

Odontogenic Tumors

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2007

Classification: The following classification is based upon the inductive effect of one dental tissue upon another. In normal tooth development, it has been observed that ameloblastic epithelium exerts an influence upon the undifferentiated mesenchymal cell of the dental papilla "**inducing**" adjacent cells to further differentiate into odontoblasts. The odontoblasts then begin to form dentine. The formation of dentine, reciprocally, has an inductive effect upon the ameloblasts, initiating enamel matrix formation.

WHO Histological typing of odontogenic tumors, 1972

A. Epithelial Odontogenic Tumors

1. Minimal inductive change in connective tissue
 - a. Ameloblastoma
 - b. Adenomatoid odontogenic tumor
 - c. Calcifying epithelial odontogenic tumor
2. Marked inductive change in connective tissue
 - a. Ameloblastic fibroma
 - b. Ameloblastic fibrosarcoma
 - c. Dentinoma
 - d. Ameloblastic fibro-odontoma
 - e. Ameloblastic odontoma
 - f. Odontoma
 - (1) Complex odontoma
 - (2) Compound odontoma

B. Mesodermal Odontogenic Tumors

- a. Odontogenic myxoma(myxofibroma)
- b. Odontogenic fibroma
- c. Cementoma
 - (1) Periapical cemental dysplasia
 - (2) Cemento-ossifying fibroma
 - (3) Benign (true) cementoblastoma
 - (4) Familial multiple gigantism cementoma

WHO Histological typing of odontogenic tumors, 1992

1. Neoplasms and other tumors related to the odontogenic apparatus

1.1 Benign

- 1.1.1 Odontogenic epithelium without odontogenic ectomesenchyme
 - 1. Ameloblastoma
 - 2. Squamous odontogenic tumor
 - 3. Calcifying epithelial odontogenic tumor (Pindborg tumor)
 - 4. Clear cell odontogenic tumor
- 1.1.2 Odontogenic epithelium with odontogenic ectomesenchyme, with or without dental hard tissue formation
 - 1. Ameloblastic fibroma
 - 2. Ameloblastic fibro-dentinoma (dentinoma) and ameloblastic fibro-odontoma.
 - 3. Odonto-ameloblastoma
 - 4. Adenomatoid odontogenic tumor
 - 5. Calcifying odontogenic cyst (tumor)
 - 6. Complex odontoma
 - 7. compound odontoma
- 1.1.3 Odontogenic ectomesenchyme with or without included odontogenic epithelium.
 - 1. Odontogenic fibroma
 - 2. Myxoma (odontogenic myxoma, myxofibroma)
 - 3. Benign cementoblastoma (cementoblastoma, true cementoma)

1.2 Malignant:

- 1.2.1 Odontogenic carcinoma
 - 1. Malignant ameloblastoma
 - 2. Primary intraosseous carcinoma
 - 3. Malignant variants of other odontogenic epithelial tumors
 - 4. Malignant changes in odontogenic cysts
- 1.2.2 Odontogenic sarcomas
 - 1. Ameloblastic fibrosarcoma (ameloblastic sarcoma)
 - 2. Ameloblastic fibro-dentinosarcoma & ameloblastic fibro-odontosarcoma

2. Neoplasms and other lesions related to bone

2.1 Osteogenic neoplasms

2.1.1 Cemento-ossifying fibroma (cementifying fibroma, ossifying fibroma)

2.2 Non-neoplastic bone lesions

2.2.2 Cemento-osseous dysplasias

1. Periapical cemental dysplasia (periapical fibrous dysplasia)
2. Florid cemento-osseous dysplasia (gigantiform cementoma)
3. Other cemento-osseous dysplasia

A. Neoplasms and other tumors related to the odontogenic apparatus

1. Tumors Of Odontogenic epithelium without odontogenic ectomesenchyme

(a). Ameloblastoma: A benign but locally invasive polymorphic neoplasm consisting of proliferating odontogenic epithelium, which usually has a follicular or plexiform pattern, lying in a fibrous stroma.

