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Clinico-radiological assessment of alveolar socket preservation using autogenous and alloplastic bone graft

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ABSTRACT:

The aim of the study is to compare the efficacy of autogenous and alloplastic bone graft in preserving alveolar socket at future implant site and to compare their comparative effects of in terms of Healing time and formed bony Architecture.Twenty patients were randomized into two groups.8 females and 12 males were included in the study. Autogenous bone graft from mandibular symphysis in group 1and Alloplastic graft nova bone putty in group 2 was used for the patients included in the study.Soft tissue healing evaluation was done as per criteria given by Landry et al. Hard tissue evaluation was done according to Kelly et al. Clinical & Mean Radiographic Score for Assessment of Bone Healing was done at baseline,1st,3rd and 6th month for both the groups. Analysis was done using software SPSS 22.0 (IBM, Chicago, USA). Chi square test, Paired t test, Independent t test and Wilcoxontest was applied for both the intergroup and intergroup comparisons. Intergroup comparison was calculated at baseline 1,3 and 6 month. It reveals that both autogenous and alloplastic bone grafts significantly result in effective healing over a period of 6 months where asautogenous bone graft proved to be significantly better than alloplast. This study reveals that both autogenous and alloplastic bone grafts significantly increase the bone density over a period of 6 months, howeverautogenous bone graft is better in increasing bone density when compared to alloplastic bone graft. Autogenous bone graft has shown to effectively increase the trabeculations in alveolar bone as compared to alloplastic bone graft.

KEYWORDS- Alloplastic, Autogenous, Socket Preservation.
Authors declare No conflict of Interest.

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INTRODUCTION

Alveolar bone loss is an inevitable consequence that occurs after tooth extraction. Transformation and resorption of the alveolar crest can create deformity.[1] Narrowing of the alveolar ridge can cause many problems in terms of cosmetic, functionality and dental implantation[2] As the controlled clinical studies have reported, the average horizontal alveolar bone loss during the first year after atraumatic tooth extraction is 5 to 7 mm[3,4]. The bone loss after tooth extraction will occur rapidly in the first 6 months in which up to 40% of the height and 60% of the width of the alveolar bone can be lost during this time.[5]These problems can be minimized following procedures of socket preservation of the extracted tooth. The best time to preserve the alveolar ridge is at the time of extraction[6]. The existing methods of ridge preservation include the use of autogenous, allogenic, xenogenous grafts and alloplasts with or without placement of absorbable and non –absorbable membranes.[7,8]

The principles behind implant site development, including ridge preservation and guided bone regeneration, originated from the principles of guided tissue regeneration. The concept of selective cell repopulation has been useful in theorizing about enhancing site development for implant placement. Bone can be regenerated by using a barrier membrane at an extraction site or deficient alveolar ridge. At the time of tooth extraction, the socket can be augmented with a graft material and sealed with a barrier membrane or a membrane may be used without graft material in the socket. The membranes can non-resorbable or resorbable membranes.[7,8]

Autogenous bone graft is obtained from same individual on whom the bone grafting has to perform. However, they are now less popular because of the necessity of harvesting from a secondary surgical site and the possible morbidity associated with the procedures.[8]

Alloplasts are a synthetic graft material which is inert and implanted into tissue. Hydroxyapatite, tricalcium phosphate, calcium sulfate and bioactive glass polymers are common examples of synthetic bone graft materials. This graft material is inert, osteoconductive filler material, which serves as a nidus or scaffold for new bone formation. Alloplasts have been shown to result in defect fill, stabilization of the remaining osseous structure, clinical attachment gain, and decreased probing depths. Allografts used by dental surgeons include: DFDBA, (decalcified freeze – dried bone) FDBA (mineralized freeze-dried bone – allogenic graft)[9.10] **(Figure 1)**

- No refrigeration required
- Great adaptability
- Does not set like a cement
- Osteoconductive
- Osteopromotive

Figure 1: ALLOPLAST

Since there are few studies of quantitative and qualitative methods to investigate the effect of socket preservation techniques after tooth extraction for dental implant treatment, this scientific and cost-effective study with the purpose of comparing the effect of Nova boneputty and autogenous graft from chin was undertaken for the patients who were referred for implant surgery in our department

MATERIALS AND METHODS:

The present study was done with Patients reporting to the Department of oral and maxillofacial surgery, I.T.S Dental College, Hospital and Research Centre, Greater Noida for 6 months' time duration.

