The wide relation of this nerve is nowhere so markedly illustrated as during the dentitional period; convulsions, skin eruptions, diarrhœas, indeed tetanus passing to a fatal termination, are all found in the category of its associations.

RÉSUMÉ.—The fifth nerve affords sensibility to the face and associate parts. It is the nerve of motion to the muscles of mastication. It has to do with taste and smell. Indirectly it is a prominent excito-motor apparatus.

CHAPTER IV.

ANATOMY OF THE TEETH.

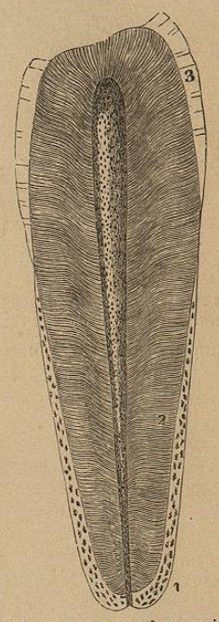
THE direct and associative lesions of the teeth being so many and so common, study of oral diseases commences naturally with these organs. Here too begins the study of dentistry proper.

A tooth is a body *sui generis;* it resembles ivory, but is not that substance; it is allied with bone, but is not osseous.

Dissection of a tooth recognizes the presence of five constituents; these are:

1. Pulp.
2. Dentine.
3. Enamel.
4. Cementum, or Crusta Petrosa.
5. Periodonteum.

FIG. 40.



Vertical section of a cuspid tooth.

Fig. 40 shows the vertical section of a cuspid tooth. 1, cementum; 2, dentine; 3, enamel. The pulp is seen occupying the central cavity. The dotted envelope of the root represents the position of the cementum. The periodonteum is a fascia attached to the cementum.

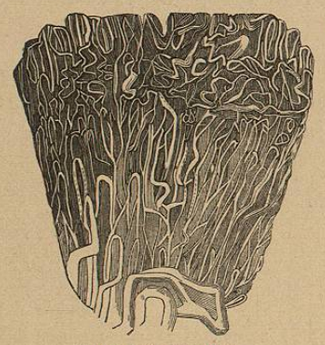
Pulp.—The pulp, exhibited here several times enlarged (Figs. 40, 41, 42), is a mass of delicate connective tissue, in which ramify the radicles of blood-vessels and nerve-filaments. It has no enveloping membrane proper, as will be understood in the study of odontogeny; it is the contracted original papilla, or tooth germ. Through the vessels of this body the internal structure of a tooth is nourished; in its death the organ loses its translucency, becoming discolored and opaque,—being, indeed, devitalized, except as nourishment is received from the periodonteum. The pulp of a tooth is so highly endowed with nerve matter that the slightest touch suffices to provoke exquisite pain.

Dentine.—The dentine, or dentinal portion of a tooth, is marked 2 in the diagram (Fig. 40). This substance is called, also, the ivory. While histological dispute exists as to the real constitution of the structure, a full surgical signification is found in accepting it as a fibro-calcareous stroma,

tubular in character. The tubuli, commencing at the enamel membrane, the original tunica propria (see *Dentition*), approach the pulp, opening into the cavity by capillary mouths, and thus receive the halitus which is their nutrition. The tubuli of dentine are in some instances almost straight, at other times curvilinear. In the neighborhood of the enamel they are dichotomous and trichotomous. Figs. 43 and 44 show these varieties of tubes. Fig. 49 shows the tubes in transverse section. The diameter of a dentinal tubule is about the $\frac{1}{3500}$ of an inch. (For mode of formation of dentine, see *Dentition*.)

Enamel.—No. 3, Fig. 40, exhibits the position and relation of the enamel as a cap to the crown portion of a tooth. This structure is almost

FIG. 41.



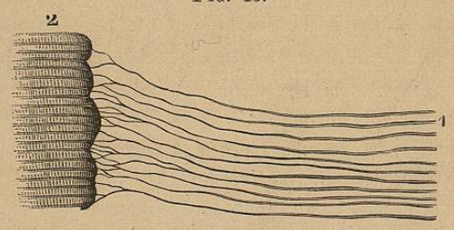
Dental pulp, magnified.

FIG. 42.

Nerves of dental pulp.

entirely inorganic in its composition, containing but about two per cent. of animal, or living, matter; it is hard, flinty, brittle, and decreases in thickness

FIG. 43.