It is a true neoplasm arising from the odontogenic apparatus prior to the formation of calcified structures of the tooth. It may arise from (1) the enamel organ; (2) epithelial remnants of the dental lamina, sheath of Hertwig (rests of Malassez) and enamel organs; (3) epithelium of the odontogenic cysts, particularly the dentigerous cyst; (4) basal cells of the surface epithelium of the jaws.

Ameloblastoma is the 2nd most common clinically significant odontogenic tumor. It is predominantly intra-osseous but may occur in the soft tissues, implying origin from remnants of the dental lamina. It is usually diagnosed in the 4th and 5th decades (mean age, 39 years); over 80% of ameloblastomas occur in the mandible, and of these, 70% occur in the molar region and the ascending ramus, 20% in the premolar region, and 10% in the incisor region. About 10-15% is associated with an unerupted tooth.

Ameloblastoma begins insidiously as a central lesion and causes expansion of the bone rather than perforation. It is benign, but local invasive with slow-growing tumor, and a non-encapsulated and destructive lesion. It seldom causes paresthesia due to its invasiveness. It may cause loosening of teeth or resorption.

Roentgenographic appearance isn't pathognomonic but is often suggestive of ameloblastoma. It may be unilocular or multilocular with distinct compartmentalization. The desmoplastic type has a marked predilection to occur in anterior regions of the jaws (maxilla). It seldom suggests the diagnosis of ameloblastoma & usually resembles a fibro-osseous lesion because of its mixed R-O and R-L appearance.

Microscopically, the **follicular** ameloblastoma mimics the enamel organ showing reverse polarity. The central portion of the epithelial islands is composed of stellate reticulum. The **plexiform** type is characterized by interdigitating cords of epithelial cells, the border cells resembling ameloblasts. The stellate reticulum may undergo cystic degeneration, follicular type in the follicle and plexiform in the stroma, or squamous metaplasia (**acanthomatous** ameloblastoma). In the **granular cell** ameloblastoma, the epithelial cells undergo granular transformation. The acidophilic granules correspond to lysosomes in the ultrastructure, implying the tumor cells are undergoing degeneration. **Basal cell** type is the least common type. These lesions are composed of nests of uniform basaloid cell. No stellate reticulum is present in the central portions of the nest. **Desmoplastic** pattern contains small islands and cords of odontogenic epithelium in a densely collagenized stroma. Peripheral columnar ameloblast-like cells are inconspicuous about the epithelial islands. **Biologically**, ameloblastoma is a non-encapsulated, locally destructive and invasive lesion likely to recur repeatedly. Therefore, it requires En block resection or hemi-resection of the jaw. It rarely metastasizes. The frequent mode of metastasis is through transplantation of tumor cells in the lung parenchyma during repeated surgical interventions. **Radiation therapy** has seldom been used for ameloblastoma, although some studies suggested that the tumor may be **radiosensitive**, therefore, the treatment of choice is surgery.

Malignant ameloblastoma means that a particular ameloblastoma is malignant in behavior due to the occurrence of metastases. This jaw tumor is a benign ameloblastoma histopathologically but metastasized to a distant site or to regional lymph nodes..

Ameloblastic carcinoma Unlike the malignant ameloblastoma, this tumor shows cytologic features of malignancy. It has the basic pattern of an ameloblastoma but may show hypercellularity, cellular atypia, hyperchromatism, and mitoses. The tumor has behaved in a malignant fashion in which the metastatic lesions do not bear any resemblance to the primary odontogenic tumor but, rather, to epidermoid carcinoma.

Unicystic Ameloblastoma: Unicystic ameloblastomas account for 10 to 15 % of all intraosseous ameloblastomas in various studies. Whether the unicystic ameloblastoma originates *de novo* as a neoplasm or whether it is the result of neoplastic transformation of non-neoplastic cyst epithelium has been long debated. It is most often seen in younger patients, with about 50% of all such tumors diagnosed during the second decade of life. (Average: 23 year-old) More than 90% of unicystic ameloblastomas are found in the mandible.