This study was approved by the Ethics Committee of I.T.S Dental College, Hospital and Research Centre **(Ref nos. ITS/OS//1762:2017)** and is in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

- Sample size- 20 patients (10 in each group).
- Age group-18 to 40years.
- Period of Study-6 months
- Autogenous bone graft will be harvested from : Mandibular symphysis region
- Alloplastic graft: Calcium Silocophosphate (Novabone)

It is a randomized split mouth study where 2 test sites were taken for comparative analysis.20 patients with age group-18 to 55 years were selected. This study was undertaken as a pilot study to initially compare the bone graft procurement technique from chin with alloplastic bone graft so that further elaborate research could be planned. Inclusion Criteria were mandibular and maxillary teeth that are indicated for extraction because of presence of periapical and periodontal pathology. Written informed consents were taken after explanation of purpose of study. Exclusion criteria were patient with uncontrolled known systemic disease, patients with deleterious habits like alcohol consumption,

tobacco and betel nut chewing, smoking, and patient with hypersensitivity to implant material, patients who are undergoing current radiotherapy or chemotherapy.

Autogenous bone graft from mandibular symphysis was procured using a standard extraction procedure by doing ostectomy using trephinebur. Socket preservation was done at the future implant site by loading it with procured graft and secured by screws and a GTR membrane.

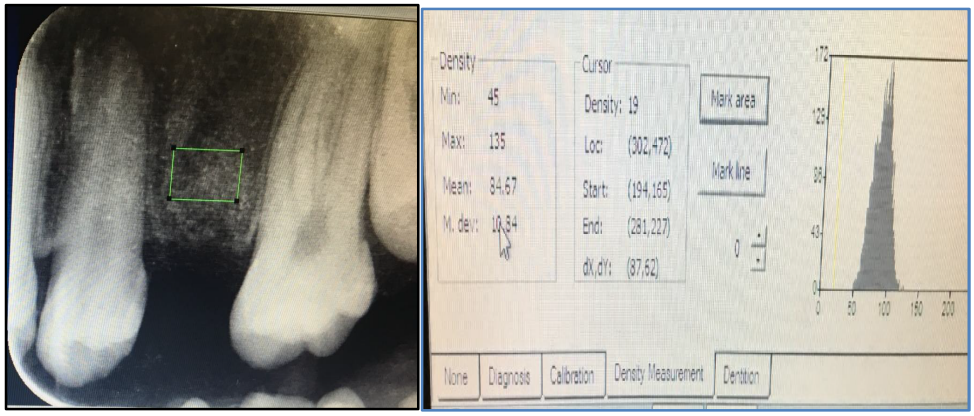
Alloplastic graft-ANova bone putty was used in study.

Soft tissue healing evaluation was done as per criteria given by Landry et al. at 1st,3rd and 6th month.[11,.12]

Hard tissue evaluation was also made by criteria given by Kellyet al[13]

Mean Radiographic Score for Assessment of Bone Healing at Different Time Points (baseline,1st,3rd and 6th month) was done between Groups**(Figure 2)**

Figure 2: RADIOGRAPHIC EVALUATION



STATISTICAL ANALYSIS:

Analysis was done using Wilcoxon test by using software SPSS 22.0 (IBM, Chicago, USA) for both the intergroup and intragroup comparisons. Chi square test, Paired t test, Independent t test and Wilcoxon test was applied for both the intergroup and intragroup comparisons. Intergroup comparison was calculated at baseline 1, 3 and 6 month.

RESULTS:

Table 1 and Graph 1- Reveals that both autogenous and alloplastic bone grafts significantly increases the bone density over a period of 6 months. It further shows that autogenous bone graft is better in increasing bone density when compared to alloplastic bone grafts which is also statistically significant (P<0.05).

