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Research Paper

Healing of Periapical Bone Lesion After Periradicular Surgery And Graft Placement- Clinical And Radiographic Evaluation

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ABSTRACT
Objectives:
1*.To clinically evaluate the healing process following periapical surgery with Chitra granules*
2.*To radiographically evaluate healing, following periapical surgery with Chitra granules.*
3.*To compare the bone healing in the study group, clinically and radiographically following the modalities of treatment, with that of the control group (without graft).*
Materials:
1.*Chitra hydroxyapatite granules.*
2. *Gutta-percha — for root canal obturation by lateral condensation.*
3. *High Copper amalgam used as retrofilling materials.*
To evaluate healing after periapical surgery using Chitra granules, 22 patients were selected from out patient section of Department of Conservative Dentistry and Endodontics, Govt. Dental College, Kozhikode,based on clinical and radiographical evaluation. The study group consisted of 13 males and 9 females. All were of the age group 15-35 years. After selection they were randomly divided into two groups A and B. In group A the Chitra granule were placed in the bony defect and in group B the defect were left as such after surgery.
Results: *Clinical parameters showed better early symptom free condition in group A compared to group B. But data found statistically insignificant (t-7.27,df-1.8, P >0.05).*
Radiographical evaluation data analysis showed statistically significant difference among group A and group B.
Conclusion: *Biocompatible Chitra granule not only obliterates the cavity but act as a scaffold for bone growth and prevent scar tissue formation.It is osteoconductive. In comparison to the conventional periapical surgery, the placement of Chitra granules facilitates bone regeneration more easily. The material is found to be very cost effective, easily available, easy to manipulate and involves least complication to both clinicians and patients.*
Keywords: *Chitra granule, periapical surgery,graft,clinical study.*

I. INTRODUCTION

Endodontic surgical procedures are major considerations in the management of endodontically involved roots and associated periradicular structures. The regeneration of bone following destruction by pathological process is an important factor in success following treatment. Various reports are there that granulomas are more common than cysts[,].With the advent of newer sophisticated equipments such as digital radiography, lasers, operating microscopes, sonic and ultrasonic instruments, electronic apex locators and super elastic nitinol instruments, failure of a root canal treatment has been reduced considerably. A success rate up to 86% was reported following conventional endodontic treatment in cases with pulpal necrosis and periapical radiolucencies.Sometimes it is not possible to complete endodontic treatment successfully by routine means. In such cases retrograde sealing of root apex following a surgical treatment becomes inevitable[]. Seltzer et al histologically observed that complete healing of a majority of periradicular lesions usually do not occur following nonsurgical root canal treatment. Localized granulomatous inflammation was frequently found in tissue sections of the periradicular tissues of asymptomatic endodontically treated teeth.

Periradicular curettage is a surgical procedure to remove diseased tissue from the alveolar bone in the apical or lateral region surrounding a pulpless tooth. **Root end resection** is the ablation of the apical portion

of the root and attached soft tissue[]. Surgery may be under taken after unsuccessful retreatment, or when retreatment is impossible or has an unfavourable prognosis. The reported success rate for endodontic surgery ranges from less than 50% to as high as 90%[]. The ultimate goal of any endodontic surgery is to create a perfect seal between root canal space and periodontium thereby aiding the regeneration of periapical tissues; including a complete repair of osseous defects. The regeneration of bone following pathologic destruction has an important bearing on tooth retention. Insufficient or inconsistent bone healing is caused by the in-growth of connective tissue in to the bone defect, preventing osteogenesis (Dahlin et al 1988).Success of a surgery depend on many factors like complete removal of necrotic tissue from the canal,sufficient and effective canal enlarging and cleaning etc[, ,].

A bony defect is defined as any space in or near bone that ultimately needs to be filled with new bone. This definition includes areas to be filled in periodontal pockets; around implants, and in cavitations after surgery or disease (Bernard 1991).Bonye (1973) suggested that the ideal reconstructive material to replace bone should:Facilitate revascularization, osteogenesis and osteoinduction.Do not exhibit antigenic properties.Exist in unlimited supply without the need of a donor site and provide adequate stability and support. Studies have shown that a mechanical barrier such as a membrane or bone graft over the bone defect can prevent the oral epithelium and gingival connective tissue from growing into these defects. This facilitates the repopulation of osteogenic cells in the defective area, thus promoting bony healing after surgery. (Nyman et al 1980; Karring et al 1980). Different types of materials are available for grafting of osseous defects. These include autografts, allografts, xenografts and alloplasts. Autografts [, , ,] are the best replacement material since they do not provoke immune reactions. Nevertheless, autogenous graft materials also carries the risk of morbidity of donor site to some extent. While these treatments under certain conditions, can lead to partial reconstruction or incomplete reconstruction of bone and periodontium, there remains a need for the development of new therapies with greater predictability, ease of use and magnitude of efficacy.Hence there is a great demand and search for indigenously prepared hydroxyapatite material.

The development of hydroxyapatite implant by the Bio medical Technology Wing of Sreechitra Tirunal Institute for Medical Sciences and technology, Thiruvananthapuram, Kerala become relevant in this context. The bone graft used in this study was the porous Chitra hydroxyapatite ceramic granules which have size of 0.5 — 1 mm with a pore size of 100-200 (xm. This material is characterized for phase purity, composition and morphology. The toxicological screening of the above material was carried out according to ISO and other standard procedures. Bone implantation studies were also carried out at the institute. This material had been used for alveolar ridge reconstruction, in periodontal bony defects and it gave good results. This study was conducted to evaluate the bone regeneration following periapical surgery and using Chitra granules in periapical lesions. The present study was conducted at the Department of Conservative Dentistry and endodontics, Govt. Dental College, Kozhikode after obtaining approval of Human Ethics Committee, Medical College, Calicut.

II. MATERIALS AND METHODS

Materials

1. Chitra hydroxyapatite granules.

Freeze dried hydroxyapatite granules, synthesized at the Sree Chitra Tirunal Institute for Medical Sciences and Technology. It is an alloplastic material having the chemical formula Ca10 (P04)6 (OH)2. It is a tribasic calcium phosphate with a calcium to phosphate more ratio of 1.67%, which is identical to that of bone mineral. At higher magnification it appears as an agglomerate of submicron crystallites.The hydroxyapatite granules have a size range from 500-1000 [xm. The pores have a size ranging from 100-200 |j.m.