Three **histopathologic variants** of unicystic ameloblastoma may be seen. In the first type (**luminal**), the tumor is confined to the luminal surface of the cyst. This demonstrates a basal layer of columnar or cuboidal cells with hyperchromatic nuclei that show **reverse polarity** and basilar cytoplasmic vacuolization. The overlying epithelial cells are loosely cohesive and resemble stellate reticulum. **Intra-luminal** ameloblastoma has the tumor tissue

project from the cystic lining into the lumen of the cyst. This is often resembles the pattern of a plexiform ameloblastoma. There is no involvement of the cyst wall. In the third variant, **mural** ameloblastoma, the fibrous wall of the cyst is infiltrated by typical follicular or plexiform ameloblastoma.

The clinical and radiologic findings in most cases of unicystic ameloblastoma suggest that the lesion is an odontogenic cyst (monolocular R-L). These tumors are usually treated as cysts by enucleation. Recurrence rates of 10 to 20% have been reported after simple excision or enucleation. This is considerably less than the 50 to 90% recurrence rates noted after curettage of conventional solid ameloblastomas.

Peripheral (extra-osseous) Ameloblastoma: This is uncommon and accounts for about 1% of all ameloblastomas. This tumor probably arises from odontogenic epithelial rests beneath the oral mucosa or from the basal epithelial cells of the surface epithelium. Clinically, peripheral ameloblastoma resemble fibrous nodules, pyogenic granulomas, or other peripheral hyperplastic swellings superficial to the alveolar ridge, and can interfere with the fit of a denture. They are slow-growing and cause little or no bone erosion. Any saucerization of the underlying bone is due to pressure rather than invasion. Histopathologically, these lesions have the same features as the intraosseous pform of the tumor.

(b) Squamous odontogenic tumor : A benign but locally infiltrative neoplasm consisting of islands of well-differentiated squamous epithelium in a fibrous stroma. The epithelial islands occasionally show foci of central cystic degeneration.

It is a rare benign odontogenic neoplasm that was first described in 1975 and is now recognized as a distinct entity. Fewer than 40 examples had been reported till 2002. **Before 1975**, this lesion was probably believed to represent an atypical acanthomatous ameloblastoma or even a squamous cell carcinoma. SOT is presumed to arise from neoplastic transformation of dental lamina rests, or the **epithelial rests of Malassez**. The tumor appears to originate within the periodontal ligament that is associated with the lateral root surface of an erupted tooth.

Clinically, SOTs have been found in patients whose ages ranged from 8 to 74 years (average age, 38).. There is no apparent sex and site predilection. A painless or mildly painful gingival swelling, often associated with mobility of the associated teeth, is the most common complaint. The **radiographic findings** are not specific for diagnostic. Most examples are relatively small lesions that seldom exceed 1.5 cm. in greatest diameter. The **microscopic** findings of SOT are distinctive and consist of varying-shaped islands of bland-appearing squamous epithelium in a mature fibrous connective tissue stroma. The peripheral cells of the epithelial islands do **not** show the characteristic **polarization** seen in ameloblastomas. In published reports, some SOTs have been initially misdiagnosed as ameloblastomas, with resulting unnecessarily radical surgery.

(c) Calcifying Epithelial Odontogenic Tumor (Pindborg Tumor): A locally invasive epithelial neoplasm characterized by the development of intraepithelial structures, probably of an amyloid-like nature, which may become calcified and which may be liberated as the cells break down.

The tumor exhibits clinical features similar to those of ameloblastoma. It is found mostly between the ages of 20 and 60 years. In two-thirds of cases, the mandible is affected, and in one-third, the maxilla. Most of the lesions are located in the premolar-molar region and most are associated with the coronal aspect of an unerupted tooth. The tumor may also occur outside the bone in the tooth bearing area.

The characteristic **radiographic** appearance is of an irregular radiolucent area containing radiopaque masses of varying size. These masses tend to be located close to the crown of the unerupted tooth. At the periphery of the lesion there is often a radiolucent zone.