Table 1: Mean values of density of autogenous and alloplastic bone grafts

DENSITY	GROUPS	MEAN	SD	P<0.05	INTERPRETATION
At 0 day	Autogenous Group	72.9	0.468	0.000	Difference significant
	Alloplastic Group	71.5	0.408		
At 1 month	Autogenous Group	77.3	0.198	0.000	Difference significant
	Alloplastic Group	73.7	0.211		
At 3 month	Autogenous Group	80.6	0.177	0.000	Difference significant
	Alloplastic Group	74.3	0.18		
At 6 month	Autogenous Group	84.7	0.277	0.000	Difference significant
	Alloplastic Group	76.9	0.212		

*Wilcoxon Test (p<0.05 significant)

Graph 1: Mean values of density of autogenous and alloplastic bone grafts

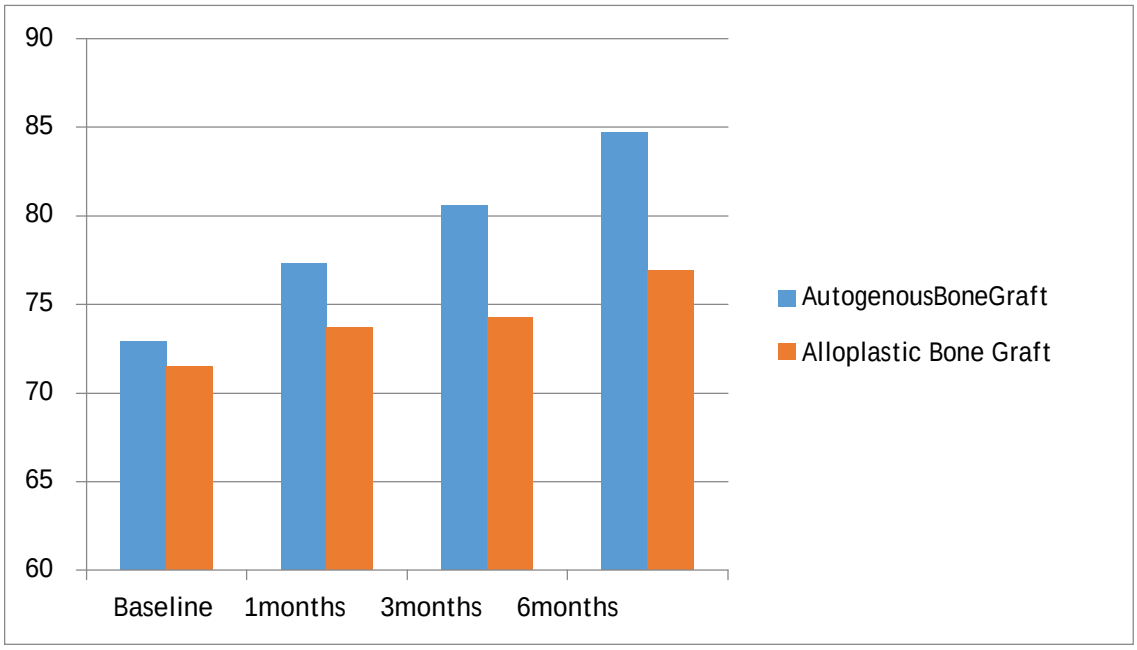


Table 2 and Graph 2 - Reveals that both autogenous and alloplastic bone grafts significantly decreases the value of healing index over a period of 6 months. It further shows that autogenous bone graft is better in decreasing the value of healing index when compared to alloplastic bone grafts which is also statistically significant (P<0.05).

Table 2: Mean values of healing index of autogenous and alloplastic bone grafts

HEALING INDEX	GROUPS	MEAN	SD	P<0.05	INTERPRETATION
At 0 day	Autogenous Group	2.51	0.121	0.000	Difference significant
	Alloplastic Group	1.86	0.109		
At 1 month	Autogenous Group	3.53	0.233	0.000	Difference significant
	Alloplastic Group	2.87	0.219		
At 3 month	Autogenous Group	4.53	0.157	0.000	Difference significant
	Alloplastic Group	3.9	0.118		
At 6 month	Autogenous Group	5.2	0.214	0.000	Difference significant
	Alloplastic Group	4.1	0.192		

*Wilcoxon Test (p<0.05 significant)

