NEAR EAST UNIVERSITY

INSTITUTE OF GRADUATE STUDIES

DEPARTMENT OF ANATOMY FACULTY OF MEDICINE

DISTANCE MEASUREMENT OF MANDIBULAR CANAL COURSE AND THE POSITION OF THE MENTAL FORAMEN BY PANORAMIC X-RAY IN NICOSIA CYPRUS INDIVIDUALS

MSc. THESIS

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Prof. Dr. Selda Önderoğlu

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Approval

We certify that we have read the thesis submitted by Ahsan Hanıf **Distance measurement of Mandibular Canal Course and the Position of the Mental Foramen by Panoramic X-Ray in Nicosia Cyprus individuals.** " and that in our combined opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master Of Anatomy

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Declaration

I hereby declare that the thesis study titled, **Distance measurement of Mandibular Canal Course and the Position of the Mental Foramen by Panoramic X-Ray in Nicosia Cyprus individuals** is the bonafide research carried out by me under the supervision of Prof. Dr. Selda Önderoğlu Department of Anatomy Faculty of Medicine, Near East University, Nicosia, Cyprus. I was not involved in any unethical behavior throughout the course of this study. I obtained all the information in the thesis based on academic and ethical guidelines. All the information not obtained by the study was properly referenced. I further declare that there was no breach of patent rights or copyright infringement during the course of this thesis.

Ahsan Hanif

05/07/2022

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List of abbreviations

MF mental foramen

CBCT cone-beam computed tomography

MC mandibular canal

MCR mandibular teeth root

IANB inferior alveolar nerve block

PAN panoramic x-rays

Distance measurement of Mandibular Canal Course and the Position of the Mental Foramen by Panoramic X-Ray in Nicosia Cyprus individuals

Summary:

A descriptive cross sectional and retrospective, study was conducted in Nicosia Cyprus. Convenient sampling technique was used. Patient X-rays are divided into two categories based on age and gender: girls 18 to 34 years old and males 18 to 34 years old. Data were collected from Near East Dental Hospital Nicosia Cyprus., The reference points selected for measuring the distances are plainly visible in panoramic X-rays. Sidexis 4 software was used to take linear measures. And those were excluded who had Pre extracted premolars, Disease or genetically inherited anomaly that may affect X-ray interpretation, X-rays of patients with poorly positioned teeth in relation to the MF and the inferior teeth, as well as MF excluded or not recognizable in the PAN. In younger people, the MF is generally located between the first and second premolar apices, while in older people, it is immediately below the inferior second premolar apex. The distances on both sides and on the right side had statistically different mean values for males and females, with males having larger mean values. Females had a moderate positive association with distances but males had a high positive correlation on right side, D2, D3, D5, and D7, on the other hand, displayed a strong left-right association. We discovered a substantial difference when compared to other populations, implying that the MC course differs by ethnic group. Variations in people and populations make it necessary for dentists and surgeons to plan carefully before doing operations in this area.

CHAPTER I:

Introduction:

The mental foramen is a bilateral hole in the vestibular section of the mandible from which nerve endings emerge, including the mental nerve. The mental foramen is usually found between the lower premolars. The inferior alveolar neurovascular bundle can nourish the teeth, jawbone, and soft tissue around the gingiva and lower lip through the mandibular canal, which runs through the mandible. It is an anatomical structure with several branches and variants, rather than a single canal. Depending on the number and shape of the branches, they are called auxiliary, bifid, or trifid canals. Anatomically, a bifid mandibular canal is more prevalent than a trifid mandibular canal.(**Ngeow & Chai, 2020**) The mental foramen (MF) is a funnel-like orifice on the lateral surface of the jaw at the mandibular canal's terminal. MF transmits a bundle of mental neurons and blood arteries on both sides of the mandible, delivering sensory innervations and nutrition to the skin and mucosa of the lower lip, cheeks, and chin.(**Nagarajappa, Alam, Alanazi, Bandela, & Faruqi, 2021**) The foramen of the mandible is the most significant factor to consider. Although the position of this foramen appears to be steady, there are numerous disagreements about it. Authors amended data from literature based on current literature, taking into account the location of the mandibular foramen.(**Lipski et al., 2013**)

In all of the patients, the dentoalveolar plane was consistently higher than the mandibular foramen. A horizontal corticotomy at a level exactly above the mandibular dentoalveolar plane protects the inferior alveolar nerve in neonatal Saint Robins people treated horizontal linear mandibular displacement.(**Do, Klement, & Denny, 2020**)

In an edentulous mandible, a previously recorded anatomic variant was discovered bilaterally, consisting of a depressed location of the MF, with seemingly compensatory extension and enlargement of the sulcus colli, resulting in to be shortened MCs. In addition, an unusual neurovascular canal of the mandible's neck was discovered unilaterally in another example and is reported here.(**Cârstocea, Săndulescu, Hostiuc, & Rusu, 2020**)

This study looked at the position of the mental foramen (MF) in relation to the occlusal plane (OP) and the anterior border (AB) of the mandibular ramus (AB) in a group of Saudi children. The position of the MF changes with age and should be considered when administering inferior alveolar nerve blocks to children in order to achieve more effective anaesthesia.(**Madiraju, Mahabob, & Bello, 2021**)

1.1 Statement of the problem:

The purpose of this study was to examine the morphology and morphometry of the mandibular canal (MC) course and the mental foramen (MF) position in relation to the inferior teeth using panoramic X-ray (PAN) in people from North Cyprus.

