

Section of Odontology.

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Do Epithelial Odontomes Increase in Size by their own Tension?

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IN the "Report on Odontomes," published by the British Dental Association in 1914, Bland-Sutton's term "epithelial odontome" was used to include the three cystic tumours, dental, dentigerous and multilocular cysts, which arise from the epithelium especially concerned with the development of teeth. Such epithelium for convenience was called dental epithelium.¹

So closely allied are all three types in their origin and development that many points of consideration apply to each one. The particular point I wish to make is that the increase in size is due to the tension within the cyst and that it ceases when the cyst is opened. I have little doubt that the answer to the question used for the title of this communication would be readily given by many of you in the affirmative. This probability induced me to undertake an investigation into the tension of these cysts. Apparatus was devised for the purpose, in which I was aided by my colleagues, Professor McIntosh and Mr. Counsell, at the Bland-Sutton Institute of the Middlesex Hospital. The apparatus has been improved gradually, but unfortunately lack of suitable material has prevented the pursuit of the subject fully, for although the inquiry has extended over many years, cysts which are large enough, and have not been injured or infected, seem to be comparatively rare.

Our investigations show undoubtedly that the tension is higher, in some cases considerably higher, than the capillary blood-pressure, but our methods have not been sufficiently accurate for a statement to be made of the exact tension. Leonard Hill [1] has determined the blood-pressure in capillaries to be about 3.5 cm. of water. One of our cysts recorded over 100 cm. of water and 12 cm. was the lowest record.

I will not trouble you with details of the apparatus. A special cannula was found necessary, as in our earlier experiments the needle became choked or sufficiently obstructed to prevent a quite accurate record. A semi-fluid nature of the contents of many cysts is commonly observed, whilst isolated degenerated cells are readily found microscopically [2 and 3]. The improved cannula (fig. 1) has an opening at one side, which is closed when inserted and opened by rotating an inner tube with a hole to correspond with that in the outer tube. The manometer with a mercury U tube was employed in most cases, but an aneroid type was also used.

¹ The Committee responsible for the Report wished to keep closely to the classification of Bland-Sutton and so extended his group, so well named, to include the three cysts arising from the dental epithelium. "Cystic odontomes" was suggested at the time and probably would have been better, as some confusion may arise from the alternative uses of "epithelial odontomes."

In making a record many factors needed to be kept in mind, such as the level of the cyst and the manometer, an elevation of one over the other giving an inaccurate reading. The apparatus used can be examined and drawings have been made for the epidiascope, also sections for the microscopical examination have been put up. One of the latter shows the point of the junction between the epithelial lining and granulation tissue.

The ætiology of tumours is obscure and is discussed by Kettle in his excellent monograph upon the "Pathology of Tumours." Amongst the many factors the rôle of irritation is important. The cells giving rise to the particular cysts under consideration proliferate as the result of a stimulus associated with changes in the surrounding tissues, induced most frequently by chronic infection—a general statement applying almost certainly to the dental and multilocular varieties and quite possibly to the dentigerous cyst as well.

It is quite clear that proliferation of the cells occurs and that degeneration supervenes, so that a peripheral layer of active cells is present, surrounding a central fluid or semi-fluid area of degenerated cells. Usually a single cavity is present in the dental and dentigerous cysts, whilst innumerable cavities are found in the multilocular variety. It has been argued that the cells degenerate because the nutriment necessary to their existence is cut off. This may be an important factor, but another of perhaps greater importance would seem to be that the life history of the cell is

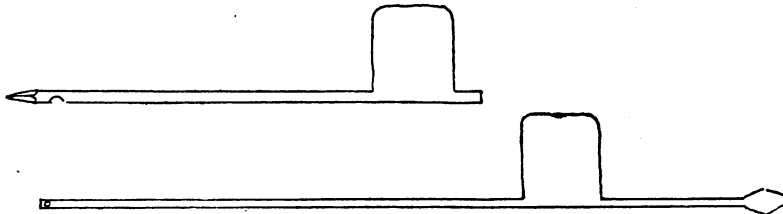


FIG. 1

completed. Very little is known of the life history of the cells in the body; nevertheless the duration of the life of a red corpuscle has been determined, and it is probable that a definite period of life will be estimated for all the cells of the body as our knowledge increases.

