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This series provides an overview of current thinking in the more relevant areas of Oral Medicine, for primary care practitioners.
The series gives the detail necessary to assist the primary dental clinical team caring for patients with oral complaints that may be seen in general dental practice. Space precludes inclusion of illustrations of uncommon or rare disorders.
Approaching the subject mainly by the symptomatic approach, as it largely relates to the presenting complaint, was considered to be a more helpful approach for GDPs rather than taking a diagnostic category approach. The clinical aspects of the relevant disorders are discussed, including a brief overview of the aetiology, detail on the clinical features and how the diagnosis is made, along with guidance on management and when to refer, in addition to relevant websites which offer further detail.

Oral Medicine: 14. Radiolucencies and Radio-opacities. A. Bone Diseases

Specialist referral may be indicated if the Practitioner feels:
- The diagnosis is unclear;
- A serious diagnosis is possible;
- Systemic disease may be present;
- Unclear as to investigations indicated;
- Complex investigations unavailable in primary care are indicated;
- Unclear as to treatment indicated;
- Treatment is complex;
- Treatment requires agents not readily available;
- Unclear as to the prognosis;
- The patient wishes this.

Radiolucencies (Tables 1–3)

Radiographic features to be assessed include the lesional size, site, shape, margins, radio-density and effects on adjacent structures (displacement of the inferior alveolar nerve or tooth displacement or resorption).

Well-defined corticated radiolucencies are often odontogenic cysts and benign tumours as they are generally slow growing and allow the bone surrounding them to remodel. If they become infected cortication may be lost and they may appear to be less well defined.

Well-defined non-corticated lesions (punched out lesions) may be odontogenic

Procedure	Advantages	Disadvantages	Remarks
Aspiration	Simple using 18 gauge needle	May introduce infection	May confirm haemangioma. Cyst fluid protein content may be diagnostic (Protein levels <4g% in keratocysts)
Bone biopsy	Definitive	Invasive	Most commonly used
Bone scan	Surveys all skeleton	Those of any isotope procedure	Reveals areas of increased bony turnover, eg metastases; lacks specificity
Endoscopy (fibre-optic)	Simple; good visualization	Skill needed	Examines nasal passages, sinuses, pharynx and larynx but not widely available
Imaging	Reveals data not obvious on clinical examination	Specialized techniques may be difficult or expensive. Cone beam CT (CBCT) is becoming more widely used and available	See Table 2

Table 1. Investigations used in diseases of jaws. (Reproduced from Scully C. *Oral and Maxillofacial Medicine.* Elsevier, 2008.)

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Region required	Standard views	Additional views
Facial bones	OM	Zygoma
	OM 30	Reduced exposure SMV
	Lateral	
Mandible	DPT	Lateral obliques
		PA mandible
		Mandibular occlusal
Maxilla	OM for maxillary antra CT sinuses or CBCT	Upper occlusal or lateral SMV
		DPT, tomography
		Endoscopy
Nasal bones	OM 30	
	Lateral	
	Soft tissue lateral	
Skull	PA 20	SMV
	Lateral	Tangential
	Townes (1/2 axial view)	
Temporomandibular joints	DPT (mouth open and closed) Transcranial oblique lateral views are rarely used	Transpharyngeal – rarely used
		Arthrography – almost obsolete
		Reverse Townes
		Consider MRI if the position of the disc is required/CT scan/cone beam CT to show abnormalities of the condylar heads or fractures

Table 2. Radiographic views for demonstrating various orofacial sites. PA = postero-anterior; OM = occipito-mental; SMV = submento-vertex; DPT= Dental Panoramic Tomogram. (Reproduced from Scully C. *Oral and Maxillofacial Medicine*. Elsevier, 2008.)

cysts, granulomas that have become infected, or more sinister rapidly-growing lesions such as multiple myeloma, malignancy or histiocytosis.

Poorly defined radiolucencies are often infections or malignant tumours.

Jaw radiolucencies may include:

- *Odontogenic diseases*, inflammation, cysts and tumours.
- *Non-odontogenic cysts,* eg nasopalatine duct cyst (in maxillary midline, with a characteristic heart shape), and traumatic bone cyst (solitary, simple, haemorrhagic bone cyst) – the aetiology of which is unknown but has been attributed to arise from trauma causing intramedullary haemorrhage that subsequently leaves a radiolucency with characteristic scalloped superior margin (it rarely damages teeth).

