The Branching Patterns and Intraosseous Course of the Mental Nerve

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언제나 아낌없는 조언과 주제에 대한 세심한 지도를 해주신 김희진 교수님께 먼저 깊은 감사를 드립니다. 그리고 논문이 완성되기까지 많은 조언과 격려를 해 주신 이승일 교수님, 한동후 교수님, 차인호 교수님, 고기석 교수님께도 진심으로 감사를 드립니다. 아울러 본 연구를 위하여 논문을 작성하는 동안 바쁜 중에도 도움을 준 허경석 교수와 연세대학교 구강생물학 교실원 모두에게도 깊은 고마움을 전합니다.

하나님에 대한 믿음을 주신 어머님과 아버님께 열매의 결실을 드릴 수 있어 기쁩니다. 철없는 아들을 아낌없이 사랑해 주시고 항상 저에게 도움이 되어 주신 어머님과 아버님께 죄송함과 고마움을 전하며 항상 모든 것에서 아낌없는 도움을 주시는 장인어른과 장모님께 감사를 드립니다.

또한 동생을 위해 항상 배려해주신 형과 형수님 그리고 누나와 매형에게도 깊은 감사를 드리며 저를 위해 기도해 주신 양문교회 이영신 목사님과 사모님 그리고 교인 여러분께 감사를 드립니다.

나의 인생의 동반자이자 꼭 없어서는 안 될 소중한 아내에게 사랑한다는 말을 전하며 우리 사랑하는 공주 윤채환과 아내 강신영에게 이 논문을 바칩니다.

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The mental nerve (MN) is the terminal branch of the inferior alveolar nerve. This nerve emerges to the lower face through the mental foramen, and supplies mouth corner, lower lip, and mental area. This nerve is vulnerable to injury during lower face surgery, dental implant, periapical abscess, and orthodontic treatment. Severe pain and/or loss of sense are noted in patients whose the MN is either entirely or partially damaged after these surgeries. For preventing these complications, it is developed surgical procedure, but there are few researches concerning topographic anatomy of the MN. For clarifying the branching pattern and intraosseous course of the MN branches, we investigated topography of the mental nerve by dissection of 31 hemifaces of Korean cadavers (male: 19, female: 12, average age: 69.9 years).

According to distribution area, the MN was divided into angular (A), medial inferior labial (ILm), lateral inferior labial (ILl), and mental branch (M). As the branching patterns of the four branches of the mental nerve, we classified five types. Type II, in which the MN was divided into three branches (A, ILm and M), then the ILl was separated from the A branch, was the most common case (35.4%). The MN was classified into loop, straight, and vertical patterns by the shape of the anterior

loop. In 61.5% of the cases, the MN showed the loop pattern. The straight and vertical patterns which do not form loop, were 23.1% and 15.4%, respectively. The average distance of the anterior loop in loop type was 1.74mm (0.73mm-2.63mm). In the mandibular canal, inferior alveolar nerve completely divided into mental nerve and dental nerve which supply teeth. In most cases (81%, 17 cases), the nerve bundles composing the A branch located at the superior aspect, whereas the nerve bundles of the IL and M branch were at the middle and inferior aspect within the mandibular canal, respectively at the mental foramen region.

These results can help clinicians predict the location or extent of paresthesia in the facial region according to the location and extent of nerve damage during dental implant installation or genioplasty.

Key words : mental nerve, inferior alveolar nerve, anterior loop

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Ⅰ. INTRODUCTION

The mental nerve (MN), which is entirely sensory, is the terminal branch of the mandibular nerve, the third division of the trigeminal nerve. This nerve exits the mandible through the mental foramen, it divides into three branches deep to the depressor anguli oris muscle, and supplies the skin and mucous membrane of the lower lip, the skin of the chin, and the vestibular gingiva of the mandibular incisor (Woodburne 1994, Standring et al. 2005, Moore 2006).

The MN is vulnerable to the surgical procedures of the chin area such as genioplasty and mandibular anterior segmented osteotomy (Jääskeläinen et al. 1996, Westermark et al. 1998, Seo et al. 2005). Likewise, the MN can be injured during some dental procedures as dental implant surgery, orthodontic treatment, and endodontic treatment (Gilbert and Dickerson 1981, Krogstad and Omland 1997, Babbush 1998, Hilu and Zmener, 1999, Di Lenarda et al. 2000, Morrison et al. 2002, Willy et al. 2004, Zmener 2004). Also, mental neuropathy may be caused by systemic diseases and neoplasms (Seeler and Royal 1982, Bodner et al. 1987, Klokkevold 1989, Chand et al. 1997, Maillefert et al. 1997). Severe pain and/or sensation disturbance are

noted in case the MN were entirely or partially damaged after such procedure. Especially, when performing the insertion of dental implant fixtures, inappropriate insertion depth or path regardless of the anatomic consideration may cause damage of the inferior alveolar nerve and MN. An incidence of seven to ten percentages, with permanent sensory disturbance in the lower lip after dental implant insertion in the mental foramen area, has been reported (Wismeijer et al. 1997, Mardinger et al. 2000). These complications such as loss of lip and chin sensation may result in lip biting, impaired speech, and diminished salivary retention. These deficits have a significant impact on a patient's activities of daily living (Mucci and Dellon 1997, Deeb et al. 2000).

