An Anatomic and Histologic Study of the Facial Nerve for Nerve Graft

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An Anatomic and Histologic Study of the Facial Nerve for Nerve Graft

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This certifies that the Doctoral Dissertation of Hyun-Ho Kwak is approved.

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2006년 12월

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ABSTRACT

An Anatomic and Histologic Study of the Facial Nerve for Nerve Graft

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(Directed by Professor Hee-Jin Kim, D.D.S., Ph.D.)

This study examined the anatomical relationships along with the variability of the facial nerve trunk and its branches with an emphasis on the intraparotid connections between the divisions. And histomorphometric observations of the facial nerve branches and fascicles were performed. Micro-dissections were performed on 40 Korean half-heads, and the facial nerve trunk and its branches were exposed. The average depth of the stylomastoid foramen from the skin surface was 21.0±3.1 mm, and the distance between the stylomastoid foramen and the bifurcation spot of the temporofacial (upper) and cervicofacial (lower) division was 13.0±2.8 mm. In 35 out of 40 dissections (87.5%), the facial nerve trunk was bifurcated into two main divisions, the nerve trunk was divided into a trifurcation pattern in the other five cases (12.5%). According to the origin of the buccal branch, the branching patterns of the facial nerve were classified into four categories. In type 1 (17.5% of cases), the buccal branch arose from the two main divisions of the trunk, but not from other branches of the facial nerve. In type II (18 cases, 45%), the buccal branch arose from the two main divisions, and was interconnected with the zygomatic branch. In type III (12.5% of cases), the marginal mandibular branch sent nerve twigs to the buccal branch, which originated from the upper and lower divisions. In type IV (25% of cases), the nerve twigs from the zygomatic and the marginal mandibular branches merged to the buccal branch arising from the two main divisions. Communications between the facial and the auriculotemporal nerve branches, which are known as the ‘communicating auriculotemporal nerves’, were observed in 37 out of 40 cases (92.5%). In the histological observation, the buccal branch had the greatest number of branches (3.47), however the zygomatic branch had the largest diameters (0.93 mm). The detailed description of the facial nerve anatomy and histological observation in this study will provide useful information for surgical procedures such as a tumor resection, a facial nerve reconstruction, autonerve graft, and a facelift.

Key words: facial nerve, nerve graft, parotid gland, surgical anatomy, nerve fascicles

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I. INTRODUCTION

The facial nerve exits the skull base by passing through the stylomastoid foramen. It then runs anteriorly within the parenchymes of the parotid gland, crosses the external carotid artery, and divides into two main divisions at the posterior border of the ramus of the mandible, an upper (the temporofacial division) and a lower division (the cervicofacial division)[1]. Each primary division is further divided into several branches in a plexiform arrangement. They are distributed over the face and the upper part of the neck, supplying the superficial muscles in these areas[2]. A plan for locating the facial nerve trunk as it leaves the stylomastoid foramen is essential for the preservation of the nerve when surgery is indicated for the removal of the parotid gland and tumors in the area as well as for the repair of injured or severed facial nerve.

The complex anatomical distribution pattern of the facial nerve, its critical role in facial expressions, and the dramatic deformities resulting from a facial nerve injury have inspired numerous anatomical and speculative studies on the nerve[3,4,5]. Previous anatomical studies reflected the surgical interests and limitations by focusing on the topics such as the approaches to the nerve trunk at the stylomastoid foramen[6], the definition of peripheral landmarks[7], the definition of the five distinct branches (temporal, zygomatic, buccal, mandibular, and cervical)[8,9], and the approaches to developing a surgical dissection procedure for exposing the facial nerve[3,4,7,10].

Many studies have examined the branching pattern of the facial nerve, but there is little data regarding the branching pattern in Asians. Wang et al.[11] and Park and Lee[12] reported the branching patterns of the facial nerve ramification in Chinese and Koreans, respectively. However, these studies reported considerably different results with a morphological aspect. In addition, anatomical textbooks and articles have rarely mentioned the communicating nerve, which connects the facial and auriculotemporal nerves[11,13].

With the development of microsurgery, autogenous nerve grafting is being used widely in the treatment of injured nerves. Nerve grafting is commonly used in facial nerve repair, and several sensory cutaneous nerves are used as donor nerves. The potential for success of a nerve graft is generally optimized when the diameters of the nerve and graft are similar, when fascicular cross-sections of the nerve and graft are maximally opposed, usually when the number and size of the fascicles are similar, and when regenerating fibers are not diluted within the graft through anastomosis or lost through branching.

This study performed a series of facial nerve dissections in order to examine the facial nerve distribution within and beyond the parotid gland in a microsurgical viewpoint. The purposes of this study are 1) to perform morphometric measurements upon the facial nerve trunk, 2) to clarify the significant variations of the facial nerve branching pattern, and 3) to describe facial nerve morphology, including a microscopic assessment of nerve size and shape, fascicular number and size.

II. MATERIALS AND METHODS

Fifteen embalmed and 25 fresh hemi-sectioned head specimens from Korean adult cadavers (25 sides from 13 males, 15 sides from 9 females; average age 58.6 years) were used in this study. The dissection was performed on all specimens using a surgical microscope (Carl Zeiss, Germany), while disregarding the left or right side of all specimens.

