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Radiographic Assessment of anatomical variables in maxillaand mandible in relation to dental implant placement

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Abstract
Oral rehabilitation using implants is rapidly replacing tooth supported prostheses. The success of implants is largely dependent on the quality and quantity of alveolar bone. Hence the present study was planned to evaluate the location of limiting anatomicalvariablesin maxilla and mandible in relation to dental implant placement.
The present study was planned in the Department of Dentistry Anugrah Narayan Magadh Medical College, Gaya, Bihar. Total 60 panoramic radiographs of the both the sexes were selected for the present study. The radiographs of complete dentate patients with full coverage of both the jaws were selected for the study.
Although oral radiology is the precious member of oral diagnosis procedures, only one imaging modality can provide us to wrong diagnosis. In the mandible, the amount of bone available in the premolar and molar regions was similar. However, in the maxilla, the vertical bone height was markedly less in the molar region as compared to the premolar region.

Keywords: panoramic radiography, mandibular canal, maxillary sinus, mental foramen, implants, etc

Introduction
Dental radiographs are commonly called X-rays. Dentists use radiographs for many reasons: to find hidden dental structures, malignant or benign masses, bone loss, and cavities.
A radiographic image is formed by a controlled burst of X-ray radiation which penetrates oral structures at different levels, depending on varying anatomical densities, before striking the film or sensor. Teeth appear lighter because less radiation penetrates them to reach the film. Dental caries, infections and other changes in the bone density, and the periodontal ligament, appear darker because X-rays readily penetrate these less dense structures. Dental restorations (fillings, crowns) may appear lighter or darker, depending on the density of the material.
The dosage of X-ray radiation received by a dental patient is typically small (around 0.150 mSv for a full mouth series, according to the American Dental Association website), equivalent to a few days' worth of background environmental radiation exposure, or similar to the dose received during a cross-country airplane flight (concentrated into one short burst aimed at a small area). Incidental exposure is further reduced by the use of a lead shield, lead apron, sometimes with a lead thyroid collar. Technician exposure is reduced by stepping out of the room, or behind adequate shielding material, when the X-ray source is activated.
Once photographic film has been exposed to X-ray radiation, it needs to be developed, traditionally using a process where the film is exposed to a series of chemicals in a dark room, as the films are sensitive to normal light. This can be a time-consuming process, and incorrect exposures or mistakes in the development process can necessitate retakes, exposing the patient to additional radiation. Digital X-rays, which replace the film with an electronic sensor, address some of these issues, and are becoming widely used in dentistry as the technology evolves. They may require less radiation and are processed much more quickly than conventional radiographic films, often instantly viewable on a computer. However digital sensors are extremely costly and have historically had poor resolution, though this is much improved in modern sensors.
It is possible for both tooth decay and periodontal disease to be missed during a clinical exam, and radiographic evaluation of the dental and periodontal tissues is a critical segment of the comprehensive oral examination. The photographic montage at right depicts a situation in which extensive decay had been overlooked by a number of dentists prior to radiographic evaluation.
The mandible is a U-shaped bone. It is the only mobile bone of the facial skeleton, and, since it houses the lower teeth, its motion is essential for mastication. It is formed by intramembranous ossification. The mandible is composed of 2 hemimandibles joined at the midline by a vertical symphysis. The hemimandibles fuse to form a single bone by age 2 years. Each hemimandible is composed of a horizontal body with a posterior vertical extension termed the ramus [1].
The mandible has a large medullary core with a cortical rim 2-4 mm thick [2]. The inferior alveolar canal begins at the mandibular foramen and courses inferiorly, anteriorly, and toward the lingual surface in the ramus. In adults, the canal comes in close proximity to the roots of the third molar. In the mandibular body, the canal courses along the inferior border close to the lingual surface. Anteriorly, the canal runs typically inferior to the level of the mental foramen, to which it ascends at its terminal end.
The mandible houses the lower dentition, which in adults

consists of 2 central and 2 lateral incisors, 2 canines, 2 first and 2 second premolars, and 3 sets of molars. Interdental septi run between the buccal and lingual cortices of the mandible, and interradicular septi run between the mesial and distal roots of the molars.

The maxilla has several roles. It houses the teeth, forms the roof of the oral cavity, forms the floor of and contributes to the lateral wall and roof of the nasal cavity, houses the maxillary sinus, and contributes to the inferior rim and floor of the orbit. Two maxillary bones are joined in the midline to form the middle third of the face.

In the midline of the anterior surface of the maxilla is found a prominence, called the anterior nasal spine, with a lateral concave rim, called the nasal notch that forms the floor of the piriform aperture. Inferiorly, the alveolar process of the maxilla houses the teeth, including central incisors, lateral incisors, canines, 2 premolars, and 3 molars in adults. The tooth roots form vertical, wavelike eminences in the anterior face of the maxilla; the canine root is the most prominent. The canine root forms a vertical ridge, termed the canine eminence, in the anterior face of the maxilla. The shallow fossae medial and lateral to the canine eminence are called the incisive fossa and the canine fossa, respectively.

