ABSTRACT

Aim: The aim of this study was to assess bone healing in large bony defect after enucleation of large jaw cyst without using graft material.

Materials and Methods: Twenty patients with large jaw cysts (average size: 6x3 cm) were treated by enucleation. Postoperative clinical examination and digital Orthopan tomogram were performed for all cases at one day, then at 6, 12, 24 months postoperatively. The rate of bone healing in the large bony defects was measured using Direct Digital radiography for densiometric analysis of bone density during follow up period.

Results: analysis of the postoperative radiographs showed reduction in size of the residual cavities and gradual increase in bone density in all bony defects all over the follow-up period in all cases. The percentage of change in bone density in mandibular bony defect was 72.2% while for the maxillary bony defects, it reaches to 79.9% at 24 months postoperatively.

Conclusion: Spontaneous bone regeneration could be obtained after enucleation of large jaw cysts without use of bone grafts.

INTRODUCTION

Bone defects accompanied jaw cysts are frequently observed because odontogenic cysts are common and their healing causes physiological effects in the bone by constant dynamics of bone resorption and apposition1.

It was reported in recent studies that the radicular cysts compromise between 42 to 44% of all apical lesions. While dentigerous cysts are the second most frequent cysts after radicular cysts. Their frequency had been estimated as 1.44 cysts for every 100 unerupted teeth23. Also odontogenic keratocyst represent about 11% of all jaw cyst29.

Enucleation is the treatment of choice for most jaw cysts. The small remaining cavities after enucleation could be healed spontaneously by the normal bone healing mechanism. While in the large bony defects,
there is some controversy about the management of the large residual bony cavities with or without using bone grafts. Many studies concluded that the bone grafts should be used to reduce risk of jaw weakness and to shorten the period of healing after cyst enucleation. It was reported that the fewer the number of remaining bony walls in the residual defects, the greater the need for osteopromotive techniques. On the other hand, some researches supported that the remaining cystic cavities for implant installation. While other researches reported that spontaneous bone healing could be occurred without use of bone graft. The increase in bone density was 48% after 12 months and 91% after 24 months as compared with the immediate postoperative values, as seen after marsupialization of large jaw cysts. Hern and Miliavec stated that the success of spontaneous bone healing is directly related to the size of bony defects, the anatomical location, the patient’s age and other parameter such as monocortical or bicortical defect.

So the aim of this study was to evaluate the extent of spontaneous bone formation after surgical enucleation of large bony cysts without using of any grafting material.

MATERIAL AND METHOD

Twenty (12 females, and 8 males) patients had large bony defects, after surgical enucleation of their bony cysts, were included in this study. Their age were ranged from 20 to 30 years with average 25 year. The predominant were with odontogenic keratocysts (10 cases 5 in mandible and 5 in maxilla), followed by radicular and dentigerous cysts (5 cases for each).

Preoperative panoramic view for the lesions, followed by incisional biopsy was done under local anesthesia for pathological examination. The patients with radicular cyst were treated with enucleation, while in case of dentigerous and keratocyst, decompression was done for three months followed by enucleation in case of dentigerous cyst and enucleation with peripheral s solution in case of keratocyst to avoid their recurrence. The affected teeth were either extracted or endodontically treated followed by apicectomies.

All cases were treated in Oral and Maxillofacial clinic of Al Zahra hospital, Al Azher University. Ten patients had mandibular bony defects while the others had maxillary defects after cysts enucleation. In all cases, the defects were monocortical and the lingual or palatal bone remained intact after surgery, as well as the inferior border of the mandible with preservation of the covering periosteum for all cases. The dimensions of the bony defects were with average mean size 2.5x6 cm. Primary closure was done in all cases without using any grafting materials in the remaining bony defects. (Fig. 1)

Clinical and radiographic assessment

Follow-up was based on both clinical and radiographic evaluation. Radiographic assessment was done, immediately and at 6, 12, and 24 months postoperatively using direct digital panoramic images (Orthophos 3, Sirona dental System, Germany, 64kV, 16mA). The postoperative radiograph was taken immediately after surgery to act as starting point to calculate bone density in the bone defect immediately after surgery and the rate of bone healing that occur during follow up period that extend for 24 months. Three points were determined on each X ray on cystic lesion, these points were on the same central horizontal plane and two cm apart from each others.

destructive large lesions preoperatively and at 24 months post operative to determine the relation of these lesions to important structures and also help in evaluation of bone healing in buccolingual dimension postoperatively using postoperative axial cuts.

