

The Anatomic Structure of the Inferior Alveolar Neurovascular Bundle in the Third Molar Region

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Purpose: The arrangement of the structures within the inferior alveolar neurovascular bundle has not been clearly defined. Because this could be of importance in surgery involving the inferior alveolar canal, a study was undertaken.

Materials and Methods: The inferior alveolar neurovascular bundle was dissected from 8 cadaveric mandibles and examined for the arrangement of the inferior alveolar artery, vein, and nerve. Histologic sections were taken for examination, and simultaneously, the bundle was exposed as part of a clinical surgical procedure for a marginal resection of the mandible.

Results: All 3 studies confirm that the inferior alveolar vein lies superior to the nerve and that there are often multiple veins. The artery appears to be solitary and lies on the lingual side of the nerve, slightly above the horizontal position. This position appeared to be consistent in all cases.

Conclusions: Knowledge of the arrangement of the inferior alveolar artery vein and nerve within the inferior alveolar canal can be of importance in surgical procedures that may involve these structures. Dentoalveolar surgery, implant-related surgery, and surgery for trauma or pathology could involve these structures.

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The neurovascular bundle occupying the inferior alveolar canal contains the inferior alveolar nerve, the inferior alveolar artery or arteries, and the inferior alveolar vein or veins. However, the precise location of these structures in relation to each other does not appear to have been determined, and because this may be of some importance in wisdom tooth and implant-related procedures, we believed it appropriate to perform an anatomic study.

Materials and Methods

Eight hemimandibles from preserved human cadavers were harvested from the School of Dentistry Gross

Anatomy Laboratory, University of California, San Francisco. The buccal plate was removed from the mandibular angle and body region, exposing the inferior alveolar neurovascular bundle from the lingula area to the mental foramen. After the gross relationship of the bundle was exposed, the vein, artery, and nerve were separated and identified to determine their exact orientation in the canal. The mandibular third molar region received the most attention.

Anatomic cross sections were prepared from the third molar regions for histologic examination to further identify histologically the relationship of the vessels.

Intraoperatively, during a marginal mandibular resection for management of an ameloblastoma, the right inferior alveolar nerve was deroofed in a patient, and the undisturbed contents of the inferior alveolar neurovascular bundle in the third molar region were observed and photographed. These were compared with the cadaveric and histologic specimens.

Results

In all 8 preserved cadaveric hemimandibles, the neurovascular bundle could be clearly identified. When the contents of the bundle were dissected out, it was clearly possible to identify the artery, vein, and nerve. In all cases the vein lay on top of the nerve in

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the 12-o'clock position. In all cases the artery appeared on the lingual side of the nerve in approximately the 9:30 position when the right inferior alveolar bundle was viewed posteriorly (Fig 1). There did not appear to be any change in the relationship from the lingula to the mental foramen region.

When the histologic specimen was examined (Fig 2), the relationship observed in Figure 1 was confirmed, and it appeared that the artery was a single vessel. In contrast, although the vein appeared to be a single vessel on gross anatomic examination, histologically, there were actually a number of veins, usually between 3 and 5.

Figure 3 shows the intraoperative photograph of the patient having a marginal mandibular resection carried out and again confirms the arrangement of the neurovascular bundle with the vein lying superiorly and the artery lying lingual to the vein in close relation to the nerve.

Discussion

Although standard anatomic textbooks and dissection manuals clearly state that the inferior alveolar canal contains a neurovascular bundle consisting of the artery, vein, and nerve, their exact relationship to each other does not appear to have been previously

