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 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 anomalies; 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 purview 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 anomalies 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 in
frequently, 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 preopera-
tive radiograph on any tooth to be extracted.

Concrescence

Concrescence occurs when two independently form-
ing teeth become fused by either cementum or bone.
Microscopically, these teeth are found to have sepa-
rate 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 gen-
erally 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 dys-
plasia, 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 miss-
ing tooth or delayed eruption of a tooth it is wise to
take a diagnostic radiograph. The early identifica-
tion of numerous missing or impacted teeth may facilitate
the early diagnosis of ectodermal dysplasia, or clei-
docranial dysostosis.

Ectodermal dysplasia is a hereditary disease that
involves all structures derived from the ectoderm.
Males are affected much more frequently 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, de-
pressed bridge of the nose, protrusion of the lips and
complete or partial endodontia.

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

Supernumerary Teeth

Teeth in excess of the normal compliment are re-
ferred to as accessory or supernumerary. Supernumer-
ary teeth frequently inhibit the normal compliment of
teeth to erupt. An accessory tooth between the maxil-
ary central incisor is called a mesiodens. Supernumer-
ary 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. Super-
numery 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, under-
development of the upper face — particularly the
maxilla, underdevelopment of the paranasal sinuses,
and prognathism. There is frequently an absence or
hypoplasia of the clavicles so that the patient can
approximate the shoulders with ease.

Cysts 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 swell-
ing 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 fre-
quently occurs during the second decade of life. The
lesion is generally asymptomatic unless it is secondar-
ily infected. Most frequently the lesion causes expan-
sion 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
<table>
<thead>
<tr>
<th>Patient</th>
<th>Clinical</th>
<th>Radiographic</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

**Chart 1. Cysts of the jaw.**
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 reddicular 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 flecks 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 jaw. 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, non-tender 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 odontogenic 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 commonly 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 14 1/2. 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

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Usual Location</th>
<th>Usual Age</th>
<th>Predominant Sex</th>
<th>Clinical and Radiographic Features</th>
<th>Treatment</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenomatoid odontogenic tumor</td>
<td>Maxillary cuspid region</td>
<td>Teenagers</td>
<td>Female</td>
<td>Expansile lesion affecting the maxillary cuspid region. Usually associated with impacted tooth. Radiographically a well-delineated radiolucency with areas of radiopaecities.</td>
<td>Extraction of impacted tooth and enucleation and curettage</td>
<td>Excellent</td>
</tr>
<tr>
<td>Ameloblastic fibroma</td>
<td>Premolar and molar area of mandible</td>
<td>Middle teens</td>
<td>Slightly female</td>
<td>Slow growing, expansile lesion of mandible. Usually impacted or nonerupted tooth. Radiographically, multiloculated radiolucency with impacted tooth.</td>
<td>Curettage and enucleation</td>
<td>Excellent</td>
</tr>
<tr>
<td>Odontoma</td>
<td>Compound maxilla complex mandible</td>
<td>Early teens</td>
<td>Either</td>
<td>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.</td>
<td>Enucleation and curettage</td>
<td>Excellent</td>
</tr>
<tr>
<td>Myxoma</td>
<td>Mandible</td>
<td>Teens</td>
<td>Female</td>
<td>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.</td>
<td>Surgical resection</td>
<td>Fair</td>
</tr>
<tr>
<td>Melanotic neuroectodermal tumor of infancy</td>
<td>Anterior maxilla</td>
<td>1st year</td>
<td>Female</td>
<td>Poorly defined radiolucency of anterior maxilla. Teeth look like floating in tumor. Usually area of pigmentation present.</td>
<td>Enucleation and curettage</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Lesion</th>
<th>Usual Location</th>
<th>Usual Age</th>
<th>Predominant Sex</th>
<th>Clinical and Radiographic Features</th>
<th>Treatment</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ossifying fibroma and cementifying fibroma</td>
<td>Maxilla and mandible</td>
<td>Later teens and early twenties</td>
<td>Either</td>
<td>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.</td>
<td>Enucleation and curettage</td>
<td>Excellent</td>
</tr>
<tr>
<td>Fibrous dysplasia</td>
<td>Maxilla</td>
<td>Before puberty</td>
<td>Either</td>
<td>Painless expansion of bone. Radiographic appearance of &quot;ground glass&quot; or &quot;orange peel.&quot; Lesion not delineated from adjacent bone.</td>
<td>Cosmetic reduction</td>
<td>Excellent</td>
</tr>
</tbody>
</table>
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 purview 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 precursor 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-
<table>
<thead>
<tr>
<th>Lesion</th>
<th>Usual Location</th>
<th>Usual Age</th>
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<th>Treatment</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osteogenic sarcoma</td>
<td>Mandible</td>
<td>Latter teens and twenties</td>
<td>Males</td>
<td>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.</td>
<td>Radiation and resection</td>
<td>Poor</td>
</tr>
<tr>
<td>Ewing's sarcoma</td>
<td>Mandible</td>
<td>2nd decade</td>
<td>Males</td>
<td>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.</td>
<td>Radiation and surgery</td>
<td>Poor</td>
</tr>
<tr>
<td>Histiocytosis X eosinophilic granuloma</td>
<td>Mandible 2nd and 3rd decade</td>
<td>Males</td>
<td>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 &quot;hang in air.&quot;</td>
<td>Surgery or radiation</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Letterer-Siwie disease</td>
<td>Anywhere</td>
<td>Before two years</td>
<td>Males</td>
<td>Disseminated-viscera, spleen, liver, lymph nodes, lungs, bone marrow and skin. Jaw lesions not as common as eosinophilic granuloma and Hand-Schuller-Christian disease.</td>
<td>Radiation and chemotherapy</td>
<td>Poor</td>
</tr>
<tr>
<td>Central giant cell granuloma of bone</td>
<td>Mandible anterior to molar teeth</td>
<td>2nd decade</td>
<td></td>
<td>Slow-growing expansile lesion of mandible. Cortex plate-paper thin. Sometimes pain or numbness of lip. Radiographically a unicocular or multicellular radiolucency.</td>
<td>Enucleation and curettage</td>
<td>Excellent</td>
</tr>
</tbody>
</table>
ceed 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-Schüller 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 histiocystoses 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-Schüller 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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