2.Gutta-percha — for root canal obturation by lateral condensation.

3.High Copper amalgam used as retrofilling materials.

Methods

Patient Selection: Twenty two patients with periapical lesions of anterior teeth were selected from the out patient section of the Department of Conservative Dentistry and Endodontics, Govt. Dental College, Kozhikode for this study. Selections were based on clinical and radiographic criteria.

Clinical criteria

Patients between the age groups of 15-35 years were selected. Patients were basically healthy and free of any systemic diseases. All the selected patients had periapical lesions in maxillary anterior region. All the selected patients had indications for periapical surgery like (1) failed conventional root canal filling with pain and sinus tract. (2) Periapical lesions of teeth with open apex which had a history of failed apexification (3) Roots affected with calcific degeneration and associated periapical lesions (4) Patients with brief period of time

available for completion of therapy for teeth with periapical lesions.A complete periodontal examination was carried out and all were devoid of periodontal pockets.

Radiographic Criteria

Pre-operative radiograph of all selected cases showed well defined periapical radiolucency. The size of each periapical radiolucency were measured in millimeter both vertically and horizontally at maximum — extent of lesion. Only lesion with size greater than 10 mm in diameter in the radiograph were included in this study. Radiographic angulations were standardized for subsequent follow up during the period of study. Radiographs were taken by using film holder. Standard angulations used in each cases. Factors were kept at 8 mA and 60 KVP.

Preparation

Patients data regarding age, sex, location of the lesion and associated signs and symptoms were recorded in the proforma. Whole surgical procedures were explained to the patient. After patient had signed the informed consent form each one was prepared for surgery. Routine blood and urine examinations were carried out. Thorough oral prophylaxis were done and oral hygiene instructions were given. Occlusal adjustments were made to remove interferences when necessary. The root canals of involved teeth were prepared prior to surgery. In already filled teeth the existing gutta-percha was removed and the canals were well prepared and cleansed with normal saline and new root canal fillings were placed with gutta-percha using lateral condensation method after taking working length. Root canal filling were done at the time of surgery. All patients were advised to take an NSAID prior to surgical procedure in order to reduce post operative pain and swelling. Patients were advised to rinse with 0.2% chlorhexidine mouth wash prior to surgery to minimize the number of microbes in the mouth.

Procedure

Effective infection control procedures and barrier techniques were used. The surgical area were anaesthetized by infiltration anaesthesis using 2% xylocaine with 1: 80,000 adrenalin. After isolating the area with guaze sponge, a rectangular flap was designed with two vertical and a sulcular incisions. The vertical incisions were put one tooth lateral to the involved teeth. The mucoperio steal flap was then carefully elevated and reflected by using retractors. In most of the cases access to the root tip area was present as a result of bony destruction. In other cases, the bony access to the root tip was prepared by cutting bone with a micromotor and a round bur at high speed, using light brushing strokes. Proper water spray was also used to protect tissues from thermal injury. After obtaining suitable bony access, the periapical curettage was performed to remove the diseased tissue surrounding the root apex. A sizable sample of soft tissue from the periapical lesion site was sent for histopathological examination.In teeth with open apex, the root canal was dried and obturated at this time. The excess filling material which extends beyond the apex were removed. The root apex was the resected with a high speed fissure bur. A standard cavity of 2 mm was then prepared at the resected root tip by using a small round bur. After drying the cavity, amalgam was placed in to the cavity very carefully without spilling; with an amalgam carrier. After initial set amalgam burnished towards the margins with a ball burnisher.In group A, Chitra granules were placed in the bony defect. In group B the bony defect was left as such (Fig.1,2 & 3).

Placement of Chitra granules

A thorough toilet of the surgical wound was done and haemostasis was achieved prior to placement of Chitra granules. The materials were supplied in sterilized plastic vials. The Chitra granules were the delivered into a sterile dappen dish, and were mixed with few drops of normal saline. The bony defect was completely filled with the material up to the level of surrounding bone walls. It was then gently spread and condensed with a plastic filling instrument.The flap was then replaced to its original position and carefully sutured with 3-0 braided black silk. A pressure pack was then placed over the site. The following post operative instructions were given.

Postoperative Instructions and Medications

1. Maintain the pressure pack (Moist guage. Soaked with Saline) over the surgical site for a period of 10-15 minutes to achieve haemo stasis.
2. Apply ice bag with firm pressure to the face directly over the surgical site for 6-8 hours following surgery, (alternatively 10 minutes on, 5 minutes off). After 8 hours ice bags should not be applied. Frequent moist heat applications to the face on the first and second post surgical days.
3. From the second post operative day onwards, rinse with antiseptic mouth wash (Chlorhexidine 0.2% was observed twice daily for 5 days following surgery).
4. Avoid any mechanical disturbances to the surgical site either in the form of vigorous brushing, raising the

lip or retracting cheeks to inspect the surgical site.

5. Avoid strenuous activity for the rest o*f the day. Smoking and alcohol consumption should be avoided for three days following surgery.
6. Maintain an adequate diet with proper solid and fluid intake
7. during the first 3 days following surgery.

Medications Given

1. Amoxycillin 500 mg tid; X 5 days
2. Ibuprofen paracetamol combination 300 mg and 200 mg) tid X 3 days

Patient were advised to report after 1 week for suture removal.

Follow UP

The patients were followed up for clinical and radiographic examination. Clinical parameters like pain on palpation, pain on percussion, mobility of the involved teeth, presence of draining sinus; swelling and vitality of adjacent teeth were evaluated at times intervals of one week, one month three months, six months, nine months and one year.

Pain on palpation was assessed by palpating with fingers on the buccal and palatal aspects of the mucosal tissue overlying the roots of the treated teeth.

Pain was graded as Mild, Moderate and severe and was scored as follows:

Score 0 — Absence of pain
Score 1 — Mild pain
Score 2 - Moderate pain i.e., noticeable pain experiencing tolerable discomfort
Score -3 — sever pain i.e., intolerable pain

Pain on percussion was assessed, depending up on the degree of pain elicited on a light tap with the handle of a mouth mirror as follows:

Score — 0: absence of pain on percussion
Score-1: Mild
Score — 2: Moderate
Score — 3: Severe

Mobility of involved teeth was assessed by using the blunt handles of two metal instruments and was scored as follows.

