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CASE REPORT

COMPARATIVE EVALUATION OF HYDROXYAPATITE and HYDROXYAPATITE WITH COLLAGEN IN CYSTIC DEFECTS – A CLINICAL STUDY

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ABSTRACT

Aim: Aim of this study is to clinically and radiologically compare the efficacy of two different bone substitute materials one is Hydroxyapatite with collagen and other one is Hydroxyapatite without collagen in alveolar bone defects caused by periapical cysts after cystectomy.

Objective: The objective is to evaluate course of cystic bone defects when grafted with Hydroxyapatite with collagen and Hydroxyapatite without collagen by clinical and radiological evaluation of grafted sites through assessment of following parameters.

1) Postoperative subjective complaints both immediate as well as delayed such as pain, swelling etc.,
2) Clinical evaluation for pathologic changes of alveolar bone defects including localized inflammation, wound infection and stability of teeth.
3) Radiographic determination of bone fill in the defect site over a period of 6 months

Materials and Methods: The study was conducted in the department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Hyderabad. Patients with periapical cyst of anterior maxilla, who required periapical surgery, were selected. A total of 10 patients aged between 15 – 30 yrs, are included in the present study and were treated by placement of graft material in the cystic defects, following cystectomy. Patients were divided into two groups with 5 in each group. In group I patients cystic defect was filled with Hydroxyapatite where as in group II patients it was filled with Hydroxyapatite with collagen. All the patients were followed for 6 months post operatively.

Results: In Group I out of 5 patients two complained of mild pain, two complained of moderate pain and one patient had no pain postoperatively after one week. In Group II all patients complained of mild pain after one week of surgery. One patient in Group I in which wound dehiscence occurred complained of persistent pain and swelling even after 10 days. In all patients soft tissue healing was uneventful when the patients were recalled after 1st, 3rd and 6th months there was no incidence of infection. Non vital teeth, involved with the lesion that had grade1 mobility prior to surgery and grafting showed good stability when they were recalled after 3rd and 6th month.

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INTRODUCTION

Bone grafting is a commonly performed procedure. Multiple sources of bone have been used to graft bony defects in head and neck region intending to stimulate bone healing and filling bone defects, with autogenous bone grafting as gold standard method of achieving these goals. Problems using an autograft however exist. Harvesting bone involves increased operative time, blood loss, postoperative pain, length of hospital stay, and cost. Moreover supply of autogenous bone is limited and successful healing and remodeling may not always be achieved. Alternatives to bone grafting potentially expand traditional indications for use.

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The surgeon's desire for new bone grafting tools and their potential marketability has provided the stimulus for developing innovative and effective products over last decade. Therefore a great deal of interest was focused on development and use of synthetic implant materials for bone regeneration. These include plaster of paris, tricalcium Phosphate and glass ceramics, synthetic polymers, non resorbable polymers and hydroxyapatite. Among these one of the first to be investigated as a substitute for bone grafts was plaster of paris, the beta hemi hydrate form of calcium sulphate ($Caso_4.H_2O$). However there were concerns about biocompatibility and toxicity as the material found in nature could contain impurities. Resorption of calcium sulfate is rapid with total resorption observed as early as few weeks to potentially longer times. This fast resorption occurs by dissolution and arguably renders no advantage to bone healing, also plaster of paris failed to provide structural support and has less than desirable

