

Incidental dentomaxillofacial findings on cone beam computed tomography images of Iranian population

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Original Article

Abstract

BACKGROUND AND AIM: The present study aimed to assess the nature and prevalence of incidental findings in cone beam computed tomography (CBCT) images of oral and maxillofacial patients.

METHODS: In this cross-sectional study, 773 CBCT samples were retrieved from archives of a private oral and maxillofacial radiology center. Any findings that were not related to the reason of CBCT request was recorded in forms designed originally for this study.

RESULTS: 475 patients out of 773 had at least one incidental finding. It composed about 60% of the patients. The largest frequency of incidental findings were cases of periapical lesions. (n = 189), followed by mucous thickening of maxillary sinus (n = 170), retained root (n = 32), impaction and 3rd molar (n = 26). Other incidental findings were torus (n = 25), dental anomalies (n = 13), vertical root fracture (n = 5), intra bony lesion and periapical pathosis (n = 4) and the lowest frequency was sialoliths (n = 1).

CONCLUSION: About half of the subjects have had at least one incidental finding, so the precise review of the CBCT images seems to be necessary.

KEYWORDS: Incidental Findings, Cone Beam Computed Tomography, Dentomaxillofacial

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During the past four decades, dentistry has seen a dramatic expansion of the imaging technology.¹ Cone beam computed tomographic (CBCT) scanners were first introduced in 1997 in Italy,² and have been commercially available since 2001 in the United States and since 2006 in Iran. Using a cone-shaped X-ray beam, CBCT scanners perform a single rotation around the patient's head at a constant angle, producing a volumetric data set that is later reconstructed into three-dimensional images.³ The CBCT scan has two major advantages over two-dimensional conventional radiographs in

that it eliminates geometric distortion and superimposition of surrounding anatomical structures.⁴ Moreover, CBCTs use much lower radiation exposure, which ranges from 29 to 577 uSV, compared to conventional CT scanner with radiation exposure approximately 2000 uSV.³ This is important especially in reducing the radiation burden in treatment of children and young adults.⁵

CBCT technology allows a dental practitioner to evaluate the patient for a wide variety reasons such as, trauma, osseous evaluation for implants, temporomandibular joint pathology, impacted and supernumerary

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teeth, developmental and congenital jaw deformities, endodontic lesions and oral and maxillofacial pathology.⁶

An incidental finding is one that is unrelated to the present illness and is discovered unintentionally. According to the American Academy of Oral and Maxillofacial Radiology (AAOMR) and the European Academy of Dentomaxillofacial Radiology (EADMFR), the entire CBCT data set needs to be fully interpreted, and if the clinician was not an expert in interpreting the entire data set, a referral was required for a review by oral and maxillofacial radiologists.³ Currently, only limited data are available regarding the occurrence of incidental findings with CBCT imaging in the craniofacial region, and most clinicians focus primarily on the teeth and jaws, even though other valuable information is often available in the image data sets.^{4,7,8} The present study aimed to retrospectively determine the nature and occurrence of incidental findings in maxillofacial CBCT scans, performed for maxillofacial diagnostic purposes.

Methods

In this cross-sectional study, 773 CBCT base images were retrieved from archives of a private oral radiology clinic. These CBCTs were requested for different purposes. The

indication of reviewed CBCT images is categorized in table 1.

All the cone beam CT images were acquired using a NewTom VGi (QR srl, Verona, Italy) flat panel-based CBCT machine. The scanner operated with a maximum output of 110Kvp and 10mAs, a minimum 0.075 voxel size, a typical exposure time of 18s and FOV of 12.8 T. Any findings apart from the indication of performed CBCT were recorded by the authors.

These incidental findings were mucosal thickness, retention pseudo cyst, retained root, periapical pathosis, impaction teeth not including 3rd molar, dental anomalies, vertical root fracture, torus, oral and maxillofacial lesion, Stafne's defect and sialoliths. All the scans were reviewed by two oral and maxillofacial radiologists, and incidental findings were noted on forms. Any conflicts in the reviews were resolved by consensus.

