The neurovascular contents of a unilateral double mandibular canal: A case study

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Background

Previous radiographical studies have documented an incidence of **bifid mandibular canals** at or below approximately 1%[1-4]. The presence of **two distinct mandibular canals**, each originating from its own mandibular foramen, is less common and has been recorded in the literature only sparingly[5].

Variation in mandibular canal quantity and morphology has been related to the formation of the inferior alveolar nerve and the process of mandibular ossification[1].

The embryological origins of the **inferior alveolar nerve (IAN)** as three distinct neurological components can explain the presence of a bifid or trifid mandibular canal following incomplete fusion of the nerves during prenatal development[6].

Ossification of the mandible begins at the mental foramen and progresses posteriorly[7]. During this process, the neurovascular bundle is surrounded by the ossifying bone, which forms the **mandibular canal** around the bundle. Multiple canals would form in cases of incomplete fusion[6]. Additionally, a bifid canal may not contain multiple components of the inferior alveolar neurovascular bundle but may instead reflect isolation of the nerve and artery into separate canals[1].

Materials and Methods

Cadaver The cadaver was of a 92 year old African-American female.

Preservation After isolating the carotid artery, two small incisions were made 1cm apart. A cannula was inserted into each incision, the superior oriented cranially and the inferior oriented caudally. Twenty liters of embalming solution (1.86% formaldehyde, 10% phenol, 10% alcohol, 10% propylene glycol) were pumped into the body.

Timeline Following embalming the cadaver was placed in cold storage for 12 months. Superficial prosection of the cadaver occurred over a four-month period prior to the gross anatomy course where the cadaver was dissected over a two-month period. Images were taken at the conclusion of the course.

Dissection To liberate the masseter superiorly, the zygomatic arch was cut medially from the most anterior aspect and laterally just anterior to the mandibular condyle using a Mopec autopsy saw. The masseter was removed from the mandibular ramus and reflected inferiorly to the gonial angle. The saw, as well as a hammer and chisel, were then used to remove the mandibular ramus, leaving behind the inferior alveolar neurovascular bundle[8]. The facial aspect of the mandibular corpus was removed to expose the course of the two mandibular canals and their neurovascular contents through the corpus of the mandible to the level of the mental foramen.

Cadaveric Study

Typical Morphology

- The **posterior division of the mandibular nerve** (CN V_3), gives **3 branches**: auriculotemporal, inferior alveolar, and lingual nerves (Fig. 2)
- The **maxillary artery** gives an **inferior alveolar branch** which joins the inferior alveolar nerve (Fig. 1)
- The **inferior alveolar artery and nerve** course through a **single mandibular canal** which begins at the mandibular foramen on the deep surface of the ramus and terminates at the **mental foramen** where those structures become the **mental nerve and artery** (Fig. 1)
- The **inferior alveolar nerve** gives the **nerve to the mylohyoid** prior to entering the mandibular canal (Figs. 1-2)

This Case

- The **posterior division of the mandibular nerve** (CN V_3), gives **4 branches**: auriculotemporal, inferior alveolar, lingual, and **mental nerves** (Fig. 3)
- The **maxillary artery** gives an **inferior alveolar branch** which then gives **2 branches** (Fig. 4)
- **Two mandibular canals** are present, each originating from their own mandibular foramen. The **superior canal** contains the **inferior alveolar nerve and artery**, and diminishes anteriorly within the corpus which is commonly observed[9-10]. The **inferior mandibular canal** contains the **mental nerve and artery** and remains defined from the mandibular foramen to the **mental foramen** (Figs. 3-4)
- The **mental nerve** gives the **nerve to the mylohyoid** prior to entering the mandibular canal (Figs. 3-4)

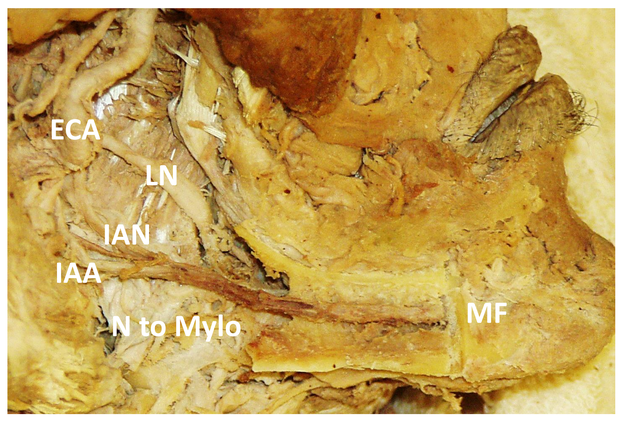

Fig. 1 Dissection of a cadaver with a typical morphology from the same preservation, cohort, and dissection methodology as the subject of this case study. MF–Mental Foramen, IAN–Inferior Alveolar Nerve, N to Mylo–Nerve to the Mylohyoid Muscle, IAA–Inferior Alveolar Artery, ECA–External Carotid Artery, LN–Lingual Nerve.

