

## RIDGE AUGMENTATION USING AUTOGRAFT OR NON-RESORBABLE HYDROXYAPATITE GRAFT: A COMPARATIVE STUDY

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### ABSTRACT

**Background:** During the healing process of the socket after tooth extraction, the height and width of the alveolar ridge reduce significantly. The healing process may result in hard- and soft-tissue deformities, affecting the ability to restore the site, and alveolar bone loss.

**Objective:** The study is aimed at comparing the effect of ridge augmentation using autografts and that using non-resorbable hydroxyapatite (HA) grafts on the quality of bone and soft tissues in the areas of missing teeth to provide better functional restoration.

**Methods:** Forty patients with constructed complete dentures were selected and divided into two groups. Both groups were treated with ridge augmentation procedures. Group I received a non-resorbable hydroxyapatite graft, while Group II received an autograft to augment the ridge. The study was conducted over 2012–14 at the Dental Clinic, Faculty of Dentistry, Al-Azhar University, Assiut Branch, Egypt.

**Results:** The study revealed that ridge augmentation using an autograft improved the alveolar ridge's delineation, altitude and breadth better than a non-resorbable hydroxyapatite graft.

**Conclusion:** Using an autograft in the ridge augmentation procedure provides better functional restoration compared to the use of a non-resorbable hydroxyapatite graft.

**Keywords:** Augmentation, autograft, non-resorbable, hydroxyapatite

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### INTRODUCTION

A difficult tooth extraction, which requires surgical intervention, may result in bone loss and surgical trauma. Tooth extraction or loss may reduce the alveolar ridge's height and width. Several reviews reported losses of up to 6 mm horizontally and 2 mm vertically<sup>1</sup>. There are different types of grafts: autografts, allografts, xenografts, and synthetic materials. Each of these graft types has advantages and disadvantages<sup>2</sup>.

The development of the osseointegrated titanium implant system opens an exciting new

avenue with regard to the total rehabilitation of edentulous patients. This is believed to be the future and the preferred technique for mandibular reconstruction<sup>3, 4</sup>.

In one study, stable denture building began three weeks after the procedure; four to six weeks later, hydroxyapatite (HA) was pooled with the autogenous cancellous bone<sup>2</sup>. Mandibular main implants were added concurrently or just after HA augmentation. The use of hydroxyapatite enhanced visor osteotomy procedures and created a wider, more curved and stable ridge<sup>2</sup>. After HA augmentation, prosthodontists achieved fewer denture relines than autografts<sup>5</sup>.

Augmentation should not lead to the need for support, stability or retention for complete denture. Preprosthetic surgery must be combined with prosthodontic treatment. Small variations in the treatment, such as variations in

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facial structure, could significantly increase the success of the prosthesis<sup>6</sup>.

Prosthetic and surgical processes with HA led to enhanced, longer-lasting results; these processes are easy to perform when compared to autografts and alloplasts. Hydroxyapatite can be probably used as “a bone substitute/marrow extender in maxillary and mandibular defects, cysts, and clefts and in osteotomies for orthognathic surgery”<sup>6</sup>. Unfortunately, hydroxyapatite has been utilized in patients who do not need it, which is not improving denture success<sup>6</sup>.

The use of a broad residual ridge with interarch relation enhances support and provides a better-balanced occlusion<sup>7</sup>. Despite the effectiveness of hydroxyapatite, its use is not recommended for all patients. The use of hydroxyapatite for augmentation created some problems in the fabrication of complete denture prostheses<sup>6</sup>. This study is aimed at comparing the effect of ridge augmentation using non-resorbable hydroxyapatite grafts and that using autografts on functional restoration.

## MATERIALS & METHODS

### Study Type

A prospective comparative study was conducted to compare the effect of ridge augmentation using non-resorbable hydroxyapatite grafts and that using autografts on functional restoration.

### Study Place and Period

This study was conducted at the Dental Clinic, Faculty of Dentistry, Al-Azhar University, Assiut Branch, Egypt, over 24 months (January 2012 to January 2014).

