

Normal Radiographic Anatomy – Maxillary Central Area

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Summary

The radiographic recognition of disease requires knowledge of the radiographic appearance of normal structures. Intelligent diagnosis requires an appreciation of the wide range of variation in the appearance of normal anatomic entities. Similarly, most patients demonstrate many of the normal radiographic landmarks. Accordingly, the absence of one or more such landmarks in any individual should not necessarily be considered abnormal.

The *objective* of this study is to present the normal radiographic anatomy of maxillary central area in the periapical, panoramic, occlusal, cephalometric radiographs and volumetric computed tomography.

Material and method. This study includes 28 images which present normal anatomy of the maxillary central area.

The *results* show the importance of radiographs in helping the clinician to visualize alveolar ridge and adjacent structures and to guide the choice of site, number, size, and axial orientation of the implants

The *conclusion* of the study encourages the use of volumetric computed tomography as a new technique that permit cross-sectional visualization and interactive image analysis, that must be considered as standard of care, especially for complex reconstructions.

Keywords: anatomy, maxillary central area, radiographs, tomography

Introduction

The dental professional's role is to make the final diagnosis through the interpretation of a radiographic image. To put a diagnosis is "the art" of identifying a disease from its signs and symptoms. The interpretation of radiographs gives us signs or symptoms on which to build a diagnosis (1). Other signs or symptoms that may be part of a diagnosis are gathered by using the patient's chief complaint, dental and medical history, clinical examination, vitality testing, advanced imaging, biopsy, and laboratory tests.

The steps that are taken in forming a diagnosis are (a) identification of an area or structure that is questionable; (b) interpretation of what has been identified; and (c) diagnosis based on the interpretation. The dental professionals need to develop interpretative skills to identify all normal anatomic structures, both tooth and bone, and artefacts that may be visible on interior radiographs and pantomographs. The dental professional also must be able to differentiate deviations in radiographic form and density from normal structures (2). To produce adequate diagnosis, the dentist must know what relevant information is being sought from the radiograph.

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If dental professionals know how periapical pathologic conditions appear radiographically, they also will understand the necessity of seeing the entire periapical area of the tooth in question in order to make a proper diagnosis.

Objectives

The purpose of this article is to illustrate the normal radiographic anatomy of maxillary central area in the periapical, panoramic, occlusal, cephalometric radiographs and finally in volumetric computed tomography (3, 4).

Material and method

The maxillary central area is presented on the skull, in different types of radiographs and in volumetric computed tomography.

Maxillary Incisor Area

Skull Anatomy (Figs. 1, 2)

In Figs. 1 and 2 are presented anatomic structures that are visualized on the skull from frontal and bottom views.

Periapical radiographs (Figs. 3, 4):

