ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 3, Issue – 5, September - 2020, Page No. : 152 - 161

A comparative evaluation of alveolar ridge dimension with different bone mapping techniques preceding to implant placement: original study

[1]Dr. Nikhil N. Pawar, MDS Oral and Maxillofacial Prosthodontics & Implantologist, Ex Post Graduate student from Department of Prosthodontics and Implantologist, Darshan dental college, Udaipur, India

[2]Dr. Payal A. Karkar, BDS, Ex Student from Krishna Institute of Medical Sciences Karad, Maharashtra, India

Corresponding Author: Dr. Nikhil N. Pawar, MDS Oral and Maxillofacial Prosthodontics & Implantologist, Ex Post Graduate student from Department of Prosthodontics and Implantologist, Darshan dental college, Udaipur, India

Citation of this Article: Dr. Nikhil N. Pawar, Dr. Payal A. Karkar, "A comparative evaluation of alveolar ridge dimension with different bone mapping techniques preceding to implant placement: original study", IJDSIR- September - 2020, Vol. – 3, Issue - 5, P. No. 152 – 161.

Copyright: © 2020, Dr. Nikhil N. Pawar, et al. This is an open access journal and article distributed under the terms of the creative commons attribution noncommercial License. Which allows others to remix, tweak, and build upon the work non commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

The aim of the study is to evaluate and compare the different bone mapping techniques, i.e,CBCT, Stent method, Graphical and surgical exposure method, which are used to measure the alveolar ridge bone width and also determine their accuracy in the clinical application. 10 cases were selected for the study whose age group were between 22 to 50 years and who needed replacement of edentulous span with dental implant. Width of alveolar ridge was studied by four techniques. Group 1- CBCT, Group 2- Stent method, Group 3-Graphical method and Group 4- Surgical exposure at two points A and B (Point A- 3 mm from the crest of ridge and Point B- 6mm from the crest of ridge using same stent) and measurements at surgical exposure site was taken as control Group. The measurements and accuracy of these methods were assessed and compared. The mean, standard deviation, standard error of mean, and degree of freedom were calculated and subjected to statistical analysis using One- way analysis of variance (ANOVA) and post hoc test. Results suggested that there was no significant difference in the measurements obtained by direct surgical exposure technique and CBCT, However there was significant difference between surgical exposure, stent method and graphical method. Within the limitations of this study it was concluded that most accurate technique for ridge mapping is surgical exposure. Following which CBCT measurements were found close to the control group in comparison to Stent and Graphical methods.

Keywords: Alveolar ridge, Computerized tomography, Mapping; measurement.

Introduction

Today, the use of dental implants has become a standard of care in many clinical situations. A vast body of evidence proves implant therapy to be a safe and efficient treatment option. The undisputed advantages that implant

therapy offers over conventional therapeutic intervention in many cases has further contributed to the swift growth of the number of implants placed. The rapidly increasing relevance and popularity of this still relatively new therapeutic approach does not only entail advantages, but it also harbors risks. In addition to treatment outcomes being largely dependent on the clinician's level of education, practical expertise and sense of responsibility, one has to be aware of the uncertainties regarding the uses and successes of new treatment modalities(Iti)

The goal of modern dentistry is to restore the patient to normal contour, function, comfort, esthetics, speech, and health, whether by removing caries from a tooth or replacing several teeth. What makes implant dentistry unique is the ability to achieve this goal, regardless of the atrophy, disease, or injury of the stomatognathic system. However, the more teeth a patient is missing, the more challenging this task becomes. As a result of continued research, diagnostic tools, treatment plan ning, implant designs, materials, and techniques, predictable success is now a reality for the rehabilitation of many challenging clinical situations. (misch)

Careful diagnosis and treatment planning are critical for a favorable outcome. Evaluation of the dimensions of the available alveolar bone is an important prerequisite. Bone evaluation limited to the use of panoramic and/or periapical radiographs may be insufficient because it only provides two-dimensional information about implant sites. The bucco-lingual ridge width can be evaluated by computerized tomography (CT). The quality and quantity of bone available at anticipated implant site is of prime importance for prosthetic therapy. Even experienced implantologists are sometimes misled by the apparent bucco-lingual dimension of the maxillary or mandibular ridges. After exposure of the bone, the reality of the resorbed ridge becomes apparent. This unexpected lack of dimensions can result in a sudden change in the treatment program, which was not previously discussed with the patient.

