CLINICO-RADIOGRAPHIC EVALUATION OF XENOGRAFTS IN MAXILLOFACIAL SURGERY

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Abstract

An endeavour to find a suitable substitute for autogenous bone graft in corrections of maxillofacial deformities has been going on. Evaluation of commercially processed xenograft (SURGIBONE) has been carried out as a substitute for autogenous grafts in various maxillofacial surgical procedures in the Department of Dental Surgery at Armed Forces Medical College. Clinical and radiographic evaluation in 15 patients revealed highly satisfactory result with complete integration of the graft without any adverse host tissue reaction within the follow-up period lasting from 12-18 months.

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KEY WORDS : Bone substitute; Surgibone; Xenograft.

Introduction

The use of bone grafts in mankind spans a period of almost three centuries when a documented report was forwarded by Von Meekren [1]. In the craniofacial skeleton, large defects of the bones of varied etiology will generally not heal spontaneously unless the defect is bridged with suitable graft material.

Bone grafting being a dynamic phenomenon is considered successful, when after incorporation, the revascularisation is complete without eliciting any adverse immunologic response. It should also be able to replace and remodel host bone tissue [2,3].

With the advances in the field of immunology, improved processing and better surgical techniques, the focus of attention is on the use of xenografts vis-a-vis autogenous bone. A study was undertaken to evaluate the suitability of commercially prepared xenograft (SURGIBONE) as a bone substitute in oral and maxillofacial surgical procedures.

Material and Methods

15 patients comprising 10 males (66.6%) and 5 females (33.4%) between the age group of 21-48 years with mean age of 30.4 years were selected for the study. These cases had bony defects as a sequel to cystic lesions of the jaws and skeletal deformities leading to facial asymmetry (Table-1).

The basic criteria followed for initial screening of patients was similar to the process followed for routine surgical procedures. These patients had no known history of hypersensitivity to any drug or food material. Written consent for the use of Surgibone (bovine bone) was taken after explaining to the patients the material to be used in the surgical procedure.

Intraoral and extraoral surgical approach was employed depending on the site and the type of defect to be corrected. The implants used were of the load bearing and non-load bearing type. Former type of implants were used in 3 cases and remaining were managed with non-load bearing implants. Rigid fixation of these implants was carried out using titanium mini bone plates and screws. All the patients, who underwent surgery via intraoral route, received Periopack/COE pack periodontal dressing as an attempt to provide hermetic seal of the operated zone from oral contaminants. Parameters followed for evaluation of the grafted site were in accordance with the study carried out by Taheri [4]. The bone graft (xenograft) used in the study was SURGIBONE, which is a chemically treated bovine bone manufactured by UNILAB SURGIBONE INCORPORATION, Ontario, Canada. The extensive chemical processing of this implant material ensures it to be free from HIV virus, Hepatitis B virus and Bovine Spongiform Encephalopathy (Mad cow disease).

Results

Patients who were selected for the study were subjected to clinical and radiological evaluation with a follow-up period lasting one year. The results at the end of the follow-up were highly satisfactory in accordance with the parameters of the study.

Clinical evaluation revealed that all but three cases had uncomplicated post-operative phase with restoration of bony deformity

TABLE 1
Location and type of bony deformities

Type of defect	Area of involvement	No. of cases	Defect size
Cystic	Maxilla	08	15-20 cm
	Mandible	03	06-08 cm
Post-traumatic	Mandible	02	
Facial deformity	Zygomatic	01	—
	Complex		
Facial asymmetry (post TMJ ankylosis)	Mandible	01	—

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and contour. Two of the patients presented with extended post-operative pain which was effectively treated with appropriate medications. One patient presented with discharge of seropurulent material via an intraoral sinus. Routine drainage, irrigation of the wound, culture of the discharge coupled with appropriate medications resulted in effective control of infection. Recovery and healing of the grafted site was satisfactory at termination of study.

Radio-opacity of the grafted area in relation to adjacent host bone was observed, which was a transient feature and reduced within 2-4 months. Increase in radiodensity was observed in check radiographs, after 3-6 months of implantation, which indicated that the implant was functioning as a 'Lattice'. High trabecular continuity was evident within one year of grafting with the host bone, which suggested very advanced state of incorporation of the implant with host bone.

At termination of study, 80% of the cases showed excellent results clinically and 86.6% cases were graded excellent radiographically (Table 2 & 3).

