Topic 10:

Jaws: Cysts and Odontogenic Neoplasms

Jaw Cysts

General Features of Jaw Cysts

To physicians, the term "cyst" means, simply, "a space." Because cystic spaces within the jaws have special characteristics, they require a more precise definition. Jaw cysts are "a space within bone lined with epithelium supported by a fibrous connective tissue wall." Once in a while cysts are discovered in soft tissues rather than bone. These soft tissue cysts are also composed of spaces lined with epithelium supported by a fibrous c.t. wall. There is at least one lesion that manifests as a space in bone that is not lined with epithelium and fibrous c.t. Ideally, to prevent confusion, epithelial lined spaces are sometimes called "true cysts" while those not lined with epithelium are called "false cysts." While this distinction makes academic sense, it is not often used.

A dozen or so different cysts arise in the jaws; some of these are common while others are rare. Jaw cysts are almost always submitted to oral pathologists for microscopic examination. Because pathologists exam large number of cysts they are able to report the relative incidence of each type. As a group, jaw cysts are common enough to make up a substantial part of an oral pathology practice. These cysts also comprise a substantial part of most oral surgery practices.

Sources of Epithelium in Cysts

If one thinks about it for a moment, there is no epithelium in the jaws; the jaws are composed of connective tissue: bone, bone marrow, and fibrous connective tissue. Where does the epithelium lining jaw cysts come from? There are two sources: epithelium left behind from developing teeth and epithelium left behind from face and mouth development.

The formation of each tooth is initiated and guided by epithelial cells that originated from the primitive oral epithelium. Epithelium is present at all stages in tooth development and covers the external surfaces of the crown until the tooth erupts into the mouth. Even after eruption, islands or "rests" of epithelium often remain. For example, remnants of Hertwig's epithelial root sheath come to reside within the periodontal ligament; they are known as the "epithelial rests of Malassez." Some jaw cysts arise from epithelium associated with tooth development—"odontogenic epithelium."

The oral cavity and face is created by the fusion of embryonic projections covered with epithelium. As these projections collide and fuse, covering epithelium in the line of collision may be trapped or, as some say, "enclaved." The trapped epithelium forms islands (rests) that will remain there for a lifetime. Because these rests are found in former fusion lines or "fissures," these are also known as "fissural epithelium." Some jaw cysts arise from epithelium enclaved during oral-facial development. The scenario just presented has undergone modification in recent years. While there are some fused processes in facial development, others once assumed to fuse are now known to develop in other ways.

The etiology and pathogenesis of jaw cysts is not known. There is very little experimental evidence that sheds light on their pathogenesis. This lack of hard evidence doesn't prevent speculation, however. The most accepted speculation goes something like this: 1) Jaw cysts arise from epithelium associated with formation of the teeth, oral cavity, and face. 2) If this epithelium is somehow stimulated, by inflammation, for example, they proliferate forming an ever-larger mass. 3) As epithelial cells proliferate, the cells in the center of the mass, being at some distance from their blood supply, die. 4) Central cell death produces a central cavity surrounded by viable epithelial cells—a true cyst is formed.

Most cysts of the oral and facial regions are located within the jaws—they are intraosseous or intrabony lesions. Given the sources of epithelium, some jaw cysts will be found in tooth-bearing areas; these are odontogenic cysts. The others will be found in places where oral-facial processes fused; these are fissural (nonodontogenic) cysts. Occasionally, cysts will arise in a soft tissue like the gingiva.

Radiographic Features of Jaw Cysts

Because most oral-facial cysts are located within the jaws, they are invisible on intraoral clinical examination; their presence is discovered on radiographic examination. Being composed of soft tissues within bone, jaw cysts appear as radiolucencies. If a cyst becomes very large it may expand the jaw's outer

limits making intraoral detection possible. Cysts arising in soft tissues outside of bone are more likely to be discovered on intraoral examination where they produce a surface swelling.

Jaw cysts usually produce well-circumscribed radiolucencies surrounded by radiopaque borders, suggesting slow growth. These single well-demarcated radiolucencies are "unilocular" lesions (uni- = one; -locular = locus). Most unilocular lesions are small, measuring less than a couple of centimeters in diameter. If, however, a cyst is undetected for some years, it may increase up to ten-fold (> 10 cm.). These large cysts may be unilocular; however, some may be partitioned; these are known as "multilocular radiolucencies."

Microscopic Features of Jaw Cysts

All true cysts have three common microscopic features. First, fully-developed cysts have a central cavity that is filled with the remnants of shed lining epithelial cells. Second, the central cavity is lined with an epithelial membrane. The most common lining type is stratified squamous nonkeratinizing epithelium; however, some cysts have keratinizing epithelium, which dramatically alter their behavior. Cysts of the maxilla, being close to the sinuses, are sometimes lined with pseudostratified columnar epithelium known popularly as "respiratory epithelium." Third, the epithelial membrane is supported by a fibrous connective tissue wall. This wall is composed of dense irregularly-arranged fibrous connective tissue; it may or may not be infiltrated by chronic inflammatory cells.

Table 1: Microscopic Features Common to Most Jaw Cysts

Feature
• Debris-filled central cavity
• Stratified squamous epithelium lining membrane
• Fibrous c.t. supporting wall

Treatment and Prognosis of Jaw Cysts

Being well circumscribed, unilocular, and relatively small, most jaw cysts can be treated successfully by cutting a hole into the jaw (osteotomy) and separating the lesion from the surrounding bone, and removing attached remnants by scraping the bone cavity (curettage). Large and multilocular lesions complicate treatment considerably. Sometimes removal of a large segment of the jaw is necessary to insure complete removal (resection). To prevent the unfavorable effects of resection, a procedure known as "marsupialization" is available. With this technique, an opening or stoma (stoma = mouth) is made into the central cavity of the cyst. The stoma is maintained for a number of weeks allowing for proliferation of bone around the cyst causing it to "decompress." If successful, the cyst will decrease in size.

Complete excision of small jaw cysts is usually possible; they do not recur. It is incomplete removal that causes recurrence problems. As just discussed, large and multilocular lesions may be difficult to excise completely; it is these lesions that have a tendency to recur. This illustrates that early recognition of jaw cysts insures their complete removal and prevent their recurrence.

Classification of Jaw Cysts

Some authors list and discuss twenty-eight different true and false cysts in and around the oral cavity. Because so many of these are very uncommon, the current discussion will be limited to about ten common and important true jaw cysts. It is common and logical to subdivide the true jaw cysts into those derived from odontogenic epithelium and those derived from fissural epithelium. Thus they are classified into the "odontogenic cysts" and the "fissural or nonodontogenic cysts."

Odontogenic Jaw Cysts

Odontogenic cysts are true cysts occurring in the jaws. They arise from stimulation of epithelium left over from tooth development. It is presumed that some develop from the reduced enamel epithelium, others from the dental lamina, and still others from the remnants of Hertwig's epithelial root sheath.