Many efforts have been given to preserve the MN during dental implant surgery using the nerve repositioning technique of the inferior alveolar nerve, or ridge augmentation (Smiler 1993, Ousterhout 1996, Shibahara 1996, Babbush 1998, Nocini et al. 1999, Morrison et al. 2002). For the preservation of cutaneous sensation, the knowledge of the precise topography and distribution area of the MN is important. However, there have been only few publications concerning the topographic anatomy of the MN.

The purpose of this study was to clarify the branching pattern and intraosseous course of the MN branches, and to determine the clinical relevence of the varied courses of the MN branches with reference to the surrounding anatomical structures.

Ⅱ. MATERIALS & METHODS

1. Materials

Observations were made on the mental nerve from 31 hemifaces (male:19, female:12) of embalmed Korean cadavers, mean age 69.9 (32 to 92 age). To study the precise course of the MN, and the extent to which it innervates, the cadavers that had no history of trauma or any surgical procedures on the chin area of the face were used.

2. Methods

A. The branching pattern of the mental nerve

After removing the skin overlying the lower face, the orbicularis oris, depressor anguli oris and depressor labii inferioris muscles were snipped off to reveal the mental foramen and the MN and mental vessels which travel though it. The MN branches were dissected carefully and distinguished into the angular (A, mouth corner region), medial inferior labial (ILm, medial half of the lower lip), lateral inferior labial (ILl, lateral half of the lower lip), and mental branch (M, mental region) according to distribution area. These nerve branches were classified into five types based on their branching patterns (Fig. 1).

Type I : The MN was divided into A, IL (inferior labial), and M branches, then the IL branch was divided into the ILm and ILl branches.

Type II : The MN was divided into three branches, A, ILm, and M branch, then the ILl branches were separated from A branch.

Type III : The MN was divided into three branches, A, ILm, and M branch, then ILl branch was separated from A branch.

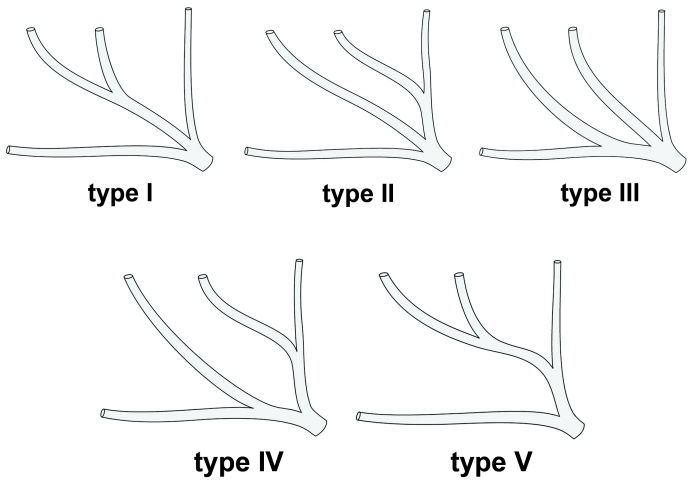

Fig. 1. The branching patterns of the mental branch (A: angular, ILm: medial inferior labial, ILl: lateral inferior labial, M: mental branch).

Type IV : The MN was divided into two branches, A and M branch, then ILm and ILl branches were separated from A and M branch, respectively.

Type V : The MN was divided into two branches, A, and M branch, then IL branch was separated from A branch and then divides into ILm and ILl branch.

B. The intraosseous course of the mental nerve

After confirming the branching pattern of the MN, a part of the buccal cortical plate of the mandible was removed from the incisor to the retromolar region in order to expose the inferior alveolar nerve within the mandibular canal. After revealing the entire structure of the mandibular and mental canal, the morphology of the transitional part of the inferior alveolar nerve between the mandibular canal and the mental foramen was classified into loop, straight, and vertical patterns according to their exit morphology (Fig. 2). In the cases showing loop pattern, the shortest distance between

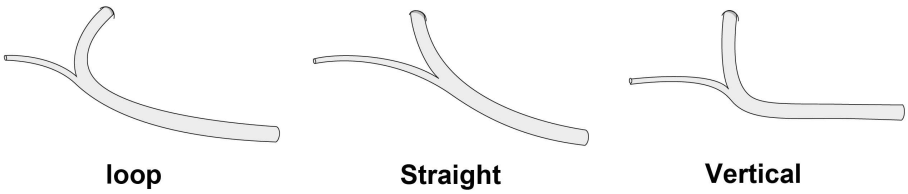

Fig. 2. The pattern of the anterior loop of the mental canal.

