

THE RELATION OF THE INNER
BORDER OF SUBGINGIVAL
CALCULUS TO THE ZONE OF
DISINTEGRATING EPITHELIAL
ATTACHMENT CUTICLE

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**THE RELATION OF THE INNER BORDER OF SUBGINGIVAL
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IN THE original description of the zone of disintegrating epithelial attachment cuticle (zdeac),¹ the statement was made that "in most places its course conforms to the course of the near-by border of the hard calculus found on such specimens."

The zdeac accurately indicates the location, before the tooth was extracted, of the outer border of the epithelial tissue (the epithelial attachment) attached to the tooth. Likewise, it indicates the extent to which the soft tissues have been removed from the surface of the tooth, in the course of the almost universal disease process, periodontoclasia.

By the inner border (or edge) of the calculus on a tooth is meant that part nearest to the zdeac and therefore nearest to the outer border of the living epithelial cells attached to the tooth. The purpose of this paper is to direct attention to the close relation of the inner border of subgingival calculus to the zdeac.

Material and Methods

Formalin-preserved specimens are selected. On teeth from young people the calculus is usually located on the enamel and, therefore, above the cemento-enamel junction line. On those from older persons, depending upon the progress that has been made by the disease process, often the calculus extends well below the cemento-enamel junction and then is located on the cementum. As the location of the zdeac moves apexward, usually calculus continues to build and follow close behind. The continuously changing location of the zdeac apexward is well illustrated in a recent paper² which is recommended to those to whom this may not be entirely clear.

In general the same equipment and technical methods are required as those originally described¹ for demonstrating the zdeac. The specimen, without brushing or cleaning, is stained in crystal violet solution (0.5 per cent in water) for one-half to one minute. It is then brushed off (medium Masso brush) and rinsed in running water. It is now ready for examination while still wet, with the aid of incident lighting, under the dissecting microscope or under very low powers of the compound microscope.

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Such stained and brushed off specimens may be allowed to dry and are useful for further study, and for demonstration to others. Such dried specimens may be permanently mounted by placing the interesting side or area onto a coverglass and running a few drops of Clarite or balsam under it. Such mounted or unmounted stained and dried specimens can be kept for long periods of time. They are convenient and ready for demonstration to students or others.

Observations

There is more or less variation in the width of the zdeac on different tooth specimens and at different locations around a given specimen. The apexward border of the disintegrating zone merges into the normal (not disintegrating) epithelial attachment cuticle. Therefore, there is no sharp line of demarcation between the affected and unaffected parts of this membrane.



Fig. 1.

The occlusalward border of the zdeac consists of cuticular material in varying stages of disintegration. There are loose particles, many of which are removed by the method of preparation suggested previously. In addition, there are partially detached particles, some of which also are broken off and removed by the brushing. Under any circumstance this side of the zdeac presents a ragged, irregular outline.

The tendency of the location of the zdeac and that of the inner border of subgingival calculus to conform to each other, and the close relation between them, may be illustrated by several photomicrographs taken of selected specimens. Fig. 1 shows the zdeac running somewhat diagonally across the root

about one-third of the way down. Note that where the calculus projects farthest the zdeac gives way to it. At places the zdeac appears to project into gaps between advancing knobs of calculus.

The parallel relation of the zdeac and the inner border of the calculus scales on enamel is shown in Figs. 2 and 3. In Fig. 2 representing the condition in the fairly early stage of periodontoclasia, the calculus is thin and in patches. Note that the zdeac is about the same distance from, and follows the same general course as, the inner border of the calculus. At the far right side of the picture a scale of calculus projects into the zdeac. In Fig. 3 the calculus is thicker or heavier, and in places gives the impression that it was encroaching upon the zdeac. Note the gap in the calculus near the middle of the picture where the zdeac has not been forced downward quite so far.

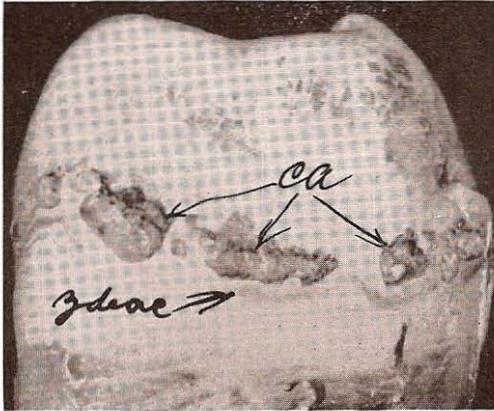


Fig. 2.

