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CLINICAL STUDY

Healing assessment of osseous defects of periapical lesions with use of freeze dried bone allograft

Lingaraj JB[1] ✉ · **Kotrashetti SM**[2] · **Nishant Gupta**[3]

[1] Reader
[2] Professor and Head
[3] Postgraduate student

Dept. of Oral and Maxillofacial Surgery, KLE Vishwanath Katti Institute of Dental Sciences, KLE University, Belgaum

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Abstract
Objectives The aim of this study was to save endodontically failed teeth with periapical pathosis by surgery. Elimination of the periapical pathology and to evaluate the clinical and radiological efficiency of freeze dried bone allograft in bony defects.
Materials and methods Ten patients were included in this study with established periapical pathology with the need for periapical surgery after failed endodontic therapy. Surgery was decided after the cessation of acute symptoms. Patients on regular medications for known medical complications were excluded from the study. A full thickness flap or modified Leubke-ochsecnbein was raised depending upon the size and location of the lesion. Thorough periapical curettage was performed to remove the pathological tissue surrounding the apices and the root of the tooth. The graft material was mixed with patient's venous blood drawn earlier from a peripheral vein to make it more cohesive. The graft material mixed with blood was then carefully packed with light pressure into the defect. The flap was replaced. All the patients received broad spectrum antibiotics one day before and five days after surgery. The cases were followed up with clinical and radiological examination and were recalled at intervals of 1 month, 3 months and 5 months postoperatively to assess the condition of the periapical area.
Results In all the ten cases at the end of 1st month postoperatively a well defined border separating the host bone from the graft material indicating simultaneous resorption of the graft. This resorption continued at 3 months follow up indicating continued graft resorption and also increasing radioopacity, haziness indicating bone regeneration. Eight of the ten patients could be evaluated at the end of fifth month and radiographs showed increase in radioopacity and reduction in size of periapical radiolucency as well as normal trabecular pattern of the bone.
Conclusion The results demonstrate successful use of FDBA in the treatment of osseous defects of periapical lesions associated with failed endodontically treated teeth.

Keywords Freeze Dried Bone Allograft (FDBA) · Bone graft · Endodontic surgery · Periapical granuloma · Periapical cyst

Address for correspondence:

Lingaraj JB
Reader
Dept. of Oral and Maxillofacial Surgery
KLE Vishwanath Katti Institute of Dental Sciences,
KLE University, Belgaum, Karnataka, India
Ph: +919845136885
E-mail: drlingaraj70@yahoo.com

Introduction

The most commonly encountered periapical lesions include periapical granuloma and cyst. The periapical granuloma is essentially a localized mass of chronic granulation tissue formed in response to infection. The periapical cyst is a common but not inevitable, sequelae of periapical granuloma originating as a result of bacterial infection and necrosis of the dental pulp [12]. Trauma to the teeth is a common occurrence in road traffic accidents, sports and assault. Secondly, carious involvement leading to bacterial invasion of the dentine and the pulp tissue, leading to necrosis of the pulp are the common causes of periapical pathology. Subsequent to the pulpal necrosis there will be an egression of bacteria in the periapical region leading to periapical abscess, granuloma or a periapical cyst. This destruction in the periapical region leads to destruction of bone known as an 'osseous defect' [12].

The treatment of pulpal pathology secondary to caries or trauma consists of Root Canal Therapy (RCT) [6]. In many

cases subsequent apicectomy is necessary to curette the periapical granulation tissue or to enucleate the periapical cyst. In small periapical lesions (0.1mm to 0.5mm) spontaneous healing occurs, but in large cysts (0.5cm to lcm) only a periapical scar is noted in the follow-up radiographs. In such cases, the complete bone healing may not be achieved leading to a compromised tooth integrity.

Osseous defects occur in about 65% to 75% of endodontically failed teeth. Endodontic treatment fails because of lack of adequate drainage, incomplete preparation for obturation, or subsequent lack of hermatic seal, perforation, overextension of gutta percha, periodontal involvement, vertical fracture, missed canals and anatomical variations [6].

To treat such osseous defects various materials to obturate the osseous defects were tried earlier, such as plaster of paris, autogenous bone grafts and xenografts. Disadvantages of these materials includes lack of regeneration of bone, need for a donor site surgery and associated wound morbidity in autogenous bone graft or severe immunological reactions in case of xenografts. Hence, to overcome these problems the Freeze-Dried Bone Allograft (FDBA) was used. FDBA is a biocompatible allograft which has osteogenic potential and is an osteoinductive material which is available commercially and has been used extensively in periodontal surgery and in the treatment of osseous defects resulting from inflammatory periodontal disease ever since Libin et al. used it in 1971.

