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Research Article

Clinical Study of Jaw Cyst by Decompression (1)

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Abstract

Objective: To observe the dynamic characteristics of the odontogenic mandibular cyst after decompression and analyze the treatment rules.

Methods: Data of patients with odontogenic cyst of mandible confirmed in our hospital from June 2017 to June 2019 who underwent decompression were collected, using retrospective analysis, according to the CBCT taken before and after the operation, through the E3D modeling software three-dimensional reconstruction, analyze the contraction speed of the cyst cavity and its relationship with age.

Results: The contraction rate of cystic cavity from small to large is as following: the odontogenic keratocysts, the apical cyst, the dentigerous cyst. The contraction speed is negatively correlated with age.

Conclusion: The effect of fenestration decompression in the treatment of mandibular odontogenic cysts is related to time. It is recommended to deal with it in a timely manner according to the characteristics of the cyst changes.

Keywords: *Odontogenic Cysts; Cone Beam Computed Tomography (CBCT); Decompression; E3D*

Introduction

Odontogenic cyst of the jaw is a common benign lesion in the maxillofacial region. Because of its slow growth and no conscious symptoms in the early stage, patients often have extensive bone destruction and maxillofacial deformities when they see a doctor [1-3]. This type of large jaw cyst is currently treated with fenestration decompression. After the cyst fluid is drained, the hydrostatic pressure in the cyst cavity is released, which eliminates the bone resorption involved in a variety of cytokines and reduces the mechanical pressure that promotes the expansion and growth of the cyst to the surrounding area and reduced or stopped the bone absorption. Osteoblast activity generates repairing new bone, remodeling the shape of the jaw, and gradually shrinking the cyst, thereby reducing the risk of fractures and damage to important anatomical structures [4-7].

Cone Beam Computed Tomography (CBCT) and three-dimensional reconstruction can accurately measure the diameter and volume of the cyst [8,9], reconstruct the boundary of the lesion and the displaced tooth, and clearly show the relationship between lesion and sur-

rounding important anatomy structures [1,9], observe the changes of the cyst cavity after fenestration and decompression, which have the characteristics of accuracy and efficiency. This study reconstructed the three-dimensional images of the jaws and teeth of patients at different time points before and after fenestrating decompression, observed the characteristics of the dynamic changes of the cyst, and analyzed the cyst contraction of the mandibular odontogenic jaw cyst.

Objectives and Methods

General data

Collected data of 40 patients with mandibular odontogenic jaw cysts diagnosed at the First Affiliated Hospital of Bengbu Medical College from June 2017 to June 2019 and underwent fenestration decompression. Inclusion criteria: (1) Patients undergoing initial surgery. (2) The pathological diagnosis was an odontogenic cyst of the mandible. (3) The diameter of the cyst is greater than 4cm. Exclusion criteria: (1) The large area of the cyst broke through the cortical bone. (2) Poor compliance, incomplete clinical and follow-up data. 21 males and 19 females among them, 5 to 84 years old, with an average of 32.3 years old. The long axis of the measured cyst (deducting the magnification ratio) was 4.3 - 14.7 cm, with an average of 9.4 cm. Pathological diagnosis: 6 patients with root end cysts, 21 patients with dental cysts, and 13 patients with of keratocysts.

Method

Therapeutic method

CBCT examinations were performed before the operation, the surgical plan was determined according to the location and scope of the cyst, and general anesthesia or local anesthesia was selected according to the patient's personal situation. Remove the irreparable residual roots and crowns affected by the opening window, and expand the creation of the tooth extraction as the opening window; if the tooth that does not need to be extracted, the near center of the cyst cavity is selected as the opening window. The diameter of the opening window was about 2.0 cm and the tissue of the cyst wall was removed and submitted for examination to confirm the pathological diagnosis. The cyst cavity was washed repeatedly with normal saline, and then iodoform gauze filled the cyst cavity and was led out at the open window. One week after the operation, the iodoform gauze was taken out and a cyst stopper was made to keep the drainage of the cyst fluid in the cavity unobstructed. After the operation, the patient was given instructions for cyst flushing, and the patient was instructed to flush the cyst cavity with saline and gargle in time after each meal. Follow-up every 3 months after operation to observe the changes of the patient's clinical symptoms and perform CBCT every 6 months to compare the changes in the lesion area.

Imaging data acquisition

All patients were in a sitting position, and CBCT was taken in the mandibular position. Through the head fixation device and the cursor positioning system, the median sagittal plane of the patient's face is perpendicular to the ground, and the body remains stable during the scanning process. Technical parameters: tube voltage 90kv, tube current 10mA. The data is stored in the form of DICOM.

