Cumhuriyet Dental Journal 2017; 20(2): 90-97
Doi: 10.7126/cumudj.345926 *RESEARCH ARTICLES*

DEMOGRAPHICS AND CHARACTERISTICS OF PATIENTS WITH TRAUMATIC BONE CYSTS: A RETROSPECTIVE REVIEW

Travmatik Kemik Kisti Bulunan Hastaların Demografik ve Karakteristik Özelliklerinin Değerlendirilmesi: Retrospektif Bir Çalışma

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Makale Kodu/Article Code ***:*** *155384*

Makale Gönderilme Tarihi ***:*** *02.12.2015*

Kabul Tarihi ***:*** *05.12.2015*

ABSTRACT

Objectives: The aim of this study was to evaluate the demographics and characteristics of the patients treated for traumatic bone cyst (TBC).

Materials and Methods: A retrospective review was conducted to determine the radiological, clinical and demographic characteristics of patients with TBC who were surgically treated over a 2-year period using data retrieved from computerized databases.

Results: The study sample consisted of 22 patients (24 lesions in total) with mean age of 22.9 years. All lesions were located in the mandible (16 in anterior mandible, 8 in posterior mandible) and diagnosed incidentally during routine dental examinations. There was no statistically significant difference between male and female patients in demographic characteristics. All patients were followed up for 6-18 months with uneventful healing.

Conclusions: TBCs should be kept in mind during examination of radiolucent lesions of the mandible particularly in younger patients. Along with the histopathological examination, clinical and radiological findings, symptoms of the patients, and surgeon's experience should be considered for a definitive diagnosis.

Keywords: Traumatic bone cysts, radiolucent lesion, mandible

ÖZ

Amaç: Bu çalışmanın amacı, travmatik kemik kisti (TKK) tanısıyla tedavi edilen hastaların demografik özelliklerini ve karakteristik bulgularını değerlendirmektir.

Gereç ve Yöntem: Çalışmamızda 2 yıllık süre içinde TKK tanısıyla cerrahi olarak tedavi edilen hastaların hasta takip dosyalarındaki klinik, radyolojik ve demografik kayıtları retrospektif olarak incelenmiş ve değerlendirilmiştir.

Bulgular: Bu çalışmaya, ortalama yaşları 22.9 olan 22 hasta (24 TKK) dahil edilmiştir. Çalışmaya dahil edilen hastalardaki lezyonların tümü mandibulada belirlenmiş (16'sı anterior mandibulada, 8'i posterior mandibulada) ve rutin dental muayene sırasında tespit edilmiştir. Hastaların cinsiyet dağılımında istatistiksel olarak anlamlı bir fark bulunamamıştır. Hastalar 6 ile 18 ay takip edilmiş ve sorunsuz bir iyileşme sağlanmıştır.

Sonuçlar: Mandibula yerleşimli radyolüsent lezyonların ayırıcı tanısında özellikle genç bireylerde TKK da değerlendirilmelidir. Ayırıcı tanıda histopatolojik inceleme ile birlikte hastanın semptomları, klinik ve radyografik bulguları ve cerrahın tecrübesi de göz önünde bulundurulmalıdır.

Anahtar kelimeler: Travmatik kemik kisti, radyolüsent lezyon, mandibula

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INTRODUCTION

The term “traumatic bone cyst” (TBC) was first used by Lucas in 1929 to describe cavities within the mandible that do not have a true epithelial lining. Since then, numerous synonyms have been used to refer to the same entity including solitary bone cyst, hemorrhagic bone cyst, extravasation cyst, progressive bone cavity, simple bone cyst and juvenile bone cyst. However, traumatic bone cyst is more extensively used in literature. The World Health Organization (WHO) defines TBC as a non-neoplastic osseous lesion because it demonstrates no epithelial lining, which differentiates this lesion from the true cysts. Thus, TBCs are included in the group of bone-related lesions, together with the aneurysmal bone cyst, ossifying fibroma, fibrous dysplasia and osseus dysplasia.[1,2]

