Journal of Oral Biology and Craniofacial Research xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Journal of Oral Biology and Craniofacial Research

journal homepage: www.elsevier.com/locate/jobcr

Original Article

Feasibility of Dentascan in planning of implant surgery in posterior maxilla and mandible

Siddhartha Chandel[a,*], Nishi Singh[b], Amiya Agrawal[c], Harmurti Singh[d], H. Nandakumar[e]

[a] Department of Dentistry, Era's Lucknow Medical College, UP, India
[b] Department of Periodontics, Career Dental College & Hospital, UP, India
[c] Department of Trauma & Emergency, KGMU, UP, India
[d] Department of Maxillofacial Surgery, Career Dental College & Hospital, UP, India
[e] Department of Maxillofacial surgery, KCDS, Bangalore, India

ARTICLE INFO

Article history:
Received 10 January 2017
Accepted 1 March 2017
Available online xxx

Keywords:
Implants
Panoramic radiography
Dentascan
Posterior maxilla and mandible

ABSTRACT

Objectives: The present evaluate the feasibility of Computed tomography (Dentascan), in assessment of the implant site in posterior maxilla & mandible.
Material and Methods: data of total 11 patients with 20 implant sites were involved in the present study. Out of the 20 implant sites selected 10 were in posterior maxilla and 10 in posterior mandible. All the patients were routinely examined by panoramic radiography and CT. All images obtained i.e., conventional panoramic radiograph, and film based Dentascan MPR- CT images were evaluated for the detectability of mandibular canal at the mental foramen, 1 cm, 2 cm, and 3 cm posterior to mental foramen. The judgments were then compared by using the four point grading score.
Results: Both the statistical analysis and radiographic observation showed that Dentascan MPR CT gives significantly clearer images at the mental foramen and 1 cm, 2 cm , 3 cm posterior to it. Dentascan also provides significantly better visualization of the vital structures along with the bone density. The panoramic and Dentascan MPR CT images did not show a significant difference in visualization of the crest of alveolar ridge in both maxillary as well as the mandibular arch.
Conclusion: The Dentascan MPR- CT images revealed significantly clearer images as well as better visualization of the vital structures than conventional panoramic radiography. Apart from providing clearer images Dentascan also gives the buccopalatal/buccolingual dimension at the implant site, along with the density of the available bone.

1. Introduction

The modern times of dental implantology was steered in by the innovative work of Branemark and his coworkers. Their research demonstrated the relationship between bone and implant that now is known as osteointegeration. They described osteointegeration in histologic terms as the direct contact of living bone with the implant surface at microscopic level.[1] Since then the use of implant has gained immense popularity and wide acceptance.[2] The placement of dental implants has revolutionized our ability as oral health care practitioner to manage and restore partially edentulous and completely edentulous state[3]. Implant prosthesis offers a more expected treatment outcome than customary restoration.

Despite of the remarkable progress done in the field of implant dentistry, the maxillary and the mandibular posterior regions present unique challenging conditions in rehabilitation as compared to other regions of the jaw.[4] This was shown by longitudinal clinical studies that have reported success rate at 10 years ranging from 81% to 85% for the maxilla and from 98% to 99% for the anterior mandible. The highest failure rate has been reported for the posterior maxilla, which has been attributed to the fact that this area often presents specific problems for the placement of dental implants.[5] The generally poor bone quality frequently faced in this region in combination with inadequate bone volume, related to both the size of the maxillary sinus and resorption of the alveolar ridge have rendered long term success rate for implants less favorable here than in the other region of the jaws. Similarly the preoperative assessment of dental implant site in the posterior segment of the mandible, requires accurate localization of the mandibular canal.[6]

* Corresponding author.
E-mail address: siddhartha.chandel@gmail.com (S. Chandel).

http://dx.doi.org/10.1016/j.jobcr.2017.03.001
0976-5662/

So for the long term success, it is important to be able to place implants in mandible and maxilla with high degree of precision. The assessment of bone support in endosseous implants is fundamental to the clinical utility of implants for restoration and function. Radiograph are critical tools for assessment of bony architecture and are useful for each of the three phases of implant placement i.e. evaluation, implant treatment and maintenance.[7]

Conventional panoramic radiography is still the most commonly used imaging modality in the treatment planning for implant placement; however they don't provide the precise determination of quantity and quality of the available bone which is critical for the long term success of implants.[8]

Computer Assisted Tomography is the method of choice for achieving the above mentioned goals, as it reveals cross sectional views of the dental arches, allows visualization of inclination of alveolar process, localization of mandibular canal and precise measurements of bone quantity and quality.[9] With these considerations a need was felt to evaluate the accuracy and feasibility of the computed tomography (Dentascan) with panoramic radiography for rehabilitation of edentulous or partially edentulous posterior maxilla and mandible with implants.