mechanical properties. Then calcium phosphate system became the subject of intensive investigation because it is from this system that vertebrate tooth and bone mineral is derived. Most widely studied calcium phosphate biomaterials are composed of either hydroxyapatite or tricalcium phosphate. Hydroxyapatite (HA) has become one of the most promising materials for human tissue transplantation due to its excellent biocompatibility and bioactivity. The crystallographic and chemical properties of HA closely resemble those of bone and teeth. It has a composition of Ca_{10} $(po_4)_6(OH)_{2}$ and a Ca/P ratio of 1.67 (Doran, 2003). Hydroxyapatite $Ca_{10}(Po_4)_6(OH)_2$ is naturally occurring mineral component of bone and tooth. It is a slowly biodegradable material with high osteocompatibility and bone binding capacity. The HA ceramic form may be subdivided into HA from synthetic and HA from natural sources. The synthetic form is prepared by compressing HA to desired shape and firing it at temperatures upto 1250^0c, a process called as sintering which causes fusion of individual crystals to each other. This polycrystalline structure is responsible for the strength of the substance. HA can be obtained for clinical use in block form or granules, in porous or dense form (Gerlach and Niehues, 2007; John *et al.,* 1986). Its resorption is relatively slow compared with rate of bone formation. Hydroxyapatite is osteoconductive material i.e., it acts as a scaffold for bony ingrowth and gradually is replaced by new bone (John *et al.,* 1986; Stephen *et al.,* 2003). Bone bonds chemically to Hydroxyapatite surface by a natural bone cementing substance if Hyroxyapatite is inlaid or onlaid with intimate contact, Separation may not occur at the interface even when established implants are purposefully fractured after three weeks of healing. Hydroxyapatite is unique biocompatible ceramic substance that is beginning to find its rightful place as a useful and versatile biomaterial.

Hydroxyapatite was used in combination with bovine derived collagen (allogenic graft material) and demineralized bone matrix anticipating increased bone formation in defect site through rapid remodeling and new bone formation. Major component of extra cellular matrix in bone is formed by Collagen. Collagens are ubiquitous proteins responsible for maintaining the structural integrity of tissues. Problems encountered with the use of HA especially in applications other than alveolar ridge augmentation centre around difficulty in handling and delivering the material, as well as inability to satisfactorily immobilize the HA crystals immediately after placement. These problems are directly related to the lack of adherence between particles and can result in subsequent loss of contour. Therefore there was need for a substance that should serve as an adherent for HA particles without altering the basic properties of HA and it must be compatible with the host tissues. Denatured Bovine Collagen was used for this purpose. It serves as a surgical haemostatic agent, weakly antigenic and is eventually resorbed by the host (William Keith Harvey *et al.,* 1985). The increased potential for new bone formation was attributed by the presence of osseoinductive factors (Gail *et al.,* 1990). A material is said to be osseoinductive when it transforms undifferentiated mesenchymal cells into osteoprogenitor cells thus inducing new bone formation. The osseoconductive nature of Hydroxyapatite combined with osseoinductive factors contained within demineralised allogenic bone was thought to offer a desirable mixture for optimal production of healing bone. Presence of collagen enables osteoclasts to invade and degrade the scaffold making room for building new bone matrix. Some other advantageous properties of collagen over other materials include hemostatic function, allowing early wound stabilization, chemotactic properties to attract fibroblasts, and semipermeability, facilitating nutrient transfer. The present study is a comparative clinical and radiological study between two alloplastic materials that is Hydroxyapatite alone and Hydroxyapatite with collagen. The goal of the study is to evaluate course of healing and osteogenesis in cystic bone defects grafted with Hydroxyapatite alone and Hydroxyapatite with collagen.

MATERIALS AND METHODS

The study was conducted in the department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Hyderabad. Patients with periapical cyst of anterior maxilla, who required periapical surgery, were selected. A total of 10 patients aged between 15 – 30 yrs, are included in the present study and were treated by placement of graft material in the cystic defects, following cystectomy. Patients were divided into two groups with 5 in each group. In group I patients cystic defect was filled with Hydroxyapatite where as in group II patients it was filled with Hydroxyapatite with collagen. All the patients were followed for 6 months post operatively.

Criteria for Selection of Patients

1. Patients with moderate sized periapical cystic lesion of anterior maxilla involving 1 or 2 teeth confirmed by clinical and radiological evaluation were included in the study.
2. No special consideration was given to either sex or any particular socio economic groups.
3. All cases were meticulously screened through routine blood and urine examination to rule out any systemic diseases like diabetes, hypertension etc., medically compromised patients were exempted from the study to eliminate bias.
4. Patients with gross mobility of involved teeth due to moderate bone loss were not included in the study.
5. Patients with frankly infected cysts were excluded in the study.
6. Patients should be readily available for periodic recalls and reviews.