Grade — 1 Normal labio-lingual (1 mm)
Grade — 2 Labio lingual mobility > 1 mm
Grade — 3 Labio lingual mobility > 2 mm and vertical mobility. Vitality of adjacent teeth was evaluated thermal and electric pulp tester methods.

Presence of draining sinus, swelling and vitality of adjacent teeth were scored in the observation chart as (+) and (-) according to the presence or absence of die conditions respectively. Radiographically the presence of trabecular bone formation and size of the lesion were evaluated by two radiologists in radiology department who were unaware of this study. Patients were evaluated at time intervals of one month, three months, six months, nine months and twelve months. The presence of trabecular bone formation and size of the lesion were evaluated in comparison with the preoperative radiographs. The border between the bone and graft was graded as definite as (Score - 1), blending of margin (score — 2). The degree of radio opacity of the graft was graded as more radio opaque than bone (score - 1) irregular radio opacity (Score -2) and uniform radiopacity of bone and graft (score — 3). The presence of trabecular bone formation and size of the lesion were evaluated in comparison with the pre operative radiograph.

III. Results

Clinical Evaluation

Clinically the effectiveness of surgery with and without using Chitra HA granules were assessed by considering various signs and symptoms like pain on palpation and percussion, presence of draining sinus tract, gingival recession, mobility of involved teeth and vitality of adjacent teeth at time intervals of one week, one month, three months, six months, nine months and twelve months. One patient of group A and one patient of group B failed to report after month and one patient of group B failed report after six months and another patient failed to report on 12th months. On evaluating pain on palpation it was observed that, preoperatively 8 patients of group A and 10 patients of group B had mild pain on palpation. 3 patients of group A and one patient of

group B had moderate pain on palpation. At one week 9 cases of group A and 10 cases of group B had mild pain. One case from group A and B had mild pain on palpation at 3 months from six months on wards, none of the cases had any pain on palpation (Graph I).

On statistical evaluation while considering the mean number of days taken for getting complete relief from pain on palpation. Patients in group A took 46 days at an average to get complete relief from pain on palpation in place of mean of sixty three days on other group. Thus numerically a group of patients took slightly increased number of days for getting complete relief, still the student Y test was found to be insignificant (t-7.27, df-18, P >0.05). Thus it is inferred that both the groups are having more of similar effects in attaining complete relief from pain on palpation (Table I). On evaluating pain on percussion, it was observed that preoperatively 7 cases of group A and 8 cases of group B had mild pain on percussion whereas 4 cases of group A and 3 cases of group B had moderate pain on percussion. At one week all cases of group A and 9 cases of group B had moderate pain on percussion. One case of group A and 3 cases of group B had pain percussion at 3 months review from 6 months onwards none of the reported cases had any pain on percussion (Graph II).

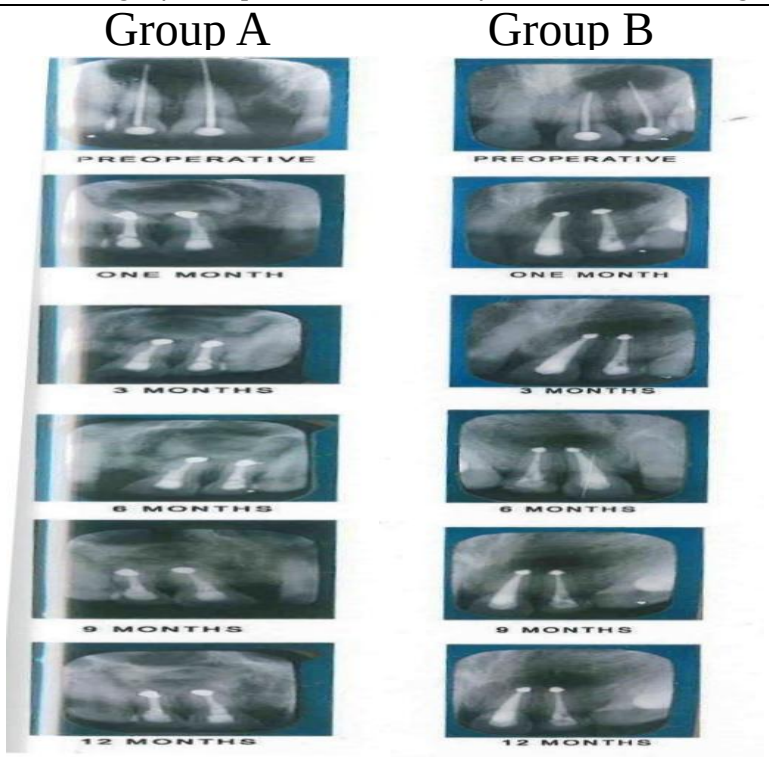
On statistical analysis, it was found that numerically the group B took 57 days to get relief from pain on percussion whereas group A took only 46 days. However, difference noted in the mean number of days for getting complete relief was not significant statistically (Table II). While evaluating die disappearance of sinus tract it was found that 8 cases of group A and 9 cases of group B had sinus tract preoperatively. 6 cases of group A and 3 cases of group B got healed on 1 week. 4 cases of group A healed by 1 month where as 5 cases of group B healed by 1 month and one case of group A healed by 3 months (Graph III). On statistical analysis it was found that cases of group A takes average 18 days for healing and sinus tract where group B takes 31 days for healing. This also appear statistically not significant Preoperatively 10 cases of group A and 10 cases of group B had swelling at one week. 8 cases of group A and 10 cases of group B had swelling. From one month onwards none of the cases showed swelling involving the treated area (Table IV).

On statistical analysis, group A patients showed disappearance of swelling with average of 25 days in group A and 30 days in group B. The difference in the mean number of days was tested statistically and was found not significant. Thus it is inferred that even though there was a numerical difference in the mean number of days taken for the disappearance of swelling, it was only due to sampling variation (Table IV). 6 cases of group A and 6 cases of group B had grade II mobility preoperatively. At one week 6 cases of group A and 6 cases of group B had grade II mobility.

From one month onwards none of the cases of group A showed abnormal mobility whereas one case of group B showed mobility at 1 month review. After 6 months none of cases showed abnormal mobility (Graph V). On statistical analysis it was observed that group A patients took 12 days for getting complete disappearance of abnormal mobility whereas group B patients took 12.7 days. But the difference in this case too was not statistically significant (Table V). The vitality of adjacent teeth were evaluated preoperatively and post operatively using both thermal and electric pulp testing method. All the adjacent teeth in group A and group B were found to be vital even after 12 months evaluation. None of the cases in group A and group B showed gingival recession post operatively.