CBCT data processing

Import the original DICOM data into the E3D modeling software, measure the effective tissue threshold interval, extract the effective tissue contour, transform the 3D digital model, complete the three-dimensional reconstruction (Figure 2 and 3), and measure the volume of the cyst.

Statistical method

SPSS 21.0 was used for statistical analysis of the data. The measurement data were tested for normality, and the data conforming to the normal distribution were expressed by the mean ± standard deviation ( ). The comparison between groups was performed by one-way analysis of variance, and the SNK method was further used for pairwise comparison. The index comparison at each time point adopts single factor repeated measurement analysis of variance, and further adopts LSD method for pairwise comparison. Pearson correlation analysis was used to analyze the correlation between the indicators. $P < 0.05$. Statistical significance was set at $P < 0.05$.

Result

Comparison of cystic cavity contraction speed at different time points in each group of patients

The E3D software was used for three-dimensional reconstruction, and the contraction volume of the cyst cavity was measured at different time points in each group of patients, as shown in figure 1 and 2. Table 1 shows the comparison of the contraction speed of the cyst cavity at different time points in each group. The results of univariate analysis of the cystic cavity contraction velocity at different time points in each group showed that there was no significant difference in the cystic cavity contraction velocity between 12 - 18 months between the groups ($P > 0.05$), and between each group 1 - 6 months The difference in the contraction speed of the cyst at 6 - 12 months was statistically significant ($P < 0.05$). The SNK method was further used to compare the cyst contraction speed at 1 - 6 months and 6 - 12 months between each group. The comparison results showed that the DC group was significantly higher than the KCOT group and the differences were statistically significant ($P < 0.05$). There was no statistical significance in the velocities of cysts in apical cyst group, KCOT group and DC group ($P > 0.05$), as shown in figure 3.

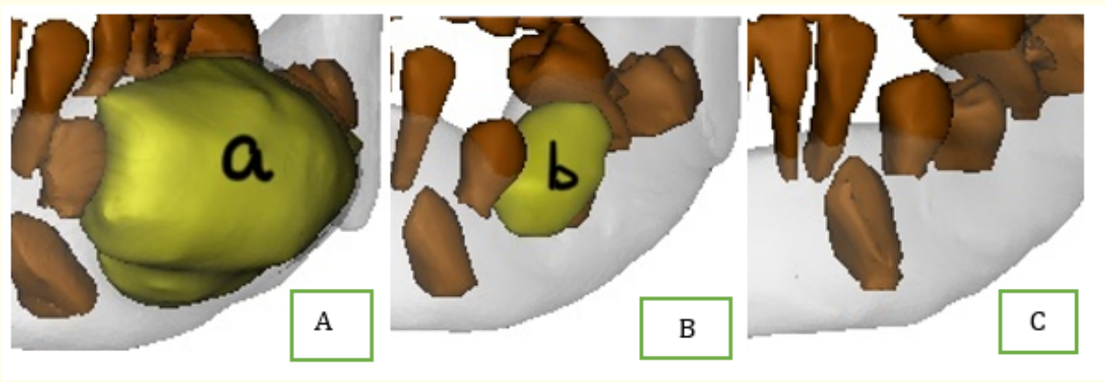

Figure 1: *3D reconstruction of the dentigerous cyst model (A: preoperative, B: 6 months after surgery, C: 12 months after surgery).*

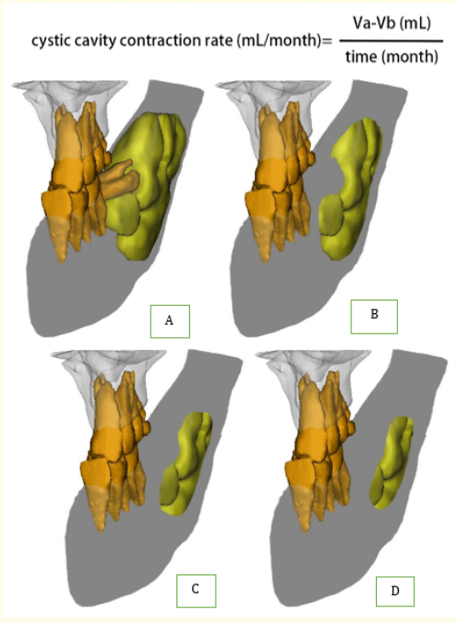

Figure 2: *3D reconstruction of odontogenic keratocyst model (A: preoperative, B: 6 months postoperatively, C: 12 months postoperatively, D: 18 months postoperatively).*

