Study of Position, Shape, Size and Incidence of Mental Foramen and Accessory Mental Foramen in Indian Adult Human Skulls

Estudio de la Posición, Forma, Tamaño e Incidencia del Foramen Mentoniano
y Foramen Mentoniano Accesorio en Cráneos Humanos de Indios Adultos

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SUMMARY: Paralysis of the mental nerve is one of the principal complications of surgery of the mandibular canal and mental foramen region. Therefore, identification of mental foramen is important for dental surgeons in nerve block and surgical procedures like apico curettage of mandibular premolars, amalgam filling, periodontal surgery etc. to avoid injury to neurovascular bundle. Accessory mental foramina tend to exist in the apical area of the first molar and posterior or inferior area of the mental foramen. The accessory branches of the mandibular canal showed common characteristics in the course of gently sloping posterosuperior direction in the buccal surface area. Verification of the existence of accessory mental foramina would prevent accessory nerve injury during periapical surgery. In root canal treatment, the possibility of accessory mental foramina-related nerve paresthesia seems low unless the mental foramen and mandibular canal are injured. Therefore, prior surgical knowledge of morphology and morphometry of mental and accessory mental foramen peculiar to particular block may enable effective mental block anaesthesia. Besides this, as mental foramen and accessory mental foramen have been found to vary in position in different ethnic groups. So, it is important to study the morphology and morphometry of mental foramen and accessory mental foramen. Hence this study was carried out. Present study was conducted using dried adult human mandibles of both sexes. Size and position were determined using digital vernier callipers. Incidences and shapes of mental foramen and accessory mental foramen were also observed. Mental foramen was present in all one hundred observed mandibles and it is bilateral. Accessory mental foramen was present in 8 percent on left side while on right side, it was 5 percent. None of the mandibles presented with bilateral accessory mental foramen. Shape was predominantly round with 94 percent on right side and 87 percent on left side while it was oval in 6 percent on right side and 13 percent on left side. Average size of mental foramen was 2.79 mm on right side while it was 2.57 mm on left side. Average size of accessory mental foramen was 1.00 mm varying from 0.5 mm to 4.00 mm. Mental foramen was located below the apex of second premolar in 68.8 percent mandibles while it is 17.8 percent between first and second premolars and in 11.5 percent, it is between second premolar and first molar. Accessory mental foramen lies 0.67 mm lateral to mental foramen and below the apex of first molar tooth.

KEY WORDS: Mental foramen; Accessory mental foramen; Mandible; Mental nerve; Premolar; Molar.

INTRODUCTION

Mental foramen (MF) is located in the body of mandible at an equal distance from the superior and inferior border Picosse (1982) and Marzola (1989). Normally, MF is located below the interval between the premolars. Mental nerve and vessels pass through MF. Variations in the position of MF have been analysed. It may lie between the apices of lower premolars, below the apex of second premolar. Data from various ethnic groups e.g. Tanzanian, Thai, Chinese, British, Saudi Arabian vary regarding the location of MF. A review by Green (1987) demonstrated a clear racial trend in the position of the MF.

Any foramen in addition to MF is known as accessory mental foramen (AMF) in the body of mandible. It is situated below the first molar tooth according to Çağırankaya & Kansu (2008). The distances between MF and AMF in three cadavers were reported to be 0.67 mm, 2.1 mm and 5.74 mm Toh *et al.* (1992). Ethnic variations in relation to AMF have also been reported by Sawyer *et al.* (1998). Hence location, size, shape, position and incidence of MF and AMF would facilitate the dental surgeon to apply nerve block in different surgical procedures involving lower jaw. As AMF

is due to branching of mental nerve before passing through MF, hence its shape size and verification of its existence would prevent Accessory nerve injury during periapical surgery. In addition to this, if this nerve is not blocked, in the structures supplied by it, parasthesia will be less.

MATERIAL AND METHOD

Present study was carried out using one hundred dried adult human mandibles of unknown sex in the Department of Anatomy, CSM Medical University Lucknow UP, India. Digital Vernier Callipers was used to measure the dimensions of MF and AMF to analyse and examine the size, shape and position of MF and AMF. The incidences of MF and AMF were also observed.

RESULTS

Position of mental foramen in relation to lower teeth. MF was situated below the apex of second premolar tooth in 68.8% mandibles whereas in 17.8% of mandibles it was observed between first and second premolars. In 11.5% it was found between second premolar and first molar and in 2.1% it was seen below the apex of first premolar. In Figure 1, MF is lying between first and second premolar on left side and below the apex of second premolar on right side. Position of MF in relation to various parameters has been described in Table I.

Position of accessory mental foramen in relation to lower teeth (Figs. 2 & 3).

Position of AMF in 8 mandibles out of 100 was found situated below apex of first molar tooth whereas it was observed to be located between first and second premolar in 5 mandibles out of the same 100. Average distance between MF and AMF was 0.67mm lateral to MF.

Shape of MF. On right side it is oval in 6% of mandibles and round in 94% of mandibles. On left side it is oval in 13% of mandibles while it is round in 87% of mandibles.