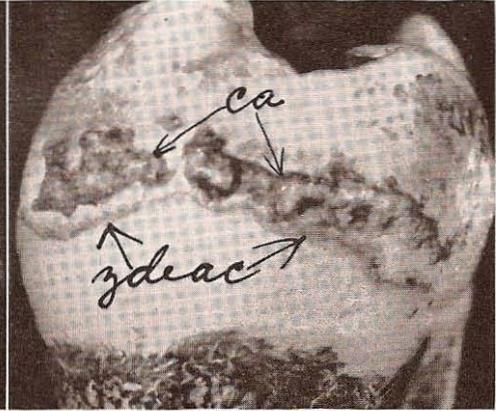


Fig. 3.

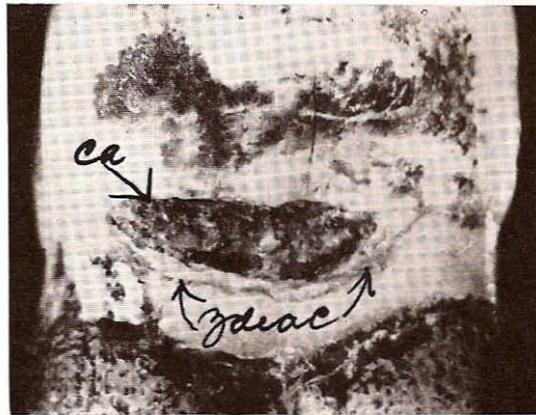


Fig. 4.

In Fig. 4 the occlusalward part of the calculus lies over the cemento-enamel junction. The zdeac dips, crescent-like, giving way to the advancing inner border of the calculus. In Fig. 5 the calculus, most of which is below the cemento-enamel junction, presents an irregular inner border, to the general

outline of which the zdeac conforms, but it does not project into the indentations.

Fig. 6 shows the course of the zdeac following, in general, the course of the inner border of the calculus, closer in some places than in others. On the right side of the picture the heavy calculus had been cracked off in the manipulations of extraction. In Fig. 7, where the periodontoclasia lesion extended as a pocket far down upon the side of the root, the course of the zdeac is seen to conform, in general, to the border of the advancing calculus. At some places knobs of calculus seem to project into the zdeac.

In Fig. 8 the zdeac runs from the cemento enamel junction at about midpoint diagonally halfway or farther along the root. Calculus which was present in the large, deep pocket on the labial side conforms, in general, to the course of the zdeac. Much of the deeper calculus consists of thin, irregular, patchy scales. On the other side the periodontal fibers are still present nearly to the cemento enamel junction, indicating that little or no destruction had occurred on this side. Note that the zdeac runs toward the incisal edge and is not satisfactorily visualized, in this specimen, above the cemento enamel junction.

Fig. 9 is a good example of a band of hard calculus, at this time located along the course of the cemento enamel junction. The course of the zdeac conforms to the general course of the inner border of the calculus. Along the middle of the picture the deeper part of the calculus consists of separate knobs or lumps, not so close to the zdeac.

Higher magnification of selected fields permits more accurate presentation of the relation of the zdeac and the inner border of calculus. Although all the specimens were brushed off as described previously, to remove soft cellular and bacterial material, some of them still had enough stained material (bacterial) left on the calculus and in cracks and depressions on it to make the calculus photograph dark.

Several of the specimens were allowed to dry for long periods of time. These were photographed direct or were mounted in Clarite before photographing. Long drying causes surface cracking. Any such cracks shown in these pictures should be disregarded.

In photographing, no attempt was made to orient the picture taken exactly perpendicular or crosswise to the tooth. Some of the fields are at the very bottom of the lesion, but others are at other locations along the quite variable course of the zdeac on such different tooth specimens.

Fig. 10 is a higher magnification of an area on enamel in Fig. 2. Now the remnants of bacterial film can be seen at protected areas where this was not dislodged by the brushing. Note the ragged outer edge of the zdeac and its projection somewhat between lumps of calculus. Perhaps this indicates that the progressive change and receding apexward is caused or promoted by the encroachment of the continuously building and advancing calculus.

