

A Radiographic Study on the Visualization of the Anterior Loop in Darbhanga Population - An Original Research

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ABSTRACT

Introduction: Knowledge of alveolar loop of inferior alveolar canal is important to prevent any post operative complications after mandibular surgery or any prosthesis placement in mandible parasymphysis region. The aim of this study was to visualize anterior loop in Darbhanga (Bihar) population on digital orthopantomogram radiographs and the objective was to evaluate the frequency of anterior loop in different age groups on digital orthopantomogram radiographs.

Material and Methods: The study was done in the Department of Oral Medicine and Radiology and Department of Public Health Dentistry. A total of 303 panoramic radiographs were examined by a single radiologist. Anterior loop was examined in all 303 radiographs. The collected data were subsequently processed and analyzed using SPSS statistical package version 17.

Results: We found that anterior loop was visible in 39.6% of population. Anterior loop was most commonly seen in younger age group. As the age advanced visibility of anterior loop was reduced.

Conclusion: In the present study, a total of 606 sites were examined on radiographs. Out of 156 male subjects, anterior loop was visible in 68 subjects and out of 147 female subjects, anterior loop was visible in 52 subjects only. Visibility of anterior loop in subjects aged 50 or more than 50 years was seen in only 9 subjects.

Keywords: Anterior loop, Inferior Alveolar Canal, Mandible, Panoramic Radiograph

INTRODUCTION

Oral and maxillofacial region of an individual is one of the most complex anatomical structures of whole body. Mandible when compared to maxilla is more compact and dense bone. In mandible, mandibular nerve enters through mandibular foramen in mandible. The mandibular foramen is present on the ascending mandibular ramus. As it passes through mandibular canal it is called inferior alveolar nerve (IAN).¹ It runs downward and forward, generally below the apices of the molar till first and second premolar. Inferior alveolar neurovascular bundle leaves the canal via mental foramen where it splits into two branches, incisive and mental nerve branch. The section of the nerve in front of the mental foramen and just before its ramification to the incisive nerve is called the anterior loop (AL) of IAN.²

Anterior loop is described as the mental canal which arises from the mandibular canal and runs outward, upward and backward to open at the mental foramen.³ The considerable variation in the course, the shape, the curve and the direction

of the nerve as well as the terminal segment of IAN complicates the regional anatomy. The anterior loop cannot be seen clinically, but can be detected in radiographs which includes dental panoramic or orthopantomograph (OPG), cone beam computed tomography (CBCT) or magnetic resonance imaging (MRI).⁴

The precise knowledge of mental foramen, mandibular foramen, inferior alveolar canal, mandibular neurovascular bundle is of utmost importance for desired outcome of different types of mandibular surgery, implant or any prosthesis placement in mandible region. Any surgery in parasymphysis region without proper knowledge of anterior loop in that region may cause iatrogenic damage which may result in neurosensory disturbances in the area of lower lip and chin.⁵ Radiographs are the diagnostic tool which provide precise information about the visibility of anterior loop and presence of it as well. Few studies have been done till date to evaluate different anatomical variants of anterior loop of IAN. Very less studies are there regarding visualization of anterior loop on panoramic radiographs. No studies have been reported till date in this region of Bihar on visualization of anterior loop. Hence, this study was planned and conducted with an aim to visualize anterior loop radiographically in Darbhanga (Bihar) population.

MATERIAL AND METHODS

This study was conducted in the Department of Oral

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Medicine and Radiology and Department of Public Health Dentistry. The study was approved by ethical committee of the institute. A total of 303 panoramic radiographs were obtained from the archives of our department as soft copies. Panoramic radiographs were obtained from Genoray Papaya Extor-C digital panoramic system using standard exposure parameters (Tube Potential: 66–85 kv, Tube Current: 6–10 mA, Total Filtration: 2.8 mm, time: 12 sec), as recommended by the manufacturer. The magnification factor for the region from the posterior border of ramus to canine, as reported by the manufacturer, is 1.25. The selected radiographs were of patients aged above 20 years. All panoramic radiographs were made and evaluated in the same manner by a single oral radiologist with the help of measuring tools on the accompanying software. Age groups were divided as follows:- 20-29 years, 30-39 years, 40-49 years, 50 or more 50 years. Inclusion criterias were i) patient aged 20 years and above ii) high quality radiographs with respect to geometric accuracy and contrast of the image, iii) teeth present between lower right and lower left first molars, iv) no deep caries, large restorations, root canal treatment in the lower teeth, iv) no supernumerary or unerupted teeth, v) devoid of any positioning errors, v) images free from the presence of implants or metal artifacts in the interforamen region. Exclusion criterias were i) presence of radiolucent or radiopaque lesions affecting mandible ii) partial or completely edentulous mandible, iii) presence of metal artifacts, iv) evidence of fracture around the mental foramen and around parasymphysis region

