Original Article

Comparative evaluation of dental implants in posterior maxilla placed using unicortical and bicortical anchorage—A split-mouth prospective study

ABSTRACT

Background: The use of dental implants has become a very predictive method of rehabilitation for patients with partial or complete edentulism. It is more challenging to treat the posterior quadrants of the maxillary ridges using dental implants due to their anatomical and physiological characteristics. So to overcome the limitations of other techniques, short implants were introduced recently as a new approach to simplify implant placement in compromised alveolar bone and to prevent possible damage to vital structures.

Purpose: This study aims to compare the clinical outcomes of dental implants placed using the osteotomized sinus floor elevation (OSFE) technique side engaging the bony floor of the maxillary sinus (bicortical anchorage) on one side and the conventional technique by split mouth on the other side.

Materials and Method: This study included 15 patients. Study participants had dental implants placed on both sides of the mouth at the same time, so one side was implanted according to the test method, while the other side used the control method. Randomization determined which side would be implanted.

Conclusion: The OSFE technique provides greater stability to the implant via bicortical anchorage than conventional techniques, which only provide unicortical anchorage.

Keywords: Bicortical implant, dental implant, posterior maxilla, unicortical anchorage

INTRODUCTION

The maxilla has a different function, physiology, and bone density from the mandible, which presents challenges to implant placement. Anatomical and physiological features such as advanced alveolar ridge resorption, increased pneumatization of the maxillary sinus, and lower bone density make the posterior quadrants of the maxillary ridge more difficult to restore with dental implants. In the posterior maxilla, these factors often leave insufficient bone to anchor the standard implant. Bone grafting procedures lead to considerable patient morbidity, require extensive healing time, and are resource-intensive. Furthermore, the origin of bone grafts causes conflict for a high percentage of patients due to religious and ethical reasons. Implant placement in the posterior atrophic maxilla can also be accomplished with zygomatic and pterygoid implants. However, these techniques require a more invasive procedure, are technique-dependent, and require expertise and additional instruments. To overcome these limitations, short implants have been introduced recently as a new approach for

Sujay M. Bhave, Sharad Chand, Lakshya Yadav[1], Uma Shanker Pal, Shadab Mohammad, Vibha Singh, Geeta Singh, Harshita Maurya

Departments of Oral and Maxillofacial Surgery and [1]Prosthodontics and Crown and Bridge, King George's Medical University, Lucknow, Uttar Pradesh, India

Address for correspondence: Dr. Harshita Maurya, Q/1168 Qanoon Goyan, Dhanokhar Talab Barabanki - 225 001, Uttar Pradesh, India.
E-mail: hrsht100@gmail.com

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simplifying implant placement in compromised alveolar bone and preventing potential harm to vital structures. Implants in the posterior maxilla are placed with corticalization, which results in a more compact bone for implant placement and offers a good prognosis. Bicortically anchored implants are more likely to survive.

MATERIALS AND METHOD

This study was initiated in June 2018 and completed in July 2019. A total of 15 patients were included. For the study, patients were recruited from the outpatient department of the Department of Oral and Maxillofacial Surgery and Prosthodontics. The patients were diagnosed based on their medical history, clinical examination, and radiographic interpretation (Orthopantomogram [OPG]/cone-beam computed tomography systems). This study used a split-mouth design, in which the implant was placed on one side according to the test method, and the implant on the opposite side according to the control method. The side was randomly assigned. Each patient signed an informed consent form and underwent routine blood testing. Ethical Clearance was obtained from Institutional Ethical Committee with Ref no. 98th ECM IIB- Thesis/PI dated 18/10/2019.

Inclusion criteria

1. Fully edentulous in the maxilla.
2. Kennedy's Applegate Class I maxilla—Bilateral posterior edentulous ridge.
3. Patient willing to sign an informed consent.

Exclusion criteria

1. Patients are not willing to give his/her informed consent to participate.
2. Systemic disease that did not permit the surgical procedure (including general anesthesia).
3. Uncontrolled diabetes.
4. Patients who are being treated with bisphosphonates therapy.
5. Heavy smokers (>10 cigarettes/day).
6. Patient with a psychiatric problem.
7. Any disorders in the planned implant area such as previous tumors, chronic bone disease, or previous irradiation in the head/neck area.
8. Severe bruxism or other parafunctional habits.

Study design

Dental implants were placed using the osteotomized sinus floor elevation (OSFE) technique side engaging the bony floor of the maxillary sinus (bicortical anchorage) on one side. On the opposite side, dental implants were placed using a conventional drilling technique without engaging the sinus floor keeping them 1–1.5 mm short of the maxillary sinus floor (unicortical anchorage).

Group-I: Dental implants placed in the posterior edentulous implants using bicortical anchorage.

Group-II: Dental implants placed in the posterior edentulous implants using unicortical anchorage.

Implants were placed using the above-mentioned technique. Clinical evaluation was done at the baseline and 1, 3 months intervals. A radiographic interpretation was done and clinical data was collected.

