Postoperative assessment of dental implants by using multi-slice computed tomography

Resha J. Al-Sudani, B.D.S. (1)
Lamia Al-Nakib, B.D.S., M.Sc. (2)
Shifaa H. Al-Naimi, B.D.S., H.D.D., M.Sc. (3)

ABSTRACT

Background: Implantology is a fast growing area in dentistry. One of the most common issues encountered in dental implantation procedures is the lack of adequate preoperative planning. Conventional radiography may not be able to assess the true regional three-dimensional anatomical presentation. Multi Slice Computed Tomography provides data in 3-dimentional format offering information on craniofacial anatomy for diagnosis; this technology enables the virtual placement of implant in a 3-Dimensional model of the patient jaw (dental planning).

Patients, Material and Methods: The sample consisted of (72) Iraqi patients indicated for dental implant (34 male and 38 female), age range between (20-70) years old. They were examined during a time period started from December 2012 to April 2013. All the patients who subjected to implant treatment depending on the pre-operative panoramic radiograph were referred Al-Kharkh General hospital, spiral CT scan Department, for postsurgical assessment evaluate the angulation of fixture in relation to the angulation of bone in coronal and sagittal sections by using Multi-Detector Computed Tomography.

Results: The present study showed that the angulation of implant affected by age, sector, and tooth position in the same jaw, and not affected by gender.

Conclusion: Multi-Slice Computed Tomography provides a great understanding about bone angulation, it necessary as a diagnostic tool for treatment planning pre and post-operatively.

Key words: dental implants, multi-slice computed tomography. (J Bagh Coll Dentistry 2013; 25(4):52-55).

INTRODUCTION

Dental implant is a surgical devices which replaces the lost roots of tooth to which an artificial tooth or complete denture can be attached (1)

The replacement of missing teeth with Ossteointegrated implants has proven to be a reliable alternative to other fixed and removable prosthesis devices. In most clinical situations it produces predictable and satisfactory treatment results (2)

The success of dental implant treatment depends on careful preoperative planning by obtaining information regarding the angulation, quality, and quantity of the bone at a potential implant site and determines the relationship of the proposed implant to anatomical structures at the implant site (3)

Panoramic radiography is readily available and provides a view of many structures in maxilla and mandible at a low cost. However, image magnification and lack of cross-sectional information are the main disadvantages of this image modality (4)

Multi-slice computed tomography provides data in 3-dimentional format offering information on craniofacial anatomy (5)

(1) Master student, Department of Oral Diagnosis, College of Dentistry, University of Baghdad.
(2) Assistant Professor, Department of Oral Diagnosis, College of Dentistry, University of Baghdad.
(3) Oral and Maxillofacial Radiologist, Al-Karkh General hospital, Ministry of Health.

Bone angulation is the fourth determinant for available bone. The initial alveolar bone angulation represents the natural tooth root trajectory in relation to the occlusal plane. Ideally, the angle formed between the long axis of the bone with the long axis of implants should be less than 20 degree (6)

PATIENTS, MATERIALS AND METHODS

The sample consisted of (72) Iraqi patients indicated for dental implant (34 males and 38 females), age range between (20-70) years old. They were examined during a time period started from December 2012 to April 2013.

The total sample was attended to different center of Implantology in Baghdad, and they subjected to clinical examination, panoramic radiographical evaluation, and treatment planning. All the patients who subjected to implant treatment were referred to Al-Kharkh General hospital, Spiral CT scan Department, for postsurgical assessment by using Multi-Detector Computed Tomography.

Several cases were excluded such as: severe bone atrophy of maxilla and mandible that need bone graft surgery, Cases need surgery of active sinus lift in maxilla, Cases need surgery of mandibular canal transposition in mandible, Cases of previous bone graft with bone manipulate.

The 1st measurement was done preoperatively directly on the OPG by using digital caliper. The

2nd measurement was done post operatively directly on the CT scan by using its own software, within the 1st month after dental implant and detected the angulation of each implant in comparable with angulation of bone in sagittal and coronal section, by measuring the long axis of bone with long axis of the implant it should be less than 20 degree.

RESULTS

Factors Associated with Improper Angulation of Dental Implant

1. Age Group

It was found that the age group (≤35 years old) show the highest percentage in improper angulation of the dental implant among the other two groups (70.7 %), and the age group (+50 years old) show percentage about (55.6%) in improper angulation of the dental implant, and (36.5%) for age between (36-49) years old. **(Table 1), Figure (1)** A

2. Gender

It was found that there was no gender effect in the incidence of improper angulation. **(Table 1), Figure (1) A**

3. Maxilla Vs Mandible

It was founded that there were no significant differences between Maxilla and Mandible in improper angulation of dental implant. **(Table 1)Figure (1)** B

4. Jaw Sector

It was founded that there were significant differences in improper angulation according to the jaw sector, in anterior area with more improper angulation chance to occur (65%) than premolar sector (60%) and in molar sector (32.5%). **(Table 1), Figure (1)** B

5. Area of Implant\ tooth Position

It was found that there were significant differences in improper angulation related to tooth area in the jaw. **(Table 1), Figure (1)** B

Improper angulation in lateral incisor was the highest (91.7%) and in the first molar was with lowest percentage (27.3%), while there was no significant difference in canine area. **(Table 1), Figure (1)** B

DISSCUSION

The present study was conducted to evaluate the accuracy of panoramic radiography as diagnostic radiograph in dental implant treatment.

