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COMPUTER TOMOGRAPHY ASSESSMENT OF ALVEOLAR RIDGE MODIFICATIONS IN ELDERLY PATIENTS

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ABSTRACT: This study aims to assessing how useful are the dental CT scans in the investigation of mandible alveolar ridge modification for diagnosis purposes and whether the jawbone density is correlated or not with the number of teeth lost. **Materials and method:** We analyzed 15 CT scans, made with the dental-CT software, belonging to some patients who wanted dental implants or dental treatments and to a control group formed by 10 patients who had undertaken an emergency cranial CT scan for severe head trauma, and a jawbone reconstruction using the Dental CT software. There have been performed symmetrical jawbone measurements on both the left and right sides. **Results:** The collected data show major differences regarding the mandible alveolar ridge height depending on the sex and age of the patient. The following have been noticed: symmetrical changes to the cortical bone density on the right-left side of the menton hole, to the cortical bone thickness around the menton hole, to the mandible cortical bone density at gonion, to the cortical bone thickness at the gonion. **Conclusion:** The hereby study confirms the efficiency of the dental computed tomography in the analysis of the mandible alveolar ridge and the density of mandible bone.

Key words: Dental-CT imaging, Mandible, Alveolar ridge, Bone Density.

INTRODUCTION

Elderly population and edentulous cases in a number of increasingly higher led to an increasing number of preoperative imaging studies performed on the analysis of dental implants. Maintaining functional morphology of the alveolar bone is totally dependent on this tooth. Teeth may be lost as a result of periodontal disease or may be extracted from other considerations. Case of alveolar bone resorption is represented of periodontal disease and other pathological processes, such as trauma, tumor resection and congenital malformations.

The imaging methods provide information on the hard tissue changes and the advantage of the x-rays is that they can be stored and reevaluated anytime. The x-rays may be affected by several sources of error. These include the variations in the x-ray projection geometry, exposure and processing errors, as well as the cover of bone structures by various anatomic structures and the experience of the examining doctor in establishing the reference points [1].

For many years, the clinicians made a diagnosis, made decisions regarding the treatment and the use of dental implants based on periapical radiographs and orthopantograms to assess the bone anatomy. The reduction of a 3D structure to a 2D image is minimized by some inherent distortional

factors, and the non-interactive nature of the film itself provides little information on the bone density, width or the proximity to the vital structures.

The digital radiography presents several advantages that increase the accuracy of interpretation for a correct diagnosis, but it is still a 2D projection.

The computerized tomography (CT) made possible the 3D view of dental structures, dental septum, periodontal structures of the maxillary bones, neighboring anatomic structures [2] as well as the accurate measurement of the mandible cortical bone density and sponginess [3].

The data from computed tomography examination can be processed with software DentalCT that provides information precise about bone height and width, alveolar ridge angulation, bone density, jaws angulation, location with-risk structures (mandibular canal, maxillary sinus and nasal cavities) and limits between jaw bones and alveolar process of maxillary bone [3,4,5,6,7,8,9]. These reconstructions made starting from the axial sections are parallel to the curve of the arches (panoscans or panoramic) or perpendicular to these curves (called transversal or paraxial) (fig.1-2).

When this software was introduced in the CT scan protocols 25 years ago, it was used for the pre-implementing assessment [8,9], but, over the last years, it has become useful for the overall study of the maxillary-mandible pathology [4,5]. The axial sections made with the Dental-CT software can be used for 3D reconstructions [4, 5, 9].

DentalCT is superior to conventional radiological techniques by eliminating overlaps and distortions. So, possible complications such as neurovascular injury and perforation of the maxillary sinus package can be avoided. The purpose of this study is to assess the efficiency of dental CT scans in the jawbone diagnosis imaging.

MATERIALS AND METHOD

We proceeded to the analysis of 15 dental CT scans made with a Siemens - Somatom Emotion device for dental implants.

This study was conducted on 10 women and 5 men with age ranging between 60-80 years. We used the Dental CT software to measure the bone density (in Hounsfield units) and distances.

The sections were of 1mm thickness (130 kV, 90mAs); we selected several sections, and we measured the thickness and density of the mandible base at the menton hole and at the gonion.