Each digital radiograph were analyzed using the Direct Digital Radiography. The relative bone density of the pixels of the bone defects was measured 3 times for each point to diminish errors, then the mean values for bone density for each defect were recorded at 6,12 and 24 month.
assessments of bone healing in large results

Post operative clinical and radiographic follow up were done immediately and at 6, 12, 24 months. In all cases the clinical healing patterns were similar. Primary closure was obtained in all cases with spontaneous bone regeneration. Infection, and defect in healing or recurrence.

Radiographic analysis using Digora revealed that there were gradual reduction in size of bone defect in all cases during follow up period. Also, there were gradual increases in bone densities in both mandibular and maxillary defects. The mean value of bone density in mandible was 143.6 one day postoperative which increased to 223.8 at the end of follow up period. While, that of maxilla was 135.5 one day postoperatively that increased to 203 after 24 months postoperatively as seen in table (1) and Figs (2, 3, and 4).

The percentage of change in the mean value of bone density in mandibular defects, after cyst enucleation during follow up period, was 22.94, 33.30, 56.4 and 79.9% at immediate, 6, 12, and 24 months respectively. While that of maxilla was 18.81, 32.3, 53.06, and 72.20% on the same follow up period. This increase in the percent of change in bone density over time intervals was statistically significant with p<0.001 (Table 2).

FIG. (1) Shows large bony defect of about 5 x 4 cm after enucleation of maxillary cyst (the defect was left to heal spontaneously).

### TABLE (1) Shows the mean value of bone density in large bony defects in mandible and maxilla after cyst enucleation during the follow-up period

<table>
<thead>
<tr>
<th></th>
<th>1 day postoperatively</th>
<th>6 months postoperatively</th>
<th>12 months postoperatively</th>
<th>24 months postoperatively</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>mandible</td>
<td>143.6</td>
<td>15.09</td>
<td>170.3</td>
<td>21.59</td>
<td>190.3</td>
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<tr>
<td>maxilla</td>
<td>135.5</td>
<td>16.49</td>
<td>155.5</td>
<td>17.68</td>
<td>175</td>
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<tr>
<td>p-value</td>
<td></td>
<td></td>
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</tbody>
</table>

### TABLE (2) Shows the percent of change in the mean value of bone density in large bony defects in mandible and maxilla after cyst enucleation during the follow-up period

<table>
<thead>
<tr>
<th></th>
<th>Percent change One day</th>
<th>Percent change 6 months</th>
<th>Percent change 12 month-post</th>
<th>Percent change 24 month-post</th>
<th>p-value</th>
</tr>
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<td></td>
<td>Mean</td>
<td>SD</td>
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<tr>
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<tr>
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<tr>
<td>p-value</td>
<td></td>
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</table>
A- Immediate postoperative panoramic radiograph for bone defect after keratocyst enucleation and Carnoy’s application.

B- Healing of the bony defect at 12 months postoperatively.

c- Healing of the bony defect at 24 months postoperatively.

FIG (2) Digital panorama showed spontaneous bone healing and increase in bone density of anterior mandibular bony defect (6.5x2.5 cm) during follow-up period at immediate, 12, 24 months postoperatively.

Fig. (3) Preoperative CT scan (axial cut) for dentigerous cyst with impacted canine causing resorption of anterior wall of maxilla.
Bone reconstruction is an essential requirement for the complete functional rehabilitation after jaw surgery. Although, many studies support the use of different bone grafts to reduce risk of jaw weakness and to shorten the period of healing after cyst enucleation, the results of the present study showed that proper healing and spontaneous bone regeneration was occurred in all large bony defects without use of any grafting materials. Taking in account that all bony defects were more than 50 mm in diameter, monocortical, and preservation of covering periosteum were done in all cases. This physiological healing occurred by organization of the blood clot which presence of large cystic cavities which are surrounded by enough bony walls.