The dissections were performed in an oblique lateral position. After removing the skin and superficial fascia over the parotid area and exposing the parotid gland, the facial nerve branches which exist from the parenchymes of the parotid gland were ligated using a surgical suture. And the dissection was performed from the anterior margin of the parotid gland toward the temporal and mandibular ramus regions of the face. After the facial nerve branches distal to the anterior margin of the parotid gland were identified, the parotid gland was carefully removed, and all the branches were traced proximally until the main trunk was reached. A further dissection proceeded peripherally and terminated at the facial expression muscles.

This study consisted of three investigations concerning the distribution of the facial nerve. Two morphometric measurements were performed in the first investigation. This study measured the depth from the skin surface to the facial nerve trunk at the stylomastoid foramen and the distance between the facial nerve trunk emerging from the stylomastoid foramen and its furcation point (Fig. 1). In the second investigation, the furcation pattern of the facial nerve trunk was observed and the distributing pattern of the facial nerve branches was classified based on the origin of the buccal branch. Lastly, the communicating nerve twigs between the facial and auriculotemporal nerves were identified. All measurements were made using the digital calipers (model #CD-15CP; Mitutoyo Co., Japan) that are capable of measuring to the nearest 0.05 mm, and all the data were presented by the percentage of cases.

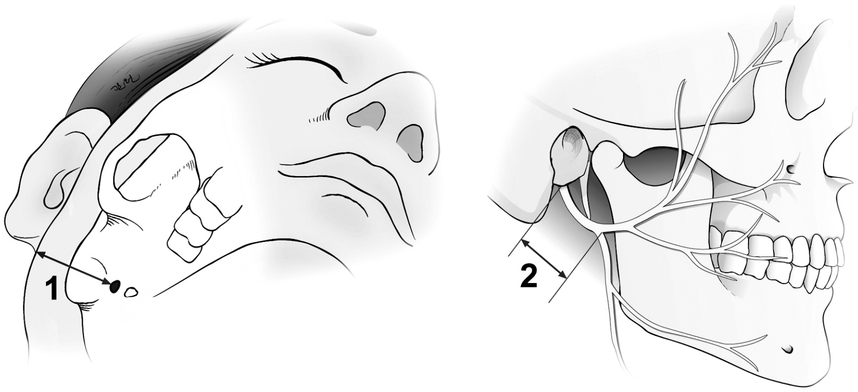

Fig. 1. Diagram of the morphometric measurements of the facial nerve trunk between its emergence and furcation at the intraparotid area. 1, the depth from the skin surface to the facial nerve trunk at the stylomastoid foramen; 2, the distance between the facial nerve trunk at the stylomastoid foramen and the furcation point of the facial nerve trunk.

To obtain histological sections, the ligated portion of the facial nerve branches existing from the parotid gland including the surrounding connective tissue was harvested. These specimens were post-fixed for 72 hours with 4% paraformaldehyde and then embedded in paraffin wax. Transverse 5 ㎛-thick sections were cut along the nerve branches, mounted on glass slides, and then stain with haematoxylin-eosin and Luxol fast blue. Histological observations were performed with the aid of a light microscope, and photographs were taken with a Spot RT digital camera (Leica, DFC300FX, Germany). 6 items on the images of the sections were measured using an image analyzing system (Image-Pro® Plus, ver. 4.0, Media Cybernetics, USA) after standard calibration. The measurement items are as follows: average number and diameter of the ligated portion of the branches, fascicular number, average fascicular diameter and area, and total fascicular area of the middle portion of the facial nerve trunk, upper and lower divisions.

No distinction was made between male and female cadavers. And all photographs and diagrams in this article were of structures viewed from the right side of the face.

III. RESULTS

1. Morphometric measurements of the facial nerve trunk

The exit of the facial nerve from the skull through the stylomastoid foramen was observed without exception in all 40 examined specimens. At the stylomastoid foramen, the nerve was bound medially by the styloid process and laterally by the mastoid tip. The mean minimal depth between the skin surface and the facial trunk at the stylomastoid foramen was 21.0 ± 3.1 mm (ranging from 16.9 to 28.8). The mean distance between the emerging point of the facial nerve trunk from the stylomastoid foramen and its furcation point was 13.0 ± 2.8 mm (ranging from 8.8 to 16.4) (Fig. 1, Table 1). In all specimens, the facial nerve trunk at the stylomastoid foramen could be exposed without any need for a mastoidectomy.

Table 1. Measurements of the facial nerve trunk with references to the surrounding anatomical structures.

Items of measurement	Measurements (n=40)
Skin surface ~ stylomastoid foramen	21.0 ± 3.1
Stylomastoid foramen ~ furcation point	13.0 ± 2.8

Unit: mm, Average ± standard deviation

2. Branching patterns of the facial nerve

The facial nerve emerged from the stylomastoid foramen, which is located immediately dorsolateral to the base of the styloid process. From the stylomastoid foramen, the facial nerve took a downward and ventrolateral course and plunged into the retromandibular fossa, which was completely filled with parotid parenchymes. Laterally, the facial nerve was covered with tough fibers of the temporoparotid fascia, which extended from the tympanomastoid fissure to the parotid gland and blended with the fibers of the parotid fascia.