Graph 2: Mean values of healing index of autogenous and alloplastic bone grafts

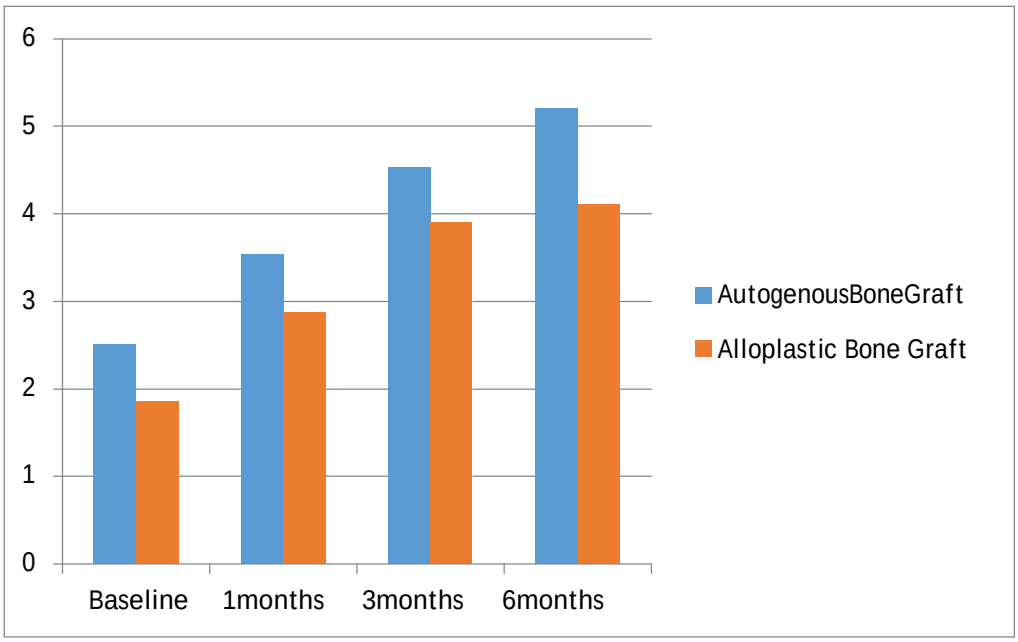


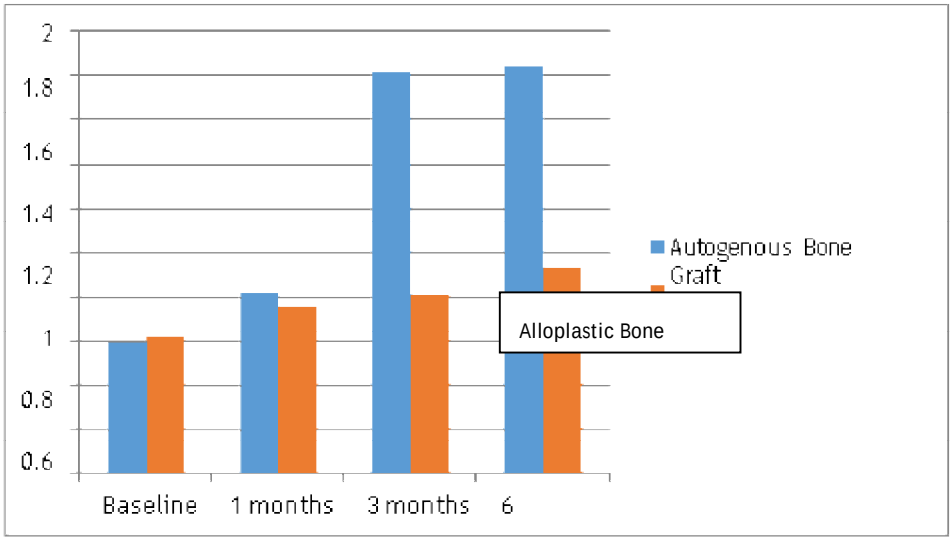
Table 3 & Graph 3- Reveals that both autogenous and alloplastic bone grafts significantly increases the alveolar bone trabeculation over a period of 6 months. It further shows that autogenous bone graft is better in increasing the alveolar bone trabeculation when compared to alloplastic bone grafts which is also statistically significant (P<0.05)