Cut surface of the tumor shows slightly yellowish due to the containing of amyloid-like substances. **Histologically**, the tumor is composed of polyhedral epithelial cells often with prominent intercellular bridges arranged in sheets or strands in a fibrous stroma. The nuclei show considerable variation. Some tumors show considerable nuclear pleomorphism, but this feature is not considered to indicate malignancy. Among the epithelial cells and in the connective tissue stroma are homogeneous eosinophilic, often spherical bodies, with the staining characteristics of amyloid, which commonly calcify and show Liesegang rings. Special staining techniques especially thioflavine T, show that the homogeneous material gives reactions similar to those of amyloid or after Congo red staining, the amyloid will exhibit from orange red to apple-green when viewed with polarized light microscope.

Although it is clearly of odontogenic origin, its histogenesis is uncertain. The possible cell origin is stratum intermedium of the enamel organ, dental lamina remnants, or the reduced enamel epithelium of the associated unerupted tooth.

Biologically, the neoplasm the neoplasm exhibits local invasion. It is slow-growing and may recur after several years.

(d). Clear cell odontogenic tumor: A benign but locally invasive neoplasm originating from odontogenic epithelium and characterized by sheets and islands of uniform, vacuolated and clear cells.

(e). Adenomatoid Odontogenic Tumor: A tumor of odontogenic epithelium with duct-like structures and with varying degrees of inductive change in the connective tissue. The tumor may be partly cystic, and in some cases the solid lesion may be present only as masses in the wall of a large cyst. It is generally believed that the lesion is not a neoplasm.

The sources of origin include:

- (1) preameloblasts**
- (2) odontogenic epithelium before histodifferentiation**
- (3) reduced enamel epithelium**
- (4) epithelium lining of the cystic cavity.**

Clinically, it affects both sexes equally, occurs at an early age, usually in the second decade of life. The maxilla is involved nearly twice as frequently as the mandible, the anterior part of the maxilla, especially the canine region, being the most common site. The tumor is commonly associated with an unerupted tooth and may simulate the dentigerous cyst at operation and radiographically, but in some cases the presence of **calcified material** within the tumor may be a useful diagnostic feature.

Grossly, this tumor is usually well-encapsulated, and may be partly cystic. **Microscopically**, in some cases the solid lesion may be present only as masses (mural) in the wall of a large cyst. The epithelium is in the form of whorled masses of spindle cells as well as sheets and plexiform strand. It may form duct-like structures(or rosette) lined by a single layer of columnar cells and contain acidophilic material. Connective tissue stroma is scant and exhibits inductive changes. Varying amounts of hyaline material, often containing strands of entrapped epithelium, which appears to be dysplastic dentine. Calcification is sometimes seen and may be extensive.

2.Tumors of Odontogenic Epithelium, with Odontogenic Ectomesenchyme, with or without Dental Hard Tissue Formations:

(a). Ameloblastic Fibroma: Neoplasms composed of proliferating odontogenic epithelium embedded in a cellular ectomesenchymal tissue that resembles the dental papilla.

In contrast to ameloblastoma, this lesion occurs in a younger age group and is not commonly seen in individuals over 21 years of age. The tumor usually produces a pain less, asymptomatic, slow expansion of the cortical plates of the premolar and molar areas, more frequently of the mandible.

Rentgenographically, it is a smooth, well-outlined cyst-like radiolucency which cannot be differentiated from the unilocular ameloblastoma. It may be multilocular and associated with unerupted teeth.

Microscopically, it is usually encapsulated. It is composed of buds, long, narrow cords, and islands of odontogenic epithelium which are usually small, 1 to 2 cells layers thick, with or without stellate reticulum, and the immature fibrous connective tissue stroma resembling dental papilla.. In contrast, ameloblastoma is composed of **mature fibrous connective tissue** stroma. **Biologically**, it is an entirely benign lesion which responds favorably to conservative treatment and seldom recurs.

