Dens in Dente
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What is This?
DENSI N DENTE

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"Dens in dente" (one tooth in another, or tooth inclusion) is one of the rarest malformations of human teeth. Since 1874, when this condition was first reported by Baume, not many more than a dozen cases have been described in dental literature, and several of these are recorded in such a cursory manner that exact conclusions as to structure and significance are impossible. Therefore, when I was fortunate enough to come into possession of a perfect specimen of "dens in dente," and to obtain serial histologic sections, it was necessary to study and analyze all previous cases of this kind. All reports bearing upon this problem will be enumerated in approximate chronologic order, and then discussed individually before describing my own case.

CASES OF DENS IN DENTE, OR RELATED DENTAL MALFORMATIONS, IN DENTAL LITERATURE


Baume, in his Textbook of Dentistry (1877), illustrated a case of what he called "development of a tooth within another." This tooth (which had been described by Baume in the Deutsche Vierteljahrschrift für Zahnheilkunde, in 1874), an upper cuspid of unusually large dimensions, was removed from a patient whose upper lateral incisors had been congenitally missing. Therefore, Baume concluded that the abnormal dental tissues, enamel and

1 See the alphabetic bibliography at the end of this paper for the original references, here and throughout the descriptions.

* I could not obtain, in Chicago, the original reports by Bodenheimer and Gnamm. Therefore, I am unable to consider Bodenheimer's case, which is only mentioned by Peckert (21); Gnamm's case, however, is described in detail by Peckert, and therefore, I shall use this reference for my discussion.

49
dentin, attached to the lingual surface of this cuspid represented the crown of the missing lateral incisor. This conclusion hardly seems justified in view of the fact that, in the abnormal dental structure contained within the cuspid, the enamel (d) lines a central cavity (f), whereas the dentin is found on the outside of this layer of enamel. If Baume's case were actually a union of lateral incisor and cuspid, we would expect, using our knowledge of united or fused teeth, to find the dentin inside of the enamel surrounding a more or less developed common pulp-chamber. Furthermore, Baume reports that the dentinal tubules of the cuspid surround the enamel crown of the included incisor tooth in a wide circle. This observation is almost conclusive evidence that the "included lateral incisor" of Baume is in reality an invagination of the enamel of the cuspid into the crown, very similar to the malformation of a cuspid described by Miller. Zeckendorf, doubting Baume's conclusions as to the fusion of lateral incisor and cuspid, suggested that absence of the lateral incisor was purely incidental, particularly since the cases of Busch, and Zeckendorf's own, showed that such a malformation may occur in mouths in which all other teeth are normally formed and in place.

Salter (1875) uses the term "warty tooth" for the malformation he studied, because this tooth, an upper lateral incisor, showed on its labial surface an irregular, warty lobulated mass. Salter prepared a labiobuccal ground section, which revealed the presence of several small tooth-like structures projecting from the distorted outer wall of the incisor into the pulp chamber. The largest of these projections (plainly visible in his illustration) contains a heart-shaped cavity, which at first sight might be mistaken for a pulp chamber. However, Salter's description of the structure of this projection and a higher magnification of its wall disclose that the inside of this dentinal projection was lined with enamel. He stated that "on the outer surface (of the whole tooth, Ref.) is a layer of enamel, not only covering the exterior surface but also that (produced by the involution) of the heart-shaped cavity within it." Evidently Salter had the correct idea of considering these small, tooth-like structures not as fused additional tooth elements, but as a result of "the involution of the surface, which originally had within it many papillary and folded processes." Salter's case may be classified either as a dens in dente, if one considers the one tooth-shaped projection into the large common pulp-chamber; or, with Salter, as a form of odontoma, considering the presence of irregular masses of dentin, enamel, and vascular canals in other portions of the specimen. At any rate, presence of enamel on the inside of the dentin of the "inner" tooth is especially typical of all folding processes of the tooth surface (figs. 1 and 6).
DENS IN DENTE