The presence of anterior loop was observed by carefully observing the course of the mandibular canal and reverse looping upward and backward. Anterior loop status was divided into four categories: i) Present on both sides, ii) Present on the right side only, iii) Present on the left side only, iv) Absent. A total of 303 radiographs which fulfilled the inclusion criterias were examined.

STATISTICAL ANALYSIS

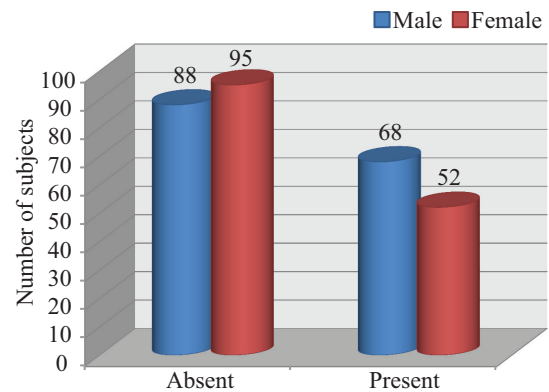
The collected data were subsequently processed and analyzed using SPSS statistical package version 17. Chi square test was applied. A p value of less than 0.05 was considered statistically significant which was observed in our study.

RESULTS

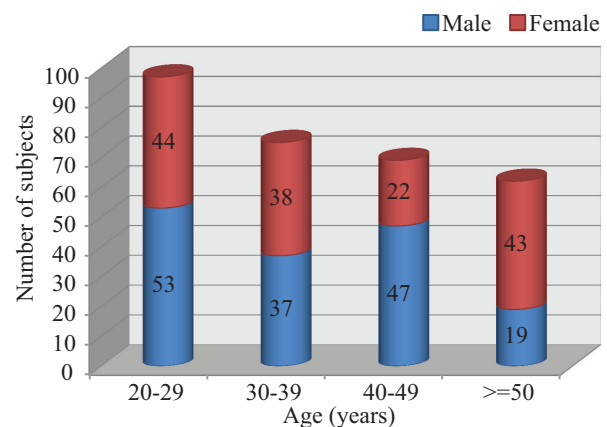
Out of 303 radiographs which fulfilled the inclusion criteria, 156 (51.5%) were males and 147 were females (48.5%). Thus a total of 606 sites were examined on radiographs. Out of 156 male subjects, anterior loop was visible in 68 subjects and out of 147 female subjects, anterior loop was visible in 52 subjects only (Graph 1). Male : female ratio was 1.06. Breakdown of subjects according to various age groups shows maximum number of subjects is in age group 20-29 years (97 subjects), followed by 30-39 years (75 subjects), 40-49 years (69 subjects) and minimum number of subjects is in 50 years or more than 50 years of age group (62 subjects) (Graph 2). Number of subjects that fulfilled the criteria reduced as the age of the subjects increased.

Age (Years)	Absent	Present
20-29	41	56
30-39	38	37
40-49	51	18
>=50	53	9
Total	183	120
$\chi^2 = 37.880$; $df = 3$; $p < 0.001$; Highly significant		

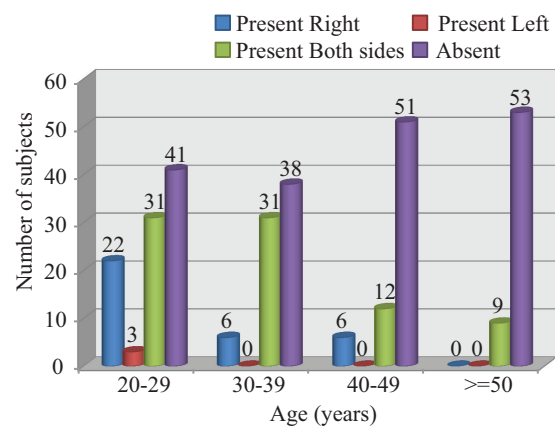
Table-1: Visibility of anterior loop according to age