(b) Ameloblastic Fibrosarcoma: A neoplasm with a similar structure to ameloblastic fibroma, but in which the ectomesenchymal component shows the features of a sarcoma.

It is a malignant counterpart of ameloblastic fibroma. It occurs more frequently in young adults, with no sex predilection. The lesion is more common in the mandible than maxilla. **Clinically**, it tends to grow rapidly, causes destruction of bone and loosening of teeth, & is almost uniformly painful. It may cause ulceration and bleeding of the overlying mucosa. **Roentgenographically** it is characterized by irregular and poorly defined radiolucency.

Microscopically, the tumor contains benign-looking odontogenic epithelium. The mesodermal components show increased cellularity, pleomorphism, hyperchromatism, bizarre nuclei, and normal and abnormal mitoses **Biologically**, it is an aggressive lesion which needs resection of the involved jaw.

(c). ameloblastic fibro-dentinoma (AFD, Dentinoma): Lesions similar to ameloblastic fibroma, but also showing inductive changes that lead to the formation of dentine.

It is essentially an ameloblastic fibroma which has undergone further histodifferentiation to form dentine. AFD seems to occur predominantly in the mandible, especially in the molar area, and frequently is associated with an impacted tooth. The patients are usually young (mean age, 26 years) **Roentgenographically**, there is a well-defined radiolucency in the bone containing varying amounts of radiopaque material.

Microscopically, like in AF, the epithelium is usually in the form of slender strands consisting of no more than a double layer of rounded or cuboidal cells, and much of the immature fibrous connective tissue may resemble that of the dental papilla. In addition, a varying degree of induction of dentinoid substance (dysplastic dentine or dentine-like substance) is seen at the epithelial-mesenchymal tissue interface. The **immature dentinoma** is regarded essentially as an ameloblastic fibroma with inductive changes that lead to the formation of dentine, and therefore named ameloblastic fibro-dentinoma. The greater part of the **mature dentinoma** is entirely composed of masses of irregular dentin (dentinoid or osteodentin), without evidence of any epithelial component. Biologically, the dentinoma is benign in its behavior but may cause considerable local destruction.

(d) Ameloblastic Fibro-odontoma: A lesion having the general features of an ameloblastic fibroma but containing enamel and dentin.

The tumors are more common in the mandibular molar area but can occur anywhere in either jaw with no sex predilection. It is mostly seen in children and teenager, with a mean age of 11.5 years, and about 10 years old younger than patients of ameloblastic fibroma. Invariably, it is associated with an impacted tooth. **Roentgenographically**, it is a circumscribed lesion, presenting an expansive radiolucency generally containing either a solitary radiopaque mass or multiple small opacities representing the odontoma portion of the lesion. Some lesions achieve considerable size, involving the body as well as the ramus of the mandible. Because the AFO has components of both an odontoma and AF, **grossly**, it will consist of

both hard and soft tissues. **Microscopically**, the tumor consists of tissue similar to ameloblastic fibroma--epithelial cells arranged in cords, rosettes, frequently a double row of cells within a very **cellular embryonic fibrous connective tissue resembling dental papilla**. In addition, typical odontoma is found. Its biological behavior is similar to ameloblastic fibroma.

(e). Odontoma: Due to its limited potential, an odontoma is regarded as a "hamartoma". It is a growth in which induction has resulted in the development of **both enamel and dentine**. The enamel and dentin are usually laid down in an abnormal pattern because the organization of the odontogenic cells fails to reach a normal state of morphodifferentiation. When the enamel and dentine are laid down in such a fashion that the structures bear considerable anatomic resemblance to normal teeth, except that they are often smaller than typical teeth, they are termed "**compound odontomas**". On the other hand, when the calcified dental tissue forms a conglomeration bearing no morphologic similarity even to rudimentary teeth, the term "**complex odontoma**" is used. Odontoma is the most common odontogenic tumor accounting for 50% of the all odontogenic tumors. It occurs predominantly in children and young adult of 2nd decade.

