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# The spatial location of the mandibular canal in Chinese: a CT study

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*Abstract.* The inferior alveolar nerve (IAN) is vulnerable to injury from mandible fractures and surgical procedures so anatomical variations of IAN are important. Postoperative sensory alteration of the lip and chin region is high after mandibular orthognathic surgery. The incidence of IAN paresthesia following sagittal split ramus osteotomy (SSRO) ranges from 54% to 86% at 4–8 days, 41 to 75% at 1 month, 33 to 66% at 3 months, 17 to 58% at 6 months and 15 to 33% at 1 year postoperatively. This study determined the anatomical position of the mandibular canal in relation to cortical bone and molar teeth in Chinese using archived CT records. The mandibular canal was the farthest from the buccal cortex at the second molar region (mean 6.79 mm; minimum distance 4.80 mm). The anatomical location of the mandibular canal in local Chinese compares with studies on Asian cadavers. The mandible body was thickest in the region of the second molar (11.9 mm). The vertical buccal cut for SSRO should be in the region of the mandibular second molar where the bone is thickest and the mandibular canal is furthest from the buccal cortex. The safe depth for the vertical buccal cut is 4.8 mm (minimum horizontal distance).

Keywords: inferior alveolar nerve; sagittal split ramus osteotomy; paresthesia.

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The inferior alveolar nerve (IAN) is of clinical significance because of its vulnerability to injury from mandible fractures, and surgical procedures including third molar surgery, implant surgery, orthognathic surgery, surgery for pathology and endodontic therapy. Anatomical variations of the IAN are therefore of significance to the clinician.

Olivier found that the neurovascular bundle divided soon after its entry into the mandibular canal in almost 34% of mandibles[11]. Carter & Keen noted a single neurovascular bundle in 7 of 8 dissected mandibles[2]. Nortje's radiographic study demonstrated posterior duplication or division of the mandibular canal in only 0.96% of 3612 cases[9]. Controversies exist regarding the tubular nature of the IAN canal (mandibular canal). Cryer described the mandibular canal as a cribriform tube with a porous nature[3].

The mandibular canal loses its tubular form at or around the molar region[1]. Others claim that the mandibular canal extends as a tube beyond the molar region, at least up to the mental foramen[5,8]. Olivier found that the mandibular canal courses lingual to the roots of the second and third molars, adjacent to the roots of the first molar and lateral to the roots of the premolars[10]. In the area of the mandibular foramen, the IAN was found to occupy almost the entire cancellous space between the lingual and buccal cortical plates and always maintained close relation to the lingual plate[5]. As it approached the mental foramen the mandibular canal turns sharply from medial to lateral towards the foramen.

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Current information on the course of the IAN is derived from studies performed on cadaveric mandibles[5,12,16,18], and to a lesser extent from studies using computed tomography (CT) to determine the position of the mandibular canal in patients undergoing orthognathic surgery[15,21]. The spatial location of the mandibular canal has only been loosely correlated to the mandibular and mental foramina and to the lower molar teeth as reference points[5,12,16]. CT studies used different planes for assessment, compared with studies using cadaveric mandibles[15,21]. This makes it difficult to compare the dimensional differences of the mandibular canal in relation to the buccal, lingual and inferior cortices at different locations of the mandible body between studies. The race of the cadavers from whom mandible specimens were obtained was omitted in several studies[5,15,18,21], whilst the gender and age were not stated in two studies[5,12].

## Clinical significance

The likelihood of postoperative sensory alteration of the lip and chin region is particularly high after mandibular orthognathic surgery[4]. The incidence of IAN paresthesia in prospective studies on IAN sensory alteration confirmed with neurosensory testing following sagittal split ramus osteotomy (SSRO) alone has been reported to range from 54% to 86% at 4–8 days, 41% to 75% at 1 month, 33% to 66% at 3 months, 17% to 58% at 6 months and 15% to 33% at 1 year postoperatively[7,13,22,23]. The upper limit of this range of incidence of IAN paresthesia was associated with SSRO using rigid fixation with screws or plates, whilst the lower limit of this incidence range derived from studies of SSRO using wire fixation. The incidence of IAN paresthesia following intraoral vertical ramus osteotomy (IVRO) is lower than that of SSRO[17,19,20,24] but IVRO cannot be used to correct mandibular retrognathism. The incidence of mental nerve paresthesia following genioplasty is lower; the long-term incidence is estimated to be around 5–10%[4].

