Available online at www.ijpcr.com
International Journal of Pharmaceutical and Clinical Research 2015; 7(2): 136-139

ISSN- 0975 1556

Research Article

Morphological Analysis of Lingula of Mandible in Dry South Indian Skulls

K. R. Rajesh Nidhi

Saveetha Dental College, 162, Poonamalee Highroad Chennai77, Tamilnadu, India

Available Online: 25th February, 2015

ABSTRACT

The margin of the mandibular foramen is irregular. Lingula is a tongue-like flap of bone that overlaps the mandibular foramen anteromedially .It is surmounted by a sharp spine, the lingual of the mandible which gives attachment to the spheno mandibular ligament; at its lower and back part is a notch from which the mylohyoid groove runs obliquely downward and forward, and lodges the mylohyoid vessels and nerve.it is located on the medial aspect of mandibular ramus and knowledge regarding its shape, size, and location is clinically significant in oral and maxillofacial surgeries.

Keywords: Lingula, Mandible, Skulls

INTRODUCTION

The ramus of mandible presents on its medial surface a little above its centre an irregular foramen called the mandibular foramen. This foramen is guarded by a thin sharp tongue shaped projection in its proximity called the lingula. This foramen transmits the inferior alveolar nerve and the corresponding artery to the mandibular canal. Here, the nerve supplies the pulps of all the teeth located on lower jaw and ends by supplying the lower lip and skin over the chin by its terminal branch, the mental nerve emerging from the mental foramen. This channel goes from the ramus to the body, below the alveoli and connected to them through small channels leading the nerve and the inferior alveolar vases. At the height of the first and second premolars it divides into the mental and incisive parts. The inferior alveolar nerve goes into the mandibular foramen together with the inferior alveolar artery. Inside the mandible the nerve supplies the pulps of all teeth located on its side and part of the periodontal ligament, and innervates the lower lip and the chin skin through the ramus. The lingula is where the spheno mandibular ligament is inserted (Gardner, 1992; Williams, Warwick, Dyson et. al. 1995; Abrahams, Hutchings and Marks, 1998).The exact location of the mandibular foramen on radiographs is not always easy to be established due to its radiolucency and the superimposition of contralateral mandibular structures[2]. It is an important landmark as it lies in close proximity to the mandibular foramen. The foramen and the lingula, because of their relation to the inferior alveolar nerve are of clinical significance for the orodental surgeon. The lingula is used for identifying the site for injection of local anaesthetics or for excision of nerve for facial neuralgia. The mandibular foramen has often considered to be the most reliable reference point for approaching the inferior alveolar nerve in several anaesthesia techniques, which led to several studies about its position and its anatomical relationships to clinically recognizable landmarks. It has been speculated that the mandibular lingula and foramen change the ratio of their positions on the ramus of growing children[3]. Tsai[4] observed in children a variation in the difference between the distance from the mandibular foramen to the anterior border and to the posterior border. This variation is caused by regional growth indifferent direction in each of Hellman's dental developmental stages[3]. Because of its connection to nerve and vascular structures the study of the lingula features provides significant information related to oral and maxillofacial surgical procedures, such as the sagittal split ramus osteotomy, vertical ramus osteotomy, inverted L osteotomy[2], orthognathic surgery, mandibular trauma management, eradication of benign and malignant lesions, preprosthetic surgery, and nerve injury during inferior mandibular nerve block[3]. The lingula is used for identifying the site for injection of local anaesthetics or for excision of nerve for facial neuralgia[4]. If oral-maxillofacial surgeons are unable to identify the lingula correctly, intraoperative complications such as haemorrhage, unfavourable fracture nerve injury and may occur[5,6]. The present study is unique in that the mandibles were collected from a single ethnic group (Turkish) with known ages and gender. The number of samples in the present study was large enough to compare the shape of the lingula and its distribution in addition to determining

**Author for Correspondence*

the location of the lingula. The subjects (both girls and boys) have a known and similar age range and the results were subjected to statistical analyses. It was therefore possible to investigate sex and side differences. The researchers analysed the morphological characteristics of the lingula, and they stated at the conclusion that such structural variability could account for failure to block the inferior alveolar nerve[7,8]. Variations in the shape of the lingula have been reported by various authors[9–11]; for example, Tuli et al.[5,6] classified lingula into four different types based on its shape, namely, triangular, truncated, nodular, and assimilated types.