Traumatic bone cysts slowly progress and usually there is no bone expansion; lesions are mostly detected during routine radiological examination. While facial deformity is not always present, occlusal radiography may show perforation of the buccal cortex in some cases.[1] Pain is reported in 10-30% of cases.[2, 3] Other symptoms including tooth sensitivity, paresthesia, fistulae, delayed eruption of permanent teeth, pathological fracture of the mandible and displacement of the mandibular canal inferiorly occur rarely and may suggest malignancy.[1, 4, 5] Usually, the adjacent teeth are vital and there is no mobility or displacement.[6] Although root resorption is reported in some studies, it is rarely seen.[7]

The lesion is mainly diagnosed in young patients most frequently during the second decade of life.[2] Men are affected somewhat more frequently than women. Apart from the jaws, large TBCs may also develop in an extremity and have the potential for further growth. On radiological examination, a traumatic bone cyst often appears as a unilocular radiolucent area with an irregular but well-defined outline. Characteristic for the traumatic bone cyst is the "scalloping effect" when extending between the roots of the teeth. Histological examination is often inconclusive; thus, histological data should be supported with an evaluation of characteristic clinical and radiological findings to reach a TBC diagnosis. Due to clinical and radiological similarities with TBC, central giant cell granuloma and aneurysmal bone cyst should be taken into account in the differential diagnosis.[8-10]

The majority of traumatic bone cysts are located in the mandibular body between the canine and the third molar or mandibular angle.[2, 11] The second most common sites include mandibular symphysis, ramus and condyle. Mandibular TBC has a much higher incidence (89%) compared to that of maxillary TBC (11%).[2]

TBC may be diagnosed when the surgeon encounters an empty, well-circumscribed cavity with no epithelial lining upon entering the cyst during a surgical procedure or biopsy. Curettage of the bone cavity gives a mixed material consisting of blood, bone fragments and connective tissue. There is no evidence for epithelial lining and microscopic examination frequently shows fibrin aggregates, erythrocytes and occasional giant cells adjacent to the bone.[6] Since material for histologic examination is often inadequate, it is difficult to reach a definitive TBC diagnosis.[1] The surgical exploration serves as both a diagnostic manoeuvre and as definitive therapy. Cryosurgery, bone grafting and autogenic blood injection could be use as alternative treatment options in some cases.[12] TBC recurrence is a rare event.[13]

This report presents the clinical, radiological and surgical findings of 22 patients diagnosed with TBC who were followed at our clinic.

MATERIALS AND METHODS

A retrospective review was conducted with the aim to evaluate clinical, radiological and surgical findings of TBC cases treated between January 2013 and January 2015 at the Faculties of Dentistry, Departments of Oral and Maxillofacial Surgery of Karadeniz Technical University and Cumhuriyet University. Age at admission, gender,

location and multiplicity of the lesion, imaging method used [Panoramic Radiography (PR) and Cone Beam Computed Tomography (CBCT)] and treatment procedures were reviewed for all patients by joint assessment of patient follow-up files and data recorded in the computerized system.

For this study, patients with clinical and radiological evidence of TBC were identified and among those, patients who were followed subsequent to confirmation of the diagnosis by surgery and histopathological examination were enrolled. Patients with TBC involving devitalized teeth or cystic epithelium and those with insufficient follow-up and inconsistent histopathology reports were excluded from the study. Patients were operated under local anesthesia using routine surgical approach. Only one vertical incision and marginal incision was performed for each lesion which was enough to expose the surgical site. Bone cavity was exposed using an appropriate flap removal procedure using a periosteal elevator followed by removal of a small part of the osseous barrier by a dental electric motor under irrigation to obtain an entrance into the bone cavity. This procedure serves as both a diagnostic manoeuvre and as definitive therapy for supplying blood accumulation in to the cavity. No futher bone removal was performed after exploring the bone cavity if the case was diagnosed as TBC. For cases suggesting a TBC, the cavity was curetted and curettage materials were sent for histopathological examination. The surgical site was closed with 3-0 silk sutures upon observing that the cavity was filled with blood spontaneously. Following the surgery, 1 g Amoxicillin + clavulanic acid twice daily, flurbiprofen 100 mg twice daily and a mouthwash containing benzydamine HCl and chlorhexidine gluconate twice daily (excluding the day of surgery) were prescribed and routine instructions were given to all patients; sutures were removed seven days after the operation.

RESULTS

Clinical, radiographic and demographic data of study patients are shown in Table 1.

