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SPONTANEOUS REGENERATION OF BONE FOLLOWING MANDIBULAR RAMUS SURGERY FOR CYSTIC APPEARANCE LESIONS: A REPORT OF CASE SERIES

СПОНТАНА КОСКЕНА РЕГЕНЕРАЦИЈА КАЈ ЦИСТИЧНИ ЛЕЗИИ НА ВИЛИЧНА ГРАНКА-РАМУС НА ДОЛНА ВИЛИЦА: СЕРИЈА НА СЛУЧАИ

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Abstract

Aim: Odontogenic cysts in mandibular ramus are pathological cavities with specific structure, containing epithelial rests and fibrous-connecting tissue that form a relationship with clinico-radiographic presentation, and it's difficult to differentiate them apart. The aim of this study was to illustrate and evaluate bone healing without the use of bone grafting materials. **Materials and methods:** This review of case series is based on the retrospective study of surgically treated patients during the past 12 months for 2022 year. All measurements with radiographic scans were made for the purpose of analysing bone cavities, where spontaneous bone healing of residual cavities occurred. **Results:** The imaging spectrum used in our study was made with CBCT scan producing 3D images as a problem-solving tool that have been used to help preoperative plan treatment, detecting the location of the lesions, assuming equal growth in all directions, identifying them by their shapes representing the extension to the ramus, swelling or bone defect of the lingual/buccal cortex. Jaw pain associated with swelling was the common presentation of clinical symptoms. All patients underwent surgical treatment and cystectomy of the mandible was performed. There was a difference in reduction rates by initial volume and no recurrence was observed during the study period. **Conclusion:** Voluminous jawbone cysts are often aggressive and CBCT scan is useful for evaluating morphological changes alongside the anatomical location of the lesions and bony margins which is crucial for differential diagnoses. Simplifying the surgical procedure for large mandibular ramus cysts without using graft materials is possible and can help reduce postoperative complications. **Key words:** mandibular cyst; cystectomy; Cone-beam computed tomography; surgery

Апстракт

Цел: Одонтогените цисти со локализација на мандибуларен рамус, претставуваат најчести патолошки промени со специфична структура, креирани со цистична празнина или лумен, епителни островца и фиброзно ткиво, чија клиничко-патолошка симптоматологија е предизвик за секој хирург. Целта на оваа студија е да ја евалуира коскената спонтана регенерација без аугментација со графт-материјали кај поголеми цистични лезии. **Материјал и метод:** За период од 12 месеци во тековната 2022 година, ретроспективно беа проследени сите хируршки третирани поголеми цисти на мандибуларен рамус чие радиолошко волуметриско испитување беше спроведено за потребните анализи на коскениот патолошки кавитет. **Резултати:** Предоперативни сликии идентификација на лигвален и букален кортекс во сите насоки со помош на апарат за тродимензионална визуелизација на структурата на цистичната празнина беше спроведена вклучително кај испитаници во студијата. Како доминантни симптоми се евидентирани болка и оток. Забележана е значајна разлика во волуметриските резултати на даденият примерок за цистични лезии. Хируршка интервенција беше изведена кај сите пациенти без притоа да се нотира рецидив во периодот на постоперативна рехабилитација. **Заклучок:** Локализацијата на цистичната промена, а особено на цисти со поголеми димензии со зафаќање на повеќе анатомски простори или се во колизија со нив, во тој случај, често пати, морфолошките отстапувања се евидентираат со помош на тродимензионална визуелизација и рендерирање, бидејќи одбележување на коскените маргини е од круцијално значење при планирање на дефинитивен третман. Изборот на тераписки пристап и соодветна оперативна техника за цисти на рамус на мандибула без користење на дополнителни материјали за коскена аугментација го минимизира времето за операција и превенција од појава на можни постоперативни инфекции. **Клучни зборови:** мандибуларни цисти; цистектомија; 3Д дигитална рентген дијагностика; хируршки третман.

