

Morphometric Analysis of Infraorbital Canal Using Digital Panoramic Radiograph and Proposing New Classification

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Abstract

Background: The infraorbital canal is one of the important anatomic structures present in the panoramic radiographic image which shows different radiographic presentations. **Aim:** To study the morphology of infraorbital canal on digital panoramic radiograph. **Materials and Methods:** The total of 1000 digital panoramic radiographs were selected from archives of the department after fulfilling the inclusion and exclusion criteria. Each radiograph was then analyzed for morphological study based on Scarfe *et al.* classification. The collected data were statistically analyzed by using descriptive statistics and the Chi-square test. **Results:** The participants' age ranged from 11 to 85 years with the mean age 37.72 ± 15.89 years. There were total 583 males and 417 females with ratio of 1.4:1. The infraorbital canals were detected in 96.8% of the radiographs. The Type I, II, and III infraorbital canals were 43.45%, 18.95%, and 34.4% of radiographs, respectively. No significant difference was noted according to sex and side ($P > 0.05$). **Conclusion:** The radiographic patterns of infraorbital canal were analyzed and a modification into Scarfe *et al.* classification was proposed.

Keywords: Infraorbital canal, orthopantomogram, panoramic radiograph, radiography

INTRODUCTION

Panoramic radiography produces a single tomographic image for facial structures including both maxillary and mandibular arch.^[1,2] The popularity of this radiograph is at peak due to overall coverage of dental arches, relatively undistorted reproduction of anatomic structures, reduced radiation dosage, and simple procedure.^[3,4] The image shows certain unique anatomical structures and variation in structures, and infraorbital canal (IOC) is one amongst it. This canal carries the infraorbital nerve, a terminal branch of the maxillary division of trigeminal nerve. The presentation of IOC on panoramic radiograph differs with individual.^[4,5] Scarfe *et al.*^[5] has described the radiographic features of IOC on panoramic radiographs.

The pre-operative radiographic assessment of IOC is important in reducing the untoward sequelae associated with surgical interventions like surgical correction of maxillofacial anomalies,^[6] antrostomy,^[7] reduction of orbital^[8] and zygomatic^[9] fractures, and microsurgical reconstruction of the infraorbital nerves.^[10] The present study was designed to study the morphologic patterns of IOC on 1000 panoramic radiographs in Indian population.

MATERIALS AND METHODS

The retrospective study was conducted in the department after obtaining permission from the Institutional Ethics Committee.

The total of 1000 digital panoramic radiographs which were taken on Kodak 8000 C Digital Panoramic System, were retrieved from the archives of the department. The radiographs with good contrast/resolution and with clear visualization of IOC formed the part of study. The radiographs with positioning and magnification errors, bony pathology in the upper jaw were excluded from the study.

Each radiograph was then analyzed for morphological study of IOC based on the Scarfe *et al.*^[5] classification i.e.,

- Type I – A radiopaque canal with two parallel ridges appearing as radiopaque lines

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- Type II – A radiolucent canal with no parallel ridging or linear radiopacities
- Type III – A combination of Type I medially (i.e., with linear parallel radiopacities) and Type II laterally (i.e., radiolucent with no radiopaque ridging).

The collected data were analyzed statistically by using the International Business Machines Corporation, Statistical Package for the Social Sciences version 19.0 (IBM SPSS v. 19.0). and descriptive statistics and Chi-square test were applied.

RESULTS

The participants' age ranged from 11 to 85 years with the mean age 37.72 ± 15.89 years. There were total 583 males and 417 females with ratio of 1.4:1 [Table 1].

The IOC were detected in 96.8% of the radiographs. The Type I, II, and III IOC were 43.45%, 18.95%, and 34.4% of radiographs, respectively [Table 2].

When the type was co-related with the sex, it was noted that on statistical analysis (Chi-square test), the obtained P value was 0.214, which was not significant ($P > 0.05$) [Table 3].

When the type was co-related with the side, it was noted that on statistical analysis (Chi-square test), the obtained P value was 0.101, which was not significant ($P > 0.05$) [Table 4].

DISCUSSION

Scarfe *et al.*^[5] has put forward three anatomic variations of the IOC complex based on 246 conventional panoramic radiographs. Till date, no further studies are traced in the literature. The present retrospective study was conducted on 1000 panoramic radiographs to study the morphology of IOC in Indian population based on Scarfe *et al.*^[5] classification and to observe any variation, if it is there.

The results of our study were better than Scarfe *et al.*^[5] in terms of demonstration of IOC. Scarfe *et al.*^[5] was able to visualize the canal in 81.3% of cases, while in our study, it was identified on 96.8% of the radiographs. This could be due to better visualization and interpretation of IOC on the digital panoramic radiograph as compared to conventional radiograph.

