# Incidental findings in OPGs and cone beam CTs

As dental practitioners, we often come across clinical findings that are incidental to the reason that the patient has presented for an examination or treatment.

In radiology, the term incidental finding describes an occult entity discovered unexpectedly on an imaging examination performed for an unrelated reason. In order to detect an incidental finding on a cone beam CT examination, the clinician or radiologist must examine the entire volume of the dataset and must place any observations into the context of physiological features, normal variants in anatomy, minor developmental anomalies and imaging artifacts. All of these features can be misidentified as potential pathology.

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**Incidental findings on panoramic radiographs (OPG):**

The OPG covers a large field of view, including structures of the neck, tonsillar regions, jaw bone, paranasal sinuses and some base of skull.

The OPG can be a very difficult film to interpret. Ghost shadows, double image projections, superimposition of structures and positioning errors in the placement of the patient's alveolar processs within the focal trough, all can make the detection of what is a normal variation and what is pathology challenging. This is particularly for structures beyond the teeth.

**Studies that have looked at the prevalence of incidental findings on OPGs:**

- ❑ Found in 6 to 43 percent of patients
- ❑ Most often look at pre-orthodontic OPGs – young group of patients
- ❑ Exclude factors related to the primary purpose of the panoramic examination: such as supernumerary teeth, altered eruption patterns

**Most frequent incidental findings:**

- o Idiopathic sclerosis
- o Thickening of the mucosal lining of the maxillary sinuses
- o Periapical inflammatory lesions
- o Hypodontia
- o External root resorption

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## Incidental findings on cone beam CT:

**Factors to consider in looking at studies which have reported the incidence of incidental findings in CBCT examinations:**

- Varying fields of view (FOV)
- Age and type of the machine
- Technique and machine operator sensitive
- Artefacts can make interpretation challenging
- The high resolution of the hard structures is often better than a MSCT – the onus is then very high to interpret the entire dataset accurately
- Soft tissues are less clearly displayed but still need to be examined for pathology
- Need good knowledge of what is anatomically normal and abnormal:
  - what is missing
  - what should not be there

**Frequency and type of incidental findings (IF) in CBCT studies will vary according to:**

- Sample size, especially for rare pathology
- Reported measure of IF
  - Absolute count of IFs
  - Number of scans containing at least one IF
- Reason for the examination
- Age and gender and racial profile of the group of patients
- What is included as an "incidental finding" worthy of note
- Who examined the dataset

Whether the research was seeking a particular pathology (eg carotid artery calcifications)

| | Caglayan et al 2012 | Cha et al 2007 | Pette et al 2012 | Pliska et al 2011 | Price et al 2011 |
|---|---|---|---|---|---|
| Indication for imaging | TMJ, paranasal, sleep apnea, dental implant, other | Ortho, TMJ, dental implants | Dental implants | Ortho | Dental implants, TMJ, pathology, ortho |
| Sample size | 207 | 500 | 318 | 194 | 100 |
| Age (mean; range) | 30.3 (9-74) | 39.3 (not specified) | Male: 64.7; female: 62.3 (16-91) | 13.0 (8-63) | 49.3 (9-80) |
| Male (%) | 38 | 45 | Not specified | 43 | 44 |
| Frequency of IF in head/neck region | 92.8% | 24.6% | 93.4%<br>2.5 IFs per scan | 65.5%<br>1.3 IFs per scan | 90.7%<br>2.9 IFs per scan |

*Table adapted from: Edwards R, Altalabi M, Flores-Mir C. The frequency and nature of incidental findings in cone-beam computed tomographic scans of the head and neck region – a systematic review. JADA 2013; 144: 161-170*

**Synthesis of results: Incidental findings in Cone beam CT**

- Frequency of IFs ranged from 1.3 to 2.9 IFs per CBCT scan;
- 24.6 % to 93.4 % of scans contained at least one IF

**Most common IFs identified:**

- Vertebral degeneration: 0.5 to 45.6%
- Sinusitis or mucosal thickening: 7.7 to 41.7%
- Pineal gland calcification: 0.5 to 19.2%
- Impacted third molars: 18.8%
- Mucous retention cysts: 2.9 to 17.0%
- TMJ condylar degenerative changes: 3.9 to 21.7%
- Concha bullosa: 3.1 to 21.7%
- Endodontic lesions: 10.8 to 32.7%
- Carotid artery calcifications: 4.3%
- Dentigerous cysts 2.6%

**The following study looked at 1000 consecutive cases presenting for cone beam CT examinations. The profile of the patients is typical of that seen in many private general dental practices, and hence the findings are relevant for the Australian use of CBCT. The results give a good overview of the types of incidental findings found.**

**Reference: Allareddy V et al. Incidental findings on cone beam computed tomography images. Int J Dent 2012; Article ID: 871532**

**1,000 scans (private imaging practice) on i-CAT machine; all reviewed by DMF radiologist**

**FOV:** **13 cm; 0.3 mm voxel**

**Age range:** **11 – 87 years**

**Sex:** **382 males; 618 females**

| REASON FOR SCAN | No of subjects |
|---|---|
| Implants/Bone evaluation for implants | 678 |
| Impaction localization | 110 |
| Orthodontic records | 67 |
| Other possible pathosis | 46 |
| Evaluation of graft in sinuses/bone assessment implants | 40 |
| Supernumerary teeth localization | 31 |
| Sinus evaluation prior to implants | 17 |
| TMJ assessment | 11 |

