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## ORIGINAL ARTICLES

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### VARIATIONS AND MODIFICATIONS OF THE FACIAL FEATURES: AN INTRODUCTORY STUDY\*

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THE study of the factor of variation, by which we mean dissimilarity between organs or qualities that are homologous, has led to the concept that variations are of germinal origin, or congenital. Modifications, on the other hand, are wrought in an individual's lifetime, are somatogenic, or acquired.

It is a matter of ordinary observation that every human face presents lineaments of character which stamp it with individuality; probably no other part of the body shows so marked a tendency to variation. Under normal conditions, the various features of the face frequently combine in so harmonious a manner that they reveal a striking symmetry. It is "actually a very wonderful and animated piece of architecture, full of beauty and inspiration for one who looks upon it with a seeing eye and considers its age-long evolution with a comprehending and sympathetic mind."

The variations of the facial features have been carefully examined by students of physical anthropology and continue to attract an increasing number of well-trained investigators. Their methods of inquiry have reached a high degree of development and constitute a highly specialized technic. Thus, photographic and x-ray studies, geometric drawings, plastic reproductions, instruments of precision, comprehensive record sheets, statistical and graphical methods of presentation are all employed.

The denture of man is a very complex mechanism and its structural units and adjacent tissues frequently exhibit *variations* and *modifications*. The history of the teeth, as explained by comparative odontology with the aid of fossil remains, is one of the most complete and interesting narratives that science has ever told; very few departments of knowledge can present a section of the past

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quite as completely. But like many other organs of the body, the teeth have not escaped the enervating influences which our changing diet and modes of life have imposed through centuries of time. The anomalies of dentition have, of course engaged the attention of dentists from time immemorial; but the modifications which these produce in the facial features of man have not been analyzed with the painstaking care which their importance merits. It seems to me that this subject offers a large field for original investigation to orthodontists, because they are qualified by training and opportunity for research in this realm.

Blumenbach (1775), Camper (1792), and Prichard (1836) were the pioneers in the study of the relation of the teeth and jaws to the facial lines of man. Since then, numerous methods for measuring human features have been sufficiently standardized to win universal acceptance.

In his work on "The Races of Europe," Ripley adopts the rule: "Long head, oval face; short head and round face. In proportion as the head becomes broader back of the temples, the face appears relatively shorter. Only a few examples of widespread disharmonism, as it is called, between head and face are known. Among these are the Greenland Eskimos, notwithstanding the fact that they are almost the longest headed race known. The aborigines of Tasmania are also *disharmonic* to a like degree, most other peoples of the earth showing an agreement between facial proportions and those of the head which is sufficiently close to suggest a relation of cause and effect. In Europe, disharmonism is very infrequent among the living populations. At times disharmonism arises in mixed types, wherein the one element contributes the head form while the other persists rather in the facial proportions. Such combinations are apt to occur among the Swiss, lying as they do at the ethnic crossroads of the continent."

In comparing a number of skulls even the beginner experiences little difficulty in detecting differences of shape. "The form of the head is for all racial purposes best measured by what is technically known as the *cephalic index*. This is simply the breadth of the head above the ears expressed in percentage of its length from forehead to back. Assuming that this length is 100, the width is expressed as a fraction of it. As the head becomes proportionately broader—that is, fully rounded viewed from the top down—this cephalic index increases. When it rises above 80, the head is called *brachycephalic*; when it falls below 75, the term *dolichocephalic* is applied to it. Indexes between 75 and 80 are characterized as *mesocephalic*.

The list of variations of the bony structures of the head is quite a long one and the following are mentioned because of their special interest to orthodontists. 1. Variations in the degree of projection of the teeth and jaws in relation to the facial form, which may be determined in crania by means of the *gnathic index*. Measured in this manner, the races of man may be classified into the *prognathic*, *mesognathic* and *orthognathic* types. 2. Variations in the size of the teeth are grouped into *macrodont*, *mesodont* and *microdont*. 3. Variations of alignment into *parabolic*, *hyperbolic*, *elliptic* and *U-shaped* type of dental arches. 4. Variations in the development of the symphysian angle of the chin, which are termed *protruding*, *straight* and *receding*.

The diet of an aborigine differs widely from that of a highly civilized

caucasian and exercises such a marked influence on the muscles of mastication that modifications in the position of the temporal ridge, the width of the ascending rami and the angles of the mandible are readily recognized.