Fig. 1. Position of mental foramen in relation to lower teeth,

Size of MF. On right side: Average size was 2.79 mm. Minimum size is 1mm and Maximum size is 5 mm.

On left side: Average size is 2.57mm. Minimum size is 1mm and Maximum size is 6 mm.

Size of AMF. Average size is 1 mm. Minimum size is 0.6 mm and Maximum size is 1.5 mm.

Incidences of MF. MF is present in all one hundred observed mandibles and it is bilateral.

Incidences of AMF. AMF is observed in 13 mandibles out of 100 mandibles. AMF was situated in 5 out of 13 mandibles on right side and in 8 out of the same 13 mandibles in left side. Thus out of total population of 100 mandibles, AMF was found in right side of the body of mandibles in 5 % while in left side it was present in 8 % of the population under study.

None of the mandibles presented with bilateral accessory mental foramen.

Table- Position of mental foramen from various parametrs.

Parameters	Mean of distances of MF from parameters in right side: in cm	Mean of distances of MF from parameters in left side: in cm
1 Symphysis menti	2.93	3.06
2 Posterior margin of ramus of mandible	7.18	8.47
3 Alveolar crest	1.70	1.86
4 Base of mandible	1.73	1.37

Fig. 3. Position of accessory mental foramen on left side along with mental foramen.

Fig. 4. Position of accessory mental foramen on right side along with bilateral mental foramen.

DISCUSSION

Position of the mental foramen. In the present study, most common position of MF is below the apex of second premolar tooth in 68.8% of Indian mandibles. In British mandibles, it was between first and second premolars in 65% mandibles.

Its position below the apex of second premolar was 49% by Tebo & Telford (1950), 58.98% by Wang *et al.* (1986) and 52.9% Santini & Land (1990).

Santini & Land, Lockhart *et al.* (1983) and Aktebin *et al.* (2003) mentioned that MF is located between the apices of two premolars. But, according to Gardner *et al.* (1988), Bennet (1989), Dangelo & Fattini (1991), usual position of foramen is below crown of second premolar. Such position has not been observed by the authors in the present study.

According to Phillips *et al.* (1992), Mwaniki & Hassanali (1992), Ngeow & Yuzawati (2003), Smajilagic & Dilberovic (2004) and Apinhasmit *et al.* (2006), it was under the apex of first premolar. According to Phillips *et al.*, the most common position of mental foramen was inferior to crown of second premolar which is similar to present study while according to Olasoji *et al.* (2004), most frequent position of MF was found between 1st and 2nd premolars, followed by the apical position of 2nd premolar.

Ratios of distances from symphysis menti and posterior border of ramus of mandibles to the MF is 1: 3.2 in present study as compared to 1:2.6 in adult Chinese mandibles by Wang *et al.* and 1:2.7 in British mandibles by Santini & Land. Wang *et al.* showed that the distance between MF and symphysis menti was 28.06 mm, between MF and posterior border of ramus of mandible was 74.14 mm and between the MF and base of mandible was 14.70 mm. According to Marzola & Freitas (2006), MF was between 13mm-15mm from the base of mandible. Souaga *et al.* (2004) studied 61 dry mandibles and found that MF was 14.89 mm above the base of mandible and 16.16 mm below the alveolar ridge in males while in females MF was 14.21 mm above the base of mandible and 15.66 mm below the alveolar ridge.

According to Yesilyurt *et al.* (2008), the mean distance between symphysis menti and MF on right side was 19.18 mm while on left side it was 19.37 mm. Mean distance between MF and posterior border of ramus of mandible on right side was 48.58 mm and on left side it was 48.27 mm.

Position of the accessory mental foramen. Cag˘ırankaya & Kansu reported that AMF below the first molar which is similar to the present study. Much literature is not available on the position of AMF in relation to teeth in India. According to Toh *et al.*, distance between the MF and AMF in three cadavers are 0.67 mm, 2.1 mm and 5.74 mm whereas the authors observed position of AMF from MF to be 0.67 mm.

Shape of the mental foramen. In the present study, on right side it is oval in 6% of mandibles and round in 94%. In left side it is oval in 13% of mandibles whereas it is round in 87%.

According to Mbajjorgu *et al.* (1998), in 32 mandibles of black adults from Zimbabwe, MF was round in 14 mandibles (43.8%) and oval in 18 mandibles (56.3%). Oliveira Junior *et al.* (2009) reported that the shape was oval in 59 mandibles (73.8%) on right side and 57 mandibles (71.3%) on left side. Larger diameter in the horizontal direction was found in 98.3% of the above mandibles on the right side and only 1.7% being the larger diameter in vertical direction. On left side all oval foramina were having larger horizontal diameter. Round shape was in 21 mandibles (26.2%) on right side while in 23 mandibles (28.7%) on left side. According to Al-khateeb *et al.* (2007), the majority of foramina were round in shape similar to the present study.