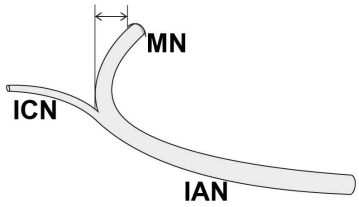

Fig. 3. Measurement of the shortest distance between the anterior margin of the mental foramen to the anterior limit of the anterior loop (MN: mental nerve, ICN: incisive nerve, IAN: inferior alveolar nerve).

the anterior margin of the mental foramen to the anterior limit of the anterior loop was measured with digital calipers (Model #CD-15CP, Mitutoyo Co. Japan) (Fig. 3).

In order to remove the connective tissue of the nerve specimen, the whole specimens were immersed within 2M Guadinine-HCl solution for 2 weeks, leaving the inferior alveolar nerve and MN exposed. All microdissections were performed under the surgical microscope (OPICO, Zeiss Co., Germany). Through the removal of the epineurium and perineurium of the inferior alveolar nerve, the positional and running aspect of the nerve bundles within the mandibular and mental canal were confirmed based on the branching patterns of the mental nerve.

C. Peparations of the histological sections

To obtain histological sections, coronal sectioned mandible specimens including the outer cortical, inner trabecular bone and mandibular canal at the mental foramen region were harvested. Each specimen was postfixed for 72h with 4% paraformaldehyde and then decalcified in 1l decalcification solution for 3 weeks. The decalcification solution was composed of 8N Formic Acid (HCOOH) (SHOWA Co., Japan) and 1N Sodium Formate (HCOONa) (JUNSEI Co., Japan), which was then diluted with 1*l* of distilled water. After decalcification, the specimens were neutralized for 2~3 days in a neutralization solution prepared from 5g sodium sulfate in 100ml distilled water.

After the decalcification of the specimens, they were embedded in paraffin wax. Cross 5㎛-thick sections were cut along the mandibular canal and mental foramen. Each section was mounted on glass slides, and then stained with hematoxylin-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). No distinction was made between the male and female cadavers. All photographs and diagrams in this article are of structures viewed from the left side of the specimen.

Ⅲ. RESULTS

A. The branching pattern of the mental nerve

When the MN exited from the mental foramen, it divided into nerve branches capable of being classified into four branches (Figs. 1, 4). From the 31 dissections, the branching patterns of the MN were observed and categorized into five types according to its distribution area and number of the nerve branches.

The MN came out through the mental foramen as three main nerve branches in type I, II, and III (61.2%, 19 cases) and two main nerve branches in type IV and V (38.8%, 12 cases). In the cases of three main nerve branches, type I, in which the MN was divided into A, IL, and M branches, then the IL was divided into the ILm and ILl branches, was observed in 22.6% (7 cases of the specimen). And type II, in which the MN was divided into three branches (A, ILm and M branch), then the ILl branch were separated from the A branch, was found in 35.4% (11 cases of the specimen). This pattern was the most observed in this study. Likewise, type III, in which the MN was divided into three branches (A, ILm, and M branch), then ILl branch was separated from the A branch, was observed in 3.2% (1 case of the specimen) (Fig. 4).

When the MN divided into two main nerve branches, it could be categorized into two types. In these cases, the MN was divided into A and M main branches and then the ILm and ILl branches were separated from A and M branch, respectively in type IV, and the IL branch was separated from A branch and then divides into ILm and ILl branches in type V. Each type was observed in 19.4% (6 cases of the specimen) (Fig. 4).