Table 2: Classification of the Most Common Jaw Cysts

Epithelium Source	*Cyst Name*
Odontogenic	• Apical Cyst • Dentigerous Cyst • Primordial Cyst[a] • Odontogenic Keratocyst • Lateral Periodontal Cyst • Residual Cyst
Non-Odontogenic	• Papilla Palatini Cyst • Incisive Canal Cyst • Median Palatal Cyst • Globulomaxillary Cyst[b] • Nasolabial Cyst

a. Existence debated
b. Existence debated

Apical Cyst (Periapical Cyst Radicular Cyst, Root End Cyst)

Epithelial lined jaw cyst found as radiolucencies at the end of roots of non-vital teeth; surgical excision coupled with removal of the cause will cure these cysts.

Apical cysts are very common lesions associated with chronic periapical inflammation. They arise within chronic apical periodontitis (CAP) by, presumably, activation of epithelial rests of Malassez.

Unless the lesion is very large or there is suppuration (suppurative apical periodontitis), apical cysts are invisible on intraoral clinical examination. The lesion is usually not associated with signs or symptoms (asymptomatic); however, patients may report past drainage and/or pain in the area. The offending tooth will have a deep carious lesion, deep restoration, or inadequate root canal filling. It will not be responsive to standard pulp testing procedures (i.e., is nonvital). Radiographic examination will reveal a well-demarcated unilocular radiolucency at the tooth apex.

Periapical radiolucent lesions should be removed for histologic examination. Such study will reveal a cyst with a central debris-filled cavity lined with stratified squamous nonkeratinizing epithelium. The outer fibrous c.t. wall shows many chronic inflammatory cells suggesting the inflammatory origin of this cyst.

Apical cysts are not dangerous lesions. They do not become malignant or develop into ameloblastoma (a benign but persistent neoplasm described later). If left to grow, apical cysts can become fairly large; some may reach 4-5 cm. in diameter. Apical cysts are treated by osteotomy and curettage. Complete removal should be expected; as a consequence, they should not recur. However, it should be kept in mind that the cause of this lesion, the nonvital tooth, must be dealt with by adequate endodontic therapy or extraction.

Dentigerous Cyst (Follicular Cyst)

A common epithelial lined jaw cyst appearing as a radiolucency surrounding the crown of an unerupted or impacted tooth; rarely, odontogenic neoplasms will arise in the cyst; surgical excision will cure a dentigerous cyst.

Dentigerous cysts are common lesions developing around the crown of an unerupted tooth. It is estimated that about 10% of impacted teeth form dentigerous cysts. These lesions are presumed to arise from either the reduced enamel epithelium (formed from consolidation of the outer and inner enamel epithelia after enamel deposition is complete) or from rests of odontogenic epithelium not incorporated into the reduced enamel epithelium.

Unless dentigerous cysts are very large, their presence cannot be detected on intraoral clinical examination. They are unaccompanied by any signs or symptoms. Dentigerous cysts are detected by observation of a well-demarcated radiolucency around the crown of an unerupted tooth. The lesions are usually relatively small (less than 2.0 cm in diameter) and are usually unilocular. If not detected early, dentigerous cysts can become large and multilocular, features that suggest their transformation into more serious lesions to be

described later. These large lesions may expand the cortical plates and, therefore, be detected on intraoral clinical examination. Since third molars and cuspids are the most commonly impacted teeth, most dentigerous cysts occur around them.

Most dentigerous cysts are lined with stratified squamous nonkeratinizing epithelium supported by a fibrous c.t. wall devoid of inflammation. A few, however, are lined with keratinizing epithelium, a feature that signals their transformation into another more aggressive lesion, the odontogenic keratocyst (to be described soon). Fewer still show proliferation of epithelial rests indicating that a benign, but aggressive, neoplasm, the ameloblastoma (described later) has developed.

As just mentioned, the most serious complications associated with dentigerous cysts are their association with one of two more serious lesions, the odontogenic keratocyst or the ameloblastoma. The potential for these transformations justify preventive removal of impacted third molar teeth. As the incidence of these unfavorable transformations rise with age and size of dentigerous cysts, early recognition and removal of this lesion is essential.

Small unilocular lesions are managed successfully through osteotomy, extraction of the impacted tooth, and removal of the lesion. Impacted cuspids may be salvaged by removal of the lesion only. Large lesions may require extensive surgery including jaw resection. With complete removal and confirmed absence of transformation, dentigerous cysts should not recur.

Primordial Cyst

A epithelial lined jaw cysts appearing as a radiolucency in the alveolar process unassociated with a tooth; depending on their lining some are difficult to remove; complete surgical excision will cure these cysts.

Because dentigerous cysts develop after the tooth crown is completed, it is assumed they arise in the late stages of tooth development. There is another cyst that is thought to arise in the early developmental stages—the primordial cyst ("primordial" means "beginning"). Some believe that primordial cysts arise from the dental lamina, an early developmental structure, forming a cyst instead of a tooth. Others believe that they arise from degeneration of the stellate reticulum during the cap or bell stages stopping tooth development and forming a cyst instead. (Still others deny their existence.) However they form, these uncommon cysts are not associated with a nearby tooth because they developed instead of one. Because primordial cysts develop instead of a tooth, often the associated tooth is missing. In cases where all teeth are accounted for, it is assumed that an extra tooth (supernumerary) would have developed it the cyst hadn't developed instead. The third molar region is the most common location for primordial cysts.

Unless large enough to produce cortical plate expansion or displacement of adjacent teeth, a primordial cyst is invisible to intraoral clinical examination. On radiographs, this cyst appears as a well-demarcated unilocular radiolucency located within the alveolar process near the crest of ridge. Sometimes they may appear below the roots of a tooth or between the roots of adjacent teeth.

Primordial cysts are lined with stratified squamous epithelium. More often than not, the epithelial lining is keratinized, a fact that imparts a more aggressive behavior to these cysts. It was observation of this fact that led to the identification of the odontogenic keratocyst, a lesion that will be covered next. Whether keratinized or not, the epithelial lining is supported by a connective tissue wall that usually has no inflammation.

As just mentioned, lining keratinization imparts aggressive behavior to primordial cysts. These keratinizing cysts are more difficult to remove completely making recurrence a possibility. Other than keratinization or excessive size, there are no other significant complications.

Complete removal of primordial cysts can be expected with osteotomy and curettage. However, if lining keratinization is present, complete removal may be more difficult. As will be discussed next, there are clues that can be observed during surgery suggesting the presence of keratinization and the likelihood of recurrence.

Odontogenic Keratocyst (Keratocyst, Keratinizing Cyst)

Jaw cysts of dentigerous or primordial origin lined with keratinizing epithelium appearing as radiolucencies around crowns of unerupted teeth or in a tooth-bearing area unassociated with teeth; these cysts may be difficult to remove surgically and often recur.

