ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Management of Giant Odontogenic Cysts

Büyük Odontojenik Kistlerde Tedavi Yaklaşımı

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ABSTRACT Objective: The purpose of this study is to determine the bony healing of giant odontogenic cysts which underwent conventional surgical operations without using any supplementary bone filling materials. Treatment of choice for large cysts depends on the size and location of the lesion (its approximity to vital structures), the patient's age and dention. **Material and Methods:** Twenty patients who were referred to Ege University School of Dentistry, Department of Oral and Maxillofacial Surgery between 1999 and 2010 for surgical operation of their giant cystic lesions were enrolled. All patients were treated under local anesthesia using standard materials and conventional surgical methods. None of the patients had bone resection as the treatment of choice and no bone filling biomaterials were utilized throughout the treatment. All cysts were subjected to histological examination after fixation in a 10% formalin solution. The final diagnoses after histological examination are reported. **Results:** Histological diagnoses of the giant cystic lesions revealed one radicular (5%), one residual (5%) and 18 dentigerous (90%) cysts of the jaws. The radiographic findings were analyzed in 24 months. During recall examinations, none of the patients showed postoperative complications and cystic lesions revealed considerable or complete bone healing. **Conclusion:** Rather than jaw resection, a well-planned conservative surgical approach following careful evaluation, meticulous treatment planning and close follow-up of patients may be preferred for treatment of giant cystic lesions.

Keywords: Odontogenic cyst; dentigerous cysts; curettage; bone regeneration

ÖZET Amaç: Bu çalışmanın amacı, herhangi bir kemik greft materyali kullanılmadan konvansiyonel cerrahi operasyon ile tedavi edilmiş büyük odontojenik kistlerin kemik iyileşmesini belirlemektir. Geniş kistlerin tedavi seçenekleri kistin genişliğine, lokalizasyonuna, hastanın yaşına ve dentisyonuna göre değişmektedir. **Gereç ve Yöntemler:** 1999-2010 yılları arasında büyük odontojenik kistik lezyonlarının cerrahi operasyonu için Ege Üniversitesi Diş Hekimliği Fakültesi Ağız Diş ve Çene Cerrahisi Anabilim Dalı'na başvuran, aynı yöntem uygulanan 20 hasta çalışmaya alındı. Tüm hastalar lokal anestezi altında standart cerrahi yöntemler kullanılarak tedavi edildi. Hastalarda kemik rezeksiyonu uygulanmadı ve tedavi boyunca biyomateryal kullanılmadı. Tüm kistler %10'luk formalin çözeltisinde fiksasyon sonrası histolojik incelemeye tabi tutuldu. Histolojik inceleme sonrası kesin tanı bildirildi. **Bulgular:** Histolojik olarak bir radiküler (%5), bir rezidüel (%5) ve 18 dentijeröz (%90) kist tanısı koyuldu, 24 ay sonra radyolojik muayeneleri yapıldı. Kontrol muayeneleri sırasında hastalarda ameliyat sonrası komplikasyon görülmedi ve kistik lezyonlarda önemli derecede veya tam bir kemik iyileşmesi görüldü. **Sonuç:** Çene rezeksiyonu yerine, dikkatli değerlendirme, titiz tedavi planlaması ve hastaların yakın takibinden sonra iyi planlanmış konservatif cerrahi yaklaşım, büyük kistik lezyonların tedavisinde tercih edilebilir.

Anahtar Kelimeler: Odontojenik kist; dentijeröz kist; küretaj; kemik yenilenmesi

Mandibular and maxillary bone cysts are described as a pathological space with fluid or gaseous substance that is partly or fully coated by an epithelial tissue. According to their origin, they are divided into two groups: inflammatory or developmental cysts. The latter are further classified as *nonodontogenic cysts* originating from ectoderm covered in the development of the facial tissues; *odontogenic cysts* which are thought to arise from epithelial proliferation of odontogenic tissue; and *nonepithelial cysts*.[1-5] The incidence of odontogenic cysts is about 10% to 15%; thus, general dentists frequently encounter these lesions.[6-8]

Odontogenic cyst appears from the epithelium related to development of teeth such as enamel organ, the residual of the dental lamina. Radicular

