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ORIGINAL ARTICLE

IMMEDIATE PLACEMENT OF WIDE BODY IMPLANTS IN EXTRACTION SOCKETS OF MANDIBULAR FIRST MOLARS: ASSESSMENT OF CRESTAL BONE LEVEL – A PROSPECTIVE COHORT STUDY IN INDIAN POPULATION

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ABSTRACT

Dental implants have become the mainstay in the management of edentulous spaces. Crestal bone loss following extractions can compromise implant placement and numerous techniques have been suggested to prevent this bone loss. One such technique is the placement of dental implants immediately post extraction. The effect of implants in preserving the crestal bone in single rooted extraction sockets has been well documented. However, the effect of wide implants in preserving the crestal bone levels in multi rooted tooth needs to be assessed further. The aim of this study was to evaluate the amount of crestal bone loss following immediate implant placement using wide implants. Mean bone loss at the end of 12th month in relation to the mesial and distal aspect were 0.25 mm and 0.207 mm respectively.

KEYWORDS: Oral Disease, Nutrition, Malnutrition, Digestion, Oral Health, Early Childhood Caries.

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INTRODUCTION

Dental implants have created a revolution in dental care for patients with missing one or more teeth with osseointegration being the foundation for implant sciences[1]. Alveolar ridge resorption after tooth extraction can considerably reduce the residual bone volume and compromise the favourable positioning of the implants required for optimal restoration[2].

The alveolar bone undergoes dimensional changes after tooth extraction, as evidenced in clinical and experimental studies[3]. The vertical resorption 6 months post extraction was 11% to 22% and horizontal resorption ranged from 29% to 63%[1].

Studies have shown the use of 3.75mm to 5mm implant placement in preserving immediate extraction sockets for maxilla as well as mandible, but no study has been done with wide diameter implant in Indian population.

Hence, the aim of the present study was to evaluate the efficacy of wide body implants in preserving crestal bone following immediate placement in extraction sites of mandibular first molars in Indian population.

MATERIAL AND METHODS

This prospective cohort study was conducted in the outpatient department of Oral and Maxillofacial surgery, Sri Ramachandra Institute of Higher Education and Research. The duration of the study including the follow up was from May 2012 to August 2013. The study protocol was reviewed and approved by the Institutional ethics committee of Sri Ramachandra Institute of Higher Education and Research, Chennai with reference number CSP/13/JAN/26/25. Written informed consent was obtained from every patient.

Patient and data collection

Patients willing for mandibular first molar extraction and immediate wide body implant placement were included. Intraoral periapical radiographs (IOPAR) using paralleling technique were obtained at regular intervals, to assess bone level changes after implant placement.

Inclusion criteria

1. Age 18 to 35 years
2. Mandibular first molars with root fracture, endodontic failure or unrestorable caries
3. Adequate amount of bone height (≥7mm) and bone width (≥9mm) = after extraction.

Exclusion criteria

1. Medically compromised patients
2. Pregnant or lactating females
3. Smoking and drug abuse
4. Untreated periodontitis
5. Local conditions that included gingivitis and abscess
6. Post radiation therapy
7. Bone and soft tissue pathologies

Surgical procedure

All procedures were done under local anaesthesia (2% lignocaine with adrenaline 1:200,000, 3 ml). The width of the alveolar bone at the crestal level was measured using a ridge measuring calliper prior to extraction of the teeth. Atraumatic extraction of mandibular molar was done. The length of the extracted tooth from the cementoenamel junction to the root apex was measured. The width of the alveolar crestal bone measured before extraction and the length of the extracted tooth, gave the approximate diameter and length of the implant to be used. The implant was placed in the socket following manufacturer's protocol, with an insertion torque of ≥ 40 Ncm. The depth of the preparation was 2mm more than the length of the extracted tooth. The cover screw was placed, and the flap was advanced and sutured using non-resorbable 3-0 silk suture.

Follow up

Patients were reviewed on the 7th day for suture removal and to check for wound dehiscence. Evaluation of bone loss was done in 3rd, 6th and 12th month. Prosthetic rehabilitation was done after the 12th month.

Method of crestal bone level evaluation

Step 1: Standardized RVG images were obtained using paralleling device.

Step 2: The obtained images were then transferred to IC measure software (Fig 1).

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Fig 1: Clinical image of a wide body implant at the extraction site.

Step 3: First, a parallel line (A) to the crestal bone was drawn through cusp tips of the teeth present (Fig 2).