In 1956, the significance of keratinizing jaw cyst epithelia was first recognized. It had been noted that some primordial and dentigerous cysts seemed to recur more often that expected. Investigation revealed that keratinization of the cyst's lining that caused the high recurrence rates. When this relationship was first discovered, oral pathologists were content to leave the existing cyst classification alone adding a footnote that keratinization of dentigerous or primordial cyst epithelium was associated with high recurrence rates. As time passed, and as recurrence rates of over 25% were reported, pathologists conferred it separate status. By doing so, they reasoned, dentists would become alert to the special treatment these cysts required. At first the new lesion was called "the keratinizing cyst." The term, however, didn't have the ring of "specialness" to it; therefore, a new term, "keratocyst," became increasingly popular. To differentiate jaw cysts with keratinizing linings from very common skin cysts with keratinizing linings (epidermoid cysts), the word "odontogenic" was added. Today, the term "odontogenic keratocyst" is the accepted designation for this lesion.

Odontogenic keratocysts are fairly common. It has been determined that about 10% of dentigerous and almost 30% of primordial cysts keratinize. Since dentigerous cysts are very common and since one of ten keratinize, it can been seen that odontogenic keratocysts are fairly common.

It is not known why the linings of some dentigerous and primordial cysts keratinize. Similarly, it is not known why keratinization makes these cysts more aggressive than their nonkeratinizing counterparts.

Like other cysts, small odontogenic keratocysts cannot be detected on intraoral clinical examination. However, these cysts can become larger in a shorter period of time than nonkeratinizing cysts causing jaw expansion. Most odontogenic keratocysts arise in dentigerous cysts. Because most dentigerous cysts are located in the mandibular third molar region, it stands to reason that most odontogenic keratocysts are located there too.

Odontogenic keratocysts produce a radiolucency located in one of two general areas: around the crown of an unerupted tooth or in the alveolar process unassociated with a tooth. The radiolucency in either site may be small, well-demarcated, and unilocular; however, by the time all too many are discovered, many have become large, multilocular radiolucencies. Some replace much of the jaw. The large, multilocular lesions produce a "soap-bubble" appearance mimicking the radiographic of a serious jaw neoplasm, the ameloblastoma (to be covered later).

Table 3: Microscopic Features of Odontogenic Keratocysts

Microscopic Feature
• Keratinizing epithelium
• Actively proliferating epithelium
• Keratin-filled central cavity
• Thin cyst wall (epithelium and c.t.)
• Flat epithelium-c.t. interface
• Epithelial pouches, cul-de-sacs, satellite cysts

While the radiographic appearance of odontogenic keratocysts can resemble other lesions, their microscopic features are distinctive. The central cavity is stuffed with keratin, a feature that oral surgeons recognize (as they remove these lesions) by the thick white foul-smelling debris. Other features displayed by the lining explain why odontogenic keratocysts are so difficult to remove completely. First, the epithelial lining cells are very active. Mitotic figures are quite common indicating that the lesion, while not a neoplasm, is capable of expanding. Second, the cyst wall is very thin, making it easy to tear. Third, the epithelium has a flat interface with the underlying c.t. wall allowing pieces to be left behind. Fourth, the cyst wall often forms

pouches, cul-de-sacs, and satellite cysts. Pieces of these excrescences may be left behind during cyst removal.

It should be obvious that the most common and significant complication of odontogenic keratocysts is incomplete removal. It is the unique features of the cyst lining that hinders surgeons in removal of these lesions. So, incomplete removal causes the high recurrence rates that are associated with odontogenic keratocysts. It is estimated that almost 30% of these cysts recur.

Osteotomy and curettage will completely remove many odontogenic keratocysts. Given that recurrence rates vary from 10-30%, standard therapy will cure 70-90% of them. The larger the lesion becomes, the more difficult it is to completely remove. As a consequence, early diagnosis will insure the highest cure rates. The largest odontogenic keratocysts are occasionally treated by marsupialization.

Lateral Periodontal Cyst

An uncommon cyst usually found in the interdental alveolar process between adjacent teeth; surgical excision, once the diagnosis is confirmed, is curative.

The lateral periodontal cyst is an uncommon lesion that, as its name suggests is located between the roots of adjacent teeth. It appears as a well-circumscribed radiolucency often near the crest of the interdental alveolar bone. Most are located in the mandibular bicuspid (premolar) area. The lesions may enlarge apically causing divergence of adjacent teeth. Surgical excision is curative if the diagnosis of "lateral periodontal cyst" is confirmed. It is not uncommon for odontogenic keratocysts to mimic the appearance of lateral periodontal cysts. Since the lateral periodontal cyst has a characteristic, almost unique microscopic appearance, its diagnosis readily can be confirmed. Also it is necessary to determine the vitality of nearby teeth to rule out inflammatory cysts (apical cysts).

Residual Cysts

An epithelial lined jaw cyst left in the jaws after removal of the associated tooth making determination of its precise origin difficult; surgical excision will cure this cyst.

Before the days of panoramic radiography, dentists had to rely primarily upon small periapical films to evaluate the presence of jaw lesions. Often, periapical films did not include the periapical or posterior regions—teeth were well-displayed, but the surrounding tissue was not. As a consequence, these films did not reveal the presence of lesions at the roots of erupted teeth or around the crowns of unerupted ones. Sometimes, teeth were removed, but cysts inadvertently were left behind. In spite of the fact that the source of the cyst (the tooth) was removed, the nearby cyst continued to grow on its own. Later on, a jaw swelling or complete radiographic survey revealed the presence of the lesion, and surgery was performed to remove it. Microscopic examination of the lesion revealed that it was a jaw cyst, but the absence of relationship to a tooth made certain determination of its origin impossible. Not being able to call the cyst "dentigerous," "apical," or whatever, the term "residual cyst" was coined.

The widespread use of panoramic radiography should all but eliminate the occurrence of residual cysts. Unlike the size limitations imposed by periapical films, panoramic radiographs allow study of the entire maxilla and mandible. Given this technologic advantage, there is no excuse for missing jaw radiolucencies. These lesions can now be identified, removed, and submitted for microscopic examination. If a residual cyst is identified, simple excision should suffice unless, of course, the lining is keratinized, in which case recurrence may occur.

Fissural (Nonodontogenic) Jaw Cysts

Fissural cysts that arise from epithelium trapped during development of the oral cavity and face—the fissural cysts. The occurrence of most is rare. Like their odontogenic cousins, the fissural cysts are lined with epithelium supported by a fibrous c.t. wall. Unlike them, however, the fissural cysts are not associated with teeth but, rather, are associated with the junctions between bones of the maxilla. The maxilla is mentioned preferentially because fissural cysts do not arise in the mandible as the mandible is not formed by the fusion of separate structures. The maxilla is the jaw in which fissural cysts arise. The maxilla arises from several distinct processes, each of which is covered with epithelium. Fissural cysts occur where the developmental processes fuse: the midline, between the premaxilla and maxilla, and the primitive

connection between the oral and nasal cavities. In addition to these, there are two rare soft tissue cysts of fissural origin.