The largest number of examples of dens in dente was reported by Busch in 1897. He was also the first to use the term, "dens in dente." Busch observed several typical cases, considering them to be twins formed by one tooth's growing completely around another smaller one. He called special attention to the fact that, in the outer tooth, the enamel is found on the outside; in the inner tooth, on the inside of the dentin. He compared the relation of the two parts to two fingers of a glove, one of which has been turned inside out and then stuck into the other. Two cross-sections in different levels through one of Busch's cases are reproduced here; they show plainly the mutual relationship of the two tooth elements, and the arrangement of the enamel on the surface and on the inside (fig. 1, A, B). Busch's cases differ from those of Baume and Salter in that the formation of the inner tooth was almost identical with that of a true and independent tooth within the pulp chamber of the outer tooth. Busch considered dens in dente a special form of true twin-formation, whereby one twin completely surrounds the other. We shall see how this opinion—erroneous, by the way—can easily be conceived from exclusive study of cross sections through specimens in which nothing can be seen of the existing connection between enamel and dentin of outer and inner teeth.

One of the most interesting dental anomalies, which seems to give the clue to the dens-in-dente problem, was reported by Miller in 1901. He described a very large upper cuspid, the crown of which was divided into eight lobes by a series of grooves and indentations. Microscopic examination of successive cross-sections through the crown revealed that some fifteen columns of enamel were suspended, like stalactites, from the dome of the enamel caps, some extending into the root a quarter of an inch beyond the neck of the tooth. In cross sections these enamel columns appear roundish, triangular, or compressed, and are usually hollow, though some of them contain a core of very irregular osseous substance or a structureless mass, apparently resulting from deposit of calcified material in the remains of the enamel organ. The presence of some fifteen such enamel columns caused many individual centers of dentin formation; between some of these, dentin fissure-shaped pulp-cavities were found. In addition to this abnormality of the crown, a small root-like structure was found within and attached to one side of the wide-open root-canal. This root showed the remarkable peculiarity that cementum lined the inside instead of the outside. This

3 It is difficult to determine the exact number of cases of dens in dente observed by Busch, because from his description it is not always possible to differentiate between dens in dente and fusions (twin formations). But at least three of his numerous cases seem to be typical.
inverted root represented continuation of one enamel column, and thus, like the crown, was turned inside out. Miller's case is interesting in many respects. Such an abnormality can be explained in no way other than as a folding of the developing tooth. This process of intussusception of one portion of the tooth into the other, with subsequent hard-tissue formation in the newly created abnormal position, can evidently occur more than once in the same tooth. In Miller's case, the enamel organ of the crown must have dipped into the pulp tissue at about fifteen different places. Nor is this invagination confined to the enamel-covered portion of the tooth, for the root of this same tooth contains another smaller root, which is also turned inside out.

Zeckendorf reported a case of dens in dente in 1910. The tooth, an upper lateral incisor of an adult, discolored and with pulp decomposed, had been extracted. Within the wide apical foramen another root-end with a fine apical opening was found. The tooth, sawed in two in a mesiodistal plane, shows, according to Zeckendorf, two root canals—one for the outer tooth, one for the inner (fig. 2). Zeckendorf suggested the term "dents télescopées" (telescoped teeth) in preference to Busch's term, dens in dente. Unfortunately, Zeckendorf does not report histologic findings in this tooth, nor does he give an exact account of the distribution of enamel in the outer and inner teeth. I especially regret this because Zeckendorf's case appears to be very similar to my own. If in his case the enamel were present on the inside of the inner tooth, I would be convinced that his case did not represent two "dents télescopées" but only one "dent télescopée"; namely, an invagination of crown into root, or a gigantically enlarged lingual pit.

The next report of a dens in dente is that published by Moral in 1918. His case was a supernumerary tooth in the upper jaw. In its pulp chamber there was a second tooth-like structure looking more like a true, small, peg-shaped supernumerary tooth than any other "inner" tooth published so far (fig. 3). Moral described and analyzed this case carefully, both macroscopically and microscopically. From the fact that the inner tooth contained enamel on its inside, and from the way it was attached to the outer tooth, he concluded that "the anomaly known as 'dens in dente' is not a fusion of two teeth, but it is only one tooth. An extension projecting within the tooth toward the apex resembles an inner tooth." Moral recognized very clearly that the space within the inner tooth was not an inner pulp-chamber, but a space formerly occupied by enamel epithelium, and that the true pulp-chamber of this tooth was represented by the narrow fissure-shaped cleft between the outer and inner dentinal walls. Moral, therefore, should receive due credit for having been the first to recognize the true nature of
this anomaly, as a malformation of one tooth, whereas his predecessors, 
Baume, Busch, Salter, and Zeckendorf, were of the erroneous opinion that 
they were dealing with a fusion of two teeth.