TABLE 2

Result of clinical grading

No. of Cases	Clinical grading	% of Total
12	Excellent	80.0%
02	Good	13.4%
01	Fair	6.5%
—	Poor	—

TABLE 3

Result of radiological grading

No. of Cases	Radiological grading	% of Total
13	Excellent	86.6%
02	Good	13.4%
—	Fair	—
—	Poor	—

Discussion

The basic requisite for the success of a bone graft is the ability of the graft to provide framework for osteoconduction, to facilitate revascularisation and osteoinduction, which initiates cellular activity on a stimulus primarily from the host bone. The incorporation is mainly by 'creeping substitution' [5-7].

Autogenous bone grafts fulfill most of the criteria for success of the graft, however their unpredictable behaviour pattern, limited availability and donor site morbidity are major limitations. Allografts (de-mineralised freeze dried bone allografts-DFDBA), though possessing many advantages, have possibility of disease transmission and storage banking expenses [8-10].

Xenografts (Surgibone) which are chemically treated and processed to make them compatible, lack the bone inducing properties which can be overcome

by impregnating the graft with autogenous bone marrow or implanting it in a bed of bleeding cancellous bone [11-13]. In this study, xenografts (Surgibone) of various sizes and dimensions have been used to fill the

Fig. 1 : Surgibone implant

Fig. 2 : Preoperative intraoral occlusal view showing dentigerous cyst in relation to impacted canine in mandible

Fig. 3 : Postoperative radiograph after one year revealing highly advanced integration between graft-host interface

defects in maxilla and mandible after extirpation of the cystic lesion, correction of post-traumatic deformities and 3 cases of facial asymmetry as a sequel to Tymphano-mandibular joint (TMJ) ankylosis. As determining the osteogenic potential of an experimental bone graft in human body is difficult and empirical at its best, clinico-radiological evaluation was carried out to assess the feasibility of xenograft. Though, clinical and radiological evaluations are valuable, they have limitations and actual picture can only be obtained by histopathological evaluation of biopsy specimen. This is not practical in humans as the same may be objectionable to patients and also interfere with the healing process.

The dimensions of the defects that were bridged with xenografts varied from 1.5 cm x 2.0 cm to 6.0 cm x 8.0 cm. In larger defects, the graft was immobilized using positional screws and bone plates of titanium, whereas in the smaller cavity defects, fixation was not done [14]. Augmentation of facial defect with xenograft was carried out in 3 cases. It was observed in our study that the healing pattern and uptake of the graft with host bed showed no specific difference in healing, irrespective of the extent of size and site of defect, after receiving the grafts [12,14].

Clinically there was complete integration of the graft with host bed and there were no untoward reactions warranting the removal of the graft in any of the cases. The cases of malunited fractures and facial asymmetries showed equally good results as that of cystic lesions. The incorporation with host bone after implanting the graft in bleeding cancellous bony bed, is attributed to the presence of large marrow vascular spaces in these grafts which permit rapid dense vascular penetration. In addition, absence of fat in the processed graft is an added advantage, as presence of lipid molecules delays healing, influences the biocompatibility of the graft and can be a source of granulomatous reactions [15,16]. Surgibone contains only 20-29% protein which is bovine BMP.

Radiologically, initially in the graft bed of the cystic lesions, a 'halo' was noticed which disappeared subsequently with incorporation of the graft in host bone. The presence of 'halo' is attributed to the high density of the implant. After the 12th post-operative week, there was loss of regularity of the graft margin which was followed by increased radiodensity between 12-36 weeks. This goes in favour of suggesting that the implant functions as a lattice followed by laying of new bone along the edges of resorbed trabeculae of the implant and advanced incorporation of the implant with host bone. Latter radiographs exhibited

higher trabecular continuity in the graft-host region, which was indicative of either total incorporation of the implant or advanced stage of incorporation.

These clinical and radiological findings suggest that even if there was any subclinical immunogenic reaction to xenograft, it ceased in the long run without encapsulation of the graft, thus permitting the vascular ingrowth and a slow but successive new bone formation by osteoconduction following the principle of fracture healing response of traumatised living tissue.

The results achieved and the clientele compliance with this graft material has been encouraging and has revealed that properly processed xenograft has the potential to be a viable substitute to auto and allograft. This study showed that the graft took comparatively longer time to resorb and be replaced with the host bone, which was evident radiographically. Since the process of osteogenesis in these types of grafts is by 'creeping substitution', it is imperative to have a high vascular bed or to impregnate the implant with autologous bone marrow to achieve maximum success rate.

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