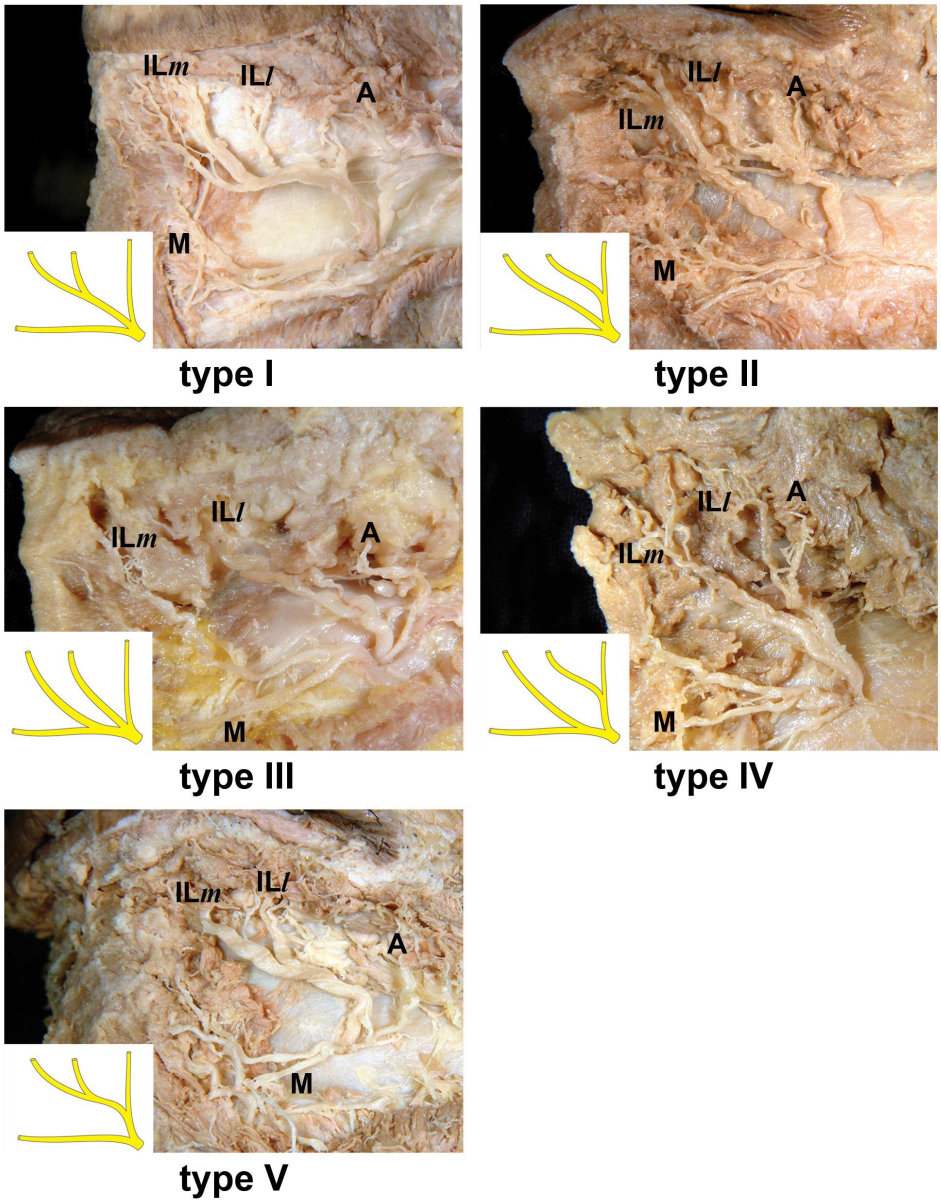

Fig. 4. The branching patterns of the mental nerve according to its distribution area and number of the nerve branches (A: angular, ILm: medial inferior labial, ILl: lateral inferior labial, M: mental branch).

B. The anterior loop of the mental nerve

The transition between the inferior alveolar nerve and MN was classified into three patterns according to the exit morphology of mental canal after the inferior alveolar nerve was divided into the incisive nerve and the MN. Loop pattern forming the anterior loop was found in 61.5% (16 cases). Whereas, straight pattern in which the mental canal showed a slight curve and opened directly through the mental foramen was observed in 23.1% (6 cases). Vertical patterns, in which the mental canal bended perpendicularly to the mental foramen was observed in 15.4% (4 cases) (Fig. 5). In the cases of the loop patterns, the average distance between each the anterior margin of the mental foramen and the anterior loop was 1.74mm (0.73~2.63mm) (Fig. 3).

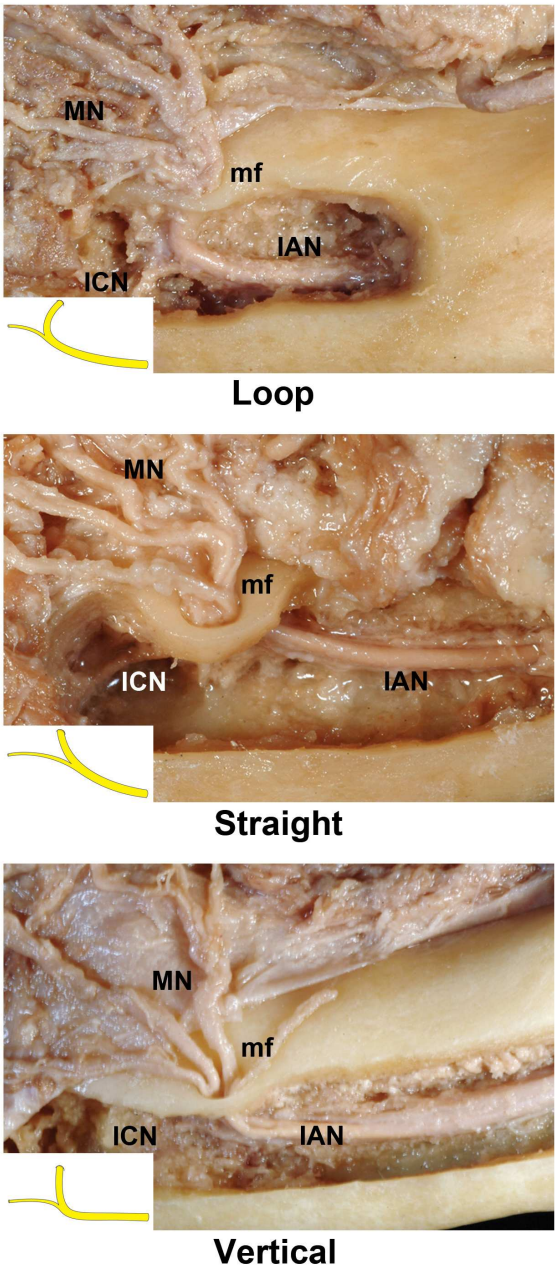

Fig. 5. The transition between the inferior alveolar nerve and mental nerve.