Results

In this study, 773 scans (437 females and 336 males) were assessed by oral and maxillofacial radiologist. The age range of the subjects was 12-86 years, with the mean age of 45 years. Statistical test included descriptive tests. 475 subjects showed at least one incidental finding in the primary regions of interest and/or outside the regions of

Table 1. Description of the subjects and their indication for CBCT (Cone beam computed tomography) referral

Indication for CBCT	Female	Male	Total
Implant/bone evaluation for implant	332	248	580
Third molar surgery	51	37	88
Trauma	12	30	42
Oral and maxillofacial lesion	17	8	25
Impaction localization other than 3 rd molar	7	3	10
Vertical root fracture	3	4	7
Temporomandibular joint assessment	2	4	6
Orthodontic root resorption	4	0	4
Evaluation of graft	3	0	3
Gun shot	2	1	3
Oroantral fistula	1	2	3
Cleft palate	1	1	2
Total	435	338	773

CBCT: Cone beam computed tomography

Table 2. The incidental findings in the study subjects

Incidental findings	Female	Male	Total
Periapical pathosis	85	104	189
Mucosal thickening of maxillary sinus floor	87	83	170
Retained root	17	15	32
Retention pseudo cyst	14	17	31
impaction	14	12	26
Dental anomaly	10	7	17
Vertical root fracture	2	3	5
Torus	10	15	25
Intra bony lesion other than PA pathosis	3	1	4
Stafne bone defect	2	1	3
Sialoliths	1	0	1
Total	245	258	503

interest. The overall rate of these incidental findings was about 60.0%.

The prevalence of incidental findings that we concluded in this study are reported in table 2. The highest rate of them was periapical pathosis (24.5%), followed by mucosal thickening of maxillary sinus (22.0%), retained root (4.0%), retention pseudo cyst (4.0%) and impaction other than 3rd molar (3.3%).

Because the images of some patients lacked the whole upper air way, we only included the mucosal thickening of maxillary sinus and retention pseudo cyst in the present study. The next was torus (n = 25) with majority of them existing in mandibular region (20 cases).

17 subjects had dental anomalies (2.1%), the most frequent was missing (n = 5), followed by microdontia (n = 5), supernumeraries (n = 4), oligodontia and hypodontia (n = 2) and transposition (n = 1).

Other findings according to frequency were intra bony lesion other than periapical pathosis (n = 4), Stafne bone defect (n = 3) and sialoliths (n = 1). Of four intra bony lesions, three of them were fibro-osseous lesion and one of them was pericoronal radiolucency.

Discussion

CBCT scans are being used increasingly during the past decade for diagnosis and treatment planning in dentistry.⁸ Due to the absence of superimposition of anatomical structures and the elimination of geometric distortion, CBCT

scans can reveal many potential pathologic findings in the maxillofacial region more clearly than the panoramic radiograph or conventional tomography.⁸ We did not include CBCT scans of whole upper airway and temporomandibular joint (TMJ) to this study, because in many scans these regions were not imaged. We included only mucosal thickening and retention pseudo cyst in air way area. The prevalence of all incidental findings in the present study was about 60.0%. In previous studies -that included many other condition- the prevalence of incidental findings was reported much greater.⁹

The highest rate of incidental finding in the present study was periapical pathosis (24.5%), that did not have had such a high rate in previous studies;^{10,11} it indicated that the endodontic treatment should have much more concern.

In one previous study of air way area using 3D imaging, it has been reported that mucosal thickening has incidence of 31.3%.¹⁰ In our study, the mucosal thickening of the maxillary was evaluated and took for 22.0% of all cases. The presence of mucosal thickening in the maxillary sinus always presupposes an irritation. Such irritation can result from odonogenic factors, trauma to the maxilla or the oral cavity that penetrates the antrum and infections.¹² Vallo et al. found the mucosal thickening of maxillary sinuses to be 12.0% in panoramic radiography.¹³ In our study as well as the previous studies, the incidental frequency of mucosal thickness in

CBCT was much greater.^{5,10,13-15} Thus, panoramic radiography may not be as reliable a method for diagnosing pathological dental or sinus findings as 3D imaging techniques. Retention pseudo cyst was the next common finding of air way area in our study. The frequency of mucous retention cyst was 4.0% in the present study.