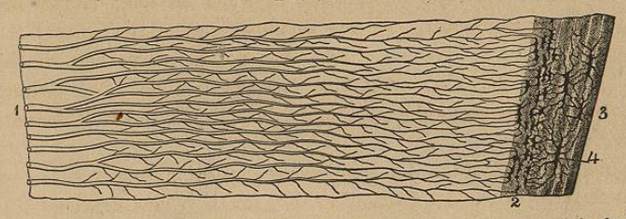


1, tubuli of dentine; 2, enamel.

as it passes from the cutting face to the neck of the tooth. In arrangement, enamel is made up of a series of hexagonal fibres, having a double direction, by which each is strengthened by its fellow as it is crossed and recrossed, one set undulating outward, another crosswise. The nutrition of enamel is received through the tunica propria. (See *Dentition*.)

Cementum, or Crusta Petrosa.—Fig. 40 (1) exhibits the relation of the cement as a sheathing to the fang. This structure so closely resembles bone

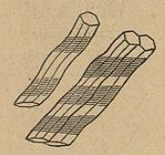
FIG. 44.



VERTICAL SECTION OF THE FANG OF A CANINE TOOTH, exhibiting the structure of the dentine and cement. 1, inner extremities of the dentinal tubules; 2, outer extremities of the tubules, terminating in interspaces at the boundary of the dentine; 3, cement; 4, lacunæ like those of bone. Highly magnified.

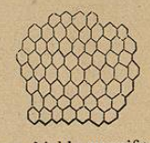
proper as to be liable to the diseases of that substance; it possesses all its chemical elements. A thick cementum contains well-marked Haversian

FIG. 45.



THREE ENAMEL COLUMNS, highly magnified; exhibiting the six-sided prismatic and waving character.

FIG. 46.



SECTION OF ENAMEL, highly magnified at right angles to the course of its columns; exhibiting the six-sided character of the latter.

canals and Purkinjean corpuscles, or lakelets; vessels from the periodonteum are occasionally traced into its substance. (See manner of its formation in chapter on *Dentition*.)

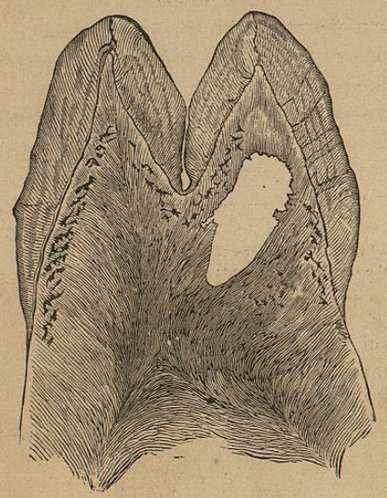
Periodonteum.—This is the analogue of the periosteum of the common osseous structures. It is a composition of fibro-cellular tissue, serving the double purpose of attaching the teeth to their alveoli and supporting the external vessels of nutrition. Originally it was simple mucous membrane forming the covering of the rudimentary jaw cartilage. At the neck of a tooth it is found dense and resisting; toward the apex it attenuates to softness and delicacy.

Interglobular Spaces.—Fig. 47 exhibits what are termed interglobular spaces, as seen in the dentine of certain teeth: these spaces possess much surgical interest, as it is to be presumed they represent an imperfect development, and thus explain the rapid breaking down of many teeth. In an excellent paper on this subject, by Dr. J. H. McQuillen,* that gentleman

* Dental Cosmos, vol. viii. p. 113.

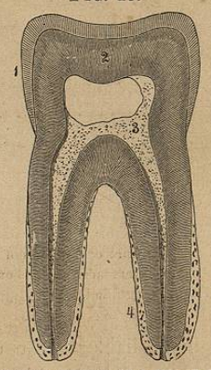
wisely remarks that it is well to direct attention to the fact that the existence of the spaces in teeth which have completed their growth must be regarded

FIG. 47.



Interglobular spaces.

FIG. 48.



