

Marsupialization as a Treatment Modality of Large Jaw Cysts

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Abstract: This study was conducted to evaluate the actual outcome of marsupialization when it is applied as the sole treatment of large jaw cysts. Twenty patients were included, where cyst marsupialization was performed, spiral CT scan was utilized in diagnosing, treatment planning and follow-up of the patients at 3 months, 6 months and 12months intervals. Results showed, that marsupialization is a reliable procedure for treatment of large jaw cysts, with complete elimination of the cystic cavity both clinically and radio-graphically in thirteen cases, while significant reduction in the size of the cavity was shown in the remaining seven cases. However it is expected that there will be complete elimination of the cavities within those patients at a longer follow-up period.

Key words: Marsupialization • Spiral C.T. scan • Dentigerouscysts • Obturator

INTRODUCTION

Marsupialization of cysts consists of the establishment of a pouch of what was formerly enclosed cyst. The pouch can be produced surgically through creating a window by removing a generous section of the overlying mucoperiosteum, bone and adjacent cyst wall to decrease intra-cystic tension. The border of the incised mucosa is then sutured to the border of the cyst wall that has been cut completely around its circumference. Ideally the window should be as large as possible, otherwise the continuity of the cyst membrane may be re-established and the cyst will refill and expand again [1].

Accordingly marsupialization is indicated in the following cases;when a cyst other than dentigerous cyst is enlarged between unerupted teeth and oral cavity. In a child if the development of the displaced teeth has not progressed very far and enucleation will expose and damage the developing tooth germs [2].

Marsupialization is also indicated when a cyst involves the apices of many adjacent erupted teeth and

when enucleation could prejudice the support and vitality of these teeth [3]. If there is concern that enucleation and primary closure of a large cyst may lead to a pathological fracture [4].

Marsupialization has also a particular application in the very elderly or for patients who are not fit for a general anesthetic because of advanced cardiac or respiratory disease or where there are other serious problems such as hemophilia [5].

Marsupialization of odontogenic cysts is probably successful, because of a variety of factors, which are ; the inherent tendency for the cyst lining to contract, probably due to the myofibroblasts in their walls, once the liquid contents are released . This allows endosteal bone formation to take place [6]. On the other hand, as the cyst lining shrinks there is also a marginal ingrowth of marginal of normal mucoperiosteum may provide additional bone regenerative factors [2]

Among the disadvantages of marsupialization, is that this procedure results in a cavity which needs to be irrigated free of stagnant food debris at regular intervals.

It therefore requires a pack or plug to obdurate the opening and prevent premature closure [7]. Furthermore the cavity created, might affect speech, if large and left uncovered might alter the voice [5]. Regular follow-up visits are necessary to see that the cavity is filling up in a uniform fashion and to adjust the size of the acrylic plug [2]. Pogrel *et al* [8], stated that marsupialization requires a cooperative patient to irrigate the cavity to keep it open, they also concluded that the cyst lining is replaced by normal epithelium during this treatment, they sought that the marsupialization can be a definitive treatment for the odontogenic keratocysts.

Can be a definitive treatment for the odontogenic keratocysts [8]. However, the poor judgment of marsupialization as the sole treatment of jaw cysts might be related to certain factors like; limited size of surgical opening, lack of meticulous care of the cystic cavity and short follow up time of the patient. It was further claimed that if those factors are well planned for, the results can be greatly enhanced [9].

While attempting to solve this controversy, another problem will be faced, this problem is the limitation imposed on evaluation of the results of marsupialization by conventional radiographic techniques. Those techniques are incapable of determining exact amount of reduction in the size of the cystic cavity. Fortunately, new radiographic techniques have evolved which are far more precise in evaluating the condition of the maxilla and the mandible, the most important of those techniques is Spiral Computed Tomography [10].

