



COMPARISON OF BONE AUGMENTATION AND IMPLANT STABILITY OF IMMEDIATE DENTAL IMPLANTS PLACED WITH DEMINERALIZED FREEZE-DRIED BONE ALLOGRAFT VIS-À-VIS AUTOGENOUS DENTIN GRAFT

Dental Science

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ABSTRACT

Aim: To evaluate clinically and radiographically the bone augmentation and implant stability of immediate dental implants placed with Demineralized Freeze-Dried Bone Allograft (DFDBA) vis-à-vis Autogenous Dentin Graft.

Material and Method: The patients who required extraction of maxillary or mandibular anterior or premolar tooth was selected for extraction followed by immediate implant placement. Patients were randomly divided into two groups; Group A (Patients received immediate implant with Demineralized Freeze-Dried Bone Allograft material) and Group B (Patients received immediate implant with Autogenous Dentin Graft obtained from the extracted tooth). Teeth were extracted, avoiding flap elevation, and a periodontal probe was used to verify the wall assessment of the fresh sockets, which were debrided before receiving graft materials. For graft materials, 15 sockets received DFDBA material and 15 sockets received Autogenous Dentin Graft.

Results: RFA values in Autogenous Dentin Graft (Group B) was slightly better than group A although statistically insignificant. Mean bone change around MB, ML, DB and DL was comparatively more in group A as compared to group.

Conclusion: Human teeth allografts showed more promising results as compared to DFDBA in achieving minimum volumetric alveolar bone loss in alveolar ridge preservation procedure.

KEYWORDS

Implant, Graft, DFDBA, Autogenous Dentin Graft

INTRODUCTION:

Alveolar ridge resorption is a phenomenon observed following the removal of teeth in an otherwise healthy individual. Currently, dental implants are regularly included in the overall treatment plan for patients. Research and clinical studies on immediate implants in animals and humans have been encouraging. Immediate implant placement was shown to have a failure rate of <5%, which is comparable to delayed placement. There is enough scientific evidence to support the procedures of immediate implant placement in comparison to the conventional two stage delayed protocol¹.

Tooth extraction is followed by physiological alveolar bone resorption, which is irreversible and can reach up to 40% in height and 60% in width with great loss occurring within the 3 months after extraction. Insufficient bone can compromise dental implant treatment with a risk of injuring anatomical structures².

Among the biomaterials used for post-extraction alveolar filling, allogenic bone has been described as a suitable material. In the particulate form, Freeze-Dried Bone Allograft (FDBA) and Demineralized Freeze-Dried Bone Allograft (DFDBA) have been used in dental surgery and alveolar ridge preservation technique. It has been shown that, when used in post-extraction sockets, allografts have positive effects on height preservation. In a histological study of alveolar preservation, it was shown that DFDBA led to a statistically significantly greater mean percentage of newly formed vital bone than FDBA³. However, fresh autogenous bone graft is still considered gold standard since it exhibits bioactive cell instructive matrix properties and is non-immunogenic and non – pathogenic in spite of the need for harvesting bone and possible morbidity resulting from it⁴.

This 'in-vivo' study was undertaken to evaluate clinically and radiographically the bone augmentation and implant stability of immediate dental implants placed with Demineralized Freeze-Dried Bone Allograft (DFDBA) vis-à-vis Autogenous Dentin Graft.

MATERIAL AND METHOD:

The present randomized prospective controlled in-vivo study was conducted to evaluate clinically and radiographically DFDBA vis-à-vis Autogenous Dentin Graft in immediate dental implant placement in selected patients. The patients who required extraction of maxillary or mandibular anterior or premolar tooth was selected for extraction

followed by immediate implant placement. Each patient was given a detailed verbal and written description of the study. Informed consent was taken from all patients prior to commencement of the study. All the selected patients undergone routine blood, urine and radiographic (CBCT) investigations before implant procedure. Patients were randomly divided into two groups; Group A and Group B.

Group A: Patients received immediate implant with Demineralized Freeze-Dried Bone Allograft (DFDBA) material.

Group B: Patients received immediate implant with Autogenous Dentin Graft obtained from the extracted tooth.

DFDBA material: Commercially-available freeze-dried cortical allograft bone (DFDBA), 250 to 500 µm in size was prepared according to the tissue bank instructions.

Procedure from tooth extraction to grafting of particulate dentin:

Teeth without root canal fillings that are extracted due to advanced periodontal bone loss or other indications are prepared for immediate grafting. Immediately after extraction, restorations like crowns and fillings should be cut off or removed. Also carious lesions and discoloured dentin or remnants of periodontal ligament (PDL) and calculus should be reduced by tungsten bur. Clean teeth including crown and root dentin are dried by air syringe, put into a grinding sterile chamber of a newly designed 'Smart Dentin Grinder™'. The 'Smart Dentin Grinder™' (SDG) is capable in 3 seconds to grind the roots and then by vibrating movement of the grinding chamber for 20 seconds the particles of less than 1200 µm fall through a sieve to a lower chamber that keeps particles between 300-1200 µm. The particles less than 300 µm fall into a waist drawer. This fine particulate (less than 300 µm) is considered as a non-efficient particulate size for bone grafting. This grinding and sorting protocol is repeated to grind the remaining teeth particles left in grinding chamber. In the collecting drawer chamber dentin particles between 300-1200 µm are collected. The particulate dentin from the drawer is immersed in basic alcohol for 10 minutes, in a small sterile glass container. The basic alcohol cleanser consists of 0.5M of NaOH and 30% alcohol (v/v), for defatting, dissolving all organic debris, bacteria and toxins of the dentin particulate. After decanting the basic alcohol cleanser, the particulate is washed twice, in sterile phosphate buffered saline (PBS). The process from tooth extraction until grafting takes approximately 15-20 minutes. It should be noted, that the efficiency of selecting the

dentin particulate of specific size for grafting is more than 95%. It is obvious that the volume of the particulate dentin is more than twice of the original root volume. Alternatively, the wet particulate can be put on a hot plate (140°C) for 5 minutes and the dry bacteria-free particulate autogenous dentin that can serve for immediate or future grafting procedures.