VERTICAL SECTION OF A MOLAR TOOTH, moderately magnified. 1, enamel, the lines of which indicate the arrangement of its columns; 2, dentine, the lines indicating the course of its tubules; 3, thin lamina of the dentine forming the wall of the pulp-cavity, the dots indicating the orifices of the dentinal tubules; 4, cement.

as an *abnormal condition*, predisposing such teeth to decay, and that when, either by mechanical action, as by a fall or blow, or by the penetration of external caries, such spaces are reached, the *disease here would run riot;* hence the importance of care on the part of patients and operators to have the most minute cavities filled; for though reached only through a microscopical opening, the result would be the same, while, if protected from the action of external influence or the *exciting causes of decay*, this *predisposition* might remain dormant for a lifetime. Reference is here to be made to these spaces, as they furnish habitations to parasites. The cavities not infrequently communicate with one another, and are in turn communicated with by breaks in the enamel. It is not uncommon to find them occupied by micrococci. (See *Parasites.*)

FIG. 49.

TRANSVERSE SECTION OF A MOLAR TOOTH OF THE NATURAL SIZE. (The cut is made through the body of the tooth.) 1, dentine; 2, enamel; 3, cavity.

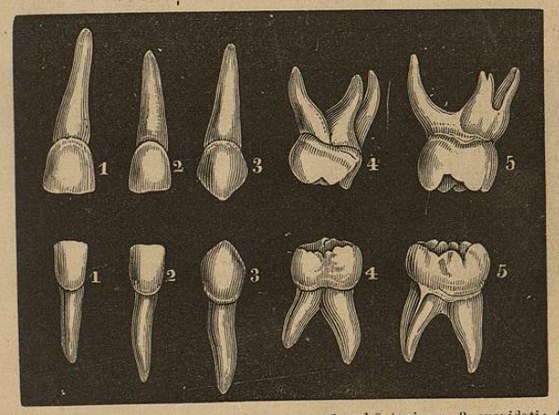
Figs. 48 and 49 represent sections of molar teeth; they will assist in comprehension of the organs. It is very necessary to have accurate ideas concerning the relations of a pulp-cavity to the external parts of a tooth. Such understanding, to be of practical use, is to be gained only through examination of many teeth. What are called the cornuæ, or horns, of pulps (extensions), are to be closely observed.

Relation of the Teeth with the Jaw.—The teeth associate with the jaw

through the intervention of a peculiar cellular bone described as the alveolar processes. (See Fig. 6.) This structure, as there seen, is hollowed into pits corresponding with the shape of the roots accommodated by them. In some persons it is very spongy, in others it closely resembles in density the cortical portion of bone; in proportion to this density teeth are found loosely or firmly fixed. It is a matter of experience that in proportion as this process is solid, teeth are found resistive of disease.

Fifty-two teeth belong to the human species. These are divided into two sets. The first pertain to infancy; the second associate with adult life.

FIG. 50.—DECIDUOUS TEETH OF THE LEFT SIDE—(After T. Bell.)



DECIDUOUS TEETH OF THE LEFT SIDE OF THE JAWS. 1 and 2, incisors; 3, cuspidati; 4 and 5, molars.

The first set, termed milk, deciduous, or temporary, consist of twenty teeth —ten in either jaw: four central incisors, four lateral incisors, four cuspidati, and eight molars; the form and general characteristics are illustrated in Fig. 50. The second or permanent set are thirty-two in number—sixteen in either jaw: four central incisors, four lateral incisors, four cuspidati, eight bicuspidati, eight molars, and four dentes sapientiæ. The derivations of these terms are as follows: incisores, from the Latin verb *incido*, to cut; cuspidati, from *cuspis*, a point; bicuspidati, from *bi*, two, and *cuspis*, point, having two points; molares, from *mola*, a mill; dentes sapientiæ, teeth of wisdom, so called from being developed in mature life.

INCISORS.—Nos. 1 and 2 of Fig. 51 represent the incisor teeth of the upper jaw, and Nos. 1 and 2 of Fig. 52, the incisor teeth of the lower jaw: two centrals and two laterals. *Labial* aspect of crown is like frustrum of pyramid, or shovel-shaped, and slightly convex. *Lingual* surface, same shape, but slightly smaller, and concave.

Laterally they are triangular, widest at neck, and represent the labial and

lingual surfaces gradually approaching one another until they unite to form the cutting edge.

When first erupted, the cutting edges of these teeth terminate in three points, which points rapidly wear away in mastication.