Table 1. Summary of clinical, radiographic and demographic data of study patients

Patient no.	Gender	Age (y)	Location	Jaw	PR	CBCT	Bilateral TBC	Apical Resection
1	M	18	anterior	mandible	+			
2	F	23	anterior	mandible	+			
3	M	17	anterior	mandible	+			
4	F	16	anterior	mandible	+			
5	M	20	anterior	mandible	+			+
6	F	19	anterior	mandible	+			
7	M	36	anterior	mandible	+			
8	F	21	anterior	mandible	+			
9	F	19	anterior	mandible	+			
10	M	21	anterior, posterior	mandible	+	+	+	+
11	M	22	posterior	mandible	+			
12	F	19	anterior	mandible	+			
13	M	58	posterior	mandible	+			
14	F	32	anterior	mandible	+			
15	M	20	anterior	mandible	+			
16	M	18	posterior	mandible	+			
17	M	19	anterior	mandible	+			
18	F	32	anterior	mandible	+			
19	F	26	anterior	mandible	+			
20	M	12	posterior	mandible	+			
21	M	20	posterior	mandible	+	+	+	
22	M	16	posterior	mandible	+	+		

Abbreviations:
M, Male; F, Female; PR; Panoramic radiography, CBCT; Cone Beam Computed Tomography. TBC, Traumatic bone cyst

Of 22 patients enrolled in the study, 12 (45%) were male and 10 were female (%55). There was no substantial difference between sexes with respect to TBC prevalence. The mean age of patients was 22.9 years (23.7 years for males and 21.9 years, respectively). A total of 24 TBC cavities were found in 22 patients. Unilateral lesions were observed in 20 patients (Figure 1) and two patients had bilateral lesions (involving anterior and posterior mandible in a patient and posterior mandible in a patient) (Figure 2).

Figure 1. PR (A1) and CBCT (A2, A3, A4, A5) images of Patient No. 22 with a unilateral TBC

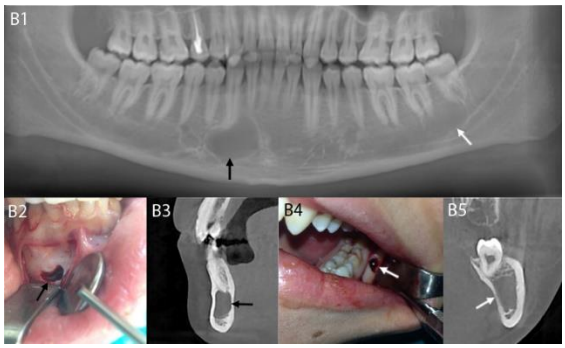

Figure 2. PR (B1), CBCT (B3, B5) and intraoperative (B2, B4) images of Patient No. 10 with bilateral TBCs

All lesions were located in the mandible including 16 in anterior mandible and 8 in posterior mandible. Apical resection treatment was performed in 2 patients due to root surface resorption possibly related to the lesion. Additional CBCT imaging was required only in 3 patients and panoramic radiographs were sufficient for other cases. All lesions found in patients included in the study were discovered incidentally routine clinical and radiological examinations. None of the lesions admitted to our clinic due to a specific complaint associated with lesion site. Patients were followed over a period ranging between 6 and 18 months (mean duration, 14 months). Healthy resolution was considered when patients showed restoration of bone structure with reformation of bone during follow-up (Figures 3 and 4).

Figure 3. Preoperative periapical radiography (C2), postoperative PR (C1), and intraoral (C3) images of Patient No. 6 with a TBC

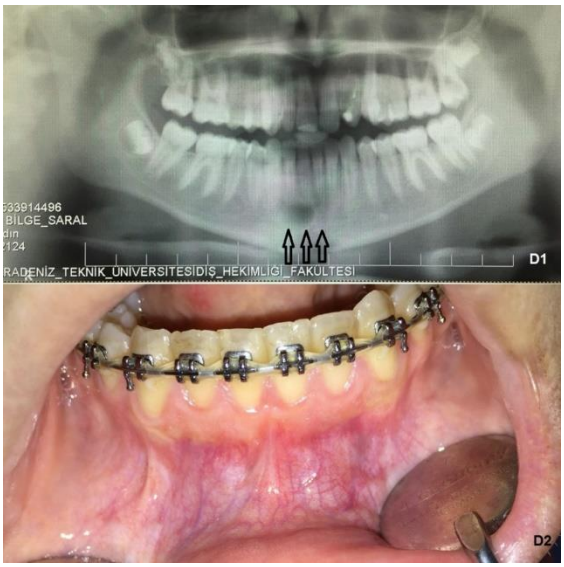

Figure 4. Preoperative PR (D1) and postoperative intraoral images of Patient No. 9 with a TBC (D2)

A second operation was performed only in one patient who showed no signs of bone healing and achieved full resolution after 12 months.

