Introduction

This case report describes a suspected osteoma in the maxillary sinus, an incidental finding from an Orthopantomogram (OPG) obtained to inform orthodontic treatment.

Radiographs are often invaluable in the diagnosis and treatment planning of an orthodontic patient. The two most common radiographs obtained for this purpose are the OPG and Lateral Cephalogram. While Orthodontists principally use these radiographs to assess the developing dentition, aid treatment planning and monitor treatment, several peripheral anatomical sites are also evident on these films. A critical element of radiographic practice in dentistry is the systematic clinical evaluation and reporting of an entire image, which is an Ionizing Radiation (Medical Exposure) Regulations (IRMER) requirement (IRMER 1999).

The importance of a systematic assessment and reporting of radiographic images was highlighted by a recent study that concluded 50% of Orthopantomogram had incidental findings of pathology and/or anomalies (Vaseemuddin 2016). These findings ranged from relatively common anomalies such as supernumerary teeth, to more rare presentations such as ''Susuk charms''(Sharif 2013) and life-threatening malignancies (Rao 2004).

We present a unilateral radiopacity in the right maxillary sinus region (suspected osteoma) detected from an OPG taken during a routine Orthodontic new patient assessment.

Case Report

History

O.M. A 15-year-old year old male presented to the Eastman Dental Hospital, University College Hospitals Foundation Trust (EDH, UCLH) following a referral from a specialist orthodontic practice. The referral was for the assessment and management of several unerupted teeth. On presentation O. M's main concern was the 'gaps between my teeth' and he pointed at the spaces in the region of his unerupted canines. Further questioning revealed that his maxillary deciduous canines were interceptively extracted 10 months previously.

Medically O.M. had allergic rhinitis, seasonal allergies and reported a 4-year history of ongoing spontaneous epistaxis which occurred as frequently as every 3 days. Local measures of head tilting and pinching of nasal cartilage usually stopped the epistaxis episodes. There was no family history of bleeding/clotting disorders and O.M. had not obtained any medical advice in relation to his recurrent epistaxis.

Intraoral Assessment

On examination, O.M. presented with a Class I malocclusion complicated by unerupted upper right and left permanent canines, the lower left permanent canine and the upper left second molar. There was mild upper and moderate lower arch crowding (Figure 1). The Index of Orthodontic Treatment Need Dental Health Component (IOTN DHC) was 5i.

Radiographic Assessment

An OPG was requested to assess the developing dentition and aid in diagnosis and treatment planning. Aside from the aforementioned features, the radiograph revealed a round radio-opacity in right maxillary sinus (Figure 2). The radio-opacity was apical to the upper right 1st and 2nd permanent molar roots. O.M. and his family were made aware of this incidental finding and advised that a radiographic report would be obtained. An orthodontic review appointment was arranged to discuss the findings of the radiographic report, additionally, a referral to O. M's general medical practitioner was sent in relation to the assessment and management of his recurrent epistaxis.

The radiographic report detailed the following: ''***Uniformly dense radiopacity approximately 1cm diameter within the base of the right maxillary sinus, most likely represents a osteoma in the base of right maxillary sinus''***.

Treatment Plan

The findings were discussed with O.M. and a referral made to the Oral Maxillofacial Surgery (OMFS) team. The OMFS characterized the radiopacity by 3D imaging with a cone beam computed tomography scan, as O.M presented with symptoms of recurrent sinusitis and epistaxis, surgical intervention was highly indicated. The surgical plan included the removal of the osteoma via Caldwell Luc approach under general anesthetic. The surgical team arranged for the elective extractions (upper right and left 2nd premolar and lower right and left 2nd premolar) surgical exposure and bonding of a gold chain to the unerupted upper right and left permanent canines, the lower left permanent canine and the upper left second molar teeth.

Discussion

Radiopacities in the maxillary sinus are relatively common (Raghav 2014), the causes of potential opacities that can be visualized on a routine OPG along with their associated features are summarized in Table 1. Examples of OPGs showing common radiopacities that clinicians may encounter are also provided in figures .

Osteomas:

Introduction

Osteomas are benign slow growing non-odontogenic tumours. They are characterised by atypical deposition and proliferation of compact or cancellous bone with sparse marrow tissue (Bhatt 2018). Typically, osteomas are differentiated into three groups; peripheral, central and extra-skeletal. Peripheral and central osteomas tend to arise from the periosteum and endosteum respectively. Extra-skeletal osteomas (otherwise known as soft tissue) arise from muscles or the dermis and are commonly referred to in the literature as ''Osteoma Cutis'' (Larrea - Oyarbde 2007).

Aetiology

Although the aeitology is subject to much debate and scrutiny, the three most commonly accepted theories are developmental, traumatic and infectious (Eller 2006). Osteomas presenting in the craniofacial region are very rare and predominantly peripheral or central in

origin with peripheral osteomas being the more common with a 14:1 ratio (peripheral : central) (Kaplan 2008). The incidence of peripheral osteomas in the craniofacial area ranges from 0.01% to 0.43%, they are mainly located in frontal and ethmoidal sinuses (Rajayogeswaran 1981), osteomas occupying the maxillary sinus account for an even smaller percentage.

The vast majority of maxillary sinus osteomas are asymptomatic and slow growing (the rate of expansion is believed to be approximately 0.79mm per year (Buyuklu 2011)), it is therefore not a surprise that they are often an incidental finding in the fifth and sixth decade of life.

