The prevalence of mandibular incisive nerve canal and to evaluate its average location and dimension in Indian population

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ABSTRACT

Aim: The aim of this study was to find the prevalence of the mandibular incisive canal, evaluate its location and dimensions using cone beam computer tomography (CBCT) in Indian population. **Materials and Methods:** CBCT scan images of 120 subjects were analyzed for the presence of the mandibular incisive canal, its location, size, and its length. The distance between the incisive canal and the buccal and lingual plate of the alveolar bone, and the distance from the canal to the inferior border of the mandible were also measured to position the canal in the mandible. **Results:** About 71.66% of the CBCT scans of Indian subjects examined showed the presence of the Incisive canal, of which 48.33% exhibited canals bilaterally and 23.33% showed unilateral canals. 28.33% of the subjects CBCT scans did not exhibit the presence of incisive nerve canal. The average length of the incisive canal was 10.173 mm. The average diameter of the Incisive canal in the CBCT scans was 2.578 mm. The distance from the Inferior border of the mandible to (a) the origin of the Incisive canal was 9.425 mm and (b) to the apex of the Incisive canal was 9.095 mm. The distance from the buccal cortex of the mandible to (a) the origin of the incisive canal was 1.48 mm and (b) to the apex of the incisive canal was 4.476 mm. The distance from the lingual cortex of the mandible to (a) the origin of the incisive canal was 4.464 mm and (b) to the apex of the incisive canal was 5.561 mm. **Conclusion:** The presence, location, and dimensions of the mandibular incisive canal are an additional required data that needs to be elicited before planning an inter-foraminal placement of implants.

KEY WORDS: Cone beam computed tomography, inter foramina area, mandibular incisive canal, mental foramen, inferior alveolar nerve, inter-foraminal implant placement

The region between the mental foramen has been considered a safe zone for most of the surgical procedures. Implant placement in this region is usually done with measurements of radiographs, which give a two-dimensional assessment. Some cases of perineural injury with associated symptoms of neurosensory disturbances associated with osteotomy in the anterior mandible have been reported. These can be attributed to the presence of the mandibular incisive canal.[1,2]

The mandibular incisive canal is the medial extension of the mental nerve, which runs in the anterior region of the mandible and may open lingually close to the genial tubercle. The nerve can have varied course, with multi-morphic representation. The number of cases with surgical intervention in the inter-foraminal area has increased considerably as this region has good bone quality and quantity along with the perception that this is a safe zone. Failure to ascertain the exact position of the neurovascular bundle in this region may lead to complication like transient or long term paresthesia of the associated region.

The ability to detect the presence of the mandibular incisive canal from orthopantomography is limited.[1-3] These images fail to show the presence of the incisive canal.[4-6] An accurate spatial orientation of the nerve anterior to the mental foramen is possible using cone beam computer tomography (CBCT). This visualization can help us in the diagnosis and treatment planning[7-11] which could prevent any unforeseen problems.[1] The aim of this study was to assess the prevalence of mandibular incisive nerve canal and to evaluate its average location and dimension in Indian population.

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Materials and Methods

Cone beam computer tomography scans of 120 random subjects were collected at Random. No data other than age and sex were collected. Care was taken to restrict the subjects to the Indian population.

Inclusion criteria

- Indian origin
- Both sexes
- Age group 30–50 years.

Exclusion criteria

- Not of Indian origin
- Any anatomical or pathological abnormalities
- Subjects below 30 and above 50 years.

The scans were sourced from a particular CBCT machine (Planmeca ProMax 3D Mid, of Idea Dental, Chennai.) using the following set acquisition parameters as follows: Tube volume, 90 kV; tube current, 10 mA, acquisition period, ≈13.88 seconds, and image size of 400 mm × 400 mm. The dose area product was maintained at 867.6 mGy × cm^2.

A single operator worked with all the files from a single DeskTop Personal Computer (Pentium® Dual-Core CPU E 5700 @ 3.00 GHz with a Ram of 2 GB). The images were analyzed and the measurements were done using the tools given in the proprietary software (Planmeca Romexis® Viewer).

