

Section of Odontology.

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Further Investigation of the Pathology of Dentigerous Cysts with a New Treatment Based Thereon.

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FIVE years ago¹ I put before you a case of multiple dentigerous cysts and some remarks on what I considered to be the probable pathology of such cysts.

I gave ten reasons in support of the hypothesis then put forward and supported it in so far that I was able to show a granuloma on a deciduous tooth, part of a dental cyst attached to a deciduous tooth, to quote another case in support, and to demonstrate three of the other points; five others of the remainder were already recognized clinical facts. Since then I am not aware that any adverse

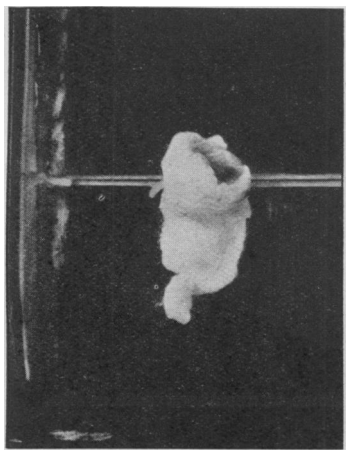


FIG. 1.—Granuloma on deciduous tooth.

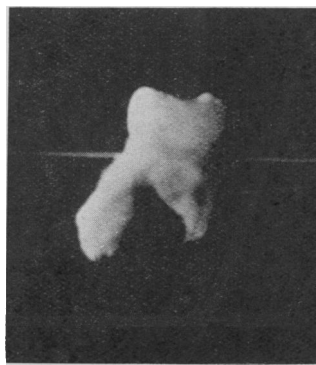


FIG. 2.—Granuloma on deciduous tooth.

criticism has been made concerning the views I then advanced, nor have I yet heard of a case of a dentigerous cyst in man involving a tooth, the deciduous predecessor of which was *in situ* and alive.

To-night I show you some further specimens bearing on the same hypothesis, and put before you a form of treatment for these cysts which, under favourable circumstances, seems to me to be an improvement on what has been done for them in the past. I will now refer to the new specimens bearing on my last paper, which are here on exhibit.

Exhibits 1, 2 (fig. 1), 3 (fig. 2), 4, 5, 6, 7 and 8 are a series of specimens of granulomata *in situ* on deciduous teeth; on the fourth specimen there may indeed be

¹ *Proceedings*, 1922, xv (Sect. Odont.), 56.

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two small cysts, one at each apex. Since I read my last paper before you I have met with many such, some of the best of which are those on view; they help to bear out my contention that the sequelæ of caries in deciduous teeth are in no way different from those occurring in permanent teeth, but are less often seen because of the much shorter time that the deciduous teeth are present in the jaws.

Two other specimens (exhibits 9 and 10), though they have no connexion whatever with cysts, also bear this out; they are specimens of productive pulpitis in deciduous teeth, commonly known as "polypus" of the pulp. This, I believe, is a much rarer condition than granuloma in the deciduous dentition.

In 1922 I also stated that the only histological difference between the granulomata on deciduous and permanent teeth which I had noticed was that in the former

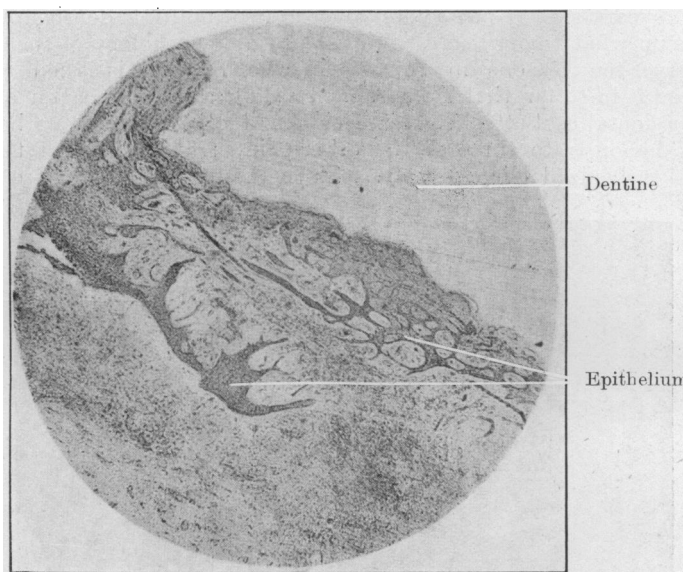


FIG. 3.—Photomicrograph of section of granuloma on deciduous tooth *in situ*.