Fig. 11 shows heavier or thicker calculus crowding the zdeac on enamel and corresponds to the fairly early stage of the periodontoclasia disease process.

Fig. 5.



Fig. 6.



Fig. 7.

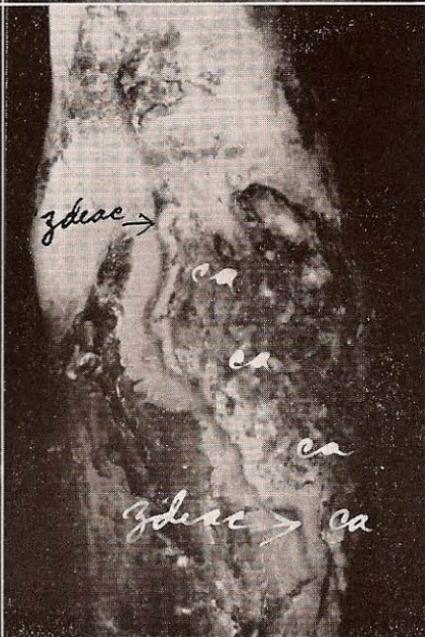


Fig. 8.

Figs. 12 and 13 are further examples of calculus crowding down the zdeac on enamel. In Fig. 12, at left, calculus is advancing toward the zdeac which is giving way to it. Fig. 13 shows the usual gap or space between calculus

Fig. 9.

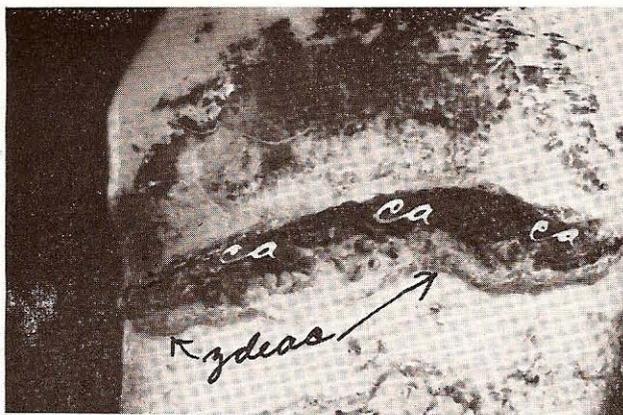


Fig. 10.