Radiographic evaluation

Radiographically, the border between the graft and surrounding bone, radio opacity of the graft in comparison to the surrounding bone and presence of trabecular bone formation were evaluated in group A. In group B, size of the lesion in comparison to the preoperative radiograph and the presence of trabecular bone formation were evaluated. These evaluations were done at the time intervals of one month, 3 months, 6 months, 9 months and 12 months. Radiographs of one case from each group is shown in Fig.1.



At one month evaluation, ail the cases in group A showed a definite margin of separation between the graft and the surrounding bone. From 3rd month onwards blending of the margin between bone and graft were present. Radiographic evidence of new trabecular bone formation were there from third months onwards (Table VI).

On evaluating the radiopacity of the graft material in comparison to the surrounding bone, it was found that at one month, the graft appeared to more radiopaque than the surrounding bone. At 3cd month, graft showed an irregular radiopacity in comparison to the surrounding bone. At six months evaluation, 9 cases of group A showed uniform radiopacity of the graft and bone, and two cases showed an irregular radiopacity of graft. At 12 month evaluation all of the cases of group Arshowed uniform radiopacity of graft and surrounding bone. In group B, from 3r month onwards, 3 cases showed presence trabecular bone formation from the periphery of lesion. The outline became irregular which indicate bone formation. The size of the lesion in comparison to preoperative radiographs showed a reduction in size from six months onwards. But even at 12 months observation except two cases a complete obliteration of radiolucency were not present (Table VI).

On Statistical Analysis it was found that cases of group A takes average 90 days to shows signs of trabecular bone formation. Where as group B takes 162 days for trabecular bone formation. This is appear statistically significant (Table VI).

IV. DISCUSSION

The ultimate goal of periapical surgery is the predictable regeneration of periapical tissues including a complete repair of the osseous defects. Inadequate bone healing is caused by in growth of connective tissue into the bone space, preventing osteogenesis. In order to prevent this soft tissue in growth, bone substitute can be used to fill the bony space. The regeneration of bone following periapical surgery can be facilitated by placing bone graft into the periapical defects. It will also help to obliterate dead space in case of large bony defects. Because of the evidence of early osseous healing, subsequent orthodontic and prosthodontic treatment can be readily performed. Different types of bone grafts are available for dental surgical procedures like autograft, allograft, xenograft and alloplasts. Traditionally autografts have been used more frequently as the first choice, as they do not provoke immune reaction that cause rejection. To avoid a separate surgical procedure to harvest a bone graft, alternative biocompatible allograft have to be used. Unfortunately many a times, allografts are immunologically incompatible with the recipient and also have a potential to transfer certain diseases. These potential problems have led to the growing interest in the development of alternative bone substitutes.

The ideal bone replacement material should be clinically and biologically inert, non carcinongenic, easily maneuverable to suit the osseous defects. It should be biofunctionable and have considerable strength to withstand masticatory load.Among them, calcium hydroxyapatite (HA) and tricalcium phosphate (TCP) have gained much attention and popularity.Certain known criteria are there such as biocompatibility, predictability,

clinical feasibility, minimal operative hazards and patient acceptability, which govern the selection of a graft material. Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram has synthetically prepared hydroxyapatite as a part of biomedical material research. The institute had conducted extensive animal studies by implanting hydroxyapatite granules in soft and hard tissues to study the tissue reactions. The results were encouraging and showed good biocompatibility. It was also found to be osteoconductive.

After attaining approval from the Human Ethical Committee, Medical College, Kozhikode, this study was designed to evaluate and compare the healing after periapical surgery with and without using chitra granules, both clinically and radiographically. In all cases, obturation of root canal was done during surgery[,].After periapical curettage, the root apex of all the involved teeth were resected and retrograde filling was given. Amalgam was used as a retrograde filling material in this study. After performing the surgery, the bony defect in group A were filled with the chitra granules. Chitra granules used in the study have a size of 500-lOOOji and pore size 100-200|Li. In group B the defect was not filled with chitra granules and kept as the control group. After surgery all cases were followed up for a period of 12 months. During this period all the findings were entered in the proforma. Healing was assessed both clinically and radiographically. Clinically pain on palpation, pain on percussion, mobility, presence of draining sinustract, gingival recession and vitality of adjacent teeth were evaluated. These evaluations were made at the time intervals of one week, one month, three months, six months, nine months and 12 months.* Radiographically in group A the border between the bone and the graft, the radiopacity of the graft in comparison to that of surrounding bone and presence of trabecular bone formation were evaluated. These evaluations were made at intervals of one month, three months, six months, 9 months and 12 months.

The statistical analysis of the collected data were done with the help of students et' test in the case of quantitative data and chi square test (x2) in the case of qualitative data. On clinical evaluation it was found that the placement of the chitra granules in the bony defect had no significant influence with regard to pain, mobility, healing of sinus tract and other soft tissue response. All the local signs and symptoms of inflammation were mild to moderate and subsided in due course. Since the chitra granules did not show any exaggerative tissue reaction. It was found to be compatible with soft and hard tissue.This was matching with study reports of Varma et al[]. When HA was used in periodontal defects found that they are biocompatible synthetic graft and well tolerated by soft tissue and did not elicit any foreign bony reaction.

In the study using porous HA on periodontal defect found connective tissue infiltration through the pores and narrow zone of bone along the walls in a third month examination. In the fourth month, continued bone formation was evident. Osteocytes, osteoblasts and organization of collagen was also apparent through out the implant. The chitra granules, are porous HA with pore size of 100-200]U and hence the mode of action may be similar[.Klawitter et alstated that minimum pore size of 5-15JLX is necessary to encourage fibrous tissue in growth[]. The placing of HA is important in this context, which will act as a filling material and prevent in growth of soft tissue into the bony defect. At the same time it also act as a scaffold which gradually gets resorbed while preosteoblasts and osteoblasts migrate from the adjacent bone (osteoconduction). In this study preoperative radiographs of all the cases showed presence of well defined radiolucencies associated with the selected teeth. The size of the radiolucency was varied from 10mm to 25mm in size. 3 cases showed wide open apex in the radiographs. At one month evaluation all radiographs of group A showed well defined border between the graft and bone. From the third month onwards there was evidence of blending of the graft with surrounding bone in the radiographs. This indicate osseous in growth into the porous HA. This is accordance with the observation found in various studies.