Method

The patient was prepared with aseptic measures, and local anesthesia (2% Xylocaine hydrochloride with 1:20,0000 adrenaline) infiltration was given. After the effectiveness of local anesthesia, full mucoperiosteal flap elevation was performed. Selecting the suitable length and diameter of the implant, initial drilling was done with a pilot drill and a sequential drill was finished. On one side after approaching the sinus floor, the floor was elevated by Summer's osteotome technique.[1] After checking for any perforation of the membrane, a dental implant 1 mm longer in size than the available bone height was placed engaging the bony floor of the maxillary sinus. On the other side, dental implants were placed using the conventional technique. On this side, the drill length was kept 0.5 to 1 mm short of the sinus floor. And a dental implant 0.5 to 1 mm short of the available bone height was placed. Post-operatively patient was recalled for suture removal. Radiofrequency analysis (RFA) reading and bone crest level was assessed at the baseline. During all these procedures, HC2 implants, Switzerland based company, were used with a roughened endosseous surface, an internal marginal taper, and a US standard internal thread

Assessment of the patients was done under the following parameters.

Clinical assessment

1. **Pain**—Visual analog scale (0–10).

The pain measurements were done postoperatively at each follow-up (First day after surgery; 1 week; 4 weeks; 12 weeks).

2. **Swelling**: Using a dermographic pencil and suture thread fixed with two clamps (surgical clips), Laskin's method measures the evolution of the inflammation at the determined points. The measurements are taken between the interest points marked with the dermographic pencil. The reference points and distances to be measured are as follows:

(a) The distance in centimeters from the bottom edge of the earlobe to the midpoint of the symphysis Hirota, called: horizontal distance to the symphysis.
(b) The distance in centimeters from the bottom edge of the earlobe to the external angle of the mouth, called: horizontal distance to the corner.
(c) The distance in centimeters from the palpebral outboard angle to the gonial angle, called: vertical distance.

Distances used in the Laskin method to measure inflammation.

Swelling measurements were done postoperatively at each follow-up (First day after surgery; 1 week; 4 weeks; 12 weeks). Grade III: 3 (severe), Grade II: 2 (moderate), Grade I: 1 (mild).

3. **Stability**: Resonance frequency analyzer (Osstell ISQ)—The stability measurements were done postoperatively at each follow-up (baseline; 3 and 6 months) as low (ISQ <60); moderate (ISQ 60–70); high (ISQ >70).

The baseline implant stability quotient (ISQ) score was obtained by applying the Osstell Mentor system (Osstell AB). A probe on this hand-held instrument emits signals that are repeated by a smart peg or transducer directly screwed onto the implant with a force of 5 to 10 N cm. The resonance frequency is calculated from the response signal on an ISQ scale from 0 to 100. The ISQ values were obtained by buccal or palatal measurements with an angulation almost equal to 90°. Primary stability was measured by RFA after implant insertion.

A new external fixation device was developed for RFA measurement with one piece dental implant, which has both external and internal connections. Internal connection snuggly fits over the abutment, the RFA peg is fixed on an external attachment, the device has been validated, and the readings were observed.

Radiographic assessment

Assessment of bone

OPG: At 1 month and 3-month intervals to assess the evidence of bone loss around the implant.

Crestal bone loss measurement

Assessment of alveolar crestal bone loss was done with the help of OPG. Radiographs were taken at baseline, 1 and 3 months intervals.

Implant length and maximum distance from the alveolar crest to the inferior margin of the implant collar were measured based on standard X-ray images using X-ray image viewer. The actual amount of bone resorption was calculated using the following formula based on the length of the embedded implant and the length of the implant measured on the image, calculation of the amount of bone loss.

Bone loss was calculated based on implant length and maximum distance from the platform to the inferior margin on X-ray images.

$$y = ax \div b$$

y: Amount of bone loss, ***a:*** Amount of bone loss on film, ***x:*** Actual implant length, ***b:*** Implant length on film.

The OPG were digitized and analyzed with the help of computer software (Image J. software).

Measurement of bone loss by Image J software.

Statistical analysis

Data entry was made in MS office Excel software in codes and analysis was done by Statistical Package for Social Sciences software version 23.0. Descriptive statistical analysis, which included frequency, percentages, mean, and standard deviation was used to characterize the data. The Chi-square test was used to check the association between categorical variables. Student's unpaired t-test was to compare discrete normal data between the groups while its non-parametric equivalent "Mann–Whitney test" was used to compare non-normal data between the groups. Within groups comparisons were made by paired t-test or Wilcoxon signed rank test subjects to the normality of the variables.

RESULT

In the study, 15 patients were included. This was a split-mouth study so, in each of these 15 patients, implants were placed on one side using the technique described according to the group-I and on the other side to the technique mentioned in group-II.

The mean age of patients in the study was 39.87 ± 12.94 years, the minimum age was 15 years while the maximum age was 65 years [Table 1 and Figure 1].

There were 9 males and 6 females in the study. The proportion of female and male in the study was 60%:40% [Figure 2 and Table 2].