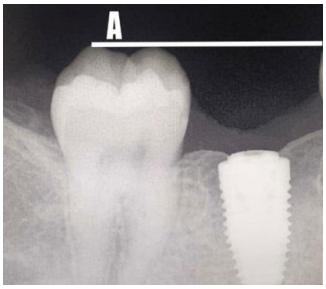

Fig 2: Line A along the cusps of second premolar and second molar

Step 4: A perpendicular line, AI was dropped from line A to the midpoint of the implant platform (Fig 3). AI was used as a stable baseline for measurement, as AI does not change over time

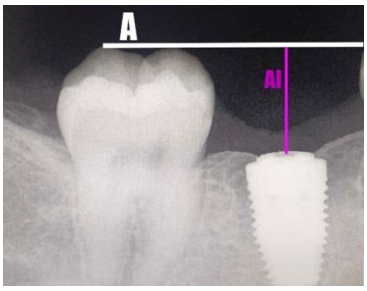

Fig 3: Perpendicular line from A to implant – AI

Step 5: A perpendicular line, AD was dropped from line A to the distal crestal bone of the implant (Fig 4).

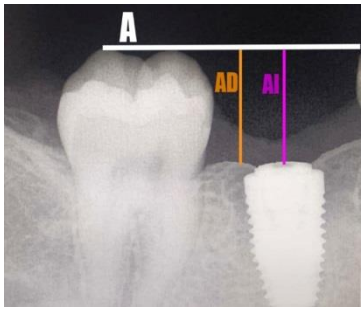

Fig 4: Perpendicular line from from A to distal crest – AD

Step 6: . A perpendicular line, AM was dropped from line A to the mesial crestal bone of the implant (Fig 5).

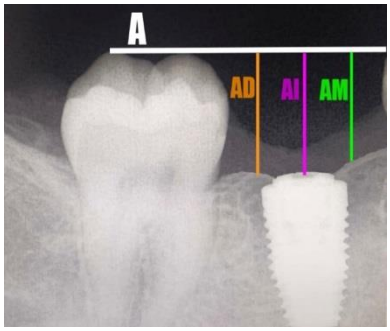

Fig 5: Perpendicular line from A to mesial crest – AM

The value of AM and AD for each review were represented as AM1, AM2, AM3 and AD1, AD2, AD3 respectively. These values provide the amount of crestal bone present around an implant. The difference between AM1 and AM0 was represented as M1, AD1 and AD0 as D1. Depending on the difference according to each month, the values are represented as M1, M2, M3, D1, D2 and D3 respectively. These values gave the amount of crestal bone loss around the implant.

RESULTS

13 patients were included in this study and a total of 15 wide body implants were placed in immediate extraction sockets of mandibular first molars. In 11 patients one implant each was placed, whereas in the remaining two patients one implant was placed on either side. Out of the 15 implants placed, one was lost to follow up, hence, it was excluded from the final statistical analysis. The mean age of the patients was 25.07 years with a range of 19 to 31 years. 8 female and 5 male participants were included in this study and 1 female patient was lost to follow up.

Table 1 lists the patient demographics, crestal bone width and details of the implants placed.

Table 2 lists the height from the reference line A to the mesial (AM) and distal (AD) crestal bone level of the implant and also the height till the implant platform (AI). It was recorded for a follow up of twelve months.

Table 3, gives the mesial and distal crestal bone loss around the implant every month

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TABLE 1: Patient Details

S. No.	Age/ Sex	Width of the alveolar crest	Tooth extracted	Implant placed Diameter xLmm	Representation
1	19/M	10mm	36	7x8.5mm	Case 1
2	26/F	11mm	46	7x10mm	Case 2
3	29/F	10mm	36	7x10mm	Case 3
4	28/F	11mm	46	7x8.5mm	Case 4
5	23/M	11mm	36	7x11mm	Case 5
6	23/M	10mm	46	7x11.5mm	Case 6
7	20/F	9mm	36	7x11.5mm	Case 7
8	20/F	10mm	46	7x11.5mm	Case 8
9	22/M	11mm	46	7x11mm	Case 9
10	28/M	10mm	36	7x8.5mm	Case 10
11	31/F	9mm	46	7x11.5mm	Case 11
12	26/F	11mm	36	7x8.5mm	Case 12
13	30/M	11mm	46	7x11.5mm	Case 13
14	23/F	11mm	36	7x11.5mm	Case 14
15	21/F	10mm	36	7x8.5mm	Case 15