By the first month the graft material appeared to be more radioopaque than the surrounding bone. Voids were noted within graft in two cases. This might be due to inadequate filling of defect with graft. From the third month onwards the radio opacity of HA was found to be decreasing and more homogenization of radiological picture could be appreciated with uniform radiodensity at subsequent follow up. This is in accordance with the study conducted by various authors[, ,]. In group B, presence of trabecular bone formation were noted from the third month onwards in 2 cases whereas in 9 cases trabecular bone formation noted in from sixth month onwards. The margin of defects become irregular which itself indicates new bone formation. During subsequent follow up the size of the lesion was found to be decreasing in comparison to preoperative size. At twelve month all except 2 shows radiolucency, the outline of which was found to be irregular. This is in accordance with the study reported earlier[]. These results suggest uneventful healing with less osseous integration.

In this study management of periapical lesions with conventional surgery alone showed insufficient bone fill even after 12 months. But at the same time placement of chitra granules in the bony defect showed a definite bone formation on radiological observation in a period 6 to 12 months. The early bone regeneration also give functional support to the tooth especially in large bony defects. Several materials have been used in the past to facilitate bone regeneration in periapical lesions after surgery. They all were found to be effective. In

this study we used the Chitra granules developed at the SCTIMST, Thiruvananthapuram. From this study it was found the Chitra granules enhance both the quality and the quantity of bone regeneration. At the same time this material is found to be cost effective, easily available, easy to manipulate and involve least complications to the clinicians and patients.

V. CONCLUSION

The bone regeneration following periapical surgery can be facilitated by using bone grafts. Hydroxyapatite is found to be very effective alloplastic material that favour bone regeneration. In this present clinical study Chitra granules, a freeze-dried hydroxyapatite, synthesized at Sree Chitra Tirunal Institute for Medical Sciences and Technology were used to fill the osseous defects following periapical surgery. The nature of healing is then compared with that of conventional periapical surgery. 22 patients were selected for this study and divided into two groups A and B. In group A, after surgery the bony defect was filled with Chitra granules and was taken as the test group. In group B, after surgery no bone graft was placed and kept as the control group. Following surgery all patients were assessed both clinically and radiographically for a period of 12 months. On clinical evaluation the Chitra granules did not show any significant immediate or delayed local tissue reactions. Radiographic assessment at various intervals following the surgery showed a change in the intensity of the radiographs and intermingling of the graft and surrounding bone which itself indicates bone ingrowth. In the follow-up period of 6 to 12 months radiographically the graft became indistinguishable from the surrounding bone, which indicate complete bone regeneration. In the control group even after 12 months the radiographs showed inadequate bone fill. The following conclusion can be drawn from this clinical study:

- Chitra granule is biocompatible and has no significant local tissue reaction
- This porous hydroxyapatite granules is osteoconductive and permits osseous ingrowth into the hydroxyapatite granules
- It not only obliterates the cavity but also act as a scaffold for bone growth and prevent scar tissue healing.
- In comparison to the conventional periapical surgery, the placement of Chitra granules facilitates bone regeneration.
- The material is found to be very cost effective, easily available, easy to manipulate and involves least complication to both clinicians and patients.

Table I

No.	CASES (GroupA)										CONTROLS (GroupB)									
	Age	Sex	Loca-tion	Pain on percussion							No	Age	Sex	Loca-tion	Pain on percussion					
				Pre	1wk	1mn	3mn	6mn	9mn	12mn					Pre	1wk	1mn	3mn	6mn	9mn	12mn
1	22	F	U	1	1	0	0	0	0	0	12	20	F	U	1	1	0	0	0	0	0
2	23	F	U	1	0	0	0	0	0	0	13	16	M	U	1	1	0	0	0	0	0
3	18	M	U	1	1	0	0	0	0	0	14	23	F	U	1	1	1	0	0	0	NR
4	21	M	U	2	1	1	0	0	0	0	15	27	M	U	2	2	1	1	0	0	0
5	28	M	U	1	1	1	1	0	0	0	16	15	M	U	1	1	0	0	NR	0	0
6	34	M	U	2	1	0	0	0	0	0	17	28	M	U	1	1	0	0	0	0	0
7	16	M	U	2	1	0	0	0	0	0	18	25	F	U	1	1	1	0	0	0	0
8	18	M	U	1	0	0	0	0	0	0	19	22	F	U	1	1	0	0	0	0	0
9	23	M	U	1	1	0	0	0	0	0	20	13	M	U	1	1	0	0	0	0	NR
10	19	F	U	1	1	0	0	0	0	0	21	21	M	U	1	1	0	0	0	0	0
11	25	F	U	2	1	NR	NR	NR	NR	NR	22	28	F	U	1	1	NR	NR	0	0	0

Group statistics

Group	Duration of days taken for Disappearance of pain or palpation		t value	p value
	Mean	SD		