The spiral C.T. fostered by the Dentascan software allows imaging the mandible and the maxilla in three planes: axial, panoramic and cross sectional. this technique would allow precise measuring of the true dimensions of the jaw lesions in those three planes [11] the dental C.T. images are displayed with a very low contrast setting (bone window) due to excellent contrast between bone and soft tissue. Since no contrast medium is used and displaying soft tissue details with digital enhanced contrast (soft tissue window) is usually not necessary, digital C.T. is ideally suited for applying dose-reduced investigation protocols [12-14]. This is primarily accomplished by reducing the tube current, which leads to increased quantum noise noted in the soft tissue compartment, whereas bone is only marginally affected. In addition, using 1.5mm slice thickness instead of 1.0mm. and/or using spiral technique with a pitch factor of more than 1.0mm can further reduce dose delivery [14].

Spiral C.T. seems to be a promising method when used in conjunction with a variety of surgical procedures.

As a matter of fact, some literature focused on the evaluation of marsupialization using spiral C.T. scan. In 1998 Bonder *et al*, [15] conducted a study on the characteristics of bone formation following marsupialization of jaw cysts [15] C.T. with multiplanar reconstruction (MPR) was performed on 23 patients with cysts of the jaw pre-operatively and 3-4 months after marsupialization. Then, the two images were compared for the three dimensional outline of the cyst, the distance between the cyst and adjacent structures (vital teeth, maxillary sinus, nasal cavity and mandibular canal) and the integrity of the cortex and mandibular canal. The characteristics of the new bone formation were also determined. The outline of the cyst was changed and partially reduced, the distance between the cyst wall and adjacent structures was increased. There was remodeling of the cortex and mandibular canal. The new bone formed at the periphery of the cyst showed either a ground glass appearance or radial bone spicules. They concluded that, C.T. with MRI are useful evaluation of morphological changes and bone formation following marsupialization of jaw cysts in mandibular. C.T. with MPR is the technique of choice for the maxilla and the entire body of the mandible and coronal C.T. for cysts in the mandibular angle and ascending ramus. Cysts can be enucleated safely as early as 3 months after marsupialization [15]. Fortin *et al* [16] documented a case of marsupialized dentigerous cyst with an amalgam. The surgical challenge was removing the amalgam from the cystic lining with zero visibility. To achieve this the surgical procedure was computer assisted and used 3D images. Distances between amalgam and various anatomical landmarks were assessed in-order to define a path from the top of the ridge to the amalgam. The path was reconstructed at the surgical site and the amalgam removed by the suction. Orthodontic treatment was associated with the surgery. Three dimensional imaging is a useful procedure for deciding on the type of surgical technique likely to minimize trauma [16].

In the present study, the use of spiral C.T. in conjunction with marsupialization procedure is further tested, to utilize marsupialization as the sole treatment of large jaw cysts.

MATERIALS AND METHODS

This study included twenty patients with large jaw cysts encroaching on nearby vital structures, who were attending Oral Surgery Department in Faculty of Dentistry, Alexandria University. All patients signed an informed consent form, before undergoing any procedure included in this study.

