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Evaluation of the Visibility and the Course of the Lingual Foramen Using Orthopantomogram

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ABSTRACT

Introduction: Lingual foramen are usually located in the midline, level with or superior to the genial tubercles. The success of implant placements is dependent on the radiological examination, which helps the clinician to determine the parameters of implant placement by revealing the structures like the course of the nerves, location of foramina, height, and shape of alveolar bone, etc. (1). **Aim:** The present study was done to evaluate the visibility and course of the lingual foramen using an orthopantomogram. **Materials and methods:** The study consisted of 2000 OPG's ranging from 18 years to 75 years at Saveetha Dental College & Dental Hospital, Chennai to evaluate the appearance and visibility of the lingual foramen in the mandible on Orthopantomogram. OPG's with malformations, trauma, musculoskeletal disorders were excluded from the study. **Results:** Out of 2000 OPG's the visibility of lingual foramen in males was 74% when compared to females which were 68% (Figure 2)**.** The visualization of the presence of lingual foramen between all the age groups ranging from 18-75 was almost the same (Figure 3). **Conclusion:** OPG can be considered for the cognizance of the position of anatomical structures during the major maxillofacial surgeries and placement of endosseous implants to provide sufficient information.

Keywords: *Orthopantomogram; lingual foramen; mandible; radiological examination; visibility and course.*

INTRODUCTION

An OPG (Orthopantomogram) is a panoramic scanning dental X-ray of the upper and lower jaw. It is also sometimes called by the proprietary name Orthopantomography or Panorex. It shows a flattened two-dimensional view of a half-circle from ear to ear. Panoramic x-rays allow images of multiple angles to be taken to make up the composite panoramic image, where the maxilla (upper jaw) and mandible (lower jaw) are in the viewed area. The structures that are outside the viewed area are blurred. X-rays are a known method that uses radiation to take pictures of bones and other parts inside the body (2,3). Orthopantomogram is a panoramic scanning dental X-ray of the upper and lower jaw. It shows a flattened two-dimensional view of a half-circle from ear to ear. Panoramic x-rays allow images of multiple angles to be taken to make up the composite panoramic image, where the maxilla (upper jaw) and mandible (lower jaw) are in the viewed area. It also demonstrates the number, position, craniomandibular of the teeth including those that have not yet surfaced or erupted through the gum. It is different from the small close up x-ray dentists take of individual teeth. It shows less fine detail, but a much broader area of view. This view is useful to check the invisible like wisdom teeth, the development of a child's jaw and teeth. It is also often used to check jaw joints, the TMJ (temporomandibular joint), on special occasions the CMA (craniomandibular articulation) (4).

There are many unnamed accessory foramina present in the mandible, especially on the lingual side. They are very variable in their distribution and may be of significance in relation to the effectiveness of local anaesthetic solutions administered for dental procedures (5–7). The lingual foramen, though an opening usually presents in the midline on the lingual aspect of the anterior part of the mandible, could have variations in number and position. The branches of the sublingual artery, a branch of the lingual artery and submental artery, a branch of facial artery send branches to the peripheral muscles, mylohyoid muscle, mucous membrane, and gingiva (8,9). To prevent hemorrhage caused due to lingual plate perforations, a thorough radiological of the foramina in the mandible can prevent complications during surgical procedures (10). The anterior aspect of the mandible, which was generally considered a safe surgical area, must receive more attention in view of the vital structures passing through the lingual foramen (11,12). However, knowledge of the anatomical structures passing through the lingual foramen is very essential, clinically, in fractures of the symphysis menti, implants and congenital defects and also to avoid pitfalls in the diagnosis of the fracture of genial tubercles (13).

Advances over the past century have meant that surgical procedures in the lower anterior segment of the mandible including orthognathic surgeries, dental implant placement, bone grafting, and lowering genial spines procedures of edentulous patients have become more frequent (14,15). This area has traditionally been considered a "surgical safe zone" because of the absence of important superficial nerves or vessels(14,16). However, recent reports of unexplained bleeding and sublingual hematoma and genioplasty and endosseous implant placement have spurred research into the content and the vascularity of the area (17). Unexpected bleeding, during or after implant placement, is a complication that all surgeons wish to avoid. Reports of unexplained bleeding from sites in proximity to implants placed in the mandibular foramen simulated research into the contents and location of the anterior lingual foramen(18–20). It is today widely accepted in literature that the foramen is an opening of the incisive canal and carries several accessory blood vessels that supply the anterior mandible (16,21,22) This present study aims to evaluate the visibility and course of the lingual foramen using Orthopantomogram in the South Indian population based on their gender and age group.

