day and been discarded, but not so the isolation and its concomitants. This probably is the result of the blind acceptance of principles founded on religious belief.

And the question naturally arises, Is there more reason for the latter than the former? Are the fads of Mauriceau or Diones any worse or based on any less secure foundation than the fetish of a despotic priesthood? Are we as a progressive profession blindly to accept the practice of the latter merely on account of its antiquity or its religious origin, without any investigation from a scientific aspect? Surely not! It is in this attitude I have ventured to bring this important subject before the society for discussion.

I know I am sailing in dangerous proximity to an explosive mine loaded with tradition, prejudice, and superstition, the products of an ancient mystic empiricism, and sentiment; but I feel if one's armour be truly tempered with the modern improvements of physical and physiological science and practical experience, its most violent explosion can only result in a passing noise.

Changes in ancient customs, like hereditary attributes, are difficult to vary, and must be slowly attempted. The profession and the public cannot be expected suddenly to alter the teachings of their childhood. The instant adoption of a reformation such as I propose cannot be expected. Like the breaking of morphine or other habits, it must be gradual; but I feel convinced, both from practical proof and scientific reasoning, that a great change is bound to come in our treatment of puerperal women. Unless there is valid reason founded on a scientific and practical basis, it seems to me unbefitting of a learned profession such as ours to condemn them to an enforced tedious convalescence, the whole object of which resolves itself into the maintenance of an ancient mystic custom of so-called "cleansing." Theoretically it rests only on precept founded on empiricism; practically it has no foundation whatever, so far as my experience shows. It is a subject the importance of which cannot be overestimated. It demands mature consideration from a rational aspect. I feel, therefore, that no apology is required for bringing it before the society for serious discussion.

Three Demonstrations ON CONGENITAL MALFORMATIONS OF PALATE, FACE, AND NECK.

GIVEN AT THE ROYAL COLLEGE OF SURGEONS, ENGLAND.

BY

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I.

THE material which has gradually accumulated in the various metropolitan medical museums during the last hundred years affords the basis for a very complete study of the various forms of cleft found in the palate and upper lip of children at birth. While the specimens which are shown at these demonstrations are derived from the museum of this college, it has also been possible for me, thanks to the unfailing courtesy of those in charge of the medical schools of London, to have free access to the valuable material on the shelves of their museums. A classified list of the total number of specimens at my disposal is given in Table I. Museum specimens are not representative of the run of cases met with in practice; the slighter and, from a surgical point of view, the more interesting lesions are sparsely represented, whereas the more severe forms, often associated with other grave lesions, predominate.*

* In 555 cases at the clinic of von Bruns at Tübingen, Dr. Gustav Haug (*Beiträge zur klin. Chirurgie*, 1904, Bd. 44, p. 254) found that the tripartite palate occurred in 15 per cent. (against 38 per cent. in the London series), bipartite palate in 23 per cent. (against 22 per cent. in the London series), unilateral harelip with no cleft of the palate 40 per cent. (against 9 per cent. in the London series).

TABLE I.—Classified List of Specimens showing Congenital Clefts of the Palate and Upper Lip in Metropolitan Medical Museums.

	A.	B.	C.	Total.
1. Palate cleft into three parts	14	12	2	28
2. Palate cleft into two parts	3	12	2	17
3. Median cleft extending from the premaxilla to the uvula	4	3	7	14
4. Cleft of soft palate	3	0	0	3
5. Cleft of uvula	4	1	0	5
6. Cleft on both sides of premaxilla	1	0	0	1
7. Cleft limited to one side of premaxilla ...	1	0	1	2
8. Median cleft due to absence of premaxilla	1	2	4	7
9. Bilateral harelip	1	0	3	4
10. Unilateral harelip	0	6	0	6
11. Median harelip	—	—	—	0
	32	36	19	87

A. Specimens in the Museum of the Royal College of Surgeons of England.

B. Specimens in the museums of metropolitan medical schools.

C. Specimens of cleft palate in mammals other than man, chiefly in the Museum of the Royal College of Surgeons of England.

TRIPARTITE PALATE.