The measurements were done on the right and the left sides. We marked a line parallel to the long axis of the mandibular horizontal ram, tangent to the inferior part.

We traced a perpendicular line to this tangent in line with the menton hole and we measured the thickness of the base plate along it.

In this study we used the average thickness of the mandible cortical bone [10,11]. We measured the thickness of the cortical bone at the gonion bilaterally and used the average value in the study [12].

The alveolar ridge height was measured in the right mental hole.

The statistical analysis used the SPSS software (SPSS 17.0 Inc, Chicago, SUA). We analyzed the differences between the study groups using the *t test* for independent samples. There is an important statistical difference at the significance level 5%.

We evaluated the associations between the study variables: age, sex, the alveolar ridge height, type of edentulism (partial and total edentulism), the bone density of mandible base plate at the menton hole, the thickness of the cortical bone at the menton hole, the density of the cortical bone at the gonion, the thickness of the mandible cortical bone at the gonion and the number of present teeth.

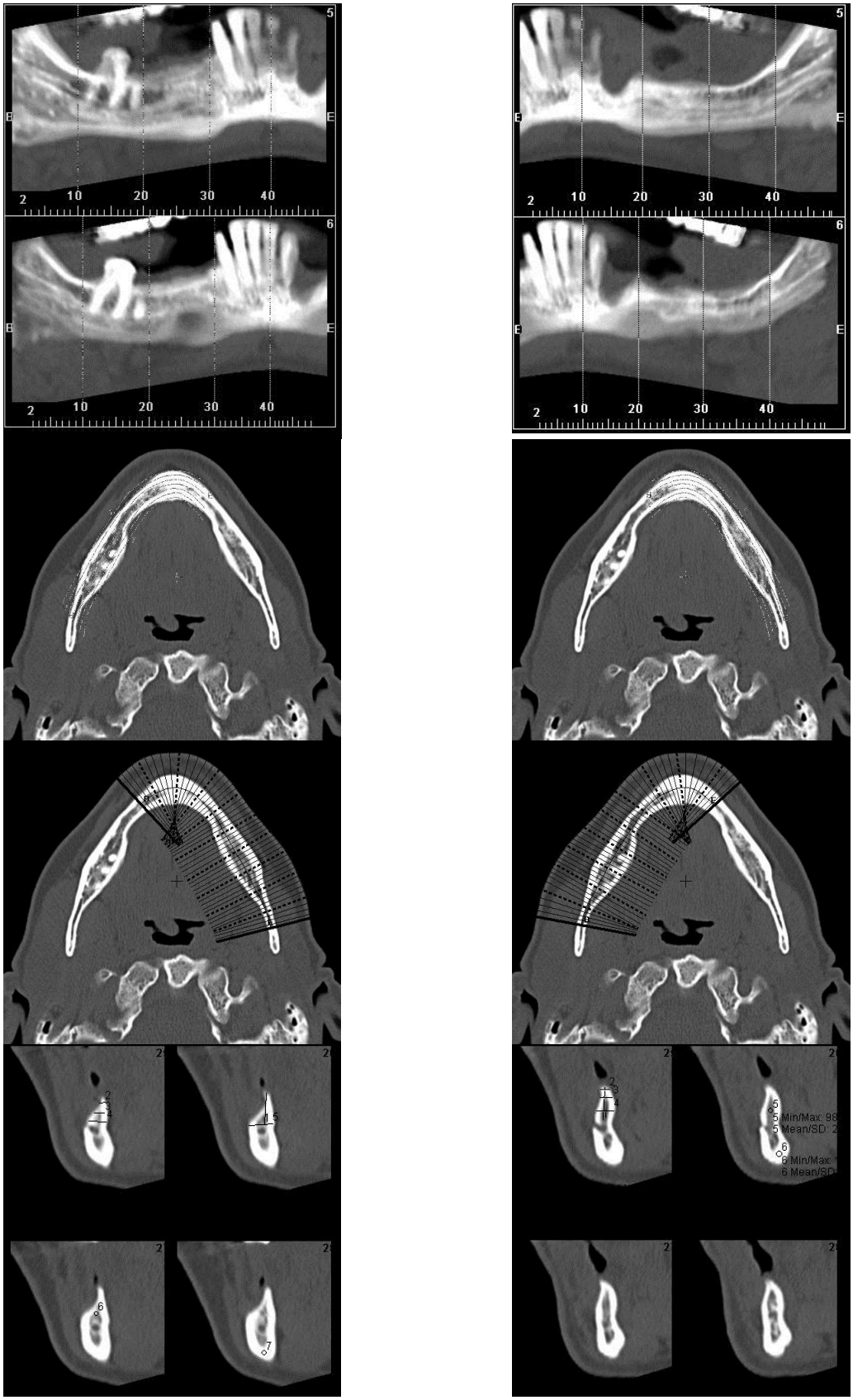

Fig. 1. Direct axial sections used in paraxial reconstructions that enable the measurement of the spongious and cortical bone density at various levels and panoramic reconstructions.

