

Rare morphologic variations of mandibular canal course: radiographic study

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ABSTRACT

Background: Mandibular canal course variations are found very rarely, nevertheless, their recognition may play a very important role prior to any surgical procedure involving the lower jaw. This study aimed to identify the variations in the different parts of the radiographic course of mandibular canal using digital panoramic imaging.

Materials and Methods: The courses of the mandibular canal in 319 panoramic images of Iraqi subjects were evaluated carefully and any rare radiographic finding was recorded when identified.

Results: A total of 5.95 % of the radiographic images examined in the present study demonstrated mandibular canal variations. The most common variation observed in the present study was bifid mandibular canal (1.88 %), followed by indistinct mental foramen (1.57%), then indistinct mandibular canal walls (1.25%) and indistinct mandibular foramen (1.25%).

Conclusion: The course and configuration of the mandibular canal should be carefully observed in different locations because it poses many variations. Recognition of these variations is important in preventing the intra and post operative complications in certain dental procedures.

Key words: Mandibular canal; Radiographic variations. (J Bagh Coll Dentistry 2012;24(1):64-67).

الخلاصة:

على الرغم من أن التباين في مسار قناة الفك السفلي هو من الحالات النادرة إلا أن اكتشاف ذلك التباين له دور بالغ الأهمية قبل إجراء أي عملية جراحية في الفك السفلي. الغرض من هذه الدراسة هو تحديد التباين الموجود شعاعياً في مناطق مختلفة على طول مسار قناة الفك السفلي باستخدام التصوير بالأشعة البانورامية الرقمية. تم تقييم مسار قناة الفك السفلي بدقة في 319 صورة أشعة بانورامية لمواطنين عراقيين وقد تم تسجيل جميع الحالات النادرة في مسار قناة الفك السفلي حيثما وجدت. أثبتت النتائج أن 5.95 % من العينة الكلية المفحوصة لديهم تباين في مسار قناة الفك السفلي. كانت قناة الفك السفلي المنقطرة هي النوع الأكثر انتشاراً بين تلك التباينات إذ شكلت (1.88 %) يتبعها عدم وضوح الثقب الذقني (1.57 %) ثم عدم تمييز جدار قناة الفك السفلي (1.25 %) وأخيراً عدم وضوح ثقب الفك السفلي (1.25 %). إن المسار والشكل العام لقناة الفك السفلي يجب أن يلاحظ بدقة في مواقع مختلفة بسبب التباينات المتعددة لهذه القناة. إن تمييز هذه التباينات أهمية في تلافي المضاعفات التي قد تحدث أثناء وبعد بعض عمليات طب الأسنان.

INTRODUCTION

The mandibular canal is usually a single channel, enclosed by bony tissue, forming an upward concave curve; it transmits the inferior alveolar nerve, a branch of the third division of the trigeminal nerve, and the associated vessels. The canal typically extends from the mandibular foramen to the mental foramen. ^(1&2)

The knowledge of the course of the mandibular canal and its anatomical variations is of great importance in certain surgical interventions, such as preprosthetic operations and the insertion of dental implants, and during the planning of removable dentures prepared in cases involving extensively atrophied mandibles. ^(3&4) Despite of its limitations, the panoramic radiograph is the most preferred radiographic technique to localize the mandibular canal and to determine the anatomy and variations of the canal. ⁽⁵⁾

The radiographic appearance of mandibular canal has been described by Worth ⁽⁶⁾ as a radiolucent dark ribbon between two white lines. White and Pharoah, ⁽⁷⁾ defined it as Dark linear shadow with thin radiopaque superior and inferior borders cast by the lamella of bone that bounds the canal.

Variations in the anatomy of mandibular canal can be in the form of bifid canals as determined by many authors. ⁽⁸⁻¹²⁾, trifid as performed in ^(13 & 14) studies. Indistinct mandibular canal walls was verified by Carter and Keen, 1971 ⁽¹⁵⁾, Nortjé et al, ⁽⁸⁾ and Ylikontiola et al, ⁽¹⁶⁾. Absence of mental foramen in the panoramic radiographs was reported by Bavitz et al, ⁽¹⁷⁾, Abdulhaleem, ⁽¹⁸⁾, Lazem, ⁽¹⁹⁾ and Al- mufti, ⁽²⁰⁾, and the absence of mandibular foramen in the panoramic radiographs was reported by Al- mufti, ⁽²⁰⁾.

These variations can be found anywhere along the course of the canal. Hence by locating these variations the clinician can take adequate precautions before planning a surgical procedure in order to avoid complications. ⁽¹⁾

Panoramic radiographs may help to find the position of the mental foramen, through which the nerve supply to the lower lip passes, failure to protect the mental foramen can lead to permanent loss of normal sensation in the lower lip. ⁽²¹⁾ Radiographic assessment of the mandibular foramen is useful for the oral and maxillofacial surgeon in orthognatic surgery, especially in ramus osteotomy procedure ⁽²²⁾. Nevertheless, its location is of a considerable importance for surgery planning and anesthesia. Incorrect estimations of its location might be the explanation to the unsuccessful anesthesia of the inferior alveolar nerve.

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MATERIALS AND METHODS

Total sample of 319 subjects (159 male and 160 female) were examined, they were attending Al-Karkh general hospital in Baghdad, with age range (20-50) years old (Table 1) and referred to Radiology department for Panoramic Imaging. Planmeca Dimax3 Digital X-Ray machine was used and appropriate exposure factors were selected according to the user manual of the

machine.

