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Radiology in the diagnosis of oral pathology in children

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Introduction

As additional information becomes available about the adverse effects of radiation, it is most important that we review current practices in the use of radiographs for diagnosis. It should be remembered that the radiograph is only a diagnostic aid and rarely can a definitive diagnosis can be made with this tool. Routine dental radiographs are often taken as a screening procedure — frequently this tool is used to replace good physical examination techniques. A review of procedures often employed in the practice of dentistry reveals that a history is elicited from the patient (usually by an auxiliary) and then radiographs are taken before a physical examination is completed. This sequence should be challenged inasmuch as most pathologic conditions that occur in the facial bones present with clinical symptoms. The following questions should be addressed before a diagnostic radiograph is taken.

1. When was the last screening radiograph taken?
2. Is there a clinical finding that suggests underlying osseous pathology?
3. Does the medical or dental history suggest underlying osseous pathology?
4. Will a radiograph augment the physical findings?
5. What type of radiograph will be most helpful?

Diagnostic radiographs should only be taken when one of the following conditions exist:

1. A physical or history finding would suggest an underlying pathological condition,
2. When the physical finding is inadequate to make a differential diagnosis or to allow treatment.

Employment of the above procedures would significantly reduce the number of diagnostic X rays taken.

It is recognized that screening radiographs (excluding bite-wing radiographs) in children are generally nonproductive without positive physical findings. With this fact in mind a child should probably have one screening radiograph (panorex) during the initial visit and not have another until the permanent dentition has erupted. Bitewing radiographs should be taken whenever the physical examination suggests that the possibility of caries or pulpal pathology exists.

Pathological conditions excluding caries and pulpal pathology, that do occur in the oral cavity in children can be classified under the following headings:
1. Congenital or developmental anomolies; 2. Cysts of the jaws; 3. Tumors of odontogenic origin; 4. Neoplasms occurring in bone; 5. Fibro-osseous lesions; 6. Trauma.

A good understanding of the clinical signs and symptoms, normal biological behavior, radiographic interpretive data, and treatment of pathological conditions which occur in the oral cavity will allow us to be more selective in the use of radiographs for diagnosis.

It is not the purvue of this presentation to cover all of the disease entities that occur in the jaws. The more common or significant conditions which effect the welfare of the child will be presented.

Congenital or Developmental Anomolies

The early recognition of congenital or developmental anomolies often determines whether the eventual treatment is successful or not. It is imperative that the clinician know the physical symptoms and radiographic features of these conditions.

"Dens in Dente"

It is most important to identify the condition known as "dens in dente" as soon as possible. Recognition of this condition before the tooth erupts into the oral cavity may save the patient the loss of this anterior tooth.

As the term indicates, "dens in dente" implies a tooth within a tooth and is caused by an invagination of all layers of the enamel organ into the dental papillae. As the hard tissues are formed, the invaginated enamel organ produces a small tooth within the future pulp chamber. It occurs in above 5% of the population and can best be diagnosed by radiographic examination. The maxillary lateral incisors are most frequently involved and the pulp is usually exposed due

to defects in the enamel and dentin. If this condition is recognized before the eruption of the tooth, surgical exposure and an appropriate restoration will often avoid loss of the tooth or endodontic therapy. Not infrequently, after the tooth has erupted, a periapical lesion is associated with this condition.

Dilaceration and Supernumerary Roots

Dilaceration is a term used to describe angulation or a sharp bend or curve in the root or crown of a forming tooth. The condition is thought to occur due to trauma during the period in which the tooth is forming. Consequently, the position of the calcified portion of the tooth is changed and the remainder of the tooth is formed at an angle. Most teeth have some degree of dilaceration. It is most important to identify this condition prior to the extraction of any tooth. As a general rule of thumb it is wise to take a preoperative radiograph on any tooth to be extracted.

Concrescence

Concrescence occurs when two independently forming teeth become fused by either cementum or bone. Microscopically, these teeth are found to have separate pulp canals and roots. Both of the teeth may be erupted or unerupted or one tooth may be imbedded and the other erupted. It has been estimated that .5% of all teeth have some form of concrescence. It is generally thought that this condition occurs when two teeth are forced together after they have completely formed. Clinically these teeth give a dull sound when they are tapped. If this condition is not identified before an extraction it is possible the adjacent, non-offended tooth will also be extracted.