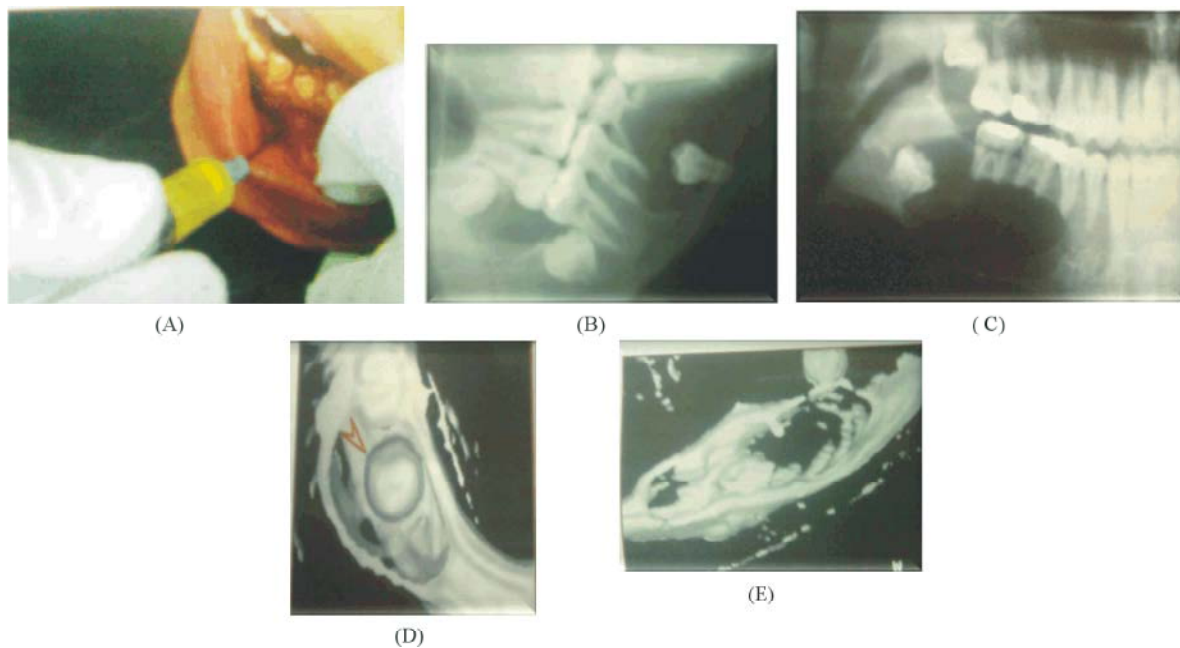


Fig. 1a: Showing yellowish straw color aspirate from large radicular cyst of the mandible.

Fig. 1b: A preoperative radiograph showing displaced impacted mandibular second bicuspid as a result of tension build up from dentigerous cyst created around its neck.

Fig. 1c: Panoramic x-ray revealing a mandibular third molar related to marked radiolucency extending from the apex of the mandibular second bicuspid to the ramus of the mandible.

Fig. 1d: Spiral 3D CT scan showing the crown of the impacted mandibular second bicuspid located at almost the center of the cavity of the body of the mandible. No lingual bony expansion, however, the buccal plate of bone showed expansion with areas of bone destruction.

Fig. 1e: Three dimensional Spiral CT showing marked resorption of the body and ramus of the mandible.

Methods: All patients underwent clinical examination; including history taking, with the reported chief complaint, duration and site of swelling, history of any previous intervention, any other accompanying symptoms, as well as the past medical and dental history.

Clinical Extra-oral Examination: General look, asymmetry, condition of lymph nodes related to the oro-facial lesion, all were recorded, together with the intra-oral examination which is involved with describing the lesion (site, size, consistency,) and inspecting the anatomical site of the swelling, condition of teeth, gingival, and oral mucosa. Further investigation including percussion of the teeth for sensitivity, vitality test of the teeth associated with the swelling and syringe aspiration (Fig. 1).

Radiographic Examination: All the patients within this study were examined preoperatively by panoramic X-ray films. Images were generated using Helical CT utilizing a dental scan software program. Panoramic views and Spiral

Computed Tomography (Spiral C.T.) were performed pre-operatively and postoperatively to determine the dimensions of the initial cystic cavity and compare and follow-up the progress of healing of the cystic cavity after marsupialization.

Panoramic Views: They are generated at right angles to the plane of the original axial slices and are useful for locating anatomical landmarks such as inferior dental canal, incisive canal and the maxillary sinus. About 5-10 panoramics spaced 1-2mm apart and generated from a stack of closely spaced axial slices should be sufficient to cover the entire jaw. Computer generated panoramic differs from the conventional OPGs in that the image is a true cross-section, not a projection and there is no magnification or distortion. Consequently, they can be printed out life-size for direct measurement. Cross sectional views: they are in general the most useful views, for indicating the bone quality especially whenever a pathologic process encroaches upon the jaw bones. It should be noted that each CT view could be related to



Fig. 2: Showing the suturing of the oral mucosa to the edges of the cystic lining.