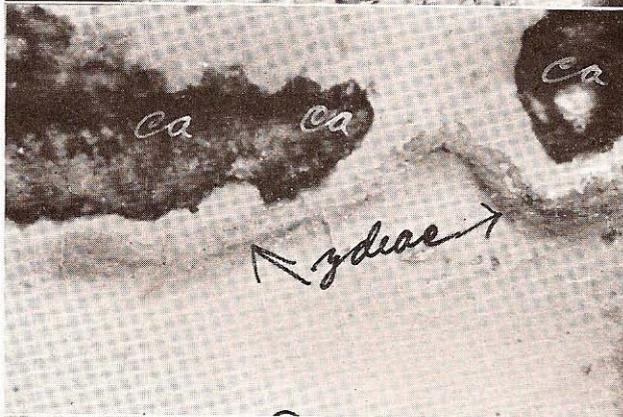
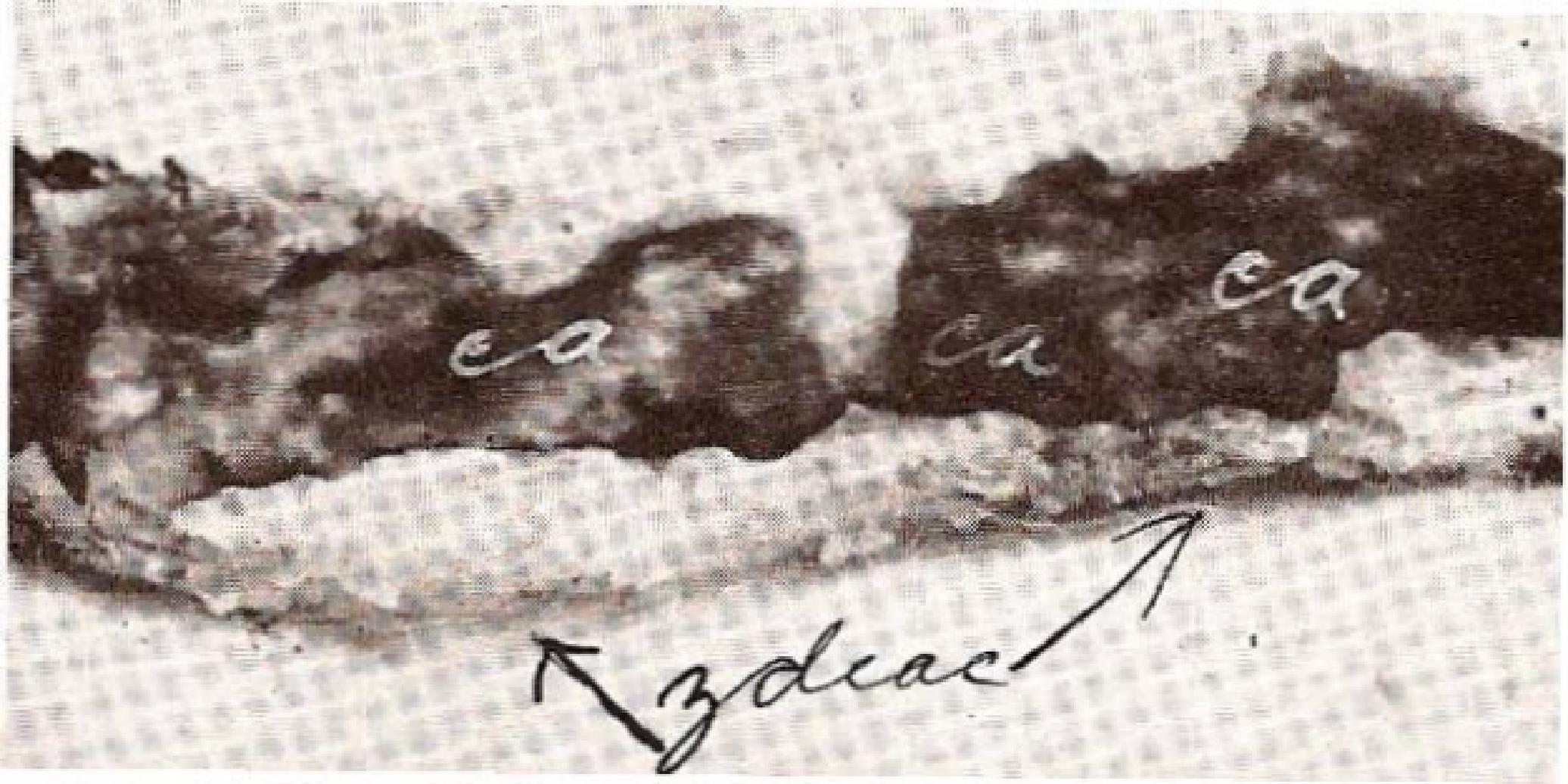


Fig. 11.



and the zdeac. Before brushing off, this space is filled with microorganismal material which overlaps the outer border of the zdeac.³

Fig. 14 shows a heavily stained thick lump of calculus. The rough, almost rasplike surface of the calculus is a constant source of irritation and injury



ca

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zodiac

to the inflamed (ulcerated) epithelial surface resting against it. Fig. 15 is a good example of what is often seen. Two lumps of forming and advancing calculus are far enough apart to leave a space in which an inverted V-shape

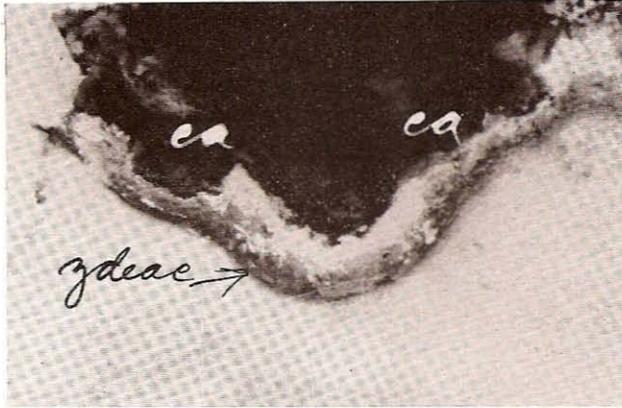


Fig. 12.