In this, which must be regarded as the most severe form, the three elementary parts of the palate are widely separated. In all cases the lesion is remarkably alike, a typical example being shown in Fig. 1. In the middle element from before backwards are to be recognized (1) the middle part of the upper lip; (2) the premaxillary part of the palate, carrying the incisive papilla, which is joined to the upper lip by a fraenum; (3) the lower border of the septum of the nose, which is wider, shallower, and longer than normal; (4) the varying number of dental sacs on the premaxilla: in 16 cases only the two middle incisors are carried; in 3 cases one lateral incisor as well as the two middle (as in the specimen shown in Fig. 1), and in 4 cases all four incisors. In no case did the premaxilla in these cases show a suture between the ectognathic and mesognathic parts. The nerves and vessels of this element are the naso-palatine. On each lateral or maxillary element three distinct areas can be recognized (Fig. 1): (1) the alveolar area on which may be seen an elevation over the sacs of the two milk molars, another over the canine and frequently a third, often on the margin of the cleft, over the lateral incisor (Fig. 1); (2) a plicate or rugose area marked by folds; (3) a smooth narrow marginal area (see Fig. 1). When the mucous membrane is removed, the maxillary or lateral element is seen to be supported by the superior maxilla and palate bones. The nerves and vessels of the maxillary elements are the descending palatine.

The Nature of the Lesion.

Seeing that fusion of the three elements to form the palate begins in the human embryo at the fifth week, a period at which the branchial arches are best marked, it is only natural that one should turn to fishes to find as a normal condition one comparable to that seen in the tripartite palate of the malformed child. Embryology, too, leaves us in no doubt as to the class of fishes in which the condition should occur; the more we know of the early development of the mammalian embryo, the more we become convinced that it has much in common with the Selachii or shark tribe. The tripartite palate is an arrest of development at a Selachian stage. In Fig. 2 is shown the mouth of the dogfish; what at first sight appears to be its upper lip is divided by two furrows—the olfactory or nasobuccal—into three parts, a mesial and two lateral. The part between the furrows represents the middle nasal process of human embryology—the process which gives rise to the nasal septum and premaxilla. The furrows which represent extensions of the nasal openings towards, or actually into, the buccal cavity of the shark, are divided by a fold from the middle process (see Fig. 2) into two functional parts—an upper, the anterior nares, by which water may enter the nasal

cavity, and a lower or posterior nares, by which the water may be drawn into the pharynx as that cavity expands during respiration. At first sight the comparison seems imperfect, for the nasal furrows of the shark appear to lie rather on what may be named its face and entirely in front of the teeth. But these teeth behind the furrows in the shark's mouth are carried not by the maxillae but by the palate bones—bones represented in the human skull by the vertical processes of the palatines—situated, as is the shark's, at the posterior nares. The premaxilla and the premaxillary part of the palate are absent in the shark, but there can be no doubt that the area of tissue lying between the nasal furrows represents the part which bears the premaxilla in higher vertebrates, and that in the course of evolution the roof of the mouth has been extended on to this area.

In those remarkable air-breathing fishes, the Dipnoi, the margins of the nasal furrows have actually fused. The bridge of tissue thus formed across the nasal furrows is the earliest form of union between the mesial and lateral elements of the palate. The condition of cleft palate, normal in the shark, has disappeared in the Dipnoi, and all vertebrates higher in the scale than fishes.

The stage of development seen in the Dipnoi may be studied more conveniently in amphibians. In Figs. 3 and 4 are shown side by side the palate of one of the larger frogs and of a lion cub—one of the many which have been born in the gardens of the Zoological Society of London with cleft palate. In the frog's palate a premaxilla has appeared, and it has extended across the nasal furrow and fused with the maxilla, so that a horseshoe-shaped alveolar arcade is now formed. The amphibian form marks a distinct stage in the evolution of the palate, and one at which development may be arrested, as shown by the specimen represented in Fig. 4. In the human embryo the Selachian stage is superseded by the amphibian during the fifth and sixth weeks of development; the mesial or premaxillary processes unite then with the lateral or maxillary element of the palate. During the seventh and eighth weeks the third or mammalian stage is entered on; from the lateral or maxillary elements two palatal processes grow out and fuse in the middle line, fusion commencing behind the premaxillary element and ending at the uvula (Fig. 4A). Within the palatal processes the horizontal plates of the maxillary and palate bones are developed. Arrest may occur at any point of the third

stage. The development of the horizontal palate rendered the evolution of mammals possible; without such a palate suction and mastication are impossible, unless the breath be held while these acts are in progress.

The Degree of Separation between the Various Parts of the Palate.

