

A Radiographic Study of Location of Mental Foramen in a Selected Turkish Population On Panoramic Radiograph

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ABSTRACT

Purpose of this study was to investigate the most common position of the mental foramen in a selected Turkish population. The study sample included three hundred and sixty one panoramic radiographs of selected Turkish population taken in Faculty of Dentistry, University of Gazi. The most common position of the mental foramen was between the first premolar and the second premolar (71.5%). The mental foramen was symmetrical in 90.4% of patients. In this study, the difference of the location of the mental foramen in different ethnics groups was discussed. Clinicians and anthropologists should expect to find the position of the mental foramen to be symmetrical and between the first premolar and the second premolar teeth.

Key words: mental foramen, anatomic location, panoramic radiography, mandible, implant

Introduction

The accurate clinical location of the mental foramen is usually a difficult procedure. Its position is generally described as being below the mandibular second premolar¹. However, individual variation could place the mental foramen anywhere from below the first premolar to between the roots of the first molar.

Knowledge of the position of the mental foramen is important both when administering regional anaesthesia, performing periapical surgery and dental implant surgery and endodontic treatments in the mandible. Although it is often possible to identify the mental foramen radiographically and by palpation, knowing the normal range of possible locations is essential².

The extra oral panoramic radiograph has gained popularity in the last four decades. The advantages of this technique over intra oral radiography include a greater area of third and soft tissue coverage, continuity of the visualized area, and rapidity with which the view is formed. The ability to view the entire body of the mandible should allow a more accurate location of the mental foramen in both a horizontal and vertical dimension¹.

Panoramic radiography is curved plane tomographic radiographic technique used to depict the body of the mandible, maxilla, and the lower one half of the maxillary sinuses on a single image. This modality is probably the most utilized diagnostic modality in implant dentistry³.

According to Yosue and Brooks^{4,5} the radiographic appearance of the mental foramen can be classified into four types: in the first the mental canal is continuous with the mandibular canal; the second is the separated type, where the foramen is distinctly separated from the mandibular canal; a third is said to be diffuse with a distinct border of the foramen, while the fourth group is the so-called »unidentified type«.

Neurovascular bundles of the supraorbital, infraorbital and mental foramina are important structures that need to be considered in local anesthesia and surgical procedures in the maxillofacial area. An understanding of the anatomy of the location of these block and avoiding injuries to the neurovascular bundles⁶.

The purpose of this study was to determine the location of mental foramen on panoramic radiographs in a selected Turkish population.

Material and Methods

In this study retrospectively panoramic radiograph taken from four hundred patients of the radiology department of Faculty of Dentistry at Gazi University was analyzed.

All radiographs were exposed at 66 kV and 16 mA for 17.6 s. with an Orthopantomograph OP100 (Trophy Instrumentarium Corp. FINLAND).

All panoramic radiographs were of dentate Turkish patients, with erupted first and second premolars and first molars. In addition, the films were free from radiolucent or radiopaque lesions in the lower arch and showed no exposure or processing artifacts. The youngest patient was 14 years-old and the oldest 57 years-old with a mean of 24.93 years. All panoramic radiographs which the mental foramen could not be identified were excluded from the study.

The panoramic radiographs of the 361 subjects were placed on a view box and a line was drawn on the radiographs with the longitudinal axis of a tooth and lying between two teeth.

Radiographs were investigated by one observer as twice. Observations were repeated with a random sample of 50 radiographs which were re-examined.

The position of the image of the mental foramen was recorded according to the categories by Jasser and Nwoku.⁷

Position 1: Situated anterior to the first premolar.

Position 2: In line with the first premolar.

Position 3: Between the first and second premolar.

Position 4: In line with the second premolar.

Position 5: Between the second premolar and first molar.

Position 6: In line with the first molar (Figure 1).

Statistical analysis was performed using a SPSS for windows release 7.5.1. Gamma test was used to deter-

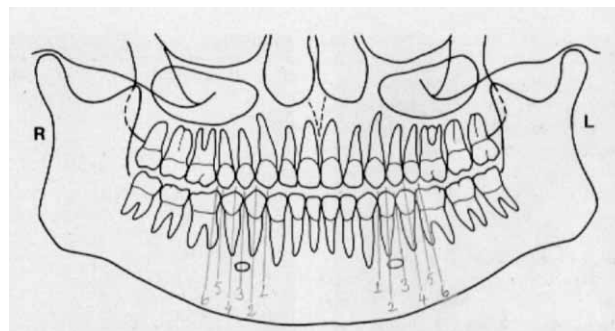


Fig. 1. Determining the position of the mental foramen.

mine the relationship between two ordinal variables (right positions and left positions of mental foramen). (Gamma statistic: 0.955, $p < 0.001$). A Chi-square-test was applied to explore the relation between two categorical variables.