Table 4: Locations and Names of Non-Odontogenic Cysts

Location	*Name(s)*
Nasopalatine Duct	• Papilla Palatini Cyst • Incisive Canal Cyst
Midline of Hard Palate	• Median Palatal Cyst
Between Premaxilla and Maxilla[a]	• Globulomaxillary Cyst
Alongside Nose on Face	• Nasolabial Cyst

a. Some say this junction does not exist

Nasopalatine Duct Cysts

In early embryonic life just after the oral and nasal cavities are separated, an epithelial tube connects them for a time. Later on, this "nasopalatine duct" disappears; however, remnants of it may persist in the anterior maxilla. A well-known foramen marks the site: the incisive canal. Epithelial rests are located within the incisive canal. There are two manifestations of nasopalatine duct cysts: cysts of the papilla palatini and incisive canal cysts.

Cyst of the Papilla Palatini

A rare true soft tissue cyst appearing as a swelling in the maxilla midline just lingual to the central incisor teeth (the incisive papilla), surgical removal will cure it.

Once in a great while, epithelial rests derived from the nasopalatine duct proliferate forming a cyst within the papilla confined to the palatal mucosa. This is a soft tissue cyst known as the "papilla palatini cyst" (the "papilla palatini" is another name for the "incisive papilla").

This cyst causes a swelling of the incisive papilla that is asymptomatic unless it becomes infected secondarily. Being confined to soft tissue, the papilla palatini cyst does not create a radiographic abnormality and, therefore, cannot be detected on radiographs. Excision of the lesion will cure it. These cysts do not become large or transform into anything more serious.

Incisive Canal Cyst

A common true jaw cyst appearing as a radiolucent lesion in the maxilla midline just lingual to the central incisor teeth (in the incisive canal), surgical removal will cure this cyst.

The incisive canal cyst arises from epithelial rests located within the tissues of the incisive canal. It is the most common fissural cyst and may affect 1% of the population.

Unless large, an incisive canal cyst is undetected by intraoral clinical examination. On rare occasions the cyst may become secondarily infected producing a fistula and suppurative drainage through the incisive papilla.

Many incisive canal cysts appear as heart-shaped radiolucency is located just posterior to the maxillary incisor teeth. The radiolucency is usually small (<1.0 cm); however, it may attain large size (> 2.0 cm). The nearby incisors cause a diagnostic challenge: as the lesion may appear, in anterior films, to lie above the incisor root simulating a periapical lesion. The absence of restorations or caries and the responsiveness to pulp vitality tests will rule out the diagnosis of a periapical lesion. These simple observations and tests will eliminate unnecessary endodontic therapy. The true size and shape of incisive canal radiolucencies can be determined by using occlusal films and orienting the x-ray beam at right angles to the hard palate.

Incisive canal cysts are lined with stratified squamous nonkeratinizing epithelium. The presence of glands, blood vessels, and nerves in the cyst wall is proof that the lesion arose within the incisive canal as these tissues are native to the region.

Simple excision of incisive canal cysts will be sufficient to prevent their recurrence. These lesions have no neoplastic potential nor do their linings keratinize.

Median Palatal Cyst

An uncommon true jaw cyst appearing as a radiolucent lesion in the maxilla midline posterior to the incisive canal, surgical removal will cure this cyst.

If epithelial rests located in the mid-palatal maxillary suture should proliferate, a median palatal cyst may form. This is uncommon but should be kept in mind if a mid-palatal swelling is encountered. Small lesions are usually invisible on clinical intraoral examination. However, these cysts do not have to become very large to raise the palatal mucosa causing an intraoral swelling. If this should occur, the absence of a diseased tooth as well as redness, pain, fever, and other signs of acute inflammation will convince the clinician that the swelling is not a palatal abscess.

The median palatal cysts produce radiolucencies in the midline of the palate well posterior to the incisive canal. While they are small in their early stages, being asymptomatic, they are difficult to see on standard radiographs, and may become quite large before detected. Like the incisive canal cysts, the radiolucencies of median palatal cysts are best seen on occlusal films.

Median palatal cysts are lined with stratified squamous nonkeratinizing epithelium. They have no potential for neoplastic or keratocyst transformation. Simple enucleation will be curative; recurrence should not be a problem.

Globulomaxillary Cyst

An uncommon true jaw cyst appearing as a radiolucent lesion between the roots of vital maxillary lateral and cuspid (canine) teeth, surgical removal will cure this cyst.

It is postulated that epithelial rests may exist in the junction of the embryonic median nasal and maxillary processes. It is further postulated that this junction forms the suture between the premaxilla and maxilla and that epithelial rests may occur in these sutures. Because these cysts are supposed to arise from the globular portion of the median nasal process and maxillary process, they are called “globulomaxillary cysts.” If stimulated, these rests may give rise to a cyst that produces radiolucencies between the lateral incisor and cuspid teeth. Some doubt that cysts seen in this location are of fissural origin; they argue that most, if not all, are periapical lesions associated with diseased or anomalous lateral incisor teeth. Most others acknowledge the existence of this cyst if the pulps of the adjacent teeth are vital, and their crowns show no abnormalities (like dens-in-dente).

Globulomaxillary cysts are usually asymptomatic and therefore are undetected on routine clinical intraoral examinations. Their presence is usually observed by discovery of a radiolucent lesion between the lateral incisor and cuspid teeth on periapical radiographs. The radiolucency is usually shaped like an upside-down pear spreading adjacent roots.

Microscopic examination reveals a cyst that is lined with stratified squamous nonkeratinizing epithelium. There is no potential for this lesion to keratinize or to show neoplastic transformation. Simple excision will cure the lesion and prevent its recurrence. As already mentioned, the most significant problem globulomaxillary cysts pose is differentiating them from periapical lesions associated with a nonvital lateral incisor or cuspid tooth.

Nasolabial Cyst (Nasoalveolar Cyst)

A rare true soft tissue cyst appearing as a facial swelling of the upper lip and the side of the nose, surgical removal will cure this cyst.

On rare occasions, a cyst will develop from proliferation of epithelium enclaved during development of the middle face and/or the tear (lacrimal) duct. The resulting cyst produces a characteristic swelling of the upper lip that extends upward obliterating the fold between the side of the nose and the cheek. This typical pattern of swelling has earned the lesion the designation “nasolabial cyst.”

The lesion is completely asymptomatic; there is no pain, redness, fever, or other signs of acute inflammation, ruling out, of course, swelling produced by an abscess. Because the lesion is confined solely to the soft tissues, it is not detected by routine radiographic examination. If suspected, however, contrast material may be injected into the lesion producing a radiopaque image that will provide information about its size and extent.