there were much grosser masses of epithelium, and I accounted for that by reason of the greater vascularity of that part during the active tooth forming and tooth absorbing period and the greater youth and activity of the epithelial cells involved. Of course one meets with masses of epithelial cells in connexion with most granulomata on permanent teeth, but there does not seem to be anything like the same exuberance of epithelial cell growth.

The following exhibits, 11 (fig. 3) and 12, well illustrate this point, and I might add that I have never yet met with a granuloma on a deciduous tooth which did not show such epithelial masses. I have now examined about twenty of these granulomata; of course only a small portion of the epithelium can be shown in the photomicrographs; one needs to see the slides on exhibit and move them about, in order to appreciate this profusion of epithelium fully. I would here like to mention that one text-book referring to my past paper on this subject denies the existence of

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granulomata on deciduous teeth, and remarks that a dentigerous cyst which involved a third molar did not seem so feasibly to have origin from a cyst on a deciduous tooth. I made the same remark myself in that paper and mentioned that though this was possible owing to the fact that cysts may burrow considerably, particularly when they reach the medullary portion of the bone, the first permanent molar (which is given as the commonest region in which dental cysts occur) was possibly, not to say probably, the most frequent source of origin of the cyst in such cases. Though the involvement of the third molar in a cyst is apparently not very rare, it has not been my good fortune yet to meet with such a case.

The next slide (exhibit 12A, fig. 4) is from the only skiagram I have seen showing the mandibular third molar involved in a cyst, and this slide confirms the probability of my suggestion; the cyst in this case most likely originated from the missing first permanent molar; I have no knowledge as to whether the second permanent molar,

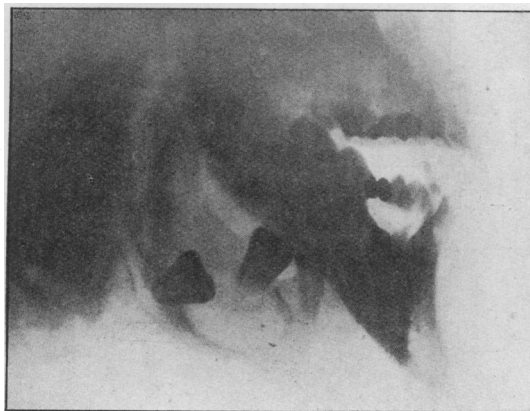


FIG. 4.—A mandibular third molar in a cyst. The first permanent molar is missing and the second permanent molar filled.

which is *in situ* and filled, was a live or dead tooth, but the cyst might alternatively, but not so probably, have originated from that tooth.

I also suggested that "there would seem to be a race between the growing cyst to envelop the permanent tooth and the tooth to escape its obstruction and erupt," and the next specimen I have to show (exhibit 13) has a bearing on this, but is a doubtful one as I was unable to make a microscopic examination.

This is a case in a female aged $10\frac{4}{5}$ years of what is apparently a cyst (exhibit 14) in the premolar region, the commonest region for such (dentigerous) cysts. This cyst has become disconnected with the deciduous tooth which probably gave origin to it by that tooth being shed; the succeeding permanent teeth were able to avoid "end on" contact with the cyst in the process of eruption, so that the cyst here appears entirely disconnected with the permanent teeth and outside them.

Such cases have been recorded previously by others and by myself and confirmed by microscopic examination.

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I am also showing another specimen (exhibit 15, fig. 5) together with a photomicrograph of a portion of it (exhibit 16, fig. 6), of a deciduous tooth with part of a cyst wall adherent to it, almost exactly similar to the photomicrograph I showed in 1922, except that this is larger and perhaps more diagrammatic; and in addition a photomicrograph of a small complete cyst (exhibit 17, fig. 7) with an entire epithelial lining, attached to the root of a deciduous tooth.

