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Research Article

COMPARISON OF FLAP VERSUS FLAPLESS TECHNIQUE FOR ENDOSSEOUS DENTAL IMPLANT PLACEMENT: A CLINICO-RADIOLOGICAL STUDY

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ABSTRACT

Dental treatment nowadays is not only directed towards enhancing esthetic results but also aims to achieve patient comfort and function with optimum satisfaction. Finer techniques are being developed so as to achieve better results that are less invasive & more conservative in nature. Dental implants have become a routine and effective treatment modality for the replacement of lost teeth. Implant dentistry too, is inclined towards minimal invasive implant technique to yield better esthetics as well as improved results, taking care of patient discomfort. Dental implants are inert, alloplastic materials embedded in the maxilla or mandible for the management of tooth loss and to aid replacement of lost orofacial structures as a result of trauma, neoplasia and congenital defects. The most common type of dental implant is endosseous comprising a discrete, single implant unit (screw- or cylinder-shaped are the most typical forms) placed within a drilled space within dentoalveolar or basal bone.

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INTRODUCTION

Dental Implants generally present with multiple therapeutic possibilities, high predictability of success and are considered to be a reliable approach to replace missing teeth regardless of the disease or injury of the stomatognathic system.¹The implants have become an important therapeutic modality in the last decade, mainly after the works developed by Branemark in 1960s, in which the direct contact between the bone, functional tissues and the biomaterial titanium was termed osseointegration.²In pursuit of perfect esthetics in dental implants and restorations, it is important to create healthy and estheticperi-implant soft tissue.³In various minimal invasive techniques, flapless techniques are gaining popularity over the older conventional technique of full thickness flap elevation techniques.⁴

In the early 1970s, studies demonstrated a correlation between flap elevation and gingival recession, as well as bone resorption around natural teeth. In recent years, number of reports have demonstrated that flapless surgery has numerous advantages over traditional flap surgery, these included reduction of

complication at patient level i.e swelling and pain, reduction of intraoperative bleeding and reduction of surgical time and need for suturing.⁵ Its also included preservation of soft and hard tissue and maintenance of blood supply to cortical plates. The importance of maintaining the buccal plate cannot be overemphasized to avoid any implant dehiscence.⁶ In 1969 Brånemark and others defined the successful, long-term clinical use of dental endosseous implants requires some type of biologic attachment of implants to bone called osseointegration. Many clinicians now consider osseointegration of dental implants to be predictable and highly effective in solving clinical problems associated with missing teeth.⁷

MATERIAL AND METHOD

- The protocol of comparison of flap verses flapless technique for endosseous dental implant placement: a clinico-radiological study was approved by ethical committee of Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow, and written consent was obtained from all patients.

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- The study consisted of placement of 40 dental implants, Patients were randomly divided in to 2 groups:
 1. Group I (Flap Elevation Technique) = 20 implants cases.
 2. Group II (Flapless Technique) = 20 implants cases.

Inclusion criteria were subjects in need of tooth replacement with a dental implant related to maxilla & / or mandible having age between 18 years to 55 years with good periodontal health, total bone width of minimum 5 mm and bone height atleast 10-13 mm. Subjects having history of osteoporosis, uncontrolled diabetes mellitus, parafunctional habits, blood dyscrasias, neuromuscular disorder, radiotherapy in head and neck region, myocardial infarction within 6 months or immunocompromised patients and pregnant females were not included in this study. All the subjects were explained about the study and both verbal and written informed consents were obtained.

After recording the patient's medical and personal history, the complete dental examinations was performed. Initial radiographic assessment was done using intraoral periapical (RVG) radiograph and Digital OPG (orthopantomograph). DentaScan was used to record the height of available bone from the crest of edentulous space to the nearest anatomical landmark (Inferior alveolar nerve / maxillary sinus / pyriform aperture / mental foramen & anterior loop).