A detailed case history including past history of trauma, past dental treatment was obtained with special emphasis on history of any systemic diseases. Through clinical examination was performed with reference to site, size, shape, extent of the lesion and vitality tests of the involved teeth are performed. Routine blood and urine examination were done to rule out any systemic disease. Standard IOPAs covering full extent of the lesion were taken. After vitality tests were obtained, endodontic treatment was performed for the nonvital teeth involved with the lesion. Operative procedures were performed with standard set of instruments on all patients using a standardized approach to surgery. Local anesthesia was obtained by infra orbital, nasopalatine nerve blocks and local infiltration by injecting 2% lignocaine with 1: 1,00,000 adrenaline. Horizontal crevicular incision and vertical releasing incisions given, mucoperiosteal flap elevated using molts periosteal elevator. Surgical field is visualized by soft tissue retraction and unsupported bone overlying the lesion removed with rotating bur. The cyst lining is gently eased away from the cavity wall using a periosteal elevator and

separated from bone using variety of curved curettes taking care not to rupture the lining of cyst. If cyst lining was punctured by careful manipulation lining was freed from the bone and removed. Once the apical portion of the roots of involved teeth not supported by surrounding bone are exposed, apicoectomy was performed by rotating bur with copious saline coolant. Apical 3-4 mm of the roots were resected and apices were prepared by creating a bevel angle of 45° for better view of the apices. Then root end gutta-percha is smoothened by heated tip of small ballburnisher to achieve a good apical seal. Through debridement of cystic cavity was performed to remove any tissue remnants and edges of bone are rounded with bonefile followed by thorough irrigation of the cavity with normal saline. After thorough debridement, cavity was packed with wet guaze and left for few minutes to secure adequate hemostasis. Hydroxyapatite granules with or without collagen in respective group of patients were placed. First the graft material was soaked in normal saline solution, then packed firmly into the defect in a step wise manner until entire defect was filled with bone graft material. After each increment of graft material was placed it was blotted with saline moistened guaze to absorb excessive fluid which also assists in condensing the graft. After ensuring that no foreign material has been left on the flap is sutured primarily with 3-0 black braided silk suture and intraoral pressure pack placed. Routine standard post operative instructions were given. The following parameters were checked in all patients at each followup visit on 1st, 3rd, 7th postop days later after 2nd week, 1st month, 3rd and 6 month intervals.

1. Clinical evaluation of operated site for any persistent pus discharge.
2. Clinical assessment included exploration of graft bed for the existence of HA particles outside the body cavity.
3. Soft tissue healing at the operated site.
4. Stability of involved teeth.
5. Radiological examination post operatively by taking standard IOPAs were taken at each follow up visit to determine graft consolidation, amount graft resorption and new bone formation.

RESULTS

A total of 10 patients were enrolled in the study to evaluate efficacy of Hydroxyapatite with collagen over Hydroxyapatite alone, in the reconstruction of jaw bone defects after cystectomy. Patients with moderate sized periapical cysts (average of 1.5 to 2 cms diameter) in anterior maxilla involving 1 or 2 non vital teeth that showed grade I mobility were chosen for the study. All patients complained of mild to moderate pain preoperatively, frankly infected Cysts were excluded in the study. Patients age ranged from 15-30 years with mean age of 24.3 years. Out of which 1 was female and 9 were male patients. Patients were divided into 2 groups. Group I patients were grafted with Hydroxyapatite granules where as Group II patients were grafted with Hydroxyapatite with collagen (Bovine derived collagen) in cystic bone defects after cystectomy. All patients were examined on 1st, 3rd, 7th postop days and later followed after 2nd week, 1st month, 3rd month and 6 months. Clinical assessment for 1st and 2nd week included through examination of operated site for existence of any migrated Hydroxyapatite particles. This was graded as either + for Hydroxyapatite particles present or – no particles. Graft particle migration was present in 1 patient of Group I and no particle migration was present in patients of Group II. Wound dehiscence occurred in 1 patient of Group I on 5th postop day at the suture line, after regular irrigation with normal saline healing occurred by secondary intention and wound healed uneventfully by 12th postop day. Mild serous discharge was present in 2 patients of which 1 belonged to Group I and other belonged to Group II, this was not considered as a post operative complication. In Group I out of 5 patients two complained of mild pain, two complained of moderate pain and one patient had no pain postoperatively after one week. In Group II all patients complained of mild pain after one week of surgery. One patient in Group I in which wound dehiscence occurred complained of persistent pain and swelling even after 10 days. In all patients soft tissue healing was uneventful when the patients were recalled after 1st, 3rd and 6th months there was no incidence of infection. Non vital teeth, involved with the lesion that had grade1 mobility prior to surgery and grafting showed good stability when they were recalled after 3rd and 6th month. IOPAs were taken for all patients in the 1st, 3rd and 6 months of follow up. The periapical radiographs were qualitatively examined by measuring with a ruler directly on radiographs. Defects that were filled with graft material showed increased radiopacity 4 weeks after surgery. A thin radiolucent area was seen delineating graft margin and margin of bone defect. This radiolucent area increased continuously upto 12 weeks after surgery suggesting occurrence of graft resorption in Group II patients. However between 12 to 24 weeks there was increased normal trabecular pattern of bone and the radiolucent area between graft material and bone margin became thinner indicating progressive osseointegration. In Group I patients the changes were not significant as Hydroxyapatite showed very minimal resorption even after 6 months. Table 1 shows preoperative evaluation of each patient in Group I and Group II. All patients had 1 or 2 non vital and grade 1 mobile teeth involved with the lesion and history revealed trauma to upper anterior teeth. Site of the lesion was anterior maxilla for all patients. Patients of age group 15-30 years were included in the study. Total sample of study is 10 with male to female ratio of 9:1 (Fig 1).