In group-I, 22 implants had been placed in 15 patients with the most frequent implant size of width 4.2 mm (63.6%) and length 13 mm (54.5%), while in group-II, 20 implants had been applied in the same 15 patients (split-mouth technique) with most frequent implant size of width 4.2 mm (75%) and length 11.5 mm (55.0%) [Figure 3].

A significant difference was observed in the proportion of implant width between the groups ($P = 0.004$) [Table 3].

In group-I, the pain score was significantly decreased from first day to first week (change = 2.27 ± 0.80, $P = 0.001$), first day to fourth week (change = 3.20 ± 0.94, $P = 0.001$), and first day to twelfth week (change = 3.93 ± 1.10, $P = 0.001$) [Figure 4 and Table 4].

Table 1: Age distribution of subjects

Variable	Mean	SD	Min.	Max
Age	39.87	12.94	15	65

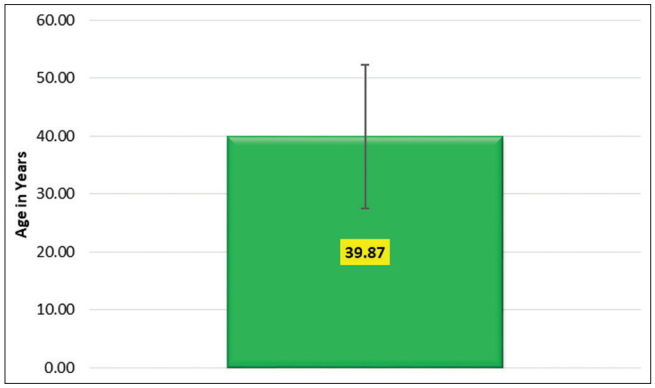

Figure 1: Age distribution of subjects

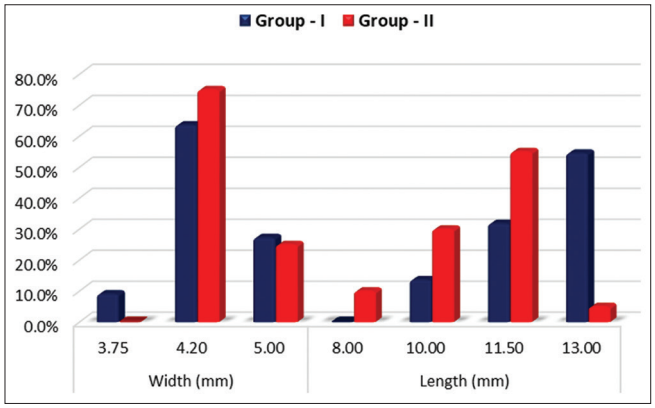

Figure 3: Implant size status of groups

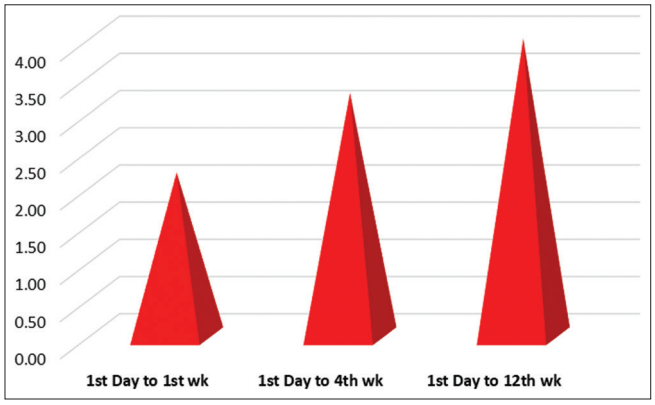

Figure 5: Pain status group-II

In group-II, the pain score was significantly decreased from first day to first week (change = 2.20 ± 0.77, $P < 0.001$), first day to fourth week (change = 3.27 ± 1.16, $P = 0.001$), and first day to twelfth week (change = 4.00 ± 1.31, $P = 0.001$) [Figure 5 and Table 5].

After comparing the pain reduction between the groups, it was found that [Figure 6 and Table 6].

On the first day, the mean pain score of group-I was 4.00 ± 1.20 and the mean pain score of group-II was

