than in female specimens. For the MP, the difference between the means was 1.3 mm (males, 14.8 ± 2.2 mm; females, 13.5 ± 1.6 mm; P = 0.004), and for the TPA, the difference between the means was 3.9 mm (males, 37.6 ± 4.4 mm; females, 32.7 ± 4.2 mm; P = 0.001).

Tables 5–7 show the differences in each distance between the three paired groups: the left and right sides, more and less dentulous sides of paired maxillae, and more and less dentulous sides of paired mandibles.

Regarding left and right comparisons, there were no statistically significant differences for any landmarks with the exception of the TP, which had a mean difference of –1.5 ± 2.7 mm (P = 0.006) (Table 5). The distance from the TP to the FNT on the left side was significantly shorter than that on the right side in the same cadaveric specimen.

For comparisons of the more and less dentulous sides of the same maxillae, the distance from the MP to the FNT was the only distance that was significantly different between more and less dentulous maxillae; the difference in the mean was –1.4 ± 1.6 mm (P = 0.027) (Table 6). The distance from the MP to the FNT was longer on the side of the maxilla with fewer teeth than on the side of the maxilla with more teeth in the same cadaveric specimen.

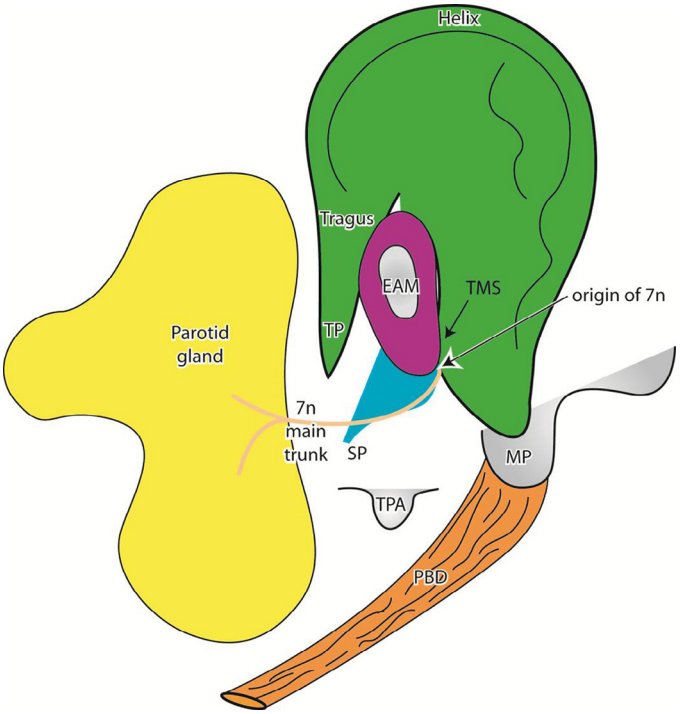

Fig. 1. Five landmarks used in the present study. Schematic diagram.

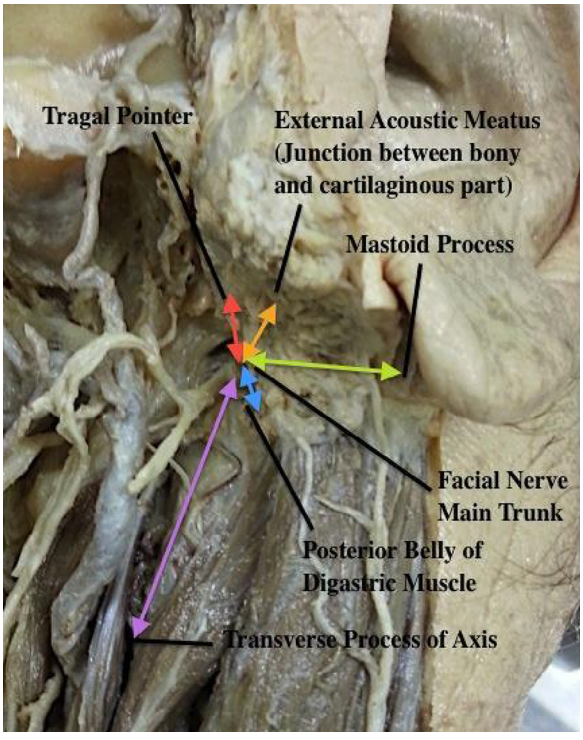

Fig. 2. Five landmarks used in the present study. Representative specimen. Double-headed arrows represent the exact distances measured.