Odontogenic Tumors

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Definition

The neoplasms that consist of the cells considered specialized for odontogenesis, and their product (dentin, enamel, cementum) are called odontogenic tumors.

Classification

To initiate odontogenesis, epithelium is a must. Same rule holds for the odontogenic tumors : without odontogenic epithelium, odontogenic tumors cannot be, without the induction of odontogenic epithelium odontogenic mesenchyme cannot develop.

In odontogenesis, mainly three consecutive inductions are mentioned (Table I).

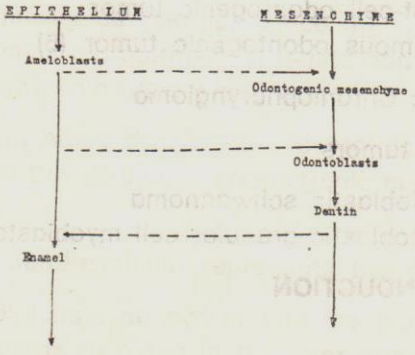

Table I.- Induction

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1. «Ameloblasts» develop in the enamel organ. This tissue transforms into «odontogenic mesenchyme» by the induction of ameloblasts on the connective tissue, thus forming the «dental papilla».

2. A second induction of the ameloblasts on the odontogenic mesenchyme causes a pattern of «odontoblasts». Without any need of a new induction, the odontoblasts go on to produce «dentin».

3. Via the induction of dentin on the ameloblasts the latter form the «enamel».

When the odontogenic epithelium does not make an induction on the mesenchyme, (1) Epithelial tumors and (2) Collision tumors develop. In case the odontogenic epithelium makes an induction on the mesenchyme, these probabilities appear (Note the classification-Tumors with Induction) :

On (A) and (B) both the odontogenic mesenchyme forms after the induction of the odontogenic epithelium, and develops by itself, thus epithelium remaining at the back of the picture.

I. TUMORS WITHOUT INDUCTION

1. Epithelial Tumors

Dentheliоblastoma
Ameloblastoma
Adenomatoid odontogenic tumor
Pindborg's tumor
Ghost-cell odontogenic tumor
Squamous odontogenic tumor (6)

Ectopic : Chraniopharyngioma

2. Collison tumors

Ameloblastic schwannoma
Ameloblastic granular cell myoblastoma

II. TUMORS WITH INDUCTION

Benign tumors

A Hamartomatous composition kinds

Compound odontoma
Complex odontoma

B True composition tumors

Denthelioblastic fibroma
Ameloblastic fibroma
Ameloblastic dentino-fibroma
Ameloblastic odonto-fibroma
Periodontioma (1)

C Odontogenic fibroma

D Cementomas

Malign tumors

Denthelioblastic sarcoma
Ameloblastic sarcoma
Ameloblastic dentino-sarcoma
Ameloblastic odonto-sarcoma
Odontogenic fibrosarcoma —

Denthelioblastoma

During odontogenesis, a primitive odontogenic epithelium is formed around the roots of the teeth. After the completion of odontogenesis, these are known as the «epithelial rests of Malassez». Such epithelium can also be seen adjacent to odontogenic cysts and tumors. Primitive odontogenic epithelium results from the transformation of mature dental epithelium. If the resulting epithelium is in fact «primitive», then the matter is the dedifferentiation of the mature epithelium. My personel opinon is that, it is only logical to accept the matter as stated, since the primitive odontogenic epithelium behaves as multi-potent blasts and can be differentiated to various odontogenic tumors and cysts.

I propose to name the «mature dental epithelium», in general, **Denthelium;** and the «primitive odontogenic epithelium», **Dentheliob-last.**

The name denthelioblast represents two different notions :

a) Denthebioblasts do not initiate the odontogenesis. On the contrary, they come to being in the later stages. In other words, when odontogenesis is considered, the term «blast» is misused.

b) The denthelioblasts initiate most of the odontogenic cysts

and tumors. Therefore they should be considered blasts. I make my proposition basing on this second opinion. I met couple of dentelioblastoma cases in the literature myself (14, 11). This tumor is classified as «Ameloblestoma, primitive type» in 1950 modificaton of Thoma and Goldman's (9) classification by American Academy of Oral Pathology (10).