TABLE 2

Cases				**Third month**			**Sixth month**			**Twelfth month**		
	AM0	AI0	AD0	AM1	AI1	AD1	AM2	AI2	AD2	AM3	AI3	AD3
Case 1	9.7	11.5	9.8	9.8	11.5	9.9	9.8	11.5	10	10	11.5	10
Case 2	10.4	12.3	9.9	10.5	12.3	10	10.6	12.3	10	10.6	12.3	10
Case 3	9.4	11.5	9.6	9.5	11.5	9.6	9.6	11.5	9.7	9.7	11.5	9.8
Case 4	8.8	10.6	9.1	8.8	10.6	9.1	-	-	-	-	-	-
Case 5	9.7	11.2	9.5	9.9	11.2	9.6	10	11.2	9.6	10	11.2	9.7
Case 6	10.1	11.4	9.9	10.2	11.4	10	10.2	11.4	10	10.4	11.4	10.1
Case 7	9.1	10.4	8.8	9.2	10.4	8.9	9.3	10.4	9	9.3	10.4	9
Case 8	10.8	11	10.5	10.9	11	10.6	11	11	10.7	11	11	10.8
Case 9	10.9	12.1	11.2	11	12.1	11.3	11.1	12.1	11.4	11.1	12.1	11.4
Case 10	10.2	10.8	9.7	10.3	10.8	9.7	10.4	10.8	9.8	10.5	10.8	9.9
Case 11	10.6	11.3	10.4	10.6	11.3	10.5	10.8	11.3	10.5	10.8	11.3	10.6
Case 12	9.1	10.3	9.3	9.2	10.3	9.5	9.3	10.3	9.6	9.4	10.3	9.7
Case 13	10.5	11.6	10.7	10.5	11.6	10.8	10.6	11.6	10.9	10.7	11.6	10.9
Case 14	11.2	12.4	11.4	11.3	12.4	11.5	11.4	12.4	11.5	11.5	12.4	11.5
Case 15	11.1	11.9	10.8	11.1	11.9	10.9	11.2	11.9	10.9	11.3	11.9	11

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TABLE 3

Cases	Third month crestal bone loss (mm) (AM1-AM0 & AD1-AD0)		Sixth month crestal bone loss (mm) (AM2-AM0 & AD2-AD0)		Twelfth month crestal bone loss (mm) (AM3-AM0 & AD3-AD0)	
	M1	D1	M2	D2	M3	D3
Case 1	0.1	0.1	0.1	0.2	0.3	0.2
Case 2	0.1	0.1	0.2	0.1	0.2	0.1
Case 3	0.1	0	0.2	0.1	0.3	0.2
Case 4	0	0	-	-	-	-
Case 5	0.2	0.1	0.3	0.1	0.3	0.2
Case 6	0.1	0.1	0.1	0.1	0.3	0.2
Case 7	0.1	0.1	0.2	0.2	0.2	0.2
Case 8	0.1	0.1	0.2	0.2	0.2	0.3
Case 9	0.1	0.1	0.2	0.2	0.2	0.2
Case 10	0.1	0	0.2	0.1	0.3	0.2
Case 11	0	0.1	0.2	0.1	0.2	0.2
Case 12	0.1	0.2	0.2	0.3	0.3	0.4
Case 13	0	0.1	0.1	0.2	0.2	0.2
Case 14	0.1	0.1	0.2	0.1	0.3	0.1
Case 15	0	0.1	0.1	0.1	0.2	0.2

TABLE 4A: COMPARISON OF BONE LOSS ON MESIAL ASPECT WITH TIME INTERVALS

	N	Mean	Std. Deviation	Chi square value	p value of Friedman Test
M1	14	.086	.0535	24.5	0.0005
M2	14	.179	.0579		
M3	14	.250	.0519		

TABLE 4B: COMPARISON OF BONE LOSS ON DISTAL ASPECT WITH TIME INTERVALS

	N	Mean	Std. Deviation	Chi square value	p value of Friedman Test
D1	14	.093	.0475	20	0.0005
D2	14	.150	.0650		
D3	14	.207	.0730		

Time intervals	Z value	P value of WSR
M2 - M1	-3.357	.001
M3 - M1	-3.416	.001
M3 - M2	-2.640	.008
D2 - D1	-2.828	.005
D3 - D1	-3.176	.001
D3 - D2	-2.828	.005

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The collected data were analysed with IBM.SPSS statistics software 23.0 Version. To describe about the data descriptive statistics, mean & S.D were used. To find the significant difference in the multivariate analysis for repeated measures the Friedman test followed by the Wilcoxon Signed rank (WSR) test was used. In both the above statistical tools the probability value less than .05 (p value <0.05) is considered as significant level.

Table 4a & 4b compares the mesial and distal mean values between each month.

There was a statistically significant difference seen for the values between the time intervals ($p<0.01$) with higher values at M3 and least at M1.

There was a statistically significant difference seen for the values between the time intervals ($p<0.01$) with higher values at D3 and least at D1.

Table 5, compares the difference in values between the time intervals

There was a statistically highly significant difference seen for the values between the time intervals

DISCUSSION

Re-establishment of the natural dimensions of the alveolar process is essential for both functional rehabilitation and aesthetic restoration, if missing teeth are to be restored with implant supported prostheses, restoring these dimensions is of crucial importance. It is agreed that endosseous implants should be completely embedded in bone and preferably surrounded by not less than 2 mm of bone in all aspects. In view of the changes in bone dimensions after tooth extraction, the issue relating to the "optimal" timing of implant placement has received much attention[4].