Anodontia

True anodontia implies the absence of teeth. It may be total involving, both the deciduous and permanent dentitions, as in some patients with ectodermal dysplasia, or it may be partial (hypodontia) and limited to a single tooth or group of teeth. It is estimated that 7% of the population exhibit at least one congenitally missing tooth. In a study by Dolder the mandibular second premolar was the most commonly missing tooth followed by the maxillary premolar and then the maxillary lateral incisor. Whenever there is a missing tooth or delayed eruption of a tooth it is wise to take a diagnostic radiograph. The early identification of numerous missing or impacted teeth may facilitate the early diagnosis of ectodermal dysplasia, or cleidocranial dysostosis.

Ectodermal dysplasia is a hereditary disease that involves all structures derived from the ectoderm. Males are affected much more freqently than females. Clinical findings are the absence or reduction in the amount of hair (Hypotrichosis) an absence of sweat or sebaceous glands, temperature elevation, dry skin, depressed bridge of the nose, protrusion of the lips and complete or partial endodontia.

A common cause for partial endodontia is the exposure of the developing tooth germ to X radiation.

Supernumerary Teeth

Teeth in excess of the normal compliment are referred to as accessory or supernumerary. Supernumerary teeth frequently inhibit the normal compliment of teeth to erupt. An accessory tooth between the maxillary central incisor is called a mesiodens. Supernumerary teeth which develop distal to the third molar are called a distomolar and one which is located buccal or lingual to the molar is called a paramolar. Supernumerary teeth occur nine times more frequently in the maxilla than in the mandible. It is estimated that 5% of the caucasian population of this country exhibit one or more supernumerary teeth.

Numerous supernumerary and impacted teeth are seen in a condition called cleidocranial dysostosis. This symptom frequently leads to the diagnosis of the disease. Cleidocranial dysostosis is characterized by delayed closure of the fontanelles, delayed closure of cranial sutures and presence of wormian bones, underdevelopment of the upper face — particularly the maxilla, underdevelopment of the paranasal sinuses, and prognathism. There is frequently an absence or hypoplasia of the clavicals so that the patient can approximate the shoulders with ease.

Cycts of the Jaws

The cysts of the jaws fall into two major categories. The odontogenic cysts which develop from epithelium of odontogenic origin are more frequently seen in the child than the developmental cysts which come from entrapped epithelium in fissures and sutures. The cysts of the jaws present with a clinical sign of swelling or with secondarily infected pain. When these cysts enlarge to any degree there is usually expansion of the cortical bone and migration of adjacent teeth (Chart I, next page).

Primordial Cyst

The primordial cyst comprises approximately 2% of all odontogenic cysts. It arises from a tooth germ which, instead of forming a tooth, degenerates into a cyst. Clinically this lesion is always associated with a missing tooth. The mandible is involved much more frequently than the maxilla and the lesion most frequently occurs during the second decade of life. The lesion is generally asymptomatic unless it is secondarily infected. Most frequently the lesion causes expansion of the cortical plates of bone and may produce migration of adjacent teeth. The teeth in the area are generally vital. Radiographic examination reveals a

Chart 1. Cysts of the jaws.