C. The intraosseous course of the mental nerve

In every case of the specimens, the inferior alveolar nerve within the mandibular canal completely divided into the mental nerve supplying the lower lip and mental region, and the dental nerve innervating the mandible, mandibular teeth and its periodontium (Fig. 6). It was found that the incisive nerve located lingually and inferiorly to the MN. Even the incisive nerve was smaller than the MN, it was totally separated by the surrounding epineurium from the mental nerve (Fig. 7).

In addition, the nerve bundles comprising the nerve fascicles for every MN branches were well arranged in the same manners. Through the microdissections of the nerve bundle composing the MN within the mandibular and mental canal, the topography of the nerve bundles was confirmed on the basis of the positional and running aspects of the nerve bundles within the bony canal. In most cases (81%, 17 cases), the nerve bundles composing the A branch located at the superior aspect, whereas the nerve bundles of the IL and M branch were at the middle and inferior aspect within the mandibular canal, respectively (Figs. 7, 8a). The nerve bundles of the IL branch were separated into the independent ILl and ILm bundles, the nerve bundle of the ILm branch located lingually to the ILl nerve bundles within the mandibular canal (81%, 17 cases) (Fig. 8a). On the other hand, the ILl nerve bundles situated lingually to the ILm nerve bundles were found in 4 cases of the specimens (19%) (Fig. 8b).

The nerve bundles composing the MN branches were arranged in the same positional order until they came out through the mental foramen. When the MN exited through the mental foramen, the nerve bundles of the ILm branch located in the deeper layer, and the rest of three branches were located in the superficial layer. The three superficial nerve branches of the MN were arranged with the M, ILl, and A branch from the anterior to the posterior aspect (Fig. 8a).

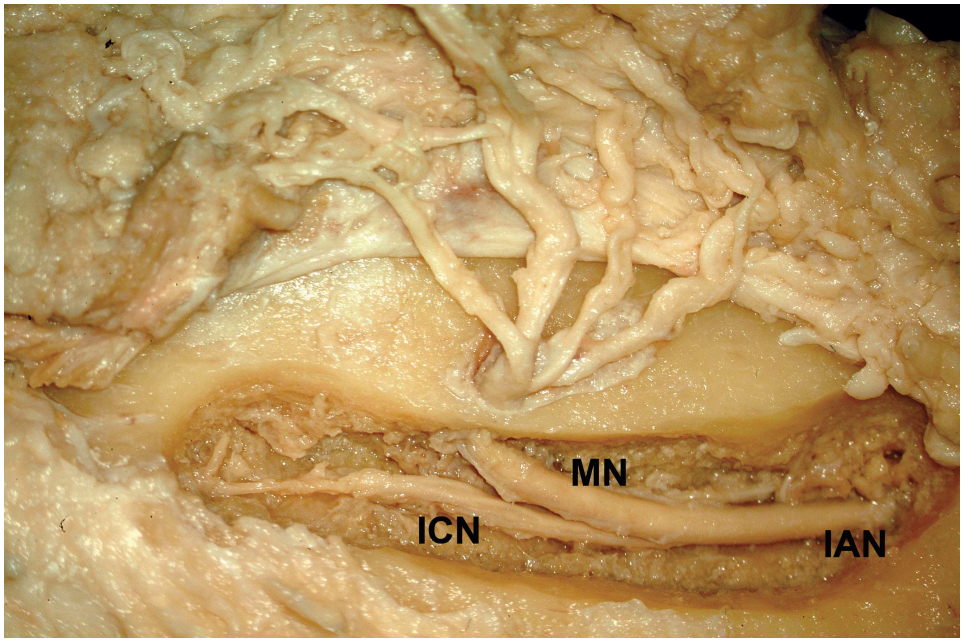

Fig. 6. A photograph showing the exposed inferior alveolar nerve (IAN), mental nerve (MN), and incisive nerve (ICN) at the mental foramen region. It is shown that the ICN located lingually and inferiorly to the MN.

