Journal of Applied Dental and Medical Sciences
NLM ID: 101671413 ISSN:2454-2288
Volume 3 Issue1 January-March 2017

Original article

Zygomatic Air Cell Defect – A Retrospective Panoramic Radiographic Study

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ARTICLE INFO

Keywords:
Pneumatized articular eminence; zygomatic air cell defect; panoramic radiography; accessory air cells.

ABSTRACT

Aim: To determine the prevalence, radiographic appearance and characteristics and establishing dominant location of zygomatic air cell defect (ZACD) on digital panoramic radiographs in south Indian population.
Materials & Methods: The dental panoramic radiographs of 500 dental outpatients were examined retrospectively for the presence of ZACD and to evaluate the variations and characteristics of ZACD. Groups were compared by v2 analysis for the presence of ZACD.
Results: ZACD was found in 24 patients with a prevalence rate of 4.8%.Unilateral and unilocular appearances were the dominant patterns. Patients with ZACD were mostly in the third decade of life.
Conclusion: Digital panoramic radiographs are considered better than conventional panoramic radiographs in identifying and locating ZACD. It may be very useful in planning surgical treatment of the temporomandibular joint and in understanding the spread of pathological processes into the joint.

Introduction

Pneumatization refers to the presence or genesis of air-filled cavities in a bone.[1] Pneumatization of the mastoid begins in the 33rd week of embryonic life and continues up to 8-9 years of age. Until after birth pneumatic cellular expansion occurs into the remainder of the temporal bone as a result of the stimulation caused by the presence of air within the middle ear.[2] In addition to the pneumatization in the mastoid process, accessory air cells may develop in numerous location like majority of paranasal air sinuses, the temporal bone, including the root of the zygomatic arch and its articular eminence.[1] The pneumatized air cells occurring in the zygomatic process of temporal bone have been termed as Zygomatic air cell defect.[3]

Tyndall and Matteson were the first to introduce ZACD as "pneumatized articular eminence". Later in

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the year 1987, the same investigators named the entity as Zygomatic air cell defects.The ZACD has been defined as "an accessory air cells in the zygomatic process and articular eminence of the temporal bone which appears similar to the mastoid air cells and which does not extend further anteriorly than the zygomaticotemporal suture".[4] These occur in the root of zygomatic arch with any frequency.

Fig 1: Panoramic radiograph showing unilateral and unilocular ZACD.

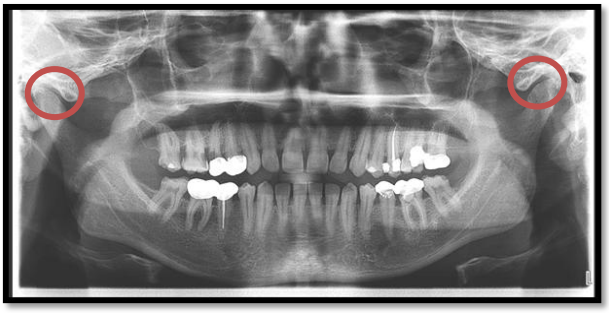

Fig 2: Panoramic radiograph showing bilateral and unilocular ZACD.

They present as asymptomatic, radiolucent, non-expansile, non-destructive entity and are incidentally detected on radiograph.

Tyndall and Matteson in 1985 and Carter et al., have classified ZACD on the basis of their radiographic appearances on panoramic radiograph into three types

(a) Unilocular type;

(b) Multilocular type ; and

(c) Trabecular type.[5]

Unilocular variant appear as radiolucent, with well defined borders. Multilocular variant shows the presence of numerous small cavities within them, resembling mastoid air cells. Trabecular type is basically a multilocular entity with internal bony striations.[5.6]

Panoramic radiographs can be considered useful in detecting ZACD of the temporal bone, as the posterior aspect of the zygomatic arch is well displayed in this radiographs.[6-8]

Computed tomography can be used for detecting ZACD but its use cannot be justified as its cost ineffective.

When ZACD are detected preoperatively on a radiograph, these might become contraindications for surgical procedures, such as eminoplasty or eminectomy for the treatment of mandibular dislocations. They can serve as potential pathway for the spread of pathological processes, cranial sepsis and infections postoperatively.[5]

Kulikowski et al. has reported the discovery of these air cells in the zygomatic arch of a patie nt who underwent surgical removal of the articular eminence for the treatment of chronic severe condylar subluxation.[9]

The aims of the present study were to determine the prevalence, radiographic appearance, and characteristics of ZACD in digital panoramic radiographs in a South Indian population.