The pre- prosthetic assessment was done by fabricating a removal partial denture (RPD) waxup for the evaluation of esthetics, before implant placement. After esthetic evaluation, surgical stent prepared. For each implant, a clinical evaluation was performed preoperatively. It involved measuring the pocket depth, assessing the periodontal index (PDI), and recording the presence of bleeding on probing (BOP). The presence or absence of attached gingiva around the implants was also recorded. Pocket depths were measured using periodontal probes. The mean pocket probing depth for each implant site was obtained from averaging the measurements taken at 5 different sites (Buccal, Lingual, Mesial, Distal & any other site) around the implant.

Surgical steps

Patients were randomly distributed to either of the groups, the procedure was performed following strict asepsis under local anesthesia with 2% lignocaine & 1:80000 adrenaline.

In case of Flap technique a sub crestal incision was given to reflect the mucoperiosteal flap

(Fig-1). Osteotomy was performed in sequential manner to prepare the implant site following the manufactures drilling sequence instructions, the proposed implant was placed in the prepared osteotomy site. During the procedure settings of physiodispensor were standardized at 800-1200 rpm with reduction handpiece at 1:16. Minimum 35-40 N-cm of torque was achieved which ensured the primary stability of the implant. After the placement of implant cover screw was placed & the flap was repositioned and sutured placed with 3-0 nylon sutures. Sutures were removed after 1 week. Any wound dehiscence post operatively was excluded from the study.

In case of flapless technique (Fig-2), osteotomy was initiated by using a pilot drill through surgical template to drill the bone followed by the use of tissue punch guide according to implant size and tissue punch to punch out the soft tissue. Subsequent drilling was done to prepare the site according to the selected implant size.

Impression transfer coping placed for closed tray technique, after selection of appropriate impression tray, it was loaded with rubber base impression material & impression done. After removal of impression tray the impression transfer coping was unscrewed & attached to implant analog & repositioned in the impression and sent for prosthesis fabrication. Appropriate abutment selection was done. All prosthetic crowns were cement retained and placed after "no contact" in lateral excursions & proper intercuspation.

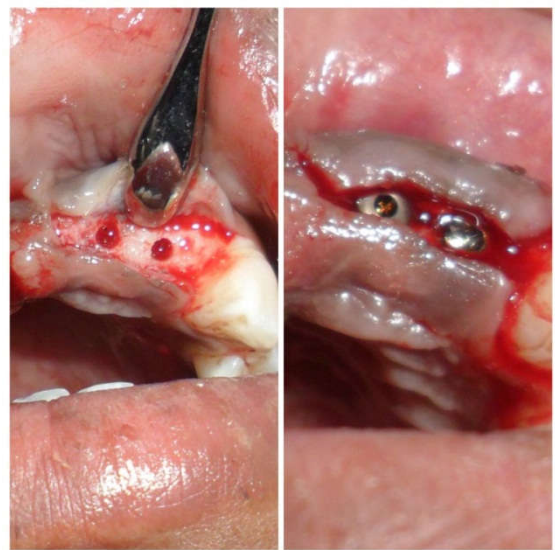


Fig 1 Implant placement with Mucoperiosteal Flap elevation technique



Fig 2 Implant placement with Flapless technique

Radiographic Assessment: To assess postsurgical changes in the crestal bone level, conventional dental radiographs were taken immediately after surgery and 6,9,12 months after implant placement. The images were digitized, and the distance between the fixture shoulder and the apical level of the marginal bone that was in contact with the implant was

measured at *8 magnification using implant height (a known measurement) for calibration. Measurements were made at the mesial and distal aspects of each fixture, and the mean for each case was calculated.

RESULT

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software. The values were represented in Number (%) and Mean±SD. 22 implants were placed in maxilla while 19 implant were placed in mandible, among the groups:

Group I had 9 implants in maxilla and 11 implants in mandible. Group II had 13 implants in maxilla and 7 implants in mandible.

