Cone Beam Computed Tomography Evaluation the Dimensional Change of Lingual Foramen and Its Canal as Related to Gender and Age in Iraqi Population

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Abstract
Background: Just above the mental spine on the back of the mandible's symphysis is a small midline aperture called the lingual foramen. Evaluation the anatomical variation of this foramen and its canal are crucial in the course of surgical and implant procedure. The aim of this study is to locate the lingual foramen and associated canal in the Iraqi population using cone-beam computed tomography and to estimate how gender and age affect these structures. Material and method: this cross-sectional study was conducted using 73 CBCT images from the radiology archive in specialties dental center in baquba-diyala. The length of lingual canal, diameters and its location according to alveolar crest, inferior border of mandible and buccal plat were assessed. These measurements were categorized by age and gender. Result: age between (20-40) years old had no effect on lingual foramen and its canal, while age over 40 years old had effect on lingual foramen and its canal with P value (0.008). There was no significant relationship between the lingual foramen and gender except the distance between terminal end of canal at lingual end and alveolar crest with a P value of (0.002) and the distance between the lingual canal's terminal end at buccal end and alveolar crest with P value (0.002) with mean value higher in male as compared to female.Conclusion: age had no effect on lingual foramen and its canal except age over 40 years old which had significant effect on the selected anatomical measurements of these structures, while gender had high effect on the distance between the alveolar crest and the lingual foramen at buccal and lingual end, as a result, gender must be taken into account when making implant in anterior mandible.
Keywords: lingual foramen; lingual canal; computed tomography

1. Introduction

The lingual foramen is located in the mandible's midline, either above or below the level of the mental spines.1. During surgical planning and treatment, interest in these anatomical markers in the anterior jaw has returned and we must pay attention to avoid complication 2

On the interior, the mandible may have a large number of lingual foramina. In addition to the midline, where they are most frequently found, lingual foramina can be encountered in the paramedian and posterior regions as well. The majority of the lingual foramen and its canal transfer the vascular and/or neural structures that pass through them and form anastomoses with the neurovascular structures of the mandibular canal and its branches.3

The medical-legal practice includes a significant amount of chronological age assessment. Age estimate processes are intricate and take a variety of elements into consideration. Both hard and soft tissue exhibit alterations related to chronological aging.4, 5. After a prolonged funeral, the only things left are typically dental hard tissues and bone since they are extremely resistant to fire.6

Gender identification is a crucial aspect of personal identity. Although the foramen magnum 7 and the maxillary and frontal sinuses 8 have been used to determine gender, these osseous structures are thought to be more challenging to maintain after death. One of the most important parts of the human body is the mandible, which outlasts other tissues in terms of wear and tear. It is believed that the mandibular canal and foramen remain in the same location in the mandible for the duration of a person's life. Despite the alveolar bone's resorption, the distance between the mental foramen and the inferior border of the jaw has not changed. Therefore, it is believed that these mandibular characteristics are essential for determining gender.

The number of postoperative implant problems may have been increasing due to the growing usage of implants and grafting techniques for anterior jaw bone. 10 Understanding the lingual foramen could be crucial for ensuring preoperative visibility of implant investiture in the mandibular midline 11, 12

To prevent the possibility of neurovascular accidents and complications, the rate of implant treatment and the aim correct oral apparatuses function must be taken in consider as these complication could happen during this type of surgical procedure.13

Cone beam computed tomography (CBCT) imaging is a previous imaging technology that provides a

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visual view of dental hard tissues and bone structures.14 The mandibular lingual foramen and its canals have been evaluated using cone-beam computed tomography (CBCT), which has been demonstrated to be more effective than panoramic radiographs. When compared to traditional computed tomography, CBCT equipments' have superior image quality, lower dose, lower cost and have three-dimensional evaluation of craniofacial anatomy in dentistry practice. 15

In order to prevent several complications during anterior dental surgery (implant implantation, genioplastic or grafting treatments), it is crucial to characterize the lingual foramen and its canals. 2

This study aimed to evaluate the lingual foramen and its canal in Iraqi population and correlate the effect of age and gender to these structures.

2. Material and Methods

In order to conduct this cross-sectional investigation, 73 CBCT image from the radiology repository in specialties dental center in baquba-diyala. Inclusion criteria include subjects with age from 20 to 50 years old and excluded criteria include any subjects with bone fracture or pathology on anterior mandibular region.