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cyst (periapical cyst) is the most frequent type of odontogenic cyst that originates as an inflammatory response to the epithelial cell rests of Malassez, and it is usually preceded by periapical granulomas.[2] Presence of a non-vital tooth with small, well-contoured periapical radiolucency is required for diagnosis of radicular cysts. Until secondarily infected, radicular cysts are asymptomatic; however, they may occasionally reach to a giant size to involve a whole quadrant and may cause root resorption and mobility. Microscopically, the cyst is defined as a connective tissue wall consisting of chronic inflammatory cell foci within the lumen and a squamous epithelial layer of varying thickness. Treatment of radicular cyst is the extraction of the affected tooth or endodontic treatment of the tooth if the tooth is to be preserved.[1]

Dentigerous cysts are the second most frequent odontogenic cysts, constituting 14-39% of all jaw cysts.[2,9,10] Expansion of dental follicles due to fluid accumulation between teeth and epithelium causes these cysts.[11] They are mostly observed around mandibular third molars and maxillary canines.[2,12,13] After they progress slowly for several years without being noticed, they may be incidentally revealed during routine dental radiography.[9,13-15] On the other hand, due to their prominent growth potential, their sizes may be quite large enough to disrupt the adjacent teeth, causing root resorption or resorption of the surrounding bone.[9,16] Histologically, slowly and rapidly growing areas are defined as different sections in the connective tissue walls and epithelial parts of dentigerous cysts.[2] The clinical symptoms of dentigerous cysts may vary from facial swelling, delayed tooth eruption, numbness and paresthesia to pathological fracture; obstruction of the sinus to blindness may occur when the maxillary sinus is invaded.[9,14-17] Their multiple formation is related to syndromes such as cleidocranial dysplasia, mucopolysaccharidosis (type VI) and basal cell nevus syndrome.[12,18]

RADIOGRAPHY

Even though dentigerous cysts shall not be diagnosed solely relying on radiographic findings due to their radiographic resemblance to odontogenic keratocysts and unilocular ameloblastomas involving adjacent unerupted teeth, they have a well-known manifestation on radiographs.[2] Radiographically, dentigerous cysts are associated with the crown of an unerupted tooth and appear as unilocular radiolucent cavities with well-defined sclerotic borders, although some are multilocular and have a scalloped margin or discontinuity.[2,13-15] Occasionally, bony trabeculations which may cause erroneous impression of multilocularity, as well.[2] Conventional radiographic images reveal these lesions sufficiently.[19] However when superior bony detail and localisation of the cyst are required, computerized tomography (CT) scans allow the determination of the size of the lesion and the involvement of orbital or nasal invasion.[13,16,20] Therefore, CT may be preferred for definitive diagnosis and evaluation of the associated pathology, correct localization of the ectopic tooth, treatment planning and determination of the level of bone remodeling and the timing of proceeding from marsupialization to enucleation.[16,19,21]

In order to differentiate a dentigerous cyst from a normal follicular space, its' diameter shall be at least 5 mm.[15,22] Very occasionally, the dental follicular and/or sulcular epithelium of dentigerous cysts may give rise to malignant tumors, or may harbour metastatic tumors.[2,8,23]

HISTOLOGY

All true odontogenic cysts are characterized by 2-4 layers of cuboidal epithelium which is in fact reduced enamel epithelium, lining a loose fibrous connective tissue cyst wall that consists of immature fibroblasts and acidic mucopolysaccharide ground substance.[2,9]

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of an odontogenic cyst includes other odontogenic cysts and odontogenic tumors, such as ameloblastoma, Pindborg tumor, odontoma, odontogenic fibroma, cementomas, and giant cell granuloma.[12,13,22]

TREATMENT

Treatment of choice for large cysts depends on the size and location of the lesion (its approximity to vital structures), the patient's age and state of dention.[2,21,24]