A	**46.4**	**52.14**	**7.27**	**>0.05**
B	**63.0**	**49.99**		

55 Pain on palpation : Absent = 0; Mild = 1; Moderate = 2; Severe =3

Graph I Pain On Palpation

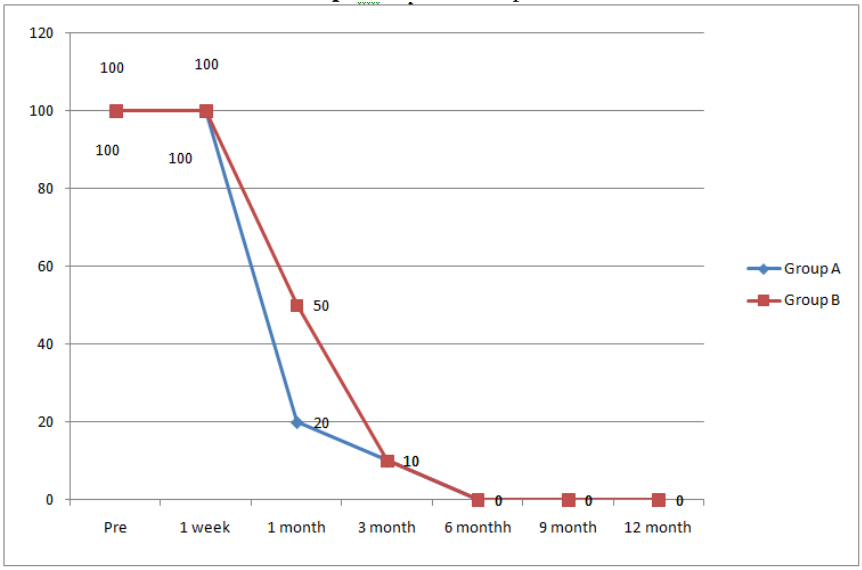


Table II

No.	CASES (GroupA)										CONTROLS (GroupB)									
	Age	Sex	Loca-tion	Pain on percussion							No	Age	Sex	Loca-tion	Pain on percussion					
				Pre	1wk	1mn	3mn	6mn	9mn	12mn					Pre	1 wk	1mn	3mn	6mn	9mn	12mn
1	22	F	U	1	1	0	0	0	0	0	12	20	F	U	1	1	0	0	0	0	0
2	23	F	U	1	0	0	0	0	0	0	13	16	M	U	1	1	0	0	0	0	0
3	18	M	U	1	1	0	0	0	0	0	14	23	F	U	1	1	1	0	0	0	NR
4	21	M	U	2	1	1	0	0	0	0	15	27	M	U	2	2	1	1	0	0	0
5	28	M	U	1	1	1	1	0	0	0	16	15	M	U	1	1	0	0	NR	0	0
6	34	M	U	2	1	0	0	0	0	0	17	28	M	U	1	1	0	0	0	0	0
7	16	M	U	2	1	0	0	0	0	0	18	25	F	U	1	1	1	0	0	0	0
8	18	M	U	1	0	0	0	0	0	0	19	22	F	U	1	1	0	0	0	0	0
9	23	M	U	1	1	0	0	0	0	0	20	13	M	U	1	1	0	0	0	0	NR
10	19	F	U	1	1	0	0	0	0	0	21	21	M	U	1	1	0	0	0	0	0
11	25	F	U	2	1	NR	NR	NR	NR	NR	22	28	F	U	1	1	NR	NR	0	0	0

Group statistics

Group	Duration of days taken for Disappearance of pain or palpation		t value	p value
	Mean	SD		
A	**46.4**	**52.14**	**4.64**	**>0.05**
B	**57.00**	**49.89**		

Pain on percussion : Absent = 0; Mild = 1; Moderate = 2; Severe =3
Location : U = maxillary anterior region

Graph Ii Pain On Percussion

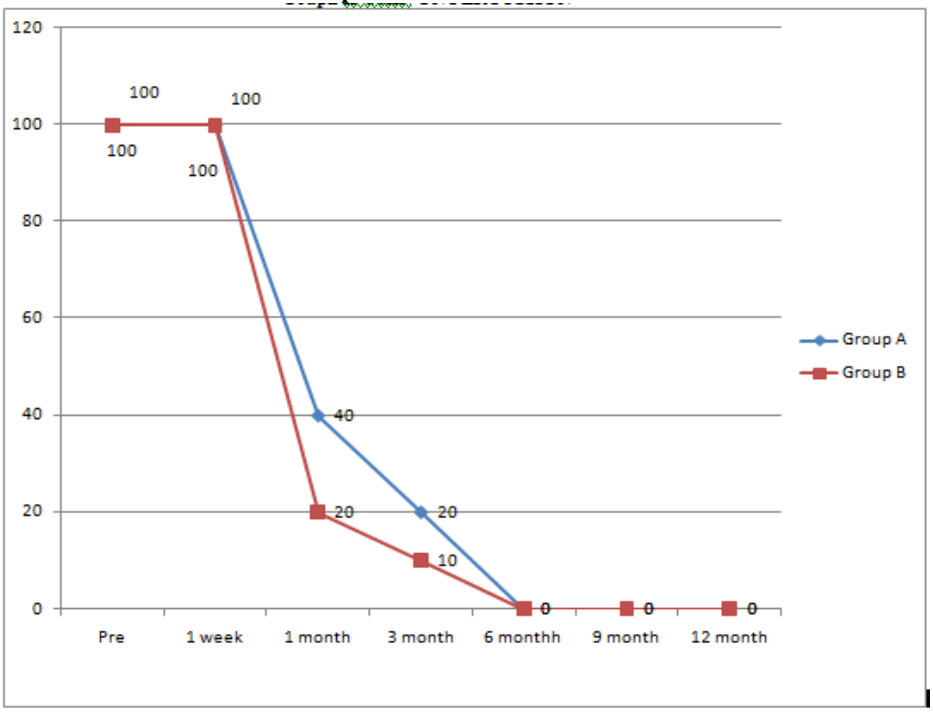


Table III

No.	CASES (GroupA)										CONTROLS (GroupB)										
	Age	Sex	Loca-tion	Pain on percussion							No	Age	Sex	Loca-tion	Pain on percussion						
				Pre	1wk	1mn	3mn	6mn	9mn	12mn					Pre	1wk	1mn	3mn	6mn	9mn	12mn
1	22	F	U	+	+	0	0	0	0	0	12	20	F	U	+	-	-	-	-	-	-
2	23	F	U	+	-	-	-	-	-	-	13	16	M	U	+	+	-	-	-	-	-
3	18	M	U	+	-	-	-	-	-	-	14	23	F	U	+	+	+	-	-	-	NR
4	21	M	U	-	-	-	-	-	-	-	15	27	M	U	+	+	-	-	-	-	-
5	28	M	U	+	+	-	-	-	-	-	16	15	M	U	+	+	-	-	NR	-	-
6	34	M	U	+	+	-	-	-	-	-	17	28	M	U	-	-	-	-	-	-	-
7	16	M	U	-	-	-	-	-	-	-	18	25	F	U	+	+	-	-	-	-	-
8	18	M	U	-	-	-	-	-	-	-	19	22	F	U	+	+	-	-	-	-	-
9	23	M	U	+	+	-	-	-	-	-	20	13	M	U	-	-	-	-	-	-	NR
10	19	F	U	+	-	-	-	-	-	-	21	21	M	U	+	-	-	-	-	-	
11	25	F	U	+	-	NR	NR	NR	NR	NR	22	28	F	U	+		NR	NR			