Surgical Protocol: Patients received 1 g amoxicillin 1 hour prior to surgery and 1 g amoxicillin twice a day for a week after surgical procedure. Surgery was performed under local anesthesia (optocaine 20 mg/ml with adrenaline 1:80,000). Teeth were extracted, avoiding flap elevation, and a periodontal probe was used to verify the wall assessment of the fresh sockets, which were debrided before receiving graft materials. For graft materials, 15 sockets received DFDBA material and 15 sockets received Autogenous Dentin Graft.

Assessment was done at day of extraction and bone grafting, 3 months' postgrafting, and 6 months' postgrafting.

STATISTICAL ANALYSIS:

The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 24.00 for windows; SPSS inc, Chicago, USA). For each assessment point, data were statistically analyzed using t test and the level of significance was set at $p < 0.05$.

RESULTS:

Mean change in RFA during baseline-3 months, Baseline-6 months and 3-6 month was 3.66, 7.26 and 3.60 among group A and the same was found to be 3.87, 7.20 and 3.33 in group B respectively with statistically insignificant difference (table 1).

Table 1: Comparison of mean change in RFA value among group A and B

Stage	Group A	Group B	t test	p value
	Mean	Mean		
Baseline-3 months	3.66	3.87	0.46	0.71
Baseline-6 months	7.26	7.20	0.11	0.86
3-6 months	3.60	3.33	0.58	0.51

Mean bone changes around MB implant surface in group A was 13.19, 12.86 and 12.57 respectively at baseline-3 months, Baseline-6 months and 3-6 month. At ML, MB and DL implant surface, the mean bone change was 12.69, 12.51 and 12.69 respectively at 6 months. Mean bone changes around MB implant surface in group B was 13.69, 13.51 and 13.31 respectively at baseline-3 months, Baseline-6 months and 3-6 month. At ML, MB and DL implant surface, the mean bone change was 13.41, 13.27 and 13.33 respectively at 6 months as shown in table 2.

Table 2: Bone changes around the implant surface among group A and B

Group	Stage	Bone changes around the implant surface							
		MB		ML		DB		DL	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Group A	Baseline	13.19	1.06	13.31	1.02	13.24	0.96	13.25	0.96
	After 3 months	12.86	1.05	13	1.03	12.86	0.99	12.97	0.95
	After 6 months	12.57	1.11	12.69	1.01	12.51	1.03	12.69	0.92
Group B	Baseline	13.69	1.01	13.73	1.04	13.64	1.01	13.73	1.06
	After 3 months	13.51	1.03	13.60	1.06	13.49	1.02	13.52	1.11
	After 6 months	13.31	1.05	13.41	1.07	13.27	1.05	13.33	1.09

DISCUSSION:

It is difficult to compare the results of this study with those of other studies because there have been few studies of implant behavior in bone grafts and because there is a diversity of biomaterials and techniques used for alveolar preservation. Our study focused on the comparison of DFDBA and Autogenous Dentin Graft in relation to bone augmentation and implant stability.

In our study, RFA values in Autogenous Dentin Graft (Group B) was slightly better than group A although statistically insignificant. The finding related to Autogenous Dentin Graft (Group B) was in accordance with the study done by Eun-Seok Kim⁴. Eun-Seok Kim⁴

revealed that histological examination showed appositional bone growth around the auto-FDT graft, and its resorption implies that the demineralized tooth was osteoconductive with a remodeling characteristic. Possible reasons for the good results in this study include the high biocompatibility of autogenous tissue, its collagen-based porous structure that is beneficial for cell function, minimal changes in the structure of mineralized collagen without dehydration (freeze drying), and rehydration procedures and preservation of beneficial noncollagenous proteins involved in mineralization.

In this study, mean bone change around MB, ML, DB and DL was comparatively more in group A as compared to group, but the difference was not statistically significant. Koutouzis et al⁵ in their study found that the average peri-implant bone loss at a period of 12 months of follow-up was 0.15 ± 0.33 mm in the group that had alveolar bone conservation with an allograft (DFDBA) and 0.16 ± 0.32 mm in the group without alveolar bone preservation with no significant difference.

Further clinical and histologic studies are needed to better understand the healing pattern of these biomaterials in relationship with dental implants positioned in grafted sites with bone substitutes.

CONCLUSION:

Human teeth allografts showed more promising results as compared to DFDBA in achieving minimum volumetric alveolar bone loss in alveolar ridge preservation procedure. Histological evidence of new bone formation by teeth allografts corroborated better clinical and radiographical results by them. Derived from an extracted human tooth, it is the most easily available and cost-effective material. Thus, rather than disposing extracted teeth as biomedical waste, they can be collected from healthy donors (tested negative for triple H along with syphilis antigens) and syphilis and pooled together.

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