First the image was viewed on the screen, and the presence or absence of the canal on both sides was noted. If present, it was noted if present unilaterally or bilaterally. The identified canals were then analyzed. The nerve tracking tool was used to measure

Table 1: Total number of cases surveyed and those with and without incisive nerve

Distribution of incisive nerve presence	
Incisive canal present bilaterally	58
Incisive canal present unilaterally	28
Incisive canal not present	34

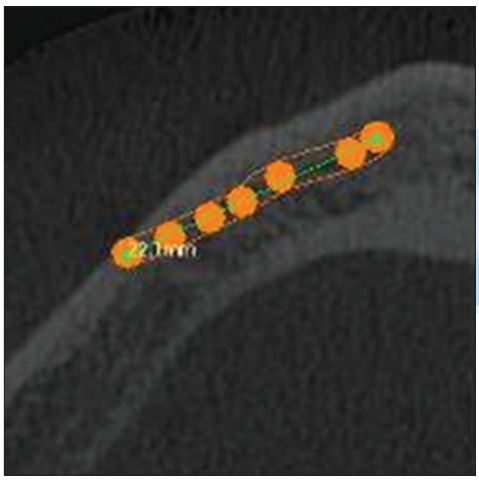

Figure 1: Nerve tracking. Nerve tracking tool used to measure the length from the origin to the end of the visible nerve canal

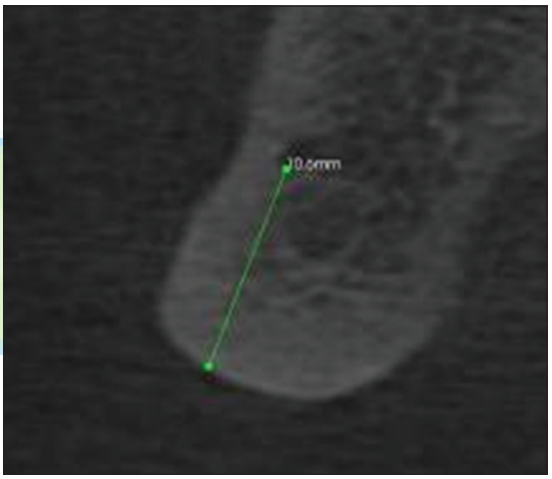

Figure 2: Nerve to Inferior border of the mandible. A sagittal section of the cone beam computer tomography used to measure the distance of the nerve from the inferior border of the mandible

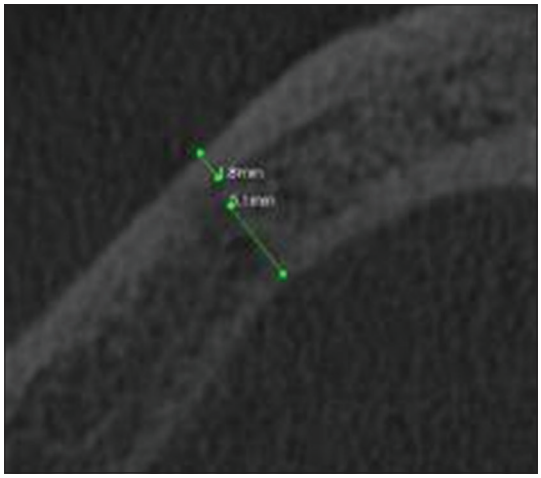

Figure 3: Nerve to buccal and labial cortex at the origin. The coronal plane used to measure the distance of the nerve from the buccal and lingual cortices at the origin