Lesion	Usual Location	Usual Age	Predominant Sex	Clinical and Radiographic Features	Treatment	Prognosis
Primordial cyst	Mandible, third molar, and bicuspid area	2nd decade	Either	Solitary, well-circumscribed radiolucent area; asymptomatic or may produce enlargement. Cyst develops in place of a normal or supernumerary tooth.	Enucleation or currettage	Excellent
Dentigerous cyst	Mandibular third molar and maxillary cuspid area	2nd decade	Either	Solitary, well-defined area of radiolucency associated with crown of impacted tooth. Enlargement of jaw and migration of teeth may be present.	Enucleation and curettage	Good
Apical periodontal cyst	Either jaw	Any age	Either	Asymptomatic with history of pain in affected tooth. Radiolucency at apex of nonvital tooth.	Root canal treatment or extraction of involved tooth	Excellent
Odontogenic keratocyst	Mandibular third molar and ramus area	Any age but usually under 20	Either	Single or multiple radiolucencies with either smooth or scalloped margins. Expansion of bone usually present. Very aggressive. Recurs 40% of time.	Curettage or resection	Fair
Keratinizing and calcifying odontogenic cyst	Mandible	Any Age	Either	Radiolucency with areas of radiopacities. Longer lesions may be predominantly opaque. Expansion of bone and occasionally tenderness.	Curettage	Excellent
Dental lamina cyst of newborn	Maxilla, anterior ridge	Newborn	Either	White elevated nodules.	None	Excellent
Traumatic bone cyst	Mandible, body area	Under 16	Male	Radiolucency which scallop between roots of teeth. Teeth vital with history of trauma. May have expansion of bone. Exploration reveals cavity empty or containing blood-stained fluid.	Exploration	Excellent
Aneurysmal bone cyst	Mandible	Under 20	Male	Solitary or honeycombed, well delineated cystic lesion with cortex expanded. History of trauma. Usually migration of teeth and often tenderness in area.	Curettage	Excellent

well-delineated area of radiolucency generally surrounded by a thin radiopaque line. The cyst is generally not associated with an erupted or unerupted tooth. Treatment is surgical removal.

Dentigerous Cyst

Dentigerous cysts comprise 34% of all odontogenic cysts. They are slightly more common in males than in females and usually occur in the second decade of life. About 70% of the lesions occur in the mandible and 30% in the maxilla. Two-thirds of these cysts occur in the molar area, generally occurring around an impacted mandibular third molar. The maxillary cuspid is the second most frequently involved tooth. The dentigerous cyst develops after the crown of the tooth is completely developed. The enamel origin surrounding the crown of the tooth undergoes cystic degeneration and the cyst enlarges by an increase in the osmotic and hydrostatic pressure. Radiographic examination shows an unerupted tooth with a cyst around the crown. These cysts are generally aggressive and can encompass the whole ramus and body of the mandible. On rare occasions the cystic lining of the dentigerous cyst may undergo malignant transformation or may transform into tumors of salivary gland or odontogenic origin. Clinically these cysts cause expansion of the cortical plates of bone and, if large enough, cause migration of adjacent teeth. Occasionally, when secondarily infected they may be extremely painful. Treatment is surgical removal.

The dentigerous cyst has a propensity to develop around the crowns of impacted third molars. The clinical problem of dealing with impacted third molars has been debated for many years. These cysts, when occurring in the adult, can frequently cause fractures of the mandible. It is good clinical practice to identify impacted third molars and remove them as soon as possible. The propensity to develop dentigerous cysts and the possibility of this cystic lining to develop into other tumors makes it imperative to remove them as soon as possible. The radiographic demonstration of the third molar should be begun at puberty. If it is determined clinically that this tooth will not erupt into the oral cavity it should be moved as soon as possible. A follow-up radiograph should be taken to determine that the cyst has been completely removed and that a residual cyst has not developed.

Eruption Cyst. The eruption cyst is a specialized form of a dentigerous cyst. It is generally seen in association with the eruption of the primary dentition. It most frequently occurs associated with an anterior tooth. Clinically a bluish, compressible, fluid-filled enlargement of the alveolar ridge is noted in an area of an erupting tooth.

Apical Periodontal Cyst

The apical periodontal cyst is usually asymptomatic. Occasionally when the nonvital tooth becomes infected this cyst may create a draining fistula and may also cause pain. This cyst is always associated with a nonvital tooth which frequently may be darker in color than adjacent teeth. The patient will always give a history of pain in the infected tooth. Radiographically, the apical periodontal cyst is characterized by a clearly demarcated radiolucency associated with the apical area of the affected tooth. The lesion varies in size but generally is less than a centimeter in diameter. Radiographically, it is impossible to differentiate between an apical periodontal cyst and a periapical granuloma. The cystic epithelium derives from the rests of Malassez. The redicular cyst may be treated in several ways. The most common manner is endodontic therapy with apical currettage. Many people believe that unless the epithelium is surgically removed the cyst will not disappear.