The chief interest in the dental epithelium has of necessity resided in connexion with the development of the teeth themselves. It certainly plays a part in their eruption, but after complete eruption we have nothing beyond our histological knowledge. A suggestion has been made that the teeth possess an endocrine function, but although this is a possibility, it is merely a theory. That the duration of life of the cells producing these cysts is the chief factor in degeneration, is supported by the character of a multilocular cyst, where quite minute cysts are found and degenerated cells can be seen enclosed by a single layer of active cells very little removed from a good blood-supply.

The rate of growth of a cyst is significant. The period of time during which one has been noticed is always considerable, and, if the cyst is large, that period may extend into years; in fact it might be said that the size varies approximately with the length of time that it has been present, but growing more rapidly in the early stages. It may be noted that the tension would diminish with the increase in size. The nature of the tissue in which it is situated certainly affects the rapidity of change in size, for once the bone is destroyed, for a short period there would appear to be a greater increase due to less resistance to the tension of the cyst. The globular shape assumed by each cystic cavity might be regarded as proving conclusively that tension exists within it

and also exerts an equal pressure in all directions upon the surrounding tissues. Inequalities of shape are produced by variation in the resistance to the rate of absorption of surrounding structures; for instance, dense bone is absorbed slowly, whilst in the multilocular type there is considerable variation in size of the individual cysts, which may remain massed together, but not infrequently extend along planes of least resistance; such projections, in a sense, become interlocked with the surrounding tissues.

The growing cyst is of an innocent character. The active cells do not infiltrate the surrounding tissues, as occurs in a malignant growth, but they push these tissues aside, causing atrophy with some proliferation, the fibroblasts producing an adventitious capsule, whilst new bone is formed and may continue until the rate of new formation cannot keep pace with the increase in size of the cyst, when perforation of the bony covering results. The thin layer of so-called "expanded bone" over the cyst accounts for the feeling of "egg-shell crackling." The tension within the cyst aids the recoil, so that such feeling is obtained more readily before an opening of the cyst into the mouth has occurred. Mr. Sprawson [4] pointed out that the cells in some cysts presented a more flattened appearance than in others; he observed this in dental cysts. I attribute this flattening to the degree of tension, and consider that where the tension is high the cells become more flattened. This statement one should be able to corroborate.

Cysts are found which do not possess an epithelial lining. Some of these have been regarded as cavities in the bone resulting from infective processes which lead to destruction without sufficient new formation to occupy the area destroyed. It is difficult to conceive that with the cessation of suppuration the cavity does not become occupied by organized granulation tissue. Mr. Mummery [5] recently recorded a multilocular cyst, a case of Mr. Pitts, in which the large cavities were not lined with epithelium. Those cavities which can be regarded definitely as cysts were lined at one time, partly if not wholly, by epithelium. It is possible that the cells may have reached their full period of activity and may have degenerated, their life history being complete. Also this may occur partially, small patches being left which remain active. Histological examination will frequently show that active epithelial cells line part of a cyst, whilst the remaining surface is covered by granulation tissue, a condition found in cysts which have become infected. It is also conceivable that as a cyst becomes large the pressure upon the lining cells may induce atrophy in them; also that attenuation of the epithelial lining may be followed by its rupture, when granulation tissue will form on the surface of the intervals produced. The increase in tension may be partly due to osmosis, but the osmotic tension of the contents has not been determined. The blood-colloid tension is given by Leonard Hill as from 25 to 30 mm. of Hg, which will be counteracted in some degree by the colloidal nature of the contents of the cyst.

Doubtless many of you have observed pulsation at the orifice of a cyst which has ruptured externally, the fluid in the orifice advancing and receding with each heart beat. In one case under my care the pulsation was so marked over the whole cyst wall that a tracing was taken by placing a tambour of a polygraph upon it whilst a tracing of the radial pulse was recorded at the same time (fig. 2), kindly taken by Dr. Bedford, of the Middlesex Hospital. I should add that the pulsation was so marked that the opinion was expressed that the wall of the bony cavity must contain one or more arteries of an appreciable size, but I was quite satisfied that the granulation tissue was sufficient to account for the pulsation. This assumption was supported by the absence of undue hæmorrhage after complete removal of the capsule. It would seem that the tension within the cyst causes atrophy of the surrounding tissues at a point where vascular resistance is higher than that of the normal capillary tension. It is conceivable that the expansion of the cyst continues until the reactionary pressure becomes higher, this being due chiefly to the closer association with vessels of greater tension.

The granulation tissue lining the cyst will then be related with such vessels and may account for the marked pulsation. The feebler pulsation of the fluid seen at the orifice of a perforation into a cyst is easily explained by the presence of granulation tissue lining a bony cavity.