Factors Associated with Improper Angulation of Dental Implant

1. Age Group

The present study showed that the improper position of implant increased with young age (-35) years old, and with old age (+50) years old, so the rate of success increase with age range from (35-49) years old.

Heij et al [7] reported that jaw growth can compromise oral implants and questioned the minimum age of a patient for implant treatment. **Salonen et al** [8] stated that advanced age was a possible contributing factor to implant failure.

2. Gender

The present study showed no relation between rate of success of implant and gender. This study was agreed with **Weyant** [9], in the rate success of implant not depend on the patient sex. This study was disagreed with **Ekfeldt et al** [10], where identified that female has more risk for implant failure due to low bone density which decrease the success rate

3. Maxilla Vs. Mandible

The present study showed no significant differences between the implant angulation and the jaw. This study was disagreed with **Adell et al** [11] and **Van Steenberghe** [12] who found that implants placed in the maxillary molar area was lost as compared with implants placed in the mandibular molar region**.**

Jaffin and Berman [13] reported the loss of implants inserted in the maxillae, generally, mandibular implants also survive longer than maxillary implants.

4. Jaw Sector

The present study showed that there was a relationship between the area and the improper angulation, which increase in anterior area and decrease posteriorly. This study was in agreement with **Baqain et al** [14]**,** when stated that the implants placed in the anterior maxilla and anterior mandible had high risk factor of failure. In addition, it was in agreement with **Van Steenberghe et al** [12] who stated that the implants failure depends on the area**.**

5. Tooth or Implant Position

The present study showed there was a relationship between implant position and improper angulation, high significant improper position in lateral incisor and lowest in the first molar, while there was no significant differences in canine area. This study was in agreement with **Van Steenberghe et al** [12] who stated that the implants failure depends on the implant position. Also agreed with **Jaffin and Berman** [13] **who** reported the success rate increase in lower posterior area and decrease in upper posterior area.

As conclusions;

(1) Computerized tomography provides cross-sectional radiographic images that facilitate proper assessment of potential recipient sites for implant placement.

(2) Bucco-lingual angulations of bone is an important dimension that should be measured before implant placement, and play an important role to determine the path of implant insertion, therefore it could determine the success or failure rate of implant, and it is cannot be measured by plane radiograph, Computerized tomography provides cross-sectional radiographic images that facilitate the measurements of bone dimensions.

(3) The age of the patient had a significant relation with the dimensions of bone, while gender had no significant relation with bone measurements.

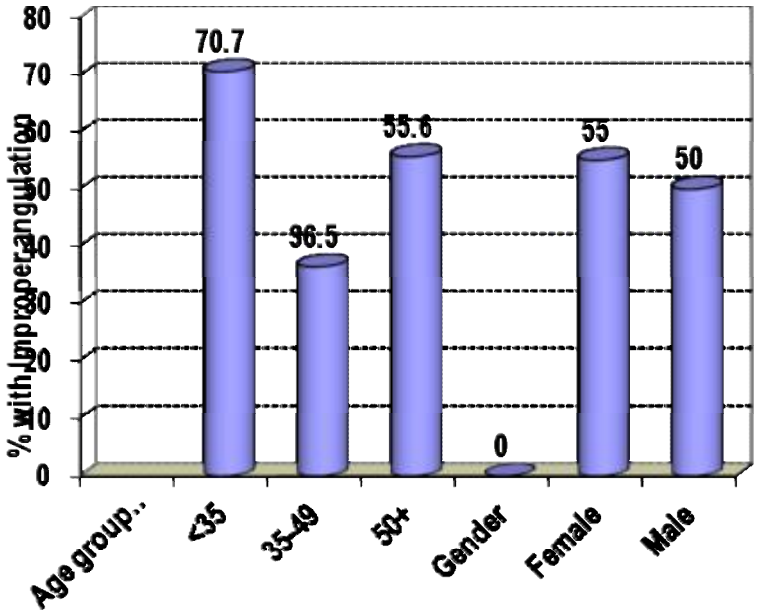
(4) There was significant relation between the jaw and the bucco-lingual direction.