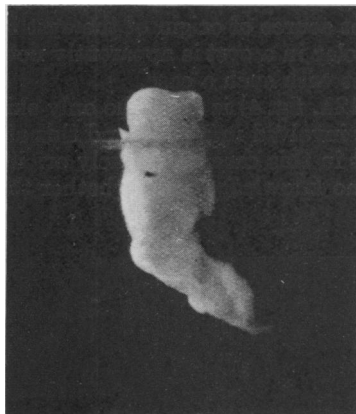


FIG. 5.—A deciduous tooth with a portion of a cyst wall attached.

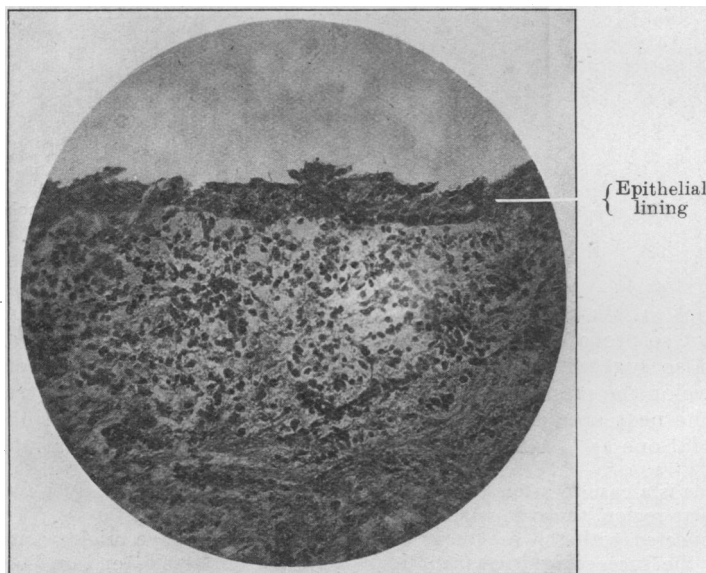


FIG. 6.—Photomicrograph of portion of cyst wall of fig. 5.

I now come to the cases, four in number, which have been subjected to a form of treatment the successful result of which is entirely dependent on the correctness of the hypothesis that the cyst is merely the obstructing agent to the eruption of the underlying permanent tooth. This underlying permanent tooth, not being readily absorbed, tends to become surrounded by the cyst as it grows.

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The new features of this operation consist in the preservation of the tooth involved in the cyst and in the retention of a considerable portion of the cyst lining. Thus the operation is simplified into opening the cyst cavity freely enough to merge it into the buccal cavity, drainage thus becoming almost automatic and lavage being made easy to the patient. The cyst lining is not removed because it is epithelial and therefore protective. If it were removed there would be considerable risk of damage to the permanent tooth concerned which it is desirable to conserve; there would be also a very much larger raw surface open to infection and the absorption of toxins after operation; there would be more hæmorrhage and more pain. After all, there does not seem to be much object in removing one epithelial lining when the desirable ultimate result is that another epithelial covering should grow in from the edges of the wound and replace it. Moreover the operation is thereby rendered much simpler and shorter and the wound does not need any packing in order to arrest hæmorrhage. I am aware, of

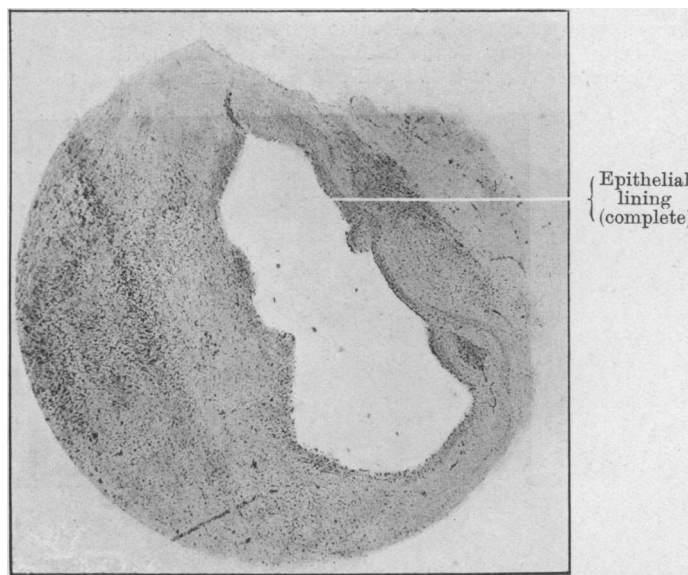


FIG. 7.—Photomicrograph of small entire cyst *in situ* attached to part of a deciduous tooth.