Introduction

Jaw cysts in oral and maxillofacial pathology constitute the largest percentage of appearance in clinical practice, and they are classified into several groups. Among all cystic lesions, the 5th edition of World Health Organization (WHO) from 2022 for Head and neck lesions and the 4th edition (2017) is not different for the classification of odon-

togenic lesions[1-5]. In 2017, they reclassified the odontogenic keratocystic tumor into odontogenic keratocyst believed to emerge from the dental lamina. The diverse spectrum of clinical signs and symptoms can be a challenge for physicians, regarding imaging modalities used for evaluation of odontogenic cysts, because they can mimic more aggressive cyst-like lesions and tumors on x-ray. In recent years, several surgical methods using various grafts materials, which help preserve and repair the bone defects after removal of the cystic-appearing lesion in the jaw, have been described[6-10]. This paper demonstrates valuable information for clinicians about spontaneous bone regeneration after the removal of large jaw cysts, making their treatment more challenging.

Material and methods

The retrospective study subjects were patients who underwent CBCT scans before and after jaw surgery of the mandibular ramus for large cystic lesions, and whose complete medical records were kept at the University Clinic for Maxillofacial Surgery in Skopje for a period of one year. This study was conducted bycollecting data on age, gender, lesion location and size, and histopathological diagnosis from medical records. All images were obtained using a Planmeca Romexis (90 kV 9.0 mA 5.07 s / thickness 0.4 mm / 3D rendering) using the soft tissue window to allow clear delineation. Two clinicians performed the manual segmentations to obtain three-dimensional (3D) representation of pathological structures. The anatomical analysis of mandibular rami was labelled as point A in three different distances in lateral view: Ao (reference point), A- (1 cm proximal and below the mandibular canal), and A+ (1 cm distal and bellow the mandibular canal). The zero reference point Ao was identified using a curve, between the occlusal plane and the anterior border of the vertical mandibular rami. Coronal (maximal widthin bucco-lingual direction), axial (maximal length in anteroposterior) and saggital plane (maximal height in coronal-apical direction, or between alveolar crest and base of mandible) were measured and then manually checked on every single slice. The linear dimension (preoperatively) was calculated using this formula: Intraosseous defect (%) = cystic appearance lesion (sum measured in coronal-X, axial-Y, and saggital-Z plane) / sum distance from the outside cortical bone measured in three directions to the cyst wall x 100.

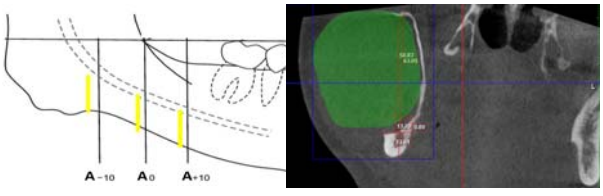

Figure 1. *Reference lines and measurement points in the mandible*

Results

Between January and December 2022, ten patients were diagnosed with large-size mandibular cysts. Two patients were excluded due to the lack of follow-up CBCT scan, and finally eight patients were included in this retrospective study, five male and four female patients, with mean age of 41.6 years (range 25–63). The male-to female ratio was an approximate 1.25:1. The majority of patients (56%) were between 20-39 years of age. In total, 3 of 8 patients were asymptomatic on presentation, discovered with routine orthopantomography. Five patients with these cystic lesions were initially seen with swelling or pain, and two of them with experience with trismus. The surgical approach involved enucleation of the entire cyst with any impacted teeth. Two patients reported paresthesia, but without significant implications. Their characteristics and digital data of pre-operative volumetric changes are summarized in Figure 1. The most common histological type of cysts was radicular (4), followed by dentigerous cyst (2), and odontogenic keratocyst (2). The measurements of cyst volumes in bone tissue indicated that the reference point Ao have shown significant dislocation of inferior alveolar nerve (IAN) trajectory caudally (Table 1). A preoperative manual segmentation results from CBCT scans illustrate the most significant volume-rendered image showing in Figure 1 and Figure 2. All patients had complete resolution and no sign of recurrence at the last follow-up visit.