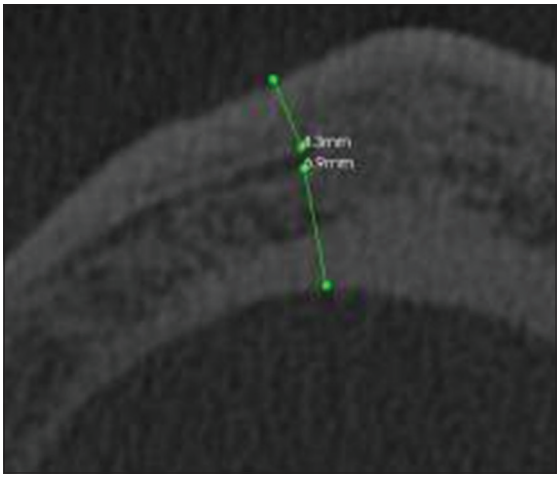

Figure 4: Nerve to buccal and labial cortex at the apex. The coronal plane used to measure the distance of the nerve from the buccal and lingual cortices at the apex

Table 2: The various dimensions of the incisive nerve

Size distribution of incisive nerve	Mean	SD	*P*
Length of the incisive canal (origin to apex)	10.173	4.6826	0.5931
Diameter of the incisive canal at its origin	2.578	0.4034	0.0047
Distance from the origin of incisive canal to base of the mandible	9.425	0.7798	0.0945
Distance from the apex of incisive canal to base of the mandible	9.095	0.6534	0.8278
Distance from the origin of incisive canal to buccal cortex of the mandible	1.48	0.221	0.0064
Distance from the apex of incisive canal to buccal cortex of the mandible	4.476	0.354	0.022
Distance from the origin of incisive canal to lingual cortex of the mandible	4.464	0.2651	0.0716
Distance from the apex of incisive canal to lingual cortex of the mandible	5.561	0.6992	0.3906

SD: Standard deviation

the length from the origin to the end of the visible nerve canal [Figure 1]. A sagittal section of the CBCT was used to measure the distance of the nerve (both at the origin and the apex) from the inferior border of the mandible [Figure 2]. The coronal plane was used to measure the distance (both at the origin and the apex) of the nerve from the buccal and lingual cortices, respectively [Figures 3 and 4]. The tabulated data were analyzed statistically.

Results

A total of 120 scans were studied. The incisive nerve canal was not identifiable in 28.33% of the subjects. The canal was identifiable bilaterally in 48.33% and unilaterally in 23.33% of the subjects. A total of 144 canals were identified and studied in 120 subjects [Table 1]. Their dimensions were measured and recorded [Table 2].

Discussion

When examining the CBCT images in the viewer, the incisive nerve canal is easily identifiable, similar to inferior alveolar nerve canal as roughly circular radio-opaque rim in a translucent medullary mandibular bone. Presence of incisive nerve was not readily identified using panoramic radiograph (11.2%) as against CBCT (88%), in the study of Pires CA *et al.*,[11] was attributed to the superimposition of anatomical structures like cervical vertebra. Hence, it is logical to assume that, the study of the inter-foraminal area of the mandible using CBCT, becomes mandatory.

In this study, the incisive nerve is identifiable in 71.66% as against Jacobs *et al.*[4] (93%) and Pires CA *et al.* (83%).[11] The nerve canal was detected till about 10.173 ± 4.682 mm anterior to the mental foramen. This is very much into the perceived safety zone in the inter-foraminal region. The canal runs an approximately horizontal course parallel to the base of the mandible, from the origin (9.425 ± 0.7798 mm) to the apex (9.095 ± 0.6534 mm). Medio-laterally, the canal runs a more medial course, increasing its distance from the buccal cortex. This study gives an approximate map of the course of the incisive nerve.

The knowledge of the course of the incisive canal is as important as that of the Inferior alveolar nerve canal in the mandible, as it might lead to injury of the nerve and lead to postoperative myalgia and other nerve related problems.[1,2]

Conclusion

It should be acknowledged that more number of patients is opting for prosthodontic treatment that includes the use of implants. In recent years, the concept of "All on Four" and similar treatment modalities have gained in popularity. One of the most easy and relevant location for placing an implant is the anterior mandible. In the past, fewer complications were reported while placing implants in the anterior mandible as they were less in number. In recent times as this number is growing, the chances for complications are increasing. Hence, with an increase in use, knowledge of the anatomy of this particular region has to be refined.

With the mapping of the incisive nerve canal, it can be used as a roadmap to plan safely and negotiate this region.

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