In American literature, in 1918, we find two cases of dens in dente: one 
by MacDonald, one by Kirk. Both cases seem to be true representatives 
of the anomaly; unfortunately, however, in neither case were histologic 
findings reported, and we have only gross descriptions to guide us. Kirk, 
in describing his case—a cuspid containing within its root another smaller 
tooth of similar shape—stated that the crown of the inner tooth had an 
enamel covering of normal appearance. This statement is very unusual, 
because presence of normal enamel on the outside of the inner tooth has not 
been observed in any other case of this kind. Unfortunately, Kirk did not 
show sections of this tooth, and we know nothing about the tissues within 
the inner tooth. In addition, the crown of the outer tooth was lost. There-
fore, Kirk's case was incomplete, and not as conclusive or important as the 
well-studied cases of Busch and Moral. The same applies to MacDonald's 
case. Although in all probability a true dens in dente, the description is 
very brief, and apparently no sections were prepared, and no facts on struc-
tural composition were indicated.

The cases of dens in dente reported by De Jonge Cohen (1918–19, 1925, 
and 1932) are quite different. He found this abnormality inside the root 
of lower bicuspids—a small root within another. By means of diagrams 
and photographs of specimens, De Jonge Cohen showed how this secondary 
inner root developed as the final stage of a process of folding-in or invaga-
tion of the mesial wall of the root along the mesiolingual sulcus (fig. 4). Oc-
casionally such a secondary root may appear entirely free within the pulp 
space (fig. 4, 5). It is obvious that in such an “inner” root, formed by 
invagination of root wall, the cementum must be found inside of the dentin. 
De Jonge Cohen's cases are very similar to the “root within a root” of 
Miller's case. The difference between the two seems to be that whereas 
the inner root of De Jonge Cohen's was derived from the wall of the outer 
root, the inner root of Miller's was the result of an extremely deep invag-
tination of tooth structure from the crown rootward into the root canal. De 
Jonge Cohen made the following statement, which explains different possi-
bilities of formation of a dens in dente in different teeth: “The question 
whether we shall find the dens in dente in the crown or in the root of a tooth 
depends entirely on the nature of the differentiation, and thus we notice 
that in the bicuspids the dens in dente remains located in the lower half 
of the root, while in the incisors, where the dipping-in is developing from 
the incisal edge to the apex, naturally we shall find the described deviation 
in the crown also.”
This opinion of De Jonge Cohen was corroborated by Erausquin, Pellegri
ti, and Ponte, in 1932, who described the formation of dens in dente as
the result of invagination and subsequent pinching-off of a portion of the
tooth, either crown or root. Their diagram, showing development of dens
in dente as a folding-in of the side of a root along the interradicular sulcus,
is practically identical with De Jonge Cohen's diagram.

In 1920 Lejeune and Wustrow reported anomalies of upper anterior teeth
that must be considered typical cases of dens in dente. In Lejeune's case, a
malformed upper central incisor of a child, the root was very short; the
crown appeared (decalcified longitudinal section) to be divided into two
individual crowns separated by enamel intruding from the occlusal side,
and united near the apical end. As Wustrow pointed out, it was probably a
case of dens in dente in an early stage of development—a dipping-in of the
enamel organ into the middle of the crown, and subsequent formation of
enamel in the center. Wustrow called attention to the fact that in a cross
section of Lejeune's case we would find in order, from without in, the
typical sequence of enamel → dentin → space (= pulp) → dentin → en-
amel (fig. 1, B). Wustrow observed an upper cuspid in a patient of 13.
This tooth showed unusually pronounced development of the lingual cin-
gulum; the lingual pit was as large as an ordinary pin-head. A radiogram
revealed the presence of a tooth-shaped structure within the outer tooth.
A longitudinal ground section showed that the inner structure contained a
cavity lined with enamel. The explanation of this malformation is rather
simple, if we consider all we have learned from the previous cases. The
“inner” enamel is continuous with the outer enamel at and through the
lingual pit (foramen coecum); this connection is not visible in Wustrow's
ground section because the latter does not run through this particular plane.
Therefore, the outer and inner enamels appear separated. Wustrow ex-
nplained the etiology of this malformation with a diagram showing abnormal
invagination of a projection of the enamel organ into the forming tooth.
Thus he, too, refuted the theory of a union of two tooth elements.