The branching variety is more common in the adult Thai population. In addition to the position of the lingula, panoramic radiograph also shows the number of its branches.[3] In more than 50% of adults, the lingula takes part in formation of half to two thirds of the wall of the mandibular foramen, and the myelohyoid line starts from the posterior border of the lingula.[4]

Inferior alveolar nerve block or the mandibular nerve block is a common injection in dentistry. Unfortunately, the failure rate of this technique even with accurate injection is 15 to 20%. Absence of appropriate bony landmarks and big differences in dimensions of the ramus and position of the mandibular foramen are the reasons for failure of this technique.[1] It can sometimes completely anesthetize the lower incisive primary teeth, but not the lower primary or permanent molars. The mandibular foramen in children is at a lower level than the occlusal level of the primary teeth and therefore the injection has to be administered lower and posterior to the position in adults.

In order to evaluate the success rate of injection, the method of pain measurement has to be determined. The basic problem is that pain is a personal experience, which cannot be visualized or felt by another person, and indirect methods have to be used for this purpose. These methods include physiological, behavioural and report by the patient.[5] The most common method is using a 10cm line with the extreme details at each end (no pain and extreme pain), which is called a visual analogue scale. The patients express pain by putting a cross on the line. However, this method can be affected by fear and expectation of pain by the patients.[5] Despite this, observations show that visual analogue scale is one of the most reliable measurement tools for personal reporting of pain in children.[2]

Hannan et al[6] compared the amount of desensitization gained by infra-alveolar block between the normal method and using ultrasound as a guide for the site of injection. A pulp tester was used to test the anterior and posterior mandibular teeth randomly in a 4-minute cycle for 60 minutes. The success rate was 38-92% in both methods and there was no significant difference in desensitization between the methods.[6]

Keros et al[7] compared 50 panoramic radiographs related to successful infra-alveolar blocks with 94 other panoramic radiographs to non-successful infra-alveolar blocks. The results showed that the lingula was prominent in 56% of radiographs of those in whom the block was successful.[7]

The aim of the present study was to assess the use of the position of the lingula on the panoramic radiograph as a landmark for injection of infra-alveolar nerve block injection in 7-11-year-old children. For this purpose, the mean distance between the lingula and the occlusal plane was measured on panoramic radiographs and analysed considering the age and gender variables. In a next stage, the success rate of the mandibular alveolar nerve block was assessed, using the mean distance of lingula and the occlusal plane as a landmark for needle insertion point.

DISCUSSION

Among all the morphological features selected ligulae shows sexual dimorphism. Lingula was described by Johannes-Baptist Spix in 1815 and was therefore named `Spix' ossicle or spine' (DOBSON, 1962) 12. Triangular type is more prevalent showing its presence in 80 bones (32 bilateral and 16 unilateral). As above table depicts our findings match with Lopez et al (2010) 14 and A Tuli et al (2000) 3. In the Thai population the truncated lingula was prevalent, followed by the nodular type, the triangular type and the assimilated type. 5. This was stated by the author Lopez et al (2010) 14 and A Tuli et al.

Information regarding the morphological shapes of the coronoid process is useful for the maxillofacial surgeon. The coronoid process can be used as an excellent donor graft site for reconstruction of orbital floor deformities (MINTZ et al., 1998) 19. Genial tubercles are four elevations on the inner surface of body of mandible, provide origin to genio glossi and stylohyoid muscles on either side. They show differential pattern in the form of their shape and size. In the present study four different patterns of genial tubercles were observed. Type II genial tubercle pattern was found in 41 (48.8%) mandibles. Type I was found in 14 (16.66%) and Type III in 27 (32.14%) mandibles. Type IV was the least common found in 2 (2.38%) bones. These differences could be of some racial significance which needs further investigation.

Various standard textbooks mention only triangular shaped lingulae. Nicholson (1985) 10 and DuBrul (1988) 13, however, reported the presence of various shapes but did not provide details about the various types and incidence. Other types of lingulae i.e. truncated 7 type was described by Hollinshead(1962), nodular 8 by Berkovitz et al. (1978), and assimilated 9 type by Morgan et al. (1982). About the shape of coronoid process which is classified as triangular, hook and rounded, our study shows triangular in 65%, hook shaped in 28% and rounded in 7%. Over all triangular type is more prevalent in males.