A final argument in favour of the view I have advanced is that the cyst when freely opened ceases to increase in size, in fact the cavity will frequently diminish, a clinical aspect of considerable importance of which surgeons have availed themselves.

I have brought this communication before you, partly with the hope that you may be good enough to provide me with more material for investigation. I should be glad to take the cases into the Middlesex Hospital, where the dental surgeons are fortunate enough to have eight beds under their care.

REFERENCES.

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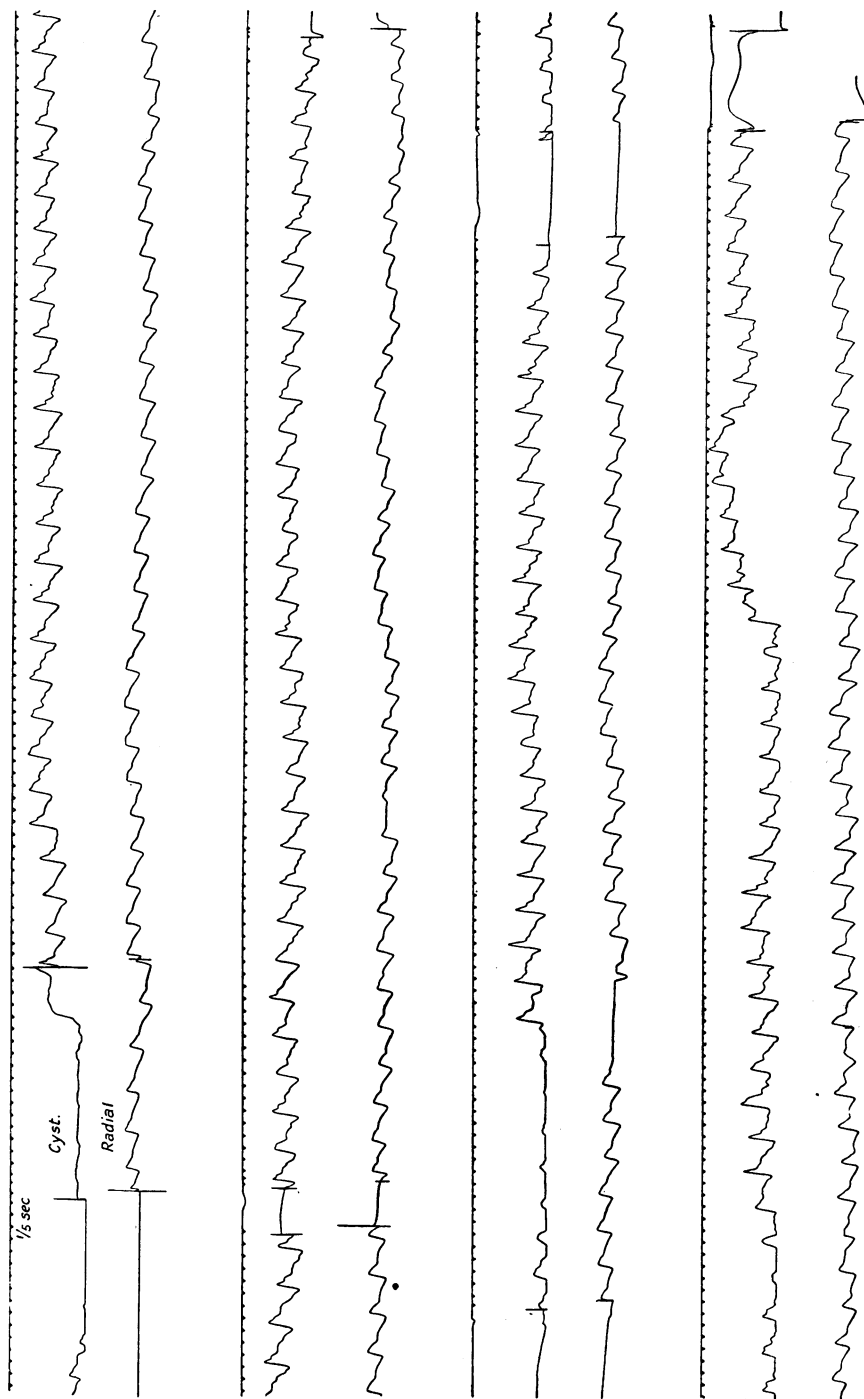


FIG. 2