MATERIALS AND METHODS

The study was done at a private dental college hospital in Chennai, India. Morphometric analysis was conducted on the anatomical structure of mandible of 2000 digital Orthopantomogram collely from patients visiting a dental hospital. Both male and female orthopantomogram with age groups ranging from 18 years to 75 years without any malformation, trauma, musculoskeletal disorder were included from the study. All calculations were processed using a statistical package for socials science statistical software (SPSS version 20. Chicago Illinois) Descriptive statistics was used to analyse the results.Ethical approval for the study is obtained from the Institutional Review Board (IRB).

RESULTS

All the calculations were processed using the Statistical Package for Social Science software. Descriptive statistics including tables and graphs are applied to show the outcome of the study.Out of 2000 OPG's collected and studied (Figure 1), the visibility of lingual foramen in males was 74% and in females, it was found to be 68% (Figure 2). The visualization of the presence of the lingual foramen between the age group 18-30 years was slightly higher compared to the other age groups showing 73% visibility. Whereas the other age groups showed similar results of 70% in 31 to 45 years and 46 to 60 years, 68% in 61 to 75 years (Figure 3).

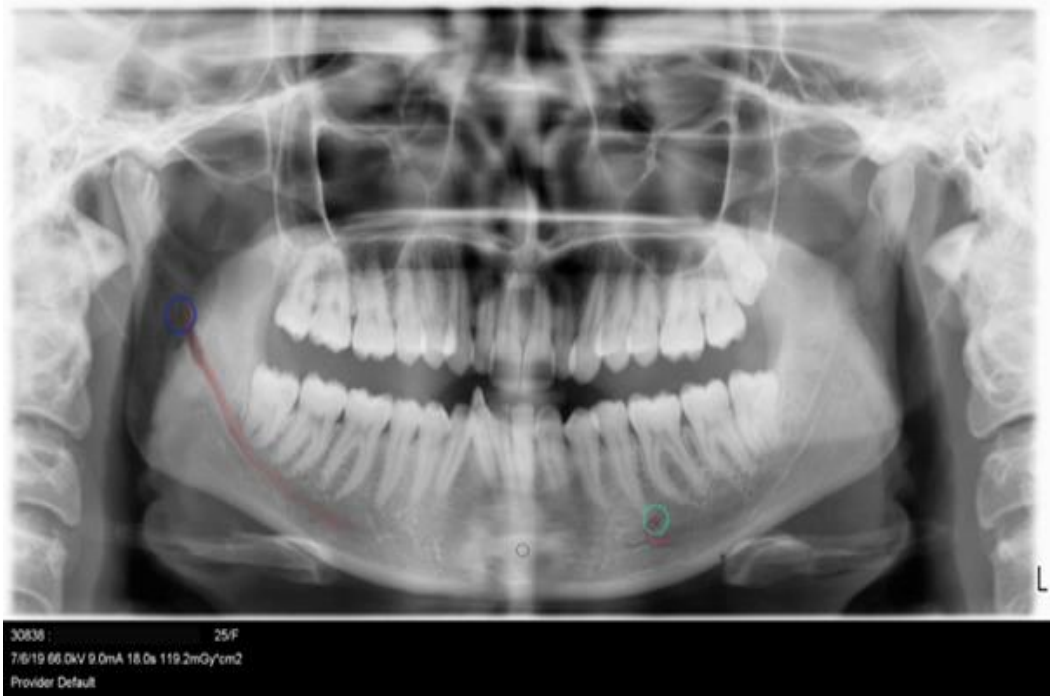

Figure 1: *Image represents the Orthopantomographic radiograph showing the presence and visibility of the lingual foramen.*