The late Professor His was of opinion that clefts in the palate resulted from irregular and inco-ordinated growth of the three elements which go to form it. That the growth of the three parts is irregular in the later months of fetal life there can be no doubt (see Figs. 1 and 5). The septal part of the mesial nasal process is abnormally long, so that the premaxilla projects some 6 or 8 mm. in front of the maxillary parts of the palate. The increase in length of the septum is due not to the vomerine part of the septum, but to that part of it which is formed by the premaxillary processes (see Fig. 7). If the premaxilla becomes adherent to the maxilla

on one side the extra growth of the septum still takes place, with the result that the premaxilla is bent towards the side on which union takes place (Fig. 5). Irregularity of growth is not the cause but the result of the cleft condition. From the evidence to be produced it is probable that the processes which form the palate were in contact during the fifth and sixth weeks of development, but for some reason—the exact cause we do not know—union did not take place then. The union of embryological processes is in every way comparable to the healing of wounds; the epithelial coverings on each side of the nasal groove come in contact and form a bridge across which the uniting mesoblast may grow. If for some reason union is delayed—and from Professor Mall's observations there can be no

doubt that uterine inflammation, sometimes from syphilis, is the most common cause—growth in the several elements of the palate causes them to separate, and once a breach in their continuity has been effected, union cannot afterwards take place. The younger the fetus the smaller the cleft, not only absolutely but relatively. The width of the fissure between the palatal processes of the superior maxilla varies from 7 to 20 mm. in the tripartite palate; 14 mm. is the average in eight full-time children; in a fetus at the fourth month this cleft measured only 1 mm. Brophy¹ has suggested that the subsequent separation is caused by pressure of the lower jaw and tongue against the palate, and the material at my disposal is in harmony with his suggestion. He also makes the statement that there is

Fig. 1.—Tripartite palate. A, Median part of upper lip; B, C, alae of nose (two tags on left); C, canine tooth buds; D, lip; E, rugose part of palate; F, marginal part; G, alveolar part; H, soft palate with uvular process; I, J, incisors; K, incisive papilla; L, septum.

Fig. 2.—Head and mouth of a young dogfish (*Scyllium canicula*). A, Internasal field; B, anterior nares; C, posterior nares; D, anterior nares and olfactory pit; E, posterior nares; F, opercular fold (turned up), which separates the anterior nares from the posterior; G, maxillary process; H, lower jaw.

Fig. 3.

Fig. 4.

Fig. 3.—Palate of frog. Fig. 4.—Palate of lion cub with cleft palate. In both figures the mucous membrane is removed and the bones exposed on the right side. A, Anterior nares; B, palatal process of maxilla; C, palate bone; D, posterior nares; E, rugose part of maxillary palate; F, alveolar palate; G, incisive papilla with organ of Jacobson opening on each side of it; V, vomer; V', vomerine teeth.

no atrophy of the parts that go to form the palate, but this is certainly not the case in the specimens I have examined. In three palates of adults the cleft was in the average 20 mm. wide, the breadth of the palate 64 mm.; the bony parts of these palates were thus 10 or 15 mm. less than normal. In newly-born children the deficiency affects the inner or marginal area of the palate (see Fig. 1), but it does not amount to more than 3 mm. on each side. Whether the cleft continues to increase after birth I am not in a position to say, but, judging from the width of the cleft in the adult palate, I conclude that the parts do not continue to separate after birth at the rate they did before birth.

Imperfect Degrees of Union.

In Fig. 5 there are shown very imperfect strands of union between the premaxillary and maxillary processes. A study of these throws much light on the condition of cleft palate. The slightest degree of union is shown in Fig. 5A, where a strand of fibrous tissue covered by epithelium unites the ala of the nose to the premaxillary process; this represents the rudiment, or rather vestige, of the union of the mesial and lateral nasal process to form the boundary of the anterior nares. In B, C, D (Fig. 5) increasing degrees of union are shown. In the fullest degree (Fig. 5D) the uniting band forms a bridge on which four elements end in attempting to reach the premaxillary process—(1) the ala of the nose, (2) the lateral part of the upper lip, (3) the dental groove, (4) the palatal process of the upper maxilla. These strands of union have apparently become stretched by the unequal or irregular growth of the parts which go to form the palate and upper lip; occasionally blunt conical processes occur on each side of the cleft, evidently the remnants of a strand which has broken under the strain.