### Patient Selection

Forty patients with constructed complete dentures were selected using the convenience sampling method.

### Inclusion and Exclusion Criteria

The patients included in this study were 40–60 years old, free from systematic diseases, partially edentulous, presented with localized bone defects that need augmentation procedures and

with lower flat ridge. Patients with tumor bone defects and systematic diseases and those who refused the operation were excluded from this study.

### Ethical Consideration

This study was approved by the Dental Health Department of the Faculty of Applied Medical Sciences in Albaha University. All participants filled the consent forms. The right of the participants to withdraw at any time was explained and preserved during the study.

### Procedure

The patients were divided into two groups. An alveolar segmental osteotomy was performed, and a vertical distractor was mounted either with an autograft, which was obtained from the autogenous cancellous bone in the iliac crest inlayed grafts (Group I), or with a hydroxyapatite graft (Group II). The vertical distraction began on the fourth postoperative day and lasted for 10–16 days, followed by a consolidation period of two months.

Earlier, mineralization was seen radiographically in the vertically distracted area during the consolidation period and three to 24 months after augmentation. Consequently, a mature bone segment was implanted vertically to lengthen the crest. In Group I, ridge augmentation was performed using an autograft. In Group II, a non-resorbable hydroxyapatite graft was used. A 24-month study and evaluation of non-resorbable hydroxyapatite to augment different alveolar ridges has been described in relation to autograft. The two methods utilized were assessed in terms of outline, altitude and breadth of the alveolar ridge.

### Data Collection

Data was collected from the two groups using a questionnaire for demographic characteristics and an observation checklist for functional stability of the grafts.

### Data Analysis and Procedure

The data was then analyzed using the Statistical Package for Social Sciences (SPSS version 20). The chi-square test was used to test the

differences in the patients' demographic characteristics in the two groups. The independent t-test was used to identify the differences between the two groups. All values were tabulated as the average (mean) with standard deviation (SD). P values less than 0.05 were considered significant, with a confidence level of 95%.

**RESULTS**

As shown in Table 1, the 40 patients who participated in this study were homogenous in terms of their demographic characteristics. There were insignificant differences in variables such as age, education level, and edentulous years (P > 0.05) between the two groups.

**Table 1.** Characteristics of patients in the study

Variable		Group I n1 (%)	Group II n2 (%)	P value
Education level	Illiterate	13 (65%)	18 (90%)	0.09
	Secondary	7 (35%)	2 (10%)	
Age of patients		56.23 ± 1.27	57.55 ± 1.63	0.62
Edentulous years		23.34 ± 3.12	19.89 ± 1.56	0.35

Table 2 shows the mean retention of ridge augmentation in the two groups. In Group I, there was a significant increase in retention after six, 12 and 24 months of using autograft. In Group II, the results also showed the mean retention with no significant difference after six, 12 and 24 months. Group I experienced better retention than Group II after six months.

Table 3 shows that the bone's width after autograft increased to 5.25 mm from 3.5 mm after two years, indicating a significant improvement. However, in the case of the hydroxyapatite graft, the width increased to 4.2 mm from 3.4 mm after two years, which is an insignificant improvement. Table 3 also shows an improvement in the segment lengths in patients who received an autograft (8-13 mm) compared to those who received an HA graft (8.1-9.5 mm).