In our study, the most common type of the IOC detected was Type I (43.45%) canal. This finding differed from the findings of Scarfe *et al.*,^[5] wherein they observed Type III (44.75%) canals. This difference may be related to the sample size and geographical variation. The co-relation of type of IOC with left and right side was statistically not significant ($P > 0.05$) in our study. This observation matched with the findings of Scarfe *et al.*^[5] Further, we also observed a unique finding that there was no correlation between IOC and sex ($P > 0.05$) suggesting no anatomical variation.

It is significant to note here that, during the present study on 1000 digital panoramic radiographs, we distinctly observed

new forms/types of IOC on few radiographs, which were different from the types described by Scarfe *et al.*^[5] The possible reason may be the population-specific variation. This new observation can be considered as additional types. Hence, the authors, More and Shah hereby propose a new classification and also modification in the Scarfe *et al.* radiographic classification of IOC, which is as follows:

1. Type I

A: Radiopaque canal having two continuous radiopaque parallel linear ridges/lines

Table 1: Distribution of study participants according to age and sex

Age groups (years)	n		Total
	Male	Female	
10-19	56	67	123
20-29	142	114	256
30-39	107	72	179
40-49	114	68	182
50-59	68	58	126
60-69	75	30	105
70-79	18	07	25
80-89	03	01	04
Total	583	417	1000

Table 2: Type of IOC

Type	Total (%)
I	869 (43.45)
II	379 (18.95)
III	688 (34.4)
Not detected	64 (3.2)

IOC: Infaorbital canal

Table 3: Co-relation of type of IOC with sex (Chi-square test)

Type	Male	Female	Total	Obtained P value	Significance
I	520	349	869	0.214	Not significant ($P > 0.05$)
II	207	172	379		
III	395	293	688		

IOC: Infaorbital canal

Table 4: Co-relation of type of IOC with side (Chi-square test)

Type	Right	Left	Total	Obtained P value	Significance
I	436	433	869	0.101	Not significant ($P > 0.05$)
II	171	208	379		
III	350	338	688		
Not detected	35	29	64		
Total	992	1008	2000		

IOC: Infaorbital canal

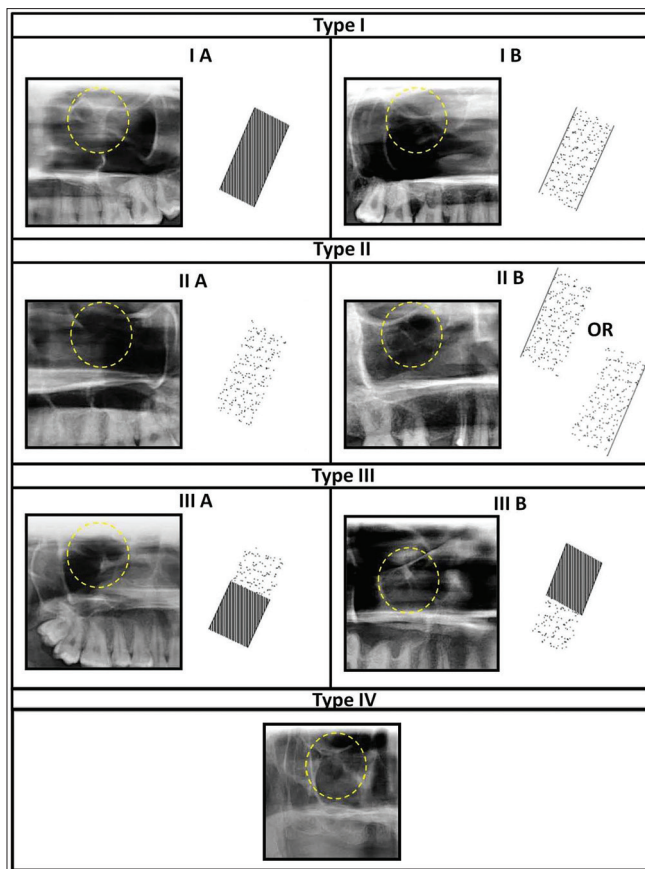


Figure 1: Proposed classification according to More and Shah. Radiopaque – ■ Radiolucent – □

- B: Radiolucent canal having two continuous radiopaque parallel linear ridges/lines
- 2. Type II
 - A: Radiolucent canal having no radiopaque parallel ridges
 - B: Radiolucent canal with radiopaque parallel linear ridge on either side
- 3. Type III
 - A: Combination of Type I medially and Type II laterally

- B: Combination of Type I laterally and Type II medially
- 4. Type IV: IOC not detected [Figure 1].

CONCLUSION

Studies conducted worldwide on IOC are negligible. The present study is conducted on the Indian population for the first time. The significance of the IOC is of high importance for the surgeons. Our study has proposed a new classification for IOC. Studies may be designed in future to validate our classification and to study the IOC on computed tomography.

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Conflicts of interest

There are no conflicts of interest.

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