Understanding the changes occurring to the alveolar process after extraction is of utmost importance when planning the rehabilitation of the edentulous jaw. It not only results in loss of hard tissue, but also results in changes of the overlying soft tissue[5]. A recent systematic review assessed dimensional changes for both hard and soft tissue for 12 months following tooth extraction in humans. The authors observed greater magnitude of horizontal reduction (3.79mm) than vertical reduction (1.24mm) on the buccal aspect. The changes on the mesial and on the distal were 0.84mm and 0.80mm, respectively. Gain of soft tissue thickness (0.4-0.5mm) have been found at 6 months. At 12 months, the horizontal reduction of soft and hard tissue was between 0.1-6.1mm, whereas the vertical changes were loss of 0.9mm to gain of 0.4mm[6]. Hammerle et al, concluded that the mean horizontal bone loss in ridge width is 3.8mm, and the mean vertical bone loss in ridge height is 1.24mm[7].

Osseointegration was defined by Branemark as the direct connection of living bone with the surface of an implant subjected to a functional load. Among the important requirements for osseointegration are the existence of a biocompatible surface, the presence of alveolar bone in the potential recipient sites and no traumatic surgery. To achieve this end, protocols were developed, since several parameters have to be defined, from the choice of the metal to the placement and preservation of the prosthesis.

The conventional clinical protocol proposed by Branemark for placement of dental implants involves two phases8. The first is the placement of the implant in a surgical cavity prepared in the bone followed by sufficient healing period for tissue reorganization which was estimated by Branemark to be between 3 and 6 months. The second phase of treatment is the prosthesis placement. With this technique, all natural teeth can be replaced, restoring function and aesthetics to the patient.

The conventional protocol can be changed so that insertion of the implant can be done immediately after extraction. In this case, the protocol is called immediate implant placement. To attain this, one must consider that the body has a minimum time to perform the reactions that leads to osseointegration. To shorten the healing time, the strategy is to alter the biocompatibility of titanium implant surfaces, modifying the surgical technique and changing the implant design[9].

According to Carl E. Misch, mandibular molar site has D2 or D3 type of bone. The maximum diameter of immediate implant placed at this site was about 5.5 mm. Therefore, we attempted to study the efficacy of immediate placement of 7mm implant in fresh extraction sockets and its

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role in reducing the alveolar bone loss which in turn will improve the aesthetic outcome of the prosthesis.

The 14 implants were reviewed after 3, 6 and 12 months. The bone loss at the mesial aspect of the implant showed a mean bone loss of 0.086, 0.179 and 0.25 mm at the end of 3, 6 and 12th month respectively. The bone loss at the distal aspect of the implant showed a mean bone loss of 0.093, 0.150 and 0.207 mm at the end of 3, 6 and 12th month respectively.

The mean values of each month for the mesial aspect and distal aspect showed a progressive decrease. Since there was no significance between the first and second month. We confirm that there is no crestal bone level change. The mean value of mesial crestal bone level between the first and the third month gives a significant value. Hence, the crestal bone level changes begin by the third month.

Gain Pietro Schincaglia et al, assessed radiographic crestal bone level changes using image analysis software9. Cafeiro et al and Luca Cordaro et al assessed crestal bone level changes with the use of IOPAR taken by paralleling technique and measured the IOPAR using a millimeter ruler[10, 11]. Similarly, in our study the assessment was done by paralleling technique and measurements were done using a computer software.

Luca Cordaro et al, in his study assessed crestal bone levels, mesially and distally for immediately placed implants through radiographs[10]. But no statistical significance between both the values was seen, with a follow up of one year. In our study, the value of mesial crestal bone level from the implant platform ranged from 0-0.3mm and for the distal, it was between 0-0.4 mm. There were no signs of mobility of the implant until the follow up period of our study.

CONCLUSION

With limits to the present trial, immediate placement of a single wide body implant, instead of two tapered implants in the fresh extraction socket of mandibular molar was found to be a suitable alternative treatment option.

A reduced radiographic bone level changes was observed in the mesial aspect of the immediate implant placement, when followed up for three months. Whereas the distal aspect of the implant did not show any significant change. Having a reduced radiographic bone level did not cause any mobility of the implant. We also conclude that, the required insertion torque for a wide body implant would be ≥ 40 Ncm as the study results reveals. As the duration of our study was limited, therefore, further follow up would be required for confirming the amount of crestal bone level changes for a wide body implant.

ETHICAL APPROVAL:

The research protocol was approved by the Human Research Ethics Committee

FUNDING:

No funding

DISCLOSURE OF INTEREST:

The authors declare that they have no competing interests.

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