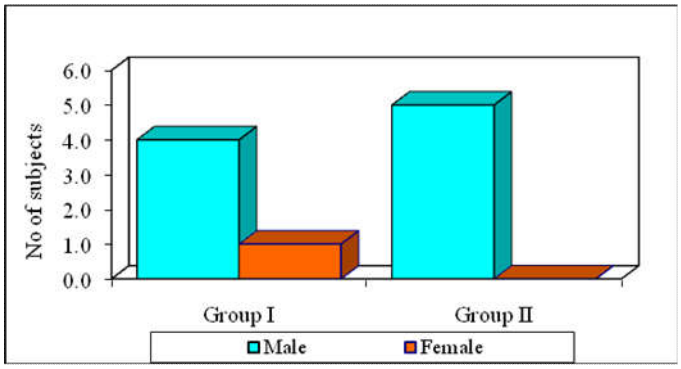

Figure 1. Distribution of study subjects according to gender and groups

Table 2, compares pain distribution of study subjects according to status of pain intensity among groups pre and post operatively after1st week in Group I out of 5 patients 2 patients complained of moderate pain and 2 patients complained of mild pain and 1 patient had no pain after 1 week of surgery. In Group II all patients had mild pain post operatively after 1 week. Remission of pain occurred by 10th day in all patients. Pain was graded as 0 for no pain, 1 for mild pain, 2 for moderate pain and 3 for severe pain based on intensity.

Table 1. Preoperative evaluation

	Case no	Age/Sex	Etiology	Site	Involved teeth	Mobility of involved teeth
Group I	1.	30/F	Trauma	Anterior maxilla	11,12	Grade I i.r.t 11,12
	2.	22/M	-do-	-do-	21,22	Grade I i.r.t 21
	3.	23/M	-do-	-do-	21,22	Grade I i.r.t 21
	4.	24/M	-do-	-do-	11,12	Grade I i.r.t 11,12
	5.	26/M	-do-	-do-	21,22	Grade I i.r.t 12
Group II						
	6.	19/M	-do-	-do-	21,22	Grade I i.r.t 21
	7.	21/M	-do-	-do-	21,22	Grade I i.r.t 22
	8.	20/M	-do-	-do-	11,12	Grade I i.r.t 22
	9.	28/M	-do-	-do-	11,12	Grade I i.r.t 11
	10.	30/M	-do-	-do-	11,12	Grade I i.r.t 11

Table 2. Assessment of efficacy of treatment by comparing pre and post operative pain after 1st week

	Case No	Pain	
		Pre - Op	Post - Op (after 1st week)
Group I	1.	2	2
	2.	1	0
	3.	2	1
	4.	1	2
	5.	1	1
Group II	1.	2	1
	2.	2	1
	3.	2	1
	4.	1	1
	5.	2	1

Pain grading based on intensity; 0- No Pain1 - Mild Pain2 - Moderate Pain3 - Severe Pain