Table 1. Distance (mm) between referencepoint (A) and the mandibular canal in lateral view between the occlusal plane and base of mandible

Odontogenic cysts (n)	A-	Ao	A+
radicular (3)	30.53	43.41	21.49
dentigerous (2)	43.16	35.71	42.67
keratocyst (2)	26.9	39.35	10.00
residual (1)	21.8	55.03	21.50
mean distance (mm)	32.36	42.29	25.90

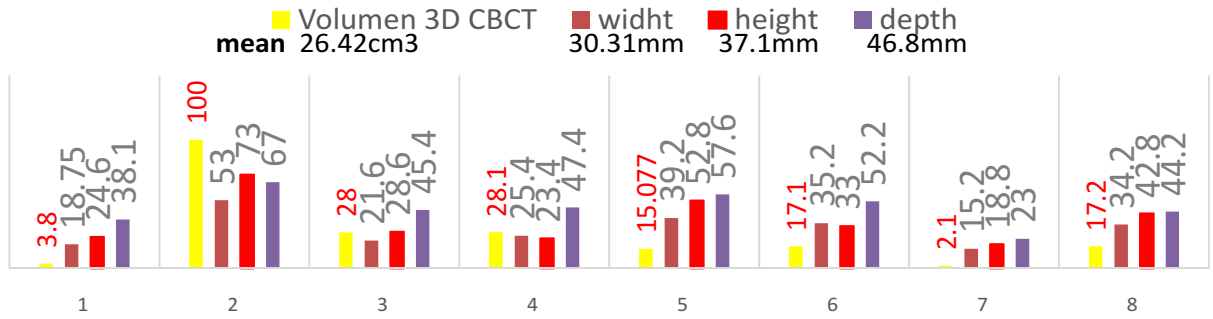

Figure 2. *Comparison between measurements of cyst volume pre-treatment size by equation with manual segmentation*

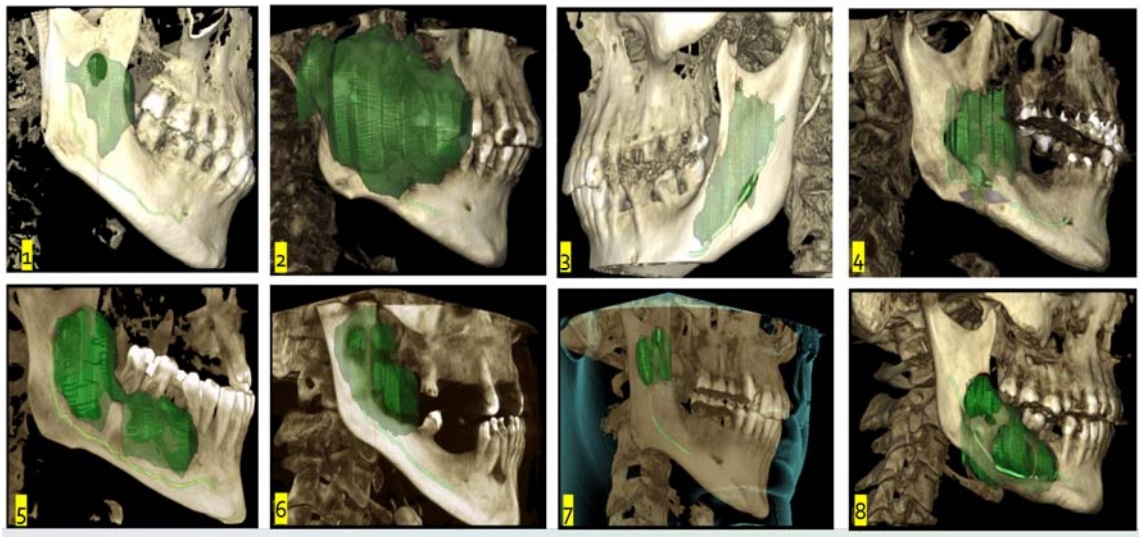

Figure 3. *Volumetric evaluation with final 3D volumetric rendering of all patients*