(1) Complex Odontoma: A malformation in which all the dental tissues are represented, individual tissues being mainly well formed but occurring in a more or less disorderly pattern.

A vast majority is diagnosed in the second and third decades of life. About 70% occur in the 2nd and 3rd molar area and they are somewhat more common in the mandible. (The compound type is more often seen in the anterior maxilla; the complex odontomas occur more often in the molar regions of either jaw.) They are often associated with an unerupted tooth. **Roentgenographically**, the lesion appears as irregular opacities surrounded by a narrow radiolucent rim. **Microscopically**, Complex odontomas consist largely of mature tubular dentine. This dentine encloses clefts of hollow circular structures that contained the mature enamel that was removed during decalcification. The spaces may contain small amounts of enamel matrix. A thin layer of cementum is often present about the periphery of the mass. As already mentioned, during its development complex odontoma may be difficult to distinguish from ameloblastic fibroma or fibro-odontoma, and even when growth has been completed, residues of the odontogenic epithelium may still be identifiable. Some odontomas, however, show features of both types. Small islands of eosinophilic staining epithelial ghost cells are present in about 20% of complex odontomas.

(2) Compound Odontoma: A malformation in which all the dental tissues are represented in a more orderly pattern than in the complex odontoma, so that the lesion consists of many tooth-like structures. Most of these structures do not morphologically resemble the teeth of the normal dentition, but in each one enamel, dentine, cementum and pulp are arranged as in the normal tooth.

It differs from complex odontoma in having achieved a higher degree of morphodifferentiation and histodifferentiation. In contrast to complex odontoma, the vast majority of compound odontomas occur in the incisor-cuspid region of the upper jaw. **Roentgenographically**, the lesion is characterized by a mass of diminutive, tooth-like structure surrounded by a narrow radiolucent band. **Microscopically**, the compound odontoma consists of multiple structures resembling small, single-rooted teeth, contained in a loose fibrous matrix. The mature enamel caps of the tooth-like structures are lost during decalcification for preparation of the microscopic slides, but varying amounts of enamel matrix are often present. True dentine is seen with dentinal tubules. Pulp tissue may be seen in the coronal and root portions of the tooth-like structures. **Biologically**, it is a non-aggressive, small lesion which is discovered on routine dental roentgenographic examination. Not uncommonly, it may occur between the roots of the deciduous anterior teeth, preventing the eruption of their permanent successors.

(f) Odontoameloblastoma :A very rare neoplasm which includes odontogenic ectomesenchyme, in addition to odontogenic epithelium that resembles an ameloblastoma both in structure and in behavior. Because of the presence of the odontogenic ectomesenchyme, inductive changes take place leading to the formation of dentine and enamel in parts of the tumor.

Radiographically, the tumor shows a radiolucent, destructive process that contains calcified structures (RO). The **histopathologic** features of the odontoameloblastoma are composed of pictures of ameloblastoma and odontoma. The ameloblastic component is intermingled immature or more mature dental tissue in the form of developing rudimentary teeth, which is similar to the appearance of a compound or complex odontoma.

3.Tumors of Odontogenic ectomesenchyme with or without Included Odontogenic Epithelium

(a).Odontogenic Myxoma: A locally invasive neoplasm consisting of rounded and angular cells lying in an abundant mucoid stroma.

It is a true neoplasm, most likely arising from the mesenchymal portion of the tooth germ, the dental papilla. It is an intra-osseous lesion, which may expand the bone and cause its destruction. It corresponds to ameloblastoma in age distribution, without any sex predilection and slight preference for the mandible. **Roentgenographically**, it shows multilocur radiolucency of varying sizes separated by straight (tennis racket) or curved bony trabeculae (soap bubble appearance). This picture may be indistinguishable from that of an

ameloblastoma. It may also present as an unilocular RL or an ill-defined RL.

Gross exam of the specimen, the gelatinous, loose structure of the myxoma is obvious.