Table 3. Post operative evaluation after 1st week

	Case No	Wound dehiscence	Graft particle migration	Serous discharge	Haematoma
Group I	1.	-	-	-	-
	2.	-	+	-	-
	3.	-	-	-	-
	4.	+	-	+	-
	5.	-	-	-	-
Group II	6.	-	-	-	-
	7.	-	-	-	-
	8.	-	-	-	-
	9.	-	-	-	-
	10.	-	-	+	-

\+ Present; -Absent

Table 4. Comparison of mobility of involved teeth preoperatively and post operatively

Case No		Pre - Op	Post -Op		
			1st month	3rd month	6th month
Group I	1.	Grade II i.r.t 11,12	Extn of 11,12 done	---	---
	2.	Grade I i.r.t 21	present	present	Nil
	3.	Grade I i.r.t 21	present	present	Nil
	4.	Grade I i.r.t 11,12	present	present	Nil
	5.	Grade I i.r.t 12	present	present	Nil
Group II	6.	Grade I i.r.t 21, Grade II i.r.t 22	GRADE I i.r.t 21 present, Extn of 22 done	Nil	Nil
	7.	Grade I i.r.t 22	present	Nil	Nil
	8.	Grade I i.r.t 22	present	Nil	Nil
	9.	Grade I i.r.t 11	present	Nil	Nil
	10.	Grade I i.r.t 11	present	present	Nil

Table 3 shows post operative evaluation of the operated site for wound dehiscence, graft particle migration, serous discharge and haematoma. This was graded as '+' if present and '-' if absent. Wound dehiscence occurred in 1 patient of Group I on 5th postop day at the suture line, after regular irrigation, wound healed uneventfully by 12th postop day. Mild serous discharge was present in 2 patients of which 1 belonged to Group I and other belonged to Group II, this was not considered as a post operative complication. Graft particle migration was present in 1 patient of Group I. No patient showed haematoma formation post operatively (Fig 2). Table 4 compares mobility of involved teeth pre operatively and post operatively after 1st, 3rd and 6th months. There was early reduction in mobility of involved teeth by 3rd month in Group II patients when compared with Group I. All teeth were stable after 6 months. Table 5 shows resorption of graft material and Osseous fill in Group I and Group II patients at different time intervals of 1st, 3rd and 6th months. By the end of 1st month no resorption was

Table 5. Radiological analysis of grafted site over a period of 6 months

	Case No	Resorption of Graft material			Osseous fill		
		1st Month	3rd Month	6th Month	1st Month	3rd Month	6th Month
Group I	1.	Nil	+	++	Nil	+	++
	2.	Nil	+	++	Nil	+	++
	3.	Nil	+	++	Nil	+	++
	4	Nil	Nil	+	Nil	Nil	+
	5.	Nil	+	++	Nil	+	++
Group II	6.	+	++	++	+	++	++
	7.	+	++	+++	+	++	+++
	8.	+	++	+++	+	+	+++
	9.	Nil	+	++	Nil	+	++
	10.	+	++	++	+	+	++

+ 15%; ++ 30%; +++ 45%

Table 6. Clinical evaluation of grafted site over a follow-up period of 6 months

	Wound Infection			Soft Tissue Healing		
	1st Month	3rd Month	6th Month	1st Month	3rd Month	6th Month
Group I	Nil	Nil	Nil	Uneventful	Uneventful	Uneventful
Group II	Nil	Nil	Nil	Uneventful	Uneventful	Uneventful

found in any of Group I patients whereas 4 patients showed 15% resorption and 1 patient showed no resorption in Group II. By the end of 3rd month 4 patients showed 15% resorption and 1 patient showed no resorption in Group I whereas 4 patients showed 30% and 1 patient showed 15% resorption in Group II. By the end of 6th month 4 patients showed 30% and 1 patient showed 15% resorption in Group I whereas 2 patients showed 45% resorption and 3 patients showed 30% resorption in Group II. . None of the patients in Group I showed new bone formation whereas 4 patients showed 15% new bone formation and 1patient showed no new bone formation by the end of 1st month. 4 patients showed 15% and 1 patient showed no new bone formation in Group I whereas 2 patients showed 30% and 3 patients showed 15% new bone formation in Group II by the end 3rd month. 4 patients showed 30% and 1 patient showed 15% new bone formation in Group I whereas 2 patients showed 45% and 3 patients showed 30% new bone formation in Group II by the end of 6th month. Table 6 shows clinical evaluation of grafted site over a follow up period of 6 months. No case of wound infection was reported and soft tissue healing was uneventful in all patients.