Table 3: Mean values of trabeculation of autogenous and alloplastic bone grafts

TRABECULAR PATTERN		MEAN	SD	P<0.05	INTERPRETATION
At 0 day	Autogenous Group	0.6	0.378	0.000	Difference significant
	Alloplastic Group	0.62	0.808		
At 1 month	Autogenous Group	0.82	0.378	0.000	Difference significant
	Alloplastic Group	0.76	0.431		
At 3 month	Autogenous Group	1.82	0.377	0.000	Difference significant
	Alloplastic Group	0.81	0.48		
At 6 month	Autogenous Group	1.84	0.377	0.000	Difference significant
	Alloplastic Group	0.93	0.482		

*Wilcoxon Test (p<0.05 significant

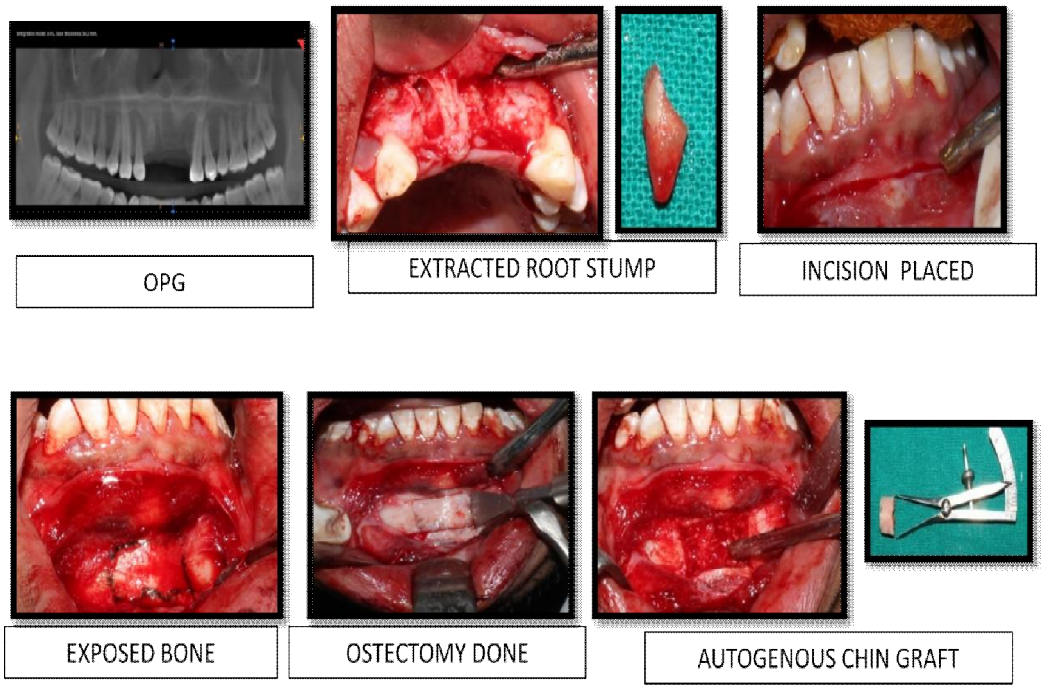
Graph 3: Mean values of trabeculation of autogenous and alloplastic bone grafts