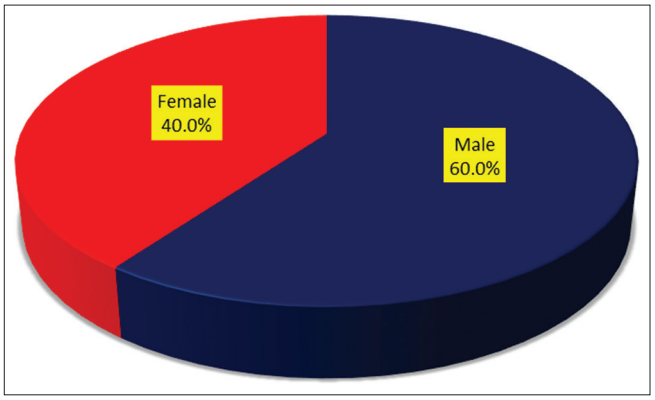

Figure 2: Sex distribution of subjects

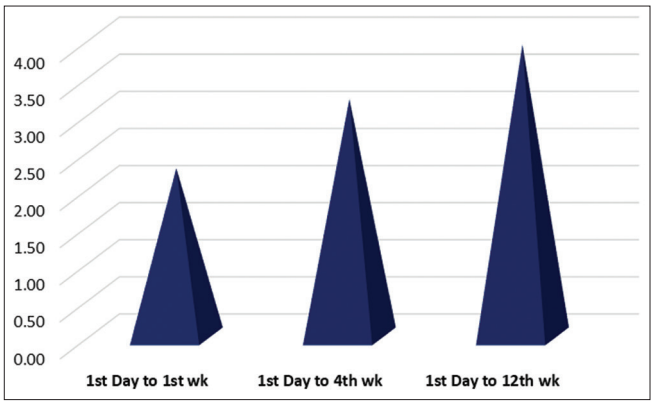

Figure 4: Pain status group-I

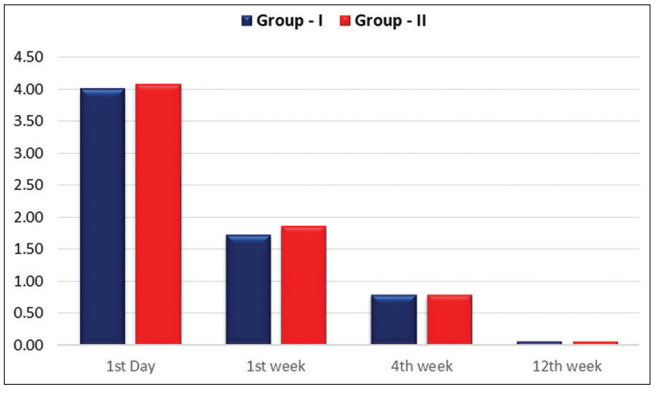

Figure 6: Intergroup comparison of pain reduction between the groups at various time points

4.07 ± 1.39. According to Mann–Whitney U test, no significant difference was found between the average pain scores of the two groups ($P = 0.967$).

In the first week, the mean pain score of group-I was 1.73 ± 0.80 and the mean pain score of group-II was 1.87 ± 0.83. According to Mann–Whitney U test, no significant difference was found between the average pain scores of the two groups ($P = 0.683$).

In the fourth week, the mean pain score of group-I was 0.80 ± 0.56 which was equal to the group-II.

In the twelfth week, the mean pain score of group-I was 0.07 ± 0.26 which was equal to the group-II.

The swelling status which was initially of grade 1 in 33.3% of cases was significantly decreased to nil from the first day to the first week ($P = 0.014$) and so the significant improvement in swelling status was found.

On the first day, the swelling of grade-1 was present in both groups, which was reduced to nil in both groups. No significant difference was found in swelling status between the groups [Figure 7 and Tables 7-9].

In group-I, the mean number of implants per subject was 1.47 ± 0.74, while in group-II, the mean number of implants per subject was 1.33 ± 0.49. No significant difference was found in the mean number of implants/subjects between the groups ($P = 0.838$) [Figure 8 and Table 10].

In group-I, the stability status was significantly changed from BL to 1 month (change = 3.32 ± 1.43, $P < 0.001$), BL to 3 months (change = 7.50 ± 2.84, $P < 0.001$), and 1 month to 3 months (change = 4.18 ± 2.24, $P < 0.001$) [Figure 9 and Table 11].

In group-II, the stability status was significantly changed from BL to 1 month (change = 4.05 ± 2.04, $P < 0.001$), BL to 3 months (change = 7.80 ± 2.33, $P < 0.001$), and 1 month to 3 months (change = 3.75 ± 1.74, $P < 0.001$) [Figure 10 and Table 12].

Table 2: Sex Distribution of Subjects

Gender	No.	%
Male	9	60.0%
Female	6	40.0%
Total	15	100.0%

Table 3: Implant size status of groups

Implant Size	Group-I		Group-II		Chi-square	*P*
	No.	%	No.	%		
Width (mm)						
3.75	2	9.1%	0	0.0%	2.04	0.362
4.20	14	63.6%	15	75.0%		
5.00	6	27.3%	5	25.0%		
Mean±SD	4.38±0.41		4.40±0.36			
Length (mm)						
8.00	0	0.0%	2	10.0%	13.13	0.004
10.00	3	13.6%	6	30.0%		
11.50	7	31.8%	11	55.0%		
13.00	12	54.5%	1	5.0%		
Mean±SD	12.11±1.10		10.78±1.25			

Table 4: Pain status group-I

Pain	Group-I			
	Mean change	SD	*z*	*P*
First day to first week	2.27	0.80	−3.48	0.001
First day to fourth week	3.20	0.94	−3.46	0.001
First day to twelfth week	3.93	1.10	−3.44	0.001

Table 5: Pain status group-II

Pain	Group-II			
	Mean change	SD	*z*	*P*
First day to first week	2.20	0.77	−3.50	<0.001
First day to fourth week	3.27	1.16	−3.45	0.001
First day to twelfth week	4.00	1.31	−3.43	0.001

Table 6: Intergroup comparison of pain reduction between the groups at various time points