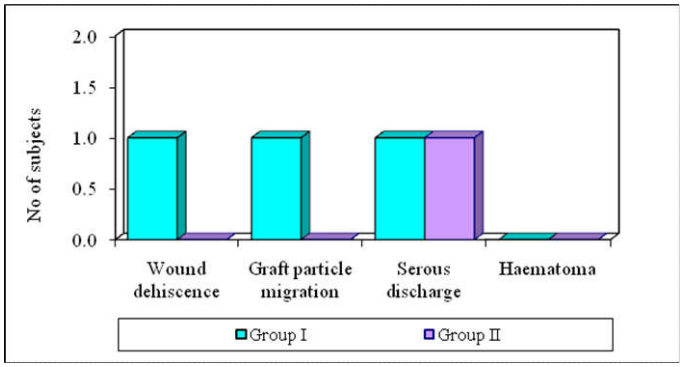

Figure 2. Post operative evaluation (after 1 week) with different variables in group I and group II with different varaible

DISCUSSION

At present bone transplantation with autologous material is still the standard procedure; this is advantageous in that it promotes bone healing. It also excludes allergic reactions and transmission of viruses which might be caused by replacement materials of animal origin.

Biomaterial implants based on the major bone mineral component of bone matrix, Hydroxyapatite have enjoyed widespread use in the last 20 years. Hydroxyapatite is an extremely attractive implant material because of its excellent biocompatibility and its ability to be synthetically produced. It has primarily been used as a ceramic formulation. It is produced by a process called sintering at temperatures more than 1200°c and they have high density and low porosity. Since burning process induces pore rupture, the inter connecting character of pores is lost to a considerable extent this production procedure reduces the osteoconductive property at the same time rendering its biodegradation more difficult (Bienengraber *et al.,* 2006). For this reason they are degraded very slowly& in most cases incompletely. Hydroxyapatite did not resorb significantly in the present study and still present even after six months. The results of this study support those of Kent *et al.* 1986 who reported that ceramic Hydroxyapatite onlays stimulated only minimal ingrowth of reactive bone into augmented mandibular ridges of dogs over 52 weeks. Hydroxyapatite is an excellent grafting material with which it induces bone formation within well contained, stable skeletal defects such as bone cysts and cavities. They should be placed in intact bone with close contact. Ceramics are brittle with poor tensile strength making their primary application in filling of contained bone defects. Hydroxyapatite did not elicit a foreign body reaction and was well tolerated by tissues. Hydroxyapatite particles enhance new bone formation and create a new buccal cortex, when it is missing. Its use in 4-5 walled like cystic defects may be indicated however further studies necessary (Chang *et al.,* 2008). Hydroxyapatite has been shown to enhance bony in growth into a bone defect. However because Hydroxyapatite particles are difficult to maintain in a specific location, particulate Hydroxyapatite can be placed directly into a bone defect, when it has minimum of 4 Wall, maintained in position by the blood clot and overlying soft tissue envelope. The hypothesis of this study was that a particulate material, will allow more bone formation in the defects. Hydroxyapatite has osteoconductive property so that autologous osteoblasts, collagen fibers and capillaries can migrate into the defect. Hence repair of bone defects is done by implanting biodegradable scaffold that can undergo remodeling, that can be degraded by osteoclasts and enable osteoblasts to build new mineralized bone matrix. In order to achieve this goal a new porous material has been developed