Group statistics

Group	Duration of days taken for		

	disappearance of sinus tract		t value	P value
	Mean	SD		
A	31.75	25 .73	1.314	>0.05
B	18.5	12.29		

Draining sinus tract : Present +; Absent-
Location : U = Maxillary anterior rigion

Graph Iii Draining Sinus

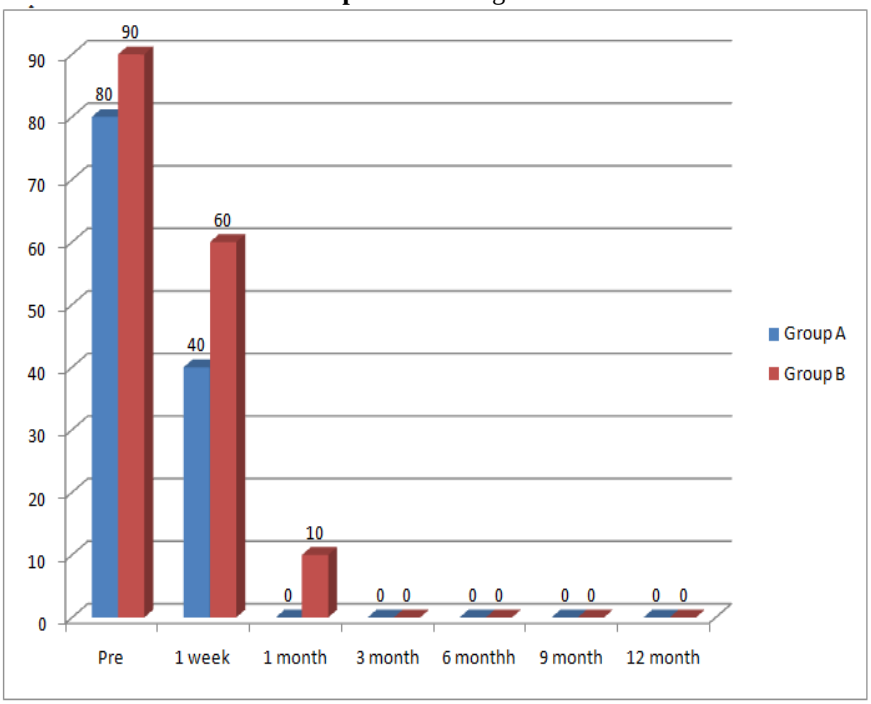


Table IV

No.	CASES (GroupA)										CONTROLS (GroupB)									
	Age	Sex	Loca-tion	Pain on percussion							No	Age	Sex	Loca-tion	Pain on percussion					
				Pre	1wk	1mn	3mn	6mn	9mn	12mn					Pre	1wk	1mn	3mn	6mn	9mn	12mn
1	22	F	U	-	-	-	-	-	-	-	12	20	F	U	+	-	-	-	-	-	-
2	23	F	U	+	+	-	-	-	-	-	13	16	M	U	+	+	-	-	-	-	-
3	18	M	U	+	+	-	-	-	-	-	14	23	F	U	+	+	+	-	-	-	NR
4	21	M	U	+	-	-	-	-	-	-	15	27	M	U	+	+	-	-	-	-	-
5	28	M	U	+	+	-	-	-	-	-	16	15	M	U	+	+	-	-	NR	-	-
6	34	M	U	+	+	-	-	-	-	-	17	28	M	U	-	-	-	-	-	-	-
7	16	M	U	+	+	-	-	-	-	-	18	25	F	U	+	+	-	-	-	-	-
8	18	M	U	+	-	-	-	-	-	-	19	22	F	U	+	+	-	-	-	-	-
9	23	M	U	+	+	-	-	-	-	-	20	13	M	U	-	-	-	-	-	-	NR
10	19	F	U	+	+	-	-	-	-	-	21	21	M	U	+	-	-	-	-	-	
11	25	F	U	+	+	-	-	-	-	-	22	28	F	U	+		NR	NR			

Group statistics

Group	Duration of days taken for Disappearance of pain or palpation	t valu	P valu

	Mean	SD		
A	**24.8**	**10.14**		
B	**30.0**	**0.0**	**1.42**	**>0.05**

Swelling : Present + ; Absent –
Location : U = Maxillary anterior region ; L = Mandibular anterior region