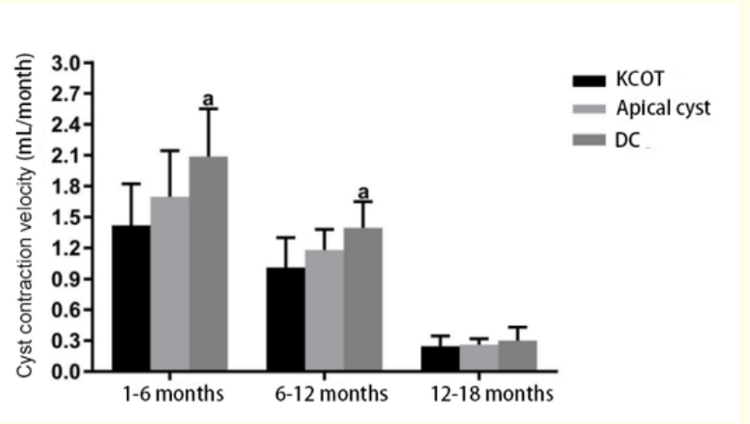

Figure 3: *Comparison of cystic cavity contraction rate at different time points in each group.*

Group	Cases	1 - 6 months (ml/month)	6 - 12 months (ml/month)	12 - 18 months (ml/month)
KCOT	13	1.42 ± 0.40	1.01 ± 0.29	0.25 ± 0.1
Apical syst	6	1.70 ± 0.45	1.18 ± 0.20	0.26 ± 0.06
DC	21	2.09 ± 0.46[a]	1.40 ± 0.26[a]	0.30 ± 0.13
F	-	9.414	8.883	1.031
P	-	< 0.001	0.001	0.367
Note: a: Compared with KCOT group, P < 0.05				

Table 1: *Comparison of cystic cavity contraction rate at different time points in each group (¯).*

Analysis of the correlation between age and the speed of cystic cavity contraction

Table 2 shows the correlation analysis results between age and sac cavity contraction speed. The correlation between age and the speed of cystic contraction at each time point The Pearson correlation analysis showed that there is a significant negative correlation between age and the speed of cystic cavity contraction at each time point ($r < 0$, $P < 0.05$). The correlation between the age of 1 - 6 months and the speed of cystic cavity contraction is the strongest. As time goes by, the correlation gradually weakens, as shown in figure 4.

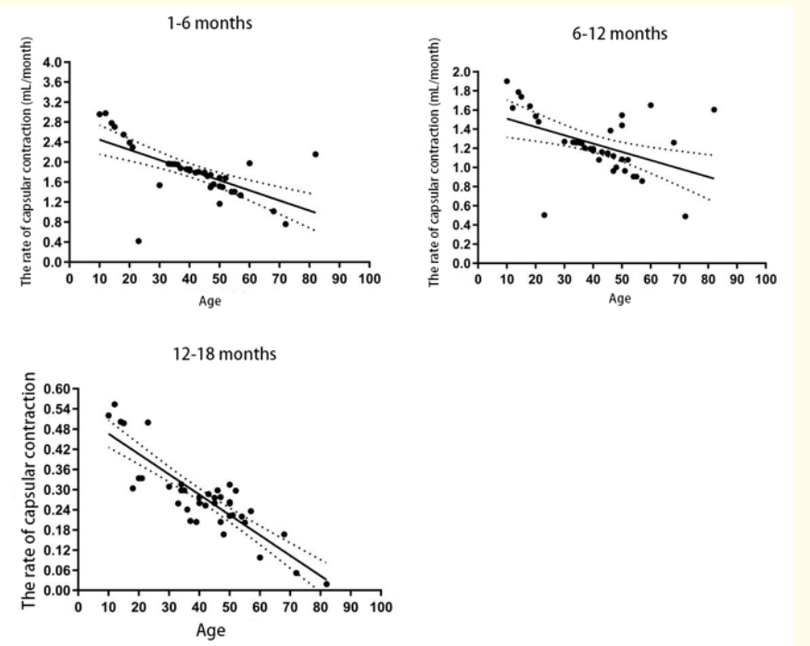

Figure 4: *Correlation between age and the rate of capsular contraction.*

Time	Age	
	r	P
1 - 6 months	-0.715**	< 0.001
6 - 12 months	-0.586**	< 0.001
12 - 18 months	-0.419**	0.007
Notes: *P < 0.05, **P < 0.01		