A very interesting case of dens in dente was described by Gnamm in 1922.
When this tooth was cut in half at right angles to its long axis, it was found
that the apical fragment of the inner tooth was loose within the pulp cham-
ber of the outer tooth, whereas the coronal fragment was firmly united with
the crown of the outer tooth. This can easily be understood from study of a
longitudinal section through my own case, which seems to be very similar
to Gnamm's. Near the incisal end of the tooth the outer and inner walls
of dentin and enamel are continuous, whereas the apical end of the inner
tooth projects freely into the large pulp chamber. The enamel of the
inner tooth was found on the inside of the dentin, covering the incisal two-thirds of this inner wall. Gnamm concluded: “The histologic structure of all cases examined so far indicates that there is always only one pulp chamber present, around which the hard tissues are arranged in a typical, although abnormal, way. So far no case of a true dens in dente has been observed in which any trace of a second pulp chamber could be found. There is no such thing as an intermediate stage between a true dens in dente and a fusion of two tooth germs.” In other words, wherever there is true fusion or concrescence of two tooth germs, we find two pulp chambers or one more-or-less-common pulp chamber, surrounded by dentin and, on the surface, by enamel; in a dens in dente, however, there is only one pulp chamber into which the “inner” tooth projects, the inner tooth containing enamel and dentin in inverse order; that is, enamel inside of dentin. Gnamm illustrated the various stages in the development of a dens in dente with a very clear diagram.

Herbst and Apffelstaedt, in 1928, revived the twin theory to explain dens in dente. They used the term, odontopagus parasiticus incresus, for this malformation and illustrated the cases of Salter, Baume, and Busch. But Herbst and Apffelstaedt apparently ignored the significance of the inverse arrangement of the hard tissues in dens in dente. For instance, in their fig. 244 one can clearly see the two fused tooth elements, each with a typical outer coat of enamel. Thus their classification seems to be based upon failure to differentiate between fusion of two tooth germs and malformation of one tooth germ.

Recently (1933) the problem of dens in dente was brought up by Hattyasy in his study of a large true denticle in a dog molar. Such large denticles, consisting of typical dentin and containing pulp tissue in an irregular central cavity, may at first glance appear similar to dens in dente. Up to this time I believe there has been no report of such a large true denticle in a human tooth.4 Hattyasy’s suspicion, however, that “according to the figures in Herbst-Apffelstaedt the cases of Salter and Baume are not true ‘dens in dente’ cases, but highly organized denticles (no enamel!),” is not justified. Had he examined the original publications instead of depending upon the reproductions in the book by Herbst and Apffelstaedt, he would have found that Salter described and illustrated the presence of enamel on

4 In dog teeth, large true denticles do not seem to be especially rare; in one of the dogs (no. 94, for instance) examined prior to 1929 by Prof. Gottlieb and me, in our study of excessive occlusal stress, such large denticles containing living pulp-tissue were observed as an incidental finding in both upper first molars. One of the denticles was lying free in the pulp: the other showed a secondary union with the dentinal wall.
the inside of his "inner" tooth, and that "d" and "e" in Baume's illustration are marked "enamel" in the original description. The only form of true denticle that might possibly have some connection with the problem of dens in dente is the type illustrated by Fridrichovsky in his figs. 2 to 6; namely, those denticles that result from folding of the dentinal wall of the tooth. Such denticles are related, in etiology and mechanism of development, to De Jonge Cohen's dens in dente. If the folding occurs in the coronal portion of the tooth, as shown by Hattyasy in his figs. 7 and 7 a, then enamel might be developed within the fold and form typical dens in dente.