Odontogenic Keratocyst

The odontogenic keratocyst is one of the most aggressive of all the cysts occurring in the jaws. Its name is derived from the production of keratin from the cystic epithelium. It should be remembered that the odontogenic keratocyst is a feature of the basal cell nevus syndrome. The peak incidence of the odontogenic keratocyst is in the second decade and decreases as the patient gets older. It occurs with equal frequency in both sexes and 65% of the reported cases were found in the mandibular third molar region. There is a tendency for multiple cysts to occur in a patient. Radiographically, the odontogenic keratocyst cannot be distinguished from other intrabony cysts. On occasions its lumen, densely filled with keratin, will cause the usual radiolucent-like image to have a hazy appearance. Occasionally the margins of the cyst will appear scalloped. It should be remembered that the odontogenic keratocyst recurs approximately 40% of the time. Clinically there is generally expansion of the buccal cortical plate. There is often crepitous associated with this lesion. When an odontogenic keratocyst has been identified it is incumbent upon the clinician to follow these patients with diagnostic radiographs every six months. Several incidences of neoplasms have been reported to develop in the odontogenic keratocyst.

Keratinizing and Calcifying Odontogenic Cyst

Approximately 25% of the keratinizing and calcifying odontogenic cysts reported have occurred in children. This unique odontogenic lesion is a cross between a cyst and a neoplasm. Approximately 70% of the reported cases have occurred in the mandible and approximately 75% have been reported to occur centrally in bone. Radiographically, the intrabony lesions appear as a radiolucency, with variable amounts of

calcified radiopaque material scattered throughout the radiolucency, ranging from tiny flects to large masses. These lesions have been reported to become very large, reaching up to 6 cm in diameter. There is usually buccal cortical expansion of bone. Occasionally these lesions become secondarily infected and present with pain. The treatment for this lesion is surgical removal.

Dental Lamina Cyst of the Newborn

The dental lamina cyst of the newborn are multiple nodules on the alveolar ridge of newborn or very young infants which represent cysts originating from reminiscence of the dental lamina. Clinically these cysts present as small discrete white swellings of the alveolar ridge, sometimes appearing blanched as though from internal pressure. Radiographs are not indicated as these lesions have no osseous involvement.

Non-Epithelial Cysts (pseudocysts)

Two non-epithelial cysts are seen which are most frequently found in the jaws of children. The traumatic bone cyst constitutes about 13% of the non-odontogenic cysts that occur within the jaws. It is usually seen in individuals under the age of 20 and males are much more frequently affected than females. The lesion is generally asymptomatic and about 50% of the cases produce enlargement of the jaws. The area most frequently affected is between the mandibular cuspid and the ramus. The teeth within the area are vital. The radiographic features of the traumatic bone cyst are unique. The cyst consists of a large radiolucency which scallops between the roots of the teeth. The teeth in the area are generally vital. There is usually a history of trauma to the area. Upon exploration of this cystic cavity, the lesion is either found to be empty or filled with a clear to blood-stained fluid. The treatment is to create hemorrhage.

The aneurysmal bone cyst is not lined by epithelium and is therefore not a true cyst. It occurs most frequently under the age of 16 and usually there is a history of trauma. Usually the lesion occurs in the mandible and there is often a firm, nontender enlargement of the affected area. The overlying mucosa is generally normal. Radiographically, the lesion is multilocular and often produces a soap bubble appearance. The lesion generally produces expansion of the cortical plates of bone. This lesion frequently displaces teeth but rarely causes root resorption. The treatment is surgical removal.

Tumors of Odontogenic Origin

Tumors of odontongenic origin are those tumors that are derived from the dental apparatus. Although all of the tumors of odontogenic origin occur in children, the tumors which predominantly occur under the age of 20 will be discussed in this presentation (Chart II, p 428).

