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Evaluation of Pterygomaxillary- Pyramidal Region For Pterygoid Implants In Patients With Atrophic Posterior Maxilla: A CBCT Study

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ABSTRACT

Background: Pterygoid implants are best treatment option for atrophic maxilla. The present study aimed at determination of the position and angulation of dental implant in pterygoid region and dimensions of the pterygomaxillary area with cone beam computed tomography (CBCT).

Materials & Methods: It comprised of 120 patients (males- 65, females- 55) requiring dental implants in posterior maxilla. CBCT scans of all patients were taken with Planmica CBCT machine. Virtual implant length, angulation and bone density was assessed.

Results: The mean± SD length of bone was 14.54 mm seen in 11 patients (males- 5, females- 6), 21.28 mm of bone was seen in 35 patients (males- 12, females- 23) and 23. 45 mm of bone was observed in 74 patients (males- 48, females- 26). The mean± SD antero- posterior virtual implant angulation in males was 75.20± 4.8° and in females was 74.31± 4.6°. The mean± SD bucco- lingual virtual implant angulation in males was 83.14± 3.5° in males and 81.22± 3.9° in females. The difference was non- significant (P> 0.05). In males, bone density in tuberosity region was 380± 148 and in females was 342± 115 and in pterygoid region was 714± 110 in males and 702± 131 in females. The difference was non- significant (P> 0.05).

Conclusion: Pterygoid implant placement in atrophic maxillary posterior region is best option. Pterygoid region had higher bone density as compared to tuberosity region.

Keywords: Atrophic maxilla, CBCT, Pterygoid implant.

INTRODUCTION

Dental implants are considered one of the best treatment options for replacing missing teeth. Amount of bone determines the success rate of dental implant. A good quantity of alveolar bone is desired for implant therapy. There are certain landmarks which greatly effects the placement of dental implant. In anterior maxilla, nasal fossa, nasopalatine canal, maxillary sinus and in mandible, lingual foramen, mental foramen and mandibular canal location, position and variation decides the implant placement.[1]

In posterior maxilla, position of floor of maxillary sinus in respect to alveolar crest is an important anatomical landmark which is challenge for dental surgeons. Pneumatization of maxillary sinus and

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low alveolar bone density makes dental implant insertion difficult. In cases of atrophic maxilla in posterior region is biggest drawback and management of such cases becomes crucial.[2] Misch[3] introduced subantral classification into SAC 1, 2, 3 and 4 depending upon amount of remaining bone in posterior maxillary region. Surgical sinus drift and placement of small implants may be useful in limited cases. Recently, pterygoid implants have proved beneficial in such cases. Assessment of anatomical landmarks becomes essential before planning pterygoid implants.

Pterygoid implants are inserted in pterygoid process of sphenoid bone. The presence of palatine artery is the biggest limitation and careful evaluation is required to prevent future complications. CBCT is the newer radiological investigation tool which is three dimensional in nature. The angulation of dental implant in pterygoid region may be helpful with CBCT.[4] The present study was conducted to determine the position and angulation of dental implant in pterygoid region and dimensions of the pterygomaxillary area with CBCT.

MATERIALS & METHODS

The present study was conducted in the department of Oral surgery. It comprised of 120 patients (males- 65, females- 55) requiring dental implants. Patients with edentulous alveolar ridge in posterior maxillary region and bone height less than 7mm were considered form the study. Poor quality images and bone height more than 8mm were excluded from the study. All patients were informed regarding the study and written consent was obtained. Ethical clearance was obtained prior to the study.

General information such as name, age, gender etc. was recorded. All were subjected to CBCT scan with Planmica CBCT machine operating at 110 kVp and 12 mAs. Field of view was 5X 7cm. Image thickness of 1mm was utilized for the study. Frankfurt horizontal plane was considered and all the measurement was done with the help of NNT software.

Implant angulation in antero- posterior and bucco-lingual direction with reference to Frankfurt horizontal plane was assessed (Fig- 1, 2).

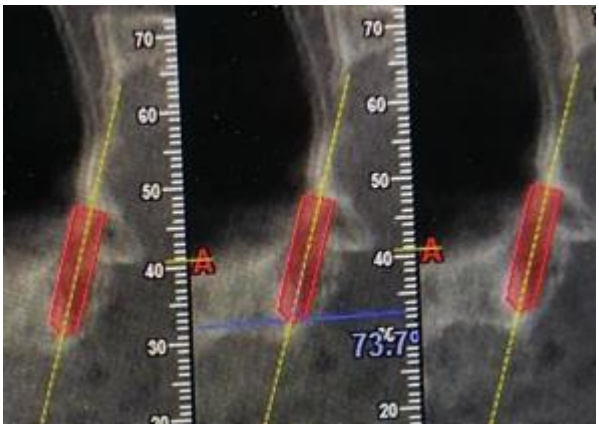

Fig 1: Implant angulation in antero- posterior axis.