DISCUSSION

Etiology and pathogenesis of TBC have not been fully elucidated yet but a number of theories were suggested in literature.[14] Degeneration of bone tumors, altered calcium metabolism, low-grade infections, local alterations in bone growth, venous obstruction, intensified osteolysis, intramedullary bleeding, local ischemia or combinations of such factors are believed to be involved in the etiology. The most widely accepted theory suggests that a hematoma within the bone caused by any form of trauma including tooth extraction may have a pivotal role in the development of this lesion.[15] Following a trauma, resorption of the blood clot takes place in the presence of impaired healing and liquefactive necrosis. The surrounding bone is destroyed by enzymatic activity and as a result, the bone cavity enlarges, stimulated by poor venous drainage.[10, 16] Nevertheless, unusually large TBCs with an aggresive course have been rarely reported.[12]

While panoramic radiography is usually sufficient for diagnosing a traumatic bone cyst.

Although roots resorption is not a common finding in TBCs, CBCT is useful for assessment of the extent of destruction/resorption within the affected bone or teeth. However panoramic radiographs do not provide much information for differential diagnosis since PR does not allow examination of the cystic epithelium. Nevertheless, some researchers reported that dynamic contrast-enhanced magnetic resonance imaging (DCE-MRI) may be used for differential diagnosis of TBC to exclude other cysts.[17] In the present study, CBCT was required only for 3 patients to evaluate the presence of lesion-related root resorption in the teeth and PR imaging sufficed for other patients.

Traumatic bone cysts are commonly found in long bones such as proximal humerus and femur but maxillofacial bones may also be affected, albeit rarely (0.5-1.2%).[18] Among all cysts of the jaw, TBCs have a prevalence of 1%. When these cysts develop in the jaws, mandibular involvement is frequent with rare involvement of maxilla. Several reasons were suggested to explain this difference in the site of origin including differences between maxilla and mandible in the amount and quality of bone marrow and in the extent of vascularization or difficulties in detecting maxillary lesions by radiography due to maxillary sinus.[19, 20] Consistently, in our study, all lesions originated from the mandible and no lesion was found in the maxillary bone.

It is rare for a TBC to develop after 25 years of age because it will have been detected earlier during routine dental examinations.[21] Literature data show that TBCs are mainly diagnosed in young patients during the second decade of life but they may also occur at a later age. Availability of PR imaging in many centers, advances in oral and dental care services and increased awareness for this condition contribute to the detection of these lesions during routine examinations at an early stage. Also, some lesions may spontaneously heal over time and this is probably the reason why they are rarely found in older age groups as suggested by several reports.[8] Similarly, the mean age of our patients was 22.9 years and only 3 patients were older than 25 years of age (28, 36 and 58 years of age). While predominance of female gender was reported in literature, generally it is considered that TBCs occur in both sexes with comparable incidences.[2, 19] Consistently, there were 12 males and 10 males in our study (total n=22) with no significant differences between sexes. Multifocal TBCs were reported to be diagnosed during the second decade of life and this is consistent with our findings.[19]

Anterior mandible has been reported in literature as the most common site for TBC.[22] Consistent with literature data, the majority of lesions were located in the anterior mandible in the present study: 8 lesions (33%) in the posterior mandible and 16 (67%) in the anterior mandible.

Multifocal and bilateral TBC cases usually occur during the second decade of life at an incidence varying between 0% and 11%.[19, 23, 24] In the current study, two patients had multiple TBCs bilaterally (one 20-year old patient and one 21-year old patient) and this low incidence was consistent with literature. Insufficient venous circulation, trauma, impaired calcium metabolism, osteogenesis imperfecta and idiopathic thrombocytopenic purpura have all been implicated in the etiology of these multifocal lesions.[9] However, none of our patients showed evidence for these etiological factors.

Studies reported that expansion of the bone was rare in TBC cases.[8] Similarly, in the present study, there were no cases of bone expansion noticed during surgical procedure or preoperative CBCT examination.