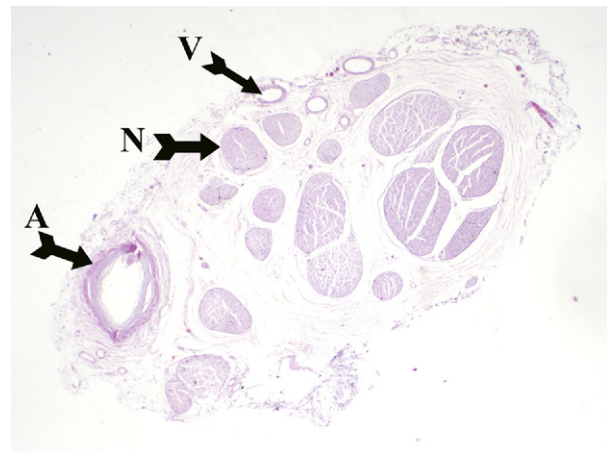


FIGURE 2. Histologic examination of specimen from right third molar region as seen from behind showing inferior alveolar canal contents. The vein (V), lying superiorly, consists of a number of venules, whereas the artery (A), lying lingually, contains only a single vessel. The nerve (N) itself consists of around 16 fascicles at this point. (Hematoxylin and eosin; original magnification $\times 40$.)

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described in the English language.¹ Statements have been made in the literature that during implant insertion, if the roof of the inferior alveolar canal is breached, bleeding may occur, but if insertion is



FIGURE 1. Gross anatomic specimen with contents of inferior alveolar canal dissected out. The vein (V) lies superiorly on top of the nerve (N), whereas the artery (A) lies on the lingual side of the nerve in the 9:30 position as viewed from behind on the right side.

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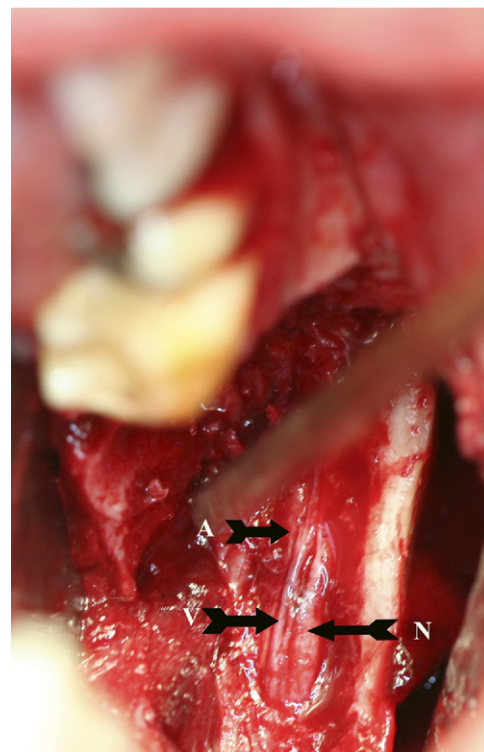


FIGURE 3. The inferior alveolar canal deroofed as part of a marginal mandibular resection showing neurovascular vessels in third molar region. The vein (V) lies superiorly, and the artery (A) lies lingually and superiorly. The inferior alveolar nerve (N) lies below.

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halted at this point, damage to the nerve can be avoided.² This implies that contact with the vessel occurs before contact with the nerve. Similarly, during third molar removal, if there appears to be an intimate relationship between the inferior alveolar vessels and the third molar, it is stated that arterial bleeding may be observed on removal and that often this will be accompanied by inferior alveolar nerve damage.³ This implies that the artery and nerve are damaged together.

The results of this study would tend to confirm the previously mentioned findings in that on gross examination of preserved cadavers, on histologic examination, and in a live human subject, contact with the vein could be made before contact was made with the nerve and could result in venous oozing. Similarly, because the artery appears to lie lingual to the nerve, it would be most usual for both to be damaged together, during either implant insertion or third molar removal, or other dentoalveolar surgery, which would result in venous and arterial bleeding. Similarly, one

could envisage a situation where only the artery was affected if surgery was being carried out on the lingual side of the neurovascular bundle, for example, an implant insertion that was being attempted lingual to the neurovascular bundle. The results of this study may be of help to surgeons who operate around the inferior alveolar neurovascular bundle.

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