MATERIALS AND METHOD:

The present study comprised of dental panoramic radiographs of outpatients aged between 15-65yrs who visited the Department of Oral Medicine and Radiology during the period of November 2014-October 2015. A total of 500 panoramic radiographs of patients were examined retrospectively. The selection criteria for panoramic radiographs included patients who visited for third molar evaluation, patients who required extensive restorative dental procedures, patients with swelling, asymmetry, missing or supernumerary teeth, or severe generalized caries, and patients who required mixed dentition analysis and examination for temporomandibular joint (TMJ) disorders. Cases in which the zygomatic arch was not adequately displayed for anatomical or technical reasons were excluded from the sample and did not constitute part of the 500-patient sample. Subjects with developmental malformations of the face and jaws, those in whom systemic conditions had affected growth, those with clinical or radiographic evidence of pathologies in the maxillofacial region, and those with a history of trauma to the maxillofacial region and who had been treated with surgical intervention were excluded from the study. Digital radiographs were obtained with PLANMECA panoramic digital radiographic machine operating at 65 to 80 Kvp, 10 mA, 16 s. A written informed consent was obtained from all the patients prior to the inclusion of the study. Diagnosis of ZACD was done if clear well defined unilocular or multilocular radiolucency is seen in the root of the zygomatic arch or articular eminence posterior to zygomaticotemporal suture. Subsequently, ZACDs were classified depending on: (1) age and gender, (2) the location: unilateral or bilateral and (3) the appearance: unilocular or multilocular. Group I consisted of panoramic radiographs of patients aged 15–35 years, group II consisted of panoramic radiographs of patients aged 36–65 years. Radiographs were examined in subdued ambient lighting using transmitted light from a standard viewing box by a single oral and maxillofacial radiologist. The data were tabulated and subjected to statistical analysis using SPSS software (version 20). Statistical comparison was performed using v2-test.

TOTAL NO.	PREVALENCE %	SEX		SITE			LOCULARITY	
		Males	Females	R	L	BL	Unilocular	Multilocular
24	4.8%	11(2.2%)	13 (2.6%)	7	11	6	20	4

Table 1: Distribution And Location Of Zygomatic Air Cell Defect.

RESULTS:

Of the 500 panoramic radiographs, zygomatic air cell defect was present in 24 radiographs, accounting for prevalence to 4.8%. Of the 24 ZACD, 11 were found in males (2.2%), and 13 were found in females (2.6%) (Table 1). This difference was not significant (P =). Of the 24, 14 ZACD were found in group I, 10 in group II. Of the 24 ZACD, 18 were unilateral and 6 were bilateral, 4 were multilocular, and 20 were unilocular, with a highly significant difference ($P < 0.001$). Patients with ZACD were mostly in their thirties. The incidence decreased after the third decade of life. The prevalence of ZACD among the 500 patients was 4.8%, and the age range of these patients was 20–60 years.

DISCUSSION:

Pneumatization of solid tissue gradually leads to the development of the mastoid air cells and paranasal sinuses (PNSs) which are the best characterized structures for aeration in humans.[10]

The cause of ZACD is unknown but may be similar to that of pneumatization of the mastoid process. Pneumatization starts with the formation of small osseous cavities developed by normal periosteal activity.[11] Dedifferentiation of the primitive bone marrow in these cavities leads to the formation of loose mesenchymal connective tissue. Epithelium invaginates into this connective tissue and produces a mucous membrane which then undergoes atrophy, leaving a thin residual lining membrane attached to the periosteum. Expansion of the air cells occurs as a result of continued sub epithelial bone resorption.[12] Pneumatization of temporal bones occurs in 2 regions- 1- primary region and 2- accessory region. The primary region includes middle ear, mastoid, petrous apex and perilabyrinthine. The accessory region includes the squamous, zygomaticooccipital and styloid. ZACD may also be produced by the extension of tegmental or periantral air cell into the zygomatic arch.[11, 13]