At follow up at 3 months only 1 case reported pain, and this case belonged to Group I. Though complaint of pain was reported in higher proportion of cases of Group I (5.0%) as compared to Group II (0.0%) this difference was not found to be statistically significant. Similar findings were obtained at follow up at 6 and 9 months, only 1 case from Group I complaint of pain. At follow up at 12 months, none of the cases enrolled in the study reported pain. (Tab-1)

Tab 1 Comparison of post-implant placement pain at different follow ups

Post-operative Follow up	Total	Group I (n=20)		Group II (n=20)		Statistical significance	
		No.	%	No.	%	χ ²	'p'
3 months	1	1	5.0	0	0.0	1.026	0.311
6 months	1	1	5.0	0	0.0	1.026	0.311
9 months	1	1	5.0	0	0.0	1.026	0.311
12 months	0	0	0.0	0	0.0	0.000	1.000

Mobility was not observed in any case at any follow up duration.(Tab-2)

Tab-2 Between Group Comparison of post-operative Mobility at different follow ups

Post-operative Follow up	Total	Group I (n=20)		Group II (n=20)		Statistical significance	
		No.	%	No.	%	χ ²	'p'
3 months	0	0	0.0	0	0.0	0.000	1.000
6 months	0	0	0.0	0	0.0	0.000	1.000
9 months	0	0	0.0	0	0.0	0.000	1.000
12 months	0	0	0.0	0	0.0	0.000	1.000

At follow up at 3 months, infection was found in only 1 case, and this case belonged to Group I. Though prevalence of infection was higher in Group I (5.0%) as compared to Group II (0.0%) this difference was not found to be statistically significant. At follow up at 6, 9 and 12 months, infection was found in none of the cases enrolled in the study. (Tab-3)

Tab 3 Comparison of post-operative Infection at different follow ups

Post-operative Follow up	Total	Group I (n=20)		Group II (n=20)		Statistical significance	
		No.	%	No.	%	χ ²	'p'
3 months	1	1	5.0	0	0.0	1.026	0.311
6 months	0	0	0.0	0	0.0	0.000	1.000
9 months	0	0	0.0	0	0.0	0.000	1.000
12 months	0	0	0.0	0	0.0	0.000	1.000

At follow up at 3 months, inflammation was found in only 1 case, and this case belonged to Group I. Though prevalence of

inflammation was higher in Group I (5.0%) as compared to Group II (0.0%) this difference was not found to be statistically significant. At follow up at 6, 9 and 12 months, inflammation was found in none of the cases enrolled in the study. (Tab-4)

Tab 4 Comparison of post-operative Inflammation at different follow ups

Post-operative Follow up	Total	Group I (n=20)		Group II (n=20)		Statistical significance	
		No.	%	No.	%	χ ²	'p'
3 months	1	1	5.0	0	0.0	1.026	0.311
6 months	0	0	0.0	0	0.0	0.000	1.000
9 months	0	0	0.0	0	0.0	0.000	1.000
12 months	0	0	0.0	0	0.0	0.000	1.000

At follow up at 3 months, Healthy interdental papilla (HIDP) was found to be Good in higher proportion of Group II (90.0%) as compared to Group I (20.0%), in rest of the cases HIDP was found to be Fair in both the groups. Difference in HIDP Status of both the groups was found to be statistically significant. Results of HIDP were found to be same at 6 months, 9 months and 12 months. (Tab-5)

Tab-5 Between Group Comparison of post-operative HIDP at different follow ups

Post-operative Follow up	HIDP	Group I (n=20)		Group II (n=20)		Statistical significance	
		No.	%	No.	%	χ ²	'p'
3 months	Fair	16	80.0	2	10.0	19.798	<0.001
	Good	4	20.0	18	90.0		
6 months	Fair	16	80.0	2	10.0	19.798	<0.001
	Good	4	20.0	18	90.0		
9 months	Fair	16	80.0	2	10.0	19.798	<0.001
	Good	4	20.0	18	90.0		
12 months	Fair	16	80.0	2	10.0	19.798	<0.001
	Good	4	20.0	18	90.0		

At all the time intervals, 18 (90%) of Group II had good and 2 (10%) had fair emergence profile whereas in Group I, 16 (80%) had good and 4 (20%) had good emergence profile, thus a statistically significant difference between two groups was observed throughout the study period (p<0.001). (Tab-6)