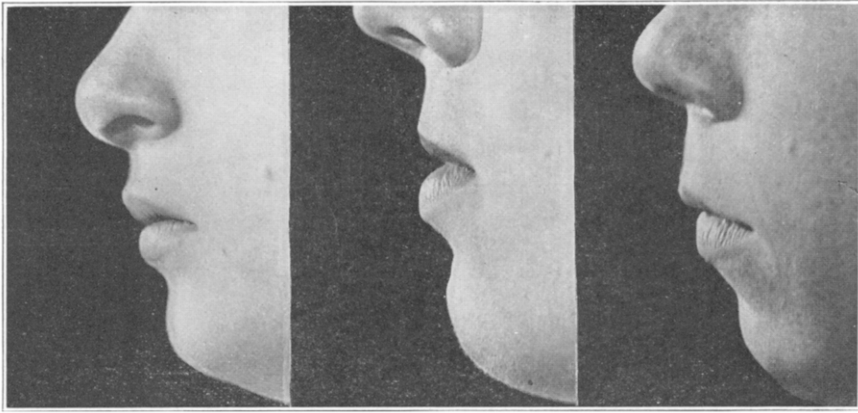


Fig. 1.

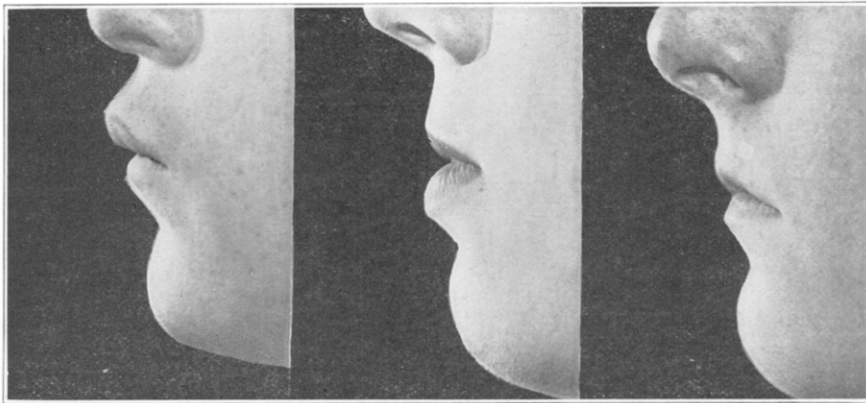


Fig. 2.

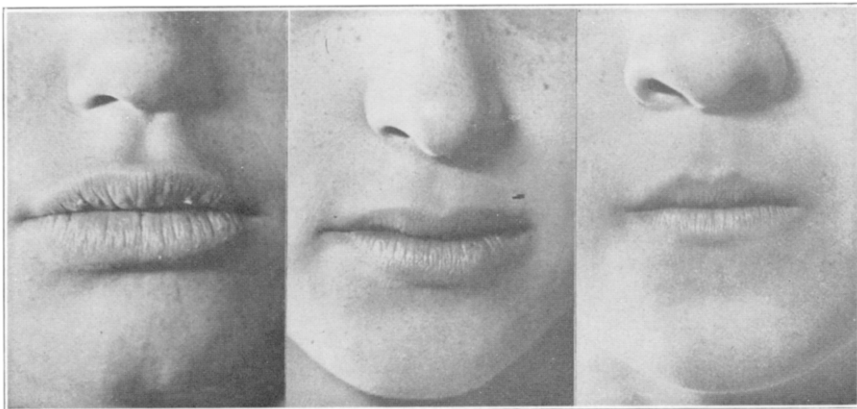


Fig. 3.

In a general way, the size and form of the head and face of man are conditioned largely by the bony structures to which the soft parts are attached, but there are many variations of the latter which can not be regarded as dependent upon the former. Let us briefly consider a few of these, especially of the lips and oral fissure. Variations in the length of the upper lip may readily be classified into the *long*, *medium* and *short* types (Fig. 1). Viewed in profile, we may also recognize the *protruding*, *straight* and *receding* forms, to which the terms *procheilia*, *orthocheilia* and *opisthocheilia* are applied (Fig. 2).



Fig. 4.