Al-Faleh *et al.* stated that ZACD may render the temporal component of the TMJ more fragile and the roof of the glenoid fossa would be extensively weakened by pneumatization. Therefore, a severe traumatic injury may cause impingement of the head of the condyle on the middle cranial fossa.[14] It requires no treatment but it may be a contraindication for performing eminectomy or eminoplasty.[7] So it is necessary for surgeons to be more cautious when dealing with mandibular condyle and articular eminence surgery because inadvertent penetration through the defect can lead to dural tear and cerebrospinal fluid leakage.[5,7,15] Panoramic radiography seems to be proper option for evaluation of ZACD, since the posterior part of zygomatic arch is usually displayed. Furthermore low cost and radiation dose compared with CT made it the initial method to check for this defect.

The overall prevalence of ZACD in this study was 4.8% which showed higher prevalence compared to previous studies that reported almost similar prevalence of 1.5%, 1.82%, 1.88%, 1.85%, 1%, and 1.3%. Miloglu et al., in a recent investigation, studied 515 CBCT images and revealed an overall prevalence of 8%. The higher rate of prevalence was perhaps due to the fact that CBCT is not subjected to superimposition and hence it has a higher diagnostic

accuracy when compared to panoramic radiographs in the evaluation of temporal air spaces.[16]

There was no statistical difference regarding the prevalence in males and females. This is in accordance with other studies in literature. The incidence of ZACD decreases with age, as found in other studies. Further, these defects are mostly found in patients in their thirties, as proved in this study.

There were 18 unilateral and 6 bilateral ZACD in the present study. This suggests that these defects mostly occur unilaterally, which is consistent with previous studies. Of the 18 unilateral, 7 occurred on the right side, and only 11 occurred on the left side. Although this difference was not significant statistically, the reason for this preference for the right side is not known. In contrast to our findings, Carter et al. and Park et al. reported an almost equal distribution of ZACD.[5, 6] This difference might be due to variations in the sample sizes, as well as the populations studied.

Of the 24 defects, 4 were multilocular and 20 were unilocular, making the unilocular type by far the more common and most significant type, although it has been suggested in some studies that multilocular are more common, and some studies have reported an almost equal number of unilocular and multilocular cases.

The present study revealed a demonstrable prevalence rate of ZACD of 4.8%, which is comparatively higher than other studies in the literature so far. This might be because digital panoramic radiographs were used in the present study compared to other similar studies, in conventional panoramic radiographs were used. All of the published literature on ZACD, including the present study, shows a low prevalence. Two possible reasons for this entity having a low prevalence include: (a) the number of ZACD might be small, and might not be observed, as there is a wide variability in the extent of accessory air cells of temporal bone; and (b) in panoramic radiographs, radiographic visualization of these defects is more difficult, because of the superimposition of adjacent anatomic structures.

In the present study, the youngest patient with the defect was 16 years of age. However, it is unknown at what age accessory air cells begin to develop, as pneumatization of the mastoid process is almost completed by 6 years of age.

Hollingshead pointed out that accessory air cells begin to pneumatize after puberty, and reach their full size after several years, as with mastoid air cells.[17] Failure to detect ZACD before the second half of the second decade of life might be due to the fact that the process of pneumatization does not become extensive enough to be radiographically evident. Orhan et al. noted that the pneumatization of accessory air cells begins before puberty, which is contrary

to general opinion and statements.

The differential diagnosis of radiolucencies within the zygomatic arch include ZACD, aneurysmal bone cyst, hemangioma, giant cell tumor, eosinophilic granuloma, fibrous dysplasia and metastatic tumor. Only the ZACD occurs in the zygomatic arch with any frequency and presents as an asymptomatic, non-expansile, nondestructive radiolucency detected incidentally on radiograph. All of the other entities in the differential diagnosis including osseous hemangioma is a rare lesion in zygoma and would be characterized by enlarging and painful cheek, bony expansion with cortical destruction and frequently mixed density lesions.

The clinical significance of ZACD is that they represent sites of minimal resistance and thus facilitate the spread of various pathologic processes into the

TMJ such as tumors, inflammation or fractures and that they may be possible complicating factors during TMJ surgery.[18] Inadvertent violation of an air cell during eminectomy, producing communication with the infratemporal or middle cranial fossa poses the genuine danger of intracranial infection and/or hemorrhage. Therefore, it is justified that a preoperative imaging evaluation is necessary to detect this entity and to prevent untoward complications.