Pain	Group-I		Group-II		Mann–Whitney Test	
	Mean	SD	Mean	SD	*U*	*P*
First day	4.00	1.20	4.07	1.39	111.50	0.967
First week	1.73	0.80	1.87	0.83	102.50	0.683
Fourth week	0.80	0.56	0.80	0.56	112.50	1.000
Twelfth week	0.07	0.26	0.07	0.26	112.50	1.000

Table 7: Swelling status of the study cases in the group-I

Time	Grade	Swelling Status		Change from first day	
		No.	%	Chi-square	*P*
First day	Nil	10	66.7%	-	-
	Grade 1	5	33.3%		
First week	Nil	15	100.0%	6.00	0.014
Fourth week	Nil	15	100.0%	6.00	0.014
Twelfth week	Nil	15	100.0%	6.00	0.014

Table 8: Swelling status of the study cases in the group-II

Time	Grade	Swelling Status		Change from first day	
		No.	%	Chi-square	*P*
First day	Nil	10	66.7%	-	-
	Grade 1	5	33.3%		
First week	Nil	15	100.0%	6.00	0.014
Fourth week	Nil	15	100.0%	6.00	0.014
Twelfth week	Nil	15	100.0%	6.00	0.014

Table 9: Intergroup comparison of swelling status between the groups at various time points

Time	Grade	Group-I		Group-II		change from first day	
		No.	%	No.	%	Chi-square	*P*
First day	Nil	10	66.7%	10	66.7%	0.00	1.000
	Grade 1	5	33.3%	5	33.3%		
First week	Nil	15	100.0%	15	100.0%	NA	NA
Fourth week	Nil	15	100.0%	15	100.0%	NA	NA
Twelfth week	Nil	15	100.0%	15	100.0%	NA	NA

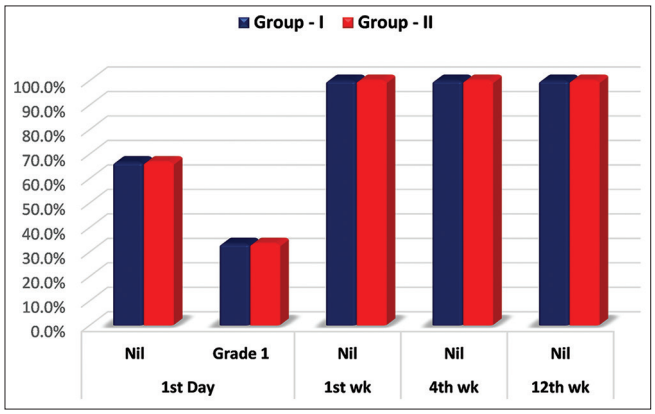

Figure 7: Intergroup comparison of swelling status between the groups at various time points

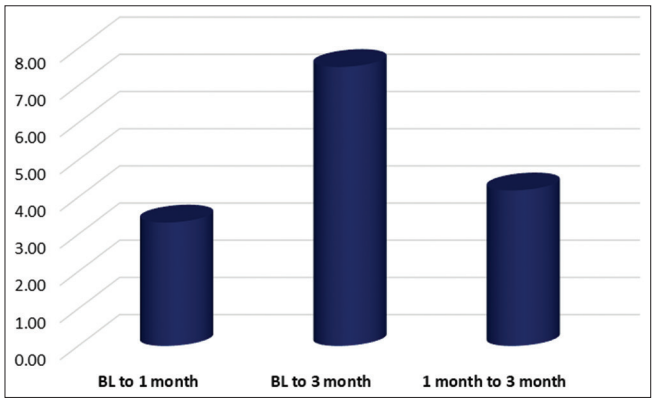

Figure 9: Stability status group-I

After comparing the stability status between the groups, it was found that.

On the baseline, the mean stability of group-I was 63.64 ± 2.57 and the mean stability of group-II was 57.90 ± 3.65. According to the unpaired t-test, a highly significant difference was found between the average stability of the two groups ($P < 0.001$).

In 1 month, the mean stability of group-I was 66.95 ± 2.48 and the mean stability of group-II was 61.95 ± 3.41. According to the unpaired t-test, a highly significant difference was found between the average stability of the two groups ($P < 0.001$).

In 3 months, the mean stability of group-I was 71.14 ± 3.37 and the mean stability of group-II was 65.70 ± 3.13.