course, that a similar retention of cyst lining is occasionally practised when treating dental cysts. This treatment conserves the permanent tooth and you will see skiagrams, serial models and photomicrographs of sections from each case quoted.

The four cases I am showing were all operated upon under local anæsthesia.

Case I.—J. H. (exhibit 18), a male, aged 9, presented himself on January 10, 1925, with a painless and non-discharging swelling in the mandibular right deciduous first molar region, that tooth being present, carious, and having a dead and infected pulp. A skiagram was taken (exhibit 19) which showed considerable rarefaction of bone round the upper portion of the underlying first premolar. The rarefied area has not the sharp outline usually associated with a non-infected cystic swelling, and the same is true of two of the other cases I am showing, in both of which the cysts were small (Cases III and IV). This is possibly accounted for by the fact that its size had not yet reached that stage when surrounding tissues have been acted upon long enough to form a really sharply defined outline.

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The deciduous first molar was removed and a piece of tissue was removed and placed in 5 per cent. saline formalin.

When this had been done the only attachment of the underlying premolar was by the pulp or dentine papilla at its base; it was very freely mobile and it seemed as if a sharp jet of water from a syringe might easily wash the tooth free from its attachment, almost the whole length of the tooth being exposed to sight. The tooth was left alone, a mouth wash prescribed and the patient instructed to use only the other side of his mouth.

The piece of tissue removed shows on microscopical examination (exhibit 20) one of the common appearances seen in the walls of such cysts, namely a lining of epithelial cells of varying degrees of depth, from two to fifteen cells deep, and in places giving rise to processes of epithelial cells which occasionally loop over and join on the outer aspect. Outside this was a somewhat thick layer of connective tissue forming a loose capsule, and external to that was a layer of thinned out alveolar bone.

In the few days subsequent to the operation the adjacent soft tissues closely invested the exposed premolar, so that even the point of a cusp was hardly to be seen. Twenty-seven days after operation it seemed safe to take an impression which (exhibit 21) shows the tip only of the larger cusp presenting at the bottom of the depression.

The subsequent history of the case is illustrated by the three following exhibits (22, 23 and 24) made respectively 124, 171 and 293 days after operation, the final one showing the

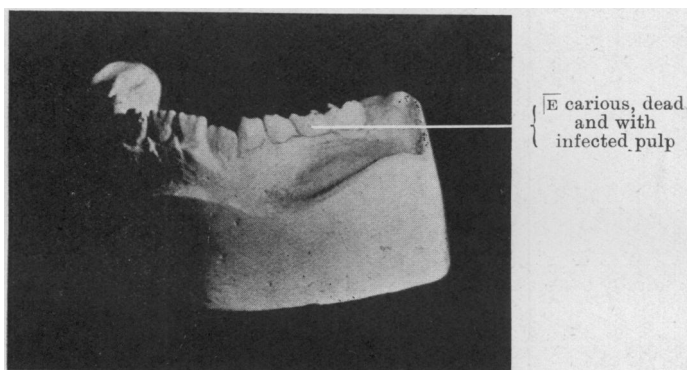


FIG. 8.—Case II, E. C., male, aged $9\frac{1}{2}$ years.

tooth fully erupted and in its normal position in the arch; it was not yet in occlusion, as the corresponding maxillary teeth were then only commencing to erupt, but it has since come into normal occlusion.

Case II.—E. C. (exhibit 25, fig. 8), a male, aged $9\frac{1}{2}$ years, presented himself on April 21, 1925, with a swelling, having a history similar to that of Case I, but in the mandibular left deciduous second molar region that tooth was present, carious and with a dead and infected pulp. There was considerable external swelling in this case as the cyst was larger.