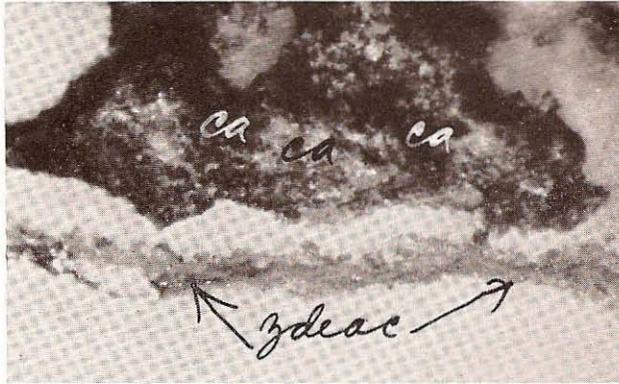


Fig. 13.

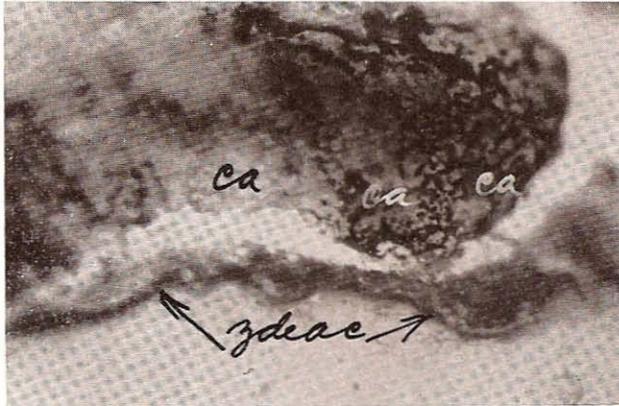


Fig. 14.

of zdeac stands up between them. Note that the inner border of these calculus lumps tends to project into the zdeac.

The rough, knobby calculus crowding down the zdeac is seen at two places, especially in Fig. 16. At the left the calculus was cracked off just

above the zdeac. Fig. 17 shows a heavy, thick lump of calculus which is made up of somewhat smooth knobs or bumps. This is not unusual and suggests some different factor or influence in its formation as compared with some other rough surface calculi. The zdeac is heavily stained and shows somewhat the

Fig. 15.

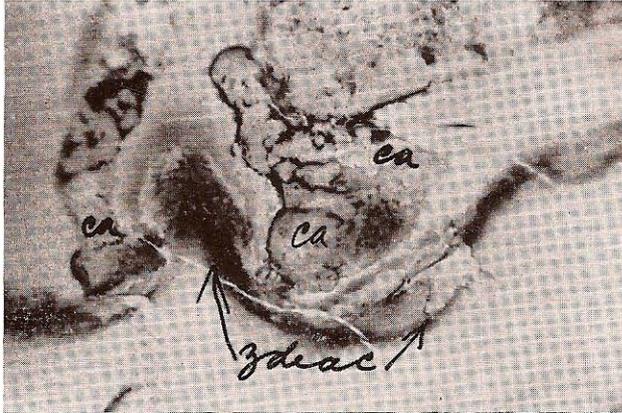


Fig. 16.

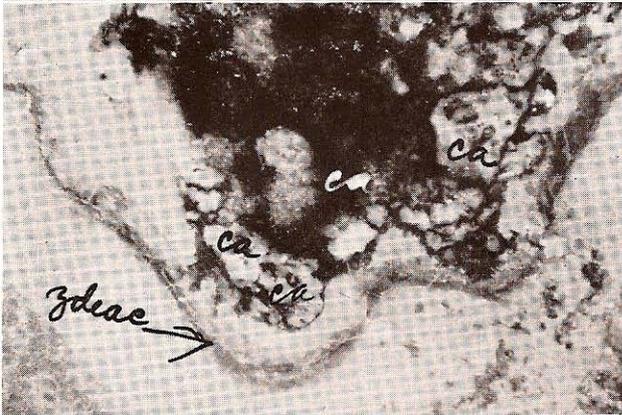
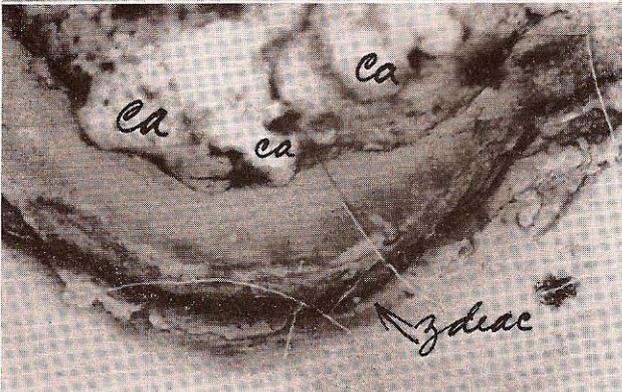