Graph IV Swelling

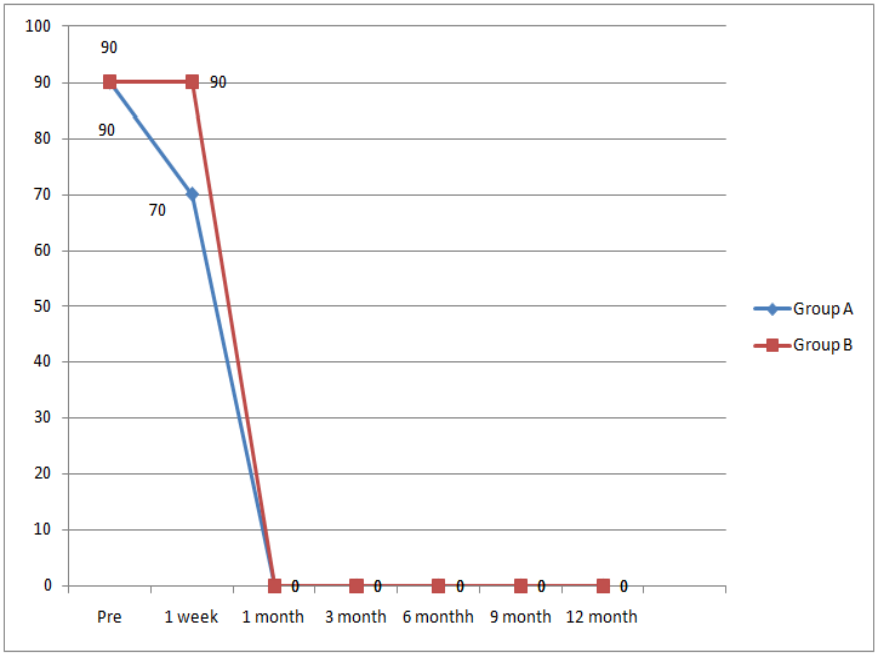


Table V

No.	CASES (GroupA)										CONTROLS (GroupB)									
	Age	Sex	Loca-tion	Pain on percussion							No	Age	Sex	Loca-tion	Pain on percussion					
				Pre	1wk	1mn	3mn	6mn	9mn	12mn					Pre	1wk	1mn	3mn	6mn	9mn	12mn
1	22	F	U	2	2	1	1	1	1	1	12	20	F	U	2	2	1	1	1	1	1
2	23	F	U	2	2	1	1	1	1	1	13	16	M	U	2	2	1	1	1	1	1
3	18	M	U	2	2	1	1	1	1	1	14	23	F	U	1	1	1	1	1	1	NR
4	21	M	U	1	1	1	1	1	1	1	15	27	M	U	1	1	1	1	1	1	1
5	28	M	U	2	2	1	1	1	1	1	16	15	M	U	1	1	1	1	NR	1	1
6	34	M	U	1	1	1	1	1	1	1	17	28	M	U	2	2	1	1	1	1	1
7	16	M	U	1	1	1	1	1	1	1	18	25	F	U	1	1	1	1	1	1	1
8	18	M	U	1	1	1	1	1	1	1	19	22	F	U	1	1	1	1	1	1	1
9	23	M	U	1	1	1	1	1	1	1	20	13	M	U	2	2	2	1	1	1	NR
10	19	F	U	2	2	1	1	1	1	1	21	21	M	U	2	2	1	1	1	1	1
11	25	F	U	2	2	NR	NR	NR	NR	NR	22	28	F	U	2	2	1	NR	NR	1	1

Group statistics

Group	Duration of days taken for mobility to Gr.II to Gr.I		t value	p value
	Mean	SD		
A	12	15.44	**1.03**	>0.05
B	12.7	15.04		

Mobility (Miller): Grade I= 1 (Normal-labiolingual lmm) ; Grade II = 2 (labiolingual >2mm) Grade III = 3 (Labiolingual >2mm + verticalmobility); NR = Patient not reported

Graph V Mobility

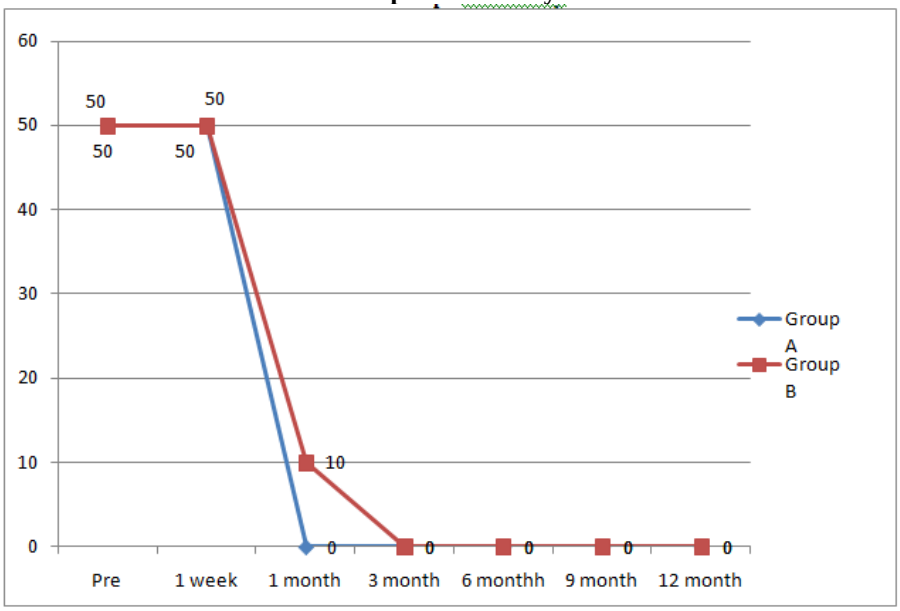


Table VI: Radiographic Evaluation

	CASES GROUP (Group a)																CONTROLS (Group b)										
No	Border b/w graft &bone					Radio opacity of graft					Presence of traubecular Bone formation					No	Presence of traubecular Bone formation					Size of lesion comparison to the preop size				
	1 mm	3 mm	6 mm	9 mm	12 mm	1 mm	3 mm	6 mm	9 mm	12 mm	1 mm	3 mm	6 mm	9 mm	12 mm		1 mm	3 mm	6 mm	9 mm	12mm	1mm	3mm	6mm	9mm	12mm
1	1	2	2	2	2	1	2	3	3	3	-	+	+	+	+	12	-	+	+	+	+	-	-	+	+	+
2	1	2	2	2	2	1	2	3	3	3	-	+	+	+	+	13	-	-	+	+	+	-	-	+	+	+
3	1	2	2	2	2	1	2	3	3	3	-	+	+	+	+	14	-	-	+	+	+	-	-	+	+	NR
4	1	2	2	2	2	1	2	3	3	3	-	+	+	+	+	15	-	-	+	+	+	-	-	+	+	+
5	1	2	2	2	2	1	1	2	3	3	-	+	+	+	+	16	-	+	+	+	+	-	-	NR	+	+
6	1	2	2	2	2	1	1	2	3	3	-	+	+	+	+	17	-	-		+	+	-	-	+	+	+
7	1	2	2	2	2	1	2	3	3	3	-	+	+	+	+	18	-	-	+	+	+	-	-	+	+	+
8	1	2	2	2	2	1	2	3	3	3	-	+	+	+	+	19	-	-	+	+	+	-	-	+	+	+
9	1	2	2	2	2	1	2	3	3	3	-	+	+	+	+	20	-	+	+	+	+	-	-	+	+	+
10	1	2	2	2	2	1	2	3	3	3	-	+	+	+	+	21	-		+	+	+	-	-	+	+	+
11	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	22	NR	NR	+	+	+	NR	NR	+	+	+

Border b /w graft and surrounding bone : Definite margine of separation =1; Blending of margin between bone and graft =2 Radiopacity of graft in comparison to surrounding bone : More radiopaque than

bone = 1; Irregular radiopacity of graft = 2; Uniform radiopacity of graft and bone = 3; Trabecular bone formation present (+) , Absent (-); reduction in size of radiolucency in comparison to preoperative size (+) increase in size (- -); NR : Not reported . No .12 – 22 – Group B

Table VI Group Station

Group	Duration for trabecular bone formation (days)		t valu	p valu
	Mean	SD		
Group A	90.00	56.2	4.00	0.003
Group B	162.00	0.00		

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