**Table 2.** Comparison of the retention between ridge augmentation using non-resorbable hydroxyapatite graft and ridge augmentation using autograft

Variable		Autograft Mean ± SD	Hydroxyapatite graft Mean ± SD	P value
Time of evaluation	At insertion	0.03 ± 0.01	0.05 ± 0.00	0.04*
	6 months	0.07 ± 0.02*	0.05 ± 0.00	0.02*
	12 months	0.09 ± 0.03*	0.055 ± 0.001	0.01*
	24 months	0.15 ± 0.05*	0.06 ± 0.003	0.01*

(\*) Significant

**Table 3.** Comparison of the mean and standard deviation of the width and length between Group I and Group II

Time of evaluation	Width of bone				Segment length	
	Autograft		Hydroxyapatite graft		Autograft	Hydroxyapatite graft
	Mean	SD	Mean	SD	Mean	SD
At insertion	3.5	0.4	3.4	0.4	8	8.1
6 months	4.5	0.5	3.9	0.6	9.7	8.6
12 months	4.8	0.2	4.1	0.65	10.2	9.1
24 months	5.25	0.3	4.2	0.79	13	9.5
<b>P value</b>	<b>0.01*</b>		<b>0.07</b>		<b>0.02*</b>	<b>0.09</b>

(\*) Significant

## DISCUSSION

The study revealed that functional restoration in ridge augmentation with a non-resorbable hydroxyapatite graft is less efficient compared to an autograft. It was clear from the findings that there were significant increases in functional restoration with time in the autograft compared to the non-resorbable hydroxyapatite graft.

The results of this study are similar to the results of another study conducted by El-Deeb ME, in which porous hydroxyapatite (PHA) blocks and granules were used in the augmentation of 30 maxillary and mandibular ridges in 28 patients<sup>8</sup>. The period of evaluation was two years in all cases, and patients were evaluated by questionnaires and an observation checklist. The overall prosthodontic assessment showed a 95% improvement in granule cases compared to the preoperative ridge and an 88% improvement was noted in PHA block cases (with an 8% decrease radiographically)<sup>9,10</sup>.

Another study was conducted on 11 patients (with a combined total of 14 atrophic edentulous ridges) who underwent subperiosteal ridge augmentation with porous hydroxyapatite blocks<sup>11</sup>. The clinical evaluation continued for 4.5 to 6.5 years. All patients suffered long-term complications. The authors recommended that porous hydroxyapatite must not be used for augmentation in the future<sup>12, 13</sup>.

A study conducted by Kent on diagnosis, classification, surgical and prosthetic techniques, supporting research, and clinical trials (for the reconstruction of the deficient alveolar ridge with a dense, non-resorbable hydroxyapatite graft) is contradicted by this study<sup>14</sup>. Kent's study demonstrated that the health and state of the surrounding tissue could be improved with the use of hydroxyapatite or hydroxyapatite and bone marrow<sup>14</sup>. The prosthetic and surgical procedures were preferred and have better results than those previously practiced<sup>15</sup>. Conversely, another study produced results comparable to Kent's study, in which particulate hydroxyapatite (HA)

was used to augment mandibular and maxillary ridges.

Prosthodontic evaluation of the retention and firmness of dentures revealed an enhancement five years after the operation. Patients receiving HA ranked their dentures favorably on the basis of the parameters of the Cornell Medical Index. The results of this study revealed that particulate HA alone can be utilized as an acceptable material for the alveolar ridge's augmentation<sup>16</sup>.

This study showed an improvement in the bone width in patients using autografts compared to those using HA grafts (with significant differences). These findings are similar to those of a study conducted in Egypt to evaluate horizontal ridge augmentation. The study, through radiographical evaluation, showed that the ridge width in Group I increased to 4.7 mm and apically to 6.12 mm, which is less than the increase in Group II (width increased to 5.2 mm and apically to 6.9 mm)<sup>17</sup>.

It can be concluded that autografts are better than non-resorbable hydroxyapatite grafts when it comes to restoring function using ridge augmentation. The findings showed that there was a significant improvement in patients with autograft ridge augmentation compared to patients with non-resorbable hydroxyapatite grafts.

The study's strengths are that it compares two different methods of implant ridge augmentation and has a long evaluation period (24 months). It is only limited by its small sample size in Saudi Arabia. Future studies will yield more useful results if conducted on a larger sample size with complete randomization all over the world.

## CONFLICT OF INTEREST

I declare that this study is my own work. It was not submitted to any other journal. I also declare that I have no conflict of interest related to this study.

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