Nasolabial cysts are lined with stratified squamous nonkeratinizing epithelium; they have no potential to undergo neoplastic transformation or keratinization. The lesions are excised through an incision made in the labial vestibule (preventing a facial scar). Complete excision will cure these lesions and prevent their recurrence.

Gingival Cysts

Gingival Cyst of the Adult

A harmless soft tissue lesion of the buccal gingiva overlying mandibular bicuspid teeth, has a characteristic microscopic appearance, and is treated by surgical excision.

The gingival cyst is thought to be the soft tissue analog of the lateral periodontal cyst. It appears as small well-circumscribed gingival swelling. Most are located in the labial-buccal gingiva overlying the mandibular bicuspid (premolar) teeth. Their histology is virtually identical to that of lateral periodontal cysts. Excision is the treatment of choice; recurrence is rare.

Gingival Cyst of the Newborn

Lesion (or lesions) appearing as white dots on the tooth bearing gingiva. These keratin-containing soft tissue cysts are harmless; they disappear with tooth eruption; no treatment is necessary.

Gingival cysts of the newborn are relatively common. They appear as single or multiple discrete white spots on the gingiva over tooth bearing areas. They are also known as "dental lamina cysts of the newborn" or, more commonly, as "Epstein's pearls." These lesions are, on microscopic examination, small keratin-filled cysts; however, they are not related nor behave like odontogenic keratocysts. No treatment is necessary, as these lesions will disappear as teeth erupt.

Benign Odontogenic Neoplasms

General Features of Jaw Neoplasms

That mesenchymal neoplasms arise in the jaws is no surprise because the jaws are composed of mesenchymal tissues like bone and fibrous connective tissue. Epithelium associated with developing teeth is the source of epithelial neoplasms within the jaws. Since tooth development is achieved by interaction of epithelium and mesenchyme, it stands to reason that neoplasms composed of epithelial and mesenchymal tissues (mixed neoplasms) may arise too.

The large majority of jaw neoplasms are "primary lesions" that arise locally. On uncommon occasions, however, malignant neoplasms arising elsewhere may spread to the jaws. These metastatic lesions constitute "secondary lesions."

As just mentioned, some jaw neoplasms arise from remnants of tooth development; like cysts, these are classified as "odontogenic neoplasms." Not all jaw neoplasms arise from tooth remnants, however. Some develop from fibrous connective tissue, bone, cartilage and other tissues. The present discussion will be limited to the most important benign odontogenic neoplasms (malignant odontogenic neoplasms are rare).

The tooth is composed of tissues derived from both epithelium and mesenchyme. The enamel organ and the enamel it produces are, of course, composed of epithelium. The remaining structures, dentin, pulp, cementum, and periodontal ligament, are mesenchymal tissues. Thus, the neoplastic portion of odontogenic neoplasms can be composed of epithelium or mesenchymal tissues (simple neoplasms) or a combination of the two (mixed neoplasms).

Odontoma

A relatively common benign odontogenic jaw neoplasm producing all dental tissues; it appears as a well-demarcated mostly radiopaque lesion in tooth-bearing areas; surgical excision will cure this neoplasm.

Odontomas are relatively common neoplasms. They may be discovered at any age, but are more commonly discovered in teenagers. The etiology and pathogenesis of these lesions are unknown. Some do not consider these to be neoplasms at all, but rather, a developmental anomaly called a "hamartoma" (an overgrowth of

tissue native to the part). Odontomas occur in any location with maxillary lesions being slightly more common than mandibular ones.

There are usually no overt signs of odontomas unless they are large enough to produce intraoral swellings. Occasionally they produce displacement of the roots of adjacent teeth. Other times odontomas may prevent a permanent tooth from erupting. The radiographic features of odontomas are usually quite distinctive. In some cases examination of radiographs will reveal tooth-like structures; some call these "compound odontomas." In other cases it will consist of a jumble of dental tissues ("complex odontomas"). Given that enamel, dentin, and cementum are radiopaque, radio pa cities are their characteristic radiographic appearance. However, since radiolucent tissues (pulp and periodontal ligament) are present too, radiolucent spots may be seen. The lesion is usually well demarcated from surrounding bone.

Whether compound or complex, odontomas are composed of well-differentiated dental tissues: enamel, dentin, pulp, cementum, and periodontal ligament. The lesion is usually encapsulated, and there are usually no signs of aggressive cellular activity. If a me lob last-like epithelial cells are particularly prominent, the lesion should be classified as an "ameloblastic odontoma" and treated like an ameloblastoma. Such transformed lesions are much less common than the classic odontoma, however.

Osteotomy and enucleation of odontomas should result in complete removal. Odontomas should not recur.

Ameloblastoma

An uncommon benign jaw neoplasm of odontogenic epithelium appearing as a unilocular or multilocular radiolucency, because of its locally infiltrative growth pattern, this neoplasm may be difficult to eradicate.

The ameloblastoma is a benign neoplasm assumed to arise from either the enamel organ or the lining of dentigerous cysts. The events triggering the development of a me lob last om as are unknown. The relationship of some ameloblastomas to dentigerous cysts has been a source of much interest in these lesions.

The ameloblastoma, while uncommon, occurs with enough frequency to be prominent in a differential diagnosis of radiolucent jaw lesions. Eighty-percent (80%) of these lesions arise in the mandibular third molar region; the remainder arise in the mandibular bicuspid, mandibular cuspid-incisor, and the maxillary molar regions. Ameloblastomas may occur at any age; they are not often seen in children, and most are detected by age 40; the rest are detected later in life. Like other intraosseous lesions, small ameloblastomas are not visible on clinical intraoral examination. Large lesions producing expansion of the jaw may cause a visible deformity that can be readily detected on clinical examination. Large mandibular lesions may impinge on the mandibular nerve causing otherwise unexplained paresthesia (altered sensation) of the lower lip.

In their early developmental stages, ameloblastomas produce small, unilocular radiolucencies. They may be associated with the crown of an unerupted tooth, around the roots of erupted teeth, or in the alveolar process unassociated with teeth. If an ameloblastoma is not removed, it will continue to grow producing a large, multilocular lesion with a growth pattern some liken to a soap bubble. These multilocular lesions may extend considerable distances from their original sites. When a multilocular lesion of the jaws is discovered, ameloblastoma should be near the top of the list of differential diagnoses.

Microscopic features of ameloblastoma are quite characteristic. They are composed primarily of well-differentiated epithelial cells organized in enamel-organ-like patterns. Typically, tall columnar epithelial cells reminiscent of ameloblasts surround regions consisting of stretched epithelial cells resembling the stellate reticulum. There are many variations on this basic histologic theme. More important than cellular variation, is the fact that ameloblastomas are not encapsulated or otherwise demarcated from the bone that surrounds them. The supporting stroma usually is composed of dense fibrous connective tissue.

