

The Experimental Production Of Dental Ankylosis

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INTRODUCTION

In the practice of dentistry the clinician often examines teeth which appear to be ankylosed. Radiographic examination of these teeth does not usually give clear-cut evidence although microscopic examination of sectioned specimens demonstrates that an actual fusion of a tooth with its surrounding bone does occasionally occur. A review of the literature offers little valid information whereby such a condition might arise. Numerous reports are available with histologic evidence that bone may be attached to cementum, dentin or enamel. Generally, resorption is a prominent accompanying feature with bony fusion seemingly related to a healing phase. Several investigators have observed ankylosis of an occasional tooth which has occurred incidentally during the conduct of an experiment involving animal teeth. Some of the situations in which fusions have been observed¹⁻²⁴ are: "submerged" or long-retained human deciduous teeth, embedded deciduous or permanent teeth in older humans, replanted teeth, and traumatized teeth.

Only one report was found in which an experiment designated to induce ankylosis was performed. Examination by roentgenography alone indicated that no bony fusion had been produced.^{25,26}

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Our study was undertaken with a twofold purpose: to determine if dental ankylosis could be produced experimentally and (2) to investigate those conditions which would produce ankylosis.

MATERIALS AND METHODS

Over a period of two years a series of operations was performed on sixteen dogs in an attempt to induce ankylosis. The dentition of each dog was examined visually and roentgenographically. Orthodontic type bands were constructed for the four or six anterior teeth in either the upper or lower jaw or both; a compound impression was taken with the bands in place; the bands were reassembled in the impression and a stone model poured. An .038 gold archwire was constructed to conform to the labial surface of the maxillary teeth or the lingual surface of the mandibular teeth and soldered to the bands. This formed a rigid splint for those teeth.

The splints were then cemented to the teeth. The dogs were operated under general anesthesia induced by an intravenous injection of nembutal at the rate of 1 cc. per 5 lbs. of weight. A flap, including the periosteum, was laid back to expose the bone. Careful dissection exposed the roots of the selected teeth and a dental bur was used to cut a wound into the root of the tooth and the adjacent periodontal bone. The flap was then replaced and sutured into position. The banded teeth were ground completely out of incisal contact. Teeth

still in occlusion in the opposing arch were operated in the same manner to serve as controls. Some of these were banded while others were left free to function. The animals were placed on a soft diet.

Because of the peculiar anatomical shape of the mesial and distal contact areas of dogs' teeth, it was found that slice preparations prior to band construction not only simplified the problem, but actually were necessary to permit the construction of well-fitted splints. Only then could the splints be maintained in position through the dog's normal activities.

Each dog was anesthetized and his teeth examined and x-rayed at two week intervals until he was sacrificed for histologic preparation of the material. The experimental periods were from four weeks to four months.

OBSERVATIONS

In no instance where teeth were operated and left in occlusion did any

roentgenographic or histologic evidence of ankylosis occur. However, in many of the dentitions where the teeth were operated, immobilized and ground out of occlusion the roentgenograms apparently suggested ankylosis. With a prolonged experimental period a classical wound repair often resulted. Obviously, some operative failures occurred for a variety of reasons.

Subsequent study of the histologic material revealed that a number of the operated teeth which apparently showed ankylosis roentgenographically were actually repairs in which the new bone was still separated from the dentin by a narrow periodontal membrane. These cases showed typical repair of the wound with cementum covering the wall of the cavity. In one case considerable irregularity occurred in the formation of the cementum (Fig. 1). In general, the healing was similar to



Fig. 1 Showing irregular cementum formation in cavity. Dog R179 H&E X100.

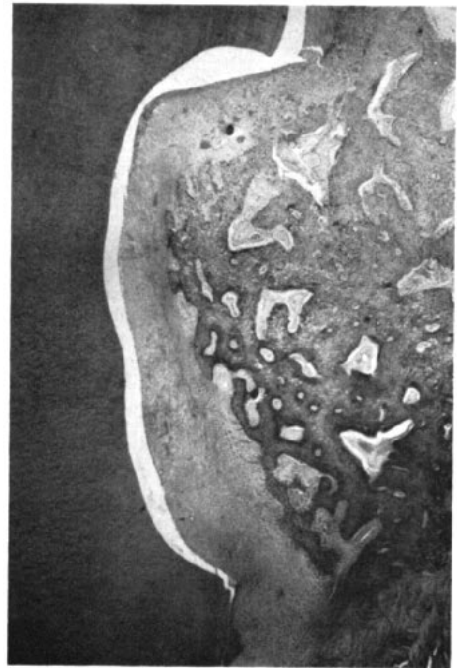


Fig. 2 Showing bone following cavity contour, with average width of periodontal membrane. Dog R177 H&E X100.