The same procedure was adopted as in Case I, a skiagram (exhibit 26, fig. 9) was taken, the deciduous molar removed and the cyst operated on; the piece of tissue removed was saved for microscopic examination. This (exhibit 27, fig. 10) showed a thin, evenly spread epithelial lining to the cyst, two to four cells deep, without epithelial processes; surrounding this was a connective tissue capsule, and external to that, thinned out alveolar bone.

Except for the fact that the cyst was larger and that entire resolution therefore took longer, the subsequent history was very similar to that of Case I, and is illustrated as follows: Exhibit 28 (fig. 11) shows the condition twenty-nine days after operation, merely the tip of the outer premolar cusp being exposed, the tooth now being surrounded and supported by adherent soft tissues. Exhibit 29 (fig. 12), 133 days after operation, shows the tooth erupting well but rather outside the arch. Exhibit 30 (fig. 13), 350 days after operation, shows the tooth now in mal-occlusion with the maxillary second deciduous molar which is locking it buccal to its

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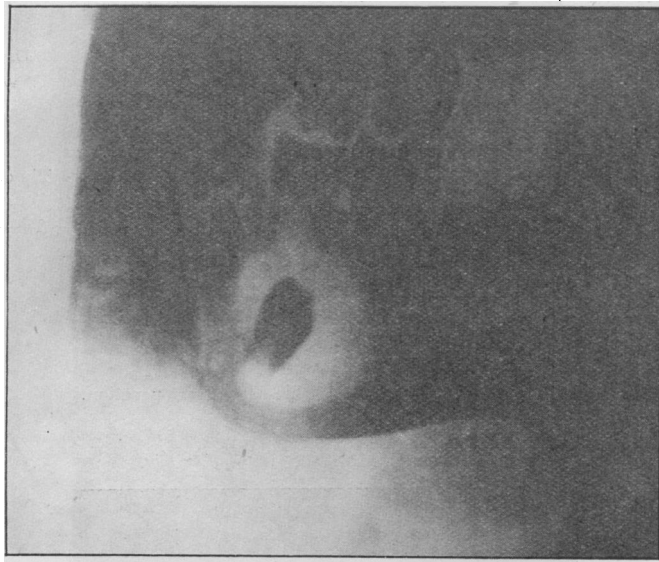


FIG. 9.—Skiagram of fig. 8.

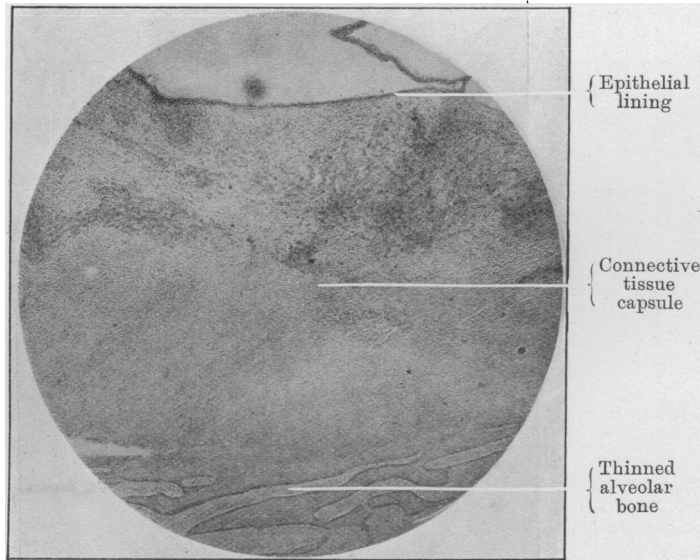


FIG. 10.—Photomicrograph of portion of cyst wall of fig. 8.