Because they are invariably benign, complete removal of an ameloblastoma should cure it. However, because ameloblastomas are not encapsulated and because their slow enlargement penetrates surrounding marrow passages, these lesions can be difficult to remove in one piece. Difficulty encountered in eliminating the lesion explains its high recurrence rate. For small unilocular lesions, simple excision should suffice. The larger multilocular lesions pose treatment dilemmas. In these cases, the lesion may be removed in a block of surrounding bone (en bloc resection) along with nearby teeth. Depending on the circumstances, it may be

Table 5: Locations of Ameloblastomas

Location
• Mandibular third molar region
• Mandibular bicuspid region
• Mandibular incisor-cuspid region
• Maxilla

necessary to remove a portion of the jaw replacing it with a rib graft. Oral surgeons have learned to treat the initial lesion with intelligent aggressiveness.

In recent times is two varieties of ameloblastoma have been recognized: the solid multicystic variety and the uncystic variety. The preceding paragraphs described the solid multicystic variety. The unicystic variety occurs in younger people; the average age at discovery is 23. It appears as a radiolucent lesion around the crown of an unerupted tooth, a location and appearance that mimics a dentigerous cyst. Since the presumptive pre-surgical diagnosis is "dentigerous cyst," these lesions are usually treated by local excision. Most often, this is adequate because the neoplastic epithelium is found lining a cyst cavity and therefore does not (usually) infiltrate surrounding bone. Theirs recurrence following local excision occasionally occurs.

Two Neoplasms that Resemble Ameloblastoma

Although the ameloblastoma is benign, the difficulty encountered in removing it may result in disfiguring surgery. Because of this potential, it would be tragic to call a lesion an "ameloblastoma" by mistake. There are two uncommonly occurring lesions that resemble ameloblastoma on microscopic examination but do not have its potential for recurrence: the ameloblastic fibroma and adenomatoid odontogenic tumor.

Ameloblastic Fibroma

An uncommon benign jaw neoplasm of odontogenic epithelium and c.t. occurring in children and appearing as a unilocular radiolucency in tooth-bearing areas, since it does not infiltrate, surgical excision will cure this neoplasm.

As its name was designed to indicate, the ameloblastic fibroma is an odontogenic neoplasm displaying both epithelial (ameloblastic) and mesenchymal (fibroma) components. A pathologist inexperienced with this lesion who focuses upon the "ameloblastic" component at the expense of the "fibroma" component may erroneously diagnose it as "ameloblastoma" an error that may result in more aggressive treatment than is required.

The ameloblastic fibroma is usually detected in children and teenagers; the average age at discovery is 14 years. It is most commonly found in the posterior mandible; however, it may appear in other locations as well. It may or may not be associated with the crown of an unerupted tooth. The ameloblastic fibroma does not produce enamel or dentin; therefore, it manifests as a radiolucent lesion. Small lesions are unilocular while larger ones may appear as a multilocular radiolucency. Whether unilocular or multilocular, the ameloblastic fibroma is well demarcated from surrounding normal bone.

As mentioned earlier, it is the microscopic features that may lead inexperienced pathologists to a wrong diagnosis. It is the mesenchymal component of the ameloblastic fibroma that differentiates it from the ameloblastoma. In the ameloblastoma it is sparse and composed mainly of collagen fibers; in the ameloblastic fibroma it resembles the dental papilla of early tooth development. The epithelial component is composed of strands composed of columnar ameloblast-like cells surrounding a stellate-reticulum-like center that seem compressed by the prominent dental-papilla-like tissue surrounding it. Ameloblastic fibromas are well demarcated from surrounding bone by a fibrous connective capsule. To a trained eye, all these features (papilla-like stroma, strands of compressed epithelial cells, and encapsulation) are unique to the ameloblastic fibroma.

Because ameloblastic fibromas are well-demarcated, encapsulated lesions that have no propensity to extend into marrow cavities, their nucleation should be curative. Complete removal is to be expected and recurrences uncommon.

Adenomatoid Odontogenic Tumor ("Adenoamelolastoma")

A rare harmless benign jaw neoplasm of odontogenic epithelium occurring in children and appearing as a unilocular radiolucency around the crown of an unerupted tooth; surgical excision will cure this neoplasm.

This lesion has been given the awkward name "adenomatoid odontogenic tumor" in an effort to avoid the use of the word "ameloblastoma." The unique microscopic appearance of this lesion led it to be once called "adenoameloblastoma." However, as its non-invasive harmless nature had no relation to the more aggressive behavior of ameloblastomas, another term was sought and "adenomatoid odontogenic tumor" or "AOT" was the result.

The adenomatoid odontogenic tumor (AOT) is a very uncommon lesion; only about 500 cases have been reported. Most are discovered in children or teenagers; the average age at discovery is 18 years. AOT is most commonly located in the anterior maxilla; it is rare to find the lesion distal to the bicuspid teeth—the ameloblastoma, to the contrary, is most commonly located in the posterior mandible. AOT manifests as a unilocular radiolucency around the crown of an unerupted tooth. Most of these lesions occur around the crown of an impacted maxillary cuspid tooth. While the radiolucency resembles dentigerous cysts, there are some subtle differences that may place AOT higher on a differential diagnosis. First, the radiolucency extends down the root further than dentigerous cysts. Second, a few small flecks of radiopaque material are often seen within the radiolucency. AOT may produce an expansion of the maxillary labial plate overlying the affected tooth. Also, it may prevent eruption of one cuspid suggesting its presence. Other than these clinical findings, the lesion is asymptomatic.

AOT is derived from epithelium, its stroma is not neoplastic or otherwise remarkable. The diagnosis of this lesion, then, rests on changes within its epithelial component. The most unique feature of this lesion is the presence of duct-like glandular structures lined with simple columnar epithelial cells—structures not found in other odontogenic neoplasms. Small amounts of calcification may be found as well. Most interpret this material as being enamel-like material that is responsible for the radiopaque spots seen on radiographic examination. AOT is well demarcated and does not extend into surrounding marrow spaces.

Simple enucleation of AOT will cure it; there is no tendency for it to recur. Preservation of the associated impacted tooth may be attempted following complete removal of the overlying lesion.

References:

Neville, Damm, Allen, Bouquot: Oral & Maxillofacial Pathology. Saunders, Second Edition, 2002.