In pediatric patients, removal of the cyst but remaining the unerupted intact teeth has been preferred.[2,15,22] Commonly, marsupialization (Partsch I technique), and cyst enucleation or curettage through either extraoral or intraoral approach with and without endoscopic intervention has been employed.[21,25,26] Cysts with limited size are treated with careful enucleation and curettage of the cyst, followed by removal of the impacted tooth/teeth.[20,27] On the other hand, cysts with extensive size are treated by marsupialization or decompression, and afterwards, enucleation is performed.[15,20,22,27] With this two-step approach, irritation of adjacent vital structures or possible iatrogenic bone fractures may be prevented; additionally, new bone formation may be stimulated by decreasing the intracystic pressure.[24] However, histological examination of the cystic epithelium of all surgical borders can not be performed with this method and potential malignant changes can not be excluded.[24] For giant cysts which may lead to pathological bone fracture, supplementary materials such as autogenous grafts or alloplastic materials may be utilized to regain integrity of the bone.[27]

In this prospective case series report, we aimed to present the results of conventional surgical approach to giant cystic lesions observed in the maxilla and the mandible without using bone resection and/or biomaterials to fill the cavities.

MATERIAL AND METHODS

Among the patients examined in Ege University School of Dentistry Department of Oral Diagnosis and Radiology between 1999-2010, 20 patients (11 males, 9 females) with ages ranging between 15 and 84 (mean 37.9 years) who were referred to Ege University School of Dentistry Department of Oral and Maxillofacial Surgery for surgical operation of their cystic lesions were enrolled into this study, that followed the Declaration of Helsinki on medical protocol and ethics (Ege University Faculty of Medicine Ethics Committee). After obtaining the patients' informed consents which also include their release forms for photographs, their demographic characteristics and the location of the present cystic lesions were recorded (Table 1). Analog or digital (depending on the time of the admission) panoramic radiographs of the patients were obtained under standard conditions, using a panoramic x-ray device under standard exposure conditions. Analog images were converted to digital by using a flat-bed scanner that has a transparency adapter (Epson EXP 1680Pro, Seiko Epson Corp., Nagano, Japan) with 8-bit gray-scale acquisition depth and 300 dpi spatial resolution. For very large cysts, computerised tomographic or dental volumetric tomographic images were requested during treatment planning. In order to classify the cysts as giant cysts, we required a diameter of at least 2 cm. Therefore, patients with cysts meeting this criteria and who had no systemical contraindications for surgery were enrolled into the study.

SURGICAL OPERATION

The operations were completed by the same experienced oral surgeon using standard materials and surgical methods. All patients were treated under local anesthesia, and the choice of anesthetic material was determined according to the general health status of the patient. A mucoperiostal flap was elevated, and access to the lesion was obtained using a round bur in a low-speed handpiece under irrigation. In some cases, we have observed the cyct epitelium just beneath the mucoperiosteal flap due to the resoprtion of the overlying cortical bone. In order to induce following bone regeneration and to provide support to the soft tissues during healing period, largest amount of bone was preserved. Whenever possible, the cysts were enucleated in one piece (Figure 1). In cases when the cyst epithelium was not totally enucleated, cyst cavity was curetted thoroughly to eradicate the residual fragments which may increase the risk of recurrence. In the mandible, the inferior alveolar nerve was carefully protected; additionally, vital roots of neighboring teeth were also spared. In all cases, primary closure was performed, and these were removed in post-operative 7-10 days. Antibiotics were prescribed to all patients (3 g ampicillin 1 hour before and 1.5 g 6 hours after surgery).

All cysts were subjected to histological examination after fixation in a 10% formalin solution. Histological evaluations of all surgical materials were provided by Ege University Faculty of Medicine, De-

TABLE 1: The demographic characteristics of the patients, clinicial symptoms and signs related to their lesions, type of operation and histological diagnoses of the cysts (All patients except patient #8 were recalled every 6 months and then, every year. Patient #8 failed to comply with radiographic controls after 6 months).