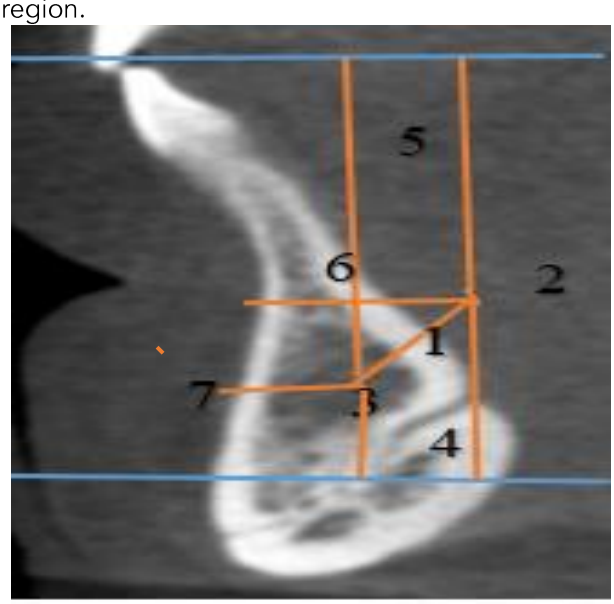

Figure 1: cross section of CBCT shows dimensional measurement of lingual foramen and its canal

The subjects were divided in to

1. Male group with age from 20 to 40
2. Female group with age from 20 to 40
3. Group with age over 40

The following measurements were taken according to protocol 1 Sheikhi et al, 2012(figure 1)

1. Lingual canal length (CL)
2. Lingual canal diameter at lingual end (CDL)
3. Lingual canal diameter at buccal end (CDB)
4. Distance from the inferior border of the mandible to the terminal end of the lingual canal at lingual (CDM) and buccal (BEM) end.
5. Distance from the alveolar crest to the terminal end of the lingual canal at lingual (CDC) and buccal (BEC) end.
6. Distance between the buccal plate and the terminal end of lingual canal at lingual end (CBP).
7. Distance from terminal end of lingual canal at buccal end to buccal plate (BBP).

The study employed by the New Tom Giano CBCT. The Kv was 90, mA10 and scanning time was 10 sec. Voxel size 0.3mm with (DICOM) software.

3. Statistical Analysis

Utilizing the computer program SPSS version 21 for statistical analysis (Statistical Package for Social Sciences). Quantitative variables are described by mean, SD, ANOVA and P value.

4. Result

There is a significant relationship between gender and CDC with mean value (17.973973) appeared, and the P value was (0.002) which is less significant than the significance level (0.05), then there is a high degree of influence in gender. (Table 1)

There is a significant relationship between BEC and gender with mean value appeared for it (21.130137) and P value (0.002), which is less than the level of significance (0.05), then there is a high degree of influence in gender. (Table 1)

(CL): The test was gender-adjusted, and as a result, the arithmetic mean (6.209589) and P value appeared (0.274), which is a non-significant relationship because it is greater than the level of significance (0.05), so gender and CL do not significantly correlate. (Table 1)

CDL: The mean value appeared for it (1.050685) and the value of (P Value) (0.359), and its value exceeds the degree of significance (0.05), meaning no connection exists between gender and CDL. (Table 1)

CDM: The mean value appeared for it (13.126027) and the value of (P Value) (0.421), and its value is greater than the degree of significance (0.05), meaning there is no relationship between gender and CDM. (Table 1)

BEM: The mean value appeared for it (10.310959) and the value of (P Value) (0.918), and its value exceeds the degree of significance (0.05), meaning gender and BEM have nothing to do with one another. (Table 1)

CBP: The mean value appeared for it (10.164384) and the value of (P Value) (0.652), and its value exceeds the degree of significance (0.05), meaning no connection exists between gender and CBP. (Table 1)

BBP: The test was analyzed with gender, so the arithmetic mean (6.483562) and the (P value) appeared (0.606), which is a non-significant relationship because it exceeds the threshold of significance (0.05), so gender and BBP don't significantly correlate with one another. (Table 1)

CDB: The mean value appeared for it (0.732) and the value of (P Value) (0.853), and its value exceeds the degree of significance (0.05), meaning gender and CDB have nothing to do with one another. (Table 1)

Table No. 1: Comparison of selected measurements with the gender		
Anatomical land mark	*Sex (P value)*	*Mean*
CL	(0.274)	(6.209589)
CDL	(0.359)	(1.050685)
CDC	(0.002)	(17. 973973)
CDM	(0.421)	(13.126027)
BEC	(0.002)	(21.130137)
BEM	(0.918)	(10.310959)
CBP	(0.652)	(10.164384)
BBP	(0.606)	(6.483562)
CDB	(0.853)	(0.732)