Learning Guide

1. After completion of this topic, the student should be able to
   - write and identify the definitions of the terms listed in items 2 and 3 below.
   - list and identify the histologic components of jaw cysts.
   - write and identify whether apical cysts, dentigerous cysts, primordial cysts, incisive canal cysts, globulomaxillary cysts, and odontogenic keratocysts are associated with vital or nonvital teeth.
   - write and identify which jaw cyst is most likely to recur and the reasons for this behavior.
   - write and identify the usual treatment for jaw cysts.
   - name and identify which of the following neoplasms contain dental hard tissues: ameloblastoma, odontoma, ameloblastic fibroma, and odontogenic adenomatoid tumor
   - name and identify which of the following neoplasms is likely to recur and the features that are related to this tendency: ameloblastoma, odontoma, ameloblastic fibroma, and odontogenic adenomatoid tumor.
   - name and identify the age the following neoplasms are most likely to occur: ameloblastoma, odontoma, ameloblastic fibroma, and odontogenic adenomatoid tumor.
   - name and identify the usual location of following neoplasms: ameloblastoma, odontoma, ameloblastic fibroma, and odontogenic adenomatoid tumor.
   - name and identify the usual treatment for the following neoplasms: ameloblastoma, odontoma, ameloblastic fibroma, and odontogenic adenomatoid tumor.
2. Associate (by identifying them) the following prefixes/suffixes and their meanings. In other words, when confronted with these prefixes/suffixes, be able to pick the correct term/definition from a list (multiple choice or matching).

blast	forming	locular	having small cavities (loculi)
esthesia	sensitivity, feeling	odont	tooth
intra	within	stoma	mouth

3. Associate (by writing them) the following terms with their definitions or with clinical examples of them. In other words, when confronted with the definition or example of the following, be able to write, and correctly spell, the defined term. In addition, be able to recognize the context in which each exists. In addition be able to pick the correct term/definition from a list (multiple choice or matching).

Ameloblastoma	A benign neoplasm arising from epithelium associated with the tooth germ; while benign, it may be difficult to eradicate.
Cyst	A space; in the jaws, a central cavity lined with epithelium supported by a fibrous c.t. wall
Dentigerous Cyst	A common true cyst found around the crown of an unerupted tooth.
Multilocular Radiolucency	Lesion consisting of several-many radiolucent loci.
Odontogenic Cysts	True cysts arising from epithelium left behind after tooth development.
Odontoma	A benign mixed neoplasm derived from developing dental tissues; calcified and soft tissues are present.
Unilocular Radiolucency	Lesion consisting of a single radiolucent “locus.”

4. Associate (by identifying them) the following terms and their definitions. In other words, when confronted with the term or definition of the following, be able to pick the correct term/definition from a list (multiple choice or matching).

Adenomatoid Odontogenic Tumor	A benign neoplasm derived from developing tooth epithelium; it is usually small and easy to eradicate.
Ameloblastic Fibroma	A benign mixed neoplasm derived from developing tooth tissues; its microscopic features can be confused for ameloblastoma; however, this lesion is easier to eradicate.
Apical Cyst	A true cyst arising at the apex of a non-vital tooth.
Curettage	Scraping; the act of removing soft tissues from bone.
En-Bloc Resection	A surgical procedure in which a lesion and surrounding tissues are removed in one piece
Epithelial Rests	Clumps of epithelial cells left behind from embryonic development.
Epithelial Rests of Malassez	Remnants of Hertwig's epithelial root sheath; the presumed origin of apical cyst linings.
Fissural Cysts	True cysts arising from epithelium left behind after formation of the mouth and face.
Fissural Epithelium	Same as epithelial rests; epithelium found in fissures formed by fusion of embryonic processes.
Globulomaxillary Cyst	A true cyst that arises from epithelial rests enclaved between the median nasal and maxillary processes appearing as a radiolucency between the lateral incisor and cuspid teeth.
Hamartoma	A non-neoplastic, developmental overgrowth of tissue native to a part.
Incisive Canal Cyst	A true cyst arising from remnants of the nasopalatine duct appearing as a radiolucency just lingual to the maxillary central in
Incisive Papilla	A mucosal "bump" just lingual to the maxillary central incisor teeth.
Intraosseous Lesion	Lesions located within bone; lesions surrounded by bone
Median Palatal Cyst	A true cyst arising from epithelial rests enclaved in the mid-palatal suture appearing as a radiolucency in the posterior hard palate.
Nasolabial Cyst	A rare cyst that arises from epithelium enclaved in the development of the face appearing as a soft tissue swelling of the mid face.
Odontogenic Keratocyst	A true cyst that shows keratinization of its lining epithelium presumably conferring high recurrence rates.
Odontogenic Neoplasms	Neoplasms that arise from tissues of a tooth or associated with its development.
Osteotomy	Making an opening into bone (osteo- = bone; -tomy = to cut).
Primary Lesions	A lesion arising in a site (e.g., the jaws).
Primordial Cyst	An uncommon true cyst presumably derived from an aborted tooth germ; a cyst that develops instead of a tooth.
Radicular Cyst	Another, more common, name for "apical cyst."
Resection	Removal of a large section of bone.
Residual Cysts	A cyst inadvertently left behind after removal of its associated tooth.
Soft Tissue Cysts	Cysts located outside of bone within soft tissues.
Unexplained Paresthesia	Tingling or numbness that is unrelated to surgical or physical trauma.

5. What are the two most common sources of the epithelial lining in jaw cysts?

Epithelial linings in cysts arise from:	1.
	2.

6. What are the category designations given cysts with the lining sources listed above?

The two categories of true cysts are:	1.
	2.

7. By placing "Xs" in the empty cells, match the terms with the printed situations.:

Jaw Cyst	*Soft Tissue Cyst*	*True Cyst*	*False Cyst*	*Situation*
				Epithelial-lined space
				Gingival epithelial-lined cavity
				Epithelial-lined cavity around impacted tooth crown
				Mandibular radiolucent space filled with bone marrow
				Cyst of the papilla palatini
				Incisive canal cyst

8. Of what three histologic components are true cysts composed?

True jaw cysts consist of:	1.
	2.
	3.

9. Which jaw cyst is most likely to recur? What is it about this cyst that causes this tendency.

Which cyst often recurs?:	1.
Why does the cyst often recur?	2.

10. By placing "Xs" in the empty cells, match the terms with the printed definitions.

Resection	*Stoma*	*Curettage*	*Osteotomy*	*Marsupialization*	*Definition*
					Scraping the walls of jaw lesions
					Opening into a jaw cyst without removing it
					Cutting a hole in bone
					Creating an opening
					Removing a large cyst in a block of surrounding bone

11. By placing "Xs" in the empty cells, match the cysts with the printed features.

Dentigerous Cyst	*Primordial Cyst*	*Keratocyst*	*Residual Cyst*	*Incisive Canal Cyst*	*Median Palatal Cyst*	*Globulomaxillary Cyst*	*Nasolabial Cyst*	*Apical Cyst*	*Features*
									Arises around the crown of an impacted tooth
									Arises in the midline of the posterior palate
									Recurrence is common
									Left behind after tooth extraction
									Cyst associated with chronic inflammation
									Many assert this cyst doesn't exist
									Arise from "fissural" epithelium
									Arise from "tooth development epithelium"
									Lined with non-keratinizing epithelium
									Arise "instead of a tooth"
									Arises in bone just behind the maxillary incisors
									Thin epithelial lining with cul-de-sacs, satellite cysts
									Many of these are probably apical cysts
									Does NOT occur within bone

12. Name two more serious lesions that may arise from or resemble dentigerous cysts?

Two more serious lesions arising from dentigerous cysts are:	1.
	2.