The gingival epithelium retains the capability of transform into odontogenic epithelium throughout the life. Any time during life, dentheliobiasts can either come out of mature odontogenic or gingival epithelium. Odontogenic tumors may either come out directly from the mature odontogenic epithelium and gingival epithelium as a sort of metaplasia (Fig. 1A) or at first dentheliobiasts develop transforming later into tumor (Fig. 1B).

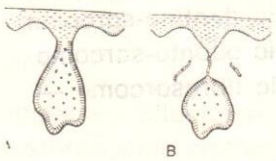

Fig. 1. — Diagram showing the origins of odontogenic tumors.

Dentheliobiastoma may at times keep its initial state, but generally is the primary stage of some other odontogenic tumors. In majority of the odontogenic cysts and tumors, dentheliobiasts are not abundant enough te be called «dentheliobiastoma». In such cases the sequence is referred to, as a proliferation of dentheliobiasts. Dentheliobiasts act as germinal cells, in many of the odontogenic cysts and tumors.

Ameloblastoma

Ameloblastoma consists of two different kinds of epithelium :

a) A single layer of ameloblasts in the periphery of tumor islets, and,

b) Cells that resemble stratum intermedium when dense, to stellate reticulum when sparse, in the center.

In other forms of ameloblastomas, some different kinds of epithelial cells are also peresent, i. e., granular cells, squamous cells, mucinous cells.

Adenomatoid odontogenic tumor (AOT)

AOT is made up of three kinds of epithelium :

a) Ameloblasts,
b) stratum intermedium, and
c) outer enamel epithelium.

Microscopically two very characteristic and diagnostic patterns are seen in low magnifications : rather roundish large masses of cells, and a network of cells in between.

1. There are roundish large masses of epithelium scattered around. I propose that each one of these should be called **Adenomatoid lobulus.** Adenomatoid lobuli consist of ameloblasts (a cells) and stratum intermedium cells (b cells). Inside the adenomatoid lobuli, there are different numbers of small round lumina. As the lesion grows older, these become elongated and take a tubular shape. Cells lining the lumina resemble the ameloblasts (a cells) and the lumen may contain an eosinophilic material.

The elongated cells along the epithelial rings in the adenomatoid lobuli, are reminiscent of the connective tissue. In reality these are epithelial cells that resemble the stratum intermedium.

2. The cells forming cords in the large areas outside the adenomatoid lobuli, take the shape of a net; these cells are c cells and may represent the outer enamel epithelium. The connective tissue between the cords is loose and has a rather rich blood supply.

Ghost-cell odontogenic tumor

I do not believe the ghost-cell odontogenic cysts are in fact a cystic tumor, in other words a «ghost-cell cystoma». My opinion is that the ghost cell odontogenic tumor should be of solid character.

Odontomas

Odontogenesis starts with a budding of the gingival epithelium. This bud extenos to the deeper layers forming the «dental lamina». Afterwards, this formation divides into two buds representing the deciduous and permanent teeth (Fig 2A). Sometimes a third bud that will eventually form a supernumerary tooth is also present (Fig 2B). If the forming buds are numerous and the teeth developed

are somewhat of disturbed structure, then the phenomenon is named compound odontoma (Fig 2C). In the cases where morpho-differentiation is inadequate, the formed buds remain as small ovoid masses; the oncoming development of these, results in complex odontoma (Fig 2D).