Two main initial trunks of the facial nerve, a major and a minor, were observed in 27.5% of cases. The minor trunk entered the cervicofacial division, and the cervical branch originated from there (Fig. 2).

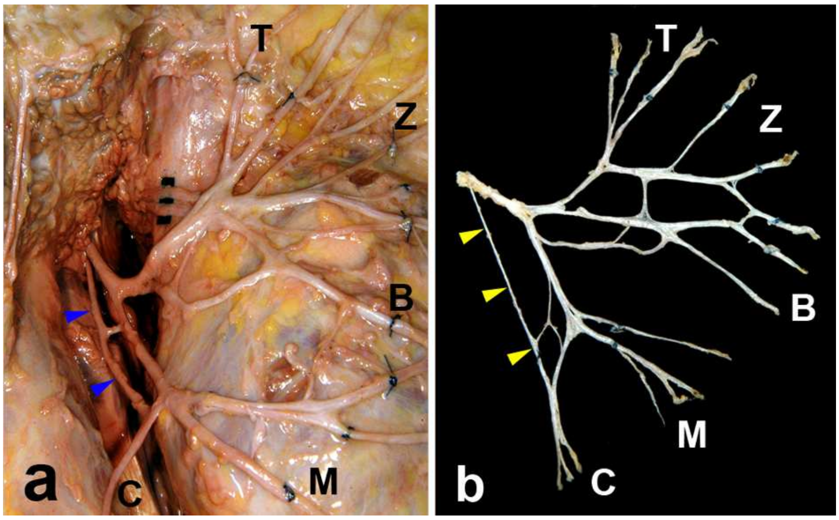

Fig. 2. Two main trunks of the facial nerve (a). The minor trunk joined the cervicofacial division, and the cervical branch originated from that division (b). B, buccal branch; C, cervical branch; M, marginal mandibular branch; T, temporal branch; Z, zygomatic branch; arrowheads, minor trunk of the facial nerve.

The first branch of the facial nerve was the posterior auricular nerve, which passed postero-superiorly between the parotid gland and the sternocleidomastoid muscle. After giving the posterior auricular nerve branch, the facial nerve trunk traveled lateral to the styloid process and its attached muscle, innervating the posterior belly of the digastric muscle.

In 35 out of 40 cases (87.57%), the facial nerve trunk terminated by bifurcating into two main divisions (Fig. 2a). In 5 cases (12.5%), the nerve trunk ended in a trifurcation pattern within the parotid gland (Fig. 2b). The bifurcation of the nerve trunk took the shape of an asymmetric "Y".

In all specimens, the two, sometimes three, main divisions divided into five distinct branches known as the temporal, zygomatic, buccal, marginal mandibular, and cervical branches. The branching patterns of the facial nerve ramification varied. According to the origin of the buccal branch, the distribution pattern of the facial nerve branches was classified into four different types (Fig. 3).

In 17.5% of the cases, the buccal branch arose from the two main divisions of the trunk, but not from other branches of the facial nerve (type I)(Fig. 4a). In the most common anatomic pattern, type II, which was noted in 18 cases (45%), the buccal branch arose from the two main divisions, and it was interconnected with the zygomatic branch. (Fig. 4b). In type III, which was observed in 12.5% of cases, the marginal mandibular branch sent nerve twigs to the buccal branch, which originated from the upper and lower divisions (Fig. 4c). In type IV, which was identified in 25% of cases, the nerve twigs from the zygomatic and the marginal mandibular branches merged to the buccal branch arising from the two main divisions (Fig. 4d).