Yousuf Saad et al. in 1991 [11] for the first time implanted freeze dried bone allograft into the osseous defects after removal of periapical lesions and reported no noticeable immunological complications and reduced humoral and cell mediated type of antigenicity as compared with response of fresh bone graft. In 1996 Bodner radiographically evaluated the changes that occur in jaw defects after enucleation of cyst, comparing between demineralized dried bone allograft and absorbable gelatin sponge and concluded superior bone healing with dried bone allograft.

Hence, a small study was undertaken to evaluate the efficacy of commercially available FDBA (TATA Tissue Bank, Mumbai) in the healing assessment of large periapical osseous defects. The aim of this study was to save endodontically failed teeth with periapical pathosis by surgery. Elimination of the periapical pathology and to evaluate the clinical and radiological efficiency of freeze dried bone allograft in bony defects.

Fig. 1 Preoperative IOPA

Fig. 2 Incision to expose the boney defect

Fig. 3 Osseous defect after apical curettage

Fig. 4 DFDB mixed with autologous blood

Fig. 5 DFDB grafting at surgical site

Fig. 6 IOPA at one month postoperative showing ill defined periapical borders between graft material and normal bone in 21, 22 region

Materials and methods

Ten patients were included in this study with established periapical pathology with the need for periapical surgery after failed endodontic therapy. Surgery was decided after the cessation of acute symptoms. Data includes patient's age, sex, location of the lesion and associated signs and symptoms. Patients on regular medications for known medical complications were excluded from the study.

A full thickness flap or modified Leubke-ochsecnbein was raised depending upon the size and location of the lesion. The incision lines of the flap did not overlie any bony defects and the base of the flap was the widest point with no sharp corners. Thorough periapical curettage was performed to remove the pathological tissue surrounding the apices and the root of the tooth. The excessive gutta percha was cut and periapical area was burnished with a hot ball burnisher to achieve a hermatic apical seal. The graft material was mixed with patient's venous blood drawn earlier from a peripheral vein to make it more cohesive. The graft material mixed with blood was then carefully packed with light pressure into the defect. The flap was replaced to its original position and sutured with 4-0 mersilk to ensure complete soft

Fig. 7 IOPA at three months postoperative. Distinct borders between graft material and normal bone in periapical area is not seen

Fig. 8 IOPA at five months postoperative. Distinct borders between graft material and normal bone in periapical area is not seen with further reduction in size of the lesion

tissue coverage of the graft. Patients were given antibiotics and analgesics for five days.

Cultured tissue was fixed with 10% formalin and sent for histopathological examination. Sutures were removed 7 days postoperatively.

The cases were followed up with clinical and radiological examination and were recalled at intervals of 1 month, 3 months and 5 months postoperatively to assess the condition of the periapical area.

Results

A total of 10 patients were included in this study to assess the healing of osseous defects of periapical lesions associated with failed endodontically treated teeth with the use of freeze-dried bone allograft.

The average age of 10 patients at the time of surgery was 28.5 years. The range was 16–45 years. The study included 5 male and 5 female patients. All surgeries were performed in either maxillary or mandibular anterior teeth. All teeth were endodontically treated and had failed and reported with persistent pain, cervico-facial sinuses, chronic infection or mild mobility of teeth.

All cases showed radiographic evidence of endodontic treatment with periapical haziness and ill defined irregular borders suggestive of chronic periapical cysts or granulomas.

Postoperatively histopathological examination of the periapical pathology was carried out in all the patients. Six out of ten cases were granulomas (60%) and four were periapical cysts (40%). All patients were evaluated at the end of 1st, 3rd and 5th months postoperatively. Two patients out of ten did not turn up for follow-up after 3 months.

All Intraoral Peri-apical (IOPA) radiographs were evaluated by an oral radiologist, preoperatively and at the end of 1st, 3rd and 5th months. Preoperatively all the ten cases showed endodontically treated teeth with irregular periapical radiolucency and at the end of 1st month postoperatively a well defined border separating the host bone from the graft material indicating simultaneous resorption of the graft. This resorption pattern was noted during the 3rd month follow-up indicating continued graft resorption and also increasing radioopacity, haziness indicating bone regeneration. Eight of the ten patients could be evaluated at the end of fifth month and radiographs showed increase in radioopacity and reduction in size of periapical radiolucency as well as normal trabecular pattern of the bone. A satisfactory outcome was noted in all the cases.

All cases were evaluated in the postoperative period with regards to hematoma, infection, graft rejection or sinus formation. No complications were noted in any of the operated cases. The photographs demonstrate successful use of FDBA in the treatment of osseous defects of periapical lesions associated with failed endodontically treated teeth.