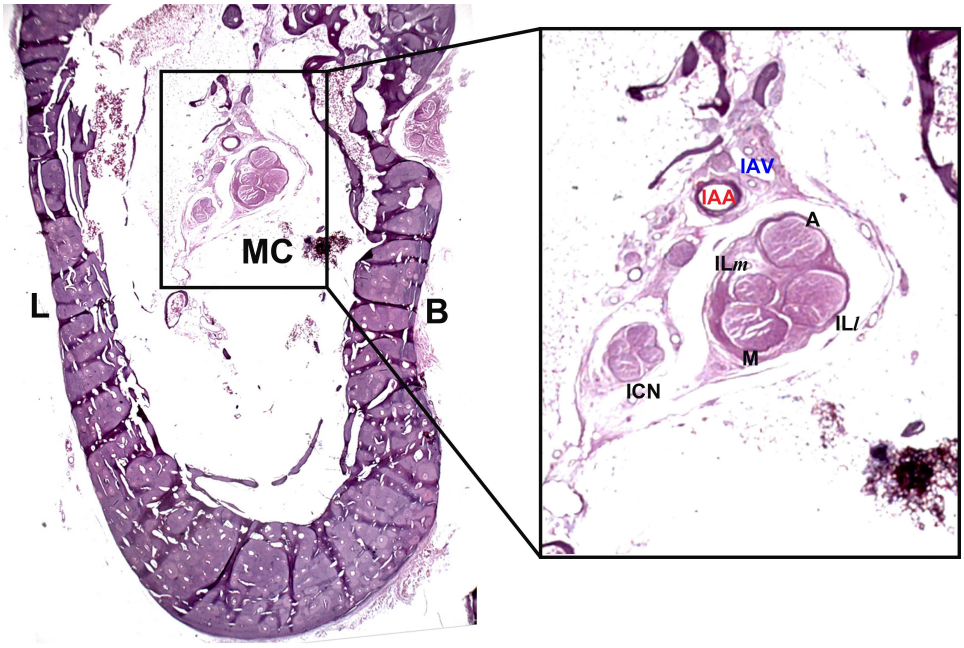

Fig. 7. Light micrographs of cross section of the mandible showing the nerve bundles composing the mental nerve (MN) and incisive nerve (ICN). The ICN is totally separated from the surrounding epineurium of the MN. The nerve bundles composing the angular (A) branch located at the superior aspect, whereas the nerve bundles of the inferior labial (IL) and mental (M) branch were at the middle and inferior aspect within the mandibular canal, respectively. The nerve bundles of the IL branch were separated into independent lateral inferior labial (ILl) and medial inferior labial (ILm) bundles, and the nerve bundle of the ILm branch located lingually to the ILl nerve bundles within the mandibular canal (MC). B: buccal aspect, L: lingual aspect, IAA: inferior alveolar artery, IAV: inferior alveolar vein.

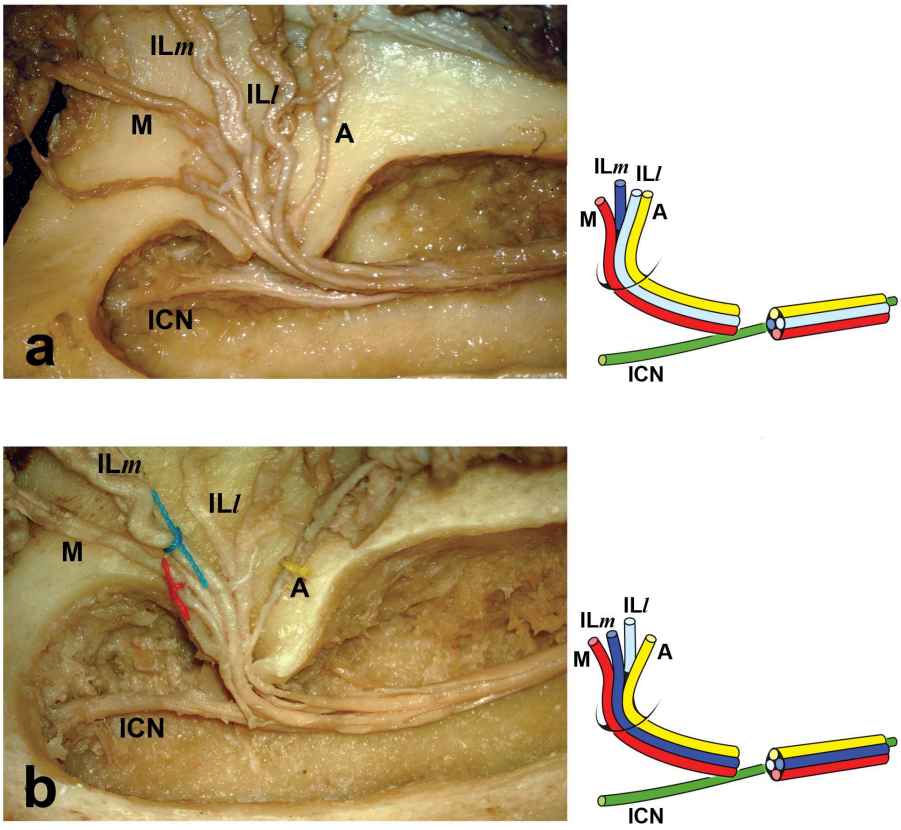

Fig. 8. Photographs and schematic drawings showing the arrangement of the nerve bundles composing the mental nerve branches (A: angular branch, ILm: medial inferior labial branch, ILl: lateral inferior labial branch, M: mental branch, ICN: incisive nerve).

Ⅳ. DISCUSSION

In this study, the branching patterns of the MN were classified on the basis of four terminal branches (M, ILm, ILl, and A branch) and their distribution area. Alsaad et al. (2003) categorized the MN as the vertical, oblique, and horizontal branch, and they classified them into three types of branching pattern. Compared with their study, the vertical branch is designated as A branch, the oblique branch as IL branch, and the horizontal branch as M branch in the present study, respectively. Also, according to the classification of the MN by Alsaad et al (2003), the first and third types of the MN were based on the nerve divisions into two branches (vertical and horizontal), and the second types were based on the three nerve branch divisions (vertical, oblique, and horizontal branch). First and third type were found in 44.4%, and the second was in 55.6% of the cases.