Hence during treatment planning for dental implant placement, there is a need for assessment of alveolar bone. Bone evaluation limited to the use of panoramic and or periapical radiographs may be insufficient, as it provides only two-dimensional information about the implant sites. Computed tomography (CT) provides three-dimensional information. The measurement of alveolar ridge dimensions can be accomplished using ridge-mapping technique. The ridge-mapping technique along with panoramic and intraoral radiograph is adequate in cases where the pattern of resorption appears more regular and where mucosa is of more even thickness

There are different bone mapping techniques like CBCT, Stent method, Graphical method and Direct surgical method, which provide good diagnostic information hence this study was performed to determine the correctness of information provided by various techniques and comparative evaluation is needed among commonly used bone mapping techniques like CBCT, Stent, Graphical and Surgical exposure.

Materials and Methods

Study sample: 15 patients were reported in the department of Prosthodontics crown and bridge,. Out of these 10 cases were selected for the study whose age group was between 22 to 50 years and who needed replacement of edentulous span with dental implant. 5 cases were excluded during treatment planning procedure (2 after ridge-mapping procedure and 3 after CBCT scan procedure). Approval from ethical committee of the institute was taken. In this study Patients were having missing teeth. They were informed about treatment options. Replacement of missing teeth by implant placement was given as first choice of treatment. The proposed study

© 2020 IJDSIR, All Rights Reserved

criteria, including alternate treatment, potential risks and benefits were explained to the participants. The participants were asked to sign a consent form.

Inclusion Criteria

- Partially edentulous ridge
- At least one periodontally healthy and stable tooth adjacent to the edentulous ridge to serve as abutment for radiographic stent
- Healing period of at least 3 months after tooth extraction
- Good oral hygiene

Exclusion criteria

- Pregnancy
- Smoking habits
- Debilitating diseases
- Immunocompromised patients

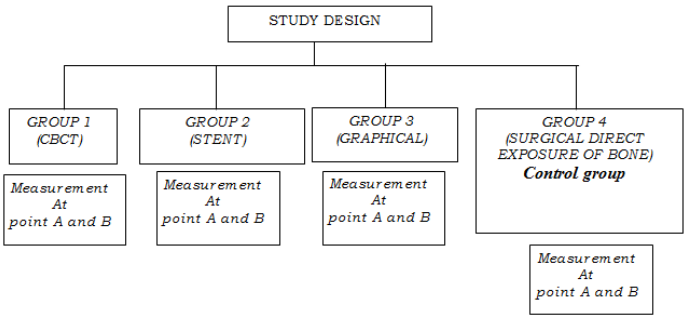
Patients were advised for the investigations. CBCT was given as primary choice of investigations. Therefore We decide to perform different investigations procedures to determine width and height of the bone for implant treatment. Width of alveolar ridge was studied by four techniques

Group 1- Cone beam computed tomography (Measurement At point A and B

Group 2- Ridge mapping before surgical exposure of flap method (Measurement At point A and B

Group 3-Graphical method (Measurement At point A and B)

Group 4-Surgical exposure (Measurement At point A and B)- control group.



(Point A- 3 mm from the crest of ridge and Point B- 6mm from the crest of ridge using same stent) and measurements at surgical exposure site was taken as control Group. Null hypothesis: there is no significant difference between the groups.

Method

Fabrication of clear acrylic stent: The diagnostic impression was made of the maxillary and mandibular ridges with irreversible hydrocolloid impression material. Reference line transferred on study model first point was marked on the crest of ridge (reference point) in reference to the adjacent teeth. Then point (point A) was marked at 3 mm distance from the reference point and another point (point B) was marked at 6 mm distance from the reference point. Points A and B were marked on both buccal and lingual/palatal aspect(fig.1)

A clear acrylic resin stent was fabricated over the study model with reference points The reference points were visible over the stent through the transparent acrylic resin material: A 1 mm diameter hole was then made over these 5 points (fig.2). The holes in the guidance stent were filled with gutta-percha . Due to the radiopaque property of gutta-percha material, the acrylic stent was converted into radiographic stent.