Histologically, it is composed of loosely arranged, spindle-shaped and stellate cells, with loose myxoid stroma. This loose myxoid stroma contains only mucoid substance and a few collagen fibrils, many of which have long fibrillar intercommunicating processes. The nuclei may show hyperchromatism or atypia but mitosis is rare. **Histochemical** study shows that the ground substance is **acid mucopolysaccharide**, chiefly **hyaluronic acid and chondroitin sulfate**. Nests of odontogenic epithelium may be found **infrequently**.

Biologically, it is a non-encapsulated gelatinous tumor, which destroys the surrounding bone by invasion. So its complete removal is difficult and recurrence is frequent. Wide resection or en bloc is necessary.

(b).Odontogenic Fibroma: A fibroblastic neoplasm containing varying amounts of apparently inactive odontogenic epithelium.

The central odontogenic fibroma (COF), considered a neoplasm that is derived from fibroblasts of periodontal ligament or dental follicle or least likely dental papilla, is a very rare proliferation of mature odontogenic mesenchyme. It is sufficiently rare that locations, sex, and age distributions cannot be accurately determined. Those reported cases have occurred over a wide age range in each jaw, with no sex predilection noted. It causes a painless expansion that may displace tooth roots or resorb portions of them. COF arising from the PDL is believed to be the counterpart to the peripheral odontogenic fibroma. **Roentgenographically**, smaller COFs tend to be well-defined, unilocur radiolucent lesions, often associated with the periradicular area of erupted teeth, or the crown portion of unerupted teeth. Larger lesions tend to be multilocular radiolucencies. Approximately 12% of COFs will exhibit radiopaque flecks within the lesion. **Grossly**, the mass is clearly circumscribed and encapsulation may be evident. **Histologically**, it is composed of mature fibrous connective tissue with or without odontogenic epithelium. The so-called simple **odontogenic fibroma** is composed of relatively acellular, the fibers are often quite delicate and they are often interspersed within considerable amounts of ground substance. Small foci of odontogenic epithelial rests and occasional foci of dystrophic calcification may or may not be present. The connective tissue of the simple odontogenic fibroma resembles that of a dental follicle, from which it is presumably derived, while that of the WHO type does not. The central odontogenic fibroma, WHO type, has a more complex pattern, which often consists of much more cellular fibrous connective tissue with collagen fibers arranged in interlacing bundles. Odontogenic epithelium in the form of long strands or isolated nests is present throughout the lesion and may be a prominent component. Calcifications composed of cementum-like material or dentinoid are present in some cases.

The peripheral lesion most likely arises from the PDL and exhibits dystrophic calcification, osseous dysplasia and/or cementum with strands of epithelium in a fibrous stroma with epithelial covering. It is clinically indistinguishable from the common fibrous epulis in that it forms a firm sessile or pedunculated mass on the attached gingiva, particularly of the anterior teeth. It is pink in color, unless traumatized.

COFs are usually treated by enucleation and vigorous curettage. Although the tumor does not always have a definite capsule, it appears to have a limited growth potential, particularly in the anterior regions of the jaws. A few recurrences have been documented, but the prognosis is very good.

(c).Benign cementoblastoma (true cementoma): A neoplasm characterized by the formation of sheets of cementum-like tissue containing a large number of reversal lines and being unmineralized at the periphery of the mass or in the more active growth area.

It is a rare neoplastic lesion which is **always** attached to the tooth root. It may involve the root canal cause root resorption. The teeth remain vital. A lower premolar or molar is most frequently involved (90% of the mandibular premolar and molar area and 50% of the 1st molar). Almost always, the tumor is closely related to and partly surrounds the root or roots of a **single tooth**. Predominantly occurs in children and young adult. (50% under 20 y/o and 75% occur before 30 y/o) **Roentgenographically**, the tumor consists of a dense radiopaque mass fused to root with a well-defined radiolucent rim at the periphery. **Microscopically**, the tumor consisting of typical of cementum, resorbs and fuses to the root of **a tooth**. Cementoclasts are often present, and the mineralized trabeculae are often lined by prominent cementoblasts with the presence of reversal line. The presence of **reversal line** imparts to it the Pagetoid appearance. The periphery of the lesion, corresponding to the radiolucent zone seen on the radiograph, is composed of uncalcified matrix, which is often arranged in radiating columns.