1.2 Objective:

The goal of this study was to use panoramic X-rays (PAN) to examine the morphological and morphometry of the mandibular canal (MC) course and mental foramen (MF) position in relation to the inferior teeth.

1.3 Hypotheses:

1.3.1 Alternative hypothesis:

There is a marked difference in the morphological characteristics and the morphometry of the mental foramen (MF) position in relation to the lower teeth and the mandibular canal (MC) course by using the panoramic X-ray (PAN) in males than in females.

1.3.2 Null hypothesis:

There is a no marked difference in the morphological characteristics and the morphometry of the mental foramen (MF) position in relation to the lower teeth and the mandibular canal (MC) course by using the panoramic X-ray (PAN) in males than in females.

1.4 Significance of the study:

When performing treatments in the mandible, understanding the mandibular canal anatomy and location is critical in order to maintain anatomical components that travel through it. Anatomical knowledge of the region not only contributes to accomplishment in some methodologies, such as effective regional anesthesia inside the inferior alveolar nerve terminal branches, but it can also be a deciding tool in

minimizing paresthesia and internal bleeding, as well as lowering the risk of complications during medical procedures such as osteotomy and mandibular implant positioning.(**Gloria Cartes, Ivonne Garay, Naira Figueiredo Deana, Pablo Navarro, & Nilton Alves, 2018**)

Previous research has revealed that the mandibular canal course and mental foramen position can differ among populations. Previous investigations with macerated mandibles demonstrated a connection among the mandibular foramen and age position, with younger males having a much higher location than older males and younger females having a more posterior site than older females.

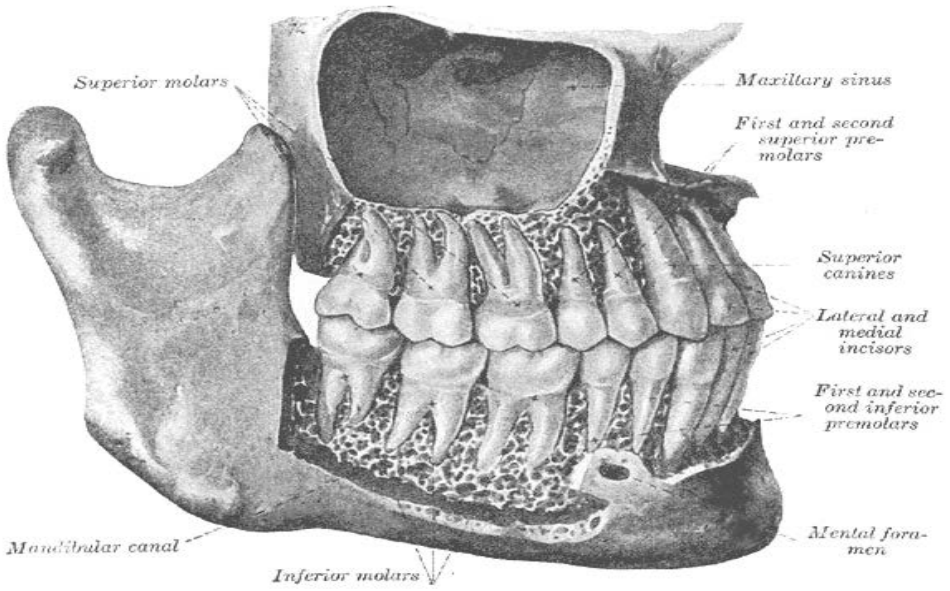
1.5 Definitions of the terms:

Mental foramen:

The mental foramen is a bilateral hole in the vestibular section of the mandible from which nerve endings emerge, including the mental nerve. The mental foramen is usually found between the lower premolars.

Mandibular canal:

In human anatomy, the mandibular canal houses the inferior alveolar nerve, inferior alveolar artery, and inferior alveolar vein. It travels down and forward obliquely in the ramus, then vertically forward from the body, crossing under the alveoli and interacting with them through small apertures. When it reaches the incisor teeth, it turns back to connect with the mental foramen, releasing a small canal called the mandibular incisive canal that leads to the incisor tooth cavities. It carries the inferior alveolar nerve and artery branches. The mental foramen (which opens onto the front of the mandible) and the mandibular foramen are connected (on medial aspect of ramus).(**Ketabi, Zelka, Lauer, & Hassfeld, 2021**)



Panoramic X–ray:

Panoramic dental x-rays use a very low dose of ionizing radiation to capture the entire mouth in one image. It's a common process used by dentists and oral surgeons to plan treatment for dentures, braces, extractions, and implants. There is no further preparation required for this exam. Tell your doctor if you suspect you could be pregnant. Remove any jewelry, spectacles, or metal objects that can distort the x-ray images. A lead apron will be required to shield the rest of your body from radiation.

CHAPTER II

Literature review

In 2021 a study was conducted by the Najmeh at el the mandible does not develop at a consistent rate, as is well known. The growth of the mandible and the maturation of the cervical vertebrae have a strong relationship the third stage of cervical vertebral development is completed; the mandible reaches its maximum growth velocity. Clinicians are interested in the position of the mental foramen (MF) and how it varies over time as it relates to inferior alveolar nerve anesthesia and mandibular surgical procedures. As a result, the purpose of this study was to see how the mandibular growth spurt affected the MF's positioning in various skeletal growth patterns. They came to the conclusion that during the mandibular growth spurt, the horizontal location of the MF in orthographic and retro gnathic patients moves in an anterior direction. During this time, the vertical position of the mandibular foramen stays unaltered.(**Movahhedian & Sardarian, 2021**)