© 2020 IJDSIR, All Rights Reserved

Fig.1: Reference line transferred on study model

Fig.2: Fabrication of stent and reference point made

Fig.3: Radiographic stent

This stent was used during the preoperative tomography to provide radiopaque landmarks indicating the locations for comparative radiographic ridge width measurements. (fig.3)

Group 1- Cone beam computed tomography (Measurement At point A and BThe stent with gutta-percha in the guide holes after disinfection with nanzidone povidone-iodine solution IP microbial solution (5%) was placed in the patient's mouth before the images are obtained. The CBCT was performed with subjects in a supine position.

Fig.4: Stent placed on patient mouth

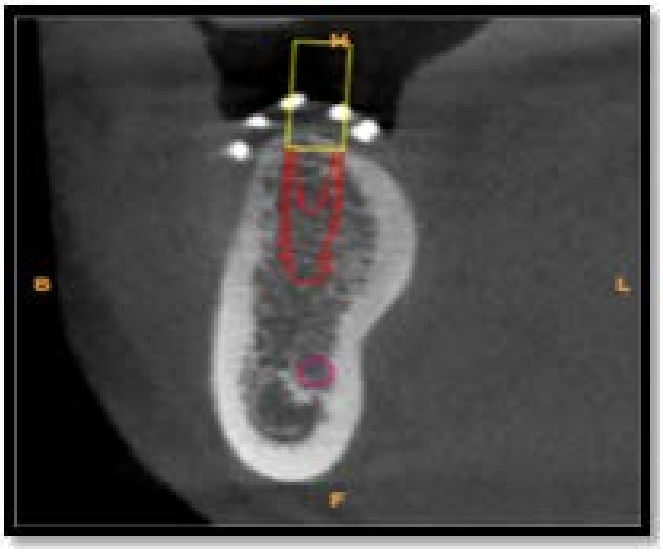


Fig.5 Radiopaque landmarks

© 2020 IJDSIR, All Rights Reserved

An image for measurement that showed the clearest gutta-percha imprints for the buccal and lingual aspects of bone and also provide 3D view of mandible bone.

Fig. 6: 3D view of mandible

Group 2- Ridge mapping before surgical exposure of flap method (Measurement At point A and B)

A study model was obtained from an alginate impression. A clear acrylic resin stent was fabricated over the study model with reference points The reference points were visible over the stent through the transparent acrylic resin material: A 1 mm diameter hole was then made over these 5 points. Administration of local anesthetic, The stent disinfection with nanzidone povidone-iodine solution IP microbial solution (5%) was placed in the patient's mouth and calibration is done with endodontic files to measure the thickness of the mucosa covering the bone(Measurement At point A and B). After calibration reference point transferred into cast and get shape of bone.

Fig.7: Calibration is done with endodontic files

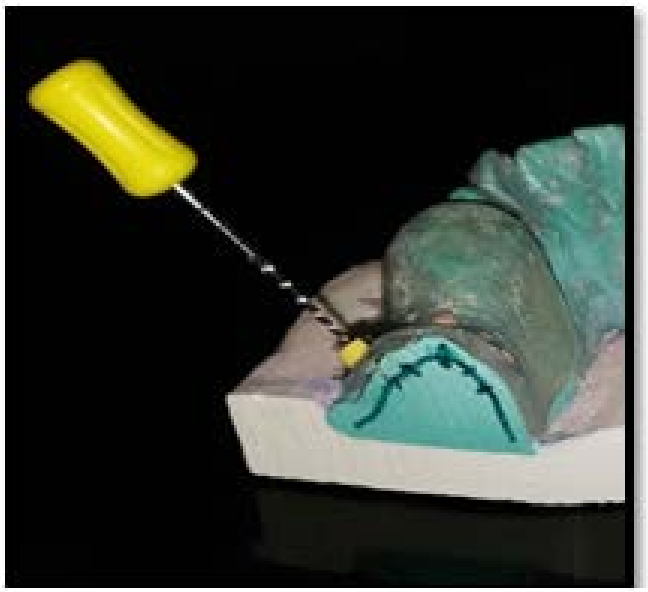


Fig.8: Reference point transferred into cast

Group 3-Graphical method (Measurement At point A and B)

A study model was obtained from an alginate impression. On the study model, a self-cure acrylic resin custom tray was fabricated with wax spacer and impression was made using poly- vinyl siloxane impression material.