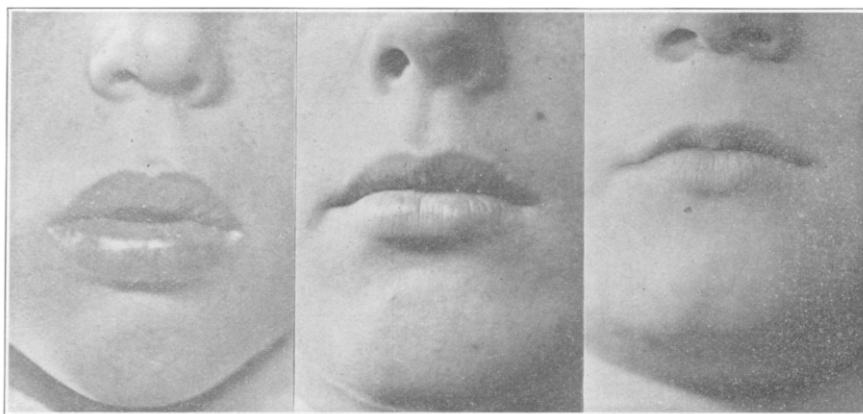


Fig. 5.

The length of the oral fissure differs widely, when measured from cheilion to cheilion, and the variations thus observed may be grouped under the *long*, *medium* and *short* types, or *macrostomia*, *mesostomia* and *microstomia* (Fig. 3). The mucuous membrane, or vermillion border, of the upper and lower lips shows a constant tendency to variation into the *narrow*, *medium* and *wide* types (Figs. 4 and 5). Large lips may be called *macrocheilia* and small lips *microcheilia*.

As orthodontists, we are particularly interested in those modifications of the facial features which are caused by anomalies of dentition. For conven-

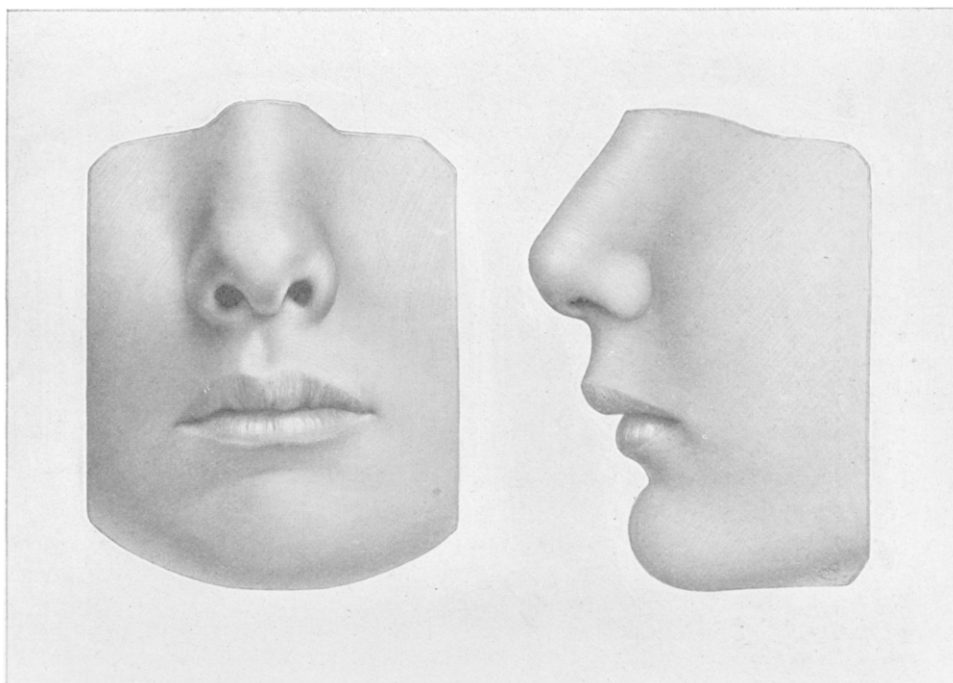


Fig. 6.