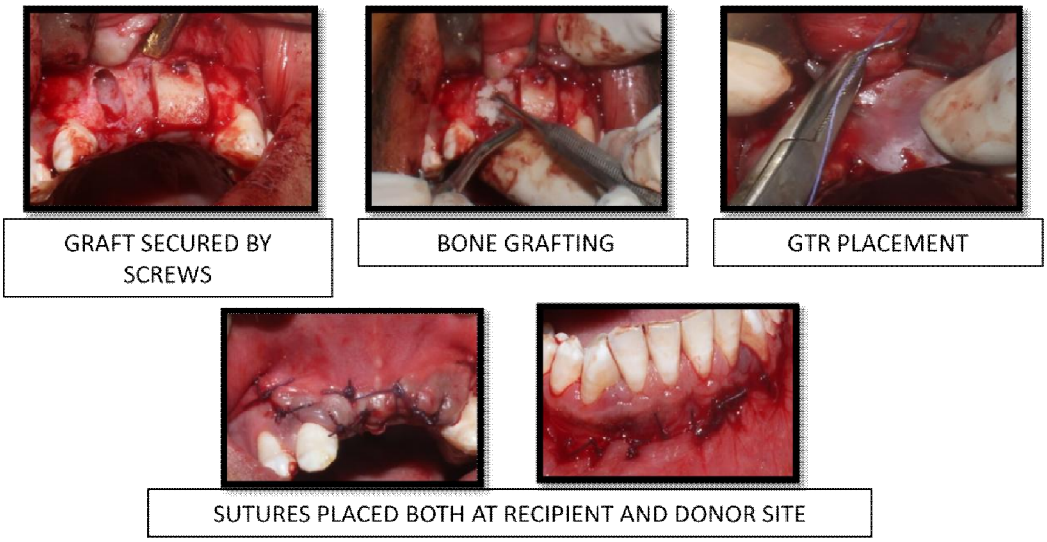


DISCUSSION

This study was conducted in the Department of oral and maxillofacial surgery at I.T.S Dental College, Hospital and Research Centre, Greater Noida for a comparative evaluation of autogenous and alloplastic bone graft in socket preservation after extraction at future implant sites. This is a randomized, controlled, clinical pilot study comparing ridge preservation with conventional Calcium-Phosphosilicate (Novabone) alloplast and ATG from symphysisregion. It is a prospective study having 4 months follow-upperiod. Intraoperative procedure was mentioned. **(Figure 3)**