Panoramic films are extra oral films, in which the film is exposed while outside the patient's mouth, and they were developed by the United States Army as a quick way to get an overall view of a soldier's oral health. Exposing eighteen films per soldier was very time consuming, and it was felt that a single panoramic film could speed up the process of examining and assessing the dental health of the soldiers; as soldiers with toothache were incapacitated from duty. It was later discovered that while panoramic films can prove very useful in detecting and localizing mandibular fractures and other pathologic entities of the mandible, they were not very good at assessing periodontal bone loss or tooth decay [3].

Oral rehabilitation using implants is rapidly replacing tooth supported prostheses. The success of implants is largely dependent on the quality and quantity of alveolar bone. Hence the present study was planned to evaluate the location of limiting anatomical variablesin maxilla and mandible in relation to dental implant placement.

Methodology

The present study was planned in the Department of Dentistry, Anugrah Narayan Magadh Medical College, Gaya, Bihar. Total 60 panoramic radiographs of the both the sexes were selected for the present study. The radiographs of complete dentate patients with full coverage of both the jaws were selected for the study.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion Criteria: The radiographs of complete dentate patients with full coverage of both the jaws were selected for the study.

Exclusion criteria: Includes unsatisfactory quality of images, incomplete coverage of the maxillary sinuses, and symptomatic patients.

Results & Discussion

Proper diagnosis and treatment planning are of paramount importance for precise placement of dental implants. The general objective is to place implants in alveolar sites that are favorable to achieving Osseo integration. Areas in which the alveolar bone is of inadequate height, width, or where implant placement will likely compromise anatomical structures-such as the mandibular nerve, maxillary sinuses, or regions of severe alveolar bony undercuts- should be accurately identified and assessed, as concluded by Shulman [4], Stella and Tharanon [5], and Lindh and Petersson [6]. The attainment by clinical observation and palpation of the "third dimension" has proven to be inadequate because of the various thicknesses of the soft tissue overlying the bony maxilla and mandible, according to Beman [7]. To some extent, the third dimension can be ascertained by utilization of a calibrated probe and sounding through anesthetized tissue to the depth of the alveolar bone, as reported by Petrokowski and Pharoah [8].

Table 1: Position of Mental Foramen

Position	Right	Left
At the first premolar	2	1
Between the premolars	4	4
At the second premolar	22	23
Between second premolar and molar	1	1
At the first molar	1	1

Table 2: Bone available in the premolar and molar regions of the mandible

Age Group	Premolar		Molar	
	Right	Left	Right	Left
18 – 30 years	13 – 17	18 – 22	14 – 18	13 – 19
31 – 50 years	13 – 16	13 – 18	12 – 17	12 – 16
51 and above	12 – 16	12 – 17	11 – 17	11 - 16

Table 3: Bone available in the premolar and molar regions of the maxilla

Age Group	Premolar		Molar	
	Right	Left	Right	Left
18 – 30 years	10 – 18	11 – 17	7 -11	7 -11
31 – 50 years	11 – 17	11 – 18	6 – 9	5 – 11
51 and above	8 – 16	10 – 16	5 – 9	4 - 10

Maxillary sinus is a pyramidal-shaped cavity in the facial skull with its floor in close approximation to the maxillary posterior teeth. The floor of the ant rum in dentate adults is approximately 1 cm below the nasal floor. Anteriorly, the sinus extends to the canine premolar region. The convex sinus floor usually reaches its deepest point at the first molar region [9]. The loss of teeth will cause the sinus floor to further dip down toward the alveolar crest. The degree of pneumatization increases as the period of edentulism increases. In the present study, the amount of bone available was measured from the floor of the sinus in both premolar and molar regions. There was a significant difference between the right and left sides in both premolar and molar regions in the older group. The amount of bone available in the molar region was comparable to a similar study done on Indian and Korean population [10]. In the molar region, the vertical bone height was much less than a study done in Turkish edentulous population [11]. The size of the maxillary sinus may be more in Indian population attributing to less bone available.

Examining the cortical outline of maxilla is a very good way to center the examination of mid face. The posterior border

of maxilla extends from superior portion of pterygomaxillary fissure down to tuberosity region around the other side. Pterygomaxillary fissure itself has an inverted teardrop appearance. It is very important to identify this area on both sides of the image because maxillary sinus mucoceles and carcinomas characteristically destroy the posterior maxillary border, which is manifested as loss of pterygomaxillary fissure. Lefort fracture often is initially diagnosed by disturbances of integrity of pterygomaxillary fissure [12].
The amount of bone available is influenced not only by the anatomic structures, but also by a number of factors such as gender, hormones, par functional habits, and race [13]. In our study, the bone height was measured in different age groups of both males and females. The bone height was measured from the alveolar crest to the limiting anatomical structures in the premolar and molar regions bilaterally. In the mandible and maxilla, the bone height was progressively reduced as the age increased. In the older age group, there was a significant difference between the right and left sides of the molar regions of the maxilla and mandible. The dimensions of the vertical bone height in both the jaws were comparable to those studies done in edentulous jaws. However, the studies done in other populations showed lesser bone height [14].

Conclusion

Although oral radiology is the precious member of oral diagnosis procedures, only one imaging modality can provide us to wrong diagnosis. In the mandible, the amount of bone available in the premolar and molar regions was similar. However, in the maxilla, the vertical bone height was markedly less in the molar region as compared to the premolar region.

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