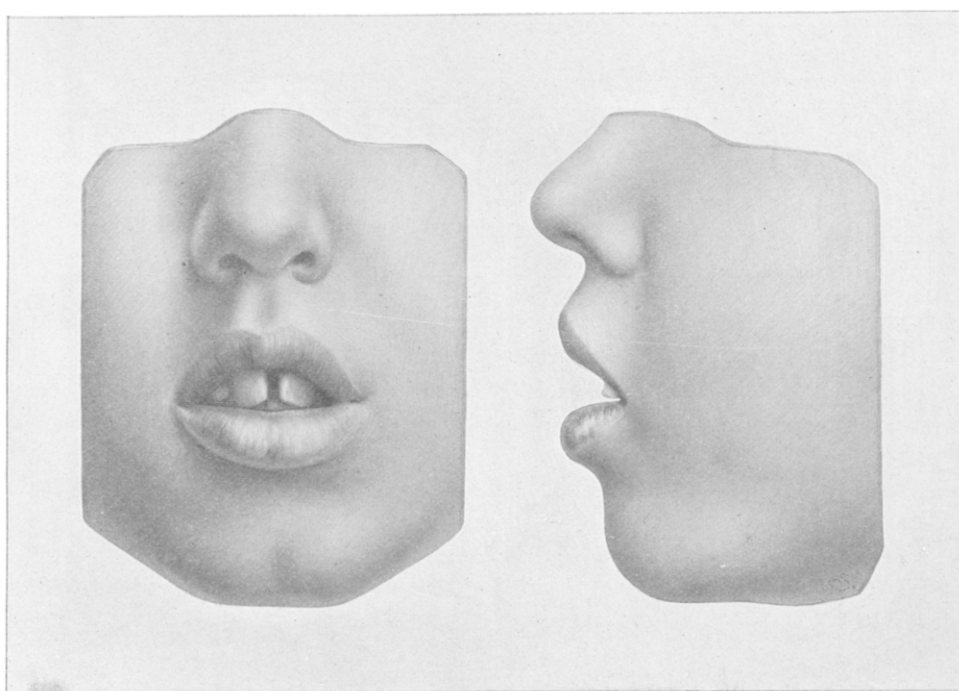


Fig. 7.