using Hydroxyapatite along with collagen. Presence of collagen enables osteoclasts to invade and degrade the scaffold there by making room for osteoblasts to build new bone matrix. More over Hydroxyapatite and collagen composite provides shear strength to the material (Ronald *et al.,* 2008). This comparative study demonstrated the possibility of achieving osseointegration by improving the stability of previously mobile teeth involved with the lesion. This occurred by the end of 3rd month in patients grafted with Hydroxyapatite and collagen whereas the same result was achieved by the end of 6 month in patients grafted with Hydroxyapatite alone. This can be attributed to relatively rapid osteointegration in the former. Poor stability of teeth even after 3 months of grafting with Hydroxyapatite alone was observed. These results can be compared with studies conducted by Hallman *et al.* 2005 who found that mainly immature nonwoven bone was present after 6 months of grafting with Hydroxyapatite. Few complications were noted during initial healing period after 1st week one case of wound dehiscence which was healed by regular irrigation and one case of graft particle migration in patients who were grafted with Hydroxyapatite alone; except for these no other complications were reported. The specific factors reviewed were soft tissue responses, ability to bind to bone, displacement of particles, resorption of graft material and osseous fill.

In the present study maximum amount of resorption of graft material at the end of 6th month was only 45%, most of the graft material remained without resorption.When two graft materials were compared resorption rates was significantly higher in defects grafted with Hydroxyapatite collagen composite than in cases where Hydroxyapatite alone was used. Ronald Mai etal in 2008[10] in their study they observed that after 18 months only residues of Hydroxyapatite granules could be observed with complete bone regeneration after inserting Hydroxyapatite and collagen composites in surgically created defects of minipigs. Pre existent woven bone was replaced to a major extent by lamellar bone. The present study was designed to verify bone healing and remodeling of bone replacement substance based on Hydroxyapatite modified with collagen. This composite was developed as a fiber reinforced material thus closely resembling native bone (Ronald *et al.,* 2008). To analyze the character of remodeling and bone fill, the Hydroxyapatite collagen composite was used in cystic bone defects by Remacle *et al.* 1990. They found that the properties shown by the applied Hydroxyapatite collagen composite describes a bone replacement substance that is stable in volume, biodegradable and osteoconductive. The study supports the suitability of this implant material as bone replacement substitute in pure bone cavities however the opportunity to perform alveolar ridge augmentation may not be possible with this material when compared with dense sintered Hydroxyapatite as resorption occurs quickly. Hydroxyapatite material though extremely studied in oral and maxillofacial surgery has limited applications due to its particulate nature. At the time placement it lacks form and cohesive strength and particles may be misplaced or may compress, dislodge or migrate under extremely applied forces. This study presents results to support efficacy of using biodegradable bovine collagen to prevent migration of particulate Hydroxyapatite. The result of the study also supports the hypothesis that collagen can be used as a biodegradable filler without significantly effecting the favorable properties of Hydroxyapatite as already reported by Richard *et al.* 1985. In general it was observed that both bone graft substitutes integrated and resulted in undisturbed wound healing without any clinical signs and symptoms of infection. The clinical and radiological assessment of osseous rebuilding process in the patients after intraosseous treatment in cases of cystectomy and apicectomy is often subjective and tentative, despite modern research technology possibilities the most accurate test for reparative and regenerative process assessment is still histopathological examination. However histopathological assessment in humans where operated site is exposed and material is collected after cystectomy raises ethical concerns and would undoubtedly be rightly objected by the patient.

Summary and Conclusion

Hydroxyapatite is a biocompatible substance that does not cause any chronic inflammatory, allergic or toxic reaction. It has been primarily used as ceramic formulation and its widespread use has been limited because of relative permanence of implant crystal lattice. The ideal synthetic implant material for reconstruction of bone defects should allow host bone formation in a relatively short span of time, Hydroxyapatite and collagen composite provides a means of achieving this goal. The present study was conducted in department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Hyderabad. A total of 10 patients were enrolled in the study to compare efficacy of two alloplastic materials Hydroxyapatite and Hydroxyapatite with collagen to reconstruct jaw bone defects after cystectomy. The results of the study seem to support the hypothesis that collagen can be used as biodegradable filler along with Hydroxyapatite. This bone graft material displayed a process of resorption that occurred simultaneously with bone formation. An easy intraoperative handling and good clinical application was observed making it more superior than Hydroxyapatite alone. To conclude collagen with Hydroxyapatite were studied in small group of patients to determine if this would improve implant form and function, prevent particle migration and improve particle consolidation. The very favourable results obtained in this study warrant further investigation of this implant system in both experimental animals and human subjects.

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