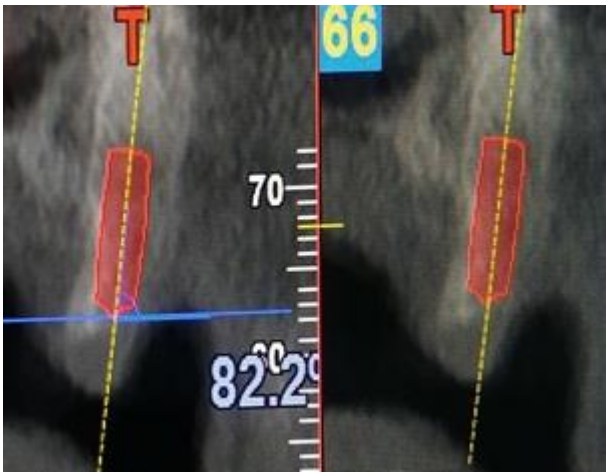

Fig 2: Implant angulation bucco- lingual axis.

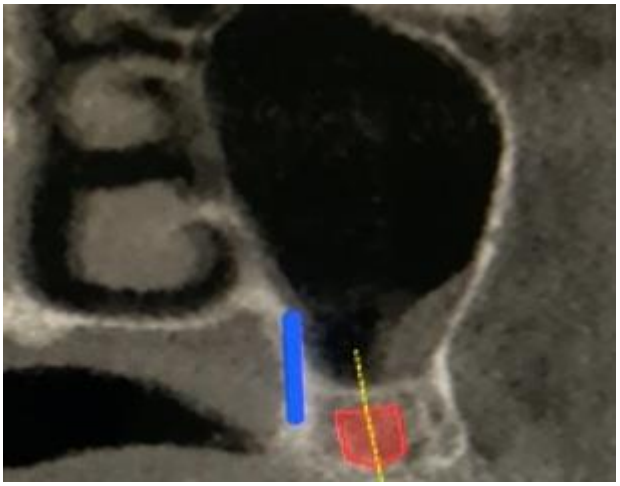

Fig 3: Evaluation of palatine artery,

Dimensions of the pterygomaxillary area and bone density at implant site were also determined. Palatine artery was evaluated (Fig- 3). Depending upon quality of bone, virtual dental implant planning was done. All the measurements were

done by two senior radiologists and the mean of their values was considered to avoid interobserver bias. Results thus obtained were subjected to statistical analysis using SPSS version 18.0. P value less than 0.05 was considered significant.

RESULTS

Table I: Determination of quantity of bone in pterygoid region.

Implant dimension	Mean± SD bone	Males	Females	Total
13mm	14.54 mm	5	6	11
15mm	21.28 mm	12	23	35
18mm	23.45 mm	48	26	74
Total		65	55	120

It was observed that 13 mm dental implant with (mean± SD) 14.54 mm of bone was planned in 11 patients (males- 5, females- 6), 15mm dental implant with (mean± SD) 21.28 mm of bone was planned in 35 patients (males- 12, females- 23) and 18 mm of dental implant with (mean± SD) 23. 45 mm of bone was planned in 74 patients (males- 48, females- 26).

Table II: Measurement of virtual dental implant in antero- posterior & bucco- lingual axis with reference to Frankfurt horizontal plane.

Angulation	Males (Mean± SD)	Females (Mean± SD)	P value
Antero-posterior axis	75.20± 4.8°	74.31± 4.6°	0.5
Bucco-lingual axis	83.14± 3.5°	81.22± 3.9°	0.21

The mean± SD antero- posterior virtual implant angulation in males was 75.20± 4.8° and in females was 74.31± 4.6°. The mean± SD bucco- lingual virtual implant angulation in males was 83.14± 3.5° in males and 81.22± 3.9° in females. The difference was non- significant (P> 0.05).

Table III: Bone density (HU) in both genders.

Region	Males (Mean± SD)	Females (Mean± SD)	P value
Tuberoisity region	380± 148	342± 115	0.1
Pterygoid region	714± 110	702± 131	0.5

Bone density in tuberoisity region in males was 380± 148 and in females was 342± 115 and in pterygoid region was 714± 110 in males and 702± 131 in females. The difference was non- significant (P> 0.05).