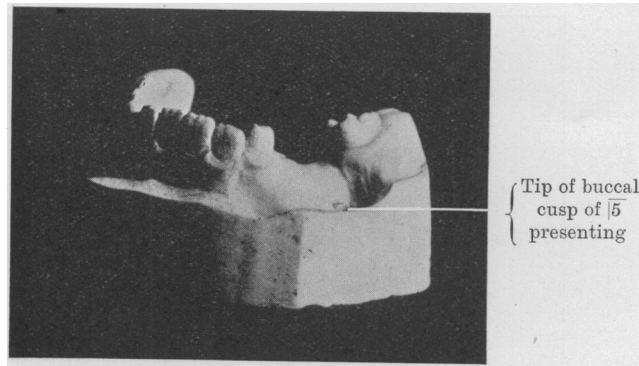
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FIG. 11.—*Case II*, twenty-nine days after operation.

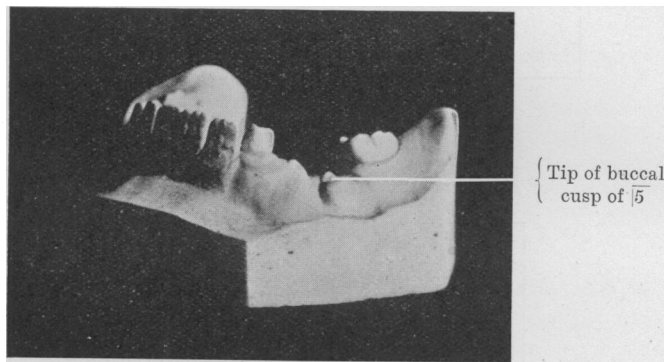


FIG. 12.—*Case II*, 133 days after operation.

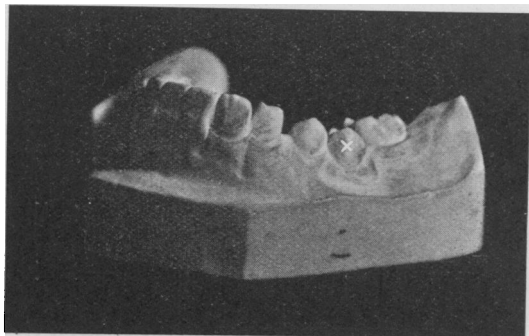


FIG. 13.—*Case II*, 350 days after operation, $\overline{15}$ in malocclusion.

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normal position in the arch; the maxillary deciduous molar was ground, and five months later, being a little loose, was removed, and since then (exhibit 31, fig. 14) the premolar which was in the cyst has come into its normal position in the arch and into normal occlusion. The photograph shows the condition 665 days after operation. There has been no mechanical assistance whatever.

Case III.—B.N. (exhibit 32), a female, aged 6, presented herself on December 17, 1925, with a swelling, having a similar history as regards the maxillary right incisor region. Both deciduous incisors on that side were in place, carious and with dead and infected pulps, but on the left side the deciduous first incisor had been lost and the corresponding permanent incisor was about one-third erupted. The skiagram (exhibit 33) shows the right permanent first incisor high up and with an area of rarefaction round its crown; both first incisors are otherwise developed to much the same extent. A piece of tissue, outlined on exhibit 32 and including both deciduous incisors on the right side, was removed and showed (exhibit 34) on microscopical examination with the first incisor *in situ*, a cyst cavity having an epithelial lining of very varying thickness, which, by moving the slide, can be traced almost into direct continuity with the root of the first incisor. Round the apex of this tooth there is much epithelial proliferation, and there are epithelial processes and loops on the outer aspect of the cyst; outside this lies connective tissue and some thinned-out alveolar bone, but in places the alveolar

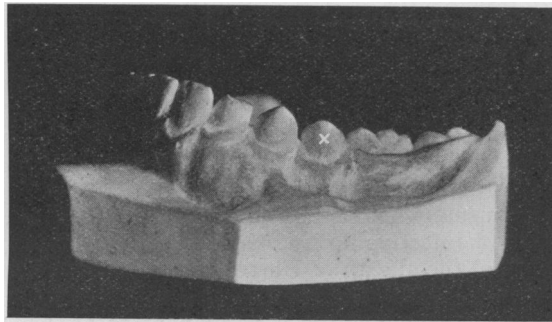


FIG. 14.—*Case II*, 665 days after operation, $\bar{5}$ in normal occlusion.

bone has disappeared, notably from the area adjacent to the tooth, so that the tooth has no bony socket on its labial aspect; gum, covered by its normal surface epithelium, is seen outside whatever bone is present.