Fig. 17.



laminated appearance of this (disintegrating) part of the epithelial attachment cuticle from which the epithelial cells had been removed in the disease process.

Fig. 18 shows two lumps of rough-surfaced calculus that have nearly closed in the space between them. The piece on the left has encroached closely upon, and has forced back, the zdeac at this location. In Fig. 19 the space between the inner border of the calculus and the zdeac appears to be of approximately uniform width all along except at one place where a knob of calculus projects and encroaches more upon the zdeac.

Fig. 18.

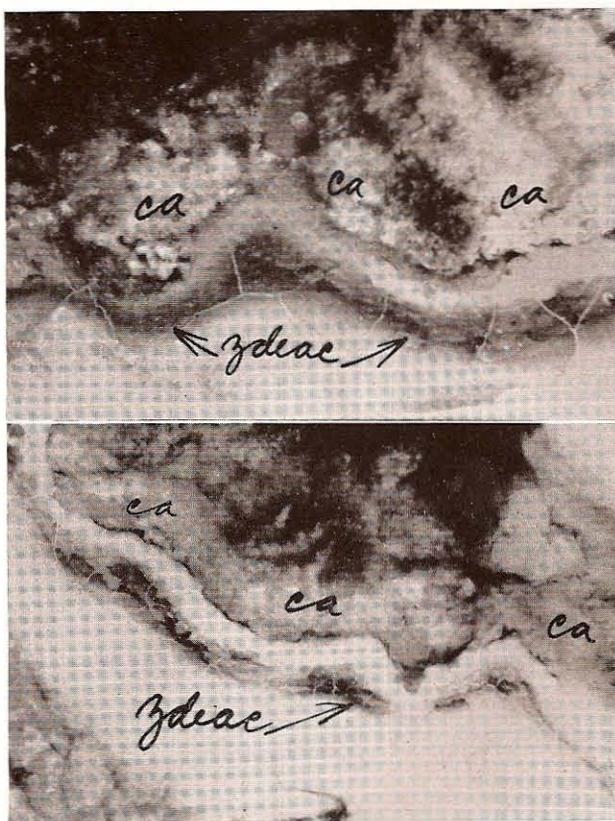


Fig. 19.

In Fig. 20 the inverted V of the zdeac extends high between two thick, well-separated lumps of calculus. At the upper part of the space between these lumps a thin, smaller scale has started to form. In Fig. 21 the inverted V projection of the zdeac between lumps of calculus and the characteristic ragged and jagged appearance of the occlusalward side of the zdeac are shown.

Figs. 22 and 23 show knobs of calculus that have been built onto or into the zdeac which tends to give way at these places especially. One should visualize inflamed crevicular epithelial tissue resting against and constantly irritated by these hard knobs of calculus (foreign material).

Fig. 24 is an example of a condition that is only occasionally seen, in which there is considerable distance from the inner border of the calculus to the zdeac. Although the specimen was brushed off as usual, some remaining fringe of bacterial material can be seen at the edge where it was somewhat protected by the thickness of the calculus. This specimen and field would tend to discount, to some extent, the idea that encroachment of the forming calculus is an essential factor in the shifting, or change apexward, of the location of the zdeac.

Fig. 25* shows a well-stained and sharply outlined zdeac with heavy, thick, knobby calculus at quite variable distances from it. The course of the zdeac is influenced, however, by the approaching projections of calculus.