Root resorption is frequently observed with orthodontic teeth movements, occlusal traumatism, periodontal disease, periapical granulomas, and re-implanted teeth, cyst or

neoplasms while the mechanisms of root resorption in association with cysts and neoplastic lesions are mostly unknown.[7] It is known that intracystic pressure or a high level of prostaglandin released by tumors may have effects on root resorption.[25] While the lack of cystic epithelium and cystic fluid in TBCs eliminates this possible pressure related cause. Immunohistochemical studies have shown that the receptor activator of nuclear factor κB (RANK), RANK ligament (RANKL), osteoprotegerin (OPG) proteins are involved in root resorption. Osteoclast (odontoclast) maturation and activity are regulated in vivo by RANK–RANKL and OPG levels of expression and mediators such as TNF-α, interleukin (IL)-1ß, IL-2ß, IL-6, and prostaglandins, can exert their effects through regulation of RANK, RANKL and OPG levels.[26] In the present study, TBCs were reported to cause resorption adjacent teeth[8] and apical resection was required only in 2 patients for devitalized teeth or teeth with excessive root resorption.

In order to decide on the final diagnosis, it is necessary to carry out an exploratory surgery, which at the same time is the main therapeutic procedure.[8] Following surgical exposition, the affected area is curetted and organization of a blood clot takes place, resulting in healing by the formation of new bone. While cochleation of the cavity stimulates the bleeding, injection of autogenic blood into the bony cavity could be preferred with large bony defects to speed up the healing period.[8, 27] Spontaneously healing may also occur in some cases.[8] Cryosurgery and bone grafting could be a treatment option in suitable cases.[12] In longstanding or large lesions treatment is by curettage of the cavity, which results in clot formation and complete bony infill.[28] Recurrences are very rare after appropriate surgical treatment (%1.7). Follow-up for 6 to 12 months is sufficient to assess healing and recurrence. Inadequate curettage was reported as the most common cause of recurrence.[15, 29] In our study, a second surgical treatment was performed for only 1 patient because no evidence for healing was observed within the bone cavity at 6 months of follow-up but full resolution of the lesion was achieved at 12 months.

Our findings are consistent with those reported in literature with respect to patient age, gender and location of the lesion. While routine CBCT examinations are not always considered to be necessary, they may sometimes be used to assess resorption in the adjacent teeth and to establish a treatment plan for root canal treatment and/or apical resection.

Care should be exercised during differential diagnosis of a traumatic bone cyst, since treatment procedure for TBC differs from those of radiologically similar cysts. In cases where the cyst arises around the apex of a tooth, radiological findings may resemble those of a radicular cyst; thus, a thorough evaluation of clinical findings such as vitality of the affected teeth is crucial. Thus, a correct diagnosis would avoid unnecessary apical resection procedures which are frequently undertaken for other cysts involving tooth roots.

In conclusion, although TBCs are infrequent, they should be considered in the differential diagnosis of radiolucent lesions located in the mandible particularly in younger patients.

In addition to histopathological examination, surgeon's experience, patient's symptoms, case history and radiological findings should also be taken into account for differential diagnosis.

REFERENCES

1. MacDonald-Jankowski, D.S., *Traumatic bone cysts in the jaws of a Hong Kong Chinese population.* Clin Radiol, 1995. 50(11): p. 787-91.

2. Hansen, L.S., J. Sapone, and R.C. Sproat, *Traumatic bone cysts of jaws.* Oral Surg Oral Med Oral Pathol, 1974. 37(6): p. 899-910.

3. Howe, G.L., *'Haemorrhagic cysts' of the mandible. II.* Br J Oral Surg, 1965. 3(2): p. 77-91.

4. Hughes, C.L., *Hemorrhagic bone cyst and pathologic fracture of mandible: report of case.* J Oral Surg, 1969. 27(5): p. 345-6.

5. Curran, J.B., S. Kennett, and A.R. Young, *Traumatic (haemorrhagic) bone cyst of the mandible: report of an unusual case.* J Can Dent Assoc (Tor), 1973. 39(12): p. 853-5.

6. Kaugars, G.E. and A.E. Cale, *Traumatic bone cyst.* Oral Surg Oral Med Oral Pathol, 1987. 63(3): p. 318-24.

7. Nakaokaa, K., et al., *A case of simple bone cyst in the mandible with remarkable tooth resorption.* Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology, 2012. 25(2013): p. 93-96.