DISCUSSION

In modern era, implant therapy has gained importance in recent few years. This is due to higher success rate of 95% over 10 years. However, it is not very easy as it appears. The quality of bone and anatomical structures demands careful assessment. The amount of bone present, the quality of bone determines the implant placement. The bone height from alveolar crest to floor of the maxillary sinus decides the selection of dental implant.[5] Pterygoid implants have been introduced by Tulasne and Tessier[6] as treatment option in atrophic maxillary region. In cases of pneumatization of sinus where sinus lift cannot be planned, pterygoid implants may be considered. Candel et al[7] in their review article suggested pterygoid implants in posterior atrophic maxillary region.

In present study, we included 120 patients requiring dental implants in posterior maxillary ridge. All were cases of atrophic ridge (<7 mm bone height) thus selected for pterygoid implants. We observed that mean bone height was 23.45 mm where 18mm dental implant could be placed in 74 patients. Similarly, 15mm dental implants in bone height of 21.28 mm were planned in 35 patients. 13 mm dental implants with bone height of 14.54 mm were planned in 11 patients. We planned 18 mm implants in maximum (74) patients. This is because denser bone in pterygomaxillary region provides sufficient implant support hence insuring success rate. Rodriguez et al[8] in their study found that in 147 patients with mean bone height of 22.46 mm in

pterygoid region 18mm dental implant was planned. Similarly, 15 mm and 13 mm dental implant was planned in 50 patients and 5 patients respectively. Balshi et al[9] conducted a study in 356 patients requiring dental implants in pterygomaxillary region. Authors suggested that 15-18 mm implants have higher success rate in this region. However, Lopes et al[10] suggested <15mm dental implant in maxillary tuberoisity region.

In present study, we assessed antero- posterior and bucco- lingual virtual implant angulation in patients. It was observed that the mean antero-posterior virtual implant angulation was 75.20° and 74.31° in males and in females respectively. The mean bucco- lingual virtual implant angulation was 83.14° and 81.22° in males and in females respectively. Graves et al[11] suggested implant angulation of 45 degree to Frankfurt horizontal plane. However, Venturelli et al[12] suggested 70 degree of pterygoid implant angulation.

Maxillary posterior region has type IV bone quality. The success rate of dental implant in such bone quality is very low. The use of tuberoisity and pterygoid region becomes essential especially when the placement of implant in such conditions poses failure rate. Fernandez et al[13] in their study on 92 patients, 152 dental implants were placed in Pterygo- maxillary pyramidal region. Authors observed 94.7% of survival rate. Only 8 dental implants failure was observed.

Curi MM[14] in their study, 66 pterygoid implants was placed in 56 patients. Authors found dental implant survival rate of 99% and prosthetic survival rate of 97.7%. There was 1.21mm bone loss around dental implants after 3 years post loading. They suggested that in atrophic maxilla, pterygoid implants are one of best treatment options.

Wood et al[15] suggested that pterygoid implants can be considered replacement modality in patients with atrophic maxilla. Sinus lift and onlay implants poses difficulty in such cases as there is considerable longer healing period. Moreover, pterygoid implants has higher success rate as compared to implant placed after sinus lift procedure.

We observed that bone density was 380± 148 HU in males and 342± 115 HU in females in tuberoisity region and 714± 110 in males and 702± 131 in females in pterygoid region. We observed significant higher bone density in pterygoid region than tuberoisity region. Martinez et al[16] suggested that pterygoid bone has higher density than tuberoisity area, hence a thorough evaluation is necessary in patients planning dental implant in this region.

Palatine artery may be traumatized while inserting implant in pterygoid region. Thus, positioning of pterygoid implant is of paramount importance. In present study we assessed palatine artery to avoid trauma to artery. Rodriguez et al[8] in their study evaluated palatine artery while planning pterygoid artery.

CBCT provided useful information such as bone height, angulation and bone density. It is best radiographic tool as it is three dimensional in nature. All the three planes such as sagittal plane, coronal plane and axial plane can be visualized. It is considered better than CT as it is relatively cheaper and uses less radiation exposure as compared to CT scan. Virtual dental implant as guided by CBCT software provides a pathway for the surgeon. The determination of potential implant site, angulation and quality of bone guides the surgeon in selecting appropriate dental implant and site.[17]

The limitation of the study is that smaller study group was selected. Only one side was selected whereas bimaxillary posterior region were not considered.

CONCLUSION

Dental implant placement in atrophic maxillary posterior region is challenging for dental surgeon. Pterygoid implants are best option in such cases. The selection of long implants such as 18 mm and 15 mm is suggested. Pterygoid region had higher bone density as compared to tuberoisity region.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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