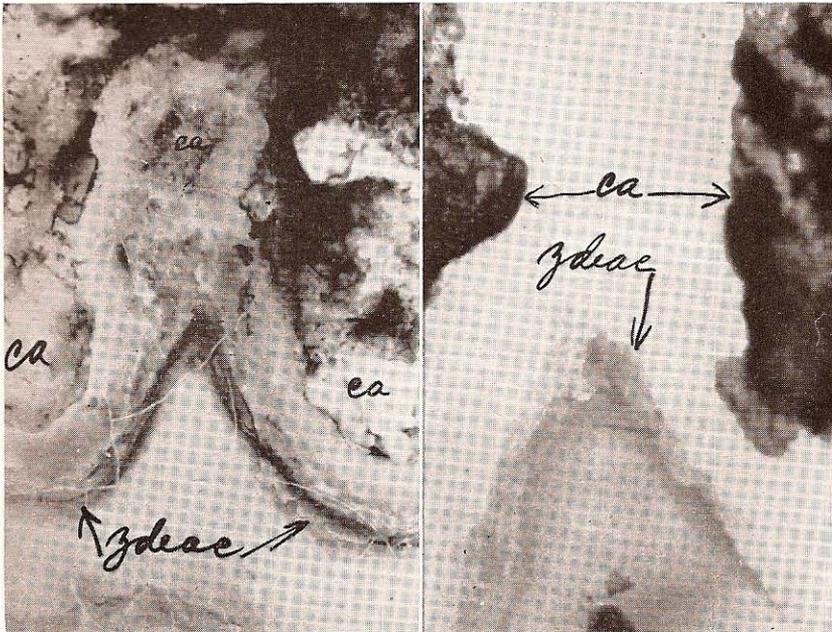


Fig. 20.

Fig. 21.

Fig. 26 shows large lumps or projections of calculus apparently made up of roundish knobs which are smooth on the outer surface. Note the usual depression of the zdeac in advance of the calculus as it builds downward, and the space in the middle where the two large lumps have not yet come together.

Fig. 27 shows thick, rough-surfaced calculus approaching the zdeac all along. At the right side of the picture a large piece of the calculus was cracked off, but a small scale, about in the center of the area, remained. This was firmly attached and considerable force was required to remove it. This is an example of what is likely to happen when large pieces of calculus are torn off by the dentist and the area is not thoroughly cleaned or smoothed. Small pieces, such as this, remain and are the nucleus onto which more calculus may be built later.

*The apparent white granules in this picture are high lights on the dry specimen and should be disregarded.

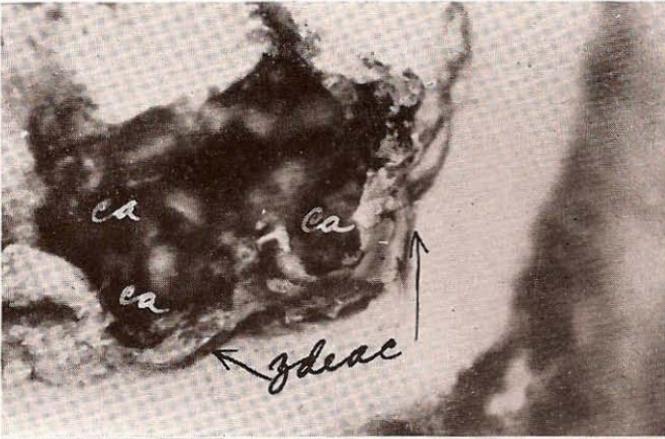


Fig. 22.

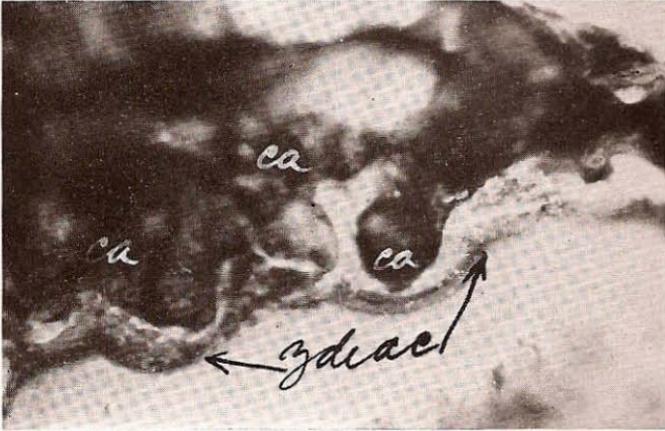


Fig. 23.