Results

The appearance and location of mental foramina were determined on panoramic radiographs of 361 patients. Of these, 144 were male and 217 were female (Table 1–3).

In 71.5% of cases the mental foramen was in between the first and second premolars and in 22.4% in line with the second premolar. The position of the mental foramen was symmetric in 85.8% and asymmetric in 14.2% of cases.

In the asymmetric cases, on the right side on the mandibular, 50% of mental foramen was located between the second premolar and first molar; while on the left side 50% were located in line with the second premolar.

In addition 42.9% of the foramens on the right side were found to be in line with the first premolar and between the first and second premolar on the left side.

It is appeared decade and location distribution of mental foramen (Table 4).

TABLE 1
FREQUENCY OF LOCATION OF THE MENTAL FORAMEN IN RELATION TO THE APICES OF TEETH AND INTERDENTAL SPACES ON THE PANORAMIC RADIOGRAPHS OF 361 SELECTED TURKISH POPULATIONS AT 722 SIDES (LEFT AND RIGHT SIDES) OF THE MANDIBLE

Location	Male		Female		Total	
	Side frequency	%	Side frequency	%	Side frequency	%
1: Situated anterior to the first premolar	7	2.4	2	0.5	9	1.2
2: In line with the first premolar	6	2.1	17	3.9	23	3.2
3: Between the first and second premolar	192	66.7	324	74.7	516	71.5
4: In line with the second premolar	78	27.1	84	19.4	162	22.4
5: Between the second premolar and first molar	5	1.7	7	1.6	12	1.7
6: In line with first molar	0	0	0	0	0	0
Total	288	100.00	434	100.00	722	100.00

TABLE 2

DISTRIBUTION OF ASYMMETRICAL MENTAL FORAMINA IN RELATION TO THE APICES OF THE TEETH AND INTERDENTAL SPACES ON THE PANORAMIC RADIOGRAPHS OF 51 PATIENTS

Location of mental foramen	Number	Percentage
1: Situated anterior to the first premolar	0	0
2: In line with the first premolar	7	2
3: Between the first and second premolar	21	6
4: In line with the second premolar	20	5.4
5: Between the second premolar and first molar	3	0.8
6: In line with first molar	0	0
Total	51	14.2

TABLE 3

DISTRIBUTION OF SYMMETRICAL MENTAL FORAMINA IN RELATION TO THE APICES OF THE TEETH AND INTERDENTAL SPACES ON THE PANORAMIC RADIOGRAPHS OF 310 PATIENTS

Location of mental foramen	Number	Percentage
1: Situated anterior to the first premolar	3	.8
2: In line with the first premolar	7	1.9
3: Between the first and second premolar	235	65.1
4: In line with the second premolar	62	17.2
5: Between the second premolar and first molar	3	.8
6: In line with first molar	0	0
Total	310	85.8

TABLE 4

DECADE AND LOCATION DISTRIBUTION OF MENTAL FORAMEN

Right								Left						
Decade	1	2	3	4	5	6	Total	1	2	3	4	5	6	Total
14–24	2	9	164	45	4	0	224	4	7	171	40	2	0	224
25–35	1	5	72	16	2	0	96	2	2	69	19	4	0	96
36–46	0	0	16	19	0	0	35	0	0	15	20	0	0	35
47–57	0	0	4	2	0	0	6	0	0	5	1	0	0	6
Total	3	14	256	82	6	0	361	6	9	260	80	6	0	361

Discussion

Radiography is the only available non-invasive method for diagnosis and treatment planning of major surgical procedures of the mandible. Panoramic radiographs are commonly used for screening, diagnosis, and selecting the best possible surgical approach⁸.

The location of the mental foramen could change during the development of the jaws⁹; therefore, panoramic radiographs taken from patients who had completed their development were evaluated in this study. In addition, patients having missing teeth were excluded from the study because the evaluation was made according to the present canines, premolars, and molars.