CONCLUSION:

In light of the higher prevalence of Zygomatic air cell defect in the present study in contrast to older studies using conventional panoramic radiographs, it is evident that ZACD could be better indentified by digital panoramic radiographs. It is of utmost importance that radiologists, diagnosticians and surgeons should be aware of this entity so that precise identification can be made, which will not only prevent unnecessary investigations and explorations but also forewarns the surgeon and thus helps to prevent potential intracranial complications.

ACKNOWLEDGEMENT:

I would like to extend my humble and extreme heartfelt gratitude to my friend and junior, Dr Gulnaaz Anjum Department of Oral Medicine and Radiology, A.M.E'S Dental College, for providing constant encouragement, unstinted support throughout the study.

REFERENCES:

1. Romannes GJ. 11th Ed. New York: Oxford University Press; 1972. Cunningham's textbook of anatomy.
2. Som PM, Curtin HD. Head and neck imaging. St Louis: Mosby; 2003. Temporal bone: Embryology and Anatomy; pp. 1061–2.
3. Orhan K, Delibasi C, Orhan AI. Radiographic evaluation of pneumatized articular eminence in a group of Turkish children. Dentomaxillofac Radiol 2006; 35:365‑70.
4. Tyndall DA, Matteson SR. The zygomatic air cell defect (ZACD) on panoramic radiographs. Oral Surg 1987; 64: 374.
5. Carter LC, Haller AD, Calamel AD, Pfaffenbach AC. Zygomatic air cell defect (ZACD). Prevalence and characteristic in a dental clinic outpatient population. Dentomaxillofac Radiol 1999; 28: 116–22.
6. Park YH, Lee SK, Park BH et al. Radiographic evaluation of the Zygomatic air cell defect. Korean J Oral Maxillofac Radiol 2002; 32: 207–11.
7. Orhan K, Delibasi C, Cebeci I, Paksoy C. Prevalence and variations of pneumatized articular eminence: a study from Turkey. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005; 99: 349.
8. Kaugars GE, Mercuri LG, Laskin DM. Pneumatization of the articular eminence of the temporal bone: prevalence, development, and surgical treatment. J AmDent Assoc 1986; 113: 55–7.
9. Kulikowski BM, Schow SR, Kraut RA. Surgical management of a pneumatized

articular eminence of the temporal bone. J Oral Maxillofac Surg 1982; 40: 311–3.

10. Kim J, Song SW, Cho JH, Chang KH, Jun B. Comparative study of the pneumatization of the mastoid air cells and paranasal sinuses using three-dimensional reconstruction of computed tomography scans. Surg Radiol Anat. 2010; 32:593–9.
11. Virapongse C, Sarwar M, Bhimani S, Sasaki C, Shapiro R. Computed tomography of temporal bone pneumatization: 1. Normal pattern and morphology. AJNR 1985; 6:551-59.
12. Beaumont GD. The effects of exclusion of air from pneumatized bones. J Laryngol Otol 1966; 80:236-49.
13. Allam AF. Pneumatization of the temporal bone. Ann Otol Rhinol Laryngol.1969; 78:49-64.
14. Al-Faleh W, Ekram M. A tomographic study of air cell pneumatization of the temporal components of the TMJ in patients with temporomandibular joint disorders.
15. Patil K, Mahima VG, Malleshi SN, Srikanth HS. Prevalence of zygomatic air cell defect in adults-A retrospective panoramic radiographic analysis. Eur J Radiol.2011; 81:957–9.
16. Miloglu O, Yilmaz AB, Yildirim E, Akgul HM. Pneumatization of the articular eminence on cone beam computed tomography: Prevalence, characteristics and a review of the literature. Dentomaxillofac Radiol. 2011; 40:110–4.
17. . Yavuz MS, Aras MH, Gungor H, Buyukkurt MC. Prevalence of the pneumatized articular eminence in the temporal bone. J Craniomaxillofac Surg. 2009; 37:137–9.
18. Weinberg S. Eminectomy and meniscorrhaphy for internal derangements of the temporomandibular joint. Oral Surg Oral Med Oral Pathol 1984; 57:241-49.