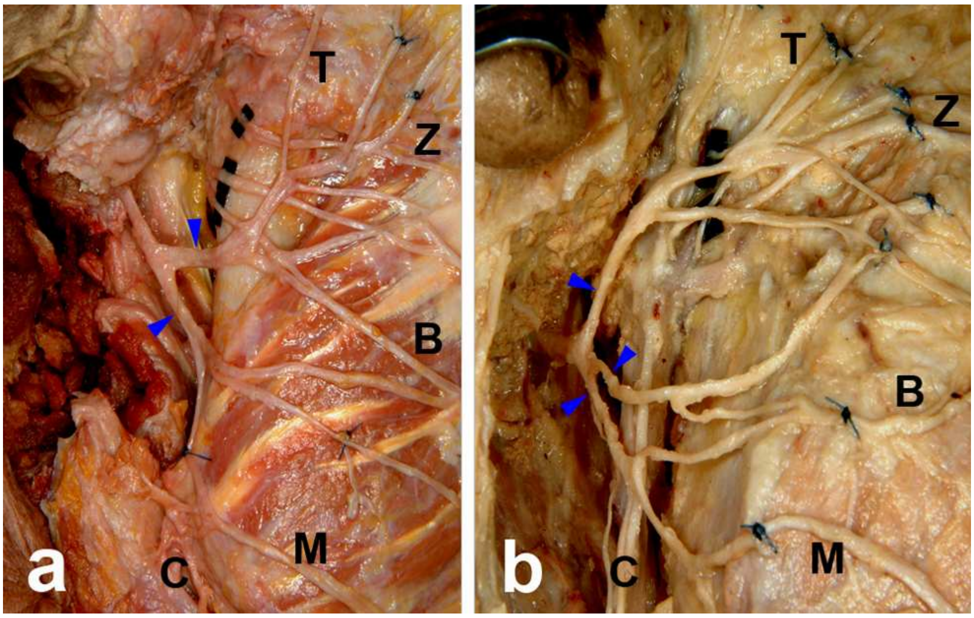

Fig. 3. Dividing patterns of the main initial trunk of the facial nerve. The facial nerve trunk bifurcated into the temporofacial and cervicofacial divisions (a). Trifurcation of the facial nerve trunk was observed in 12.5% of cases (b). B, buccal branch; C, cervical branch; M, marginal mandibular branch; T, temporal branch; Z, zygomatic branch; arrowheads, divisions of the main trunk of the facial nerve.

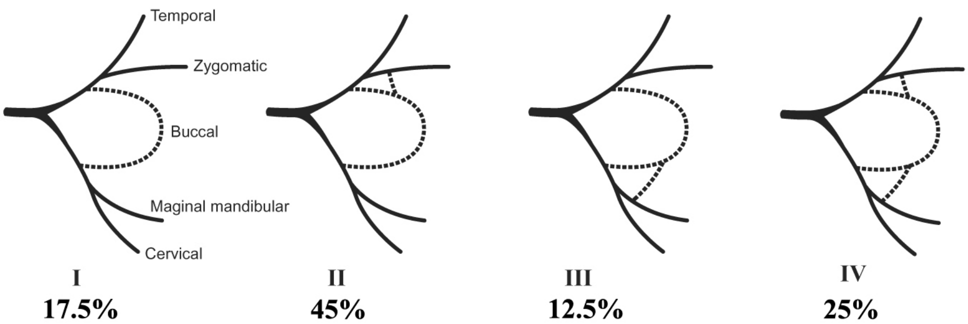

Fig. 4. Four categories of the branching patterns of the facial nerve according to the origin of the buccal branch.