Adenomatoid Odontogenic Tumor

The adenomatoid odontogenic tumor is derived from odontogenic epithelium. This tumor occurs primarily in teenagers. Females are affected approximately twice as frequently as males. Clinically the lesion presents as a painless, slow-growing expansile lesion of bone. The maxilla is involved twice as common as the mandible. Approximately 75% of the lesions occurring in the maxilla occur in the cuspid region. Three-quarters of the reported cases have occurred associated with impacted teeth and are most frequently misdiagnosed as dentigerous cysts. The tumor is most frequently asymptomatic. Radiographically the lesion usually presents as a solitary cystic-appearing lesion associated with an impacted tooth. Frequently calcifications are seen in association with the tumor, producing a faintly detectable radiolucency. The lesion rarely penetrates the cortical plate of bone. Treatment is extraction of the tooth and removal of the offending tumor mass.

Ameloblastic Fibroma

The ameloblastic fibroma is a mixed odontogenic tumor composed of both epithelial and mesenchymal elements. The ameloblastic fibroma occurs predominantly in younger patients with the average age approximately 14½. The mandible is more frequently involved than the maxilla and there is a propensity for this tumor to occur in the premolar-molar area. The tumor is associated with an impacted tooth 75% of the time. There does not appear to be any sex predilection. Clinically the lesion is a slow-growing mass which is generally asymptomatic. The lesion usually causes enlargement of the jaw with occasional migration of the teeth. Radiographic examination shows a multilocular radiolucency with displacement of teeth. Generally the impacted tooth associated with this lesion is pushed to the inferior border of the mandible. Treatment of the ameloblastic fibroma is conservative and curettage appears to give an adequate cure rate. Larger lesions have been treated with marginal resection.

Odontoma

The odontoma is the most common of all odontogenic neoplasms. The odontoma is derived from both odontogenic epithelium and mesenchymal components of the tooth germ. Odontomas are typically subclassified into compound and complex types. The complex type is composed of a mass of irregularly arranged dentin, enamel, cementum, and connective tissue arranged in a disorganized pattern not resembling normal tooth morphology. The compound variety is com-

Chart II. Tumors of odontogenic origin.

Lesion	Usual Location	Usual Age	Predominant Sex	Clinical and Radiographic Features	Treatment	Prognosis
Adenomatoid odontogenic tumor	Maxillary cuspid region	Teenagers	Female	Expansile lesion affecting the maxillary cuspid region. Usually associated with impacted tooth. Radiographically a well-delineated radiolucency with areas of radiopacities.	Extraction of impacted tooth and enucleation and curettage	Excellent
Ameloblastic fibroma	Premolar and molar area of mandible	Middle teens	Slightly female	Slow growing, expansile lesion of mandible. Usually impacted or nonerupted tooth. Radiographically, multiloculated radiolucency with impacted tooth.	Curettage and enucleation	Excellent
Odontoma	Compound-maxilla complex mandible	Early teens	Either	Delayed eruption of a permanent tooth with slow expansion of the cortical plates. Radiographically a radiopacity surrounded by an area of radiolucency. The compound variety look like small teeth.	Enucleation and curettage	Excellent
Myxoma	Mandible	Teens	Female	Expansile lesion which occasionally perforates the cortical plates. Frequently associated with missing tooth. Radiographically a multilocular or soap bubble like radiolucency. Margins may be poorly defined.	Surgical resection	Fair
Melanotic neuroecto-dermal tumor of infancy	Anterior maxilla	1st year	Female	Poorly defined radiolucency of anterior maxilla. Teeth look like floating in tumor. Usually area of pigmentation present.	Enucleation and curettage	Excellent

Chart IV. Fibro-osseous lesions. (see page 431)

