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ORIGINAL ARTICLE

Assessing the Radiographic Position of the Mental Forament in a Brazillian Population

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ABSTRACT

The mental foramen is a clinically important landmark for several clinical dental procedures. The aim of this study is to assess the anatomic position of the mental foramen (MF) in panoramic radiographs of a Brazilian population. The sample consisted of 2,100 panoramic radiographs, obtained from 8,600 clinical files from the School of Dentistry at the Universidade Federal do Paraná. Two calibrated examiners investigated the MF according to the classification of Tebo and Telford, which locates the right and left MF into 6 different positions in relation to the apex of the adjacent teeth. Results: The MFs were similarly distributed between the apices of the mandibular premolars (class III) and below the apex of the mandibular second premolar (class IV). More specifically, on the right side 41.8% (n = 878) of the MFs were classified as class III, while 47.52% (n = 998) were classified as class IV. On the left side 42.47% (n = 892) were classified as class III, while 47.38% (n = 995) were classified as class IV. The results indicate that MFs are often located adjacent to the apex of the mandibular second premolar. However, slight variations may occur in the positioning of the MF to the mesial direction. Clinicians and surgeons must be aware of the position of the MF and its potential variations prior to anaesthetics and surgical procedures in the mandible.

Keywords: anatomy, mental foramen, panoramic radiograph, oral surgery

Introduction

The technical knowledge on the position, course, and morphology of the Inferior Alveolar Nerve (IAN) plays a strategic and important role for clinical dental procedures in terms of diagnosis, treatment planning, and surgical approaches.[1] The IAN is part of a neurovascular bundle responsible for carrying blood and neural supply to the lower teeth, lower lip, adjacent bone, gingiva, and mucosa.[2,3] The mental nerve emerges through the mental foramen (MF) as a final branch of the IAN in the anterior region of the mandible. Thus, the MF is considered an important anatomic landmark for anaesthetic and surgical procedures in the mandible.

Current literature presents several studies on the localisation of the mental foramen.[4-13] However, there is no consensus on an accurate position of the MF. In 1950, Tebo and Telford proposed a classification postulating six different classes according to the position of the MF, in relation to the adjacent teeth.[14] This classification is still encouraged in epidemiological surveys and aims to detect any potential anatomic variations of the MF. This present study aims to investigate the position of the MF in a Brazilian sample of 2,100 patients utilitsing the classification proposed by Tebo and Telford.

METHODS

The present study was approved by the Committee of Ethics in Research of the Universidade Federal do Paraná–UFPR under the protocol number: 928.053.10.05.

Sample

A sample of 8,600 panoramic radiographs obtained from the clinical files of the Federal University of Paraná–UFPR (Curitiba, Brazil) were analysed. The images were taken for dental treatment purposes using an Orthopos Plus® (Siemens AG®, Berlin,

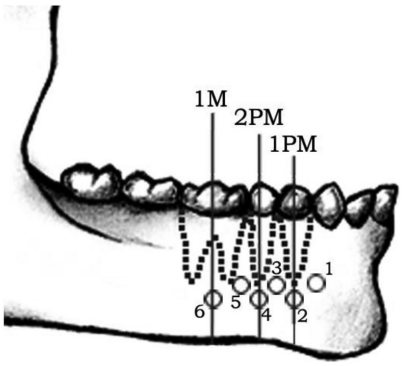

Figure 1. Illustrative distribution of the position of the mental foramen according to Tebo and Telford. 1M: mandibular first molar; 2PM: mandibular second premolar; 1PM: mandibular first premolar; Numbers from 1 to 6: Tebo and Telford's classes from I to VI, respectively.

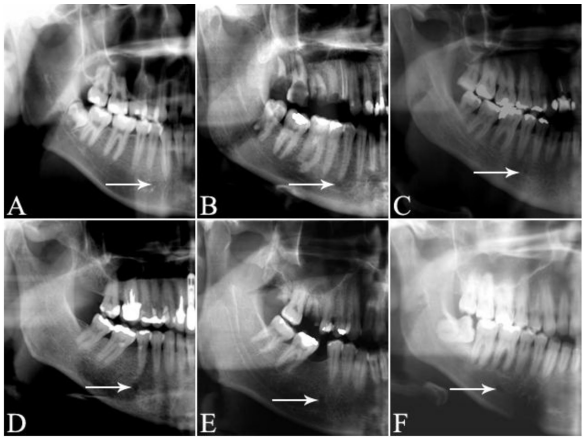

Figure 2 Radiographic findings on the position of the mental foramen according to the classification of Tebo and Telford. A: class I; B: class II; C: class III; D: class IV; E: class V; F: class VI.

Germany) panoramic device. A total of 6,500 patients without medical history, local pathologies visible in the panoramic radiographs, and low-quality images were excluded from the total sample. The final sample consisted of 2,100 panoramic radiographs, comprised of both male (n=798) and female (n=1302) patients. As such, the positions of 4,200 individual MFs were examined.