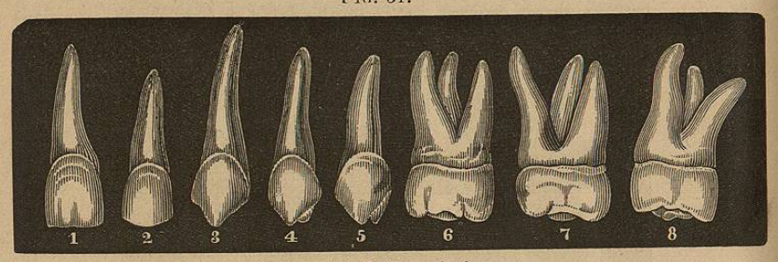
Enamel extends to greatest distance toward root on labial and lingual surfaces, and terminates at neck in a curve, with convexity directed toward gum. On mesial and distal surfaces enamel does not extend up so high, and again terminates in curve line, but in this case with convexity toward cutting edge.

In other words, outline of enamel corresponds to outline of festoon of gum.

All of these teeth have single conical roots.

Superior Centrals (Fig. 51, 1).—Larger than laterals; about one-third wider, and usually a little longer. Their greater width at cutting edges than

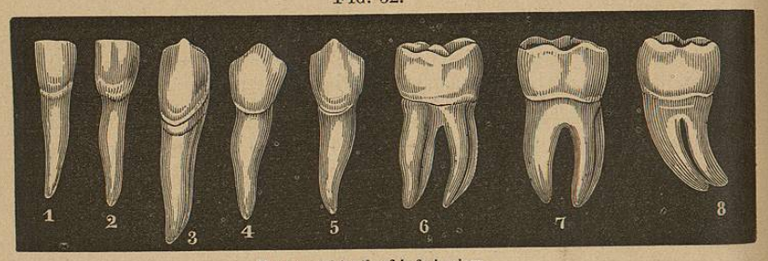
FIG. 51.



Permanent teeth of superior jaw.

at neck leaves spaces between themselves and fellows at latter point. Median side straighter and longer than distal; consequently a more acute angle at median corner than at distal. Lingual surface, which is concave, often ter-

FIG. 52.



Permanent teeth of inferior jaw.

minates near gum in a ridge, or prominence, called the *basal ridge*, or cingulum; this is most frequently found and is most pronounced in laterals; it is a favorite spot for caries.

Superior Laterals (Fig. 51, 2).—In every way smaller than centrals, but quite similar in general outline. Greater disproportion between width of cutting edge and neck than in centrals. Distal angle of crown more rounded than

same angle of central. Median surface slightly concave, and distal more convex than in central. Basal pit more strongly marked, and hence more ready to decay.

Lower Central Incisors (Fig. 52, 1).—Very much narrower than superior centrals; not much more than half the width at cutting edges. From before backward are very deep at neck; hence fangs are much flattened from side to side. Termination and outline of enamel at neck is similar to superior incisors, but there is neither basal ridge nor pit.

Lower Laterals.—Unlike the superior laterals, these are larger than their adjoining centrals in every respect, but especially in length of root. Distal angle of cutting edge is not rounded off as in laterals of opposite jaw.

Cuspidati.—Eye-, Stomach-Teeth (Figs. 51, 52, 3).—Are thicker and stronger teeth than the incisors. Crowns are distinctly conical, with a slight bulging near middle of tooth; consequently they are (unlike the incisors) convex on lingual as well as on labial surface. Crown terminates in a blunt point, and the root is much longer than that of any of the other oral teeth. Slight ridge runs from cutting edge to neck on labial surface, dividing it into two unequal portions, of which the distal is the longer. This enables us to tell the side of the jaw to which it belongs. On lingual surface a slight median ridge runs from cusp to neck, sometimes terminating in a slight prominence or cingulum. Outline of enamel on lateral surfaces is more distinctly angular than in incisors, with angle pointing toward cusp. Section at neck shows root to be a rounded triangle in outline. Synonyme, eye-teeth.

Inferior Cuspidati.—Singular, Cuspidatus, Cuspus (Fig. 52, 3).—Less pronounced in form than upper. Point more blunted, fang shorter, and lingual surface more distinctly convex. Synonyme, stomach-teeth.

Bicuspidati.—Singular, Bicuspidatus, Bicuspis (Figs. 51, 52, 4, 5).—Eight in number, two on each side of upper and lower jaws.