Graph-1: Number of subjects with visible anterior loop according to sex

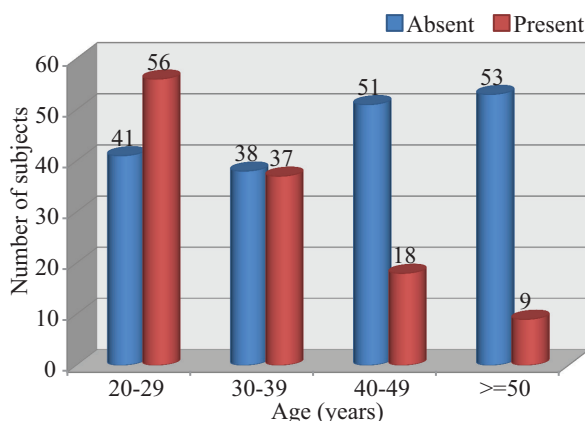


Graph-2: Age / gender wise distribution



Graph-3: Visualization of anterior loop on 303 radiographs

This may be because of increasing frequency of subjects who were fully or partially edentulous beginning from the first premolar. Large number of anterior loop was visible in 20-29 years of age group (57.7%) followed by 30-39 years



Graph-4: Number of subjects with visible anterior loop according to age

(49.3%), 40-49 years (26.1%) and 50 or more than 50 years of age group (14.5%) (Table 1). No anterior loop was visible on left side in subjects ranging from 30-39 years, 40-49 years and 50 or more years (Graph 3). Visibility of anterior loop reduced as the age of the subject increased (Graph 4). More than half of the subjects (57.7%) aged between 20-29 years had at least one anterior loop identified whereas as the age advanced visibility got reduced to 14.5%. Males showed no anterior loop in left side.

DISCUSSION

Anterior loop is an important anatomical landmark in mandible region which is often overlooked because of negligence or due to poor visualization of anterior loop or lack of knowledge about anterior loop among various radiologist and surgeons. However, of late, growing interest has been generated in this structure with the advent and increase in popularity of dental endosseous implants. To avoid any inadvertent damage to anterior loop which may lead to neurosensory disturbances, a 5 mm distance to most distal fixture from anterior loop has been proposed.⁶

The result of present study showed that anterior loop was visible in 39.6% of 303 subjects. This result coincides with the observation made by Ngeow et al who found loop was visible in 40.2% of Malaysian population. But studies conducted by Jacobs et al and Arzourman et al showed lower percentage of visibility of anterior loop of 11% and 12% respectively.^{7,8} Higher visibility of anterior loop may be due to use of new panoramic imaging system having high resolution radiographs. Panoramic radiographs were selected for the present study owing to its cost effectiveness; larger area can be compared bilaterally at the same time, and ease of availability. Difficulty in visualization of anterior loop may be due to presence of relatively thick cortical plates or due to error in patient's positioning which results in object being outside the plane of focus (focal trough). The visibility of anterior loop decreased as age of subjects increased. This finding was common with the observation made by Ngeow et al. as the age advances, bone remodeling occurs. Bone undergoes various changes qualitative and quantitative. There is an increase in cortical bone porosity and resorption of haversian canals which results in enlargement of marrow

spaces. All this phenomenon leads to change in trabecular pattern too which in turn affects the visibility of anterior loop. Dentate subjects were included in this study because it has been observed in studies conducted by Kuzmanovic et al that due to poor bone quality in edentulous patients, visibility of anterior loop is extremely difficult. Also as the age advances in edentulous patients, resorption of alveolar ridge in edentulous patients may progress to such an extent that mental canal is also resorbed and mental neurovascular bundle is exposed. Therefore this study was done to visualize anterior loop in this region of Bihar.

CONCLUSION

Dentistry is advancing at a fast pace in recent years. Many new treatment modalities are coming every day with new materials and prosthesis. Diagnostic radiology is also making progress in leaps and bounds. With new imaging modalities coming up, its very important for various surgeons to properly examine the area of surgery with thorough knowledge of all anatomical landmarks in the concerned area. This will not only help the dentists but will also be helpful to patients. In the present study, anterior loop was found in 39.6% of population. With age, visibility reduced. This is the only study that was done on such a large patient size in this part of Bihar (India), however, further studies are recommended with larger sample size, so that visualization of the anterior loop can be evaluated.

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