Name	Gender	Age	Location	Symptoms and signs	Operation	Histology	Operation date
MO	K	23	Maxillary right central-left second molar-orbit	Swelling, sinus problems	Cystostomy + delayed cystectomy	Dentigerous cyst	03.11.2010
MC	K	72	Mandibular right canine-third molar-ramus	Swelling, fluid secretion	Cystostomy + delayed cystectomy	Dentigerous cyst	26.08.2009
IA	K	22	Mandibular right lateral-second molar	Swelling, pain	Cystectomy	Dentigerous cyst	16.02.2010
HK	E	32	Maxillary right second molar-left canine	Swelling	Cystostomy + delayed cystectomy	Dentigerous cyst	22.05.2007
MA	E	23	Maxillary left central-third molar	Swelling, sinus problems	Cystostomy + delayed cystectomy	Dentigerous cyst	06.02.2009
GG	K	18	Mandibular left second premolar-third molar	Swelling, pain	Cystostomy + delayed cystectomy	Dentigerous cyst	02.03.2010
TS	K	45	Mandibular right third molar-ramus	Swelling	Cystectomy	Dentigerous cyst	12.04.2010
NE	E	73	Mandibular right second molar-left first premolar	Swelling	Cystectomy	Residual cyst	15.01.1999
YC	E	71	Mandibular right second molar-left canine	Swelling	Cystectomy	Dentigerous cyst	27.10.2000
HO	E	41	Mandibular right second molar-left third molar	Pain	Cystostomy + delayed cystectomy	Dentigerous cyst	01.11.1999
OT	E	25	Maxillary left second premolar-tuber maxilla	Swelling	Cystostomy + delayed cystectomy	Dentigerous cyst	26.03.2002
FD	K	84	Mandibular right canine-left second molar	Swelling	Cystostomy + delayed cystectomy	Dentigerous cyst	13.05.2002
ET	K	29	Mandibular right second molar-condyl	Swelling	Cystostomy + delayed cystectomy	Dentigerous cyst	28.03.2008
MOC	E	29	Maxillary right second premolar-left lateral-nasal cavity	Swelling	Cystostomy + delayed cystectomy	Dentigerous cyst	29.12.2010
AOG	E	15	Mandibular right first molar-left canine	Swelling	Cystostomy + delayed cystectomy	Dentigerous cyst	24.01.2006
OS	E	16	Maxillary left canine-floor of orbit-processus pterygoideus	Swelling, pain	Cystectomy	Dentigerous cyst	12.08.2010
SA	K	17	Mandibular right central-left second premolar	Swelling	Cystectomy	Dentigerous cyst	07.11.2006
İİ	E	53	Left angulus mandible	None	Cystectomy	Dentigerous cyst	12.01.2004
DA	K	41	Right angulus mandible	Pain	Cystectomy	Dentigerous cyst	08.05.2006
GDO	E	21	Right angulus and corpus mandible	Swelling, pain	Cystectomy+46-47 extraction	Radicular cyst	16.12.2004

FIGURE 1: Complete enucleated cyst that was attached to the root of the tooth.

partment of Pathology. The final diagnoses after histological examination are reported in Table 1.

RESULTS

Histological diagnoses of the giant cystic lesions revealed one radicular (5%), one residual (5%) and 18 dentigerous (90%) cysts of the jaws. Of these, 6 lesions (30%) were observed in maxilla, whereas 16 (70%) were located in the mandible; these findings were in accordance with the literature that state the predilection of the mandible for dentigerous cysts.[2,10,12,13,28] Clinical and radiological follow-up was performed at 6, 12, and 24 months postoperatively to evaluate the reduction in size of the residual cavity and the change in bone density compared with the immediate postoperative panoramic radiographs (Table 2). None of the patients reported postoperative complications that interfered with the healing process of the lesions. The radiographic findings were analyzed subjectively regarding the compression of the lesion size and filling of the cavity with reperative bone. In 24 months recall examinations, none of the patients showed recurrences.