The Relationship of the Incisor Teeth to the Clefts.

It is well known that the cleft usually lies between the middle and lateral incisors. In 41 cases I was able to verify the position of the fissure; in 23 it passed between the lateral and middle incisors; in 9 it passed between the lateral incisor and canine. In 7 cases the lateral incisor had not developed on the side of the fissure; in 2 cases a third incisor was developed. To explain the varying relationship of the fissure to the incisor teeth Albrecht supposed that the premaxilla was developed in two parts, that carrying the mesial incisor being developed in the mesial nasal process, and that carrying the lateral, in the lateral nasal process. Koelliker, and afterwards His, showed conclusively that Albrecht was wrong—that the lateral nasal process did not enter into the formation of either the palate or lip, but because Albrecht offered an explanation of appearances with which surgeons are familiar while the great anatomists offered none, his theory has been widely accepted in England. The true explanation of the varying relationship of the teeth to the fissure is extremely simple. The germ of the lateral incisor, although carried by the mesial nasal process, is

laid down in the cleft between the maxillary and premaxillary (mesial nasal) processes. In cases of cleft palate the processes move apart under the strain of growth during the middle and later months of fetal life. Three fates may then overtake the bud of the lateral incisor: it may be destroyed, it may remain attached to the premaxillary process, but more frequently it moves outwards attached to the maxillary process. I have seen it stranded on the bridge of tissue between the processes or loosely attached at one side of the fissure or the other (see Fig. 5, C).

Mr. Clement Lucas has pointed out that families in which harelip and cleft palate are hereditary have usually the lateral incisor of very small size; Professor Warnekros regards an irregularity in the development of the lateral incisor as the actual cause of cleft palate, and points out not only the frequent absence but the occasional duplication of this tooth in families in which cleft palate is apt to occur. Yet the bud of the lateral incisor belongs to and is developed in connexion with the mesial nasal process. In the condition of cyclops, where this process fails to take part in the formation of the palate, all the incisor teeth are absent.

Abnormalities in the Ossification of the Premaxilla.

Albrecht called attention to the fact that there is often a double centre of ossification in each premaxilla. (See Fig. 6.) It will be observed that the amphibian premaxillae are subdivided (Fig. 3). The position of the suture between the premaxilla and maxilla and its relationship to the teeth are extremely variable. As a rule it ends between the lateral incisor and canine, but it may vary in position, as Schumacher has pointed out, to the degree illustrated in Fig. 7, ending in extreme cases either between the lateral and middle incisor or between the canine and first milk molar. The lateral part of the premaxilla is formed within the maxillary process; the process of ossification is not influenced by the position of embryonic fissure; the premaxilla is laid down in adjacent parts of all three processes that go to form the face.

THE BIPARTITE PALATE.

Having discussed in some detail the tripartite palate it will be sufficient to deal with the less severe, if commoner, forms more briefly. In the bipartite palate the premaxillary element has undergone normal union on one side, usually the right, with the maxillary process (Fig. 7). Of the 15 cases in man, the cleft passed to the left side of the premaxilla in 11; Hang found it on the left side in 149 cases out of 216. Why the left side is the more frequently cleft I cannot say. The nasal septum in such cases is always markedly deformed, presenting its convexity to the side on which the cleft is situated. In 4 of these cases union had occurred not only between the premaxilla and maxilla, but also between the nasal septum and edge of the palatal processes of the maxilla and palate bone (see Fig. 7). In the usual form the lower border of the nasal septum is free, there being no union between the maxillary and mesial nasal elements.

Fig. 4.—Model of the developing palate of a human fetus about 6 weeks old (28 mm. long) (Anna Pölzl). *a*, Premaxillary part of palate; *b*, septum of nose; *c*, naso-pharynx; *d*, maxillary plates about to meet; *e*, soft palate and uvula.

Fig. 5.—Four specimens of cleft palate showing various degrees in the development of the bond between the premaxillary, maxillary, and lateral nasal elements. *A*, The bond or bridge of tissue crossing the cleft; *I¹*, central incisor sac; *I²*, lateral incisor sac; *C*, canine sac; *L*, median part of upper lip; *S*, septum of nose.

Intermaxillary Clefts.