REFFERENCES

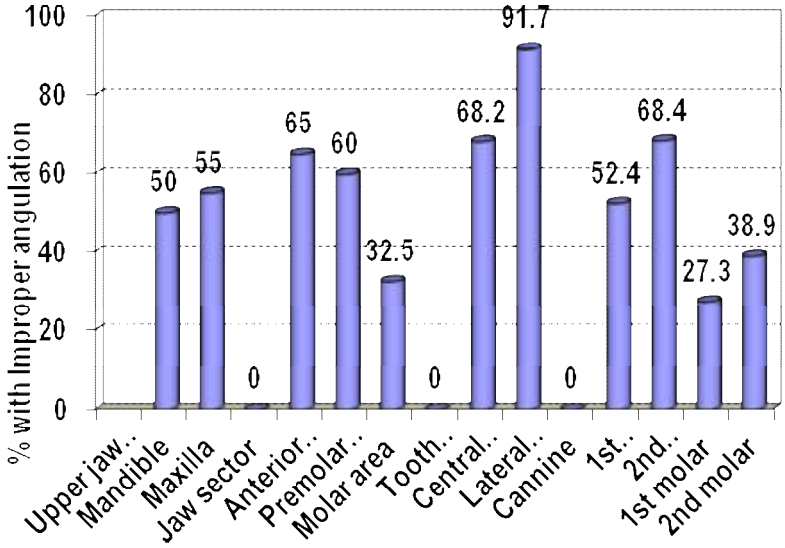
1. Lemons J, Natiella J. Biomaterials, Biocompatibility and Peri implant consideration. Dental Clin North Am 1986; 30: 43-51.
2. Brown S. Dental Implants- New Horizones in the Diagnosis and Treatment Planning. Periodontics and implant dentistry, Periodontal Letter, Philadelphia, PA 2004; 19102,(215):735-3660.
3. Harris D, Buser D, Dula K, Grondahl K, Jabcobs R, Lekholm U, Nakielny R, Vander Stelt P.E.A.O. :Guidelines for the Use of Diagnostic Imaging in Implant Dentistry. A Consensus Workshop Organized by the European Association for Ossteointegration in Trinty College Dublin. Clin Oral Implants Res 2002; 13(5): 566-570.
4. Sakakur A CE, Morais JA, Leffredo LC, Scaf G. A survey or radiographic prescription in dental implant assessment. The British Institute Radiology. DentoMaxillofacial Radiology 2003; 32(6): 397-400.
5. Zhejiang UnivSci B. Assessment of volumetric bone mineral density of the neck with and without vertebral fractures using quantitative multi-slice CT 2009; 10(7): 499–504.
6. Lam RV. Contour changes of the alveolar process following extraction. J Prosthet Dent 1960; 10: 25-32.
7. Heij DG, Opdebeeck H, van Steenberghe D, Quirynen M. Age as compromising factor for implant insertion. Periodontology 2003; 33:172-84.
8. Salonen MA, Oikarinen K, Virtanen K, Pernu H. Failures in the osseointegration of endosseous implants. International Journal of Oral and Maxillofacial Implants 1993; 8: 92-7.
9. Weyant RJ. Characteristics associated with the loss and peri-implant tissue health of endosseous dental implants. International Journal of Oral and Maxillofacial Implants 1994; 9: 95-102.
10. Ekfeldt A, Christiansson U, Eriksson T, Lindén U, Lundqvist S, Rundcrantz T, Johansson LA, Nilner K Billström C. A retrospective analysis of factors associated with multiple implant failures in maxillae. Clinical Oral Implants Research 2001; 12: 462-7.
11. Adell R, Lekholm U, Rockler B, et al. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg 1988; 6: 387-416.
12. Van Steenberghe D, Quirynen M, Collbersson L, Demanet M. A prospective evaluation of 697 consecutive intra oral fixture and modem Branemor in the rehabilitation of edentulism. J Head Neck Pathology 1987; 53-8.
13. Jaffin RA, Berman CL. The excessive loss of Branemark fixtures in type IV bone: a 5-year analysis. Journal of Periodontology 1991; 62: 2-4.
14. Baqain Zaid H, Moqbel Wael Yousef, Sawair Faleh A. Early Implant Failure. Oral and Maxillofacial Surgery Department, University of Jordan Hospital, Br J Oral Maxillofac Surg, 2011.

Table 1: Effect of different factors associated with improper angulation

	Total N	Improper Angulation N	%	P
Age group(years)				0.004
-35	41	29	70.7	
36-49	52	19	36.5	
+50	27	15	55.6	
Gender				0.58(NS)
Female	60	33	55.0	
Male	60	30	50.0	
Maxilla Vs. Mandible				0.58(NS)
Maxilla	60	33	55.0	
Mandible	60	30	50.0	
Jaw Sector				0.007
Anterior Area	40	26	65.0	
Premolar Area	40	24	60.0	
Posterior Area	40	13	32.5	
Tooth Position				0.001
Central Incisor	22	15	68.2	
Lateral incisor	12	11	91.7	
Canine	6	0	0.0	
1st premolar	21	11	52.4	
2nd premolar	19	13	86.4	
1st molar	22	6	27.3	
2nd molar	18	7	38.9	



A- Age and gender



B-tooth area

Figure 1: Effect of different factors associated with improper angulation