Signs & Symptoms

Osteomas are usually symptomless but as with any space occupying lesions that are slow growing, there is a point at which symptoms may arise. The potential signs and symptoms associated with maxillary sinus Osteomas include (Koivunen 1997)-;

- Sinusitis
- Nasal discharge and
- Epistaxis are reported
- Disturbance to the structures nearby such as the orbital cavity and sphenoid complex

The management of maxillary sinus osteomas can range from periodic monitoring to surgical excision, nonetheless non-invasive surgery with positive outcomes can be expected depending on the location and size of the pathology. Koivunen 1997 recommended that osteomas in the paranasal sinuses should be removed if:

- There are signs of growth
- The lesion occupies more than 50% of the volume of sinus
- The lesions are symptomatic e.g. bleeding, chronic sinusitis

Associated conditions:

It is important to remember that osteomas may be a feature of Gardner's syndrome (OMIM 2019). Gardner's syndrome is a form of familial adenomatous polyposis that is characterized by multiple colorectal polyps. Adenomatous Polyposis in the colon have a high degree of malignant change (Liang 2013). It is therefore important to consider whether other features of Gardner's syndrome such as multiple supernumeraries, fibromas which a dental health care professional may encounter are present. Therefore, if Gardner's syndrome is suspected in a patient, an immediate referral for medical investigation should be made.

Conclusion

Osteomas in the craniofacial region are rare and represent a non-odontogenic tumor that may be identified incidentally on routine dental radiographs. Crainofacial osteomas are often symptomless until a critical point is reached, where the size is impinging on adjacent structures causing a range of minor symptoms such as epistaxis, sinusitis to facial deformity. Management can range from routine monitoring to surgical excision depending on size and location. It is important to consider the possibility of the presence of an underlying condition when osteomas are identified, namely, Gardner's syndrome.

A systematic approach to radiographic interpretation not only aids comprehensive assessment and treatment planning for patients, but also enables the clinician to play a vital role in identifying any underlying abnormalities or pathologies. This reinforces the need for all dental clinicians to be aware of radiopaque lesions that can be incidentally identified on routine dental radiographs.

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Table 1- Potential Opacities That Can Be Visualised On An Orthopantomogram With Radiographic Features

Classification	Pathology	Radiographic features
Developmental Radiopacities	1. Bony Exostoses 2. Dense Bony Island (figure 3)	1. Dense radio opaque cortical bone (Cure 2012)[1] 2. Sclerotic bone lesion which constitute a small focus of compact bone within cancellous bone (Stanislavsky 2019)[1]
Inflammatory Radiopacities	1. Osteomyelitis (figure 4) 2. Condensing Ostetitis 3. Salivary Calculi (figure 5)	1. Cortical interruption, sclerotic sequestra in low-attenuation zones, periosteal new bone formation, and areas of gas attenuation (Cure 2012)[1] 2. Periapical, poorly marginated, nonexpansile, sclerotic lesion associated with a carious tooth (Cure 2012)[1] 3. Radiopaque calculi formed within the duct or parenchyma of salivary glands (Gaillard 2019)[1]
Odontogenic Tumours	1. Calcifying Epithelial Odontogenic tumour 2. Cementoblastoma 3. Odontomes (figure 6)	1. Radiolucent with scattered areas of calcification - Radiodensities clustered around a tooth with varied well defined or indistinct margins (Gaillard 2013) [1] 2. Periapical, sclerotic, with sharp margins lesion with a low-attenuation halo (Cure 2012)[1] 3. Compound- composed of separate tooth-like structures (denticles) budding from the dental lamina. Embedded in fibrous connective tissue (Cure 2012) [1] Complex- irregular mass of hard and soft dental tissues in a disordered radial pattern (Cure 2012) [1]
Non-Odontogenic Tumours	1. Benign a. Osteoma b. Chondroma	a. Appear as a non–tooth-related circumscribed sclerotic mass (Cure 2012)[1] b. Appears as cortical and medullary bone with an overlying hyaline cartilage cap (Murphey 2000) [1]
	2. Malignant Osteosarcoma	2. Appears with medullary and cortical bone destruction with aggressive Sunburst type periosteal reaction (Gaillard 2019)[1]
Bone Related Lesions	1. Osseous Dysplasia 2. Ossifying Fibroma	1. Initially lytic, with a mixed lytic and sclerotic appearance seen later, often with a central area of calcification (Cure 2012)[1] 2. Ground-glass attenuation may contain lytic or sclerotic areas (Cure 2012)[1]
Bone Diseases	1. Paget's Disease 2. Fibrous Dysplasia (figure 7)	1. Cotton wool appearance with mixed lytic and sclerotic lesions of skull (Gaillard 2019)[1] 2. A ground-glass appearance, well circumscribed lesion with endosteal scalloping and cortical thinning (Singh 2019) [1]

Figure 1 - Intraoral Photographs of the Dentition

Figure 2 - Orthopantomogram of O.M.with Radiopacity (circled) in right maxillary sinus

Figure 3 showing dense bony island present apical to the lower right 2nd molar roots

Figure 4 showing salivary stones overlapping left body of mandible

Figure 5 osteomyelitis present in left body of mandible

Figure 6 showing large odontoma present in the right ramus

Figure 7 showing fibrous dysplasia in the right maxilla