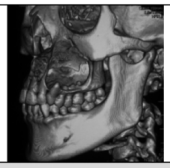
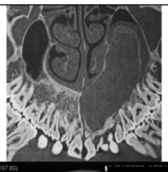
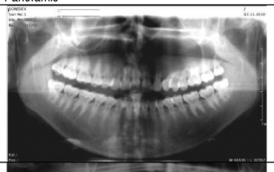
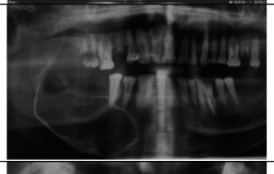
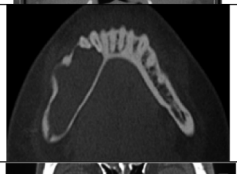
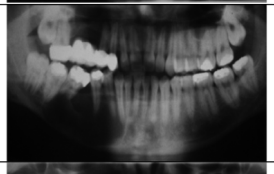
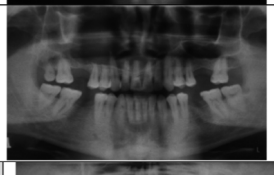
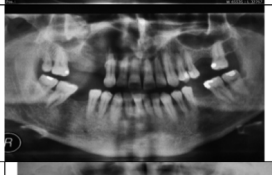
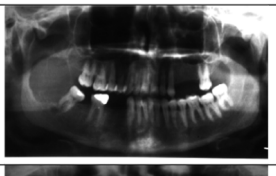
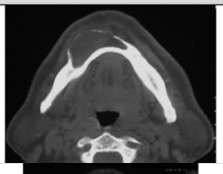
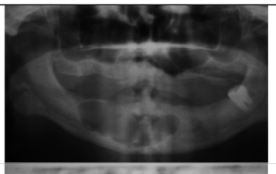
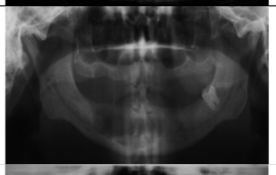
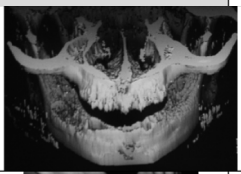
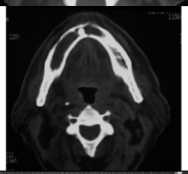
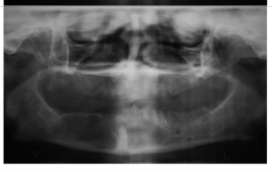
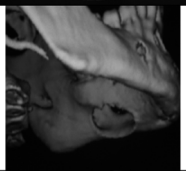
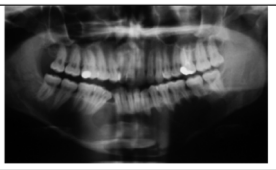
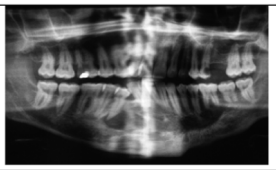
DISCUSSION

Koseoglu et al. examined 90 clinical cases of odontogenic cysts in a Turkish population and reported that of all cases, 59% were radicular cysts, 27% were keratocysts and 14% were dentigerous cysts.[10] Tekkesin et al. stated that in their Turkish sample, almost all of the cysts observed in oral region were odontogenic (98.3%), and radicular cyst was the most frequent diagnosis (52.09%), followed by odontogenic keratocyst (20.6%) and dentigerous cyst (10.39%).[28] Acıkgoz et al. screened 12,350 patients' records in Turkey and they declared that the most frequent odontogenic cyst was radicular (54.7%), followed by dentigerous (26.6%), residual (13.7%) and odontogenic keratocyst (3.3%) in their study sample.[29] We have not performed a clinical or histological screening among cases; rather, we have included inpatients who were admitted to Department of Oral Diagnosis and Radiology with giant cysts that present diameters over 2 cm. Therefore, we can not provide a meaningful frequency for dentigerous cysts, but in our limited sized study sample, 18 out of 20 patients had dentigerous cysts, as confirmed by histological evaluation.

Even though the extensive size of the cysts observed in our cases carried the potential to cause either bone fractures or other post-operative complications related to the size of the lesions, our case series revealed that giant cysts can be managed using conventional methods and can heal perfectly without resection of the involved bone. We have observed that the patients have experienced minimal functional and esthetic loss since their original bone contours were preserved throughout the treatment period. Radiological recall examinations revealed that even the cysts large enough to cause pathological bone fractures have healed without any complications and anatomical bone contours were attained successfully. We have not observed postoperative infection of the coagulum, which would be considered as a consequence of correct treatment planning for giant cysts in this study.