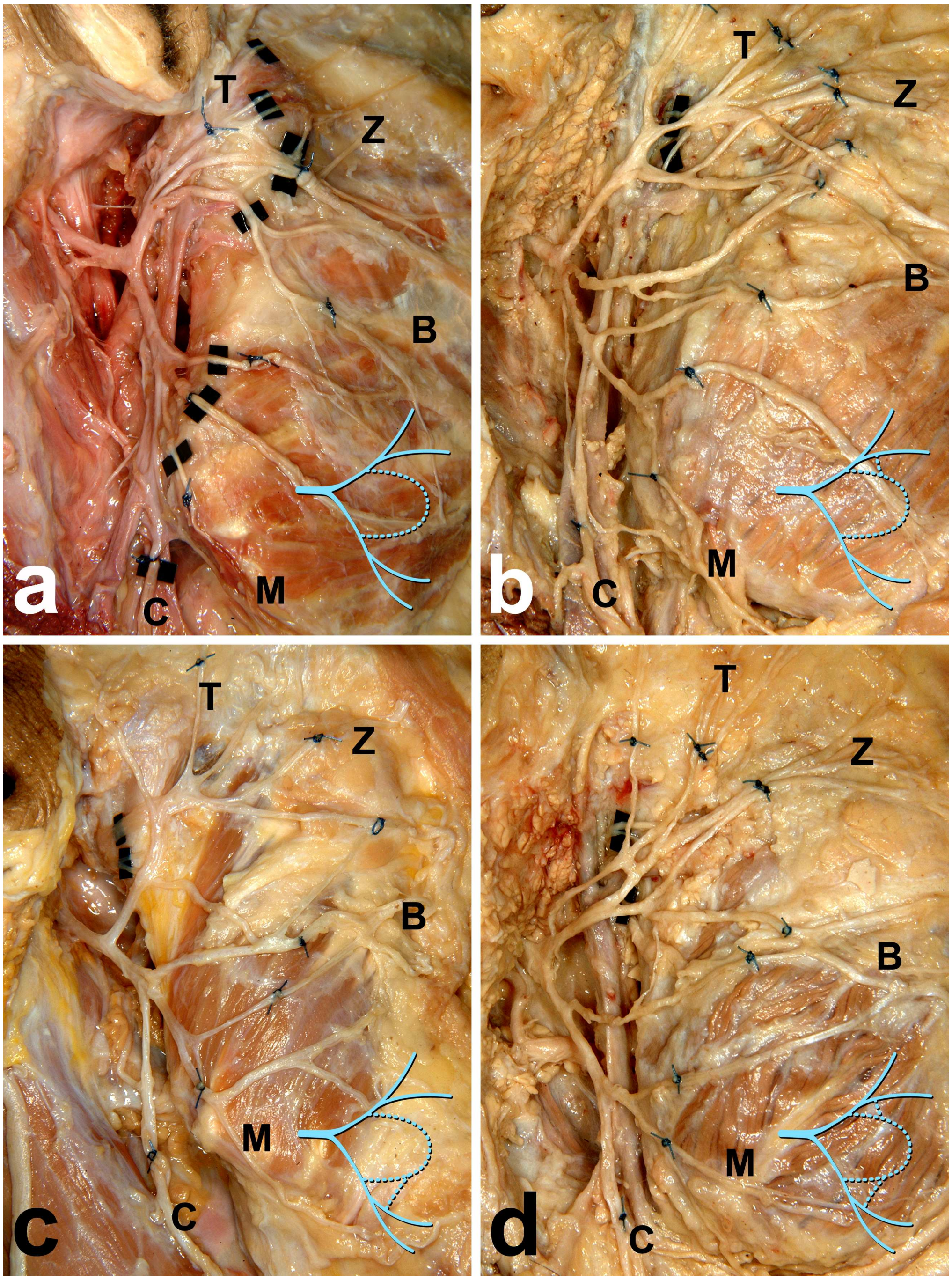

Fig. 5. Photographs and diagrams showing the branching patterns of the facial nerve according to the origin of the buccal branch. Type I, which is a buccal branch

originating from the upper and lower divisions, was observed in 17.5% (a), type II, which is a buccal branch originating from the two main divisions and zygomatic branch, was identified in 45% (b), type III, which is a buccal branch originating from the two main divisions and marginal mandibular branch, was in 12.5% (c), and type IV, which is a buccal branch originating from the two main divisions, zygomatic and mandibular branches, was identified in 25% of cases (d). The white or black arrowheads indicate the origins of the buccal branch. B, buccal branch; C, cervical branch; M, marginal mandibular branch; T, temporal branch; Z, zygomatic branch.

3. Communicating nerve twigs between the facial and auriculotemporal nerves

The communications between the facial and auriculotemporal nerves, known as the ‘communicating auriculotemporal nerves’ (CATNs), were identified in 37 out of 40 cases (92.5%). The CATNs communicated with the branches of the facial nerve within the parotid gland. The CATNs branched off from the auriculotemporal nerve near its root and passed laterally to join the facial nerve posteriorly at the upper division within the parotid gland (Fig. 5). The number of branches from the CATNs ranged from 2 to 4, and the most common pattern was the three-branched CATNs pattern (46.7%). A single branched CATNs pattern was not observed in this study.

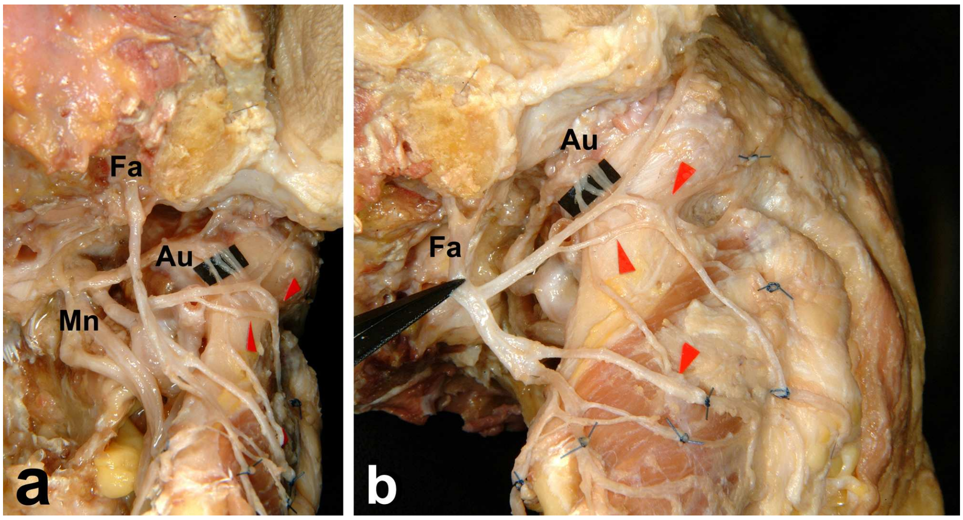

Fig. 6. Photographs showing the communicating auriculotemporal nerve branches (arrowheads) connecting the auriculotemporal nerve with the facial nerve. posterior view (a) and dorsolateral view (b). Au, auriculotemporal nerve; Fa, facial nerve trunk; Mn, mandibular nerve.

4. Histological observations of the facial nerve branches

At the border of the parotid gland, the facial nerve specimens were found to have an average of 11 branches (ranging from 8 to 16) (Table 2). The branches were distributed among the five distinct branches, the buccal branch had the greatest number of branches (3.47), however the zygomatic branch had the largest diameters (0.93 mm). The buccal branch usually consisted of one or two larger fascicles and one or two much smaller fascicles, although there was some variation in fascicular arrangement. The distribution of fiber size was uneven.

As can be seen in Figure 7 and Table 3, the number of fascicles varied from one to 9 over the course of the nerve, the trunk had the greatest number of fascicles (4.36), and a trend was observed toward decrease distally.

Table 2. Histomorphometric observations of the facial nerve branches at the border of the parotid gland.

Facial nerve branches	Average number of branches (range)		Average diameter (mm)	
	present study	Lineaweaver[19] (1997)	present study	Lineaweaver[19] (1997)
Temporal	2.7 (1~4)	2 (1~3)	0.8	0.9
Zygomatic	2.0 (1~4)	3 (1~4)	0.9	0.8
Buccal	3.5 (2~5)	4 (3~7)	0.8	1.4
Mandibular	1.6 (1~3)	2 (1~3)	0.8	0.9
Cervical	1.3 (1~3)	1 (0~4)	0.9	1.0
total	11 (8~16)	12 (9~19)		

Table 3. Fascicular structure and characteristics of the facial nerve.