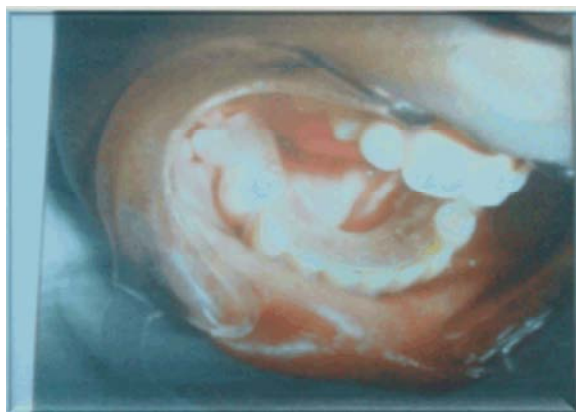


Fig. 3: A photograph showing the acrylic plug fixed in place to function as an obturator as well as a space maintainer for the vertically impacted second bicuspid.

the other by a series of scale marks that appear on the film. Marks, which run along the side of cross sectional and panoramic images, correspond to the direct axial slices that are used to reformat the images. A millimeter scale displayed on the bottom of the cross sectional films are used to verify the degree of magnification and to obtain accurate measurements. The effective dose of the standard DentaScan Protocol is around 8.16.

General Steps of Marsupialization Procedures: If the cyst has perforated through the bone and this perforation is within the range of one of the surface dimension of the cystic cavity, a scalpel was stabbed directly through the oral mucosa and the underlying cyst lining against the bone edge and an opening was made into the sac by cutting from inside the cavity out against the bone margin, If the cyst has not perforated through the bone,

or the perforation is less than one third of the surface dimension of the cyst cavity, an inverted U shaped flap based on the buccal sulcus was created. Following reflection of the mucoperiosteum, the bone was cut to the appropriate dimensions. Then the cyst lining was cut around the bone margins and specimen was sent for histo-pathological study, if necessary; the margins of the oral mucosa and the cyst lining were sutured together (Fig. 2). An iodoform gauze drain was placed in the cavity to keep it opened. In indicated cases, when a non-vital tooth was involved in the cystic lesion, marsupialization was performed through extraction of that tooth.

Patient Post-Operative Care

Immediate Follow up: This period extended for the first two weeks after surgery, where the patients were given antibiotic therapy for three to five days in the form of Amoxicillin 500mg tid following the first five days the sutures and the drain were removed.

Delayed Follow up: This period followed the immediate phase and extended for twelve months. An acrylic plug was constructed to seal the cystic cavity and prevent food impaction. The patients were instructed to irrigate the cystic cavity with diluted hydrogen peroxide after every meal. For the first week, the patients were examined daily, then for the next three weeks they were examined twice a week. Starting from the second month, the patients were examined once a week. The clinical examination focused on the condition of cyst lining, the mucosa surrounding the opening, the cleanliness of the marsupialized cavity and the need for any adjustment for the acrylic plug (Fig. 3).

The patients were examined by Spiral CT three months post-operatively. Further follow ups were performed with panoramic x-ray films at six and twelve months intervals.

RESULTS

From the twenty patients included in this study, 12 are males and 8 are females their ages ranged from 13 to 55 years old, with a mean of 24 years old. All patients were complaining mainly of a significant painless hard swelling, 70% of the patients had posterior mandibular swelling, and 30% had posterior maxillary swelling.

Clinical Results: In our series of patients, 7 cases suffered from dentigerous cyst, 9 cases had large periapical cysts, while the last 4 cases presented with



Fig. 4: 3 months postoperative 3D Spiral CT Scan showing marked shrinkage of the expanded buccal bone in comparison with the preoperative one (Fig.1D).

residual cysts. All those lesions were significantly large, the size of the lesion and the associated facial asymmetry were the main factors to attract the patients attention to seek treatment. The lesions were associated with significant bony expansion and cortical bone perforation. Syringe aspiration was positive for cystic fluid in all of the cases, lesions were located mostly in areas where encroachment upon nearby vital anatomical structures would be highly suspected like inferior alveolar canal, or the maxillary sinus.