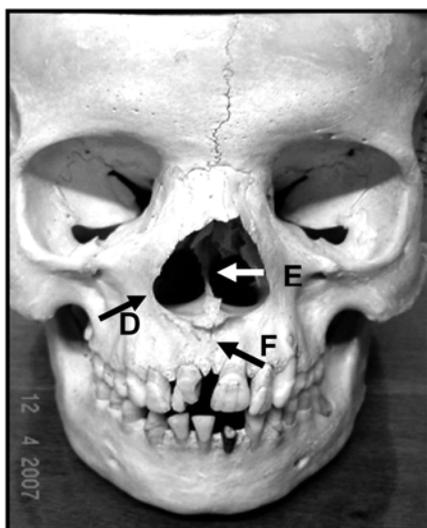


Fig.1 Skull - frontal view

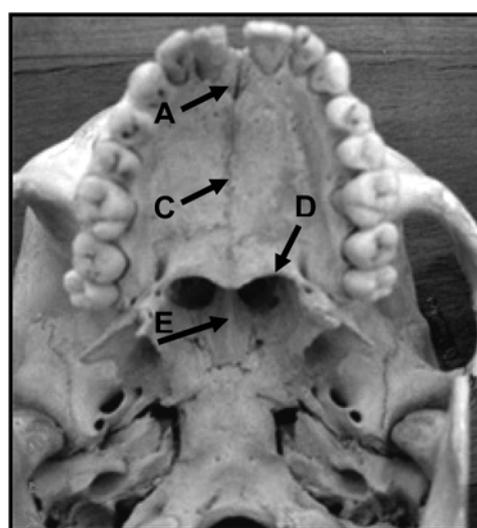
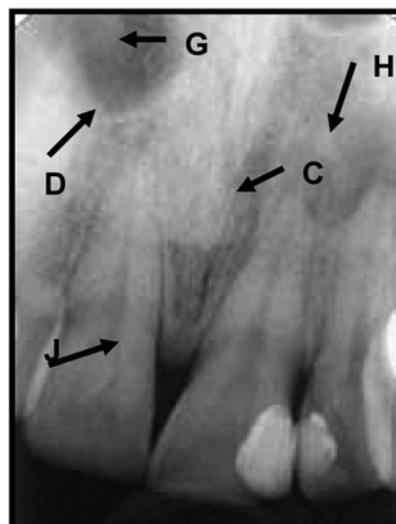


Fig.2 Skull - bottom view



Figs. 3, 4 Periapical radiographs - maxillary incisor area

Figs.1, 2, 3, 4: Maxillary Central Incisor Area: (A) Nasopalatine foramen, (B) Nasopalatine canal, (C) Median palatine suture, (D) Nasal fossa, (E) Median nasal septum, (F) Anterior nasal spine, (G) Inferior concha, (H) Lateral fossa, (I) Columella of nose, (J) Lip line, (K) Floor of nasal cavity

(A) **The incisive foramen** (also called **nasopalatine** or **anterior palatine foramen**) (Fig. 2A, 3A) is seen as an oval radiolucency between the roots of the maxillary central incisors. It is actually in the anterior part of the palate, but superimposition makes it appear to be located between the roots of the central incisors. The radiographic position of the nasopalatine foramen may vary from just above the crest of the alveolar crest to the level of the apices of the teeth because there are anatomic size variations and the X-rays have different vertical angulations. In some cases, the shadow of the foramen may be superimposed on the apex of a central incisor, situation that required attention to differentiate it from periapical diseases. This is done by taking another radiograph at a different horizontal angulation or by testing pulp vitality. Another option is to trace the lamina dura and periodontal ligament space. These structures will be completely intact if it is a foramen and interrupted if a periapical pathologic condition is present. Familiarity with the incisive foramen is important because it is a potential site of cyst formation. The presence of the cyst is presumed if the width of the foramen exceeds 1 cm or if enlargement can be demonstrated on successive radiographs.

In some radiographs, (B) **the incisive canal** (Fig. 3B) can be seen leading to the incisive foramen, in the midline of the palate behind the central incisors at approximately the junction of the median palatine and incisive sutures.

(C) **The median palatine suture** (Fig. 2C, 3C) is seen as a thin radiolucent line going vertically between the roots of the maxillary central incisors. It must be differentiated from a (1) fracture line, (2) fistulous tract, or a (3) nutrient canal.

(D) **The nasal fossa** (Fig. 1D, 2D, 3D, 4D) is a paired radiolucency situated superior to the apices of the incisor teeth. It is also seen on the canine prejection, where it may overlap or appear near the maxillary sinus.

The radiopaque band that separates the left and the right nasal fossa is called (E) **nasal septum** (Fig. 1E, 2E, 3E). This ends inferiorly in the radiopaque (F) **anterior nasal spine** (Fig. 1F), which has a V-shape. Attention must be paid to don't misinterpreted anterior nasal spine which is near or even superimposed on the incisive foramen.

The radiopacity that sometimes projects into the nasal fossa from its lateral wall is (G) **the**

inferior concha (turbinate) (Fig. 4G). This is not calcified, so it does not appear as radiopaque as the walls of the nasal cavity. Where the concha are very large, the thickness of the soft tissue may make it look slightly opaque.