Size of the mental foramen. According to Chung *et al.* (1995), horizontal opening of MF was 2.4 mm and Apinhasmit *et al.* reported the average horizontal opening was 2.8mm. Oguz & Bozkir (2002) did measurements in 34 dry mandibles of people from Turkey. The horizontal dimension of MF was 2.93mm on right side and 3.14 mm on left side. The vertical dimension was 2.38 mm and 2.64 mm on right and left sides respectively. Souaga *et al.* studied 61 dry mandibles. The average sizes of long and short axes of foramina were 5.66 mm and 3.97 mm in mandibles while dimensions of female mandibles were 4.99 mm and 3.87 mm.

The present observations brought out average horizontal dimension of MF to be 2.79 mm on right side and 2.57 mm on the left side.

Size of the accessory mental foramen. In the present study, the average dimension of AMF is 1 mm. Published literature related to the size of AMF for common scholars is hardly available.

Incidence of the mental foramen. In the observations under this study, MF was present in all the 100 mandibles (100%) and it was bilateral. Oliveira Junior *et al.* analysed 80 mandibles and established 100% presence of MFs. de Frietas *et al.* (1979) reported 0.4% absence of MFs.

Incidence of the accessory mental foramen. In the present study AMF was present in 13 mandibles (13%) out of 100. 8% of total 100 mandibles were found on left side and 5% on right side. Thus, 67% of total incidences of AMF (13) were observed in left side and rest 33% in right side.

According to Gershenson *et al.* (1986), AMF was present in 2.8% Israeli adults' mandibles. It is 1.8% for American whites and 12.5% in Polynesians. Oliveira Junior *et al.* reported 5% AMF in mandibles. Highest incidences of AMFs were reported in Negros and Maori males. The

incidences of AMFs did not differ significantly between right and left side of the mandibles.

In conclusion, the present analysis revealed variations in position, shape and size of MF and AMF. This may be related to feeding habits of different regions which may ultimately, effect the development of mandibles. The variability of the position of MF and AMF should alert the dental surgeons while performing periodontal or endodontic surgery.

AMF is found due to branching of mental nerve prior to its passing through the mental foramen. Thus, verification of existence of AMF would prevent accessory nerve injury during periapical surgery. In root canal treatment, possibility of AMF related paraesthesia will be less. Besides this, further if the studies are carried out in large volumes related to variation in the position, size, incidence and shape of MF and AMF it will be of immense use to the anthropologists in identifying the deceased.

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RESUMEN: La parálisis del nervio mentoniano es una de las principales complicaciones de la cirugía del canal mandibular y la región del foramen mentoniano. Por lo tanto, la identificación del foramen mentoniano es de gran importancia para cirujanos dentistas en el bloqueo del nervio y los procedimientos quirúrgicos como el legrado apical de premolares inferiores, obturación de amalgamas, la cirugía periodontal, etc., a fin de evitar lesiones del paquete neurovascular. Los forámenes mentonianos accesorios tienden a existir en la zona apical del primer molar y la zona posterior o inferior del foramen mentoniano. Las ramas accesorios del canal mandibular presentan características comunes en el curso de la leve pendiente de dirección posterosuperior de la superficie bucal. Verificar la existencia de forámenes mentales accesorios evitaría la lesión del nervio accesorio durante la cirugía periapical. En el tra-

tamiento del canal radicular, la posibilidad parestesia relacionada con daño de los forámenes mentonianos accesorios es baja a menos que el foramen mentoniano y el canal mandibular se lesionen. El conocimiento de la morfología y la morfometría del foramen mentoniano y los forámenes mentonianos accesorios puede permitir un efectivo bloqueo anestésico mentoniano, y es fundamental previo a una cirugía. Además de esto, se ha encontrado que los forámenes varían en su posición en diferentes grupos étnicos, siendo importante estudiar su morfología y morfometría. Se realizó el estudio sobre mandíbulas humanas adultas secas, de ambos sexos. El tamaño y la posición de los forámenes se determinaron utilizando calipers digitales. La incidencia y la forma del foramen mentoniano y forámenes mentales accesorios también fueron observados. El foramen mentoniano estaba presente en las 100 mandíbulas observadas, y fueron bilaterales. Forámenes mentales accesorios estaban presente en un 8 % en el lado izquierdo, mientras que en el lado derecho, un 5%. Ninguna de las mandíbulas presentó forámenes accesorios bilaterales. La forma era predominantemente redonda, 94% lado derecho y 87% lado izquierdo, mientras que ovalada se observó 6% lado derecho y 13% lado izquierdo. El tamaño promedio de foramen mentoniano fue de 2,79mm en el lado derecho, mientras que 2,57mm en el lado izquierdo. El tamaño promedio de los forámenes accesorios fue 1,00mm (rango 0,5-4,00 mm). El Foramen mental se ubicó por debajo del ápice del segundo premolar en un 68,8%, entre el primer y segundo premolar 17,8% y en el 11,5% se encontró entre segundo premolar y primer molar. Los forámenes accesorios se ubicaron 0,67mm lateral al foramen mentoniano y por debajo del ápice del primer molar.

PALABRAS CLAVE: Foramen mentoniano; Foramen mentoniano accesorio; Mandíbula; Nervio mentoniano; Premolares; Molares.

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