In the classification of the present study, type I, II, and III of the MN were classified based on the nerve division as three branches (61.2%), and type IV and V as two branches (38.8%). Even though more cases showed that the MN divided into three nerve branches in both studies, there is a discrepancy in the aspect of the frequency of occurrence because of the insufficient number of the materials. Alantar et al. (2000) reported that the IL branches were found to run on the orbicularis oris muscle fibers in an oblique direction, and that the nerve divided into two IL branches. In the same way as the present study, it was described that the IL branch divided into two separate branches (ILm and ILl branch). Therefore, it was thought that four nerve branches (A, ILm, ILl, and M branch) were more pertinent in classifying the mental nerve branching instead of three nerve branches (A, IL, M branch).

There have been many studies on the intraosseous course of the inferior alveolar nerve (Olivier 1928, Carter and Keen 1971, Gowgiel 1992, Wadu et al. 1997, De Andrade at al. 2001, Hwang et al. 2005). However, most of the studies only focused

on the relationship between the incisive nerve and the MN or the location of the MN within the mandibular canal. The studies on the relative location of the each branch of the mental nerve inside the mandibular canal are rare.

The relative location of each nerve bundle of the MN branches is important in order to estimate the region and extent of the loss of sensation when the inferior alveolar nerve is partially damaged within the mandibular canal. In most cases, it was shown the uniform arrangement of the nerve bundles which compose the MN branches. Within the mandibular canal, the nerve bundle composing A and M branch always located at the superior and inferior aspect, respectively. Whereas, nerve bundles composing IL branch located in the middle of the mandibular canal in every case of the specimens. However, in 81% of the cases, ILl nerve bundles located buccally to the ILm nerve bundles within the mandibular canal (17 cases), and the other cases were shown that the nerve bundles composing the ILm located in the buccal part of the mandibular canal (19%, 4 cases). Furthermore, these arrangements of the nerve bundles for each MN branch was maintained until these nerve branches approached to the mental foramen. Also, at the deepest region of the lingual aspect within the mandibular canal, the dental nerve branch was running. These results can explain in predicting the exact region and extent of the loss of sensation after the nerve damages from various surgical procedures.

This relation is maintained while they bend to go to mental foramen, and when it exits the mental foramen, there is M, ILl, and A branch in order, from anterior to posterior, and the ILm branch is located at the deep layer. Therefore, when the superior part of the mandibular canal is damaged during dental implant surgery at the posterior area to the mental foramen, there could be lost sensation at the mouth angle and the lateral region of the lower lip, but not the medial region of the lower lip and mental region.

Within the mandibular canal, the dental nerve and the MN organizing the inferior alveolar nerve were easily distinguished. Chávez-Lomeli et al. (1996) demonstrated that

since bony canals develop around nerve paths, it was assumed that the canal pattern in early prenatal developmental stages could reflect the pattern of innervation of the dentition. Also, they suggested that the dental branches may be innervated by the first-developed as well as by the second-developed nerve branch. Based on their results, it could be thought that the dental nerve and the MN are covered by different perineurium, and run independently from each other because they are distributed at a different region and develop at a different stage.

Topographic anatomy of the anterior loop of the MN is very important during surgery of the mental region. Mardinger et al. (2000) described that 3mm of safety margin from the mental foramen is necessary because the length of the anterior loop is 0.4~2.19mm. Many other studies agreed with the 3mm safety margin (Nishioka et al. 1988, Ritter et al. 1992 Wismeijer et al. 1997). However, Kuzmanovic et al .(2003) mentioned that 4mm of safety margin is necessary because the length of the anterior loop is up to 3.31mm. Babbush (1998) reported that 6mm of safety margin is necessary because the length of the anterior loop is up to 5mm. On the other hand, Rosenquist (1996) and Bavitz et al. (1993) reported that the anterior loop seldom developed and that 1mm safety margin is enough. In this study, the average length of the anterior loop was 1.74mm(0.73~2.63) and 3mm safety margin will be necessary to avoid the damage of the MN.

There were also many reports on the shape of the anterior loop. Rosenquist (1996) classified the anterior loop of the mental nerve into 8 types. Among them, only 25.9% formed the loop, and there were no loops formed in most cases. Vertical and straight type which did not form any loop were found in 50% and 24.1%. On the other hand, Babbush (1998) categorized the anterior loop into loop type (59.4%) and non-loop type (40.5%) using the silmilar categorization as Solar et al. (1994). In this study, 61.5% were loop type, similar to the results of Babbush (1998), and 23.1% were straight type and 15.4% were vertical type. Therefore, the anterior loop should always be considered during surgery of the mental region.

These results provide an useful information for anatomical description and clinical application at the area where the inferior alveolar nerve transits to the MN. Also, these results can give the crucial data to the clinicians to predict the location or extent of paresthesia in the facial region followed by the nerve damage during dental implant installation and genioplasty.