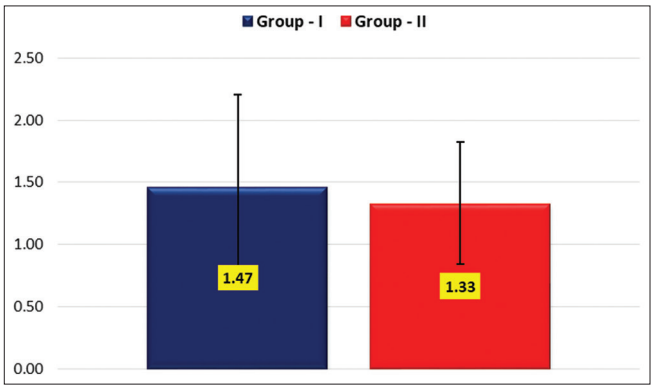

Figure 8: Intergroup comparison of the number of implants/subjects

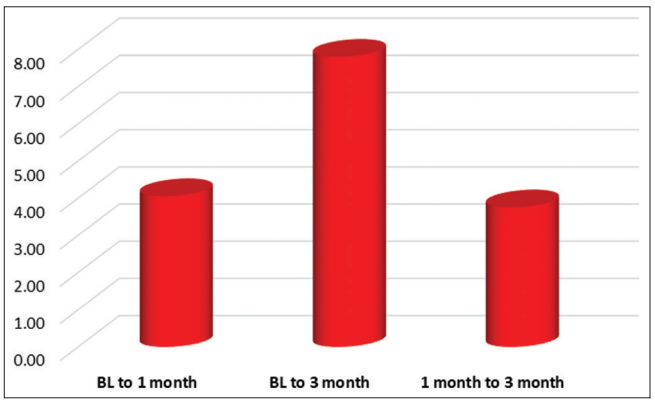

Figure 10: Stability status group-II

According to the unpaired t-test, a highly significant difference was found between the average stability of the two groups ($P < 0.001$) [Figure 11 and Table 13].

After comparing the mesial crestal bone loss between the groups, it was found that.

In 1 month, the mean mesial crestal bone loss of group-I was 0.00 ± 0.00 and the mean bone loss of group-II was the same 0.00 ± 0.00.

In 1 month, the mean mesial crestal bone loss of group-I was 0.09 ± 0.20 and the mean bone loss of group-II was 0.08 ± 0.18. According to the unpaired t-test, no significant difference was found between the average bone loss of the two groups ($P = 0.789$) [Figure 12 and Table 14].

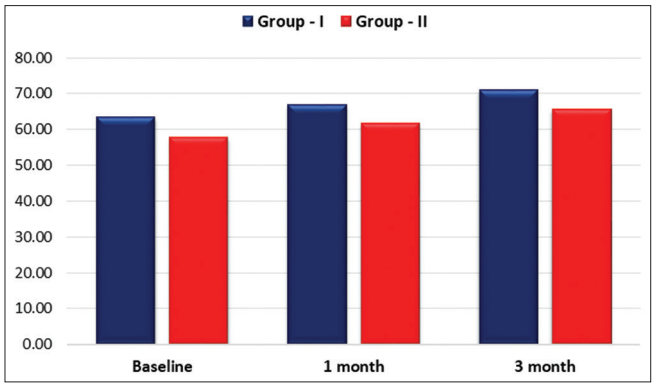

Figure 11: Intergroup comparison of stability status between the groups at various time points

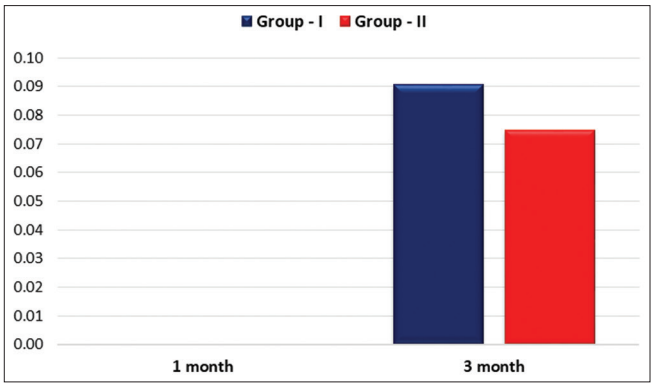

Figure 12: Intergroup comparison of mesial crestal bone loss between the groups at various time points

Table 10: Intergroup comparison of the number of implants/ subjects

Group	Group-I		Group-II		Mann–Whitney Test	
	Mean	SD	Mean	SD	*U*	*P*
No Implant	1.47	0.74	1.33	0.49	107.50	0.838

Table 11: Stability status group-I

Stability	Group-I			
	Mean	SD	*z*	*P*
Base Line (BL) to 1 month	3.32	1.43	−10.91	<0.001
BL to 3 months	7.50	2.84	−12.38	<0.001
1 month to 3 months	4.18	2.24	−8.76	<0.001

Table 12: Stability status group-II

Stability	Group-II			
	Mean	SD	*z*	*P*
BL to 1 month	4.05	2.04	−8.89	<0.001
BL to 3 months	7.80	2.33	−14.97	<0.001
1 month to 3 months	3.75	1.74	−9.62	<0.001

After comparing the distal crestal bone loss between the groups, it was found that.

In 1 month, the mean distal crestal bone loss of group-I was 0.00 ± 0.00 and the mean bone loss of group-II was the same 0.00 ± 0.00.

In 1 month, the mean distal crestal bone loss of group-I was 0.07 ± 0.18 and the mean bone loss of group-II was 0.08 ± 0.18. According to the unpaired t-test, no significant difference was found between the average bone loss of the two groups ($P = 0.903$) [Figure 13 and Table 15].