Pain control during dental procedures is very important in children to maintain a positive relationship between the child and dentist building trust and allaying fear and anxiety[12]. The inferior alveolar nerve block is the most common technique for providing local anaesthesia[13] before restorative and surgical procedures of the mandibular posterior teeth[14]. This technique provides anaesthesia of teeth, jaw, lip, gingiva, and mucous membrane up to the midline at the related part. However, Malamed identifies the inferior alveolar nerve block as the injection with the highest clinical failure rate, which he reports to be 15 to 20

percent when properly administered[15]. This high failure rate is often attributed to a high degree of variation in the morphology of the mandibular ramus and the location of the ML, especially in childhood and adolescence[16]. Therefore, defining the anatomical characteristics of the ML region plays an important role in successful anaesthesia for dental and surgical procedures. Several factors contribute to the reliability of landmark identification in children: the density and sharpness of the images, the anatomic complexity and superimposition of hard and soft tissues, the definition of the landmark, and the training level or experience of the observers[17,18]. CBCT in dentistry has provided an imaging solution that has neither the projection errors associated with magnification north super imposition problems associated with traditional panoramic imaging[19]. In addition, CBCT has a wide range of tools, such as 3D reconstructions in any direction to permit the accurate identification of landmarks. Studies have reported excellent accuracy with 3D computed tomography (CT)[20]. Using CBCT (3D) in our study, identification of the AMF reflected a real clinical situation.

The height level of the mandibular foramen is an important reference for the inferior alveolar nerve block. Kanno et al.[3] found the mandibular lingula position to be 6mm above the occlusal plane in 7- to 8-year-old children and 10mm in 9- to 10- year-old children. Nicholson[7] found the foramen located to be below the occlusal surfaces of the molar teeth. Murlimanju et al.[23] reported in 38 dry, adult, Negroid, Zimbabwean mandibles that 47.1%wereatthe same level with the occlusal plane, 29.4% were above the and 23.5% were below the plane. Hwang et al.[27] reported that the location of the mandibular foramen changed with age, and that in children, it was located below the occlusal plane,

While in adults it was 4.16mm above the occlusal plane. In Kositbowornchai et al.'s[24] study, the mandibular foramen, measured from three-dimensional CBCT images, was 10mm above the occlusal plane. In the present study, the mean height level (*h*2) was measured to be 2.0 ± 1.2 mm above the occlusal plane. A study on Thai mandibles[28] showed that the lingular heights on the right and left sides were 8.7 ± 2.0 mm and 8.2 ± 2.1 mm, respectively. Another study in the Thai population by Jansisyanontetal[21] reported the height of the lingula to be 8.2 ± 2.3 mm. In the present study, we defined the distance as 5.3 ± 1.6 in the pediatric population. Woo et al.[29] reported a study on a Korean population, in which the height of lingula was found to be higher, that is, 10.51 ± 3.84 mm. In a study reported by Sam anta and Kharb[30], the lingular height was found to be 5.5 ± 2.02 mm. Another study in a Brazilian population by Monnazzi et al.[2] reported the height of lingula to be 5.82 ± 0.43 mm. Nicholson[7] studied eighty dry, adult human mandibles of East Indian ethnic origin and reported a height of the lingula on the right side to be 8.6 ± 4.7 mm and left side to be 9.1 ± 5.7 mm. In the present study, the mean height of the lingula was 5.3 ± 1.6 mm, with a statistical difference between gender on right and left sides (Table 3). The location of the lingula varies among the various ethnic and racial groups[7,24,31,32]. Nevertheless, the common trend was that the distances in females were shorter thano nearly equal to those found in males.

Authors Reference Year Population Tuli et al.[5] 2000 Triangular Devi et al.[1] 2003 Truncated Hossain et al.[22] 2001 Triangular Murlimanju et al.[23] 2012 Triangular Kositbowornchai et al.[24] 2007 Truncated Nirmale et al.[25] 2012 Triangular Lopes et al.[26] 2010 Triangular Jansisyanont et al.[21] 2009 Truncated

Figure 1: The most prevalent shape of lingula in reported studies.

Triangular Shaped Lingula, Assimilated Shaped Lingula,Tracunated shaped lingula, nodular shaped lingual

CONCLUSION

The present study provides new information to the literature concerning the shape, height, and location of the mandibular lingual in the Turkish pediatric population. The findings of the present study could be utilized in clinical and dental procedures to localize the lingula and avoid intraoperative complications. The bilateral nodular shape of the lingula was most common in the whole population of study and in each sex. The mean height of the lingula was 5.3mm. The lingula was located an average of 13.3mm from the anterior border of the mandibular ramus, 11.4mm from the mandibular notch, and 24.7mm from the distal surface of the mandibular permanent first molar. The landmarks for the mandibular nerve block are important for efficient anaesthesia during dental treatments. The results from the present study suggest that clinicians or oral surgeons should insert a needle approximately 13.3mm from the anterior border of the ramus, and approximately 2.0mm above the occlusal plane

due to fact that the lingula in the majority of the samples was found above the occlusal plane.

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