(H) **The lateral fossa** (Fig. 4H) is a depression in the labial plate in the lateral incisor region. It appears as radiolucency between the lateral incisor and canine because it represents an area of thin bone.

(I) **Cartilaginous shadow of the tip of the nose** (Fig. 3I) and (J) **the soft tissue of the lip** (Fig. 3J, 4J) may be superimposed from the crest of the crest to the crowns of the teeth. These soft tissue shadows are seen most clearly on edentulous films in which even the nares of the nose and the columella (separating column) are seen. The reality is that these soft tissues are best seen in lateral cephalometric radiographs (Fig. 5).

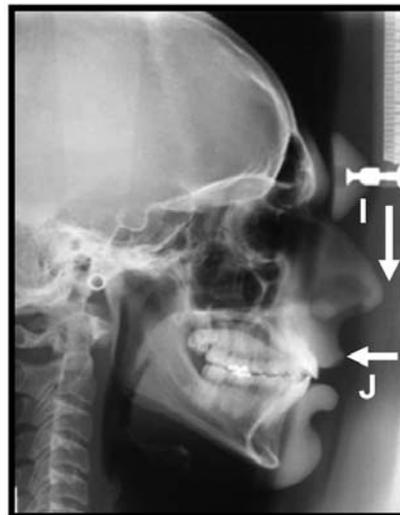


Fig. 5 Cephalometric radiograph:
(I) Cartilaginous tip of the nose,
(J) Soft tissue of the lip

(K) **The anterior floor of the nasal fossa** (Fig. 3K) appears as opaque lines extending laterally from the anterior nasal spine.

Panoramic radiographs (Fig. 6):

The anatomic structures from the maxillary central area which might be seen on the panoramic radiographs are: (A) Orbit, (B) Palate, (C) Septa in Maxillary Sinus, (D) Nasal fossa, (E) Median nasal septum.

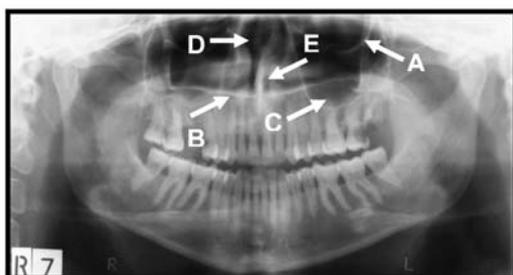


Fig. 6 Panoramic radiograph:
 (A) Orbit,
 (B) Palate,
 (C) Septa in Maxillary Sinus,
 (D) Nasal fossa,
 (E) Median nasal septum

Occlusal radiographs (Fig. 7):

The anatomic structures from the maxillary central area which might be seen on the occlusal radiographys are: (A) Nasolacrimal duct, (B) Anterior palatine foramen, (C) Lateral wall of maxillary sinus (D) Lateral wall of nasal fossa, (E) Nasal fossa, (F) Median nasal septum, (G) Inverted "Y".

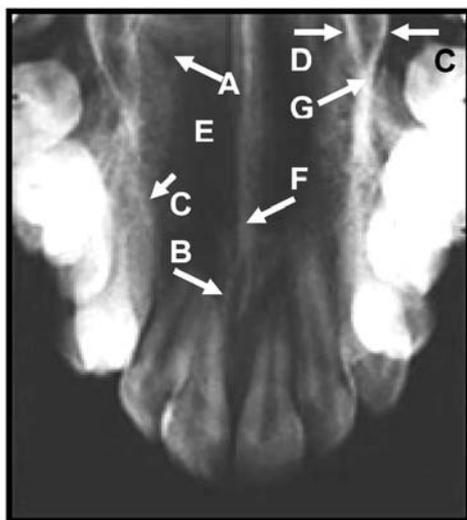


Fig.7 Occlusal radiograph:
 (A) Nasolacrimal duct,
 (B) Anterior palatine foramen,
 (C) Lateral wall of maxillary sinus,
 (D) Lateral wall of nasal fossa,
 (E) Nasal fossa,
 (F) Median nasal septum,
 (G) Inverted "Y"

Maxillary Canine Area

1) Skull Anatomy (Fig. 8)

In Fig. 8 are presented anatomic structures that are visualized on the skull from fronto-lateral view, in maxillary canine area.