2. Material and methods

Total 11 patients involved in this study were aged 18 to 58 years (average age 24 years; all of them were males). Total 20 implant sites were considered in the study. Out of these 10 were in mandible and 10 in maxilla. All patients had been routinely examined using conventional panoramic radiographic machine, EC PROLINE (Planmeca Of Asentajankatu – Helinski Finland). Ten panoramic radiograph had been processed using standard processing conditions.

High resolution,1.5 mm thick axial slices with 1 mm slice interval,120 kVp,120 Ma, 512 × 512 matrix had been used as the protocol of CT examination. The axial CT data had been transferred to a workstation and reformatted by Dentascan to generate paraxial and panoramic images and printed on films (Kodak T mat). The archived axial CT data were stored on CD- R and transferred to a personal computer with 15.1 in LCD monitor. Paraxial and Panoramic images were reconstructed using Dentascan software.

All images obtained i.e., conventional panoramic radiograph, and film based Dentascan MPR- CT images were evaluated for the detectability of mandibular canal at the mental foramen, 1 cm, 2 cm, and 3 cm posterior to mental foramen. The judgments were then compared. The four point grading score was used for assessment (1 = no display as a result of impossible demarcation from the surrounding tissue 2 = localization of canal/sinus not possible; discontinuity >3 mm; 3 = some artifacts, local bloating/too narrow/or discontinuation for short distance (1–3 mm); 4 = continuing smooth sharply defined contour.)

For qualitative evaluation of the panoramic radiography with Dentascan, the proximity of the vital structures (maxillary sinus and inferior alveolar canal) was assessed on a four point grading score utilizing the image evaluation questionnaire. The four point grading was used to assess the visualization of the inferior border of the maxillary sinus and the crest of the alveolar ridge at the implant site. Similarly the superior border of the inferior alveolar canal and the crest of mandibular alveolar crest were assessed using the four point grading scale.

Further the assessment of quantity of bone was done by measuring the height and width of bone available for implant placement, by utilizing panoramic radiography and Dentascan. The height of the bone was calculated from crest of the alveolar ridge to the superior border of the inferior alveolar canal for mandible and from the alveolar crest to the floor of the maxillary sinus for maxilla. Similarly the width of the bone was calculated in the mesiodistal direction. Dentascan was utilized to obtain the buccolingual and the buccopalatal dimensions of bone in the mandible and the maxilla respectively. Further Dentascan software was used to calculate the density of the available bone in Hounsfield units and Misch classification was used know the type of bone available for implant placement. Misch classified the type of bone as D1- dense cortical bone(>1250 HU), D2- thick dense to porous bone on crest and course trabecular bone within (850–1250 HU), D3- thin porous cortical bone on crest and fine trabecular bone within (350–850 HU) D4- fine trabecular bone (150–350 HU), D5- immature- non mineralized bone (<150 HU.

3. Results

The distribution of grading score for visibility of mandibular canal according to the radiographic methods (panoramic radiography/Dentascan) in the four regions (at the mental foramen, 1 cm, 2 cm, and 3 cm posterior to mental foramen) (Table 1). The mandibular canal was better visualized with Dentascan MPR-CT than panoramic radiography in all the four regions. Especially at

Table 1
Comparison of Visibility of Mandibular Canal And Mental Fo Ramen in Panoramic Radiograph and Dentascan.

Visibility of mandibular canal and Mental foramen		Poor (1)	Severe limitation (2)	Slightly limited (3)	Excellent (4)	Mean ± SD	P value
At mental foramen	Panoramic radiograph	1 (10.0%)	0	5 (50.0%)	4 (40.0%)	3.20 ± 0.92	0.589
	Dentascan	1 (10.0%	0	3 (30.0%)	6 (60.0%)	3.40 ± 0.97	
At 1 cm from mental foramen	Panoramic radiograph	1 (10.0%)	3 (30.0%)	5 (50.0%)	1 (10.0%)	2.60 ± 0.84	0.009**
	Dentascan	0	0	3 (30.0%)	7 (70.0%)	3.70 ± 0.48	
At 2 cm from mental foramen	Panoramic radiograph	0	2 (20.0%)	5 (50.0%)	3 (30.0%)	3.10 ± 0.74	0.034*
	Dentascan	0	0	3 (30.0%)	7 (70.0%)	3.70 ± 0.48	
At 3 cm from mental foramen	Panoramic radiograph	0	2 (20.0%)	4 (40.0%)	4 (40.0%)	3.20 ± 0.79	0.038*
	Dentascan	0	0	1 (10.0%)	9 (90.0%)	3.90 ± 0.32	

Please cite this article in press as: S. Chandel, et al., Feasibility of Dentascan in planning of implant surgery in posterior maxilla and mandible, J Oral Biol Craniofac Res. (2017), http://dx.doi.org/10.1016/j.jobcr.2017.03.001