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Effect of decompression on cystic lesions of the mandible: 3-dimensional volumetric analysis

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Abstract

Decompression is effective in reducing both the size of cystic lesions on jaws and the associated morbidity of resection. However, quantitative measurement of reduced volume after decompression among different cystic diseases has not been fully investigated. We have retrospectively investigated the difference in reduction in volume among keratocystic odontogenic tumours (n=17), unicystic ameloblastomas (n=10), and dentigerous cysts (n=10) of the posterior mandible using 3-dimensional computed tomography (CT). Various other influential factors such as age, sex, the presence of impacted teeth, and the number of drains were also recorded. There was no significant difference in the speed of shrinkage among the 3 groups, but there was a significant correlation ($p<0.01$) between the initial detected volume of the lesion and the absolute speed of shrinkage in each type of cyst. Initial volume was also significantly associated ($p<0.01$) with reduction of total volume in each type of cyst. Age may correlate negatively with the rate of reduction in dentigerous cysts, which means that the older the patient is, the less the reduction. Treatment seemed to last longer as the speed of shrinkage lessened in the keratocystic tumours and dentigerous cysts ($p<0.05$) as multiple regression has shown. The relative speed of shrinkage of unicystic ameloblastomas seemed to be slower when an impacted tooth was involved in the lesion ($p=0.019$). However, the sample size was too small to make any definite statistical statement. These results suggest that the rate of reduction of volume was related to the original size of the lesion. Despite the need for a second operation and longer duration of treatment compared with excision alone, decompression is a valuable way of reducing the size of large cystic lesions, with low morbidity and recurrence rate. There was no difference in the rate of reduction according to the underlying histopathological picture.

Keywords: Surgical decompression; Odontogenic tumor; Ameloblastoma; Dentigerous cyst

Introduction

Decompression is an effective treatment for large cystic lesions of the jaw, with low morbidity.[1–3] The size of cystic lesions decreases after relief of intracystic pressure by decompression, and for large lesions adjacent to vital structures such as the inferior alveolar nerve and vital teeth it is a conservative treatment that avoids local damage. Spontaneous eruption of impacted teeth has also been reported when a cystic lesion has shrunk.[4–6]Marsupialisation and decompression are different procedures, but they share the same main principle. Marsupialisation entails creating a large window in the bone followed by connection of the inner cystic wall to the oral mucosa, which results in a wide open lesion that drains easily.[7] During decompression, however, a small hole is made in the cystic cavity, and a tube or stent is anchored for drainage and continuous irrigation.[8] A critical size defect remains after

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marsupialisation but the defect after decompression is smaller, which helps patients to recover without large bony defects and enables primary closure after the second operation.[9]

Despite the benefits of conservative treatment, the quantitative measurement of reduction of volume after decompression has not to our knowledge been fully investigated. We know of 2 reports of volumetric analysis using computed tomography (CT).[10,11] One was confined to keratocystic odontogenic tumours, and calculated the pattern of shrinkage according to the exponential function,[10] while the other dealt with all 3 cystic lesions at once.[11] The correlation between reduction of volume and age among different kinds of cystic disease has also not yet been studied to our knowledge.

The aims of this retrospective study were to investigate the difference in reduction in volume among keratocystic odontogenic tumours (n=17), unicystic ameloblastomas (n=10), and dentigerous cysts (n=10) using 3-dimensional CT, and find out which factors influence shrinkage.

Patients and Methods

Patients

We studied 37 patients who had cystic lesions decompressed at the Department of Oral and Maxillofacial Surgery in Seoul National University Dental Hospital from 2004 to 2013. Seventeen patients had keratocystic odontogenic tumours, 10 had unicystic ameloblastoms, and 10 had dentigerous cysts, and had had CT images taken before and after decompression. Patients with initial lesions of the posterior mandible or ramus without a fistulous tract were selected. Patients were excluded if they had an acute infection, multilocular lesions, or basal cell nevus syndrome.

Patients were treated by decompression and concurrent incisional biopsy, which provided histological confirmation of the diagnosis. Because part of the cystic lining was removed for biopsy, the window was wide enough for sufficient drainage on the buccal or alveolar crest. It is important to remove solid contents or fluid by gentle curettage followed by copious irrigation, because the material may become thickened and hinder drainage during decompression. We tried to separate the operative field from the oral cavity so as not to spread tumour cells during irrigation. Involved teeth that were mildly to moderately mobile could be saved, although root canal treatment was needed.

One or two polyethylene drains were anchored to the oral mucosa in each lesion for drainage and irrigation with saline. Patients were recalled for follow-up periodically over several months. The lesions were removed if the size of the lesion did not decrease appreciably. Either enucleation of the cyst by curettage, or excision of the mass with or without ostectomy, was the second-stage procedure. Some lesions were not removed because the patient refused, or because spontaneous dissolution was expected.

This work was approved by the Clinical Dental Research Institute in Seoul National University Dental Hospital (IRB No. CRI14003). The inspector was unaware of the patients' names and identifying information.

Methods

The various factors that influence the pattern of shrinkage include age, sex, initial and final volume, speed of shrinkage, number of drains, and presence of impacted teeth within lesions. Duration of decompression was measured from the date of decompression to the date of the final CT examination, which was made when cystic lesions did not shrink adequately on monthly checkup by panoramic radiography.

Images 0.75 mm thick were obtained with a CT scanner (SOMATOM Sensation 10, Siemens AG, Berlin, Germany), and the measurements were 120 kV and 100 in quality reference mAs. A cone-beam CT scanner (Dinnova3, Willmed, Seoul, South Korea) was also used. The exposures were 24 seconds/rotation at 100 kV, 9 mA, and 0.2 mm of reconstruction slice thickness. A detector (Varian 3030, Varian Medical Systems, Inc., Palo Alto, California) was also used. Differing images between the two scanners can yield inaccurate data, although software programs can compensate by constructing the images with unified variables.

Mimics 13.1 (Materialise NV, Leuven, Belgium) software was then used to measure the total volume of each patient's lesion. The cross-section of the lesion was demarcated on slices of CT images, and the demarcated images filled up to reconstruct the 3-dimensional structures before volumetric measurement (Fig. 1).

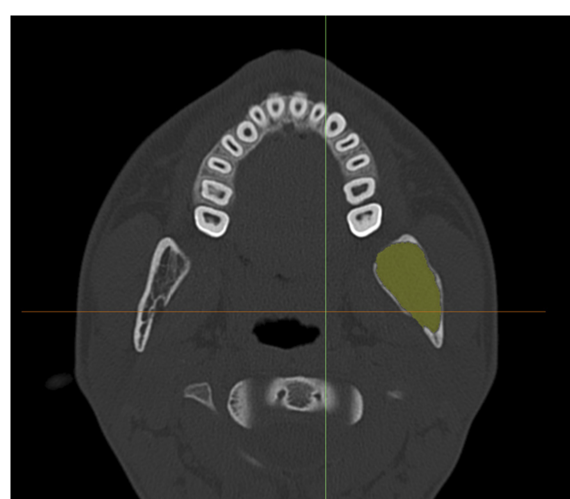

Fig. 1. Three-dimensional volume analysis using computed tomography CT. Cross-sectional CT images of each lesion were demarcated, and the demarcated images filled up to reconstruct the 3-dimensional structures. Volume was measured using the Mimics 13.1 (Materialise NV, Leuven, Belgium) software program.