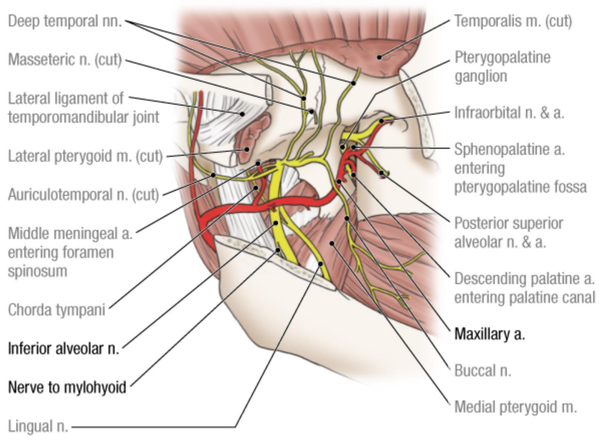

Fig. 2 Branches of the maxillary and mandibular nerves (CN V_2 and V_3) and the maxillary artery in the infratemporal region. The mandibular nerve enters the infratemporal region through foramen ovale. The posterior division gives the auriculotemporal, lingual, inferior alveolar, and mylohyoid branches. From Grant's Dissector, Figure 7.33[8].

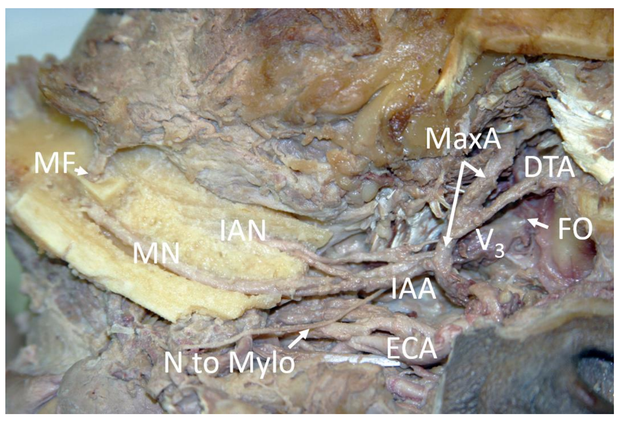

Fig. 3 Dissection of the infratemporal region and mandible. MF–Mental Foramen, MN–Mental Nerve, IAN–Inferior Alveolar Nerve, N to Mylo–Nerve to the Mylohyoid Muscle, IAA–Inferior Alveolar Artery, ECA –External Carotid Artery, MaxA–Maxillary Artery, V3 –Mandibular Nerve, FO–Foramen Ovale, DTA–Deep Temporal Artery.

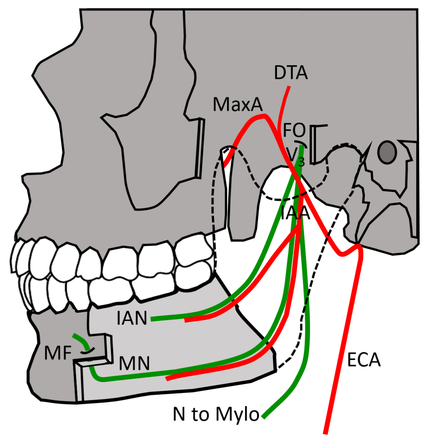

Fig. 4 Schematic of observed anatomy. MF–Mental Foramen, MN–Mental Nerve, IAN–Inferior Alveolar Nerve, N to Mylo–Nerve to the Mylohyoid Muscle, IAA–Inferior Alveolar Artery, ECA –External Carotid Artery, MaxA–Maxillary Artery, V3 –Mandibular Nerve, FO–Foramen Ovale, DTA–Deep Temporal Artery.

Discussion and Conclusions

Presented here is the first documented case of independent inferior alveolar and mental nerves in the infratemporal region. Each branch of the posterior division of the mandibular nerve (CN V_3), courses through one of two mandibular canals with a branch of the inferior alveolar artery (Figs. 3-4).

The mechanism of this variant is not related to the embryological development of the inferior alveolar nerve and mandible. The superior canal contained a sizeable nerve with a presentation similar to that of 40% of cadavers in two mandibular canal variation studies[9-10]. The separation of the two nerves occurs proximal to the mandible and therefore is unlikely to reflect non-fusion of the components of the inferior alveolar nerve prior to mandibular ossification.

Given the variation in the contents of a bifid or accessory mandibular canal, radiographic identification of osteological anatomical variants is not informative for predicting potential complications during procedures. Caution must be taken prior to any dental or surgical procedure involving the mandible or mandibular dentition. While radiographs can show the presence of this osteological variant, further imaging is recommended to ascertain the contents of the various canals prior to surgery.

References

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