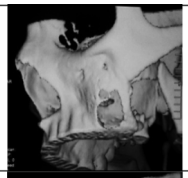
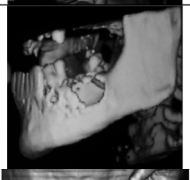
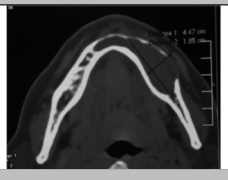
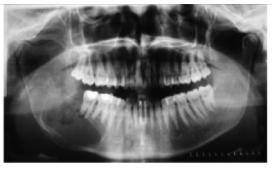
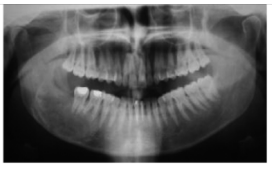
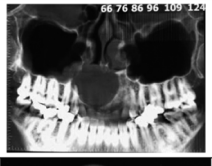
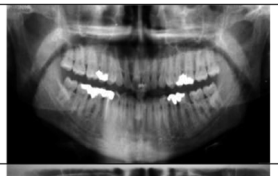
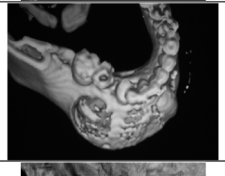
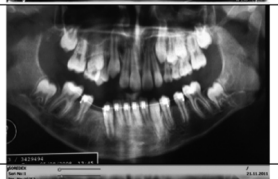
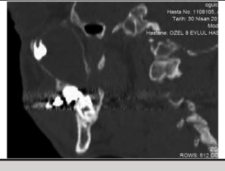
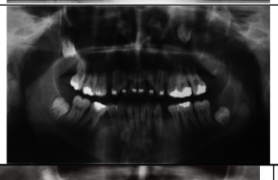
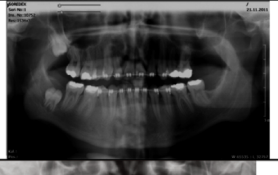
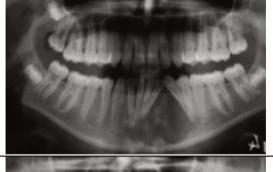
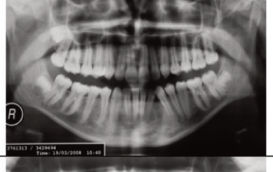
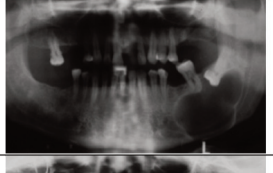
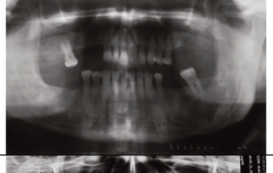
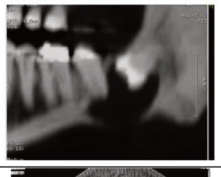
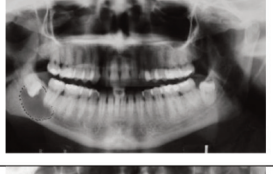
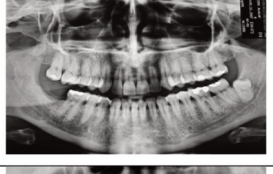
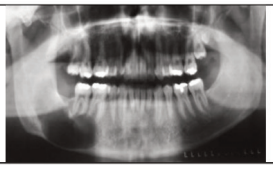
In our cases, we have abstained using grefts during surgery. Considering that enormous amount of biomaterial was required for surgical treatment of giant cysts, we have also avoided utilization of biomaterials due to the economical burden of this approach.

TABLE 2: Pre and post operative radiographic images of the patients.

		Preoperative			Postoperative
	Name	3-D	CT	Panoramic	Panoramic
1	MO				
2	MC				
3	IA				
4	HK				
5	MA				
6	GG				
7	TS				
8	NE*				
9	YC				
10	HO				

continued →

TABLE 2: Pre and post operative radiographic images of the patients *(continued)*.

11	OT				
12	FD				
13	ET				
14	MOC				
15	AOG				
16	OS				
17	SA				
18	İİ				
19	DA				
20	GDO				

The complete packing of the bone cavities of older patients was deferred, and this was an established condition observed in elderly due to their delayed bone regeneration capacity.[30]

CONCLUSION

Regarding our 20 cases, we concluded that with careful evaluation, meticulous treatment planning and follow-up of patients, a well-planned conservative surgical approach rather than jaw resection may lead to favorable results in giant oral cystic lesions.