© 2020 IJDSIR, All Rights Reserved

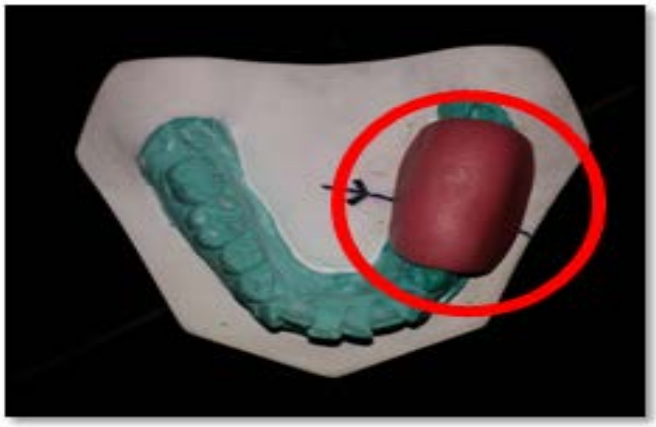


Fig.9:Fabrication of Self-cure acrylic resin custom tray

Fig.10 The cut half of the impression

The cut half of the impression with the markings was then traced on a graph paper to give the shape of the ridge. The points on the impression were transferred on the graph paper measure at point A and point B.

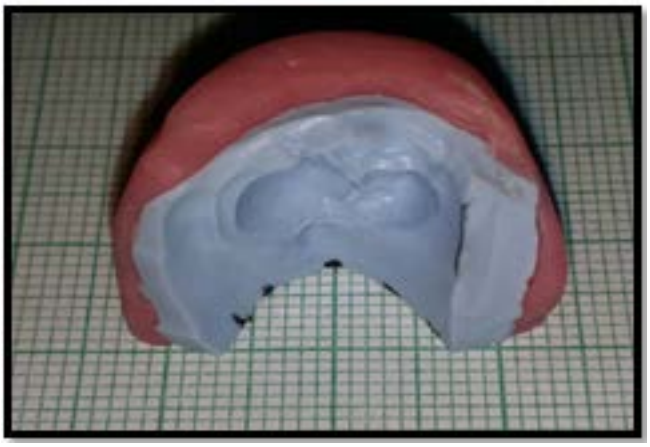


Fig.11: Markings was then traced on a graph paper

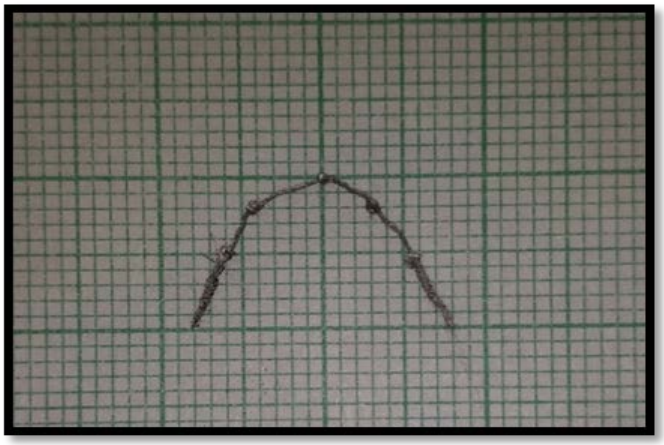


Fig.12: Marking traced on graph paper

The same impression after disinfecting was then transferred to the patient's mouth and the thickness of mucosa (under local anesthesia) on points A and B on both buccal and lingual/palatal aspect were measured with William's periodontal probe and transferred on the graph paper having ridge tracing.