Lesion	Usual Location	Usual Age	Predominant Sex	Clinical and Radiographic Features	Treatment	Prognosis
Ossifying fibroma and cementifying fibroma	Maxilla and mandible	Later teens and early twenties	Either	Painless expansion of bone. Radiographic appearance varies from radiolucent to radiopaque. Lesion is often associated with apex of teeth and is well-delineated from adjacent normal bone.	Enucleation and curettage	Excellent
Fibrous dysplasia	Maxilla	Before puberty	Either	Painless expansion of bone. Radiographic appearance of "ground glass" or "orange peel." Lesion not delineated from adjacent bone.	Cosmetic reduction	Excellent

posed of tooth-like structures arranged in an organized pattern resembling small teeth. The compound variety is more common than the complex variety, and is usually seen in the maxilla. The complex odontoma, on the other hand, is more common in the mandible and approximately 70% of these tumors are located in the second and third molar areas. The most common complaint of a patient with an odontoma relates to the delayed eruption of a permanent tooth. The majority of odontomas are diagnosed under the age of 15. The lesions are nonaggressive but may reach sizes up to 3 cm in diameter. The treatment for the odontoma is enucleation and curettage.

Myxoma

The myxoma is thought to derive from odontogenic mesenchymal tissue. The tumor frequently occurs in a region of an unexplained missing tooth which strengthens the opinion that in these instances the tumor may have originated from the dental papillae of the aborted tooth bud. Clinically the myxoma presents as a slowly enlarging painless expansion of the jaws and associated migration of adjacent teeth. There is occasionally numbness of the lip associated with this lesion when it occurs in the mandible. This tumor occurs most frequently in the molar-premolar region of the mandible and frequently the ramus is also involved. Root resorption occurs in approximately 60% of these cases. The peak incidence of this neoplasm is in the middle teens. The myxoma is considered to be one of the most aggressive odontogenic neoplasms. Females are affected slightly more often than males. Radiographically, the lesion presents as a multilocular radiolucency or as a soap bubble radiolucency. The tumor borders may be well-defined or poorly delineated radiographically. It is not uncommon for the lesion to show scalloping and interdigitation between the teeth. Treatment for this tumor is surgical resection.

Melanotic Neuroectodermal Tumor of Infancy

The melanotic neuroectodermal tumor of infancy is known by many names (retinal anlage tumor, anlage tumor, progonoma, and pigmented ameloblastoma) each of which refers to a different theory of origin. Currently the tumor is thought to be derived from neuroectoderm. This tumor occurs in most instances during the first six months and is much more commonly seen in females than in males. The maxilla is the most common site of occurrence with more than 80% of the reported cases occurring in the anterior portion of the maxilla. The tumor is a relatively rapid growing mass. The overlying mucosa is generally intact and 75% of these lesions exhibit pigmentation. Often the teeth, in association with the tumor, appear to be floating in space and a differential diagnosis of histiocytosis X is therefore entertained. The tumor mass should be enucleated and curetted as soon as possible inasmuch as these tumors have a propensity to reach a very large size.

Neoplasms Occurring in Bone

There are four primary neoplasms that affect the jaw bones of children. There are many neoplasms that are of soft tissue origin that eventually invade bone. It is not the purvue of this discussion to discuss those lesions (Chart III, p 430).

Osteogenic Sarcoma

The osteogenic sarcoma is the most common primary malignancy of bone and is a highly malignant neoplasm with the potential to cause extensive destruction within the jaws with eventual metastasis. Males developing the lesions outnumber females and the peak occurrence is in the third decade, although 25% of the lesions occur before the age of 15. Frequently there is a history of previous irradiation or a pre-existing bone disorder or trauma to the jaws. The lesion occurs much more frequently in the mandible than in the maxilla. The initial presenting symptom is a lump or swelling in the jaw with pain being the second most common symptom. Other clinical symptoms are loose teeth, paresthesia, and nasal obstruction. Radiographically, the lesion may present as a radiolucency, mixed radiolucency and radiopacity, or a radiopacity. The typical "sun-ray" appearance is a rare occurrence in the jaws. The most commonly seen radiographic picture is an increased thickening of the periodontal membrane space. The prognosis is better for jaw lesions than when they occur in the long bones. The five-year survival rate for jaw lesions is approximately 25%. Treatment is surgical resection.