Ⅴ. CONCLUSION

The mental nerve (MN), which is the terminal branch of the mandibular nerve, is distributed to the skin and mucous membrane of the lower lip, and the skin of the chin. The mental nerve branch were classified into angular (A), medial inferior labial (ILm), lateral inferior labial (ILl), and mental branch (M) according to distribution area. These nerve branches were classified into five types based on their branching patterns. Type II, in which the MN was divided into three branches (A, ILm and M), then the ILl was separated from the A branch, occurred the most frequently (35.4%). In the shape of the anterior loop, the loop pattern was the highest as 61.5%. The straight and vertical patterns which do not form loop, were 23.1% and 15.4%, respectively. The average distance of the anterior loop was 1.74mm. In most cases (81%, 17 cases), the nerve bundles composing the A branch located at the superior aspect, whereas the nerve bundles of the IL and M branch were at the middle and inferior aspect within the mandibular canal, respectively. These results can serve as useful data for anatomical description and clinical treatment on the area where the inferior alveolar nerve transits to the mental nerve.

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Abstract (in korean)

턱끝신경의 나뉨양상과 턱뼈관내에서의 주행경로

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턱끝신경 (mental nerve)은 아래이틀신경 (inferior alveolar nerve)의 마지막 가지로 턱끝구멍 (mental foramen)을 빠져나와 아랫입술 (lower lip), 턱끝 (mentum) 부위, 입꼬리 (angle of mouth) 부위에 분포하는 가지를 내는 순수 감각신경이다. 이러한 턱끝신경은 턱끝부위의 수술, 치과 임플란트 수술, 치아뿌리끝 병소 및 교정치료 등과 같은 임상시술 시 손상을 입을 수 있고, 이의 결과로 부분적 감각이상이나 완전 감각이상이 나타날 수 있다. 이러한 부작용을 막기 위해 여러 임상적 술식이 고안되어 사용되고 있다. 그러나 턱끝신경의 나뉨양상이나 각 가지들의 분포영역과 같은 기본적인 해부학적 연구들이 부족한 실정이며, 각 신경가지들을 구성하는 신경다발 (nerve fascicle)의 위치관계 및 국소미세구조에 관한 지식은 전무하다. 따라서, 턱끝신경의 나뉨양상과 턱뼈관내 주행을 확인하기 위하여, 고정된 한국시신 31쪽 (남: 19쪽, 여: 12쪽, 평균나이: 69.9세)을 대상으로 해부하여 턱끝신경의 국소해부학적 관계를 확인하고 신경다발을 미세해부하여 다음과 같은 결과를 얻었다.

턱끝신경을 각각의 분포위치에 따라 입꼬리가지, 안쪽아래입술가지, 가쪽아래입술가지, 턱끝가지로 나누었고, 이 4가지의 나뉨양상에 따라 5유형으로 구분하였다. 턱끝신경이 입꼬리가지, 안쪽아래입술가지, 턱끝가지로 나뉘고, 가쪽아래입술가지가 입꼬리가지에서 나뉘는 Ⅱ유형이 35.5% (11예)로 가장 많이 관찰되었다. 턱끝신경이 입꼬리가지와 턱끝가지로 나뉘고, 안쪽·가쪽아래입술가지가 입꼬리가지에서 나뉘는 Ⅴ유형은 16.1%에서 확인되었다. 아래이틀신경이 턱끝신경으로 이행되어 턱끝구멍으로 나오는 부위의 형태에 따라 고리 (loop)형, 곧은 (straight)형, 수직 (vertical)형등 3가지 형태로 구분하였다. 일반적으로 널리 알려져 있는 고리형

은 61.5%로 가장 많이 관찰되었으나, 곧은형과 수직형은 각각 23.1%, 15.4%에서 확인되었다. 아래이틀신경이 턱끝신경으로 이행되는 부위가 고리 유형인 경우, 턱끝구멍의 앞쪽 끝에서 신경 고리의 앞쪽 끝까지의 거리는 평균 1.74㎜ (0.73㎜~2.63㎜)로 계측되었다. 신경다발 (nerve bundle)을 미세해부하여 신경다발의 국소적인 관계 및 위치를 확인한 결과, 턱끝신경을 이루는 신경다발은 턱뼈관 (mandibular canal) 속에서 아래이틀신경과 완전히 분리되어 있었으며, 아래이틀신경의 나머지 신경다발은 앞니신경 (incisice nerve)으로 계속되는 양상이었다. 한편, 턱뼈관 내에서 턱끝신경을 구성하는 신경다발 중, 입꼬리가지는 위쪽에, 아랫입술가지와 턱끝가지는 중간과, 아래층에 위치한 경우가 대부분이었다 (81%, 17쪽).

이러한 결과는 치과 임플란트 식립 도중 턱뼈관의 손상이 발생하는 경우에 신경의 손상부위나 정도에 따라 얼굴 부위의 감각이상 부위나 정도를 예상할 수 있는 임상해부학적 지식을 임상의사들에게 제시할 수 있을 것으로 생각한다.

핵심되는 말 : 턱끝신경, 아래이틀신경, 앞고리