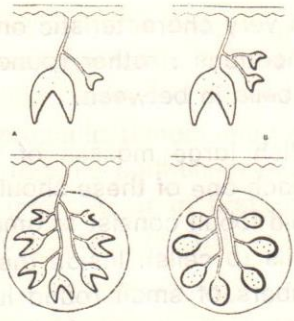

Fig. 2. — a) Deciduous and permanent tooth buds.
b) Supernumerary tooth bud
c) Compound odontoma
d) Complex odontoma

The developmental phase of the compound odontoma is parallel to normal odontogenesis (Fig. 3 a-d). Since in normal odontogenesis and compound odontoma, ameloblast line on the inner surface, dentin and enamel form on this side. But in complex odontoma the ameloblasts are on the outer face of the epithelial masses. Thus the newly formed dentin and enamel will surround these masses as crusts (Fig. 3 g-h). The stages of odontomas can be divided into four according to the elements they cover. In compound odontomas, these stages can be followed easily since they are on parallel with normal odontogenesis (Fig. 3 a-d). The following explanations are necessary for an easier understanding of complex odontomas :

1. Ameloblastic fibroma stage - with the induction of ameloblasts on the outer border of epithelium masses upon connective tissue, an «odontogenic mesenchyme» develops among these islands (Fig. 3 e).
2. Ameloblastic dentino-fibroma stage .- a further induction of the ameloblasts on the odontogenic mesenchyme causes

the development of the «odontoblasts». After this, «dentin» is made (Fig. 3 f).

3. Ameloblastic enamelo-dentino-fibroma (ameloblastic odonto-fibroma) stage .- After the dentin comes to being, ameloblasts start to make «enamel». Enamel forms a second layer in between the ameloblasts and dentin (Fig. 3 g).

4. Enamelo-dentinoma . stage (Mature odontoma). - as the production of dentin gradually increases, the mases of dentin unite and weld together since enamel is produced inwards. As enamel accumulates, epithelium becomes imprisoned at center and eventually dissappear. The resulting picture is reminiscent a **sponge** with spaces full of enamel (Fig. 3 h).

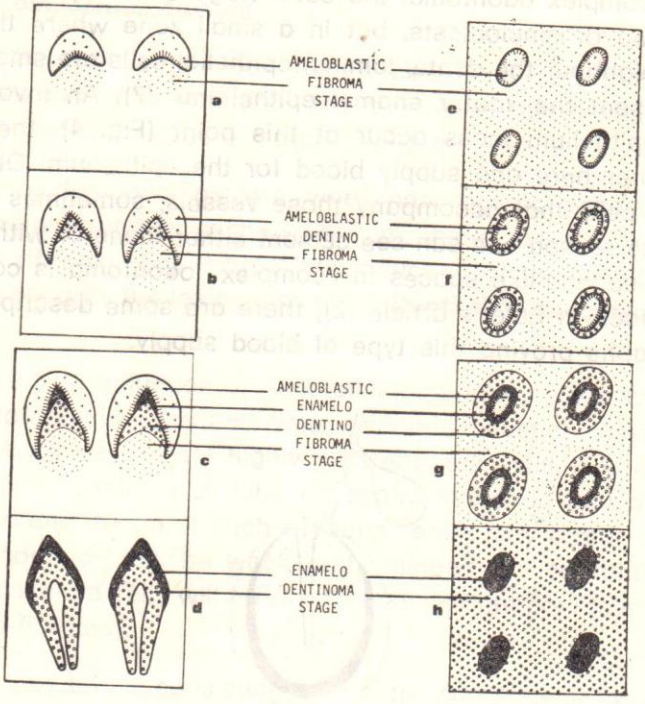

Fig. 3. — A comparison between the odontogenesis and the stages of odontoma

Complex odontoma has a regular spongelike structure, therefore I propose the name «Spongious odontoma» instead of complex odontoma for this entity.

Some odontomas are a mixture of complex (spongious) and compound odontoma. Although in odontogenesis each bud gives rise to only one tooth, in compound odontoma, more than one tooth may develop from each bud (5). (Fig. 2 C).

Generally, odontomas are seen as local developments at any place in the jaws. Very rarely, one may encounter odontomas that occupy both the maxilla and the mandible, as a whole. This phenomenon may be called **Diffuse odontomatosis.** In a case reported by Herrmann (3), there were about 1200 teeth and tooth sketches in the maxilla and 900 in the mandible.