Frequent follow up visits applied in this study proved to be an important indicator of the patient's willingness to co-operate. 16 patients followed the excessive follow ups schedule while the other 4 patients were less committed, as expected the progression of healing in the latter group was much less significant than the first group. All twenty patients stated that they performed daily irrigation of the cystic cavity, but most probably the commitment of those four patients to the daily irrigation was not any more significant to their commitment for the weekly follow up visits.

Radiographic Results: The use of Spiral CT dental scans for determining the progression of healing of the cystic cavity were proved to be less beneficial than those preoperative dental scans. In the postoperative views taken three months following the procedure, the cavity seemed to be filled with radiopaque bone, (Fig. 4). Panoramic x-ray films proved much better for postoperative follow ups, since they were more sensitive to changes taking place in the cystic cavity.



Fig. 5: Panoramic radiograph showing the surgical defect after removal of retained primary second molar.



Fig. 6: 3 months postoperative panoramic x-ray, showed somewhat increased radiopacity of the cystic lesion with coronal eruption of the impacted mandibular second bicuspid.



Fig. 7: 6 months postoperative panoramic x-ray showing more increase in the radiopacity of the cystic cavity with more coronal eruption of the impacted mandibular second bicuspid.



Fig. 8: 9 months postoperative radiograph showing more coronal eruption of the impacted mandibular second bicuspid .Note the increased opacity at the lower border of the mandible due to the coronal migration of the impacted bicuspid.

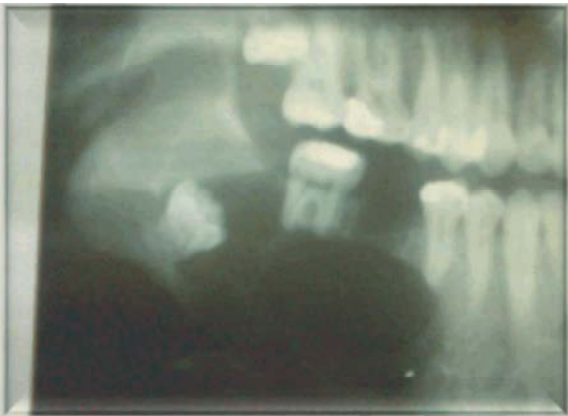


Fig. 9: Panoramic radiograph showing immediate postoperative after extraction of the first molar for depressurizing of the dentigerous cystic cavity.



Fig. 10: Panoramic x-ray showing the healing process at 3 months postoperatively.



Fig. 11: Panoramic x-ray showing the healing process after 6 months postoperatively.

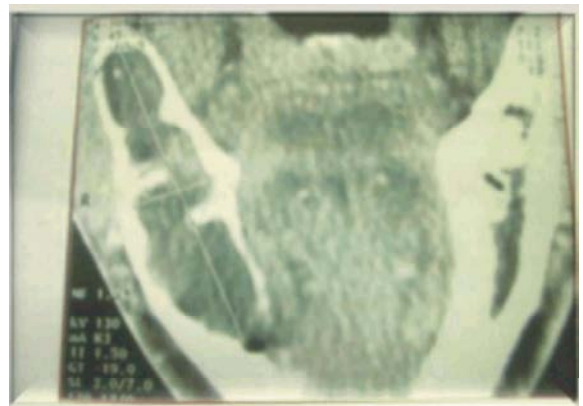


Fig. 12: Coronal CT Scan revealing the presence of large cystic cavity involving both the body and ramus of the mandible and measuring 2.7cm length, and 1.8 cm width.

In addition the surgeon doesn't need any accurate information right now about the extent of the lesion. Therefore Panoramic x-ray films are excellent for postoperative follow ups, especially that they are much cheaper and associated with much less exposure to x-rays (Figs. 5,6,7,8,9,10, and 11).