The subsequent history is seen in exhibit 35 which shows the condition eighteen days after operation, with the right permanent first incisor well presenting, and exhibit 36 which shows the condition 102 days after operation, with the tooth erupted still further. I then lost sight of this child for some ten months, but eventually traced her to Devonshire, and through the kindness of a friend obtained the final model (exhibit 37) which shows the condition 397 days after operation, with the permanent right first incisor erupted as far as its fellow of the opposite side, but rather crowded in the arch.

Case IV.—The details of this case need not be given. It occurred in a male, aged 8, in the mandibular right deciduous first molar region, that tooth being present and "dead." The course of the case was similar to that of others. The serial models, skiagram and section are on view as exhibits 38, 39, 40, 41, 42 and 43, and the dates of each are appended.

It will be noticed that in the four cases I have quoted—which are the only cases I have so far treated in this manner—the ages of the patients were very near to the normal eruption dates of the permanent teeth affected by the cysts, and I have

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no doubt that this was much in favour of the treatment which was carried out. I have not had the opportunity of trying it in a case at a later age though I should much like to do so. I imagine that the nearer the age of normal eruption the obstruction is removed, the greater and more rapid will be the degree of success attained. But, again, this will depend on the size of the cyst.

In conclusion, I suggest that I have now demonstrated to you:—

- (1) That granulomata occur on deciduous teeth.
- (2) That dental cysts occur on deciduous teeth.
- (3) That when dental cysts occur on deciduous teeth they may envelop adjacent unerupted permanent teeth.
- (4) That cysts on deciduous teeth may obstruct, delay or misdirect the eruption of adjacent permanent teeth.
- (5) That, on the removal of the obstruction, eruption of the underlying tooth may be resumed.
- (6) That, when in the process of its growth a dental cyst envelops an unerupted tooth, a dentigerous cyst is produced.

Of the ten reasons I gave you in support of my thesis in 1922, five (Nos. 1, 2, 4, 9 and 10) were already recognized clinical facts which I incidentally confirmed or demonstrated. Five others (Nos. 3, 5, 6, 7 and 8) I demonstrated at that time, and now again demonstrate in some detail.

You will observe that I have not tried to prove that dentigerous cysts *always* arise from septic, deciduous teeth but only that they very frequently and indeed usually do so.

It has been suggested that a comparison of the different innocent epithelial growths, believed to originate from the epithelial dental formative organs, might usefully be made at this point (exhibit 44, fig. 15).

The *dental cyst* as usually found has been shown by Mr. J. G. Turner to be caused by the stimulus of infection derived from a dead permanent tooth acting on the epithelial remnants of the sheath of Hertwig, that being the only epithelium in the neighbourhood.

The *dentigerous cyst* which involves a permanent tooth I have endeavoured to show as arising in a similar manner, except that the stimulus usually originates in a dead deciduous tooth, but may be derived from a dead permanent molar, when it involves permanent molars. In the case of this cyst, however, there are several groups of cells from which it may grow.

The *cyst of eruption over a deciduous tooth or a permanent tooth which has no predecessor*, though of similar histological structure to both the former cysts, obviously cannot arise from the same cause. It might arise from trauma, but I do not think this is probable unless it is the gentle force of an unusually slowly erupting tooth which is the stimulus. Consideration of this cyst surely emphasizes the important fact that we do not yet comprehend all the possible causes of epithelial cystic growth. In this particular instance there appears to be merely a perversion of an ordinary physiological process.

We may, therefore, surmise that both dental and dentigerous cysts may occasionally be due to such a cause as would give rise to this cyst of eruption, or to some other cause at present unrecognized. An eruption cyst with the deciduous, or any other tooth presenting, is to all intents and purposes a dentigerous cyst, and should consequently, I affirm, be classed as an odontome.

Apart from the effects of infection, of certain light rays, of thermal changes, of trauma and of certain drugs on the proliferation of cells, we know only too little about the causes of cell growth.