All participants were clinically healthy with no syndromes, clefts, or other malformations. Malocclusion type was not a criterion of sample selection, however, no sever malformations were included and all subjects had no history of previous orthodontic, orthopedic or surgical treatment procedures. High quality images with respect to geometric accuracy and contrast was only studied.

Table 1: Classification of the study groups according to age and gender

AGE	MALE	FEMALE	TOTAL
20-29	54	55	109
30-39	53	53	106
40-50	52	52	104
TOTAL	159	160	319

RESULTS

- Duplication or division of the canal were identified unilaterally on six radiographic images, five of them were on the right side (two male & three female), their ages ranged from (20 to 29) years, and on
- Other variations included when the mandibular canal walls were partially indistinct on both sides (right and left) on 3 radiographic images (1 male & 2 female), while there were complete absence of the canal walls on one side of
- The mental foramen was unidentified on both sides (right and left) on 5 radiographic images (2 male & 3 female),
- The mandibular foramen was unidentified on both sides (right and left) on 4 radiographic images (2 male & 2 female), so male to female ratio was (1:1), these 4 images were consisting

the left side one image was identified (male aged 23 years). These six images represent 1.88 % of the total sample, males and females were affected equally, as illustrated in table (2), one image (1 male) and partial absence of the canal walls on the other side of the same radiographic image, the 4 excluded images were consisting 1.25 % of the total sample.

the 5 radiographic images were consisting 1.57 % of the total sample.

1.25 % of the total sample. The 19 radiographic images are consisting 5.95 % of the total sample, male to female ratio was (0.9:1) as illustrated in table (2).

Table 2: Rare findings types stratified by their percentage & male to female ratio

Type of rare finding	N	% of total sample	N Male	N Female	Male:Female ratio
Unilateral bifid canal	6	1.88	3	3	1:1
Indistinct mandibular canal walls	4	1.25	2	2	1:1
Indistinct mental foramen	5	1.57	2	3	0.7:1
Indistinct mandibular foramen	4	1.25	2	2	1:1
Total	19	5.95	9	10	0.9:1

Note: Total sample N = 319

DISCUSSION

The present study was conducted to evaluate the morphologic variations of mandibular canal using panoramic imaging.

Duplication or division of the canal were identified unilaterally on six radiographic images representing 1.88 % of the total sample, this type of mandibular canal variations was also reported by Nortjé et al, ⁽⁸⁾ which was 0.9%, Langlais and

co-workers, ⁽¹¹⁾ which was 0.95 % of the total sample, while Devito & Tamburús in 2001 ⁽⁵⁾ found that bifid MC percentage was 7.85% of the total sample. In the present study male to female ratio was (1:1), so no significant gender differentiation was found that was in accordance with previous studies done by Langlais et al, ⁽¹¹⁾ and Ossenber, ⁽²³⁾.

Other variations included when the mandibular canal walls were partially indistinct on both sides (right and left) on 3 radiographs (1 male & 2 female), while there were complete absence of the canal walls on one side of one radiograph (1 male) and partial absence of the canal walls on the other side of the same radiographic image. The reason for indistinct mandibular canal walls could be due to the thickness of the lingual cortical plate of the mandible or due to the trabecular pattern which affect the appearance of the canal in the area of examination.

Miller et al, ⁽²⁴⁾ suggested that the degree of cortication of the mandibular canal on the panoramic film may serve as a predictor of the proximity of the mandibular canal to the cortical plates.

Denio et al, ⁽²⁵⁾ and Juodzbalys et al, ⁽²⁶⁾ have reported that the mandibular canal pathway in some mature mandibles followed in S-shaped curve in the buccolingual plane. In a typical S-shaped configuration the canal was located buccal to the distal root of the second molar, crossed to the lingual below the second molar mesial root, ran lingual to the first molar, and crossed back to the buccal apical to the apex of the second premolar. That could be the reason of partial absence of the canal walls in 4 radiographic images in the present study.

These 4 radiographs were consisting 1.25 % of the total sample, this conflicts with the much higher rates of apparent partial and complete absence of the mandibular canal found by Carter and Keen, ⁽¹⁵⁾ and Ylikontiola et al, ⁽¹⁶⁾, who had used conventional film panoramic radiography in their studies.

The mental foramen was unidentified on both sides (right and left) on 5 radiographs (2 male & 3 female). The reason for unidentified mental foramen could be due to the thickness of the lingual cortical plate of the mandible or due to the trabecular pattern which affect the appearance of the foramen in the area of examination. These 5 radiographic images were consisting 1.57 % of the total sample, this ratio is smaller than these reported by Bavitz et al, ⁽¹⁷⁾ and Abdulhaleem, ⁽¹⁸⁾, which constituted about 20% and 9.6 %, respectively. Those have used conventional film panoramic radiography in their studies.

The smaller the ratios of indistinct mandibular canal walls and unidentified mental foramina reported in the present study could be due to the use of digital X-ray machine which permits enhancing the resolution as needed by the examiner and exclude the artifacts of the processing.

The mandibular foramen was unidentified on both sides (right and left) on 4 radiographs (2 male & 2 female). The reason for unidentified mandibular foramen could be due to the trabecular pattern or due to the superimposition of the foramen at the area of examination. The 4 radiographic images were consisting 1.25 % of the total sample, this ratio was consistent with the findings of Al- mufti, 2008 ⁽²⁰⁾, who has used digital panoramic radiography in her study.

Although these variations are found rarely, their recognition plays a very important role prior to any surgical procedure involving the lower jaw, thus avoiding postoperative complications.

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