AUTHOR'S CASE

My own specimen, an upper lateral incisor of a girl of 15, had been observed and extracted by Dr. Ira P. Schofield of Chetek, Wisconsin, to whom I am greatly indebted. Before extraction the radiogram revealed a large area of bone destruction around the root-end. During the last few weeks before extraction, there had been swelling, and discharge of pus through the overlying soft tissues (p. 58). Radiographically the tooth showed a marked anomaly (fig. 5). Inside the large pulp-chamber there was a round radiopaque mass separated, on the mesial and labial sides, from the outer dentin by a fine cleft or fissure. Within this central mass was an irregular cavity, which apparently was completely closed and separated from the actual pulp-chamber of the incisor. The enamel covering the outside of the tooth projected upward near the tip of the crown; it then seemed to spread out and to line the incisal portion of the secondary cavity within the crown. The similarity of these radiographic findings to the illustration of Gnamm made me think of the possibility of dens in dente. I was then faced with the difficult decision as to whether to prepare ground sections or decalcified sections. The obvious advantage of being able to cut a complete series of sections made me decide in favor of the latter method, despite the unavoidable loss of the enamel. Therefore, the tooth was decalcified, embedded in celloidin, and cut into longitudinal serial sections. The extracted tooth had an abnormally thick rounded crown, making it difficult to tell which sides would normally be labial and lingual. The lingual pit, however, could be distinguished clearly. At this point there appeared to be a fine dark opening with slightly roughened edges in the otherwise normal enamel surface. The apical foramen was wide open, the canal filled with necrotic-pulp débris.
Fig. 6 shows a longitudinal mesiodistal section through the specimen. Within the large pulp-chamber, P, is a round body of dentin, the incisal border of which is attached to the outer dentinal wall, whereas the apical end extends freely into the pulp-chamber and, in the level of the lower third of the root, ends with a short blunted extension. In the center of this dentinal formation is a mass of enamel, bone, and necrotic soft-tissue remnants, which at the incisal end are connected with the surface of the crown through a fine opening between enamel walls. The pulp-chamber continues incisally as a narrow fissure extending between and separating the two layers of dentin. On the left side this extension can be followed well into the crown portion; on the right side, it appears to be obliterated. But examination of subsequent serial sections reveals that the obliteration is only partial, as indicated by a gap between dentin walls further down in the crown. In fig. 7 another section of the same series runs through the apical foramen in its widest diameter, but misses the point of communication between the inner cavity and the tooth surface. The resulting picture is thus almost identical with Wustrow's illustration, with the difference that in Wustrow's case the inner cavity appears empty, whereas in my specimen it contains islands of bone in fibrous connective-tissue.

Figs. 8 and 9 are higher magnifications of figs. 6 and 7. In fig. 9 the incisal end is illustrated. On both sides we see sections through a duplicature of dentin, including the incisal end of the pulp-chamber. The course of the dentinal tubules in this incisal border of dentin, while not recognizable in fig. 9, is indicated in the diagram (fig. 10). This arrangement of tubules in the dentin indicates that we are dealing with the result of a folding of one and the same layer of dentin, and not merely with a close apposition of two separate dentinal layers. The outer and inner surfaces of each dentinal wall are covered by enamel; the inner enamel is still partly preserved, whereas the outer was completely lost during the preparatory decalcification. Between the two inner layers of enamel, near the surface, is a fine strand of necrotic soft-tissue; further up in the cavity the amount of tissue is greater, and islands of bone begin to appear. The lower opening between the inner layers of enamel corresponds to the fine dark opening in the area of the lingual pit, which could be seen on the extracted tooth.
Fig. 8 shows a higher magnification of the apical end of the inner tooth-like structure in fig. 7. In this area the otherwise rather smooth, inner, dentin surface shows a small cusp-like projection covered with an enamel layer of uniform thickness. The most interesting thing in this area, however, is the presence of a fine central canal, and of numerous smaller peripheral canaliculi leading from the bottom of the cavity in the crown into the pulp-chamber. These communications between crown cavity and pulp-chamber explain an observation made in almost all cases of dens in dente in which a clinical history was available; namely, death and decomposition of pulp, and subsequent periapical involvement (Zeckendorf, MacDonald, Lejeune, Wustrow, author's case). The sequence of events is in all probability this: Connective tissue and bone in the crown cavity were formed before the tooth erupted. After eruption, perhaps the connective tissue remained vital for a while through the existing vascular connection with the pulp. Soon, however, bacteria invaded the tooth through the incisal opening (fig. 9, x), and the tissue in the crown cavity became infected and died. Subsequently the pulp also underwent infective and degenerative changes, and later periapical tissues became infected. The fact that most of the infected cases were removed in patients between 10 and 15 suggests that it usually takes from one to several years for infection to pass from the point of entry on the crown into the periodontium. This might also explain why in Moral's case—a supernumerary incisor extracted very soon after its eruption—clinical symptoms of periapical infection had not yet developed. In a case of dens in dente that develops in the way described by De Jonge Cohen (fig. 4), there is no possibility of pulp infection.