Gloria cartes et al in 2018 conducted a study that the goal of this study was to use panoramic X-rays (PAN) the structure and morphological characteristics of the mandibular canal (MC) course, as well as the position of the mental foramen (MF) in regard to the lower teeth Vertical linear assessments of each mandible were evaluated to calculate the length of the distances investigated. The MF and inferior premolar tooth roots, as well as the MC and mandibular tooth roots, were studied. The MF was generally located between the apices of the first and second premolars in younger people, and just below the apex of the inferior second premolar in older persons. Both MC and the third molar had a close association that was unaffected by sex or age group. There was a notable gender difference in the distances evaluated in this study, with males having higher values than females. Dentists and surgeons must plan ahead of time for surgeries involving this area due to the variances that can develop between people and communities.(**G. Cartes, I. Garay, N. F. Deana, P. Navarro, & N. Alves, 2018**)

Navin Hadadi et al conducted a study in 2017 and the objective for Inferior Alveolar Nerve Block (IANB), the Mental Foramen (MF) is a marker for delivering local anesthetic solution. Even within the same person, the position of MF varies greatly depending on ethnicity, age, and even on both sides. Failure to obtain IANB, which

results in repeated injections of the local anesthetic solution, can cause not only behavioral problems in children, but also systemic hazardous levels of anesthetic solution to be delivered. In all three groups, the distance between the mandibular lingual and the occlusal plane increased gradually, which was statistically significant. For any of the age groups studied, the position of the mandibular foramen is not bilaterally symmetrical.(**Krishnamurthy, Unnikrishnan, Ramachandra, & Arali, 2017**)

Hooman Khorshidi et al. conducted a study in 2017 that estimating the relative position of the inferior alveolar nerve (IAN) canal and its relationship to mandibular anatomical landmarks might help reduce the risk of surgery problems including neurosensory abnormalities that can develop after invasive mandibular surgical operations. The researchers wanted to compare the anatomical position & computed tomography path of the mandibular canal to anatomical features on CBCT, discuss clinical implications, and investigate whether there were any possible connections between both the mandibular location and the patients' age. Pre - operative CBCT evaluation of the IAN's exact course through the mandible's body may help in precise and effective preoperative treatment and, as a result, enhance surgical outcomes. The findings of this study support the use of CBCT to determine differences in the relative position and course of the IAN canal prior to invasive surgical treatments.(**Khorshidi, Raoofi, Ghapanchi, Shahidi, & Paknahad, 2017**)

In 2016 this study was carried out by the Abdullah Ibrahim et al. that the site of the mental foramen in cadaver specimens has been widely studied, both radiographically and intraoperatively. To our knowledge, the location of the mental foramen in respect to the mandibular third molar teeth was assessed using ultrasonography for the first time in a study population. Ultrasonography has the potential to revolutionize medicine and dento-maxillofacial surgery even more. Ultrasound, a sensitive tool, can be used to locate the mental foramen. The most common location of the mental foramen in respect to the premolar teeth's long axis varies. Ultrasonography has the potential to transform dental and maxillofacial surgery.(**Laher, Motara, & Moolla, 2016**)

Christiano et al. conducted a study in 2012 that the surgical operations involving the mandible can put the neurovascular bundle at risk, especially when anatomical differences are present. Because of the increased demand for implant procedures, the

increased availability of three-dimensional tests, and the lack of unambiguous descriptions in the literature, anatomical variances should be addressed. The purpose of the research was to look at structural alterations in the mandibular canal (MC), such as bifid canals, the anterior loop of the mental nerve. Our findings, when merged with previous reports limitations of conventional exams, demonstrate the uncertainty of pathological changes in neuro-vascularization, trying to demonstrate the significance of personal evaluation have used differing opinions of three-dimensional image analysis previous to mandibular surgical procedures.(**de Oliveira-Santos et al., 2012**)

Ayla Ozturk DDS et al. in 2012 carried out a study that the goal of this research was to look at the topography of the mandibular canal (MC) in both vertical and occlusal dimensions and describe it. The vertical and axial diameters of the mandibular canal, as well as variations in its route, have been categorized. In addition to the diverse anatomic configurations of MC, doctors should be aware of them before doing any surgical treatments involving the posterior mandible.(**Ozturk, Potluri, & Vieira, 2012**)

In 2011 Marcello Rodrigues de et al. conducted a study that the goal of this study was to determine the proper location of the mandibular canal (MC), which is critical for avoiding damage to the inferior alveolar neurovascular bundle during oral surgical operations. Our morphometric findings may aid in the clarification of the precise anatomy of the MC and its topographical relationships for dental implant planning.(**de Oliveira Júnior et al., 2011**)

CHAPTER III:

Methodology

3.1 Research Design:

A cross-sectional, descriptive, retrospective study

3.2 Participants/Population & the Sample / Study Group:

Patient X-rays were divided into two groups based on age and gender: females between the ages of 18 and 34, males between 18 and 34 years. Data was collected from Near East Hospital Nicosia North Cyprus.

3.3 Inclusion criteria

Patients age of 18-34

The reference points for measuring distances are plainly visible in panoramic X-rays.

PAX-400C orthopantomography was used to take PAN x-rays , and sidexis is 4 program was used to take linear measures.

3.4 Exclusion criteria

Pre extracted premolars

Injuries and operations in the region that could alter the interpretation of X-rays

X-ray interpretation may be affected by illness or a genetic abnormality.

X-rays of individuals having crooked teeth in the mental foramen/lower teeth relationship.

In the PAN, the mental foramen is nonexistent or barely discernible.