8. Sebastijan Sandev, K.S., Joπko Grgurevi, *Traumatic Bone Cysts.* Acta Stomat Croat, 2001. 35: p. 417-420.

9. Gümrükçü, Z., B. Cezairli, and C. Üngör, *Mandibulada görülen bilateral travmatik kemik kisti: 2 olgu sunumu.* Atatürk Üniv. Diş Hek. Fak. Derg., 2015. 12: p. 26-31.

10. Cortell-Ballester, I., et al., *Traumatic bone cyst: a retrospective study of 21 cases.* Med Oral Patol Oral Cir Bucal, 2009. 14(5): p. E239-43.

11. Forssell, K., et al., *Simple bone cyst. Review of the literature and analysis of 23 cases.* Int J Oral Maxillofac Surg, 1988. 17(1): p. 21-4.

12. Schreuder, H.W., et al., *Treatment of simple bone cysts in children with curettage and cryosurgery.* J Pediatr Orthop, 1997. 17(6): p. 814-20.

13. Suei, Y., et al., *Radiographic findings and prognosis of simple bone cysts of the jaws.* Dentomaxillofac Radiol, 2010. 39(2): p. 65-71.

14. Lucas C, B.T., *Do all cysts in the jaws originate fromthe dental system?* J Am Dent Assoc 1929;16:659–61.

15. Suei, Y., A. Taguchi, and K. Tanimoto, *Simple bone cyst of the jaws: evaluation of treatment outcome by review of 132 cases.* J Oral Maxillofac Surg, 2007. 65(5): p. 918-23.

16. Satish, K., S. Padmashree, and J. Rema, *Traumatic bone cyst of idiopathic origin? A report of two cases.* Ethiop J Health Sci, 2014. 24(2): p. 183-7.

17. Yanagi, Y., et al., *Usefulness of MRI and dynamic contrast-enhanced MRI for differential diagnosis of simple bone cysts from true cysts in the jaw.* Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 2010. 110(3): p. 364-9.

18. Saito, Y., et al., *Simple bone cyst. A clinical and histopathologic study of fifteen cases.* Oral Surg Oral Med Oral Pathol, 1992. 74(4): p. 487-91.

19. An, S.Y., et al., *Multiple simple bone cysts of the jaws: review of the literature and report of three cases.* Oral Surg Oral Med Oral Pathol Oral Radiol, 2014. 117(6): p. e458-69.

20. Kahn, M.A., *Clinicopathologic correlation quiz: unilocular periapical radiolucencies. Traumatic bone cyst.* J Tenn Dent Assoc, 1997. 77(1): p. 24, 35-6.

21. Madiraju, G., et al., *Solitary bone cyst of the mandible: a case report and brief review of literature.* BMJ Case Rep, 2014. 2014.

22. Surej Kumar, L.K., N. Kurien, and K.A. Thaha, *Traumatic bone cyst of mandible.* J Maxillofac Oral Surg, 2015. 14(2): p. 466-9.

23. Brannon, R.B. and G.D. Houston, *Bilateral traumatic bone cysts of the mandible: an unusual clinical presentation.* Mil Med, 1991. 156(1): p. 20-2.

24. Markus, A.F., *Bilateral haemorrhagic bone cysts of the mandible: a case report.* Br J Oral Surg, 1979. 16(3): p. 270-3.

25. Struthers, P. and M. Shear, *Root resorption by ameloblastoma and cysts of jaws.* Int J Oral Surg 1976. 1976(5): p. 128-32.

26. Tyrovola, J.B., et al., *Root resorption and the OPG/RANKL/RANK system: a mini review*. J Oral Sci, 2008. 50(4): p. 367-76.

27. Precious, D.S. and L.R. McFadden, *Treatment of traumatic bone cyst of mandible by injection of autogeneic blood*. Oral Surg Oral Med Oral Pathol, 1984. 58(2): p. 137-40.

28. Anderson, L., et al., *Oral and maxillofacial surgery: Cystic lesions of the Jaws.*: Blackwell Publishing 2010, United Kingdom.

29. Copete, M.A., A. Kawamata, and R.P. Langlais, *Solitary bone cyst of the jaws: radiographic review of 44 cases*. Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 1998. 85(2): p. 221-5.

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