In complex (spongious) odontoma, after the formation of dentin and enamel, the problem of supplying blood for the epithelium arises. In complex odontoma, the outer ridge of the epithelial mass is composed of ameloblasts, but in a small zone where the ameloblasts neighbour the dental lamina, epithelial cells are smaller and they represent the «outer enamel epithelium» (7). An invagination into the epithelium mass occur at this point (Fig. 4), the blood vessels enter here and supply blood for the epithelium. Other mesenchyme cells that accompany those vessels, sometimes produce sement, the reason one can see cement either alone or with enamel filling the sponge-like spaces in complex odontoma is connected with this fact. In Euler's article (2), there are some descriptive microphotographs proving this type of blood supply.

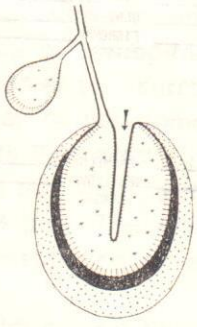

Fig. 4. — Blood supply in complex odontoma

There is also a «Nodular type» of complex (spongious) odontoma which displays the maturation stages of odontoma from pe-

riphery to a center placed eccentrically in each nodule (Fig. 5). Rywkind's case (7) is a sample to this variety.

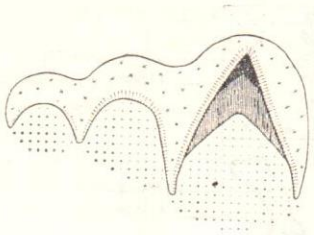

Fig. 5. — The maturation of the Nodular type complex odontoma

True composition tumors

In the true composition tumors there is no morpho-differentiation but only histodifferentiation. The tumors of this group can be classified from primitive to mature types as follows :

a) In dentheliоblastoma, when odontogenic mesenchyme forms due to the induction of the epihelium, the lesion is called Dentheliоblastic fibroma (Fig. 6 a). If the induction of the epithelium is not strong enough, the lesion displays a **Dentheliоblastic myxoma** appearance.

The first induction of dentheliоblasts may cause the production of odontogenic mesenchyme (dentheliоblastic fibroma). Since dentheliоblasts are not highly differentiated cells, it is doubtful that they are capable of making a second induction and begat odontablasts and dentin. If such a phenomenon may exists, than the second induction will be weak and instead of odontoblasts, only odontoblastoid cells will form and produce dentinoid (dentheliоblastic dentino-fibroma).

b) The tumor consisting of mature odontogenic epithelium and odontogenic mesenchyme is called **Ameloblastic fibroma** (Fig. 6 b).

c) Ameloblastic fibroma generally resumes this structure unchanged, and displays the same scene even in rest tumrs. In few of the cases, one may see dentin or dentinoid due to the induction of epithelium. This tumor is then called **Ameloblastic dentinofibroma** (Fig. 6 c).

d) Very rarely, there is a patchy production of enamel in ameloblastic dentinofibroma mass. This type is called **Ameloblastic odonto-fibroma** (Fig. 6 d).

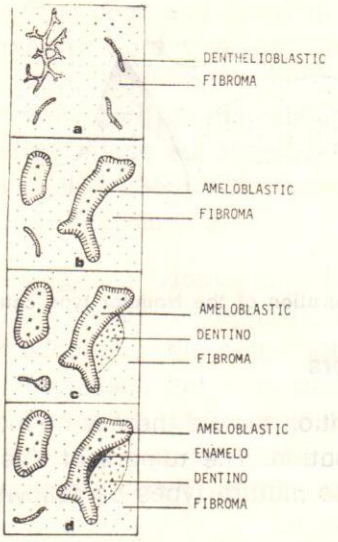

Fig. 6. — True composition tumors

Generally this second group of tumors (b, c, d) also contain the earlier stages (dentheliobla stoma or dentheliobla stic proliferation, dentheliobla stic fibroma). It is also possible to see the same stages in the peripheral parts of odontomas.