3.5 Data Collection Tools / Materials:

Linear measurements for mandibular foramen and mandibular canal

Using sidexis 4 software, exact relationship data were measured in digital PAN using particular places on the mandible as points of reference.

3.6 Reference points for mandibular canal

D1 Vertical distance between the mental foramen's inferior border and the base of the mandible's inferior limit

D2 The distance between the superior border of the mental foramen and the upper border of the highest alveolar ridge in the vertical direction.

D3 Vertical distance along a vertical line along the anterior border of the mandibular ramus from the inferior border of the mandibular canal to the inferior border of the base of the mandible.

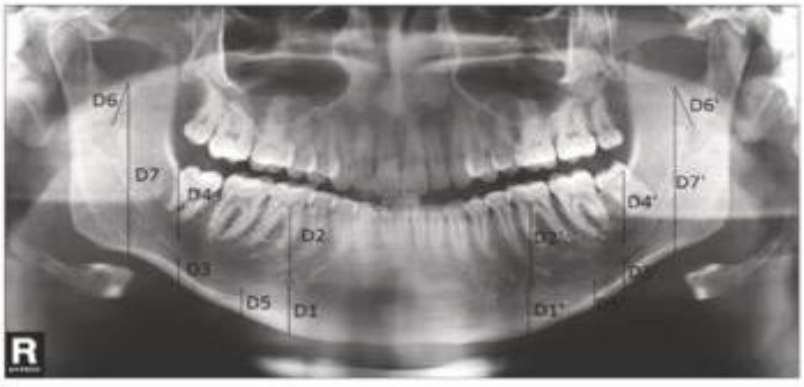
D4 On a vertical line along the anterior border of the mandibular ramus, measure the length from the superior border of the mandibular canal to the lower boundary of the horizontal line.

D5 Vertical distance between the mandibular canals' lowest point and the inferior limit of the mandible's base.

D6 Vertical distance between the mandibular foramen and the lowest point of the mandibular prominence.

D7 Vertical distance between the mandibular notches' lowest point and the lower boundary of the mandibular ramus.

For distances, average results were derived taking into account sex, gender, and age group.



3.7 Reference points for mental foramen

There are five classifications for the relationship between the mental foramen and the inferior premolar roots.

Type 1: anterior to the first premolar on the lower jaw

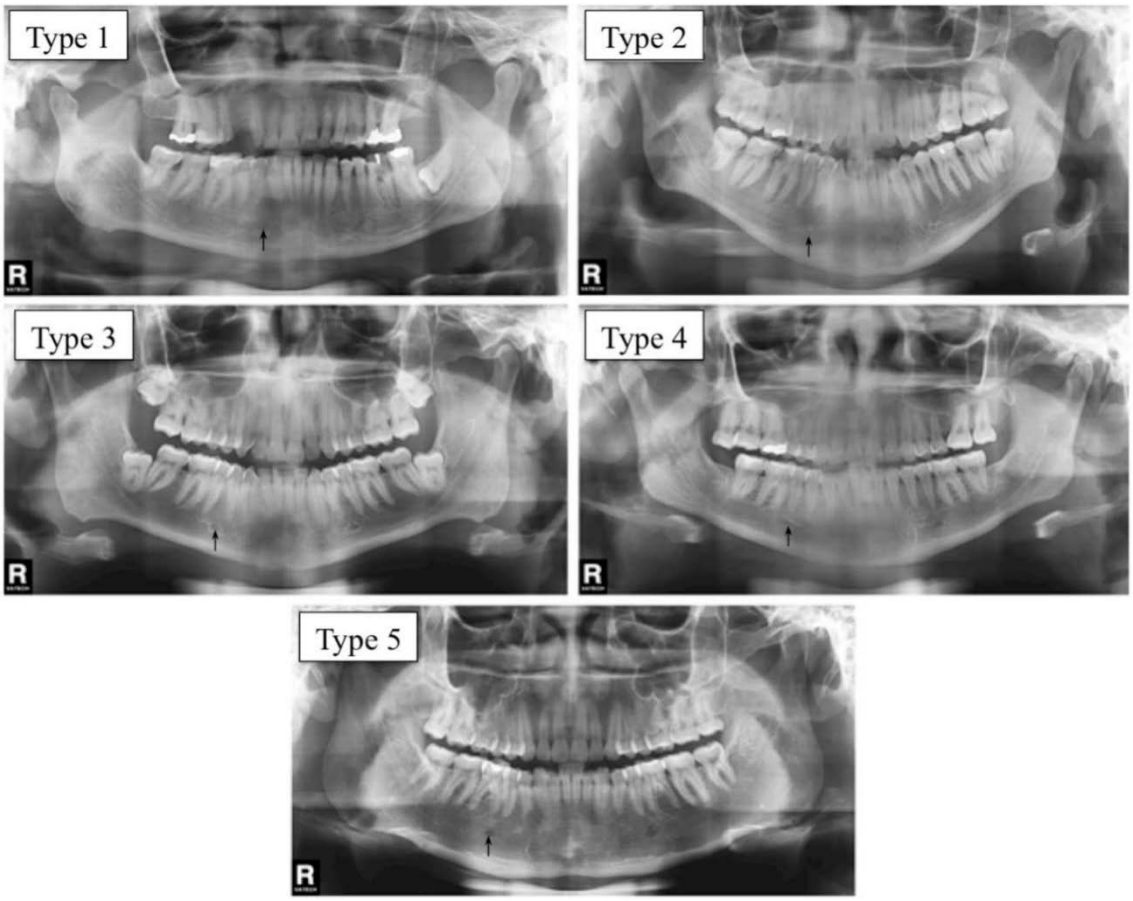
Type 2: below the tip of the inferior first premolar

Type 3: between the roots of the inferior premolars

Type 4: just behind the apex of the lower second premolar

Type 5: dorsal to the second premolar on the lower jaw.