In fig. 10 the findings in this specimen are reproduced diagrammatically, in longitudinal and cross section: the arrangement of the hard tissues in the cross section is identical with that in Busch's case (fig. 1, A).

De Jonge Cohen probably best expressed the true significance of the development of dens in dente when he said (quoted by Peckert): "It is quasi an apical extension of the lingual pit." This explanation can be verified by demonstrating the various steps of this malformation that lead from a normal tooth to a dens in dente (after Peckert):
**Fig. 1, A and B.** One of Busch’s cases of dens in dente. Cross sections through different levels.  
*Fig. 1, A.* Cross section through crown of twin formation. Outer tooth has coat of enamel on outside; inner tooth, on inside. Dentinal walls united in one small area.  
*Fig. 1, B.* Cross section through root of twin formation, showing partial union of dentinal walls: a, inner tooth; b, outer tooth; c, area of fusion.

**Fig. 2.** Zeckendorf’s case of “dents telescopes.” Tooth has been cut apart and shows two roots and two root canals.

**Fig. 3.** Moral’s case of dens in dente.  
*Fig. 3, A.* Tooth cracked open longitudinally; within crown is space occupied by enamel organ.  
*Fig. 3, B.* Peg-shaped inner structure taken out of large pulp-chamber.

**Fig. 4.** De Jonge Cohen’s explanation of etiology of dens in dente. Apical ends of five lower first bicuspids showing various stages of dipping-in of mesial wall of root along mesiolingual sulcus.
Fig. 5. Radiogram of author's case. Shows round radiopaque body with central cavity within crown of (slightly rotated) upper lateral incisor. Enamel of incisor seems to extend up into inner structure. Extensive periapical bone destruction resulting from decomposition and infection of pulp.

Figs. 6 and 7. Longitudinal sections through tooth. Section in Fig. 6 runs through area of lingual pit. Fig. 7 shows section in slightly more labial plane, so that inner cavity appears completely separated from outside of tooth. C, cavity within crown. P, pulp chamber.
Fig. 8. Higher magnification of middle portion of section illustrated in Fig. 7. Shows apical end of inner cavity and connections with pulp chamber.


Fig. 9. Higher magnification of incisal tip of section in Fig. 8. Shows incisal end of dentinal duplicature and, in center, communication between oral cavity within crown of incisor.


61
Fig. 10, A

Diagrams of author's case of dens in dente.

Fig. 11, A and B. Horizontal sections through crown of upper lateral permanent incisor; age 2. Shows development of lingual pit.
DENS IN DENTE

(a) The smallest degree of this anomaly is a tooth with a markedly developed lingual cusp or cervicolingual ridge and a deep lingual pit (Dent. Cosmos, 1892, 34, p. 1036, figs. 1 and 2; Endelman's Special dental pathology, 1927, p. 75, fig. 53). (b) A more advanced stage is represented by cup-shaped ("cornet-shaped") teeth, in which the lingual pit is enlarged and extends considerably into the crown; the incisal opening leading into the crown is still wide open (Zeckendorf; fig. 3). (c) In a still more advanced stage the incisal opening is almost completely closed, and invagination of the crown extends well into the root (author's case, figs. 8 and 9). (d) The last stage is the one in which the invaginated portion of the crown does not end with a blind sac, but is open all the way through the root, thus causing the appearance of an apex within an apex (Miller's case, or MacDonald's).

Histologic examination of the lingual pit in a human incisor shows that here occurs the process that was illustrated by De Jonge Cohen for the root of a lower first premolar (fig. 4). Fig. 11 shows two serial sections in different levels through the crown of an upper lateral permanent incisor of a child of 2. In fig. 11, A, the lingual pit is being formed through folding-in of the lingual wall of the tooth germ. In the folded portion, the sequence is, for obvious reasons, the reverse of that of the rest of the crown, namely, enamel epithelium in the center, then enamel, and dentin on the outside. In fig. 11, B, a section in a more apical level is reproduced. Here the lingual pit appears almost completely pinched off from the lingual wall of the tooth; it is seen as a semicircular structure consisting—in order from within outward—of enamel epithelium, enamel, and dentin, lying in the pulp toward the lingual side of the tooth. One can easily understand how an abnormal enlargement of this lingual pit in a cross section would appear very much like fig. 1 or fig. 10, B.