Giant cell lesions such as the *Central Giant Cell granuloma* – initially a small, unilocular radiolucency – eventually become multilocular, and may then mimic brown tumours of hyperparathyroidism (histologically similar). Biochemistry distinguishes these entities. Other giant cell lesions include brown tumour of hyperparathyroidism, cherubism and aneurysmal bone cysts.

Vascular or neurogenic lesions include:

- *Arteriovenous malformation* – abnormal communication between arteries and veins, or central haemangioma.
- *Neurofibroma* – may present as widening of inferior alveolar canal (Figure 1).

Metabolic disorders include:

- Osteoporosis;
- Osteomalacia;
- Renal osteodystrophy;
- Osteitis fibrosa cystica (hyperparathyroidism).

All cause a loss in bone density making radiographs appear over-exposed and there is also loss of corticomedullary differentiation (loss of lamina dura, outline of maxillary antrum, ID canal tramlines).

Neoplastic lesions include:

- *Malignant tumours*: squamous cell carcinomas (invading mainly from mouth or antrum), osteosarcomas (a symmetrically widened periodontal membrane in a single tooth may be earliest indication), lymphomas (ill-defined lesions), and multiple myeloma ('punched-out' ovoid lesions).
- *Metastases:* from prostate, thyroid, kidney, lung and breast tumours (but 30% originate from an occult primary lesion) typically have ill-defined borders. Posterior mandibular metastases are four times more common than maxillary.

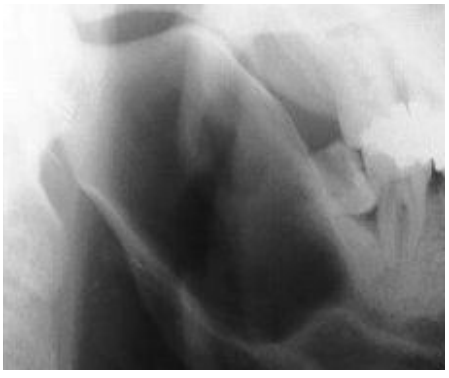

Figure 1. Oblique lateral radiograph of the right mandible, showing a well-defined corticated radiolucency. The corticated margins are continuous with the ID canal, suggesting a differential diagnosis of a lesion arising from the contents of the ID canal, in this case a neurofibroma.

Radio-opacities

Radio-opaque lesions may be either of soft tissue origin or bony origin and therefore require localization with radiographs taken from two different aspects, and include:

- Unerupted teeth;
- Foreign bodies;
- Calcified lymph nodes;
- Salivary stones.

- *Congenital and developmental anomalies*, such as torus and other bone lumps. Gardner's syndrome (colorectal polyposis, soft-tissue tumours, and skeletal abnormalities) an autosomal dominant condition caused by adenomatous polyposis coli (APC) gene mutation, with multiple osteomas and often impacted and supernumerary teeth and odontomas. Carriers may also have jaw radio-opacities.
- *Odontogenic cysts and tumours* (Articles 15 and 16).
- *Fibro-osseous lesions.*
- *Inflamed and infected lesions*:
  - *Odontogenic infections*
  - *Osteomyelitis* – shows no imaging findings until the acute inflammatory reaction leads to bone lysis (osteolysis). Bone density has to fall by 30–50% to show on plain radiography and this usually takes 2–3 weeks (Figure 2). Plain radiographs, and more accurately CT (either MSCT [multislice CT] or CBCT [Cone Beam]) can demonstrate the osteopenia and cortical lysis (including the inferior alveolar canal and mental foramen), sequestra and periosteal new bone formation. MRI has high sensitivity in detecting cancellous marrow abnormalities. In osteomyelitis, periosteal new bone apposition causes cortical thickening and mandibular enlargement, most common on the buccal plate of the mandibular angle or body, especially in young people. Radiologically this may have a lamellar 'onion skin' appearance. Swelling of masseter and medial pterygoid muscles is common and both CT and MRI show soft-tissue inflammation, especially in the masticatory and submandibular spaces.
  - *Idiopathic osteosclerosis* (dense bone island) – area of dense bone in the jaw without apparent cause or signs or symptoms, typically seen in the mandibular premolar/molar area, which may be associated with root resorption (Figure 3).
  - *Osteonecrosis*. This may follow radiation (osteoradionecrosis; ORN) or drug use (bisphosphonate-related osteochemonecrosis of the jaws; BRONJ).

Primary non-odontogenic tumours, eg prostatic carcinoma and breast metastases are occasionally radio-opaque. Sarcomas can cause osteolytic or osteoblastic lesions.