2) Periapical radiographs (Figs, 9, 10, 11):

(A) The lateral wall of nasal fossa (Fig. 8A, 9A, 11A) is seen as a more mesial large radiolucency.

(B) Anterior extent of the maxillary sinus (Fig. 8B, 9B, 10B, 11B) is seen as a more distal large radiolucency.

(C) Inverted "Y" is seen in edentulous films as opacity formed by the anterior and inferior border of the maxillary sinus as the arms and the **(D) floor of the nasal cavity** as the stem (Fig. 9D).

(E) The soft tissue of the nose (Fig. 9E) is a radiopaque shadow.

In some canine projections a radiolucent area is seen distal to the canine and represents the **(F) nasolabial fold (Fig. 9F)**.

Results

With the introduction of new and advanced imaging techniques as computed tomography (CT) scanning, magnetic resonance imaging (MIR), digital imaging, the field of dental radiology has greatly expanded. These new techniques can be used by dental professionals to analyze dental images in ways that were before unobtainable. The use of CT scans for diagnosing lesions and planning implant cases and the use of MRI to visualize soft tissues of temporomandibular joint and evaluate pathologic components are now accepted as standard procedures in dental radiology (5). Volumetric computed tomography is the newest method of analysing and discussing with the patient the treatment plan aprior using dental implants, and it makes possible to check the results (6).

The further images show the maxillary central area structures on volumetric computed tomography (Figs. 12, 13, 14, 15).

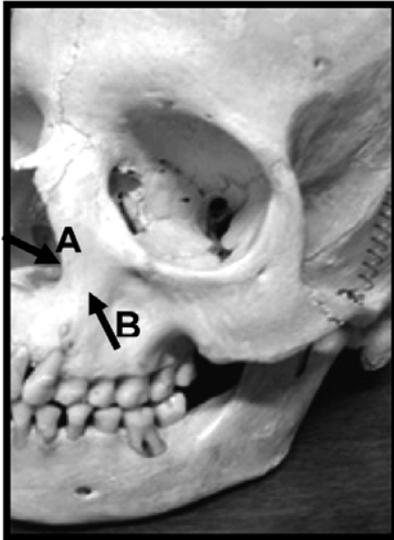


Fig. 8 Skull – fronto-lateral view

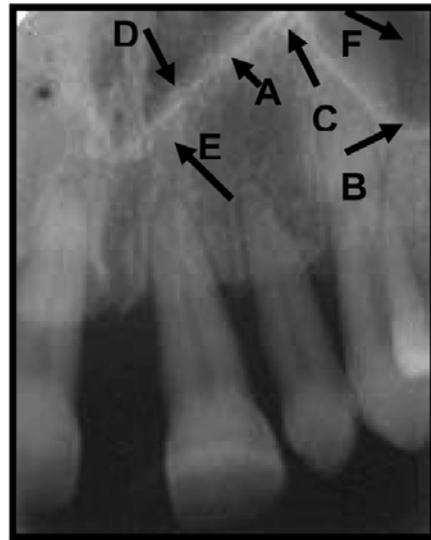
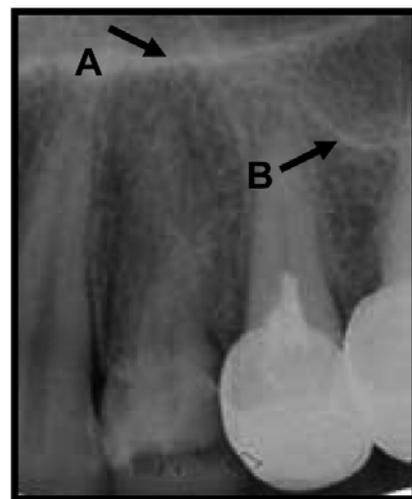