Mucous retention cyst is a type of secretory cyst that is rarely seen according to Vallo et al.¹³ the prevalence of mucous retention cyst was reported 3.0% in Caglayan and Tozoglu study.¹⁰ The prevalence of impacted teeth other than third molar was 4.0%, with the most and the least respectively, upper canines and lower premolar. In previous studies impactions were reported between 2-6-6.0%.⁹⁻¹¹

Our study is the largest study looking at incidental finding using 733 subjects compared to prior studies by Prince et al. (n = 300)¹⁶, Caglayan and Tozoglu (n = 207)¹⁰, Cha et al. (n = 500)¹⁷ and Pette et al. (n = 318)⁴. Such a large sample provides a better clarification of incidental findings. The drawback of our study compared to other studies was that CBCT scans of our patient mostly did not include the TMJ and whole upper airway.

Conclusion

Accordingly it can be concluded that all CBCT images need to be reviewed comprehensively.

Conflict of Interests

Authors have no conflict of interest.

References

1. Scarfe WC, Farman AG. What is cone-beam CT and how does it work? *Dent Clin North Am* 2008; 52(4): 707-30, v.
2. Mozzo P, Procacci C, Tacconi A, Martini PT, Andreis IA. A new volumetric CT machine for dental imaging based on the cone-beam technique: preliminary results. *Eur Radiol* 1998; 8(9): 1558-64.
3. Carter L, Farman AG, Geist J, Scarfe WC, Angelopoulos C, Nair MK, et al. American Academy of Oral and Maxillofacial Radiology executive opinion statement on performing and interpreting diagnostic cone beam computed tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008; 106(4): 561-2.
4. Pette GA, Norikin FJ, Ganeles J, Hardigan P, Lask E, Zfaz S, et al. Incidental findings from a retrospective study of 318 cone beam computed tomography consultation reports. *Int J Oral Maxillofac Implants* 2012; 27(3): 595-603.
5. Price JB, Thaw KL, Tyndall DA, Ludlow JB, Padilla RJ. Incidental findings from cone beam computed tomography of the maxillofacial region: a descriptive retrospective study. *Clin Oral Implants Res* 2012; 23(11): 1261-8.
6. Guttenberg SA. Oral and maxillofacial pathology in three dimensions. *Dent Clin North Am* 2008; 52(4): 843-73, viii.
7. Pazera P, Bornstein MM, Pazera A, Sendi P, Katsaros C. Incidental maxillary sinus findings in orthodontic patients: a radiographic analysis using cone-beam computed tomography (CBCT). *Orthod Craniofac Res* 2011; 14(1): 17-24.
8. Rheem S, Nielsen IL, Oberoi S. Incidental findings in the maxillofacial region identified on cone-beam computed tomography scans. *J Orthod Res* 2013; 1(1): 33-9.
9. Allareddy V, Vincent SD, Hellstein JW, Qian F, Smoker WRK, Ruprecht A. Incidental Findings on Cone Beam Computed Tomography Images. *International Journal of Dentistry* 2012; 2012: 9.
10. Caglayan F, Tozoglu U. Incidental findings in the maxillofacial region detected by cone beam CT. *Diagn Interv Radiol* 2012; 18(2): 159-63.
11. Lofthag-Hansen S, Huuonen S, Grondahl K, Grondahl HG. Limited cone-beam CT and intraoral radiography for the diagnosis of periapical pathology. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007; 103(1): 114-9.
12. Rhodus NL. The prevalence and clinical significance of maxillary sinus mucous retention cysts in a general clinic population. *Ear Nose Throat J* 1990; 69(2): 82, 84, 86-7.
13. Vallo J, Suominen-Taipale L, Huuonen S, Soikkonen K, Norblad A. Prevalence of mucosal abnormalities of the maxillary sinus and their relationship to dental disease in panoramic radiography: results from the Health 2000 Health Examination Survey. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010; 109(3): e80-e87.
14. Hatipoglu HG, Cetin MA, Yuksel E. Nasal septal deviation and concha bullosa coexistence: CT evaluation. *B -ENT* 2008; 4(4): 227-32.
15. Smith KD, Edwards PC, Saini TS, Norton NS. The Prevalence of Concha Bullosa and Nasal Septal Deviation and Their Relationship to Maxillary Sinusitis by Volumetric Tomography. *International Journal of Dentistry* 2012; 2010: 5.
16. Rogers SA, Drage N, Durning P. Incidental findings arising with cone beam computed tomography imaging of the orthodontic patient. *Angle Orthod* 2011; 81(2): 350-5.
17. Cha JY, Mah J, Sinclair P. Incidental findings in the maxillofacial area with 3-dimensional cone-beam imaging. *Am J Orthod Dentofacial Orthop* 2007; 132(1): 7-14.