Lesion	Average age presentation	Gender predilection	Site and other comments
Nasopalatine duct cyst	40–60years	M>F 4:1	1% of population. Midline palate >1 cm consider cystic
Radicular cyst	20–60 years	M>F 3:2	3x maxilla: mandible
Dentigerous cyst	<20 years	M>F 2:1	L8; U3; L5
Paradental cyst	4–62 years	M = F	93% mandible 3rd>2nd>1st molar
Keratocystic odontogenic tumour	20–40 years	M>F 1.7:1	80% mandible 50% of these angles
Lateral periodontal cyst	40–70 years	M>F 2:1	76% L3; L4&5; U2 teeth vital
Central giant cell granuloma	60% <20 years	F>M 2:1	Mandible anterior to 1st molar 2x maxilla
Aneursymal bone cyst	90% <30 years	F>M slight	Mandible>Maxilla 3:2 molar region
Central haemangioma	<20 years	F>M 2:1	Mandible>Maxilla 2:1 Body freq.
Arterio-venous malformation	10–25 years	F>M	Mandible>maxilla Retromolar area
Solitary bone cyst	<20 years	M>F? M = F	95% mandible 65% molar/ premolar area
Stafne cavity	>40 years	M>F	Seen on up to 1% of DPTs. Lower 7 to angle of mandible below ID canal

Table 3. Summary of cyst and cyst-like lesions of the jaws. Not recognized as a true entity = keratocyst odontogenic tumour.

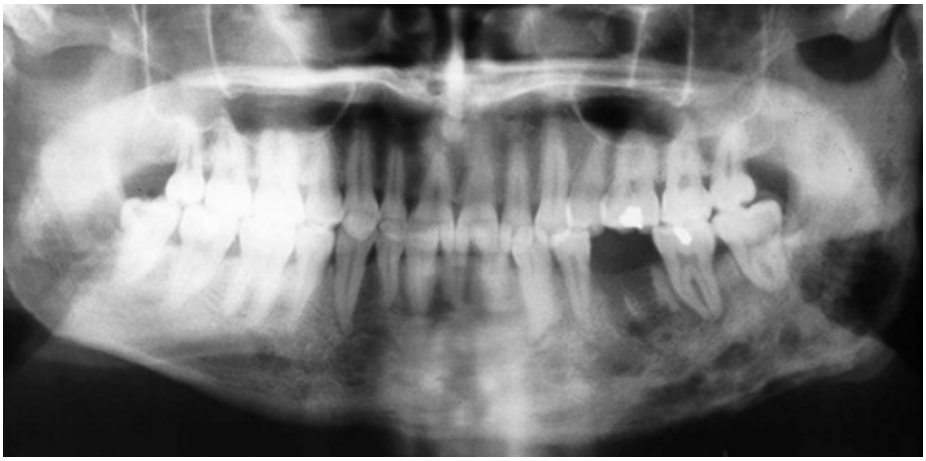

Figure 2. DPT, showing ill-defined radiolucency and radio-opacity within the left body of the mandible. Note the loss of the lower cortex and ID canal tramlines compared to the right side. This was a case of osteomyelitis.

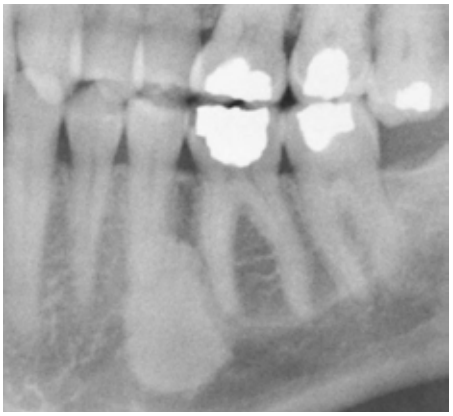

Figure 3. Section of a DPT showing well-defined increased density of alveolar bone associated with no obvious clinical or radiological pathology, diagnosed as idiopathic osteosclerosis (dense bone island).

Mixed radiolucent and radio-opaque lesions

Mixed radiolucent and radio-opaque lesions are mainly fibro-osseous lesions, inflammatory processes (eg osteomyelitis, actinomycosis, osteonecrosis) and, less commonly, odontogenic tumours (mainly adenomatoid odontogenic tumour and calcifying epithelial odontogenic tumour). Florid osseous dysplasia is one of the commonest causes of multiple radio-opacities of the tooth-bearing area of the jaws.