The «fibroma» component in the above mentioned tumors, may be malignant or undergo a malignant change. As seen on the classification table, these are named **dentheliobla stic sarcoma, amelobla stic sarcoma** respectively. In one ameloblastic sarcoma case we saw, the odontogenic epithelium had transformed into epidermoid carcinoma. We chose to the call this tumor Odontogenic carcinosarcoma (8).

As very well known, periodtium is made up of (a) alveolar bone, (b) periodontal membrane (connective tissue) and (c) cementum. It is natural to find (d) dentheliobla sts islets in periodontal membrane. My colleague Çöloğlu (1) has described a tumor composed of these four elements and named it **Periodontioma.** As can be seen, in the camposition tumors generally the first induction is

made by the dentheliobiasts. This some what changes the induction table compared to that of normal odontogenesis (Table II).

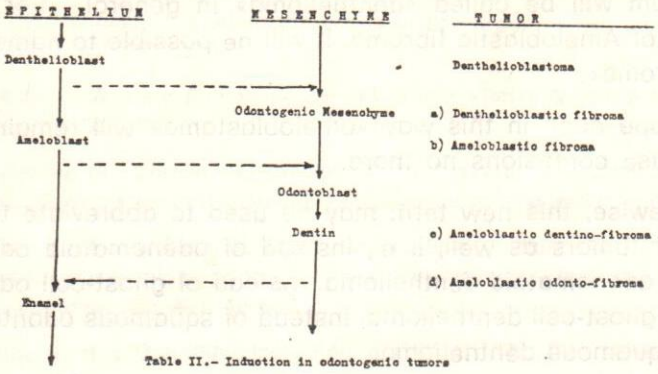

Table II.- Induction in odontogenic tumors

Odantogenic fibroma

In dentheliobiastic fibroma both the epithelium and the mesenchyme develop together. If the epithelial development becomes interrupted and mesenchyme development comes forth, **odontogenic fibroma** comes to existence. It is of this reason that odontogenic fibroma displays abundant odontogenic mesenchyme as compared very few dentheliobiast islets. The malignant equivalent of this tumor is **odontogenic fibrosarcoma**. It is useful to bear in mind that to be able to call a fibroma or fibrosarcoma definitely odontogenic, it is necessary to identify the dentheliobiasts in that particular tumor.

As in previous examples, insufficient induction of dentheliobiasts on the mesenchyme in odontogenic fibroma again will result in **odontogenic myxofibroma** or **odontogenic myxoma**.

The trouble of «Ameloblastoma»

Even in our day, many clinicians and pathologists when the term **«ameloblastic»** is mentioned (for instance Ameloblastic fibroma), automatically bring ameloblastoma to mind. As well known, ameloblastomas require a rather radical surgical operation to prevent recurrences. On the contrary, induction tumors that contain «ameloblastic» component need only a through curettage, which in most of the cases yield a satisfactory result. The collison tumors in the classification behave as true ameloblastomas.

I have proposed that «primitive odontogenic epithelium» be called «dentheliobIasts» and mature «dental epithelium», «dentheli-um» before. This way tumors composed of mature odontogenic epithelium will be called «denthelioma» in general. For instance, instead of Ameloblastic fibroma, it will be possible to name it «dent-heliofibroma».

I hope nope in this way «ameloblastoma» will remain by itself and cause confusions no more.

Likewise, this new term may be used to abbreviate the names of other tumors as well, i. e., instead of adenomatoid odontogenic tumor - adenomatoid denthelioma, instead of ghost-cell odontogenic tumor - ghost-cell denthelioma, instead of squamous odontogenic tu-mor - squamous denthelioma.

Addendum :

Among measures to avoid erroneous histological interpretations of odontogenic tumors, two points are of great importance.

1. In various odontogenic tumors, there is a deposition of amyloid, which is sometimes interpreted as «dentinoid». As mentioned above, ameloblasts induce odontogenic mesenchyme to produce dentin. In other words, dentin and dentinoid must be found be-tween ameloblasts and odontogenic mesenchymel (odontoblasts).

2. Via the induction of dentin, ameloblasts produce **enamel.** This means that, to call a material enamel, one must see that this ma-terial is placed between the ameloblasts and dentin.

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