Source of Finance

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Hüseyin Koca;* ***Design:*** *Pelin Güneri;* ***Control/Supervision:*** *Aylin Sipahi Çalış;* ***Data Collection and/or Processing:*** *Aylin Sipahi Çalış;* ***Analysis and/or Interpretation:*** *Candan Efeoğlu;* ***Literature Review:*** *Candan Efeoğlu;* ***Writing the Article:*** *Pelin Güneri, Aylin Sipahi Çalış;* ***Critical Review:*** *Pelin Güneri;* ***References and Fundings:*** *Hüseyin Koca, Aylin Sipahi Çalış;* ***Materials:*** *Aylin Sipahi Çalış.*

REFERENCES

1. Underbrink M, Pou A, Quinn, Jr FB, Ryan MW. Odontogenic cysts and tumors. Grand Rounds Presentation, UTMB, Dept. of Otolaryngology. February 13, 2002., downloaded on 12 Dec 2011.[Link]
2. Shear M, Speight PM. Cysts of the Oral and Maxillofacial Regions. 4th ed. Singapore: Blackwell Munksgaard; 2007. p.228.[Crossref]
3. Prockt AP, Schebela CR, Maito FDM, Sant'Ana-Filho M, Rados PV. Odontogenic cysts: analysis of 680 cases in Brazil. Head Neck Pathol. 2008;2(3):150-6. [Crossref] [PubMed] [PMC]
4. Nuñez-Urrutia S, Figueiredo R, Gay-Escoda C. Retrospective clinicopathological study of 418 odontogenic cysts. Med Oral Patol Oral Cir Bucal. 2010;15(5):e767-73. [Crossref] [PubMed]
5. Larsen PE, Hegtvedt AK. Odontogonesis and odontogenic cysts and tumors. In: Cummings CW, ed. Otolaryngology Head and Neck Surgery. 2nd ed. Vol 2. St. Louis: Mosby Year Book; 1993. 3-17.
6. Driemel O, Rieder J, Morsczeck C, Schwarz S, Hakim SG, Müller-Richter U, et al. [Comparison of clinical immunhistochemical findings in keratocystic odontogenic tumours and ameloblastomas considering their risk of recurrence]. Mund Kiefer Gesichtschir. 2007; 11(4):221-31. [Crossref] [PubMed]
7. Grossmann SM, Machado VC, Xavier GM, Moura MD, Gomez RS, Aguiar MCF, et al. Demographic profile of odontogenic and selected nonodontogenic cysts in a Brazilian population. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007;104(6):e35-41. [Crossref] [PubMed]
8. Eichhorn W, Wehrmann M, Blessmann M, Pohlenz P, Blake F, Schmelzle R, et al. Metastases in odontogenic cysts: literature review and case presentation. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010;109(4): 582-6. [Crossref] [PubMed]
9. Aziz SR, Pulse C, Dourmas MA, Roser SM. Inferior alveolar nerve paresthesia associated with a mandibular dentigerous cyst. J Oral Maxillofac Surg. 2002;60(4):457-9. [Crossref] [PubMed]
10. Koseoglu BG, Atalay B, Erdem MA. Odontogenic cysts: a clinical study of 90 cases. J Oral Sci. 2004;46(4):253-7. [Crossref] [PubMed]
11. Edamatsu M, Kumamoto H, Ooya K, Echigo S. Apoptosis-related factors in the epithelial components of dental follicles and dentigerous cysts associated with impacted third molars of the mandible. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2005;99(1):17-23. [Crossref] [PubMed]
12. Ustuner E, Fitoz S, Atasoy C, Erden I, Akyar S. Bilateral maxillary dentigerous cysts: a case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2003;95(5):632-5. [Crossref] [PubMed]
13. Tournas AS, Tewfik AM, Chauvin PJ, Manoukian JJ. Multiple unilateral maxillary dentigerous cysts in a non-syndromic patient: a case report and review of the literature. Int J Pediatr Otorhinolaryngol Extra. 2006;1(2):100-6. [Crossref]
14. Akyol UK, Salman IA. A case of an extensive dentigerous cyst in the maxillary sinus leading to epiphora and nasal obstruction. J Emerg Med. 2012;43(6):1004-7. [Crossref] [PubMed]
15. Passi S, Gauba K, Agnihotri A, Sharma R. Dentigerous cyst in primary dentition: a case report. J Indian Soc Pedod Prev Dent. 2008;26(4):168-70. [Crossref] [PubMed]
16. Avitia S, Hamilton JS, Osborne RF. Dentigerous cyst presenting as orbital proptosis. Ear Nose Throat J. 2007;86(1):23-4. [Crossref] [PubMed]
17. Litvin M, Caprice D, Infranco L. Dentigerous cyst of the maxilla with impacted tooth displaced into orbital rim and floor. Ear Nose Throat J. 2008;87(3):160-2. [Crossref] [PubMed]
18. Roberts MW, Barton NW, Constantopoulos G, Butler DP, Donahue AH. Occurrence of multiple dentigerous cysts in a patient with the Maroteaux-Lamy syndrome (mucopolysaccharidosis, type VI). Oral Surg Oral Med Oral Pathol. 1984;58(2):169-75. [Crossref] [PubMed]
19. Dağistan S, Cakur B, Göregen M. A dentigerous cyst containing an ectopic canine tooth below the floor of the maxillary sinus: a case report. J Oral Sci. 2007;49(3):249-52.[Crossref] [PubMed]
20. Prabhakar V, Sandhu SV. Nonsyndromic bilateral maxillary dentigerous cysts: review of literature and report of an unusual case. Int J Pediatr Otorhinolaryngol Extra. 2011;6(1):5-8.[Crossref]