We utilized panoramic radiographs because they have certain advantages over intra-oral radiography. It includes a greater area of hard and soft tissues and also the visualized area in continuity, thus allowing for a more accurate location of the mental foramen in both the horizontal and vertical dimensions. On the other hand, periapical radiographs may not show several positions of the mental foramen if it is below the edge of the film¹⁰.

In the research literature the mental foramen is frequently described as situated in the region of the second premolar in the fully developed mandible, but individual variations may occur occasionally^{1,10,11}. In our analysis of 361 panoramic radiographs, we found the mental foramen

positioned anywhere between the long axis of the canine to that of the mesiobuccal root of the first molar. The result of our study was similar to the other studies.

According to the anatomy text by Sicher and DuBrul, the mental foramen lies midway between the free alveolar border and the border of the mandible or closer to the latter¹².

Studies done in other ethnic and racial groups were shown (Table 5)^{13, 14}.

Sample size of the studies above varied between 40 and 2000. In our study our sample size was 361 people. The weighted frequency of the location of the mental foramen in the above studies was in position 3. It was similar in our study.

Our study design was similar with Jasser's study design⁷. Our results and Jasser's studies results were shown (Table 6).

The location of the mental foramen most commonly was found along the longitudinal axis of the second premolar tooth in other studies, our study of Turkish patients placed the location of the mental foramen between the first premolar and the second premolar teeth.

Although our study is limited with a group of people; according to the analysis of the Table 5, our results are similar with the other countries. But also advanced studies are necessary to achieve clearer results.

TABLE 5
SUMMARY DATA ON THE POSITION OF THE MENTAL FORAMEN (GREEN 1987, SHANKLAND 1994)

Sample size	Distribution %						Population studied	Reference
	Average	1	2	3	4	5		
50	1.96	40	28	30	0	2	French	Olivier
150	2.30	20	27	48	3	0	Yugoslavian	Stosic
262	2.40	10	42	46	2	0	Russian	Gruber
150	2.40	6	48	46	0	0	German	Moral
60	2.44	8	45	42	5	0	German	Merkel
100	2.46	0	61	32	7	0	German	Hubner
108	2.52	8	39	46	6	0	Italian	Esposito
72	2.55	11	36	39	14	0	Meican(Ketchipauan)	Kay
100	2.57	12	22	63	3	0	Central European	Ashley-Montagu
1033	2.59	1	44	50	5	0	British	Kay
138	2.62	7	34	49	10	0	Whites	Simonton
1000	2.63	6	35	50	8	1	Italian	Toni and Favero
336	2.67	5	32	55	8	0	Mixed Amerindian	Simonton
55	2.69	6	26	62	6	0	German	Sachse
494	2.69	6	32	51	9	2	Italian	Martani and Stefanini
300	2.70	0	34	58	7	0	Russian	Kuznetsova
372	2.73	2	25	63	8	0	Brazilian	De Freitas
40	2.76	11	40	32	16	5	European	Esposito
75	2.79	3	38	40	20	0	Hindu	Miler
114	2.83	4	25	56	14	1	Eskimo	Simonton
898	2.88	1	29	54	9	6	Egyptian	Kay
250	2.89	1	13	78	7	0	Beijing Chinese	Zhang
60	2.90	0	23	63	13	0	Australasian(Sarawak)	Kay
150	2.92	2	20	64	13	1	Kentucky Indian	Simonton
272	2.92	0	22	64	14	0	Japanese	Akabori
76	2.99	0	31	43	23	3	Melanesian	Esposito
760	3.00	1	20	58	20	1	Shenyang Chinese	Zhang
100	3.01	2	23	49	24	2	American	Tebo and Telford
860	3.01	0	18	64	17	1	Chengdu Chinese	Wang
87	3.05	0	21	51	25	2	Hong Kong Chinese	Green
152	3.07	4	26	32	34	4	Egyptian(Sud Kerma)	Kay
58	3.07	0	21	59	14	7	African(Teita)	Kay
516	3.08	0	12	66	19	2	Kunming Chinese	Zhang
108	3.14	0	6	79	9	6	Arkansas Indian	Simonton
330	3.15	0	6	57	33	0	East African(Bantu)	Zivanovic
1100	3.15	0	10	66	23	1	Shanghai Chinese	Wang et al
302	3.16	0	13	61	23	3	Thai	Boonpiruk
159	3.16	3	19	47	25	7	Egyptian	Simonton
262	3.17	0	15	54	30	1	Japanese	Hori
192	3.21	0	15	51	32	2	African	Kay
2000	3.26	0	6	65	26	3	Chengdu Chinese	Zhang
58	3.34	2	10	41	41	5	Melanesian	Simonton
41	3.37	0	2	70	12	15	East African(Bantu)	Schultz
208	3.69	0	1	45	38	16	Australian aboriginal	Murphy
313	3.04	4	18	55	15	7	Singaprean Malasy and Indians	Neo
604	2.89	2	27	56	12	3	Nigerians	Kekere-Ekun
100	3.00	0	21	59	19	1	Chinese	Wang et al
150	3.01	0	18	63	19	0	Unknown	Phillips et al
138	3.16	0	6	75	12	4	Asian Indian	Shankland

TABLE 6
SUMMARY DATA ON THE POSITION OF THE MENTAL FORAMEN (JASSER AND NWOKU 1998, GUNGOR ET AL., PRESENT STUDY)

Reference	Population	Sample size	Distribution %					
			1	2	3	4	5	6
Jasser and Nwoku (1998)	Saudis	794	0.6	5.3	42.7	45.3	5.2	0.9
Present study	Turkish	722	1.2	3.2	71.5	22.4	1.7	0.0

In conclusion, according to our results the location of the mental foramen on the panoramic radiographs of selected Turkish population was most commonly in between the first and second premolars. In majority of cases there was bilateral symmetry in the position.

Clinicians and anthropologist should expect to find the positions of the mental foramen to be symmetrical and between the first premolar and the second premolar teeth.

REFERENCES

1. PHILLIPS, J. L., N. R. WELLER, J. C. KULILD, J. Endod., 18 (1992) 383. – 2. MOISEWITSCH, J. R., Oral Surg. Oral Pathol. Oral Radiol. Endod., 85 (1998) 457. – 3. GULER, A. U., M. SUMER, P. SUMER, I. BICER, J. Oral Rehabil., 32 (2005) 741. – 4. YOSUE, T., S. L. BROOKS, Oral Surg. Oral Med. Oral Pathol., 68 (1989) 360. – 5. YOSUE, T., S. L. BROOKS, Oral Surg. Oral Med. Oral Pathol., 68 (1989) 488. – 6. AGH-TONG, S., T. HUANMANOP, V. CHENTANEZ, J. Oral Maxillofac. Surg., 63 (2005) 800. – 7. JASSER, N. M., A. L. NWOKU, Dentomaxillofac. Radiol., 27 (1998) 341. – 8. KAFFE, I., L. ARDEKIAN, I. GELERENTER, S. TAICHER, Oral Surg. Oral Med. Oral Pathol., 78 (1994) 662. – 9. KJAER, I., Scan. J. Dent. Res., 97 (1989) 1. – 10. PHILLIPS, J. L., R. N. WELLER, J. C. KULILD, J. Endod., 18 (1992) 271. – 11. PHILLIPS, J. L., R. N. WELLER, J. C. KULILD, J. Endod., 16 (1990) 221. – 12. SICHER, H., E. DU BRUL: Oral anatomy. (The CV Mosby Co., St. Louis, 1975). – 13. GREEN, R. M., Oral Surg. Oral Pathol., 63 (1987) 287. – 14. SHANKLAND, W. E., J. Oral Implantol., 20 (1994) 118.

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ISTRAŽIVANJE LOKACIJE MENTALNOG FORAMENA PANORAMSKIM RADIOGRAFIJAMA NA ODABRANOJ POPULACIJI U TURSKOJ

SAŽETAK

Cilj ove studije bio je istražiti najčešću lokaciju mentalnog foramena na odabranoj populaciji u Turskoj. Ova studija uključuje tristo šezdeset i jedan panoramski radiograf odabrane turske populacije uzete na stomatološkom fakultetu, sveučilišta u Gazi. Najčešći položaj mentalnog foramena bio je između prvog i drugog pretkutnjaka (71.5%), a simetričan je bio u 90.4% pacijenata. U studiji je raspravljano i o različitoj lokaciji mentalnog foramena kod raznih etničkih grupa. Kliničara i Antropolozi trebali bi očekivati simetričan položaj mentalnog foramena između prvog i drugog pretkutnjaka.