Superior Bicuspidati (Fig. 51, 4, 5).—Crown, as seen on grinding surface, is a rounded quadrilateral. Buccal side is larger than palatine, which latter is more distinctly circular than former. The mesial and distal sides are nearly plane surfaces, though slightly rounding toward the palatine side. They have two cusps, the external being larger and broader than the internal. A deep transverse fissure separates the cusps, and slight elevations border the anterior and posterior edges of the grinding surface. First bicuspis usually has its root bifurcated for about half its terminal length, and if not bifurcated, is deeply grooved.

Second Bicuspidatus—Superior.—Differs from first in having cusps more nearly of a size, and in having an unbifurcated root. Root is, however, constricted in the middle, in the direction of its length. Like the canine, both bicuspidati have distal slope of cusp greater than medial.

Inferior Bicuspidati (Fig. 52, 4, 5).—Are smaller than the upper, and differ considerably in shape. The buccal surface is much more convex, and dips strongly inward at the masticating surface. In the first bicuspis the lingual cusp

is so much shorter than the buccal as often to seem but rudimentary. Another distinguishing feature of first bicuspis is the joining of both cusps by a ridge of enamel instead of being separated by a fissure, as is the case with all the other bicuspidati. Roots of lower bicuspidati are rounder and less constricted than the upper,—more decidedly oval in outline. The second bicuspis is squarer and larger in all its dimensions than the first, with a higher inner cusp than its fellow. This inner cusp is often divided by a fissure.

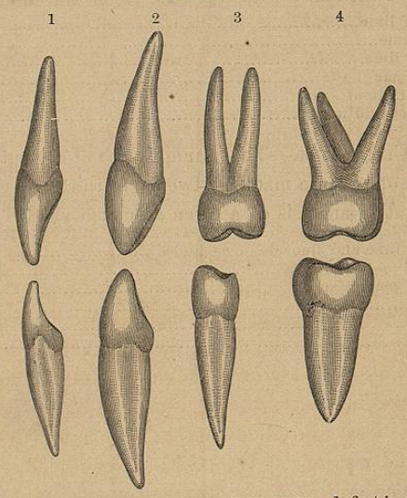
Molares—Molars; Singular, Molar.—Largest and strongest teeth. Have quadrilateral crowns, surmounted by several cusps and implanted by means of two or three roots. Twelve in number, named respectively First, Second, Third. The last commonly called "wisdom-teeth," dentes sapientiæ.

Superior Molars.—Crowns are rhomboidal in sectional outline. Buccal and lingual surfaces (more particularly the latter) are convex, while the proximal surfaces are flattened. The angles connecting these sides are rounded; the mesio-palatine and the disto-buccal more markedly than the other two. The crown is surmounted by four cusps,—two buccal and two lingual,—which cusps are separated by fissures running between them. One main fissure extends from the anterior to the posterior margin in an irregular line, while from this there branch off two others. One of these starts from the anterior part of the main fissure and runs obliquely backward and outward between the two buccal cusps, terminating on the buccal surface. The other branches off from the main fissure near its posterior terminus and runs obliquely forward and inward between the lingual cusps, and terminates on the lingual surface near the gum. Of the four cusps, the mesio-palatine is the largest. After it, in point of size, come respectively the mesio-buccal, the disto-buccal, and the disto-palatine. The crowns of the first and second molars differ but little from one another, but in the latter the two lingual cusps are sometimes united into one larger one, thus giving the lingual surface a more distinctly semicircular outline. When they are not so blended, the fissure dividing the lingual cusps will be found to be less pronounced in second than in first molar. The roots of these teeth are three in number,—two buccal and one palatine. Of the two buccal, the anterior is the larger, and stands out more prominently toward the cheek. Both are compressed laterally. The palatine fang is much larger than either of the others. It is round, long, and curved obliquely upward toward its fellows. Usually the three roots are separate and divergent. The enamel terminates in a nearly even line around the neck of the tooth.

Inferior Molars.—First molar the largest. Has five cusps,—three on buccal and two on palatine surface,—visually separated by fissures. Of the three buccal cusps, the anterior is the largest and the posterior the smallest. The second molar has but four cusps, separated by a crucial fissure. One arm of this fissure generally extends to and over the buccal surface between the cusps, and terminates near the gum in a small depression, where caries is apt soon to show itself. These teeth have usually but two roots, situated anteriorly and posteriorly. They are flattened and grooved, and the anterior is the broader and longer of the two. They are usually divergent and curved slightly backward. The roots of the second inferior molar differ from those of the first principally in their lying closer together and in their greater backward curvature.