Tab 6 Comparison of post-operative Emergence Profile at different follow ups

Post-operative Follow up	Profile	Group I (n=20)		Group II (n=20)		Statistical significance	
		No.	%	No.	%	χ ²	'p'
3 months	Fair	16	80.0	2	10.0	19.798	<0.001
	Good	4	20.0	18	90.0		
6 months	Fair	16	80.0	2	10.0	19.798	<0.001
	Good	4	20.0	18	90.0		
9 months	Fair	16	80.0	2	10.0	19.798	<0.001
	Good	4	20.0	18	90.0		
12 months	Fair	16	80.0	2	10.0	19.798	<0.001
	Good	4	20.0	18	90.0		

At follow up at 3 months, change in Gingival height was observed in all the patients of Group I while no change in gingival height was observed in any of the patient of Group II. Difference in change in gingival height in both the groups at 3 months follow up was found to be statistically significant. At follow up at 6 months, 9 months and 12 months no change in gingival height in any of the patient of either groups was observed hence no difference in change in gingival height of both the groups was observed.

At radiographic evaluation the crestal bone loss started at 6 months in group I with no difference in mesial and distal aspect while no radiographic change was observed in Group II. At follow up at 9 month and 12 months radiographic changes was observed in both groups but more in group I. Mean radiographic change at 6 months in Group I (0.07±0.05) was found to be significantly higher than that of Group II (0.00±0.00). At 9 months in Group I (0.13±0.06) radiographic change was significantly higher in Group II (0.05±0.05). At 12 months too, radiographic change in Group I (0.19±0.03) was significantly higher in Group II (0.12±0.04). (Tab-7a,7b)

Table 7(a) Between Group Comparison of Radiographic Chart Mesial aspect of the implant

	Group I (n=20)		Group II (n=20)		Statistical significance	
	Mean	S.D.	Mean	S.D.	't'	'p'
3 month	0.00	0.00	0.00	0.00	-	-
6 month	0.07	0.05	0.00	0.00	6.658	<0.001
9 month	0.13	0.06	0.05	0.05	4.094	<0.001
12 month	0.19	0.03	0.12	0.04	6.102	<0.001

Table 7(b) Between Group Comparison of Radiographic Chart Distal aspect of the implant

	Group I (n=20)		Group II (n=20)		Statistical significance	
	Mean	S.D.	Mean	S.D.	't'	'p'
3 month	0.00	0.00	0.00	0.00	-	-
6 month	0.07	0.05	0.00	0.00	6.658	<0.001
9 month	0.13	0.06	0.05	0.05	4.094	<0.001
12 month	0.19	0.03	0.12	0.04	6.102	<0.001

DISCUSSION

Osseointegration is a predictable, achievable, reproducible phenomenon and has revolutionised the science and art of replacing missing teeth providing excellent function, esthetics and preservation of remaining masticatory apparatus.

Flap elevation technique permits easy access and visibility to the operator of the planned site. It is considered advantageous when esthetics of the soft tissue is critical, since it can be manipulated to a desirable position. However when the implants are placed with flap, there generally is bone resorption due to elevation of periosteum at alveolar crest.

Moreover during osteotomy we felt that the external irrigation system would be lacking in cooling of the osteotomy drill hence frequent removal of drill from the osteotomy was required sometimes tending to change the direction of osteotomy while doing free hand osteotomy. These difficulties in placement were much less in flap elevation technique.

During insertion of implant in the osteotomy site in flapless technique great care has to be taken that no soft tissue element travels with the surface to the depth of osteotomy site also it was slightly difficult to ascertain the correct depth of placement as the surface of bone was not directly visible from the site.

In flap elevation technique the implant was completely submerged after placing cover screw and required a second procedure to attach the gingival former at the completion of osseointegration however a non submerged technique was used in flapless procedure and a gingival former of matching height were directly placed at the time of implant placement.

This we found gained an excellent gingival cuff at the time of placement of abutment and resulting in a very good emergence profile.