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The *cyst of eruption over a permanent tooth which has a deciduous predecessor* may originate either in the same way as the eruption cyst of a deciduous tooth or it may be a cyst caused by a deciduous tooth which has been shed, the cyst remaining in the path of eruption of the permanent tooth, as shown in the diagram.

Finally, with regard to the *multilocular cyst*, we have no certain knowledge about its cause or source of origin, and after the possible sources of origin as shown in the diagram (fig. 15) I would put a large note of interrogation. I recently saw such a cyst present with all three permanent molars *in situ*.

Taking into consideration the recent paper by Drs. Critchley and Ironside on "The Pituitary Adamantinomata," published in *Brain*, 1926 (vol. xlix, part 4), and

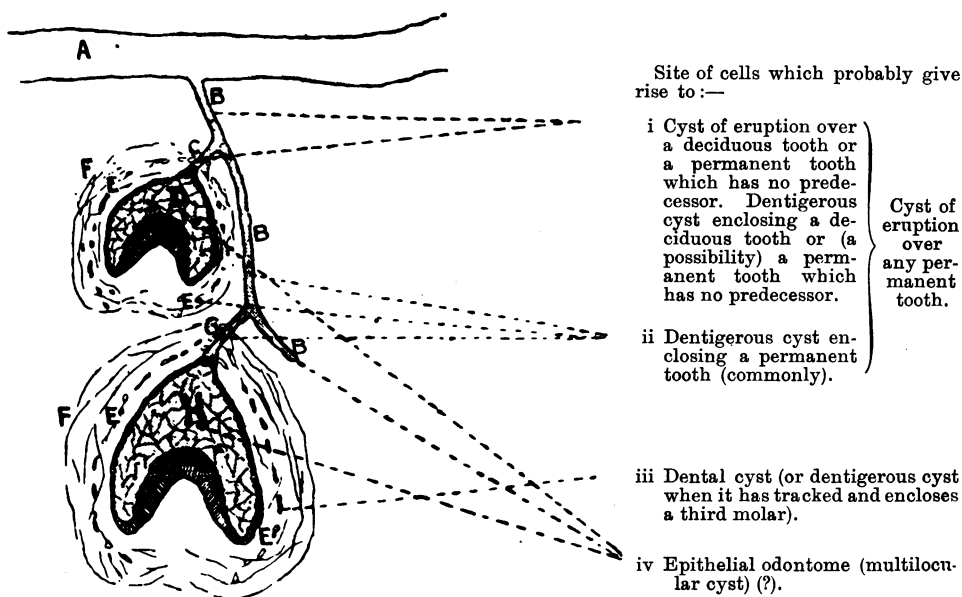


FIG. 15.—Diagram of named parts of epithelial dental formative organs. (This diagram is not true of any age.) A, surface epithelium; B, tooth band; C, remains of neck of deciduous enamel organ; D, deciduous enamel organ; E, sheath of Hertwig; F, tooth follicle or sac; G, remains of neck of permanent enamel organ; H, permanent enamel organ.

referred to in the *British Dental Journal*, March 15, 1927, I think that there may be some similarity in the origin of multilocular cysts and the somewhat similar epithelial growths of the anterior part of the pituitary body, although I am inclined to believe that the histological similarity of the cells of both these growths to those of the normal enamel organ has been somewhat overstated. Apparently the stimulus which gives rise to the multilocular cyst is not necessarily one peculiar to their situation in the jaws such as the immediate vicinity of micro-organisms and toxins to septic teeth or trauma.

It has been thought that the multilocular cyst may be due to an atavistic tendency to polyphyodontism, but one cannot readily see that the intracranial growths can be ascribed to such a cause, although it is true that the epithelium from which

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they arise was once in direct continuity with that of the tooth-bearing area. I am reminded of a case reported several years ago in the French press, of the continued backward growth of the maxillary tooth band beyond the third molar, which gave rise to many teeth in excess of the normal number in the neighbourhood of the orbit.

[*Most of the exhibits referred to in this paper have been presented to the Odontological Section of the Museum of the Royal College of Surgeons, England.*]