As we have seen, the union of the premaxillary element with the alveolar parts of the maxilla marks a distinct stage in the evolution of the palate—a stage well seen in amphibians. The next stage—the mammalian—lies in the development and union of the maxillary palatal processes already to be seen in the amphibian palate (Fig. 3). One would expect arrests to occur in the passage from the amphibian to the mammalian stage (see Fig. 3), although such specimens are comparatively rare in museums (of the 14 cases on my list, 7 are from the human subject, the others are from the dog, lion, sheep, and calf); they are the more common form of cleft palate met with in practice. Mr. J. Berry² records a list of 67 cases, of which 36 were due to non-fusion of the maxillary processes in the roof of the mouth. In these cases there is a real arrest, not only of the fusion of the processes, but of their actual growth. Clefts of the soft palate alone or of the uvula alone, as may be seen from Table I, are comparatively rare; I have seen 3 of the former and 5 of the latter. They indicate an arrest towards the end of the development of the palate when the fetus is about 50 mm. long and entering the third month of intrauterine life. Even when the palate is completely cleft the two halves of the uvula are clearly indicated as tags projected from the border of the palatal folds. The dissections in the College Museum show the tensor and levator palati well developed; the upper part of the superior constrictor and palato-pharyngeus are stronger than in normal palates.

Premaxillary Clefts.

The cleft or clefts may be limited to the premaxillary

a mesial cleft is thus left in the lip and palate. Of the 7 cases on my list 3 are from human subjects (see Fig. 8) and 4 from pigs. In such cases a lateral incisor may be present. The other form is very rare—namely, where a mesial cleft occurs in the upper lip similar to that which occurs in the hare. Cases of this cleft are described by Mr. Clutton and Mr. Edmund Owen in man. The two globular processes have not completely united together.

This anomaly is much commoner in the domestic mammals than in man, as shown by the specimens in the College Museum.

THE CAUSATION OF HARELIP.

Although comparatively few family histories are at present available, there is a general agreement among those who have inquired into the matter that harelip and cleft palate are very apt to occur in certain families. Mr. Edmund Owen, Mr. Clement Lucas, and Professor Warnekros have recorded family trees showing the degree to which the condition may be inherited.* More suggestive of the true cause of the condition are (1) the malformation with which cleft palate is so often associated (spina bifida, anencephaly, morbus cordis, atresia ani, and club-foot); (2) the observations of experimental embryologists. Such malformations may be produced by disturbing the

development of the embryo by various means, but one may conclude from Professor Mall's observations on malformed human embryos that morbid uterine or placental conditions are the commonest cause of malformation of the lip and palate in man. In a group of sixteen malformed human fetuses, the prevailing lesion being anencephaly, the following defects of the palate were found: Divided uvula 4, divided soft palate 1, division of hard and soft palates 1, anterior bilateral fissure 1, unilateral pre-

Fig. 6.—Palate of newly-born child (natural size) to show the elements entering into its formation. A, suture between premaxilla and maxilla ending behind canine tooth; B, the same ending behind central incisor; C, canine; D, vomer appearing in naso-palatine fossa; E, marginal part of maxillary palate; F, horizontal process of palate bone.

Fig. 7.—Bipartite palate. A, Septal process of premaxilla; B, vomer; C, canine; D, premaxilla; E, marginal part of palate; F, ala of nose; G, maxillary part of lip; I¹, I², incisor teeth; M¹, M², milk molars.

part of the palate. In the three cases included in Table I the fissure was unilateral in two cases and bilateral in the third. In these cases arrest had occurred during the period of formation of the primary palate, whereas the process of formation of the secondary palate had been successfully carried out. Besides lateral premaxillary clefts, there are two others, mesial in position, which are rare but worthy of notice. In one of these forms the embryological elements (the globular processes) which go to form the middle third of the upper lip and premaxillary palate have been arrested at an early stage, and

Fig. 8.—Absence of premaxillary part of palate (preparation No. 203). A, Vestige of septum and premaxillary process; B, anterior nares; C, lateral part of upper lip; D, marginal part of maxillary palate; E, F, rugose and alveolar parts; G, soft palate and uvula.

maxillary fissure 1, bipartite palate 1, failure of ossification of hard palate 1. Eleven out of the sixteen showed malformation of the palate. These malformations are rarely met with amongst natives of Africa and of the South Sea Islands.†

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* For details as regards heredity see Le Dentu. *Comptes rendus de l'Académie des Sciences*, 1908, t. 146, p. 1138.

† A skull of a South Sea Islander in the college collection shows a cleft of the palate.