The mean RBH of group-I was 11.18 ± 1.097 mm and the mean RBH of group-II was 11.55 ± 1.202. According to the unpaired t-test, no significant difference was found between the average RBH of the two groups ($P = 0.306$) [Figure 14 and Table 16].

Table 13: Intergroup comparison of stability status between the groups at various time points

Stability	Group-I		Group-II		Unpaired *t*-test	
	Mean	SD	Mean	SD	*t*	*P*
Baseline	63.64	2.57	57.90	3.65	5.92	<0.001
1 month	66.95	2.48	61.95	3.41	5.48	<0.001
3 months	71.14	3.37	65.70	3.13	5.40	<0.001

Table 14: Intergroup comparison of mesial Crestal bone loss between the groups at various time points

Mesial Crestal Bone Loss	Group-I		Group-II		Unpaired *t*-test	
	Mean	SD	Mean	SD	*t*	*P*
1 month	0.00	0.00	0.00	0.00	NA	NA
3 months	0.09	0.20	0.08	0.18	0.27	0.789

No nasal discharge or nasal congestion was found in any group [Table 17].

DISCUSSION

The placement of implants in the posterior edentulous maxilla poses a problem due to poor bone quality and quantity. A study was conducted by Motofumi Sogo *et al*.[2] where he did a cross-sectional study on bone quality and quantity in the posterior edentulous maxilla. Also, there are factors such as the presence of the maxillary sinus and cantilever force over the posterior region which are responsible for early failure of the prosthesis. Hence in the present study, dental implants were placed in the posterior maxilla using osteotomised elevation of the sinus floor without perforating the maxillary sinus lining so that a longer implant could be placed as compared to the available RBH so as to provide bicortical anchorage to the dental implant. Implants that are anchored into the cortical bone provide greater stability and support since the cortical bone is more resistant to resorption. This technique was compared as an alternative technique to the conventional technique of implant placement in posterior edentulous maxillae.

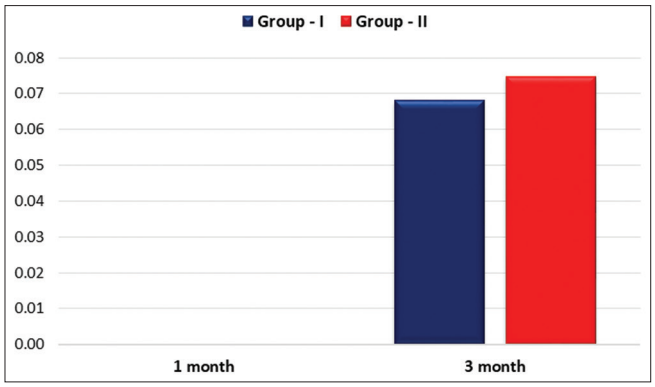

Figure 13: Intergroup comparison of distal crestal bone loss between the groups at various time points

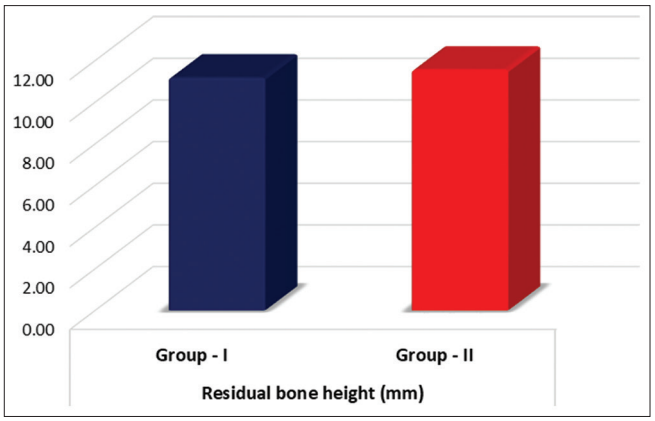

Figure 14: Intergroup comparison of RBH between the groups

Table 15: Intergroup comparison of distal crestal bone loss between the groups at various time points

Distal Crestal Bone Loss	Group-I		Group-II		Unpaired *t*-test	
	Mean	SD	Mean	SD	*t*	*P*
1 month	0.00	0.00	0.00	0.00	NA	NA
3 months	0.07	0.18	0.08	0.18	−0.12	0.903

Table 16: Intergroup comparison of residual bone height (RBH) between the groups

Group	Mean	SD	*t*	*P*
Residual bone height (mm)				
Group-I	11.18	1.097	1.038	0.306
Group-II	11.55	1.202		

Table 17: Intergroup comparison of nasal status between the groups

Nasal Status	Group-I		Group-II	
	No.	%	No.	%
Nasal Discharge	0	0.0%	0	0.0%
Nasal Congestion	0	0.0%	0	0.0%

In the present study mean age group was 39.87 ± 12.94 years in both group-I and group-II for rehabilitation of bilateral posterior edentulous maxillae. There were 9 males and 6 females and the proportion of female and male in the study was 60%:40%.