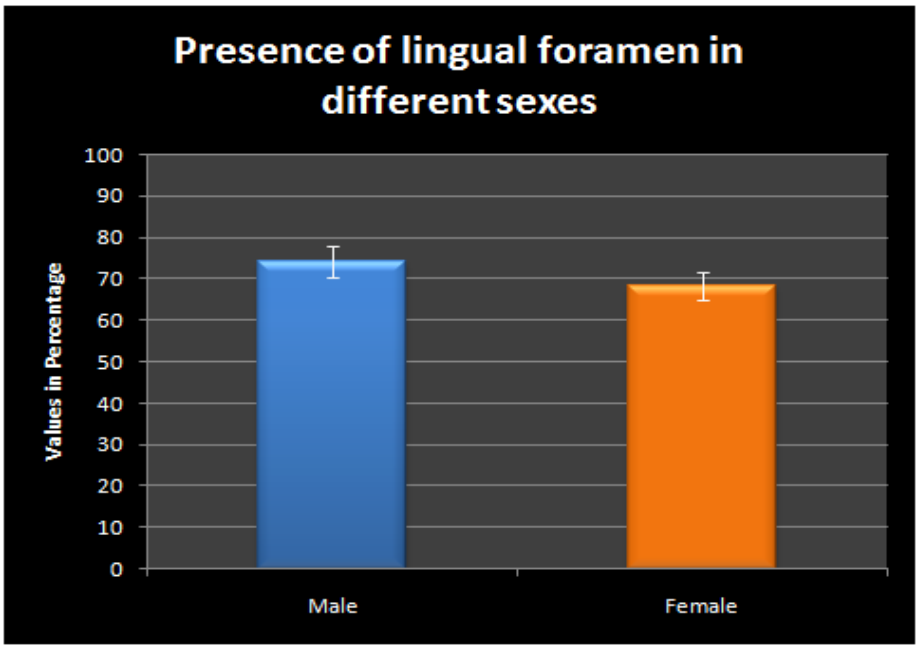

Figure 2: *Bar chart represents the frequency of the presence of lingual foramen in different genders. X axis represents the gender of the participants and Y axis represents the frequency of the presence of lingual foramen in percentage. Blue denotes male participants (74%) and orange denotes female participants (68%). The visibility of the lingual foramen was found to be greater in males than females.*

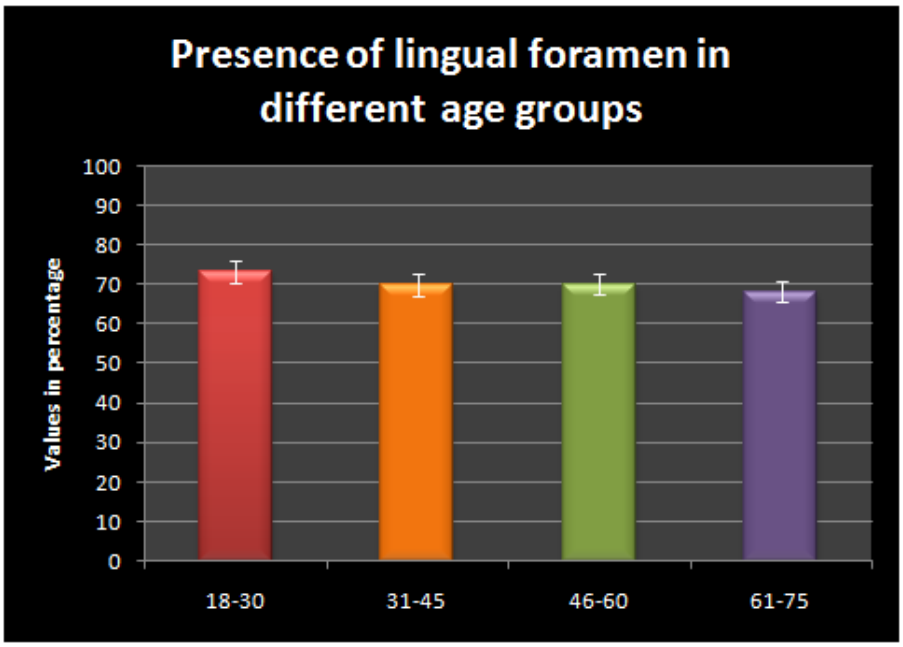

Figure 3: *Bar chart represents the frequency of the presence of lingual foramen in different age groups. X axis represents the age of the of the participants and Y axis represents the frequency of the presence of lingual foramen in percentage.Red denotes the age group 18-30 (73%), orange for 31-45 (70%), green for 46-60 (70%) and violet for the age group 61-75 (68%). The visibility of the lingual foramen was found to be slightly higher in 18-30 years and almost the same in other age groups.*