This result is in agreed with results obtained by Schmitz and Hollinger. They divided bony defects as critical and non critical size defect according to the number of their surrounding walls, and proved that, the defect with two walls lost is non critical size defect and can heal spontaneously in spite of its size while the defect that have only one wall and lose all other walls is a critical size defect and need for reconstruction.

Hern and Milijavec studied spontaneous healing of large bony defects in the mandibles of 33 patients with clinical and radiographic examinations at 2, 6 and
12 months. They concluded that, the spontaneous bone regeneration occurred in all patients clinically, and the computer analysis of radiographs showed that the bone density of the surrounding healthy bone.

healed with 84% of the bone density of the surrounding bone. Furthermore, there was a study, used rabbit skull, showed that the unicortical bone defects larger than 8 mm healed perfectly but the full thickness bicortical bone defects greater than 15 mm in diameter failed to heal spontaneously.

The results of the present study, reveled that there were increase in bone density during the follow-up period. This agrees with the results which were reported by Pradel et al. They concluded that the bone density will be increased by 48% after 12 months and 91% after 24 months as compared with immediate postoperative values after enucleation of large mandibular cysts without grafting.

Chiapasco found that, the bone healing could be occurred and completed with no need for bone grafts in all cystic cavities whatever their sizes.

On the other hand, many researches advocate the use of alloplastic materials fill bony defects after cyst enucleation. In spite of they are greatly reducing the morbidity and risk of autogenous bone graft complications and they are available in unlimited quantities, they have reduced osteogenic activity and their replacement with a new bone is a very slow process which delays bone healing. Furthermore, synthetic bone grafts have drawbacks particularly in a vascular compromised environment. Moreover, alloplastic materials don’t integrate immediately with the surrounding bone and therefore the strength of the mandibular segment is not significantly increased.

Horowitz and Bodner stated that there was a percent of failure (20% of 20 cysts) in cases treated with grafts (autogenous and xenograft) after enucleation. The exudation and exfoliation of the grafts was recorded that necessitated graft removal with further operation and delay in bone healing. In addition, there were performed by Bodner and Marx et al measured the healing of jaw defect after cyst enucleation. The results were evaluated by comparing the density of the affected area at 6, 12, 24 and 36 months. They found that, cyst defects, and recorded that there were postoperative complications in 12.5% of the cases.

Some reported that the healing of bony defects depend on the preservation of the periosteum where it has an osteogenic activity and this coincide with the study of about 30 mm segmental bone defects in dog mandible, almost half of the bone volume formed spontaneously with periosteum preservation and titanium mesh protection.
So, on the basis of these results, it could be concluded that bone regeneration can occur after surgical removal of large jaw cysts without the aid of any graft materials with accepted clinical and radiographic criteria despite of their sizes. This will simplify the surgical procedure, decrease economic and biological costs, and reduces the risk of postoperative complications.

REFERENCES


10-Schmitz J, and Hollinger J: The critical size defect as an experimental model for craniomandibular non


of calvarial split bone grafts after alveolar ridge

2006.


18-Aaboe M, Pinholt EM, and Hjorting-Hansen E: Unicortical critical size defects of rabbit tibia is larger


20-Hallman M, Sennerby L, Zetterqvist L, and Lundgren S: A 3-year prospective follow-up study of implant of deproteinized bovine bone and autogenous bone


21- Esposito M, Grusovin MG, Worthington HV, and teeth: bone augmentation techniques for dental

22-Aghaloo TL, Moy PK, and Freymiller EG: Evaluation of platelet-rich plasma in combination with freeze-


J, and Vahalova D: The sinus lift with phycogenic


25- Macdonald -Jnkowski DS: Traumatic bone cysts


26 -Horowitz J: Use of xenograft bone with aspirated bone marrow for treatment of cystic defect of the jaws


27-Bodner L: Osseous regeneration in the jaws using de-


27-Bodner L: Osseous regeneration in the jaws using de-


27-Bodner L: Osseous regeneration in the jaws using de-


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