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Anatomical location of inferior alveolar canal in different age groups in local population

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ABSTRACT

Objective: To assess the radiographic location of the inferior alveolar canal and its association with age and gender.

Methodology: This observational study was conducted at the dental department of Isra University Hospital Hyderabad, in the time duration of six months (Sep-2015 to Feb-2016). All the adult patients aged ≥18 years with permanent teeth underwent diagnostic quality imaging with suitable contrast and density, presence of first molar, 1st & 2nd premolar and canine in images, superimposition of structures and either of gender were included. Patients underwent panoramic digital imaging. The manufacturer's guide-based images were produced using panoramic machine (digital) to assess multi-pattern of inferior dental canal using software "OWANDY OPG I-MAX TOUCH OSP and Quick vision to get histogram equalization and gray values. The entire data was entered in self-made proforma and was analyzed by using SPSS 20th version.

Results: Overall 70 patients were studied; their mean age was 28.23+12.43 years, females were found in the majority (57.14%). Most of the patients (54.28%) were seen with inferior alveolar variations of Type I, followed by 21.42% Type II, 14.28% type III and 10% with Type IV. According to the site of mandibular canal locations; 21 of 70 had right side, 15 had left side and 34 had bilateral. There was statistically no significant variance in the appearance of inferior alveolar nerve according to age and gender.

Conclusion: Localized superior and inferior borders were 54.28% in our population to avoid injury during the maxillofacial surgery or during dental implant procedures. There was an insignificant difference in location according to age and gender

Keywords: Inferior alveolar canal, gender, age.

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Introduction

The mandibular canal or inferior alveolar canal (IAC) is a vital osseous channel found within mandible that enables neurovascular bundle passage as well as passage of mandibular trigeminal nerve division (V3) and the inferior alveolar nerve (IAN).[1] The IAN is important in the lower 3rd division of face for proper functioning of the nervous system.[2] The IAC runs from mandibular to mental foramen, in the mid-third of the ramus surface generally underneath the edge of the 2nd premolars or between 1st and 2nd premolars.[3] The IAN proceeding in the mandibular canal anteriorly passes through the mandible between lingual and buccal sides.

The IAC's route is grouped into four regions: mental, body, angle and Ramus.[2] Radiographic photographs are deemed as crucial diagnostic tools when assessing and planning treatment. In this approach lateral surgery reaches the skull base. Variations in maxillary vessels and the branches of mandibular nerve and the mandibular nerve itself can contribute to neurovascular contraction that can cause numbness, headache and localized pain.[4] Mandibular canal evaluation techniques include flat panel CT, orthopantomography and CT scan.[5,6] Impairment in mandibular nerves bundles mostly occurs due to surgical complications while dental installations and also failure to recognize these constructs.[7] IAN is by far the most frequently damaged nerve while implant therapy (64.4 percent). Precise evaluation of crest of IAC (particularly superior border) and alveolar bone is necessary before any surgical procedure is planned, otherwise, inferior alveolar neurovascular bundles are highly prone to damage.[8,9] Determining the IAN's location and orientation and associated anatomical constructs is crucial in minimizing the chance of injury.[10] The aim of the current study was the evaluation of radiographic presentation of inferior canal to assess the patterns in these constructs, and their association with the gender and age in local population to obtain a clear evaluation of the IAC that can possibly assist implantologists and surgeons while planning the treatment.

Methodology

The observational study was executed at the Dental Department of ISRA University Hospital Hyderabad, from September 2014 to February 2015.

All the adult dentate patients aged ≥18 years with permanent teeth underwent diagnostic quality imaging with suitable contrast and density. The presence of the first molar, canine, 1st and 2nd premolars in images, superimposition of structures and either of gender were included. All the patients with radiopaque or radiolucent lesions in mandibular body present in the regions of third molars (from right to left), posterior mandibular implant such as bone platting as well as missing incisors or right/left mandibular first molar and bone pathologies or jaw fracture were excluded. All the patients underwent panoramic digital imaging. The manufacturer's manual based images were obtained by digital panoramic device to assess the various patterns of inferior alveolar canal (IAC) by using OWANDY OPG I-MAX TOUCH software O.S.P and Quick vision for histogram equalization and gray values. The criteria for inferior alveolar canal variations: [2]

Type	IAC variations
I	Visible inferior and superior borders
II	Invisible inferior and visible superior borders
III	Invisible superior and visible inferior borders
IV	Invisible inferior and superior borders

The entire data was entered in self-made proforma and was analyzed by using SPSS 20th version.