Assessment of immediate post operative pain was done to compare post operative healing between both the groups. It is presumed that conventional implant surgery involving flap elevation and reflection of a mucoperiosteal flap is always associated with some post operative discomfort. Inflammatory sign such as pain, swelling and bleeding are normally seen post operatively. The patients in both the group were re-evaluated at 1 month interval and none of the patient in group II flapless technique reported any pain or discomfort while in group I flap elevation technique 1 patient complaint of discomfort though not restricted to the implant site but was along the healing flap margin irrigation and routine analgesics brought relief to this patient. The difference in discomfort in the two group with references to immediate post-operative discomfort was found to be statically insignificant, this finding is in agreement with *Alexander et al (2013)*.⁸

During immediate post operative phase the prevalence of inflammation was higher in Group I as compared to Group II. This difference was not found to be statistically significant. Similar finding have been reported by *Fortin T et al in 2006*⁹ who reported significant reduction in pain & swelling for patients receiving flapless surgery.

At follow up at 3 months, inflammation was found in only 1 case, and this case belonged to Group I, probably since lower incisor tooth traumatized the attached gingiva surrounding the implant. After grinding of incisal edge of lower incisor and proper administration of chlorhexidine mouthwash for 7 days, the inflammation were totally resolved and it was completely absent at 6 months follow up. At follow up at 6, 9 and 12 months, inflammation was found in none of the cases enrolled in the study. The above findings were in association with *Hadi et al (2010), Siddharthnarula et al (2012)*.^{2,10}

Maintaining the interdental papilla following implant placement also has been a challenge for the clinician specially in the esthetic zone(maxillary anteriors). Several techniques to preserve interdental papilla have been advocated. In our study we observed that in Group I, papilla regeneration was completed by the 6th month follow up visit. However in Group II there was no loss of interdental papilla. This corresponds to an 18 month follow up study by *Jemt Tet al 1997*¹¹. The cause for papilla reduction after implant placement would be due to elevation of adjacent papilla during implant surgery as seen in all Group I patients

A clinical study by *Gomez Roman G 2001*¹² showed that the elevation of the adjacent papilla caused more bone loss compare to a technique that does not include the papilla.

*Van der Zee et al 2004*¹³ reported post surgical tissue loss following flap reflection for implant placement implying that flap surgery may negatively influence implant esthetic outcome especially in maxillary anterior region.

Marginal bone around the implant crestal region is usually a significant indicator of implant health. Several studies report yearly radiographic marginal bone loss after the first year of junction in the range of 0 to 0.2 mm. Most common method to

assess the marginal bone loss is with a conventional periapical radiograph. After implant placement if bone loss is observed it can be attributed to one of two reasons. In our study we observed a higher degree of bone loss in Group I at 3,6,12 months follow up interval as compared to Group II. Difference in radiographic findings of both the groups was found to be statistically significant. The above finding seen are in agreement of *Seung-MiJeong et al (2008)¹⁴*. The higher rates of bone loss at with flap sites were related to the fact that whenever a papilla is detached from bone, the interdental bone in proximity to the adjacent tooth is denuded from the periosteum. This can affect the nutrition of the bone and papilla resulting in an individually unpredictable degree of resorption of the interproximal crestal bone. ¹²*Sunitha et al 2008¹⁵* also studied the effect of two different flap designs on crestal bone height and stated that flap elevation leads to increased bone loss during the healing period.

Although the systematic review by *Chrcanovic et al⁶* and the study conducted by *Lindebom & Van Wijk¹⁷*. Attributed greater failure of implants placed with flapless surgery, it is a controversial issue for other authors ^{18,19} who relate these failure to incorrect selection of patients.

CONCLUSION

Within the limitation of this study it can be concluded that none of the patient complaint of swelling in any of the groups, post operative pain was unrelated to the implant procedure and was result of either traumatic occlusion or faulty prosthesis. Healthy interdental papilla was found to earlier in group II, thus demonstrating better tissue adaptation with flapless implantation in present study. Both the techniques lead to crestal bone loss but flapless (Group II) procedure results in a lesser bone loss as compare to Flap technique (Group I). Therefore, the flapless technique can be considered as a better treatment approach for placement of implants, especially where adequate width and height of bone with ideal contours is available.

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