Fig. 9 Periapical radiographs – maxillary canine area



Figs. 10, 11 Periapical radiographs - maxillary canine area

Figs. 8, 9, 10, 11: Maxillary Canine Area: (A) Lateral wall of the nasal fossa, (B) Anterior extent of the maxillary sinus, (C) Inverted “Y”, (D) Floor of nasal fossa, (E) Soft tissue of the nose, (F) Nasolabial fold

In evaluating a potential implant site, particular attention should be given both to the quality and quantity of bone required for placement of the fixture. The bone must have the necessary dimensions and quality to provide support the implant fixture. The thicker the cortical bone, the greater the likelihood of osseous

integration and subsequent success. Bone quantity is assessed by documenting the height and width of available alveolar bone, as well as the morphology of the ridge. In Figs. 22 - 27 are presentated bone densities in the central maxillary edentulous crest visualized on volumetric computed tomography.

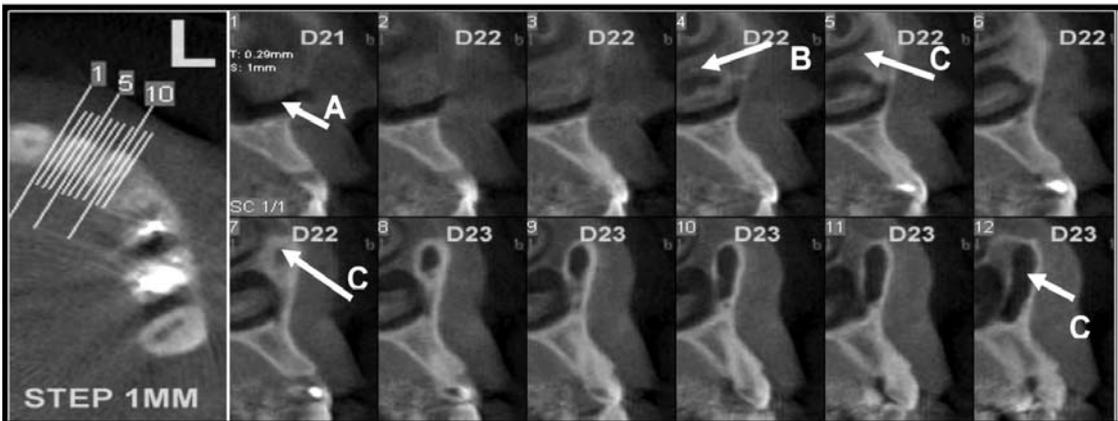
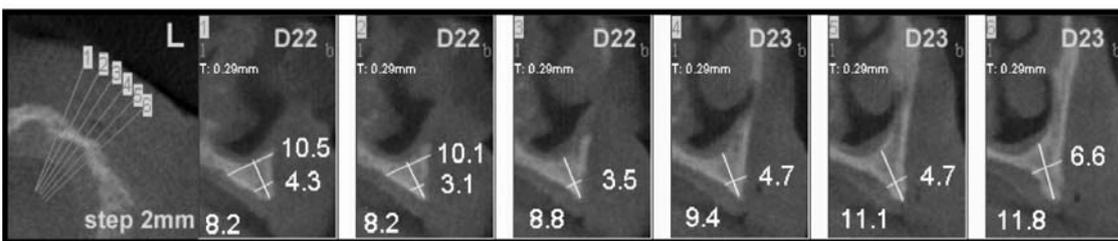
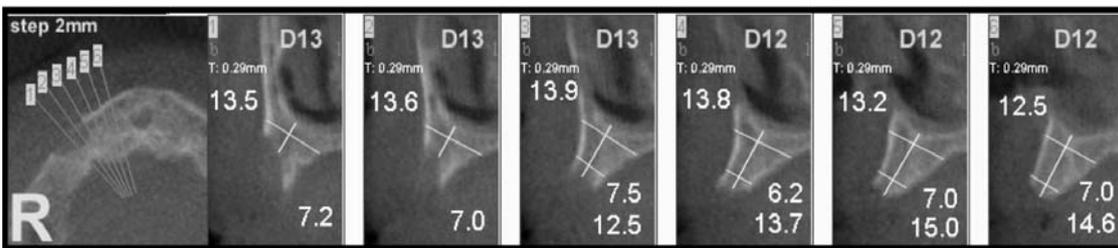
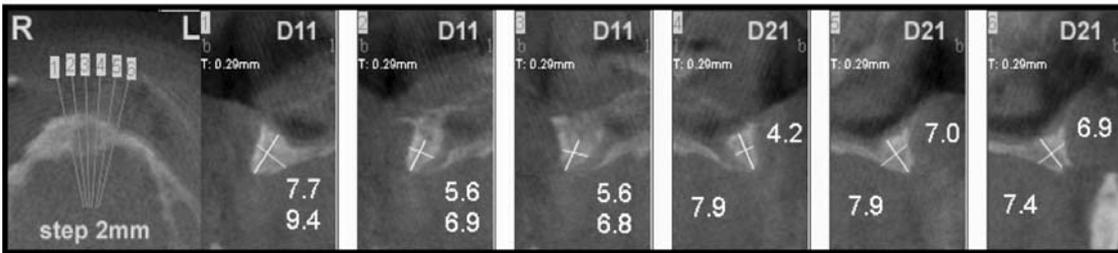
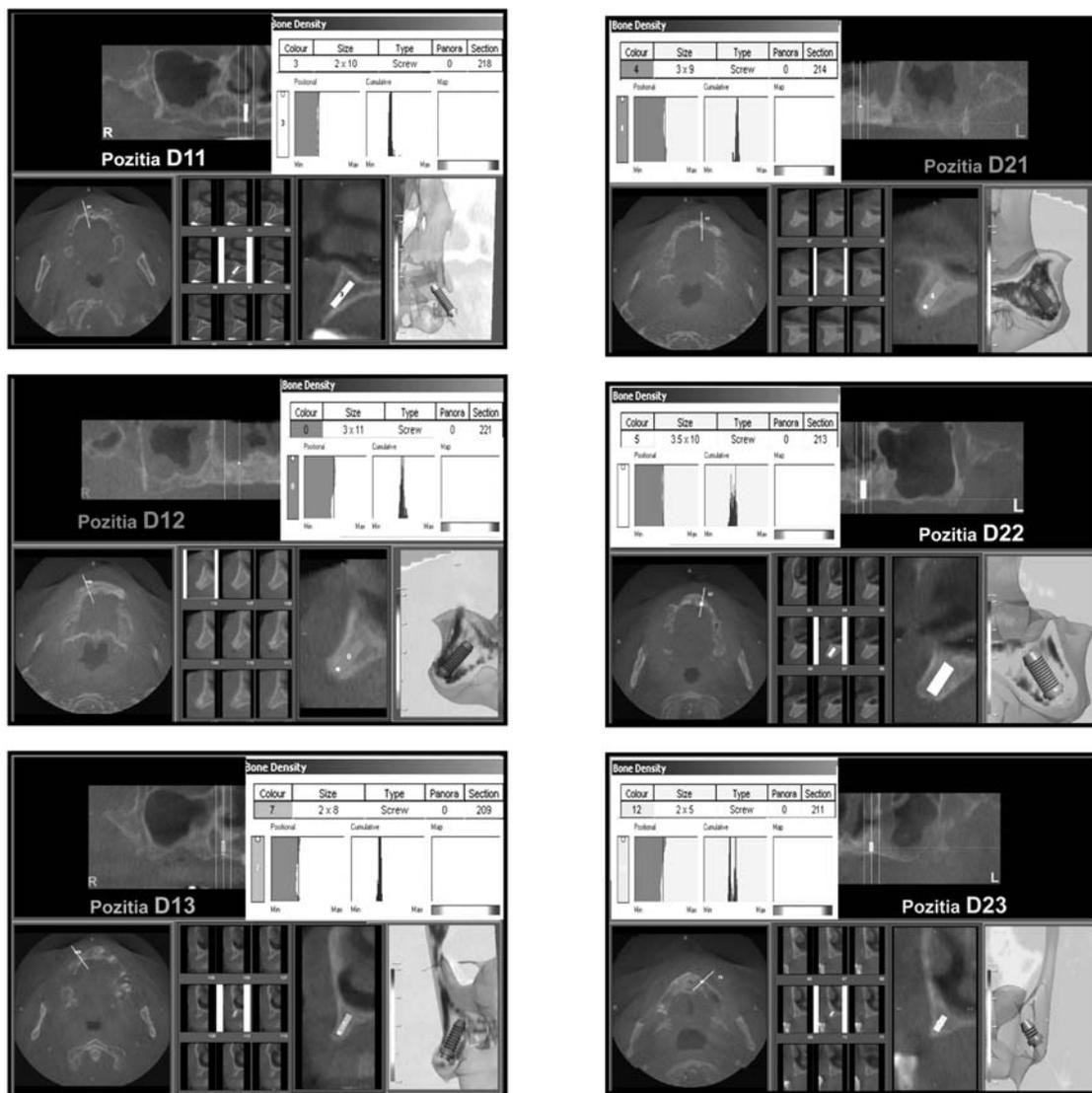