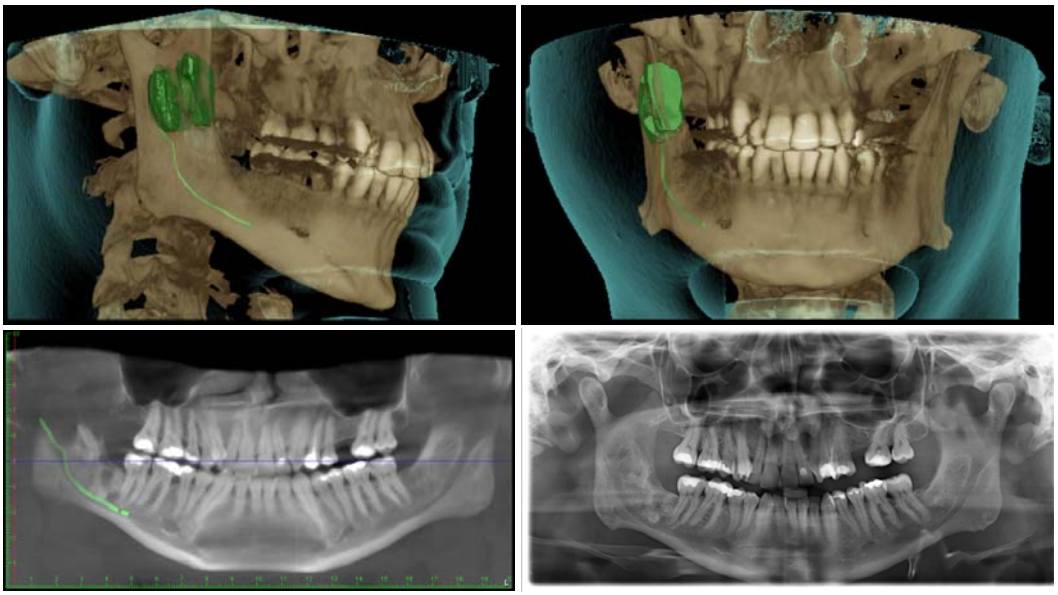

Figure 4. *Significant bone regeneration (with a ground glass appearance) and reconstitution of normal anatomic structures were observed in the patient with number 7 over a period of 5 months.*

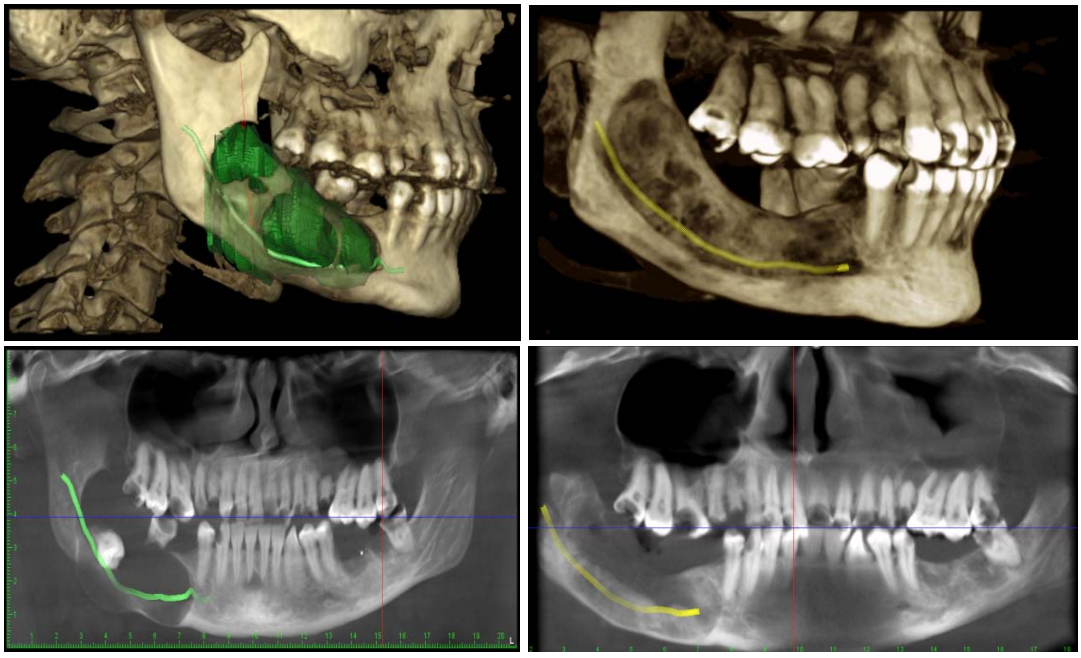

Figure 5. *Changes in bone density and cyst volume, along with marked inferior alveolar nerve (IAN) involvement, were observed before surgical treatment of a mandibular odontogenic keratocyst in the patient represented by case number 8. This assessment includes pre - and postoperative follow-up over a period of 3 months.*

Discussion

Cystic lesions are common pathologies in the maxillofacial region, often requiring invasive surgical treatment[11-15]. These lesions are typically diagnosed through routine.