B.Neoplasms and other lesions related to bone

(1) Periapical cemental dysplasia: A non-neoplastic lesion affecting the periapical tissues of one or more teeth, and with histological features similar to those of the lesions of the cemento-ossifying fibroma group, but without a sharply defined margin.

It occurs most commonly in middle-aged women (Female: Male = 14:1) and marked predilection for black, involves multiple teeth especially in the mandibular anterior region. In the **first stage, osteolytic stage**, of development it appears as a radiolucent lesion attached to the apex of the tooth, in which case it is indistinguishable from periapical granuloma or radicular cyst. However, in periapical cemental dysplasia, the involved teeth are normal in color and vitality. In the **second stage, osteoblastic stage**, the lesion is partly radiolucent and

partly radiopaque due to deposition of cementum and/or osseous tissue. In **stage III, mature state**, the lesion is changed into a calcified mass surrounded by a thin radiolucent line representing periodontal ligament and separating it from the tooth apex. **Microscopically**, in the osteolytic stage, the bone is destroyed and consists of a fibroblastic proliferation that may contain small foci of cementum or bone formation. In the later stages, the lesion shows progressive deposition of bone or cementum-like material. In the end stage, the lesion consists of a dense mineralized mass.

Biopsy is not usually required. The clinical history, age, race, sex, and radiographic findings are sufficient to diagnose most cases. Each periapical lesion is inconsequential and self-limiting, rarely exceeds 1 cm in diameter, and ultimately becomes a dense mineralized mass.

(2) **Cemento-ossifying fibroma**: Demarcated or, rarely, encapsulated neoplasms consisting of fibrous tissue containing varying amounts of mineralized material resembling cementum and/ or bone.

It differs from periapical cemental dysplasia in that (a) it occurs mostly in the mandibular premolar or molar region; (b) it may produce a noticeable swelling and deformity; (c) it shows no racial predilection. There is a definite **female predilection**, with female-to-male ratios as high as 5:1. The **cemento-ossifying fibroma** is a well-demarcated and occasionally encapsulated neoplasm composed of fibrous tissue that contains varying amounts of calcified tissue resembling bone, cementum, or both. Formerly, many investigators separately classified **cementifying fibromas**, which were considered to be odontogenic tumors, from **ossifying fibromas**, which were believed to be tumors of osteogenic origin. Today, however, it is agreed that these are one and the same lesion and are best classified as osteogenic neoplasm. **Clinically**, it is slow-growing, painless, and well-circumscribed. **Radiographically**, the lesion most often is well defined and unilocular. Depending on the amount of calcified material produced in the tumor, it may appear as completely radiolucent; more often it shows varying degrees of radiopacity.

Microscopically, exhibits multiple cementicle-like structures and bone within dense connective tissue. Within the dense connective tissue stroma, which exhibits a high degree of cellularity, there are isolated small islands of cementifying or ossifying structures as well as metaplastic bone. Some areas of **cemento-ossifying fibroma** also may not be distinguishable microscopically from periapical cemental dysplasia or from other focal cemento-osseous dysplasia, but overall it is better circumscribed and poorly vascular. The prognosis is good and recurrence is rare.

(3)Gigantiform cementoma (Florid cemento-osseous dysplasia) : **Lobulated masses of dense, highly mineralized, almost acellular cemento-osseous tissue typically occurring in several parts of the jaws. Black persons are affected more commonly than white, and sometimes there is a familial distribution.**

It is seen most commonly in middle-aged black women and most patients will show lesions in all four quadrants of the jaws. It is inherited as an autosomal dominant trait. The lesion may cause expansion and deformity of the jaws. Histologically, the lesion consists of large sheets or fused globules of cemento-osseous tissue sometimes strongly basophilic, which may be fused to the roots of one or more teeth or may lie separately.