The frequency and nature of incidental findings in cone–beam computed tomographic scans of the head and neck region

A systematic review

Ryan Edwards, DDS; Mostafa Altalibi, DMD; Carlos Flores-Mir, DDS, DSc

ABSTRACT

Background. The authors analyzed the literature critically to determine the frequency and nature of incidental findings (IFs) in cone-beam computed tomographic (CBCT) scans of the head and neck region.

Types of Studies Reviewed. The authors conducted a systematic search of several electronic databases (MEDLINE, Embase, PubMed, Scopus, Web of Science, the Cochrane Library) through July 14, 2012, as well as a limited gray-literature search (in Google Scholar). Inclusion criteria encompassed the frequency of reports of IFs in the head and neck region in CBCT imaging, regardless of the sample origin. The authors used no search limitations. They evaluated methodological quality according to 15 criteria related to study design, population characteristics and statistical analysis.

Results. Initially, the authors identified 66 articles from the electronic database searches and another one via the gray-literature search. Once they applied the final selection criteria, they found that only five articles satisfied the inclusion criteria. In articles in which investigators reported the number of IFs as the absolute number of IFs detected, the frequency ranged from 1.3 to 2.9 IFs per CBCT scan. Conversely, in articles in which authors reported the number of IFs as the number of scans containing IFs, the frequency ranged from 24.6 to 93.4 percent of CBCT scans. Methodological quality averaged 77.2 percent (range, 60-93 percent) of the maximum possible score.

Conclusions and Clinical Implications. IFs are detected relatively frequently in CBCT imaging, and considerable variation is evident in their frequency and nature. The majority are extragnathic findings (that is, those found outside the region of the dentition and alveolus), thus emphasizing the need for complete and proper review of the entire image, regardless of field of view or region of interest.

Key Words. Review; cone-beam computed tomography; incidental findings.

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Imaging techniques play a principal role in diagnosis and in medical management of patient care. In the past 20 years, both the quality of and access to imaging techniques have improved considerably. However, as imaging techniques continue to improve, the possibility of identifying incidental findings (IFs) increases. An IF detected on a radiographic image can be defined as any abnormal or pathological finding that is unrelated to the original purpose of the imaging test or tests being performed; it may be a variant that is normal or benign or is of pathological concern. The failure to identify, report or provide follow-up care related to the IF can have adverse effects on the patient and potential medicolegal ramifications for the clinician. In addition, the possibility of inadvertent false-positive findings may lead to increased health care costs and increased patient anxiety.[1]

The use of computed tomographic (CT) technology is increasing in the dental field with the development of cone-

Dr. Edwards is a student, Orthodontic Graduate Program, Department of Dentistry, Faculty of Medicine and Dentistry, University of Alberta, 11405 87th Ave., Edmonton, Alberta, Canada T6G 1C9, e-mail rje@ualberta.ca. Address reprint requests to Dr. Edwards.
Dr. Altalibi is a student, Orthodontic Graduate Program, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Alberta, Canada.
Dr. Flores-Mir is an associate professor and the head, Division of Orthodontics, Department of Dentistry, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, Alberta, Canada.

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beam computed tomography (CBCT). Suggested dental applications include localization of impacted teeth, planning of orthognathic surgery, temporomandibular joint (TMJ) analysis, upper airway assessment, implant placement, and routine orthodontic diagnosis and treatment planning.[2] Although various diagnostic advantages of CBCT have been demonstrated in some specific areas in dentistry, using CBCT is not considered the reference standard,[3] and guidelines regarding CBCT use in dentistry are emerging in different parts of the world.[4-6]

During CBCT image acquisition, the desired field of view (FOV) can be modified, as determined by the region of interest. Small-FOV images are used to view a limited anatomical region of the maxillofacial complex, whereas large-FOV images can include paranasal sinuses, cervical spine, neck, airway, intracranial and cranial base structures. However, it remains the responsibility of the clinician to analyze the entire volume of data, and not just the region of interest, to avoid missing a significant finding regardless of the imaging modality used or the image size generated.[4-6]

IFs routinely are detected in other forms of diagnostic imaging, including, in the medical field, traditional CT and magnetic resonance imaging.[7-10] Research also has shown that when traditional two-dimensional (2-D) dental images are interpreted, IFs are identified in 6 to 43 percent of patients.[11-13] Given that CBCT scans contain more information than do 2-D radiographs, it is probable that CBCT images could demonstrate considerably higher rates of IFs.

Therefore, we undertook a critical analysis of the literature to determine the frequency and nature of IFs in the head and neck region that were found during CBCT use. In addition, we will hypothesize as to the clinical significance of such findings. Quantifying the frequency of IFs discovered in three-dimensional radiography may affect evolving CBCT guidelines and has significant considerations for both the doctor, in medicolegal terms, and the patient, in terms of the potential diagnosis of as-yet-undetected disease.

METHODS

We conducted the reporting of this systematic review, as much as was feasible, in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement checklist.[14]

Information sources and search. With the assistance of a senior health-sciences librarian, we conducted a computerized search of various electronic databases. We systematically searched MEDLINE via OvidSP, Embase via OvidSP, PubMed, Scopus via Elsevier, Web of Science via Thomson Reuters and the Cochrane Library electronic databases from their earliest records to literature published at the end of the second week of July 2012. We also hand searched bibliographies of the relevant articles for additional relevant publications that may have been missed in the electronic database searches, and we conducted manual gray-literature searches with Google Scholar.

We developed detailed search strategies for each database. We based them on the search strategy developed for MEDLINE (Table 1) but modified the strategy appropriately for each database to take into account differences in controlled terminology. The general search terms we used were "cone beam computed tomography" and "incidental findings." Specific words, truncations and their combinations used for each database are found in Appendix 1 in the supplemental data to the online version of this article (found at http://jada.ada.org).

Eligibility criteria. The studies included in this systematic review fulfilled the following criteria. In phase 1, in which we reviewed titles and abstracts, we included articles describing studies that involved human participants of all ages, were published in any language, and contained reports of IFs from CBCT scans of the head and neck region (large FOV). We excluded case reports and studies involving participants with craniofacial syndromes.

In phase 2, in which we evaluated complete articles, we included studies that involved categorization of IFs into discrete head and neck anatomical locations, studies in which the authors reviewed randomized or consecutive images and articles including descriptions of imaging parameters. We excluded articles about studies in which investigators reported IFs from only a select region of a large-FOV CT scan (for instance, maxillary sinuses only).

Search selection. Using the previously described inclusion and exclusion criteria, we conducted a two-phase search. In the first phase, as noted above, two reviewers (R.E.,

ABBREVIATION KEY. 2-D: Two-dimensional. **CBCT:** Cone-beam computed tomography. **CT:** Computed tomography/tomographic. **FOV:** Field of view. **IF:** Incidental finding. **LFOV:** Large field of view. **MeSH:** Medical Subject Headings. **OMFR:** Oral and maxillofacial radiologist. **STROBE:** Strengthening the Reporting of Observational Studies in Epidemiology. **TMJ:** Temporomandibular joint.

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