## Results:

### 89 subjects had variations in size, shape and number of teeth

| VARIATION IN THE NUMBER, SIZE AND SHAPE OF TEETH | Number of individuals |
|---|---|
| Oligodontia | 38 |
| Supernumerary teeth | 31 |
| Transposition | 5 |
| Compound odontoma | 4 |
| Microdontia | 4 |
| Dentin dysplasia/ dentinogenesis imperfecta | 3 |
| Amelogenesis imperfecta | 1 |
| Taurodontism | 1 |
| Gemination | 1 |
| Macrodontia | 1 |



### 783 subjects had peri- or paradental findings

| PERIAPICAL/PARAPICAL/PERIDENTAL FINDINGS | Number |
|---|---|
| Rarefying osteitis | 281 |
| Enostosis | 136 |
| Graft material and sclerotic healing | 108 |
| Root fragments | 100 |
| Impactions (not including third molars) | 66 |
| Restorative material in periapical regions | 59 |
| External resorption | 42 |
| Oro-antral fistulae | 14 |
| Hypercementosis | 13 |
| Osseous dysplasia | 10 |
| Fibrous dysplasia | 8 |
| Osteomyelitis | 2 |
| Radio-osteonecrosis / Chemo-osteonecrosis | 2 |

## 605 subjects had paranasal sinus findings

| PATHOSIS/ANATOMICAL VARIANTS IN THE PARANASAL SINUSES | Number |
|---|---|
| Mucositis/sinusitis/mucous retention pseudocysts | 551 |
| Surgical changes in the sinuses | 29 |
| Hypoplastic sinuses | 21 |
| Osteoma | 4 |

## 245 subjects had findings in the cervical vertebrae

| FINDINGS IN THE CERVICAL VERTEBRAE REGION | Number |
|---|---|
| Osteoarthritis | 240 |
| Osseous screws in the vertebrae | 3 |
| Fusion of C2-3 cervical vertebrae | 1 |
| Non-segmentation of C2-3 vertebrae | 1 |

## 180 subjects had findings in the TMJ and associated structures

| FINDINGS IN THE TMJ REGION/ASSOCIATED STRUCTURES | Number |
|---|---|
| Osteoarthrosis | 158 |
| Coronoid hyperplasia | 17 |
| Condylar hyperplasia | 3 |
| Condylar hypoplasia | 2 |

## 331 subjects had soft tissue calcifications

| CALCIFICATIONS VISUALIZED IN THE CBCT VOLUME | Number |
|---|---|
| Pineal gland calcifications | 147 |
| Tonsilloliths | 92 |
| Carotid artery calcifications | 57 |
| Osteoma cutis | 23 |
| Sialoliths | 4 |
| Dystrophic calcifications: temporal, adenoids, epiglottis regions | 7 |
| Vertebral artery calcifications | 1 |

## 168 subjects had a variety of other findings

| OTHER FINDINGS (NOT COMPLETE LIST) | Number |
|---|---|
| Adenoidal hyperplasia | 107 |
| Soft tissue swelling in airways | 9 |
| Palatal tori | 8 |
| Cleft palate | 5 |
| Shot gun wound | 4 |
| Malignancy | 3 |
| Unhealed fracture | 1 |
| Implant impinging on inferior alveolar canal | 1 |

**SUMMARY:**

Only 57 subjects of the 1000 patients scanned had no osseous pathosis or incidental findings

- Often the scan showed an incidental finding in more than one area

**PERCENTAGE OF INCIDENTAL FINDINGS: 94.3%**

**Malignancies:**

- one in sella region – extensive destruction of the sella turcica
- Two metastatic lesions in mandible – one breast cancer; one prostate cancer

## Cone beam reporting:

Currently there are no guidelines on how to report incidental findings in dentistry and no consensus on the most appropriate management protocol

However, there are professional body guidelines on who should be reporting cone beam images

- All datasets should be comprehensively reviewed preferably by a DMF radiologist (or medical radiologist with appropriate training in dental radiology), who should supply a written report
    - This takes time and is an integral part of CBCT imaging
- Whoever reads the dataset must be familiar with the incidence, location and presentation of commonly presenting incidental findings – and keep up their skills through CPD
- If there is an indeterminate finding (diagnostic dilemma) –
    - must seek an appropriate formal second opinion – formalize the referral in writing
    - send appropriate details, including previous images, pathology results, dental and medical history, when seeking an opinion
    - provide the entire dataset, not just a single saved image
    - avoid the "corridor" consultation

**If you own your own cone beam machine, are you prepared to take the time and responsibility to view and report on the entire dataset?**

If you are the one taking AND interrogating the CBCT dataset – YOU need to:

- observe all main and incidental findings
- deduce the likely diagnoses
- know the likely significance of the findings and the appropriate follow up strategies
- write up a formal report for each scan
- know when to get a second opinion; and
- keep up to date with the changing knowledge and recommendations that may be found within and outside the dental literature

## Advantages of having your cone beam dataset read by Teledent

1. **Observation** Dr Brown is trained in the systematic interrogation of the entire cone beam dataset
    - pattern analysis

2. **Deduction** – Dr Brown has advanced training and knowledge of pathology of teeth, alveolar processes, TMJ, paranasal sinuses, airways, and surrounding structures of the head and neck
    - normal or abnormal?
    - differential diagnosis?

3. **Knowledge** – Dr Brown has the background of being a periodontist and years of clinical experience in complex diagnoses, complex extractions and other surgical procedures, and implant dentistry . Combined with her advanced specialist training in dento-maxillofacial radiology, she provides comprehensive written radiology reports on the normal and abnormal findings within the relevant clinical context and can guide the dentist and the patient on the need for any follow up.
    - What do I do with this finding?
    - Is further follow up required?



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