Fig. 12: Maxillary central area: Sections of 1 mm 2.1 – 2.3 (A) nasal fossa, (B) inferior concha, (C) lateral fossa

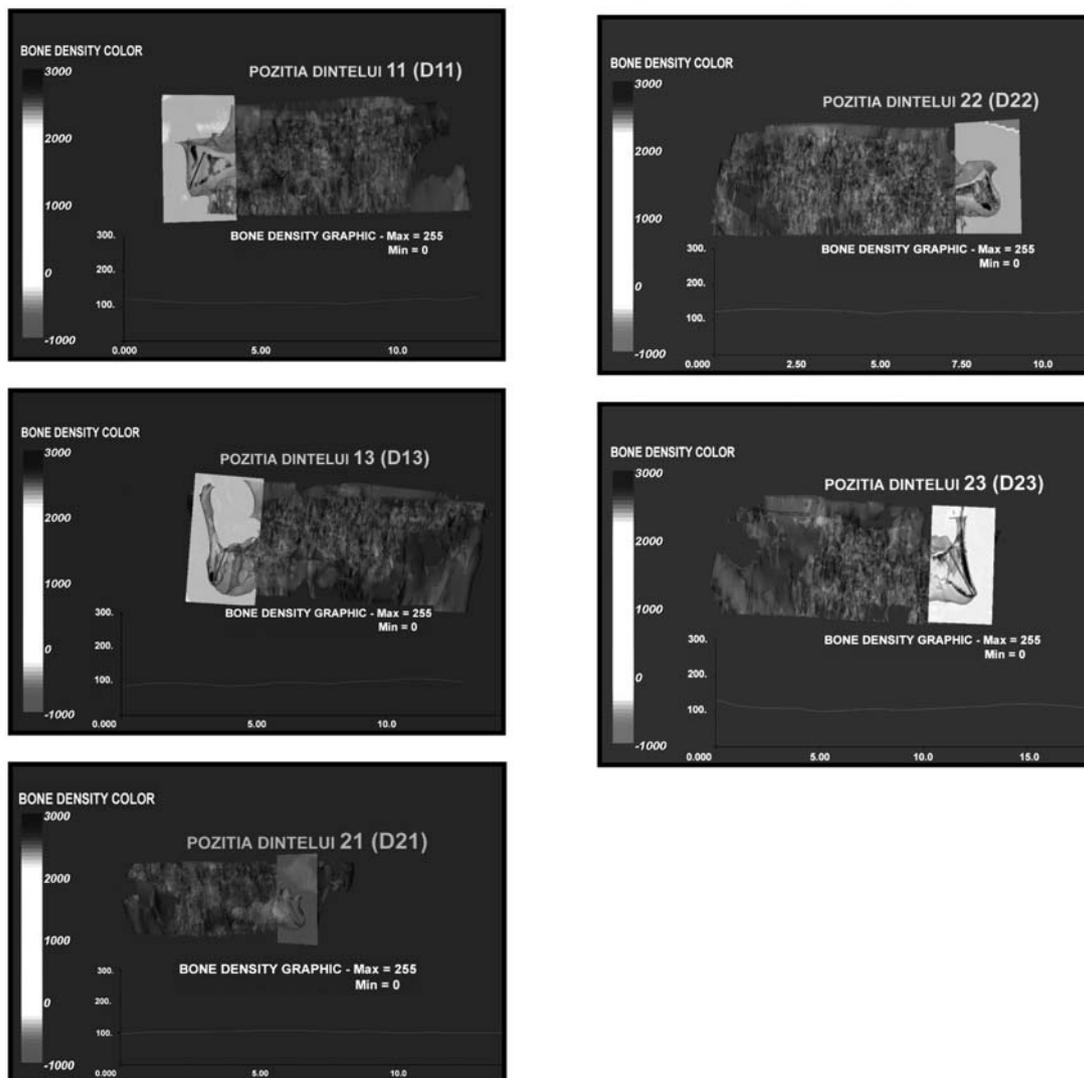


Figs. 13, 14, 15: Maxillary central area: Sections of edentulous crest 2.2–2.3



In Figs. 16 - 21 are presented implant simulations in maxillary central area visualized on volumetric computed tomography.

Figs. 16 - 21: Implant simulations - central maxillary edentulous crest



Figs. 22 - 27: Bone densities - central maxillary edentulous crest

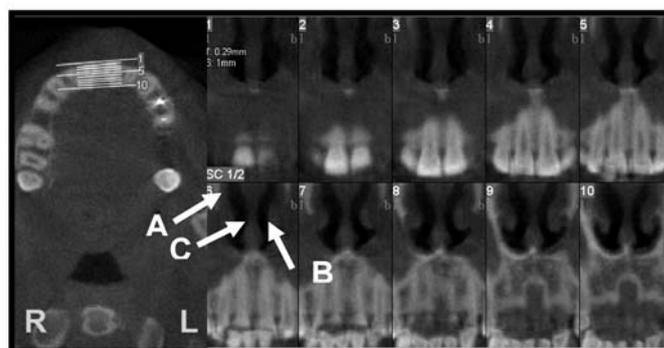


Fig. 28: Maxillary central area: Frontal sections of 1 mm 2.1 – 2.3 (A) nasal fossa, (B) inferior concha, (C) nasal septum

Discussion

Accurate bone measurements are essential for determining the optimal size and length of the proposed implants. The clinician should be aware that the magnification factor of radiographic images may vary with the imaging technique used. Except for reformatted CT, all radiographic images are magnified because the object is never in the same plane as the film.

The ideal imaging technique for dental implant radiography should have the ability to visualize: (a) the implant site in the mesial-distal, facial-lingual, and superior-inferior dimensions, (b) the density of trabecular bone and cortical thickness, (c) and to correlate the imaged site with the clinical site.

Panoramic radiographs are useful in making preliminary estimations of crestal alveolar bone, maxillary sinus, and nasal fossa. Computed tomography provides reliable dimensional measurements at proposed implants sites, including the cross-sectional dimensions and at least complex cases may require an advanced imaging study.

Conclusion

Although CT scanners and MRI units are not found in dental offices, except dental radiology specialty practices, the dental professional should

have some familiarity with these newer imaging systems. Patients may have to be referred for such radiology institutes or copies of the images may be brought to the dental office by the patient for opinions and interpretation. This is a perfect reason for a real necessity of understanding and using volumetric computed tomography in dental images interpretation.

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