Facial nerve branches	Fascicular number (range)	Average fascicular diameter (mm)	Average fascicular area (mm^2)	Total fascicular area (mm^2)
Trunk	4.4 (2~8)	0.8	0.5	2.7 ± 0.08
Upper division	3.7 (1~9)	0.9	0.6	1.9 ± 0.07
Lower division	3.6 (1~8)	0.8	0.6	1.0 ± 0.07
Temporal	2.9 (1~6)	0.8	0.4	1.1 ± 0.08
Zygomatic	2.9 (1~7)	0.9	0.4	1.3 ± 0.06
Buccal	2.6 (1~5)	0.8	0.2	1.1 ± 0.09
Mandibular	2.4 (1~6)	0.8	0.2	0.9 ± 0.06
Cervical	3.0 (1~6)	0.9	0.5	1.0 ± 0.08

Average ± standard deviation

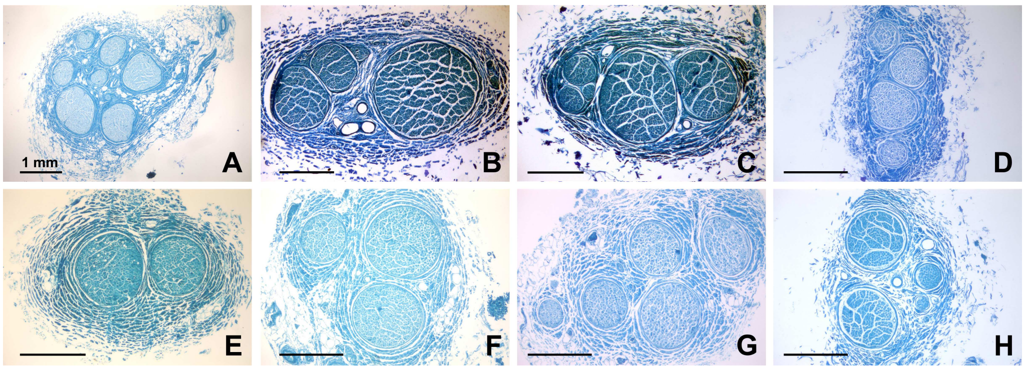

Fig. 7. Photographs showing the histological cross-sections of the facial nerve (Luxol fast blue stain). A, facial nerve trunk; B, upper division; C, lower division; D, temporal branch; E, zygomatic branch; F, buccal branch; G, marginal mandibular branch; and H, cervical branch.

IV. DISCUSSION

Successful surgery involving the parotid gland with a tumor lesion requires the identification and preservation of the facial nerve along with the complete removal of the tumor and the surrounding anatomical tissue[6,14,15]. This study presented the various divisions and anastomotic patterns of the facial nerve branches that a surgeon would encounter when removing tumors of the parotid and retromandibular region.

While there are many articles that have carefully described the segment of the facial nerve trunk between its emergence from the stylomastoid foramen and its furcation point at the parotid area[6,16], the minor trunk of the facial nerve has rarely been reported. Katz and Catalano[8] reported three cases (3%), where they observed two main trunks, known as the major and minor trunks, with the minor trunk joining the larger temporofacial division, which was the origin of the main buccal branch.

In this study, the minor trunk of the facial nerve was noted in 11 out of 40 cases (27.5%), and in all cases, the minor trunk entered the lower division of the facial nerve, where the cervical branch originated. According to Botman and Jongkees[17], the facial nerve within the mastoid segment of the temporal bone can split into two or three branches, and each branch exits through a separate osseous foramen. This may explain the origin of the minor trunk. Therefore, surgeons must always be careful, even after identifying the main facial nerve trunk, because a minor trunk may be also present.

Baker and Conley[16] reported the possibilities of trifurcation, quadrifurcation or even a plexiform branching pattern of the facial nerve trunk. Salame et al.[6]

identified one case of trifurcation out of 46 cases, and Park and Lee[12] reported its prevalence to be 4.4% in Koreans. This study identified five cases (12.5%) of trifurcation of the facial nerve trunk inside the parotid gland, but did not encounter any case of quadrifurcation or a plexiform branching pattern of the facial nerve trunk. In the trifurcation cases, the middle division originated from somewhere between the upper and lower divisions, and made various patterned anastomoses with the other two main divisions.

The intraparotid and extraparotid course of the facial nerve has been studied extensively with cadaveric dissections[4,7,12,18,19]. However, the fixed points, according to anatomic landmarks, are not always the same during surgery with parotid tumors that deviate, obscure, and even involve the main divisions or the main trunk[8].