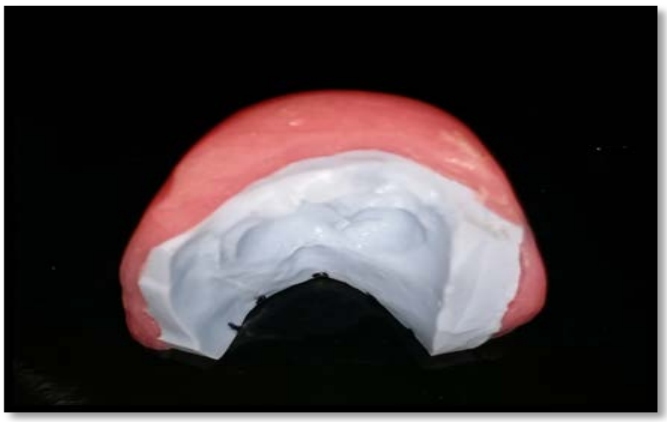


Fig.13: Marking transferred on impression

Fig.14: Impression transferred into patients mouth

© 2020 IJDSIR, All Rights Reserved

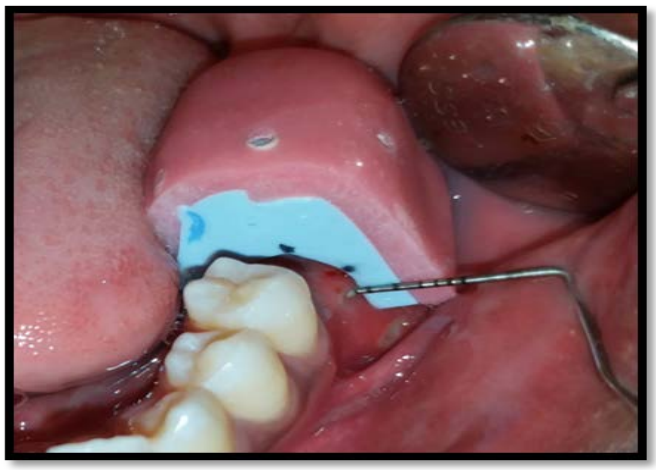


Fig.15: Measured with william's periodontal probe

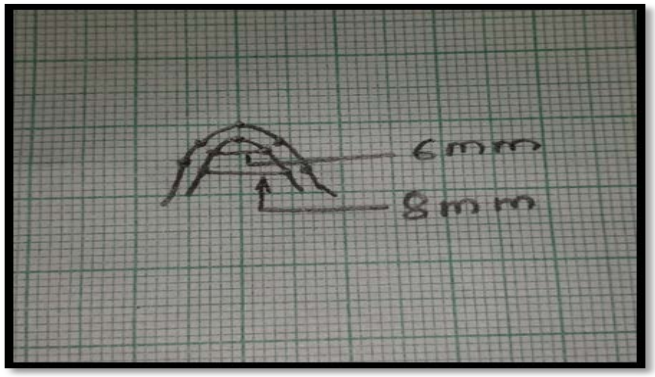


Fig.16: Marking traced on graph paper

Group 4-Surgical exposure using bone caliper (Measurement At point A and B)-control group.

Following surgical flap reflection, ridge width was measured directly on the exposed bone at the various locations of the guide holes using the ridge mapping caliper device and stent.

Fig.17: Surgical exposure of bone

Fig.18: Measurements made using caliper with stent

Fig.19: Placement of implant

We have taken null hypothesis as there was no significant difference between four groups in the study.

Result

Collected data was tabulated and subjected to statically analysis. One way analysis of variance (ANOVA) and post hoc test was performed and following results were obtained. According to the results obtained from the study a table-1 shows mean value amongst four groups group 1-.42164, group 2-.39441, group 3- .74536 and group 4-.48305 respectively at point-A and 1.46818, 1.58465, 1.30809 and 1.27366 respectively at point B. Table2 showed one way ANOVA test for comparison of bone dimensions of all four groups at point A respectively indicate statistically significant different.

© 2020 IJDSIR, All Rights Reserved

Table 1: Descriptive analysis of all four groups

Groups	Point of Measurements	N	Mean	Standard Deviation
1.CBCT	Point-A	10	6.7000	.42164
	Point-B	10	9.6000	1.46818
2.Sten mapping procedure	Point-A	10	7.6000	.39441
	Point-B	10	10.8000	1.58465
3.graphical procedure	Point-A	10	8.5000	.74536
	Point-B	10	11.4000	1.30809
4.Direct measurement	Point-A	10	6.2000	.48305
	Point-B	10	8.3000	1.27366

Table 2: One way ANOVA at point-A

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	30.900	3	10.300	36.713	.000
Within Groups	10.100	36	.281		
Total	41.000	39			