An important issue in orthognathic surgery of the mandible is the prevention of injury to the IAN, with the attendant dysfunction from sensory loss of the lower lip and chin, such as drooling, lip biting, speech difficulties and interference with psycho-social function[6]. Knowledge of the relationship of the IAN will be particularly useful when performing SSRO for correcting mandibular prognathism, retrognathism or asymmetry.

The aim of this study was to determine the anatomical position of the mandibular

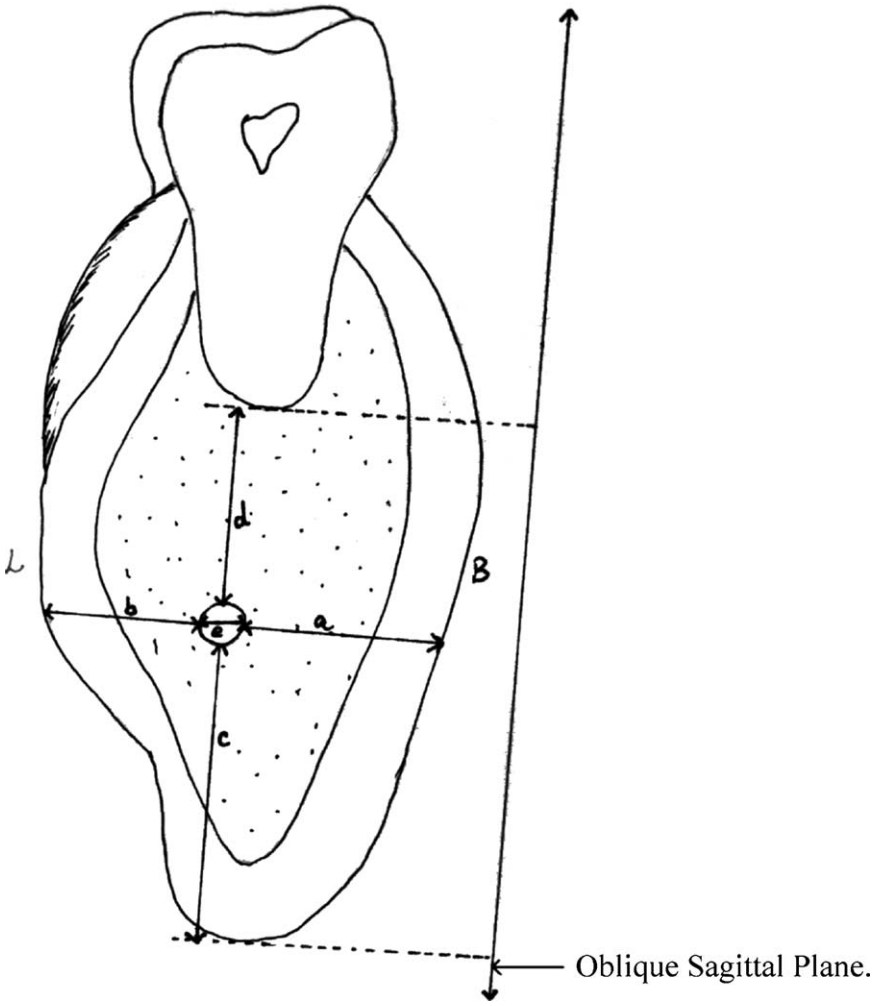


*Fig. 1.* Cross-sectional view of the mandible showing the measurements taken. (a) Distance of the outer/buccal edge of the mandibular canal to the outer surface of the buccal cortex. (b) Distance of the inferior edge of the mandibular canal to the outer surface of the inferior border of the mandible. (c) Distance of the inner/lingual edge of the mandibular canal to the outer surface of the lingual cortex. (d) Horizontal diameter of the mandibular canal. (e) Distance of superior edge of the mandibular canal to the root apex or alveolar crest.