In this study, the mean implant length was 12.11 mm in group-I as compared to 10.78 mm in group-II, whereas the available mean RBH was 11.18 mm in group-I whereas 11.55 mm in group-II. OSFE without bone grafting material was much more effective than the conventional technique since a longer implant could be placed using this technique while using the same residual bone height. After three months, all implants placed with the OSFE technique showed significant endo-sinus bone formation. The total "bone implant contact area" (BIC) in group-I was significantly higher than in group-II. A similar study was conducted by Nedir *et al*. in 2009,[3] in which he placed 10 mm implants in 17 patients with mean RBH of 5.4 ± 2.3 mm using OSFE technique without bone graft with a mean implant protruding length of 4.9 ± 2.1 mm. At the end of 3 years, he measured a mean endo-sinus bone gain of 3.1 ± 1.5 mm.

This study evaluated and compared post-implant symptoms of pain and swelling between groups I and II, pain status was recorded on first day, first week, fourth week, and twelfth week intervals. In terms of pain and swelling, there was no significant difference between groups I and II. From day 1 to the first week, the pain and swelling significantly decreased, and neither of the patients complained of pain or swelling after 12 weeks in either group. Neither of the patients in either group complained of postoperative nasal discharge, heavy headedness, or nasal congestion. It can be proposed that the OSFE technique can be safely applied in cases with posterior atrophic maxilla with no associated postoperative complications. In our study, the mean ISQ value of implants in group-I at the baseline was 63.64 compared to 57.90 in group-II. At 1 and 3 months follow-up, the mean ISQ value in group-I increased to 66.95 and 71.14, respectively, whereas in group-II it increased to 61.95 at 1 month and 65.70 in 3 months. After comparing both the groups, it was found that the implant stability was significantly higher in group-I as compared to group-II at baseline, first month as well as in the third month of follow-up.

A study by Fawad Javed *et al*. (2013)[4] reported that successful osseointegration leads to good primary stability in implant which favors this study. Raquel Zita Gomes *et al*. (2017)[5] also measured implant stability in the posterior maxilla and concluded that the evaluation of the primary and secondary implant stability may contribute to higher implant survival/success rates in critical areas, such as the posterior maxilla. It could, therefore, be concluded

that after using the OSFE technique for implant placement in the posterior atrophic maxilla, a bicortical anchorage is established for dental implants, which is associated with higher implant stability due to the greater BIC area as compared to the conventional technique. Furthermore, more stability in the bicortically engaged implant is due to the fact that cortical bone is more dense and more resistant to resorption than medullary bone. This study evaluated the peri-implant crestal bone loss in groups I and II. Both groups showed no significant difference in crestal bone loss on the mesial and distal sides. Emre Mumcu *et al*.[6] (2011) examined age, gender, and cantilevers affected bone loss rates.[6] Tadi DP *et al*.[7] (2014) measured average the crestal bone levels around implants in the immediate implant.[7] Massimiliano Negri *et al*.[8] (2014) evaluated bone changes around endosseous implants in a partially edentulous patient.[8] Maiko Suzuki *et al*.[9] (2016) analyzed factors that affect peri-implant bone loss around dental implants. Factors that affected the amount of peri-implant bone resorption were sex, presence or absence of vestibuloplasty, and length of the implant. The amount of bone loss in group-I was similar to that of group-II which suggests that pertaining to peri-implant bone loss, OSFE technique has no significant advantage over the conventional technique, but it could be quoted that as a longer implant can be placed in the OSFE technique the total percentage bone implant contact area (%BIC) is decreased to a lesser extent in OSFE technique as compared to the conventional technique used in the same region. This can be attributed to a lesser chance of a decrease in implant stability and implant failures in the OSFE technique as compared to the conventional technique. Due to the close proximity of the maxillary sinus lining with the bony sinus floor, there are chances of complications that can result after the OSFE technique such as perforation of the maxillary sinus leading to subsequent implant failure. Some cases of oro-antral fistula formation and other complications like nasal bleeding and maxillary sinusitis are also associated with this technique, which is documented in the literature but in this study, no such complications were seen.

This study still requires a larger sample size and longer duration of follow-up for a more valuable long-term outcome and to conclude definite results of using "OSFE technique" in dental implants placed in the posterior atrophic maxilla. Also, this study does not assess the implant stability, crestal bone loss, and implant failure rates after functional loading of the implant. So a longer follow-up is required even after the functional loading of the dental implant.

CONCLUSION

In this study, researchers concluded that the OSFE technique could be used instead of the conventional implant placement technique in posterior maxilla patients with atrophic dentition. When using the OSFE technique, implants are more stable compared to those placed using the conventional technique, which allows only unicortical anchorage. By using blunt-ended, smooth-surfaced implants, complications like perforation of the maxillary sinus lining, postoperative nasal bleeding, and maxillary sinusitis could be avoided. This technique is less invasive and more time efficient than other alternatives for rehabilitation of the posterior maxilla, like direct sinus augmentation, zygomatic and pterygoid implants, so it can be a viable alternative for providing a complete and successful prosthetic rehabilitation to the patient. This study relates the experiences of one hospital with one patient population. An empirical study with a large sample size and longer follow-up will be necessary to answer the scientific question of which technique offers the best results.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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