Table 3: Comparison of all four groups at point-A

Groups	N	Subset for alpha = 0.05		
		1	2	3
4	10	6.2000		
1	10	6.7000		
2	10		7.6000	
3	10			8.5000

Table 4: One way ANOVA at point-B

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	56.475	3	18.825	9.413	.000
Within Groups	72.000	36	2.000		
Total	128.475	39			

According to above table-3 there was no significant difference between Group 4 v/s Group 1 at point A. However there was significant difference between Group4 v/s Group 2 and Group 4 v/s Group3 at point A. Above table-4 showed one way ANOVA test for

© 2020 IJDSIR, All Rights Reserved

comparison of bone dimensions of all four groups at point B respectively indicate statistically significant different

Table 5: Comparison of all four groups at point-B

Groups	N	Subset for alpha = 0.05		
		1	2	3
4	10	8.3000		
1	10	9.6000	9.6000	
2	10		10.8000	10.8000
3	10			11.4000

According to above table-5 showed that there was no significant difference between Group4 v/s Group1 at point B. However there was significant difference between Group4 v/s Group2 and Group4 v/s Group3 at point B

Discussion

The use of dental implants to support prosthodontic restorations has a high success rate. Careful diagnosis and treatment planning are critical for a favorable outcome. Evaluation of the dimensions of the available alveolar bone is an important prerequisite. Bone evaluation limited to the use of panoramic and/or periapical radiographs may be insufficient because it only provides two-dimensional information about implant sites. Assessment of the bucco-lingual dimension of the osseous ridge also is needed for proper treatment planning. The bucco-lingual ridge width can be evaluated by computerized tomography (CT). The direct caliper measurement following surgical exposure of alveolar bone of the ridge gives the most accurate measurement. There are different bone mapping techniques like CBCT, Stent method, Graphical method and Direct surgical method, which provide good diagnostic information. Hence we performed this study to evaluate ridge dimension by CBCT, Stent, Graphical and Surgical exposure methods and keeping surgical exposure method as a control group.

According to the results obtained from this study There was no significant difference between measurements obtained from CBCT and Surgical exposure method at point A and at point B which is similar to the study done by Perez et al and Goulet et al. There was significant difference between measurements obtained from stent method, graphical method and surgical exposure method at point A and B which is similar to the study done by Chen LC et al. The ridge mapping method has the advantage of being simple to use, and avoids exposure to radiation for the patient. This technique has been advocated by Wilson and Traxler et al which is similar to our study.

Conclusion

- There was no significant difference in the measurements obtained by direct surgical exposure technique and CBCT at point A and at point B.
- There was significant difference between measurements obtained from stent method, graphical method and surgical exposure method at point A and point B
- Measurement obtained by direct surgical exposure and CBCT was same at point A and point B
- Hence null hypothesis was rejected.

© 2020 IJDSIR, All Rights Reserved

References

1. Different methods of assessing alveolar ridge dimensions prior to dental implant placement. J periodontol 2008 mar;79(3): 401-405.
2. Perez LA, brooks SL, wang HL, eber RM. Comparison of linear tomography and direct ridge mapping for the deter-mination of edentulous ridge dimensions in human cadav-ers. Oral surg oral med oral pathol oral radiol endod 2005 jun;99(6):748-754.
3. Veyre-goulet S, fortin T, thierry A. Accuracy of linear measurement provided by cone beam computed tomography to assess bone quantity in the posterior maxilla: a human cadaver study. Clin implant dent relat res 2008 dec;10(4):226-30.
4. Lindh C, Petersson A. Radiologic examination for location of the mandibular canal: A comparison between panoramic radiography and conventional tomography. Int J Oral Maxillofac Implants 1989 Fall;4(3):249-253
5. Frederiksen NL. Diagnostic imaging in dental Implantology. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995 Nov;80(5):540-554.
6. Bousquet F, Bousquet P, Vazquez L. Transtomography for implant placement guidance in non-invasive surgical proce-dures Dentomaxillofac Radiol 2007 May;36:229-233.
7. Chen Lc, Lundgren T, Hallstrom H, Cherel F. Comparision of different methods of assessing alveolar ridge dimensions prior to dental implant placement. J Periodontol 2008 Mar;79(3): 401-405

© 2020 IJDSIR, All Rights Reserved