Radiographic analysis of the mental foramen

Two trained examiners analysed the panoramic radiographs simultaneously on light-boxes, in a dark room, in order to reach a consensus on the position of the MF, according to the classification of Tebo and Telford.[14] This classification places the right and left MF into six different positions in relation to the apex of adjacent teeth: i) class I – MF located mesial to the mandibular first premolar; ii) class II – MF located below the mandibular first premolar; iii) class III – MF located between the two mandibular premolars; iv) class IV – MF located below the mandibular second premolar; v) class V – MF located between the mandibular second premolar and first molar; and vi) class VI – MF below the mandibular first molar (Figures 1 and 2). Virtual vertical lines were drawn along the long axis of the adjacent teeth in order to aid the classification, accurately detecting horizontal variations within the position of the MF.

Statistical analysis

The obtained results were analysed using descriptive statistics. Additionally, the data was analysed using the normality test of Kolmogorov-Smirnov, Levene's Test for Equality of Variances, and Student's-test. Differences were considered statistically significant when $p<0.05$. All data was tabulated and statistical tests were performed with SPSS for Windows 13.0 (SPSS Inc., Chicago, Illinois, USA).

Table 1. Distribution of the position of mental foramina according to the classification of Tebo and Telford

Classification	Right side N (%)	Left side N (%)
Class I	5(0.23)	9(0.42)
Class II	100(4.7)	107(5.09)
Class III	878(41.8)	892(42.47)
Class IV	998(47.52)	995(47.38)
Class V	111(5.28)	87(4.14)
Class VI	8(0.38)	10(0.47)

RESULTS

The distribution of the MF into the six different classes revealed that 14 MFs (0.33%) were located according to class I; 207 MFs (4.93%) according to class II; 1,770 MFs (42.14%) according to class III; 1,993 MFs (47.45%) according to class IV; 198 MFs (4.72%) according to class V; and 18 MFs (0.43%) according to class VI.

The same pattern of distribution was detected when analysing the position of the mental foramen separately by each side (Table 1) and gender (Table 2). Statistical analyses did not reveal differences between sides and genders ($p>0.05$)

DISCUSSION

Epidemiological investigations provide scientific data that supports research on the prevalence of variations of anatomic structures in a specific population.[15] In

Table 2. Distribution of the position of mental foramina according to the classification of Tebo and Telford stratified for the gender

Classification	Male		Female	
	Right side N(%)	Left side N(%)	Right side N(%)	Left side N(%)
Class I	3(0.37)	4(0.5)	2(0.15)	5 (0.38)
Class II	36(4.52)	38(4.77)	64(4.92)	69(5.09)
Class III	301(37.81)	321(40.02)	582(44.8)	566(43.57)
Class IV	414(52.01)	382(47.98)	584(44.95)	613(47.19)
Class V	39(4.89)	46(5.77)	62(4.77)	41(3.15)
Class VI	3(0.37)	5(0.62)	5(0.38)	5(0.38)

addition, the epidemiological outcomes enable quality assurance prior to clinical interventions.

The interpretation of the MF position is often hampered by the superimposition of dental roots in panoramic radiographs, which can potentially culminate in inadequate clinical planning. Moreover, the incidence of radiation in the region of mandibular premolars does not follow the opening axis of the MF, highly varying the radiographic shape of the MF.[16] Clinically, the MF plays an important role during dental procedures such as local anaesthesia, periodontal flap surgery, endodontic apicoectomies, orthodontic mini-implant placement, conventional implant placement, and orthognatic osteotomies.[10,17] Accidents involving the violation of the MF consequently cause damage to the Mental and Inferior Alveolar nerves, and usually culminate in paraesthesia, hypoaesthesia, hyperaesthesia, and anaesthesia.[18]

This present study indicates that most of the MFs were located below the apex of the mandibular second premolars in this Brazilian population (47.4%). Sankar et al. (2011) reported a prevalence rate of 73% of MFs located below the mandibular second premolar in the dried skulls of Indian individuals.[19] Other studies have also observed similar results, such as Shankland (2004), Chong et al., (2017), and Singh and Srivastav (2010) who detected prevalence rates of 75.3%, 70%, and 68.8% respectively, of the MF in the same location.[5,20,21] Chkoura and El Wady also conducted a radiographic analysis of the mental foramen location in 2013.[21] Their study found a prevalence rate of 62.7% for the mental foramina positioned below the apex of the mandibular second premolar in a Moroccan population.

MFs located between both mandibular premolars also represented a large part of the sample investigated in this present study (42%). This position was reported by Gungor et al. (2006), and Gada and Nagda (2014) as the most prevalent in radiographs of Turkish (71.50%) and Asian (63%) individuals, respectively.[23,24] Similarly, Von Arx et al. (2013) used cone-beam computed tomography to report the same anatomic trend (56%).[25]

Despite certain similarities with previous epidemiological surveys, our results mainly found a distribution of the position of the MF below the apex of the mandibular second premolar and between the mandibular premolars. A similar distribution was also found in a study by Haghanifar and Rokouei in 2009 who investigated panoramic radiographs of Iranian subjects.[26] They found that 47.20% of MFs were located between the premolars, whilst 46% were located below the apex of the mandibular second premolar.

This present research indicates that the location of the MF varies slightly around the apex of the mandibular second premolar. Based on this, professionals in the field of health sciences must be updated according to the advances of epidemiological surveys in order to adequately face potential clinical challenges. More specifically, anatomic variations can represent an important barrier during surgical procedures in the mandible. Accurate detection of the position of the MF is useful to predict and reduce transoperative accidents and allows for optimal interventions.

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