Results

Total 70 patients were studied; their mean age was 28.23±12.43 years; 40 females were found in majority 57.14% while 30 males were 42.85% with male to female ratio of 1:1.3

In terms of inferior alveolar canal (IAC) variations; most of the patients 54.28% were seen with Type I, followed by 21.42% had Type II, 14.28% had type III, while 10% of the cases were found with Type IV (See IAC variation criteria). According to inferior alveolar canal locations 21 of 70 had right side, 15 had left side and 34 had bilateral (Table No I).

Statistically no significant variance was found in the appearance of inferior alveolar canal according to age and gender, p-value 0.604 and 0.094 respectively. Table No: II.

Table I: Locations of inferior alveolar canal (n=70)

Appearance of IAC	Locations			Total
	Right Side	Left Side	Both Side	
Type I: Visible superior and inferior borders	10	07	21	38
Type II: Visible superior and invisible inferior borders	05	03	7	15
Type III: Visible inferior and invisible superior borders	03	03	4	10
Type IV: Invisible superior and inferior borders	03	02	2	07
Total	21	15	34	70

Discussion

Precise assessment of the morphology and size of bone is essential in preoperative preparation for the placement of mandibular implants. The size of preferred implant varies as per width and height of bone, and mandibular canal location. In this study out of 70 patients 30(42.85%) were males and 40(57.14%) were females; with male to female 1:1.3 ratio. Whereas, male to female ratio of 1.06:1 reported by Ngeow WC et al,[12] was higher

Table II: Appearance of the inferior alveolar canal according to age and gender (n=70)

Effect modifies		Types of IAC				Total	p-value
		I	II	III	IV		
Gender	**Male**	14	7	6	3	30	
	Female	24	8	4	4	40	0.604
Age	**20-35 years**	19	6	5	0	30	
Groups	**36-50 years**	11	5	5	3	24	0.094
	>50 years	8	4	0	4	16	

then the current study. The patients' mean age (28.23+12.43 years) in this study was similar to a study conducted by Ngeow WC et al[12]. Freitas GB et al[13] reported that females were 62.7% and males were 37.3% with age range of 13 to 87 years. On the other hand, Mirbeigi S et[11] also reported similar findings regarding gender.

In this study according to inferior alveolar canal (IAC) locations 21 of 70 had the right side, 15 had left side and 34 had bilateral. Similarly, Freitas GB et al[13] demonstrated that of 90 (32.2%) bifid IAC cases occurred entirely on right side, whereas 24.5% were left side and around 43.3% were bilateral bifid IAC. Other studies also observed higher incidence of right side among around 57 to 63%.[14,15]

The IAC structure is anatomical reference guide to the surgeries performed in jaws. The third molar extraction, placement of implants, orthognathic surgical procedures, fixation and reduction of fractures within different mandibular regions are the procedures carried out near this channel which raise the likelihood of injuries to the IAN.[16]. Measuring the bone volume can prevent injuries that occur due to implant procedures conducted within the inferior alveolar nerve (IAN). The mandibular canal trajectory at an implantation site can modify the lower lip sensation because of IAN impairment and remains among the most severe complications of surgical procedures in mandibular implant.[17] In the current study according to IAC variation criteria, most patients 38(54.28%) were of Type I, after that 15(21.42 %) cases of Type II, 10(14.28%) cases of Type III and 7(10%) cases of Type IV. In contrast, Pria CM et al[2] reported that the location and the outline of IAC were Type I in 36.75% cases, after that type III in 34.14% cases. In another study Taha OB et al[18] demonstrated that 63.33% cases of IAC were Type I, 17.3% had type III and 19.3 % representing type IV, while Type II classification was not seen in any patient.

The current study found no significant variance in the appearance of inferior alveolar canal according to age and gender. Similarly, an international study reported that relative site of IAC and linked foramina among adults were fairly persistent regardless of age and gender. While inconsistently Simonton JD et al[20] indicated that age and gender both are prognostic of anatomically surgical endodontic associations and must be taken into account in the pre-surgical planning. Thus further studies based on large population should be done to evaluate the proper anatomical variation of inferior alveolar canal.

Conclusion

It was concluded that localize inferior and superior borders 54.28% canal in our population in order to avoid injury during the maxillofacial surgery or during dental implant procedures. There was statistically no significant variance in location according to age and gender. Further large sample size studies are required on this assessment.

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