However, axial CTs can still be used to show the exact reduction in size of the cystic lesion in debatable cases, (Fig. 12).

The Final Outcome: Panoramic radiographs taken at three, six and twelve months intervals post operatively showed progressive obliteration of the cystic cavity. Thirteen cases showed radiographic evidence of cavity obliteration in the period of twelve months. While the remaining seven cases

showed obvious clinical reduction in the size of the cystic cavity by the end of the twelfth months. Among those seven patients were the four patients with reduced level of commitment to the postoperative care of the cystic cavity.

DISCUSSION

Several doubts have been raised regarding the efficiency of marsupialization for the treatment of jaw cysts. Many surgeons find it necessary to follow marsupialization procedure with enucleation to ensure complete removal of the pathological cavity. Others consider marsupialization is contraindicated for treatment of certain types of cysts, especially Keratocyst. Some other surgeons prefer to take the risk of applying enucleation in case of large jaw cysts because of lack of confidence in the efficiency of marsupialization [5]. However a load of research work has proved that marsupialization is an adequate method of treatment of large jaw cysts. Pogrel and Jordan [8], in their study showed that marsupialization allowed complete resolution of odontogenic keratocysts both clinically and radiographically in a period ranging from 7 to 19 months.

Nakamura *et al* found that this procedure does not appear to affect the recurrence tendency of odontogenic keratocysts and the probable changes in growth characteristics become rather less aggressive. The research conducted by Ninomiya *et al.* [17], suggested that, marsupialization may reduce the size of odontogenic keratocyst by inhibiting IL-1 alpha expression and the epithelial cell proliferation. Sakkas *et al.* [18], reached the conclusion that marsupialization is a well established, nonaggressive treatment of large odontogenic cysts and shows advantages in preserving vital structures, with reduced risk of pathological mandibular fracture. The patient however must be compliant and accept the prolonged treatment of marsupialization.

Our results came in agreement with the above mentioned authors and confirmed an additional advantage for marsupialization, when applied in treatment of dentigerous cysts which is the eruption of the offending tooth following the extraction of the retained deciduous tooth through which marsupialization of the cyst was made. Accordingly the function of that tooth was restored and this result came in accordance with many other authors, [19,20].

In addition to the evaluation of the efficiency of marsupialization, our study was concerned with the evaluation of the use of Spiral CT for the management of jaw cysts. All x-ray transmission –based radiographs suffer the limitation in that they are two dimensional projections of complex intrinsically three dimensional anatomy. Superimposition of other structures hinders traditional methods of dental radiography for viewing internal dental anatomy. Greater number of conventional films are thus needed with an increased total radiation dosage to the patient [21]. Precise detailed anatomical images are not possible due to the jaw's complex, curving surfaces, artifact from dental restorations and improper patient positioning [22]. In an attempt to eliminate the imaging problems of the mandible and maxilla, a computer program that reassembles data from a series of axial CT scans into a complete series of oblique cross-sectional and panoramic CT reformations was designed. This is the multiplanar reformation or Dentscan [23]. DentaScan is a computed tomography (CT) software program that allows the mandible and the maxilla to be imaged in three planes; axial, panoramic and cross-sectional. DentaScan also demonstrated, true cross sectional (para-axial) images which revealed the bucco-lingual extension of the pathologic lesion and its relation to the vital anatomic structures and thus provided a more precise localization of the lesion and a more accurate image of the normal anatomical structures of the mandible and the maxilla [24].

CONCLUSION

Spiral CT imaging of the jaws helped significantly in the diagnosing of cystic lesions and determination of the extent of the lesion and its proximity to the nearby vital structures. However, Spiral CT didn't prove to be highly efficient in determination of the progression of healing of the cystic lesion. The first follow up image which was taken three months following the surgery, showed significant change in the cystic lesion. However images taken later at subsequent intervals didn't show considerable difference from the first follow up image. Therefore, spiral CT is not a highly sensitive imaging technique for evaluation of progression of healing of the cystic lesion.

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