Table 2: *Correlation analysis between age and contraction rate.*

Discussion

Odontogenic cysts account for up to 90% of jaw cysts, which are caused by proliferation or degeneration of odontogenic epithelium [10,11]. Curettage is often chosen for the treatment of small and medium cysts. For larger cysts involving important functions of the jaw, curettage has the risk of pathological fractures and damage to adjacent tissues [1,2,7]. Recently, as the concepts of minimally invasive surgery and functional surgery have been widely accepted, large jaw cysts are mostly treated with fenestrating decompression, and the scope of the lesions after surgery is gradually reduced, and the shape and function of the jaw can be retained to the greatest extent [2,10]. In this study, only cases of the mandible were included, and the influence of the cavity of the maxillary sinus on the contraction of the sac was excluded. Large-scale breakthroughs in the cortical bone of the cyst wall were excluded. The reason is that in cases of breakthrough in the cortical bone, the contraction of the cyst cavity will be affected by the surrounding soft tissues, which cannot accurately reflect the changes in the cyst cavity caused by osteogenesis.

The volume change of the sac is the main indicator for observing the therapeutic effect of fenestration, and accurate measurement is of great significance. Some scholars measure the volume of the lesion by injecting saline into the cavity, but its accuracy is limited, because the residual capsule contents and local hemorrhage in the cavity will affect the measurement results; there are also studies reporting the use of conventional panoramic films to calculate the volume, but Because it is a two-dimensional image, it cannot display the changes of the cyst in a three-dimensional manner [1,12-16]. In this study, CBCT was used to obtain the stereoscopic data of cystic cavity, and E3D software was used for 3D reconstruction, which overcame the above shortcomings and improved the accuracy and reliability of the results.

The results of this study show that decompression surgery has differences in the healing of different populations and different pathological types. Among them, tooth-bearing cysts have the largest contraction speed, and keratocysts have the smallest contraction speed, which may be related to the following reasons [17-20]: (1) The level of polysulfonic mucopolysaccharides in the cyst cavity fluid of keratinous cysts is higher than that of tooth-bearing cysts, polysulfonic mucopolysaccharides It will stimulate the differentiation of bone marrow-derived macrophages, leading to the formation of osteoclasts, which may have a certain impact on the growth of new bone. (2) The cyst fluid of keratotic cysts is usually semi-solid and is characterized by a large amount of keratin. Compared with dental cysts, odontogenic keratotic cysts are more likely to have shed epithelial cells in the aspiration. The contraction speed of the cyst has a certain influence. (3) Scattered ascos in the cyst wall of keratocyst will affect the contraction of the cyst cavity. (4) The eruption of teeth in a dentate cyst has a certain traction effect on the cyst wall. (5) Dental cysts are common in children, and children have strong bone regeneration ability. Combining these reasons and clinical experience, this study believes that: (1) When a dental cyst is opened, the teeth in the cyst can be preserved. Generally, the position of the impacted tooth changes the most within 3 months after the operation, which may be due to the impacted permanent tooth (There is no deciduous teeth and alveolar bone above the embryo), and the resistance is small, and the volume of the cyst shrinks, the pressure in the jaw defect area suddenly decreases, and the resistance of the permanent tooth eruption is significantly lower than that of the opposite side. No significant changes are seen within 3 months of teething, and extraction or orthodon-

tic treatment can be considered. (2) When opening windows for odontogenic keratocysts, attention should be paid to whether there are ascuses. The ascuses can be penetrated or the number of windows can be increased during the operation. (3) For postoperative irrigation methods, guidance is needed, especially for children with poor compliance, parents need to supervise and help maintain oral hygiene.

The results of this study showed that after fenestrating decompression, the speed of cyst volume shrinkage was inversely related to age, which may be related to cell regeneration and replacement frequency [17]. Some scholars believe that the younger the patient is, the stronger the bone tissue regeneration and the faster the bone formation [15]. Scholars such as Kubota and Gao., *et al*. believe that there is no correlation between age and the growth rate of new bone. However, Park and Anavi., *et al*. have also conducted related studies and pointed out that there is a correlation between the two, which supports the results of this study [1,10]. The difference between the research results may be related to the selection and size of the sample size, which needs to be further explored.

Collectively, fenestration decompression has certain curative effects on different ages and different pathological types of odontogenic jaw cysts, but there are differences. If the cyst cavity is not fully healed and the contraction speed is significantly slowed, according to the type and size of the cyst and the age of the patient, a second-stage curettage may be considered to shorten the treatment period and relieve the patient. The burden of treatment and promote the healing of the cyst. The law of contraction of the other parts of the cyst cavity and the application points of the second-stage curettage still need to be further explored.

Conclusion

The effect of fenestration decompression in the treatment of mandibular odontogenic cysts is related to time. It is recommended to deal with it in a timely manner according to the characteristics of the cyst changes.

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