21. Bodner L, Bar-Ziv J. Characteristics of bone formation following marsupialization of jaw cysts. Dentomaxillofac Radiol. 1998;27(3): 166-71. [Crossref] [PubMed]

22. Kirtaniya BC, Sachdev V, Singla A, Sharma AK. Marsupialization: a conservative approach for treating dentigerous cyst in children in the mixed dentition. J Indian Soc Pedod Prev Dent. 2010;28(3):203-8. [Crossref] [PubMed]

23. Elo JA, Slater LJ, Herford AS, Tanaka WK, King BJ, Moretta CM. Squamous cell carcinoma radiographically resembling a dentigerous cyst: report of a case. J Oral Maxillofac Surg. 2007;65(12):2559-62. [Crossref] [PubMed]

24. Litonjua LA, Aguirre A, Estrada MCL. Radiolucency in the mandible. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2004;98(5):511-5. [Crossref] [PubMed]

25. Wang CC, Kok SH, Hou LT, Yang PJ, Lee JJ, Cheng SJ, et al. Ectopic mandibular third molar in the ramus region: report of a case and literature review. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008;105(2):155-61. [Crossref] [PubMed]

26. Saia G, Fusetti S, Emanuelli E, Ferronato G, Procopio O. Intraoral endoscopic enucleation of a solitary bone cyst of the mandibular condyle. Int J Oral Maxillofac Surg. 2012;41(3):317-20. [Crossref] [PubMed]

27. Yüzügüllü B, Araz K. Validity of conventional surgical treatment methods for mandibular dentigerous cysts. Two case reports. N Y State Dent J. 2011;77(2):36-9. [PubMed]

28. Tekkesin MS, Olgac V, Aksakalli N, Alatli C. Odontogenic and nonodontogenic cysts in Istanbul: analysis of 5088 cases. Head Neck. 2012;34(6):852-5. [Crossref] [PubMed]

29. Açikgöz A, Uzun-Bulut E, Özden B, Gündüz K. Prevalence and distribution of odontogenic and nonodontogenic cysts in a Turkish population. Med Oral Patol Oral Cir Bucal. 2012;17(1): e108-15. [Crossref] [PubMed] [PMC]

30. Janicki P, Boeuf S, Steck E, Egermann M, Kasten P, Richter W. Prediction of in vivo bone forming potency of bone marrow-derived human mesenchymal stem cells. Eur Cell Mater. 2011;21:488-507. [Crossref] [PubMed]