The proportion of each MF location category was computed, and an analysis of sex, side, and age were performed.



Panoramic X-rays show the link between the mental foramen (arrows) and the inferior premolar roots. Type 1: on the lower jaw, anterior to the first premolar. Type 2: below

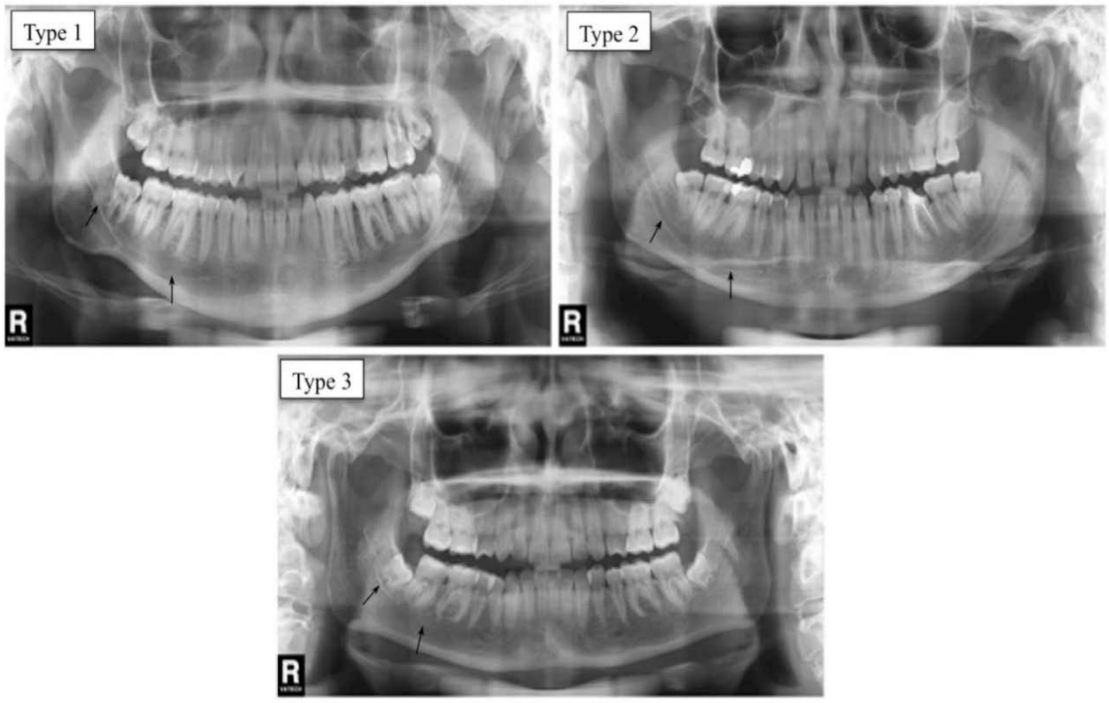
the inferior first premolar's apex. Type 3: Between the inferior premolars' roots. Type 4: right beneath the inferior second premolar's tip. Type 5: on the lower jaw, posterior to the second premolar.(**Gloria Cartes et al., 2018**)

3.8 Data Collection Procedures:

A descriptive, retrospective, cross-sectional study was conducted in Nicosia Cyprus. Convenient sampling technique was used. Patient X-rays are divided into two groups based on age and gender: females between the ages of 18 and 34, males between 18 and 34 years. Data were collected from Near East Hospital Nicosia Cyprus. Those patients were included who had the Patients age of 18-34, The reference points selected for measuring the distances are plainly visible in panoramic X-rays. PAX-400C orthopantomography was used to take PAN x-rays, and sidexis 4 software was used to take linear measures. And those were excluded who had Pre extracted premolars. Data was analyzed by using SPSS version 23. Both descriptive and inferential statistics were applied. In order to evaluate the statistical significance P-values were calculated by applying the chi square test by setting confidence interval at 95%. Level of satisfaction was calculated against the derived cut of values.

3.9 Data Analysis Procedures:

Data were analyzed by using SPSS version 23. Both descriptive and inferential statistics were applied. In order to evaluate the statistical significance P-values were calculated by applying the chi square test by setting confidence interval at 95%. Level of satisfaction was calculated against the derived cut of values.



The different types of relationships between the mandibular canal and the inferior roots are depicted in panoramic X-rays. Type 1: The mandibular canal and the root of the third molar are close together. At this point, the mandibular canal begins to diverge somewhat from the roots. Type 2: The mandibular canal and roots are separated. Type 3: The roots and mandibular canal are near together.(**Gloria Cartes et al., 2018**)

CHAPTER IV

4. Results

There were 222 females and 178 males among the 400 panoramic X-rays were analyzed. The 222 females between the ages of 18 and 34, with a mean age of (25.99+4.93).178 males between the ages of 18 and 34 Means (26.16 + 4.74)

Linear Measurements D1-D7: Table 1 shows the mean values for D1-D7, broken down by sex, side, and age group.

Analysis between Age Groups: When the distances D1 to D7 were evaluated across age groups and left/right sides, statistically significant differences were discovered in both male and female participants.

Analysis by Sex: Males and females aged 18-34 years showed statistically significant differences in all distances except D3xD5, with males having higher mean score than females on both sides. On both sides and on the right side, males and females had statistically different mean values for the distances D1, D2, D6, and D7, with males having greater mean values. A significant difference was discovered between males and females for all distances (p0.01) b when the full sample was evaluated using the paired t sample test, with males having higher mean values than females.

Correlation between Distances: Females had a moderate positive association with distances D6xD7, but males had a high positive correlation with D1xD2 right side, D2, D3, D5, and D7, on the other hand, displayed a strong left-right association. Table 2 shows the associations between the distances.

Relation between the Mandibular Canal and the Roots of the Inferior Teeth (MCR):

The MCR did not distinguish substantially in between two groups statistically. In both boys and females, the mandibular canal was most commonly seen near the third tooth. The second most common association in males was no proximity between the mandibular canal and roots, while the second most common relationship in females was proximity between the mandibular canal and all roots, with statistically significant differences. ($p<0.01$).

The Chi-squared test was used for qualitative variables which indicate highest p value (1.000) but the data was statistically significant. It also found that females had high asymptomatic significance than males both in left and right sides presented in table 3.

MF positions:

The percentages found for each MF type by sex, side, and age group are shown in Table 4. Males' MF position percentages differed significantly by side, with Type 3 being more common on the left side and Type 4 on the right. For the MF position, no significant differences between sexes were discovered.

Distances	Female Mean	Female S. D	Male Mean	Male S. D
$D1^{L}$	13.86	±2.40	14.14	±2.26
$D1^{R}$	14.33	±2.40	14.79	±2.42
$D2^{L}$	22.70	±1.34	22.47	±1.40
$D2^{R}$	22.03	±1.40	22.09	±1.52
$D3^{L}$	9.65	±1.98	9.45	±2.03
$D3^{R}$	9.46	±1.53	9.42	±1.62
$D4^{L}$	19.68	±2.09	19.77	±1.99
$D4^{R}$	20.47	±2.02	20.76	±2.05
$D5^{L}$	9.23	±2.34	9.35	±2.38
$D5^{R}$	9.98	±2.06	9.8	±2.04
$D6^{L}$	10.75	±2.26	11.15	±2.04
$D6^{R}$	11.02	±2.12	11.01	±2.04
$D7^{L}$	51.45	±8.10	50.82	±8.06
$D7^{R}$	55.03	±11.20	55.83	±11.39

Table 1 shows the mean values for D1-D7, broken down by sex, side, and age group.

Table 2: association among distances, by sex and age group

Sex/ age	Females	Males
Distance measured below the mandibular canal		
D1x D3	0.00	0.00
D3xD5	0.04	0.68
D5xD7	0.00	0.00
Distance measured above the mandibular canal		
D2xD4	0.00	0.00
D2xD6	0.00	0.00
D4xD6	0.00	0.00
Distance measured along the same vertical line		
$D1^{R}xD2^{R}$	0.018	0.014
$D1^{L}xD2^{L}$	0.077	-0.016*
$D3^{R}xD4^{R}$	0.033	0.000
$D3^{L}xD4^{L}$	0.011	0.066
$D6^{R}xD7^{R}$	-0.147*	0.065
$D6^{L}xD7^{L}$	-0.057*	-0.027*

*Statistically significant L=left side R= right side

Females had a moderate positive association with distances D6xD7, but males had a high positive correlation with D1xD2 right side, D2, D3, D5, and D7, on the other hand, displayed a strong left-right association. Table 2 shows the associations between the distances.

Table 3: Chi square values

Left side	Female chi square	Female Mean df	Male chi square	Male Mean df
D1	16.39	201	15.50	157
D2	23.96	186	28.69	145
D3	24.48	189	18.51	158
D4	26.60	191	14.30	162
D5	24.90	192	17.37	160
D6	30.11	192	16.73	158
D7	9.35	213	5.59	171
Right side				
D1	21.14	196	19.69	152
D2	36.59	183	27.92	148
D3	30.70	186	18.79	154
D4	33.00	184	17.28	157
D5	24.16	197	19.05	157
D6	27.91	184	17.281	157
D7	3.85	217	3.82	173

The Chi-squared test was used for qualitative variables which indicate highest p value (1.000) but the data was statistically significant. It also found that females had high asymptomatic significance than males both in left and right sides presented in table 3.

Table 4: Percentage of each mandibular canal relation type with inferior roots, taking sex, side, and age group into account

	Female (18-34years)		Male (18-34years)	
	Right	Left	Right	Left
Type 1	70.7%	71.6%	82.6%	78%
Type 2	8.6%	6.4%	13.8%	14%
Type 3	21.2%	23%	7.2%	9%

Table 4 shows the percentages discovered for each MF type by sex, side, and age group. Males' MF position percentages differed significantly by side, with Type 3 being more common on the left side and Type 4 on the right. For the MF position, no significant differences between sexes were discovered.

Table 5: The percentage of each mental foramen position type on the right and left sides of males and females aged 18 to 34 years

Sex, size and age group (18-34years)	Type 1	Type 2	Type 3	Type 4	Type 5
Females^{R}	3%	4.4%	56%	37%	7%
Females^{L}	5.4%	2.6%	56%	38%	5.2%
Males^{R}	0.9%	6%	52.6%	38%	10.5%
Male^{L}	4.9%	4%	50.2%	40%	7%

CHAPTER V

5.Discussion

The structure and morphological characteristics of the mandibular canal course, as well as the position of the mental foramen in relation to the inferior teeth, were assessed using panoramic X-rays in this study. The panoramic scan as a screening tool for odontogenic infections and mandibular injuries.(**Sklavos, Beteramia, Delpachitra, & Kumar, 2019**) While patient movement, metal distortions, gadget exposure settings, the software utilized, and manual vs. automated methods are all likely to impair the validity and consistency of linear measurements on CBCT pictures in clinical practice.(**Fokas, Vaughn, Scarfe, & Bornstein, 2018**)

When the distance from the mental foramen to D1 to D7 was compared between age groups and left and right sides in this study, a statistically significant difference was found in both male and female participants. In terms of gender comparison and side disparity, the mean difference of assessed variables was statistically insignificant (p0.05). There was no obvious imbalance. The differences in mandible size were not statistically significant. In Saudi Arabian subpopulations, the mandibular canal has no gender differences, is essentially symmetrical with no side disparities, and its location is unaffected by mandible size.(**Alam et al., 2019**)

In our study we evaluated that there was a significant difference between females and males aged between 18-34 years for all the distances except D3×D5 in males, on both sides, males have higher mean values than females. The mandibular canal was measured in relation to the molars and premolars. The root apices of the second and third molars were substantially closer to the mandibular canal than the apices of other assessed teeth (p 0.05). Male respondents had substantially greater measures than female subjects (p 0.05). Age and gender had an impact on the physical relationships between mandibular teeth and the mandibular canal, which should be considered when planning endodontic and surgical procedures to avoid nerve injury.(**Aksoy, Aksoy, & Orhan, 2018**) Males and females had statistically different mean values for the distances D1, D2, D6, and D7 on both sides and the right side, with males having higher mean values. When the full sample was analyzed using the paired t sample test,

males and females had significantly different mean values for all distances (p0.01) b, with males having higher mean values than females.(**Maschenko et al., 2021**)

The results of or study showed that Females had a moderate positive relationship with D6xD7, while males had a strong positive relationship with D1xD2 right side, while D2, D3, D5, and D7 had a strong positive relationship with left and right sides. While another study was conducted that showed significant changes in the measurement and position of the mandibular canal in relation to gender were discovered, which can be induced by a variety of factors including hormones and masticatory muscle stress.(**Kim, Lee, & Han, 2015**) The findings of the study was that the mean value of the vertical linear measurements of the left mandibular canal revealed that male measurements D1, D2, D4, D5, D6, and D7 were greater than female measurements, whereas female measurements D3 were larger than male measurements. There is a significant difference in horizontally linear measurements of the mandibular canal D1, D2, D4, D5, D6, and D7 in relation to gender, but no significant difference in mandibular canal location.(**Gupta et al., 2018**)

Current study determines that the MCR did not differ statistically significantly between the two groups. Both males and females had the mandibular canal near the third tooth. The second most common relationship in males was no proximity between the mandibular canal and roots, while the second most common relationship in females was proximity between the mandibular canal and all roots, with statistically significant differences. ($p<0.01$). The inferior alveolar nerve travels through the mandibular canal before colliding with the mental nerve as it emerges from the mental foramen. To avoid catastrophic complications, it is a key and delicate landmark that must be appropriately identified prior to various surgical procedures, such as the removal of the third molar or any extraction where the teeth are attached.(**Anbiaee, Eslami, & Bagherpour, 2015**) An osteological or stomatological procedure could be used to identify an unknown person based on the study of bodily remains, and the dentist's expanding horizons have made him a forensic expert witness. But the result of this study showed that when measuring MCr-Line A and MCl-Line A, males had significantly higher mean values than females (p0.001), and measurements revealed a highly significant difference between ethnic groups (Malay, Chinese, and Indians) (p0.001).(**Abdullah Ebrahim Laher et al., 2016**)

This study evaluates that the males' mental foramen (MF) position percentages differed significantly by side, with Type 3 being more common on the left side and Type 4 on the right. For the MF position, no significant differences between sexes were discovered. The most prevalent location of MF was below the apex of the 2nd premolar, accounting for 52.8 percent of scans, while only 29.6 percent saw MF between the 1st and 2nd premolar ($p > 0.05$). In 38.7% of cases, a distance of 1–3 mm from the nearest root apex (2nd premolar) was detected, followed by a distance of less than 1 mm in 17.05 percent of cases. Females had 63.2 percent of foramen below the apex of the second premolar on the left side of the jaw ($p = 0.023$). The position of MF in different age groups yielded statistically significant results (p 0.05). The linear IAC pattern was the most common, accounting for 46.2 percent of all cases, followed by the perpendicular pattern, which accounted for 46.2 percent of all cases (38.6 percent). Only 15.2 percent of the cases had AL.(**Al-Mahalawy, Al-Aithan, Al-Kari, Al-Jandan, & Shujaat, 2017**)

Another study looked at the position of the mental foramen in respect to the inferior border of the mandible and the skeletal midline in an Iranian population, as well as gender and age differences on CBCT projections. The vertical and horizontal locations of the mental foramen can be determined using reliable anatomical markers such as the mandibular inferior boundary and skeletal midline in both dentulous and edentulous people. The distance between the upper border of the mental foramen and the inferior border of the mandible had sexual dimorphism.(**Sheikhi & Kheir, 2016**) In 2016 another study evaluated the location of the mental foramen in different age groups was compared. Using digital panoramic radiography, determine the variance in position of the mental foramen with gender. The average distance between the sites of the mental foramen varied significantly across the five age groups.(**Voljevica, Talović, & Hasanović, 2015**). In terms of three metrics, female patients in the first group had a bigger mean distance of mental foramen location. From the second to the fifth groups, male patients demonstrated an increase in the mean distance of mental foramen location. The first and fifth age groups exhibited a lower mean distance of mental foramen location than the other age groups.(**Mohamed et al., 2016**)

CHAPTER VI

6.Conclusion:

In younger people, the MF is positioned between the first and second premolar apices, while in older people, it is located just below the inferior second premolar apex. Males and females had statistically different mean values for the distances on both sides and on the right side, with males having higher mean values. Females had a moderate positive association with distances but males had a high positive correlation on right side, D2, D3, D5, and D7, on the other hand, displayed a strong left-right association. We discovered a substantial difference when compared to other populations, implying that the MC course differs by ethnic group. Variations in people and populations make it necessary for dentists and surgeons to plan carefully before doing operations in this area.