Ewings Sarcoma

Ewings sarcoma is a highly malignant tumor occurring primarily in the second decade of life. It produces pain, swelling, or both, and characteristically, the patient appears ill, with low-grade fever, moderate leukocytosis and sometimes secondary anemia. Trauma is frequently a precurser to this disease. Clinically, the jaw lesions present as a bony, hard expansion with an exceptionally fast growth rate. Occasionally ulceration is present and there is frequently secondary infection. The mandible is more frequently involved than the maxilla and the lesion is seen more frequently in males than in females. The radiographic appearance is extremely variable and nonspecific. The lesion will frequently present as an onion-skin layering of subperiosteal new bone. The most common radiographic appearance in the jaws is that of osteolytic mottled destruction of bone associated with bone expansion and soft tissue swelling. The tumor is radiosensitive, but even with the radical treatment of excision, pre-

Chart III. Neoplasms occurring in bone.

Lesion	Usual Location	Usual Age	Predominant Sex	Clinical and Radiographic Features	Treatment	Prognosis
Osteogenic sarcoma	Mandible	Latter teens and twenties	Males	Fast growing expansile lesion of jaws. Frequently painful and causes migration or exfoliation of teeth. Radiographically radiolucent, mixed or radiopaque. Rarely a sun-ray appearance.	Radiation and resection	Poor
Ewings sarcoma	Mandible	2nd decade	Males	Patient ill with low grade fever, secondary anemia and moderate leukocytosis. Pain and bony swelling. Radiographically variable picture, most frequently an osteolytic mottled destruction. Rarely onion-skin appearance.	Radiation and surgery	Poor
Histiocytosis X eosinophilic granuloma	Mandible	2nd and 3rd decade	Males	Fever, malaise and headaches. Sore mouth, fetid breath, pus, pain, swelling, loosening of teeth, retarded healing after extraction, swollen gingiva. Single radiolucency of the alveolar bone with the teeth appearing to "hang in air."	Surgery or radiation	Good
Hand-Schuller-Christian disease	Either	1st decade	Males	Bone involvement, eruptions of skin and ulceration of oral mucosa. Generally enlargement of liver, lymph nodes, and spleen. Triad-bone lesions, exopthalmas, and diabetes insipidus.	Radiation therapy	Questionable
Letterer-Siwe disease	Anywhere	Before two years		Disseminated-viscera, spleen, liver, lymph nodes, lungs, bone marrow and skin. Jaw lesions not as common as eosinophilic granuloma and Hand-Schuller-Christian disease.	Radiation and chemotherapy	Poor
Central giant cell granuloma of bone	Mandible anterior to molar teeth	2nd decade		Slow-growing expansile lesion of mandible. Corticle plates-paper thin. Sometimes pain or numbness of lip. Radiographically a unilocular or multilocular radiolucency.	Enucleation and curettage	Excellent

ceded and followed by radiation therapy, the prognosis is poor and the number of patients who survive three years is small. The lesion metastasises early and produces widespread dissemination.

Histiocystosis X

Histiocystosis X includes eosinophilic granuloma, Hand-Schuller Christian disease, and Letterer-Siwe disease which may represent individual entities or reflections with a spectrum of disease. In either case it is now accepted that these histiocystosis have in common a proliferation of a unique histiocyte, the langerhans' cell. The pathogenesis and etiology of histiocystosis X remains obscure.

It is generally conceded that eosinophilic granuloma, which occurs primarily in bone, has a benign course. The term Hand-Schuller Christian disease and Letterer-Siwe disease are best not considered in other than clinical terms, since there is no specific histopathology associated with these syndromes. A minority of patients with histiocystosis X demonstrate the classical clinical triad of skull lesions, exophthalmos, and diabetes insipidus. Most patients are children and in some series there is a predominance of males. Clinically the initial signs and symptoms of histiocystosis X are oral in 27% of the cases. Jaw involvement is often manifested as a swelling or ulceration of the gingiva associated with mobility and loss of teeth with radiographic evidence of alveolar bone resorption. Soft tissue involvement may occur without osteolytic lesions, however, osteolytic lesions are often encountered without associated soft tissue involvement.