DISCUSSIONS

Panoramic radiography also called pantomography is a radiologic technique for producing a single image of the facial structures that include both the maxillary and the mandibular dental arches and their supporting structures. It is a two-dimensional (2D) image which is very cheap and hence used as a routine imaging technique in dentistry. There are two main methods in imaging the oral structures according to the place of the films. In intra oral radiography film is placed inside of the mouth and in extra oral radiography film is placed outside of the mouth. Dental panoramic radiography is one of the methods of extra oral radiography. Dental panoramic radiography is a unique extra oral film technique that allows the dentist to view the mechanism of carcinogenesis (23,24). Quality assurance of dental panoramic radiographs is very important as properly planned quality control tests and quality management programs contribute to producing a good quality image. Good quality image is the basic means to proper diagnosis. Dental panoramic radiography imaging is mostly used for orthodontic assessments. Therefore image quality should not be minimized to avoid misinterpretation (25–27). In panoramic imaging both principal of tomography and principle of scanning are used. Hence correct positioning of the dental arch inside the focal trough is important to obtain images with high diagnostic value. Images can be obtained as plain film radiographs and digital radiographs.

Several anatomical variations show the necessity of radiography before surgical procedures on the mandible in order to estimate the possible dangers during surgery. OPG is a two-dimensional image, lacking sufficient data in the buccolingual region and enhancing in both vertical and horizontal regions. It serves as a valuable tool for planning surgical assessment of an implant (28). This technique also used to evaluate the topographic relationship between the mandibular canal and impacted third molars. Moreover, it serves as part of the standard of care for the preoperative evaluation of an implant site. The advantages of panoramic imaging include visualization of many anatomic features, low cost, and availability. The digital panoramic images when compared with conventional images are equally efficient in the localization of mental and mandibular foramina (29).

Depending on the position and visibility of lingual foramen the common errors with inferior dental nerve block that is the insertion of the needle too low on the medial side of the ramus (below the lingual foramen) and the insertion of the needle too far anteriorly on the medial side of the ramus the errors during blocks can be minimized and also for planning the horizontal osteotomies during bilateral sagittal split osteotomy surgical procedures. The type of the third molar and premolar impactions can also be detected based on anatomical landmarks depending on the visibility in the panoramic radiography (30).

Different studies have shown that OPGs are considered as an unreliable tool in determining the foramen region due to intrinsic drawbacks of imaging planes to record the complete region accurately (27). Inappropriate postures of persons to be exposed also can contribute to poor visibility (31). In the present study, the visibility of the lingual foramen present in the mandible was assessed using a panoramic radiograph. From the 2000 OPG's collected and studied, the visibility of lingual foramen in males was 74% and in females, it was found to be 68%**.** The presence of the lingual foramen between the age group 18-30 years was slightly higher compared to the other age groups showing 73% visibility.

In the study done by Paul Stelt, the visibility of the lingual foramen using Cone-beam computed tomography was found to be 88%, The high detection rate of the incisive canal and the lingual foramen in the anterior region of the mandible using CBCT indicates the potential high preoperative value of CBCT scan for surgical procedures in the anterior mandible (32). Similarly, in the study done by Michelle Briner, it was found that there was no statistically significant difference between sexes regarding the amount and size of the lingual foramina, neither regarding the size and age of the patients (33). The present study has reiterated this fact that the lingual foramen is visible between the age group of 18-30 years and is moderately visible among the other age groups. It is similar between male and female genders.

CONCLUSION

The prevalence of the mandibular lingual foramen seems to be nearly universal in the South Indian population. Surgeons looking to place implants in the mandibular anterior region should take cognizance of the position of the anatomical structures during major maxillofacial surgeries to provide sufficient basic information to minimize the chance of complications.

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