Orthopantomographic images in primary dental care units, but the final diagnosis is confirmed by histopathological examination. The primary treatment goal is the surgical enucleation of the cystic lesion, which is usually the preferred approach and plays a crucial role in postoperative bone healing. When dealing with large intraosseous cysts, especially in the mandible and its ramus, surgeons must consider the specific anatomy of nearby structures and the size of the lesion. Cone beam computed tomography (CBCT) is valuable for preoperative analysis. Surgical protocols for treating cysts, particularly those of odontogenic origin, focus on regenerative strategies that involve graft materials to enhance patient outcomes and manage bone defects. However, the choice of graft material and its potential for bone contact, distance osteogenesis, and regeneration capacity remain areas of ongoing research. Remarkably, some published studies demonstrate spontaneous bone regeneration after surgical treatment of large cystic lesions in the jaws. While many trials explore factors related to graft materials and prognoses, other studies suggest that new bone formation without graft materials may yield similar results[3,4,16,17]. Our current manuscript evaluates spontaneous bone healing following enucleation of large mandibular cysts, minimizing morbidity risk. Radiographic controls reveal differences in bone density for representative clinical cases. Although the study is based on a limited number of patients, it aligns with other published papers that support the hypothesis of complete bone healing after cyst enucleation without graft materials[15-20]. Notably, this technique warrants further research, especially for cysts in the mandibular ramus region. Comparing changes in the cortices of the mandibular canal between the primarily affected skeleton and the normal contralateral side highlights visibility differences in CBCT and panoramic radiography. Overall, wound healing after cyst enucleation and tooth removal, including wisdom tooth extraction, appears to occur effectively even in larger defects without the use of bone grafting materials. Taking into account factors related to graft materials and certain prognoses that can reduce overall treatment time while improving the quality of bone regeneration, many studies continue to explore these aspects[3,7,8,11,12,15]. However, contrary to some findings, other studies have suggested that the quality of new bone formation without the use of graft materials may not significantly differ from the results reported above[15,17,19]. Additionally, our current manuscript evaluates spontaneous bone healing after enucleation of large mandibular cysts, minimizing the risk of morbidity. Radiographic controls reveal differences in bone density for represen-

tative clinical cases[16,17,20]. Interpreting bone regeneration and changes in bone density, which were completely or partially ossified, and comparing cystic areas provide insights into the course of bone healing in our patients. Although the analysis is based on a limited number of patients, it aligns with other published papers supporting the hypothesis that complete bone healing can be achieved after cyst enucleation without the need for graft materials. It is worth noting that this technique requires further research due to the significant dilemma it poses, especially for cysts in the mandibular ramus region. Characterizing and comparing changes in the cortices of the mandibular canal between the primarily affected skeleton and the normal contralateral side differences in visibility using CBCT and panoramic radiography. Additionally, wound healing after enucleation of cysts and tooth removal, including wisdom tooth extraction, appears to occur effectively even in larger defects without the use of bone grafting materials[15-20]. Race, with the most frequently reported factors in published studies and factors associated with minority and majority results, we should also focus on evaluating more critical data covered in meta-analysis associated with interventions who should be used going forward for spontaneous bone healing framework after odontogenic cysts remova[15-7,19,20]. However, this study has limitations as well as evaluating immunomodulatory mediators and assessing the quality of regenerated bone after surgery when periosteum is not lost or the majority of the contour of bone is not detracted, and interpreted themselves in micro-computed tomography data conducted by histomorphometric analysis.

Conclusions

We emphasize the importance of CBCT scans for cystic lesions and evaluating nearby anatomical structures. This approach minimized the risks of failure by directly informing preoperative surgical planning. Nevertheless, these cysts can cause significant local bone destruction. We also anticipate that pushing the boundaries of 3D CBCT reconstruction with artificial intelligence will play a significant role in delineating the boundaries of bone cavities in the future. Enucleation and primary closure without additional bone substitutes facilitate the physiological organization of the blood clot, simplifying the surgical procedure and spontaneous bone healing is possible after removal of large cysts inmandible ramus.

Conflict of interest

The authors declare no conflict of interest.

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