Davis et al.[18] dissected 350 cadaveric half-heads with mostly intraparotid facial nerve findings, and Bernstein and Nielson[7] dissected 35 half-heads with extraparotid nerve dissections. They classified the branching patterns of the facial nerve into six main types. However, each author had a different percentage of dissections in each type. Davis et al.[18] having dissected the anterior border of the masseter muscles the peripheral extent of their dissection, did not observe a branching pattern of the buccal and zygomatic branches distributed anterior to 2 cm from the anterior margin of the parotid gland. They reported that the buccal branch originated only from the temporofacial division with a prevalence of 20%. In this study, the dissection was extended peripherally, and various interconnections between the facial nerve branches were encountered before they innervate the facial expression muscles. In every case, the buccal branch of the facial nerve originated from both the temporofacial and cervicofacial divisions, and not solely from one division.

The branching patterns of the facial nerve in this study also varied. According to the origin of the buccal branch, the facial nerve branching pattern could be classified into the four types of configurations. In this study, type II and IV presented anastomoses between the buccal and zygomatic branches with a prevalence of 70%. Anastomoses among the buccal, temporal, and marginal mandibular branches were observed in the type III and IV, which involved 37.5% of cases. In the report of Gosain[20], these two patterns of the anastomoses were observed in 70% and 15% of cases, respectively. Accordingly, the present results indicate that the anastomoses between the buccal and marginal mandibular branches occur more frequently in Koreans compared with Caucasian. In addition, Wang et al.[11] reported a 60% prevalence of these anastomoses in Chinese, and Niccoli and Varandas[10] reported a 9% prevalence in Spanish cases.

Communications between the facial and auriculotemporal nerves (CATNs) appear to be common findings (92.5%). Since the CATNs are situated within the parotid gland deep in the branches of the facial nerve, it is difficult to locate them during normal dissection. The present study shows that the CATNs are branches of the auriculotemporal nerve, which join the upper division of the facial nerve posteriorly at the posterior border of the masseter muscle. This study observed that all the CATNs were united with the branches of the temporofacial division of the facial nerve. In the current study, the number of CATNs ranged from 2 to 4, and 3 rami as predominant (46.7%). In contrast, Namking et al.[13] reported a range of 1 to 3, and Woodburne and Burkel[21] suggested 2 rami as a rule. The function of these communications has never been definitely established, but it is reasonable to assume that they have some purpose or potential function shared by both nerves. Martin and Helsper[22] reported that the communications between the branches of the trigeminal and facial nerves included, or were closely associated with the motor end plates. Consequently, they suggested that following a complete and permanent interruption of the motor pathway through the facial nerve, voluntary motor impulses by re-education may find their way from the cortex through the trigeminal nerve to the respective muscles. It is believed that proprioception is conveyed via the same cutaneous nerves, which innervate the skin over the muscles of the facial expression and from multiple communications with the branches of the facial nerve[9]. After reviewing previous reports and our results, it is possible that the CATNs convey the proprioceptive impulses from the facial expression muscles to the trigeminal nuclei of the brainstem.

There are many different suitable potential donor nerves such as the hypoglossal[23], accessory[24], and masseteric[25] nerves for cross-face nerve grafting and sural[26], great auricular[27], and large cutaneous[28] nerves for autogenous free nerve grafting. Micro-anatomical similarity between the recipient and donor nerve is thought to be important in nerve repair and this study was carried out to suggest the basis for the finding the most suitable donor nerve for a facial nerve graft[29]. The selection of a donor site for interpositional nerve grafting is determined by multiple factors, including correlation of the size between the recipient nerve and the donor, compatibility of neural functions (sensory, motor, or mixed), relative ease of graft procurement, and the degree of associated donor site morbidity[30]. Severe mismatching of the fascicular number and arrangement between the graft and recipient nerve can result in inadequate axonal regeneration[29,30].

Quantitative studies on nerve fibers in the human facial nerve revealed a wide divergence among the total numbers given by different researchers[30-32]. Fujii and Goto[31] suggested that the aging process of the facial nerve produced no decrease connected with particular sizes of nerve fibers. It seems reasonable to conclude that the number of facial nerve fibers decreases slightly with age, but there is no evidence that the axonal area or the circularity ratio of the axon decreases with age. With regard to the quantitative studies[33], no correlation with age was identified in the assessment of nerve fiber regeneration in the present study, although, in experimental studies[34,35], nerve fiber regeneration was found to be less efficient in older animals.

Interfascicular repair requires that the surgeon be intimately familiar with the fascicular anatomy of the facial nerve. Full description of the facial nerve including its anatomic course and histological analysis confirms the utility of many nerves as a donor nerve for the facial nerve grafting. And careful attention to the anatomic and histological survey presented will allow safe identification and preservation of this important structure.

V. CONCLUSION

The following conclusions were obtained from a careful and precise dissection and the histological observation of 40 adult cadaver half heads:

1. The mean minimal distance between the skin surface and the facial trunk at the stylomastoid foramen was 21 mm, and the mean distance between the emerging point of the facial nerve trunk from the stylomastoid foramen and its furcation point was 13 mm.

2. Two main initial trunks of the facial nerve, a major and a minor, were observed in 27.5% of cases.

3. In 35 out of 40 dissections (87.5%), the facial nerve trunk was bifurcated into two main divisions, and the nerve trunk was divided into a trifurcation pattern in the other five cases (12.5%).

4. According to the origin of the buccal branch, the branching patterns of the facial nerve could be calcified into six categories. In the type II cases, which is most common anatomic pattern and was noted in 18 cases (45%), the buccal branch arose from the two main divisions, and was interconnected with zygomatic branch.