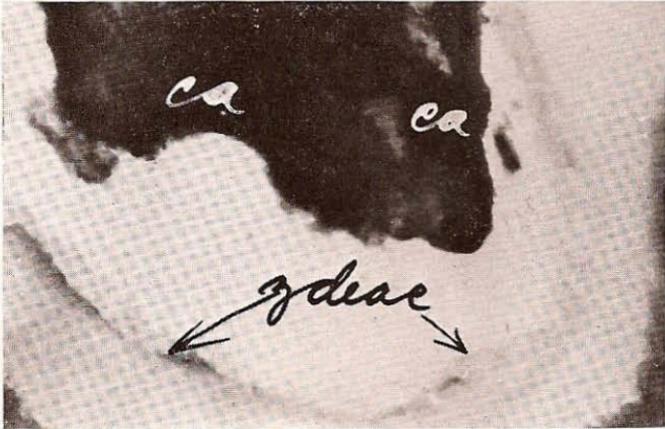


Fig. 24.

Fig. 25.

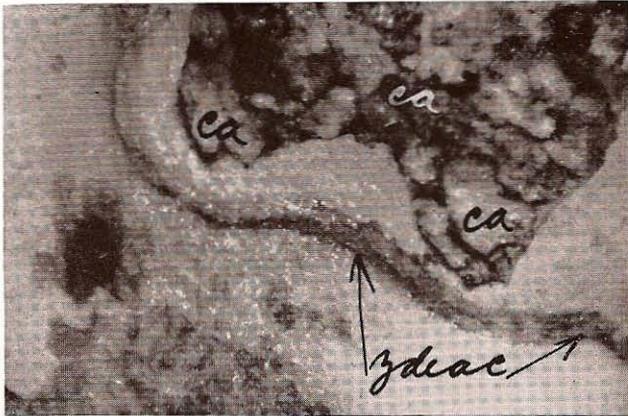


Fig. 26.

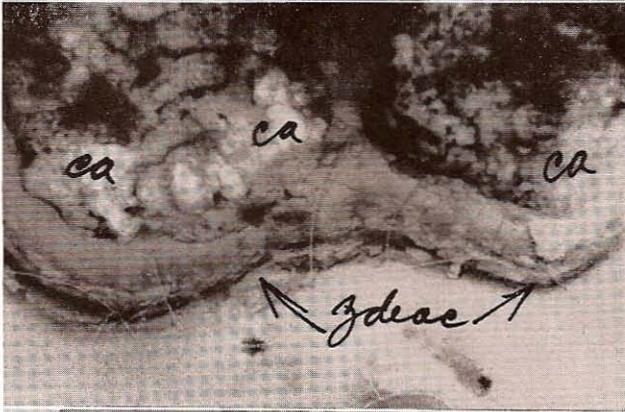


Fig. 27.



Discussion

Almost all adults (and many younger persons) have more or less subgingival calculus on from a few to many of their teeth. In most instances it extends very close to the zdeac, which is always located at the outer border of the receding epithelial attachment. The rough, hard calculus against which the inflamed crevicular epithelial tissue rests not only promotes further progress of the disease, but it also is very much in the way of effective application of the method of personal oral hygiene which is necessary⁴ for prevention of lesions and for prevention of further progress of lesions that have already developed.

Successful prevention and control of periodontoclasia, therefore, requires a clear knowledge and application of the information presented in this paper, and in addition information as to the relation of the inner border of bacterial film on the tooth, within the gingival crevice, to the zdeac, which was presented in a previous paper.³ Dental students who do not have the opportunity to examine and study large numbers of specimens prepared as indicated herein simply cannot know and fully comprehend the conditions at the locations where the lesions of this most important disease advance.

Summary

It has been shown that the inner border of subgingival calculus is closely related to the zdeac. In general the course of the zdeac about the tooth parallels that of the advancing calculus.

As the calculus builds and advances apexward the zdeac moves correspondingly, and the space between them tends to be about the same width all the way along.

The constancy of these conditions tends to support the idea of a cause and effect relationship.

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