Central Giant Cell Granuloma

The central giant cell granuloma is an aggressive bony lesion that occurs in young adults with the peak incidence occurring at the end of the second decade. The lesion usually presents as a swelling or expansile lesion within bone and is commonly associated with a sensation of increased pressure or pain. The classic radiographic appearance is that of a soap bubble, honeycombed, or multilocular central osseous radiolucency. The cortical bone may be eggshell thin and the lesion appears to affect the jaw anterior to the molars much more frequently than the posterior jaws. The mandible is affected in better than three-quarters of the cases. Occasionally the lesion may perforate the cortical plates, mimicking an aggressive malignant neoplasm. Giant cell granulomas of the jaws have been considered to be reactive lesions and not true neoplasms with malignant potential. Several giant cell granulomas of the jaws have been seen to be extremely aggressive. The central giant cell granuloma is the most common multilocular radiolucency of the jaws. Treatment is surgical removal.

Fibro-Osseous Lesions

Ossifying Fibroma

The ossifying fibroma is a distinct entity of unknown etiology. Oftentimes the cementifying fibroma is classified with the ossifying fibroma, although the cementifying fibroma is thought to have its origin from the periodontal membrane space. The lesions are most often distributed equally between the maxilla and mandible, although there seems to be a distinct paucity of the lesions reported in the anterior maxilla. A large percentage of ossifying fibromas are found in intimate relationship to the roots of teeth or in the periapical regions of the jaws. Large lesions generally cause expansion of the cortical plates. There can be great variation in the radiographic features of the ossifying fibroma ranging from totally lytic lesions with varying amounts of radiopaque calcific foci to lesions that are totally radiopaque. Radiographically the lesions are generally well-circumscribed and this feature separates them from fibrous dysplasia. The lesion most frequently occurs in the later teens or early twenties. Treatment is enucleation and curettage. (Chart IV, p 428).

Fibrous Dysplasia

Fibrous dysplasia is a disease of unknown etiology. The disease generally infects the jaws as a monostotic lesion although polyostotic forms occur less frequently. Clinically the lesion presents as a painless enlargement of involved bones. The maxilla is much more frequently involved than the mandible and the lesion generally occurs at puberty. Characteristically the maxillary lesions appear to have a radiographic appearance of ground glass or an "orange peel" radiopacity. The borders of the lesions are difficult to define which separates this lesion radiographically from ossifying fibroma. It should be noted that numerous cases of sarcoma have been reported developing in fibrous dysplasia. More recent studies have shown that this tendency occurs following radiation therapy. Treatment is generally limited to cosmetic reduction.

Trauma

Trauma to the teeth and facial bones may cause underlying pathology which may not be physically evident. Radiographic examination is most important to determine the extent of injuries. Follow-up radiographs are usually necessary if there is a diagnosis of underlying pathology.

Trauma to Teeth

Trauma to the teeth may produce clinical fracture or underlying osseous pathology. It is most important to take radiographs of the involved area to determine the extent of damage. Radiographs are important to

determine if the pulp is involved during a fracture of a tooth. Frequently when there is trauma to the teeth the soft tissues are hemorrhagic and swollen and may not reveal alveolar fractures or extrusion of the involved teeth. It is most important to take diagnostic radiographs in the area of trauma and to follow the healing process radiographically. Follow-up radiographs should be taken if there are any deliberations regarding delayed healing.

Trauma to the Jaws or Facial Bones

Trauma to the jaws or facial bones may cause dislocation of the jaws and or fractures. Dislocation of the temporomandibular joint occurs when the head of the condyle moves anteriorly over the articular eminence into a position such that it cannot be returned voluntarily to its normal position. Clinically, luxation is characterized by a sudden locking and immobilization of the jaws when the mouth is open, accompanied by prolonged spasmodic contraction of the temporal, internal pterygoid, and masseter muscles, with protrusion of the jaw. All activities requiring motion of the mandible, such as eating or talking, are impossible; the mouth cannot be closed and the patient frequently becomes panicky. Ofttimes luxation of the jaw may mimic a fracture. It is most important to radiographically investigate injuries or luxation of the condyle when a patient complains of a sudden change in occlusion or to symptoms related above.

Trauma to the facial bones frequently causes fractures which are clinically not evident. Whenever significant trauma has occurred to the facial bones it is imperative that the clinician take radiographs of the affected area. Most often a good clinical examination will reveal the underlying pathology.

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