Third Molars—Dentes Sapientiæ, Wisdom-Teeth.—In the upper jaw these teeth closely resemble the second molars. The two palatine cusps are always blended into one, and the three roots are usually confluent, forming an abrupt tapering cone. The crown is the smallest of the three molars. Often it is abnormally small, almost rudimentary in character. In the lower jaw these teeth are considerably larger than the corresponding ones above, and are also usually larger than the superior second molars. They are very little, if any, smaller than the first lower molars, and greatly resemble these in crown, having five cusps similarly situated. They are usually two-rooted, but the roots are often confluent and curve strongly back toward angle of jaw.

FIG. 53.



LATERAL VIEW OF THE UPPER AND LOWER PERMANENT TEETH. 1, first incisors; 2, canines; 3, first premolars; 4, middle molars.

Recapitulation of Names.—The names of the teeth, expressed in the singular number, are, incisor, cuspidatus, bicuspidatus, molar, dens sapientiæ.

A tooth is divided into three parts; a crown, root or fang, and neck. The crown of a tooth is the exposed part; the fang, the part which associates it with the jaw; the neck is the intermediate part. In the language of dentistry the surfaces of the teeth are known as mesial, distal, labial, buccal, palatal, lingual, articulating, cutting.

ANALYSIS OF DENTINE.—

Phosphate of lime	62.
Fluorate of lime	2.
Carbonate of lime	5.5
Phosphate of magnesia	1.
Soda and muriate of soda	1.5
Gelatin and water	28.

Attention is to be directed to the variable density of the teeth; consequently any individual analysis can only be an approximate.

ANALYSIS OF ENAMEL.—

Phosphate of lime	85.3
Fluorate of lime	4.
Carbonate of lime	7.
Phosphate of magnesia	1.5
Soda and muriate of soda	1.
Animal matter and water	2.

ANALYSIS OF CEMENTUM.—The near approach of cementum to bone affords large proportions of organic matter,—twenty to thirty parts to the one hundred. A quantitative analysis of a given specimen yielded as follows:

Phosphate of lime and fluoride of calcium	58.73
Carbonate of lime	7.22
Phosphate of magnesia	0.99
Salts	0.82
Cartilage	31.31
Fat	0.93

CHAPTER V.

DENTITION.

BY dentition is meant the development of teeth. Teeth, together with the alveolar process, develop upon the bone proper of the jaws.

In the earliest days of fœtal existence the jaws are planes of cartilage. These planes are overlaid by mucous membrane. Between the cartilage and the membrane the papillæ known as dental germs are first met with.

The period at which dental germs are earliest seen is about the sixth week of intra-uterine life. At this period, a little sooner or later, such germs are to be exposed by lifting the mucous covering from the basement cartilage. At all subsequent periods previous to eruption section through the overlying parts exhibits their presence.

The alveolar process, with its many pits, is simply an osseo-spongy tissue, serving as a common envelope to the growing tooth-germs. In its origin it constitutes the primitive dental groove. This groove is never, however, a ditch, or depression, except as such an idea is conveyed by the pits and depth of an adult jaw. Neither are alveolar process and body of bone one except as regard is had to relationship. Alveolar process is a provision associated with teeth; as dental germs develop so does it; when the teeth are lost so also does it disappear. Alveolar tissue grows around papillæ; the dental pits signify obstruction. The papillæ are not first met with in a groove.

A dental germ is made up of a congeries of granular nuclei dispersed irregularly through a firm homogeneous blastema. It is not enclosed in a cell-wall, or membrane of its own; it is a hyaloid structure.

A developing germ carries with it the overlying mucous membrane; the membrane hugging it closely. This covering, or envelope, constitutes a tunic; it is to be denominated coat first, or tunica propria. The relationship of this covering to a papilla is precisely that of parietal peritoneum to a knuckle of intestine in incarcerated or strangulated hernia. The shape of this coat is that of the papilla it encapsules.

While, after the manner described, a tunic has been secured by the tooth-germ, it is recognized that the common mucous membrane has in no wise altered its relation to surrounding parts; it abuts closely all the circumference of a papilla; it is contracted, like an elastic substance, about its base; it associates from this base with adjoining parts.

Corresponding with the growth of a papilla is that of its alveolar envelope.