Fig. 3 Showing core of bone in central part of coronal portion pulp area. This is separated from a thin layer of cementum found covering the dentinal wall by a band of periodontal membrane. Dog R175 Gordon-Sweet X15.



Fig. 5 Showing site of bony attachment to tooth. Dog R192 H&E X15.

examples previously reported by Köhler⁷ and Orban,²⁷ as illustrated by Figure 2, where bone follows the cavity contour with an interposed average width of periodontal membrane.

Figure 3 shows an unusual example of healing in which the pulp was exposed during the operation. In this case bone tissue built into the incisal

part of the pulp canal and cementum was laid down on the former pulpal dentinal wall continuous with the root surface cementum. Periodontal tissue with attaching fibers may be observed interposed between the osseous tissue and the cementum.

In at least one animal, however, the experimental approach resulted in histologic evidence of true ankylosis. This animal was sacrificed six weeks after the operation. Figure 4 shows roentgenograms of the area before and after the operation. Figure 5 illustrates the surface of the tooth and Figure 6 the continuity of bone with tooth substance.

DISCUSSION

The review of the literature suggests that the conditions producing ankylosis

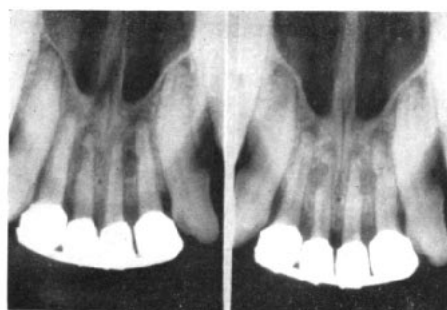


Fig. 4 Roentgenograms following initial operation and at time of sacrificing animal. Dog R192.

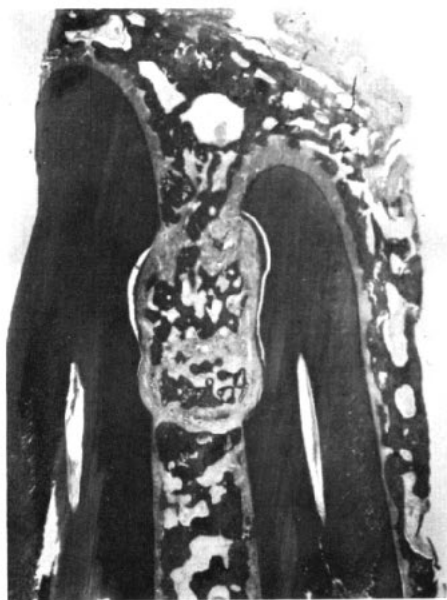


Fig. 6 Some sections removed from Fig. 5. (Tooth reversed from Fig. 5) Showing continuity of ankylosed site to deeply located bone, as traced through serial sections. H&E X15.

most often involve the factors of tissue injury, immobility and lack of function; this study would seem to verify this conclusion. In evaluating reports of ankylosis based on roentgenographic evidence, our work would suggest that such evidence is not valid. Indeed, several of the experimental animals showed roentgenographic evidence of ankylosis which was not substantiated by histologic examination of the material. It is interesting to note that the ankylosis may occur at only a microscopic point on the tooth. This would substantiate a suggestion for clinical action by Biederman²⁶ that "apparently" ankylosed teeth be anesthetized and mechanically broken loose. If the area of ankylosis is small, the fracture of this fusion and restoration of mobility to the tooth may well reverse the process.

SUMMARY

This report presents the details of a

series of experiments to produce ankylosis in dogs' teeth. The dogs were anesthetized and their teeth examined roentgenographically. Splints were formed and cemented to immobilize selected teeth. The investing tissues of these teeth were reflected and the roots and adjacent bone mechanically injured and the teeth ground out of incision. While roentgenographic studies of the results sometimes seemed to indicate ankylosis, histologic study of the material revealed only one animal with true ankylosis.

CONCLUSIONS

1. This series of experiments on dogs' teeth indicates that ankylosis can be produced experimentally in vivo.
2. Since the comparison of roentgenographic evidence of ankylosis with histologic studies shows poor correlation, the use of x-rays to diagnose ankylosis is questionable.
3. Further studies should be conducted on animals to observe all stages in the production of ankylosis.
4. A study should be conducted to learn the correlation between the clinical diagnosis of ankylosis and the histologic picture. This should be done with roentgenographic examination as a concurrent study.

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