13. By placing an "X" in the empty squares, match the cysts with the printed locations?.

Cyst	*Apex of a Non-Vital Tooth?*	*Around Crown of Unerupted Teeth*	*Anterior Hard Palate*
Dentigerous Cyst			
Incisive Canal Cyst			
Keratocyst			
Apical Cyst			

14. By placing an "X" in the empty squares, match the cysts with their relation to teeth.

Cysts	*Vital Tooth*	*Non-Vital Tooth*	*Not Tooth-Related*
Apical Cyst			
Dentigerous Cyst			
Primordial Cyst			
Incisive Canal Cyst			
Globulomaxillary Cyst			
Odontogenic Keratocyst			
Nasolabial Cyst			
Median Palatal Cyst			

15. By placing an "X" in the empty squares, match the cysts with their locations.

Cysts	*Posterior Palate*	*Anterior Palate Midline*	*Between Lateral Incisor and Cuspid*	*Face Near the Nose*	*Periapical Region*	*Mandibular Third Molar Area*	*Site of an Absent Tooth*
Apical Cyst							
Dentigerous Cyst							
Primordial Cyst							
Incisive Canal Cyst							
Globulomaxillary Cyst							
Odontogenic Keratocyst							
Nasolabial Cyst							
Median Palatal Cyst							

16. By placing an "X" in the empty squares, match the printed features that relate to MOST true cysts.

	Do Recur	*Do Not Recur*	*Local Excision Curative*	*Jaw Resection Necessary*	*Classed by Epithelium Source*	*Classed by Radiographic Appearance*	*Stratified Squamous Non-Keratinizing Epithelium*	*Stratified Squamous Keratinizing Epithelium*
MOST true cysts								

17. By placing an "X" in the empty squares, match the items with the appropriate fictitious printed history.

Incisive Canal Cyst	*Odontogenic Keratocyst*	*Apical Cyst*	*Dentigerous Cyst*	*Recurrence Likely*	*Recurrence Unlikely*	*Odontogenic Cyst*	*Non-Odontogenic Cyst*	*History*
								A 32 year-old man came to a dental office for a "complete examination." Study of a panoramic radiograph uncovered a large radiolucency surrounding the crown of an impacted mandibular third molar tooth. The patient was referred to an oral surgeon who removed the tooth and the lesion filling the radiolucency. The biopsy report stated that the lesion "consisted of a central cavity surrounded by stratified squamous keratinizing epithelium. The epithelial lining was very thin.
								A 44 year-old woman came to her dentist to evaluate the "teeth on the lower right side." The patient stated that "there was dull pain in the region several months ago that went away." Clinical examination revealed a asymptomatic mandibular first molar tooth that had been restored with a full porcelain crown. Radiographs of the area revealed a well-circumscribed radiolucency located at the apices of the first molar. Vitality testing proved the first molar to be non-vital. The radiolucent area was explored and the removed lesion was sent for microscopic examination. The biopsy report stated that "the lesion consisted of a central cavity surrounded by stratified squamous nonkeratinizing epithelium. The epithelial lining rested on a wall fibrous c.t. that contained many lymphocytes."
								A 53 year-old woman came to her dentist for her "annual checkup." Given that radiographs had not been taken for several years, the dentist suggested that panoramic radiograph be taken. Examination of this radiograph revealed a radiolucent lesion near the apices of the maxillary central incisor teeth. Since these teeth were caries-free and had not undergone any trauma, the dentist ordered an occlusal film. Vitality testing proved the maxillary anterior teeth to be vital. This film revealed that the radiolucency was located in the anterior maxilla posterior to the central incisors. The area was explored; the subsequent biopsy stated that the lesion consisted of "a central cavity surrounded by a stratified squamous epithelial membrane. The supporting c.t. wall had large nerve trunks and large blood vessels."

18. By placing an "X" in the empty squares, match the listed features with the printed neoplasms.

Odontoma	*Ameloblastoma*	*Ameloblastic Fibroma*	*Odontogenic Adenomatoid Tumor*	*Statement*
				Composed of mixtures of all dental tissues
				Recurrence is a significant problem
				Simple neoplasms
				Some consider them to be hamartomas
				Mixed neoplasm
				Enamel organ-like structures
				Rare, most common in the anterior maxilla
				May be associated with the crown of an unerupted tooth

19. By placing an "X" in the empty squares, match the listed statements with the printed neoplasms.

Odontoma	*Ameloblastoma*	*Ameloblastic Fibroma*	*Adenomatoid Odontogenic Tumor*	*Statement*
				Contain enamel, dentin, and cementum
				Recurrence is a significant problem

20. By placing an "X" in the empty squares, match the ages with the printed neoplasms.

Odontoma	*Ameloblastoma*	*Ameloblastic Fibroma*	*Adenomatoid Odontogenic Tumor*	*Ages*
				Before 21 Years
				After 21 Years

21. By placing an "X" in the empty squares, match the neoplasms with the printed statement.

Ages	*Odontoma*	*Ameloblastoma*	*Ameloblastic Fibroma*	*Adenomatoid Odontogenic Tumor*
Radiopacities may be associated with:				

22. What are four likely diagnostic possibilities for a radiolucent lesion occurring around the crown of an impacted mandibular third molar tooth?

Four likely diagnoses for a radiolucency around an impacted mandibular third molar tooth are:	1.
	2.
	3.
	4.

23. By placing an "X" in the empty squares, match the neoplasms with the radiographic appearances.

Neoplasm	*Unilocular Radiolucency*	*Well-Defined Radiopacity*	*Radiopaque "Flecks"*	*Mutiloculate Radiolucency*
Ameloblastoma:				
Odontoma				
Ameloblastic Fibroma				
Adenomatoid Odontogenic Tumor				

24. By placing an "X" in the empty squares, match the items with the appropriate fictitious printed history.

Odontoma	*Ameloblastoma*	*Calcified Tissue Present*	*No Calcified Tissue Present*	*Adenomatoid Odontogenic Tumor*	*Local Excision Usually Cures*	*Wide Excision or Resection Often Necessary*	*History*
							A 46 year-old female had a large multiloculated radiolucency in her posterior mandible. Biopsy proved the lesion to be an odontogenic neoplasm.
							15 year-old male had a unilocular radiolucency in the bicuspid-first molar region of his mandible. The lucency was not associated with a tooth. Biopsy proved the lesion to be an odontogenic neoplasm.
							A 12 year-old female had a unilocular radiolucency surrounding the crown of an unerupted maxillary cuspid. Biopsy proved the lesion to be an odontogenic neoplasm.
							A 16 year-old male had an irregular radiopacity surrounding the crown of an unerupted third molar. Biopsy proved the lesion to be an odontogenic neoplasm.

Notes: