Research Article

Role of multi-detector computed tomography in evaluation of jaws density prior to dental implant.

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Abstract
Objectives: The aim of this study is to evaluate the role of multi-detector computed tomography of jaw bones through measurement of jaw density in patients submitted to dental implant restoration .
Patients and methods: Our study included 30 systemically healthy patients with partially edentulous areas planning for dental implantation, 20 females and 10 males, ranged in age from 21-65 years with mean age of ±45 years. All patients were referred from the Out-Patient Clinic, Oral Medicine and Periodontology Department, Faculty of Dental Medicine, Al-Azhar University, Assiut Branch , during the period from February 2018 to October 2018. **Results:** Our study included 30 cases and our results shows that 9 cases are suitable for implantation (D1, D2) (30%), 15 cases are relatively suitable for implantation (D3) (50%) and 6 cases are not suitable for implantation (D4) (20%). **Conclusion:** Applying the findings of the current study, it is concluded that dental MDCT is considered an excellent noninvasive imaging modality in the preoperative evaluation of dental implant patients through measurement of jaw bone density .
Keywords: Dental implant, dental MDCT imaging, jaw density.

Introduction
According to the World Health Organization, complete or partial absence of natural teeth is a public health problem with potential poor outcomes. The development of the osseointegrated type of dental implant in the l970s by Branemark was the break through that made dental rehabilitation more reliable [(1).]

The advent of three-dimensional (3D) imaging and surgical planning software for implant placement has profoundly affected the science of implantology. Proper implant treatment planning remains the first priority for implant success[(2)].

Dental imaging is an important tool to accomplish this task. It is now possible to plan more accurately and place dental implants more precisely. This research will focus on the role of computed tomography (CT) in dental implant treatment planning through measurement of density[(3)].

The technique of dental CT also known as dentascan was developed by Schwartzetal. The dental CT can be performed with a conventional CT, a spiral CT or a multi-slice CT scanner[(4)].

Quantitative CT (i.e., quantitative interpretation of values derived from Hounsfield units with a suitable calibration procedure) is the modality of choice to determine bone mineral density (BMD). Quantitative CT to measure BMD by using simultaneous scanning for calibration has been extended to the jaws[(5)].

Patients and methods
I- Study setting and population:
This study included 30 systemically healthy patients, 20 female and 10 male, ranged in age from 21-65 years with mean age of ±45 years) that were divided into 2 groups; Group I included 15 partially edentulous patients planning for maxillary dental implantation, Group II included 15 partially edentulous patients planning for mandibular dental implantation .

All patients were selected from those attending at the Out-Patient Clinic, Oral Medicine and Periodontology Department, Faculty of Dental Medicine, Al-Azhar University, Assiut Branch, during the period from February 2018 to October 2018. Ethics committee approvals in addition to informed written consent were

obtained from all patients. The examination were done by multi-detector computed tomography machine (Siemens SOMATOM emotion 16 slice) at Alazhar university hospital Assuit branch, Department of Radiodiagnosis

II- Patients instructions and scanning protocol
Prior to imaging by MDCT, each patient was informed about the investigation and instructed not to move or swallow during the scan. Patient lye supine and should be motionless during scanning. In order to assure this, the patient's head should be firmly attached to the head holder.

The transaxial jaw region tomograms produced a lateral topogram of the skull base. The transverse images are scanned parallel to the alveolar ridge or occlusal plane of the teeth by using a bone algorithm, 15-cm field of view, and 512 x 512 matrix. The mandible and maxilla are each imaged with separate studies. Scan direction is caudocranial beginning with the mandible base and extends to include the alveolar crest for the mandible, whereas for the maxilla the scan plane starts with the alveolar crest and extends upward to include all root tips.

Post processing techniques:
Once the axial images have been obtained, the dental software program is performed on a dedicated workstation. The raw data from the axial sections are used to create.
1. Superimposed curve images (curved planar reformation).
2. Panoramic images.
3. Sagittal oblique images (cross sectional images).

III- Implant site assessment:
The following parameters were measured for each patient:
1) The density of bone at the possible implant site at Para-axial cuts.
2) Alveolar margin Length at Para-axial cuts.
3) Alveolar margin width at Para-axial cuts.

The density of bone at the possible implant site was assessed and the bone density was evaluated and classified according to the MISCH classification as the following:
MISCH D-1 and D-2 are considered suitable for implant placement.
MISCH D-3 is relatively suitable for implant placement .
MISCH D-4 is considered not suitable for implant placement .

Statistical analysis
The data were tested for normality using the Anderson-Darling test and for homogeneity variances prior to further statistical analysis. Categorical variables were described by number and percent (N, %), where continuous variables described by mean and standard deviation (Mean, SD). Chi-square test used to compare between categorical. A two-tailed $p<0.05$ was considered statistically significant. All analyses were performed with the IBM SPSS 20.0 software.

Results
Our study included 30 systemically healthy patients with partially edentulous areas planning for dental implantation, 20 females and 10 males, ranged in age from 21-65 years with mean age of ±45 years, as shown in table (1) .

Table (1): Age and sex distribution of the 30 patients in this study:

Age	Male	Female	Number of patients (%)
21-30	1	4	5 (16.6)
31-40	3	3	6 (20)
41-50	1	7	8 (26.6)
51-60	4	5	9 (30)
61-70	1	1	2 (6.6)
Total	10	20	30(100)

In our study patients were divided into 2 groups

* Group I included 15 partially edentulous patients planning for maxillary dental implant-tation.
* Group II included 15 partially edentulous patients planning for mandibular dental implantation .

Results of maxillary cases (group I):

These are 15 cases having 15 edentulous areas with age ranging from 27-65 years (Mean±SD) = (45±9.354) .

At anterior maxilla 3 cases with one case D2 (suitable for implantation); 33.5% and 2 cases D3 (relatively suitable for implantation); 66.5% .

At posterior maxilla 12 cases with 7 cases D3 (relatively suitable for implantation); 58.33% and 5 cases D4 (not suitable for implantation); 41.66% .

Results of mandibular cases (group II):

These are 15 cases having 15 edentulous areas with age ranging from 21-65 years (Mean± SD)= (45.5±8.936) .

* At anterior mandible 4 cases with 3 case D2 (suitable for implantation); 75% and 1 cases D3 (relatively suitable for implantation); 25% .
* At posterior mandible 11 cases with 5 cases D2 (suitable for implantation); 45.4 % , 5 cases D3 (relatively suitable for implantation); 45.4%; and 1 case D4 (not suitable for implant-tation); 9% .

Discussion

Radiographic evaluation of the dental and periodontal tissues is a critical segment of the comprehensive oral examination, especially for the implant patients where imaging is an important diagnostic adjunct to the clinical assessment[6].

The purpose of this study is to evaluate the role of Multi-detector computed tomography of Jaw bones through measurement of jaw density in patients submitted to dental implant restoration.

Studies have shown the relationship between high bone density and a high rate of success with implants. There is also good correlation between high bone density and the primary stability of the implants[7].

Among the factors affecting implant success, Bone density and implant stability are key factors to take into account and important for implant osseointegration, which has been widely demonstrated by several authors. Clinical studies show greater implant survival in the mandible than in the maxilla, due to the area's characteristics of bone density; more type I, II, or III bones are observed in the mandible than in the maxilla[8], This agrees with the results of our study in which most of D2 seen at mandible and most of D3 and D4 seen at maxilla .

Conclusion

Applying the findings of the current study, it is concluded that dental MDCT is considered an excellent noninvasive imaging modality in the preoperative evaluation of dental implant patients through measurement of jaw bone density.

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