5. The communications between the facial and auriculotemporal nerves was noted in 37 out of 40 cases (92.5%).

6. The buccal branch had the greatest number of branches (3.47), and however the zygomatic branch had the largest diameters (0.93 mm).

Knowledge of the aforementioned variations in the facial anatomy and the histological analysis should help to protect the facial nerve from surgical injury and confirm the utility of many nerves as a donor nerve for the facial nerve grafting.

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국문요약

자가신경이식술을 위한 얼굴신경의 해부학적 연구

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일곱째뇌신경인 얼굴신경 (facial n.)은 붓꼭지구멍 (stylomastoid foramen)을 통하여 머리속공간을 빠져나온 후 바로 뒤귓바퀴신경 (posterior auricular n.)을 내어 뒤귓바퀴근과 머리덮개근의 뒤통수힘살에 분포하고, 줄기는 계속되어 귀밑샘 (parotid gland)속에서 아래 앞쪽으로 달리며 바깥목동맥과 아래턱뒤정맥의 바깥쪽을 가로지른다. 턱뼈목의 모서리 뒤에서 두 개의 주된 가지인 관자얼굴가지 (temporofacial branch)와 목얼굴가지 (cervicofacial branch)로 나뉘며, 귀밑샘 속에서 복잡한 귀밑샘신경얼기를 이룬다. 이 부위는 머리뼈 바닥에 도달하기 위해 귀밑샘 속으로 꼭지돌기에 접근하는 시술에 있어서 얼굴신경을 손상시킬 위험이 크므로 임상적으로 중요한 부위이다. 또한 귀밑샘 속에서 복잡한 양상을 취하는 얼굴신경가지들 또한 귀밑샘절제술 시에 손상되기 쉽다. 얼굴신경의 손상은 기능적인 장애뿐 아니라 심미적, 정신적으로도 심한 문제를 야기하기 때문에 얼굴신경의 결손치료를 위한 다양한 자가신경의 이식술 (autonerve graft)이 시행되고 있다. 자가신경이식의 성공을 위해서는 신경의 절단면적, 신경다발의 개수 등 얼굴신경의 미세해부학적 구조에 대하여 명확히 알고 있어야 한다. 그러나 한국인의 얼굴신경에 대한 미세해부학적 연구가 없다. 따라서 이 연구의 목적은 한국인 얼굴신경줄기 및 가지들이 나뉘는 양상을 밝히고, 각 부위에 대한 얼굴신경가지들의 미세해부학적 구조를 확인하는데 있다.

한국인 시신이 머리 40쪽을 대상으로 미세해부와 얼굴신경의 조직염색을 시행하였다. 얼굴신경을 노출시키고, 피부에서 붓꼭지구멍까지의 깊이 (21.0 ± 3.1 mm), 붓꼭지구멍부터 얼굴신경줄기가 위가지인 관자얼굴가지와 아래가지인 목얼굴가지로 나뉘는 곳까지의 거리 (13.0 ± 2.8 mm)를 계측하였다. 대부분의 얼굴신경줄기는 두 개의 가지로 나뉘고 있었으며, 세 개의 가지로 나뉘는 경우도 있었다 (13.3%). 볼가지 (buccal branch)가 일어나는 양상에 따라 얼굴신경이 나뉘는 양상을 1) 볼가지가 위가지와 아래가지에서 함께 일어나는 경우 (type I, 13.8%), 2) 볼가지가 두 개의 주된 위 및 아래가지와 광대가지 (zygomatic branch)에서 일어나는 경우 (type II, 44.8%), 3) 볼가지가 두 개의 주된 가지 및 턱모서리가지 (marginal mandibular branch)에서 일어나는 경우 (type III, 17.3%), 4) 볼가지가 두 개의 주된 가지와 광대가지 및 턱모서리가지에서 일어나는 경우 (type IV, 24.1%)의 네 유형으로 분류할 수 있었다. 대부분에서 귓바퀴관자신경과 얼굴신경의 연결 관계가 관찰되었으며 (93.3%), 얼굴신경과 연결되는 귓바퀴관자신경가지의 수는 두 개 (37%), 세 개 (44%), 네 개 (11%) 등으로 다양하였다. 얼굴신경가지의 개수는 볼가지가 평균 3.47개로 가장 많았으며, 관자가지 2.67개, 광대가지 2.03개, 턱모서리가지 1.57개, 목가지 1.27개였다. 얼굴신경가지의 평균직경은 광대가지가 0.9 mm로 가장 두꺼웠으며, 관자가지가 0.8 mm로 가장 얇았다. 얼굴신경줄기, 관자얼굴가지, 목얼굴가지의 신경다발 수, 신경다발의 평균직경, 평균단면적, 총단면적을 계측하였으며, 관자가지, 광대가지, 볼가지, 턱모서리가지, 목가지가 귀밑샘을 빠져나오는 부위에서도 동일한 항목을 계측하였다. 이상의 결과는 얼굴신경의 결손 치료를 위한 자가신경이식을 위한 기초자료로 활용할 수 있을 것이다.

핵심되는 말: 얼굴신경, 신경이식, 귀밑샘, 수술해부학, 신경다발