Discussion

Root canal or endodontic treatment involves cleaning, shaping, disinfecting and obturating the canal with a suitable sealant material. The importance of canal cleaning and shaping rather than relying on antiseptics cannot be overemphasized. Histologic examination of pulpless teeth in which root canal therapy has failed often shows that the canals were only superficially cleaned [6]. Despite good root canal treatment many a times complete resolution of the periapical pathology is not noted. Hence, apicectomy is indicated in order to curette the periapical granulation tissue or to enucleate the periapical cyst. At times apicectomy is indicated to correct persistant pain after root canal treatment, severely curved and unfilled root ends, apical resorption and procedural accidents. Depending upon the access, the root may or may not be resected and root canal filling is exposed. The periapical region may be filled with amalgam or may be burnished with a heated ball burnisher to achieve apical seal [6].

After curettage or enucleation of the periapical cyst spontaneous healing is noted in small lesions of 0.1 to 0.5 mm diameter but in large lesions of 0.5 to 1 cm in diameter spontaneous healing is not noted, and a periapical scar remains forever as a radiolucent area, although it is not considered to be a pathological entity [5]. Biopsies have shown that these bony defects are filled with fibrous connective tissue leading to formation of dense collagen. The reason for this incomplete osseous repair remains a mystery. However Masscares and Marchand have shown apical scar to occur even when one of the two cortical plates remain intact [8].

Hence, to achieve complete bone healing, various graft materials were tried to obturate these osseous defects. Such as plaster of Paris, autogenous bone grafts and xenografts. These materials have certain disadvantages, such as, lack of regeneration of bone and rejection in case of plaster of paris, severe immunological reactions were noted with the use of xenografts, although the autogenous bone grafts taken from ilium, rib or calvarium overcome the above mentioned disadvantages and good bone regeneration is noted, it requires another surgery to obtain the graft and hence the morbidity [4]. To overcome these graft associated disadvantages, FDBA were first used in early 1970 by periodontologists to reverse the disease process and to achieve clinical as well as histological bone repair [7].

The use of FDBA in the periapical area has not been studied in great detail, only incidental case reports regarding its use in alveolar cleft grafting, orthognathic surgery, ridge augmentation, delayed fracture union treatment and reconstructive surgery have been reported [3,4,13].

In the study conducted by us, a total number of 10 patients were included, the number of male and female participants were equal, and the age range was between 16 to 45 years. The patients in our study also demonstrated failed endodontic treatment with established periapical pathology, evident on an IOPA radiograph and reported with chronic infection, recurrent pain and pus formation with cervico-facial sinues [11] and is comparable to an earlier study.

One of the chief observation was to investigate any noticeable immunological alteration. No noticeable immunological complication was observed. This finding was parallel to that reported by Mellonig JT [9] in 1991 who has shown that freeze drying of bone graft markedly reduces both humoral and cell mediated type of antigenicity compared with the response of fresh bone graft.

Gary E. Friedlander et al. in 1984 and Quattlebaum B et al. [10] in 1988 reported 14% donor specific antibodies in 43 orthopaedic patients receiving FDBA for treatment of bone tumors, but reported clinically successful results in periodontal and maxillofacial surgery. The incidence of donor specific antibodies may not be observed in oral and maxillofacial surgeries, due to the small dose and route of administration of the antigen.

This supports the observation that allogenic FDBA is biologically useful alternative to autogenous bone and has definite advantages over autografts. These allografts have good inductive potential, are readily available, inexpensive, eliminate a secondary surgical procedure, demonstrate an enhanced bone reparative potential and could reduce hospitalization time [2].

Healing appeared to occur in two steps: Phase of resorption and Phase of bone replacement. In the resorption phase, the FDBA was resorbed where as in replacement phase the remaining part of the graft acted as matrix for ingrowth or deposition of the new bone. Hence FDBA was considered a graft material of osteogenic potential [1].

The results of this study are comparable, demonstrating simultaneous resorption of the graft, which continued 1 and 3 months postoperatively indicating resorption and regeneration of new bone. Marked reduction in the size of periapical radiolucency, merging host bone and grafted area as well as increased radioopacity at the end of 5th postoperative month indicates satisfactory bone incorporation [7].

Further it is advised not to exert an excessive pressure while grafting as it may lead to rapid resorption and loss of volume, a similar concern is shared by us. We did not encounter any complications such as hematoma formation, infection, graft rejection and sinus formation. Hence our observations during the study encourage the use of Freeze Dried Bone Allograft (FDBA).

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