As far as the mechanism of formation of a dens in dente is concerned, we have to consider our present knowledge of the mechanism of tooth development. Orban has shown that the growth of tooth germs occurs on the whole in a centrifugal direction. This suggests that a dens in dente may develop not by actual ingrowth of enamel organ into underlying pulp, but by relative retardation in growth of a portion of the enamel organ, possibly at or near the lingual pit, while the surrounding dental tissues continue to expand and to grow in a
peripheral direction. The final result would then be the same as if the enamel organ were to grow into the pulp; namely, an intussusception of one portion of the tooth into another. However, it will be impossible to make a definite decision in regard to this question until suitable material (such as a dens in dente in an early stage of tooth formation) becomes available for study.

Summary of histologic findings. The case of dens in dente reported here is the result of an invagination of a portion of the crown of an upper lateral incisor into the pulp chamber, resulting in the formation of a large cavity within the crown. The outer enamel of the incisor is continuous with the enamel lining the cavity within the crown; the point of reflection of the outer and inner enamel is the lingual pit. The cavity in the crown contains connective tissue of periodontal origin, and islands of bone; at its apical end, the cavity is connected with the pulp-chamber by numerous fine canals. The pulp-chamber of the incisor, in its incisal portion, is reduced to a fine fissure, which encircles the inner body of dentin and partly separates the outer and inner dentinal layers. Beyond the incisal end of the pulp chamber, the outer and inner walls of dentin are continuous.

SUMMARY

Our present general knowledge of dens in dente may be summarized as follows:

(1) The anomaly is very rare.

(2) Among the cases reported so far, in the world's dental literature, there is an almost equal distribution among upper anterior teeth—central incisor, lateral incisor, cuspid, and anterior supernumerary teeth. In addition, a special form has been described as occurring within roots of lower bicuspids.

(3) True dens in dente is characterized by presence of a tooth-like structure within the pulp chamber of another tooth. The arrangement of tissues in the inner tooth is reversed—enamel lies inside of dentin, or cementum inside of dentin.

(4) The tooth thus affected contains two cavities: the actual pulp chamber, which opens at the apex; a second, abnormal cavity within the crown, which opens near the incisal end of the tooth. The latter cavity is lined with enamel, and contains remnants of enamel organ, and sometimes connective tissue and bone of periodontal origin.

*See the Addendum on page 66.*
(5) Dens in dente is the result of an invagination of one portion of a tooth into the other; it is not a twin formation, but a malformation of only one tooth germ.

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Addendum

All who engage in research have to depend to a large extent upon the reliability of earlier sources and references. Thus, from a study of all available literature, I believed that Baume and Salter were the first to describe dens in dente. After this manuscript had been sent to the printer, I happened to read in the work of John Tomes a description of a dens in dente of the type reported in my paper, even including presence of cementum on the enamel of the inner cavity. Tomes interpreted this malformation correctly as a deformity of one tooth and not as two teeth. His excellent description follows (John Tomes, A system of dental surgery, pp. 266 and 267; Lindsay and Blakiston, Philadelphia, 1859):

"The defective tooth, although not necessarily the subject of any very obvious deformity, is usually a little irregular in shape, and at some part slightly enlarged. The enamel investing the crown may be, and often is, perfectly well developed; but we shall find upon the crown a slight depression, in the centre of which is a small dark spot. If the tooth be divided through its long axis, it will be seen that the dark centre of the depression is in fact the choked-up orifice of a cavity situated within the substance of the tooth, external, however, and perfectly unconnected with the pulp-cavity. If the section be a fortunate one, we shall be able to trace the enamel as it is continued from the exterior of the tooth through the orifice into the cavity, the surface of which is lined more or less perfectly with this tissue. The layer of enamel which forms the surface of the cavity is, however, thinner, and less perfectly developed than that upon the surface of the tooth, and is in some cases covered here and there with a small amount of cementum."

His illustration (fig. 98) shows a longitudinal "section of an upper tooth in which a cavity is formed external to the pulp cavity. It is lined with a thin layer of somewhat imperfectly developed enamel, and communicates with the surface of the tooth at a" (near the incisal edge. Ref.). It is surprising that this excellent description has apparently been ignored for a period of seventy-five years.