Figure 3: INTRAOPERATIVE





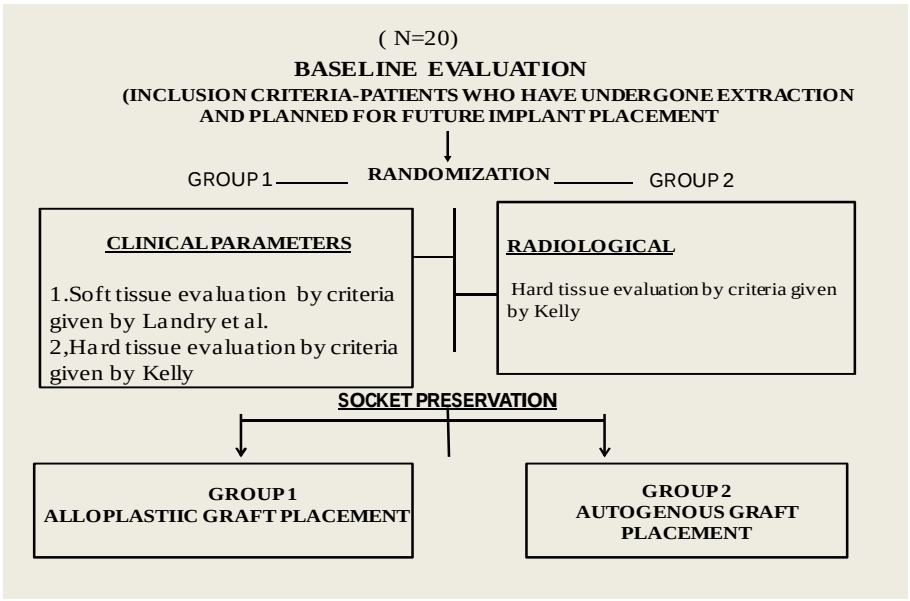
Postoperative

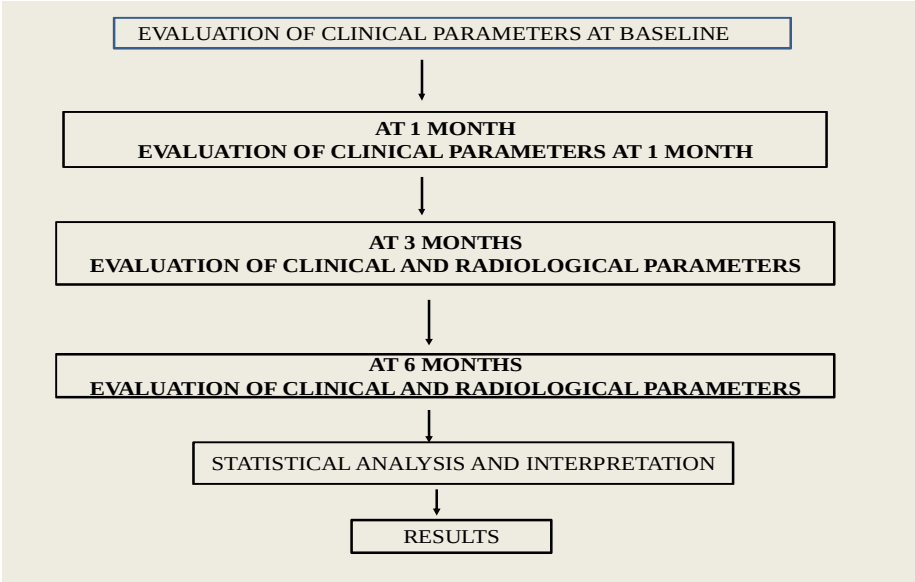
Radiographically and statistically significant differences were found in both the experimental groups. This was assessed based on the primary outcome variables of hard tissue such as a change in density, bone trabaculae pattern and soft tissue healing outcome variables like response to probing, suppuration present and epithelisation.(Table &Graph 1,2,3 respectively) Significant resorption and healing of calcium silicophosphate particles are expected in 3–6 months after its placement[14].Most of the calciumphosphosilicate gets biodegraded by both osteoclastic activities subsequent to the particle disaggregation and/or chemical dissolution of the molecule in the calcium and phosphate components followed by replacement with healthy bone.[15] ATG resorbs within 4–6 months after grafting. The remodeling process with new bone formation continues up to 1–2 years.[16,17] Based on these references, follow‑up period of 0 day, 1month, 3 month and 6 month was selected for the current study. (Figure 2)

CBCT scans were taken on the day before extraction after 6 month post treatment. Radiographic density was measured with the help of RVG done at 0 day,1month, 3 month, 6 month post operatively with the help of Soredex Digora software CBCT scan being threedimensionalinnaturehashelpedustoevaluatechangesinalveolarboneinallpossible dimensions and measure them precisely.(Figure 2) After 6 months post treatment, the mean bone loss was more for alloplastic sites followed by ATG sites.

The change in mean width was statistically significant when ATG-grafted sites were compared with other grafted sites ($P < 0.05$). When vertical bone resorption was compared, at ATG sites mean height showed consistently least reduction with respect to calciumsilicophosphate.Thischangeinalveolarheightwasstatisticallysignificantfor ATG sites ($P < 0.05$).Literature has provided evidence in support to the fact that ridge preservation procedures reduce the bone dimensional changes compared with extraction without ridge preservation procedures.[18,19] However, systematic review demonstrates, in spite of employing evidence-based ridge preservation techniques, a complete prevention of vertical and horizontal bone resorption is an unpredictableevent.[17]

Figure 4: Study flow chart





The results of this study are in accordance with these findings as there was some loss of ridge width and height in both the experimental groups despite performing ridge preservation technique.

Thus, ridge preservation procedures do not result in complete dimensional stability but are designed to reduce the loss of ridge dimension compared to sites left to heal naturally after tooth extraction. In our study, within the ridge preservation groups, ATG sites showed consistently minimum vertical, as well as horizontal bone resorption, as evidenced by least change in alveolar width and height 6 months after therapy.

Study Flow Chart **(Figure 4)**was suggested and it recommends that Radio graphical analysis was performed to validate clinical results. Long term follow-up with major samples need to be done for better results.

CONCLUSION:

This study reveals that both autogenous and alloplastic bone grafts significantly increase the bone density over a period of 6 months, howeverautogenous bone graft is better in increasing bone density when compared to alloplastic bone graft. Alloplastic graft also showed in effective healing over a period of 6 months whereas autogenous bone graft proved to be significantly better than alloplast. Autogenous bone graft has shown to effectively increase the trabeculations in alveolar bone as compared to alloplastic bone graft.

ETHICS APPROVAL:

This study was approved by the Ethics Committee of I.T.S Dental College, Hospital and Research Centre **(Ref nos. ITS/OS//1762:2017).**Study was conducted in accordance with the Declaration of Helsinki.

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