6.1. Limitations:

There is no study which measure the distance and mental nerve emergency pattern in individual male and females.

Limited sample size was used for the specific target population that was also the drawbacks of this study.

There is lack of data due to small study size that only includes the males and females aged 18-34 years.

6.2. Recommendations:

A large-scale study should be conducted to include the large sample size of different age groups in different populations.

Given the great variety of the mental nerve's emergency pattern, as well as the prevalence and placement of the anterior loop, each patient should be examined separately.(**Prados-Frutos, Salinas-Goodier, Manchón, & Rojo, 2017**)

More research, involving groups with varied volumes and biological characteristics of lesions, could be valuable in determining the link between mandibular canal displacement and clinical symptoms such paresthesia.(**Evangelista et al., 2021**)

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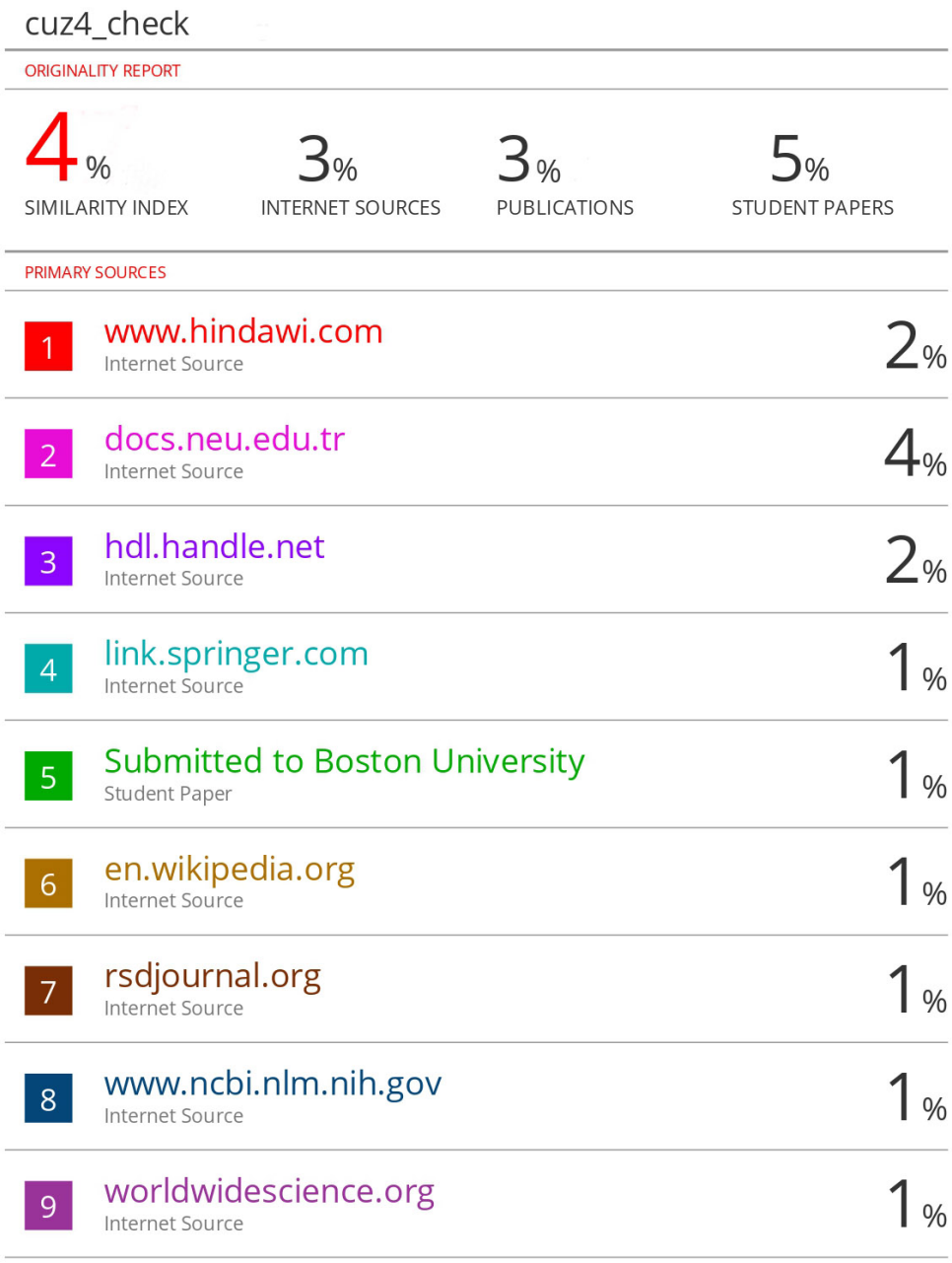
Distance measurement of Mandibular Canal Course and the Position of the Mental Foramen by Panoramic X-Ray in Nicosia Cyprus individuals



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