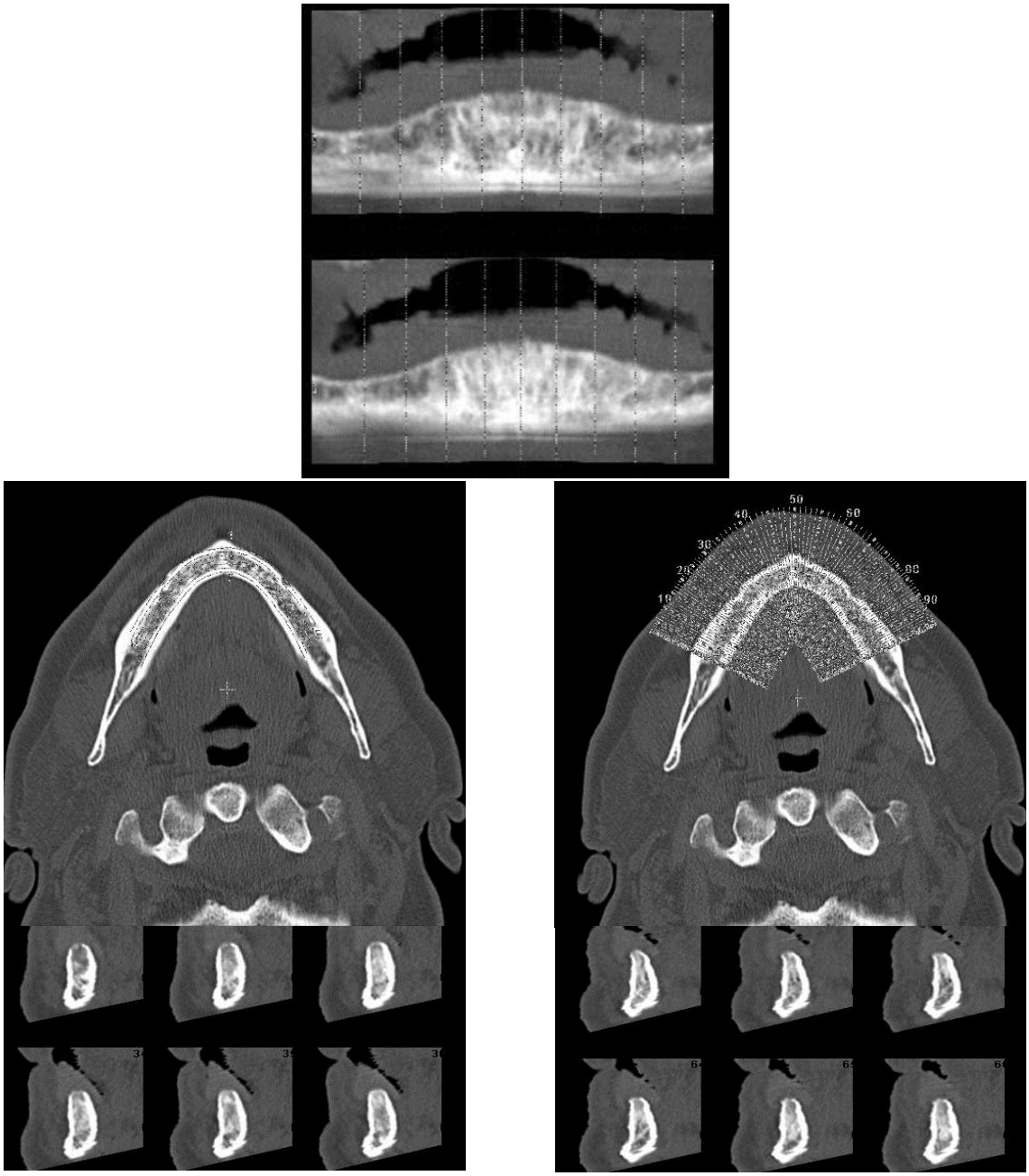

Fig. 2. Axial sections, paraxial and panoramic reconstructions that enable the measurement of the spongious and cortical bone density at various levels.

RESULTS AND DISCUSSIONS

The statistical analysis shows major differences regarding the alveolar ridge height and cortical width at the gonion depending on the age and sex of the patient.

We noticed asymmetrical changes to the mandible alveolar ridge height because of the teeth loss in different periods of time and symmetrical changes to the bone density of the mandibular base plate at the menton hole, of the cortical bone density at gonion, to the cortical bone thickness at the gonion, and to the cortical bone thickness at the menton hole, as well as a significant correlation between the measurements made on the right and the left sides of the mandible.

The bone density of the base plate at the menton hole on the right side is correlated with the bone thickness of the base plate at the menton hole on the right side. Also, the thickness of the mandibular cortical bone at the gonion on the left side has a significant

statistical correlation with the density of the mandibular cortical bone at the gonion on the left side.

Scaderea densitatii corticalei mandibulare la gonion si gaura mentoniera se coreleaza cu scaderea inaltimii crestei reziduale de la nivelul osului mandibular. De asemenea, s-a identificat o asociere intre creasta accentuat resorbita cu varsta si sexul.

The hereby study confirms the efficiency of the Dental CT software in the imaging-based diagnosis of the mandible bone. In this study we achieved significant correlations with the previous ones regarding the asymmetry of the alveolar ridge atrophy datorita pierderii grupurilor dentare in perioade diferite de timp [14,15].

The Dental CT software or Dentascanner enable the measurement of bone density [3,4,5,6,7,8,9]. Misch (1993) classified the bones into 5 categories, depending on the density: the D1 category includes the bones with over 1250 HU density; the D2 category comprises bones whose density ranges between 850 and 1250 HU; the D3 category is formed by the bones with the density ranging between 350 and 850 HU; D4 corresponds to the values ranging between 150 and 350HU, and D5 the values under 150 HU. Misch proved that the bone density measurement values achieved using the CT scans provide more accurate quantitative results than the radiographic qualitative analysis [16].

Therefore, the measurements of the mandible's bone density using this method may provide more valuable information than the information acquired with other imaging methods [17].

While the dental CT scan provides 3D images, the capacity of mono-slice devices to emphasize fine details is still limited. Presently, the fine sections achieved with the multi-slice spiral CT scans have a submillimeter resolution in all the three dimensions (in pixels). Although the details are considerably fewer than in the case of the conventional intra-oral radiographs, the use of CT scans satisfies almost all the situations requiring the analysis of periodontal tissue images from the viewpoint of a correct diagnosis. The published studies show that the CT analysis of the alveolar bone height and of the infra-bone pockets is reasonably accurate [18,19,20].

CONCLUSSIONS

Despite the net advantages and the enthusiasm of the beneficiaries, the use of the dental CT for the periodontal diagnosis still presents an disadvantageous cost-benefit ratio. The studies show that the dose of radiations necessary for the CT scan of the maxilla and mandible is much bigger than in the conventional radiography. Although the progress made by the CT technology minimizes the dose applied to the patient, the achievement of high resolution CT scans still remains a technique that uses high doses of radiations. Among other disadvantages, we notice the limited addressability and the often prohibiting costs incurred by the achievement and processing of scans [4,5,18].

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