According to age (20-40), it was found that all the given data in this analysis with (*P* Value) higher than the level of significance (0.05), so there is no significant relationship between the selected measurements and age. **(Table 2)**

Table No.2: Comparison of selected measurements with the age (20-40)		
Anatomical land mark	*Age (P value)*	*Mean*
CL	(0.127)	(6.209589)
CDL	(0.649)	(1.050685)
CDC	(0.478)	(17. 973973)
CDM	(0.678)	(13.126027)
BEC	(0.496)	(21.130137)
BEM	(0.746)	(10.310959)
CBP	(0.492)	(10.164384)
BBP	(0.643)	(6.483562)
CDB	(0.443)	(0.732)

For ages over 40 years old, we note the value of (Sig. = 0.008) which the significance threshold is lower than the significance level (0.05), so there is a very important connection, so there is a significant relationship with a high degree between the selected measurements and the age and therefore this age group is highly affected by the measurements. **(Table 3)**

Table No.3: Comparison of selected measurements with the age over 40 years old					
ANOVAa					
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.501	9	.500	3.134	.008b
	Residual	5.266	33	.160		
	Total	9.767	42			
a. Dependent Variable: age						
b. Predictors: (Constant), CDB, CDM, CBP, CL, CDL, BEC, BEM, CDC, BBP						

5. Discussion

Forensic anthropology plays a significant role in determining a person's gender and age. **Stanojevich** [16]. The strongest bone in the human body is the mandible. The existence of a thick covering of compact bone allows it to stay in its original state longer than any other bone. **Uppal *et al*** [9]

The present study evaluate the lingual foramen and its canal and showed the gender and age influenced these structures. When the subjects were classified according to age from 20 to 40, there was no significant different between the selected measurements and the subjects in this age. Our result agreed with the study made by **Sheikhi *et al*** [1] who discovered that there was no significant relationship between the dimensions of the lingual foramen and its canal and age, with the exception of the distance between the foramen and the alveolar crest which according to the study of **Sheikhi *et al*** [1], this distance decrease with increasing in age and this come disagreement with the result of our study.

Yu *et al* (17) used cone-beam CT to analyze the morphology of the lingual foramen and lateral lingual foramen in elderly Koreans and discovered that age had no significant effect on the foramen. This finding appears to be consistent with the findings of our study.

Our study become accordance with the study made by **Denny *et al*** [18] who showed that there was no much different in position of lingual foramen and age.

Our study become agree with the result of the study made by **Kim *et al*** [19] who showed that there was no effect of age on lingual foramen.

With regard to age more than 40 years old, the outcome of the present study revealed that this group of age is highly affected by the dimensional measurements that were selected with *P* value (0.008) and this result may be related to periodontal disease or tooth loss causing atrophic alterations to the alveolar process.

Relative to the gender, our study show that there was no significant relationship between the selected dimensional measurements and gender except the measurements of distance between the canal's terminal ends at lingual end and alveolar crest(CDC) with *P* value (0.002) and distance between the lingual canal's terminal end and at buccal end and alveolar crest (BEC) with *P* value (0.002).The distant between the lingual foramen's terminal end at lingual and buccal end to alveolar crest was greater in male than female and this result come accordance with the study made by **Sheikhi *et al*** [1] who demonstrated a significant relationship between gender and the distance between the lingual foramen and the alveolar crest and he explain this results because the mandible has large size in male. **Sheikhi *et al*** [1] also showed that the gender effect on the distance between the lingual foramen to the inferior cortex and the distance between the buccal end of lingual foramen to inferior and buccal plate which are

greater in male than female, these results come disagreement with the result of our study.

Yu *et al* [17] show that there was no significant difference between lingual foramen and gender which agreement with our study with the exception the distance between lingual foramen and alveolar crest which is greater in male than female in the result of our study.

In contrast to the findings of our investigation, **Maciel *et al* (20)** discovered that women had a considerably shorter distance from the mandibular incisive canal to the mandibular boundary than men (p<0.0001). Contrary to the results of our study**,** **Alani *et al*** [21] shows that the gender significantly effected on all dimension of lingual foramen.

6. Conclusion

This study showed that the age between L 20-40 had no effect on the dimensional measurements of lingual foramen and its canal while the age over 40 years old had significantly effect on the anatomical dimension of lingual foramen and its canal. The gender had significant effect on the distance between the lingual foramen and alveolar crest, which is higher in male than female, so it is crucial to take this into account when choosing a dental implant in anterior mandible.

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