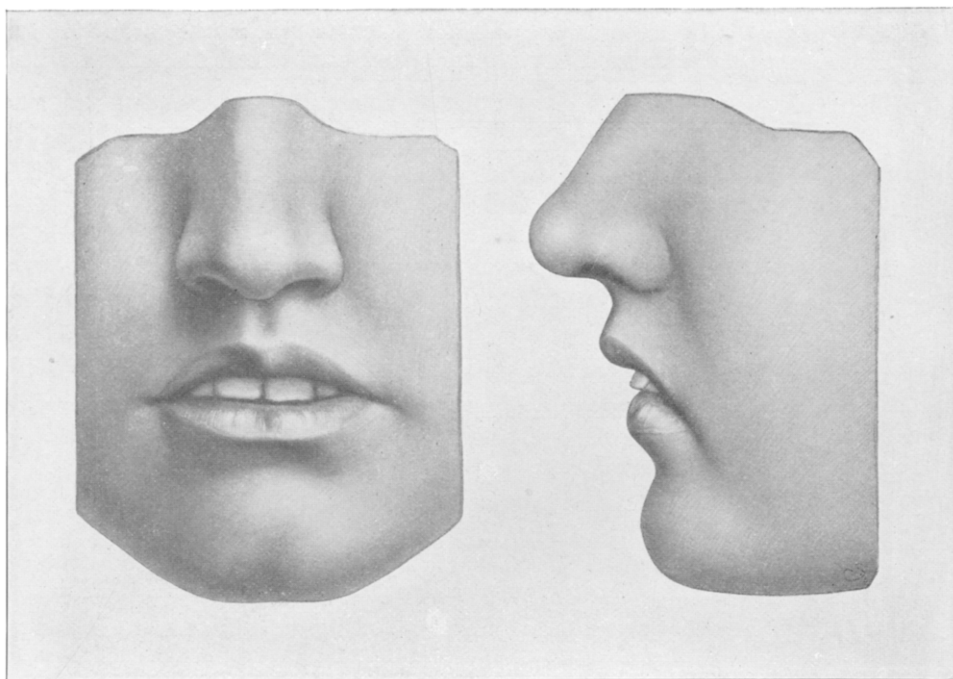


Fig. 8

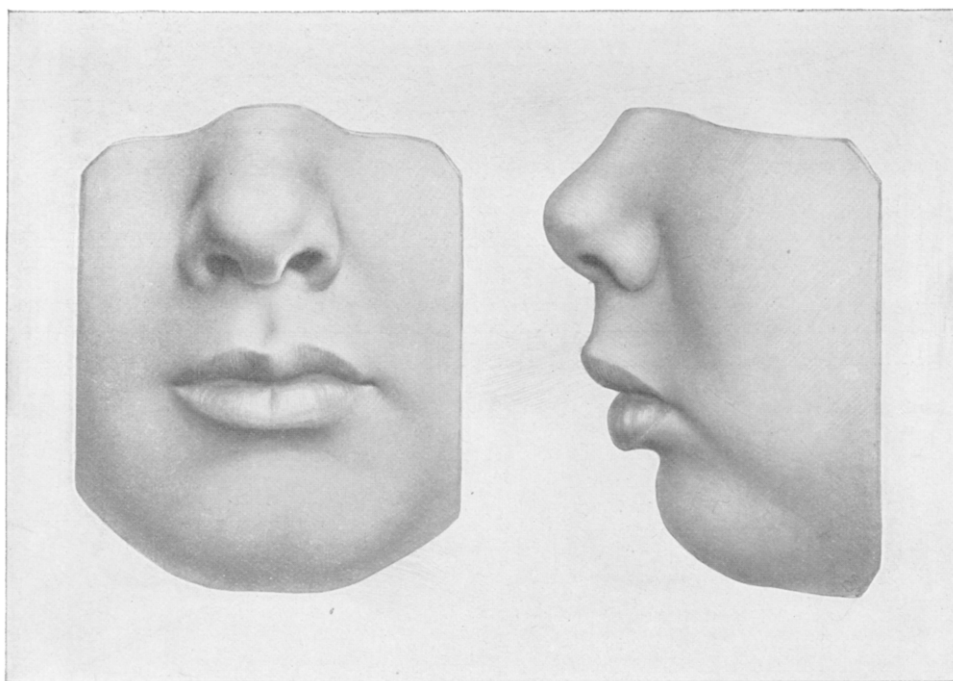


Fig. 9.

ience we may classify these into (a) malrelation of the lips, (b) malfunction of the lips, (c) malformation of the lips and (d) malformation of the jaws and their processes.

*Malrelation of the lips* may or may not be associated with malfunction and malformation (Fig. 6). In its simplest form it is most frequently found in distoclusion not complicated by mouthbreathing. The dental arches in these cases are more symmetrical in form, though malrelated, and extreme malposition of the anterior teeth is absent.

*Malfunction of the lips* is usually associated with extreme malposition of the incisors and arrest of development of their surrounding alveoli. It is common even in young patients with mixed dentures, and in neutroclusion and distoclusion complicated by nasal obstruction (Fig. 7).

*Malformation of the lips* (Fig. 8) is the ultimate result if the above-mentioned modifications are neglected and permitted to continue indefinitely. It is always a serious condition and may be found as a complication in many forms of dentofacial deformity.



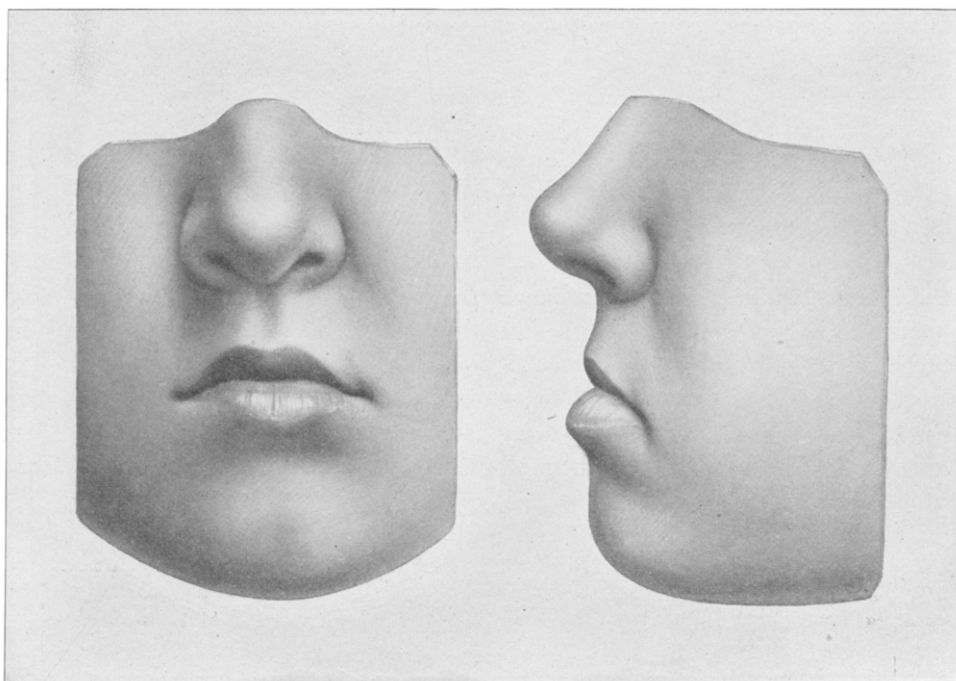
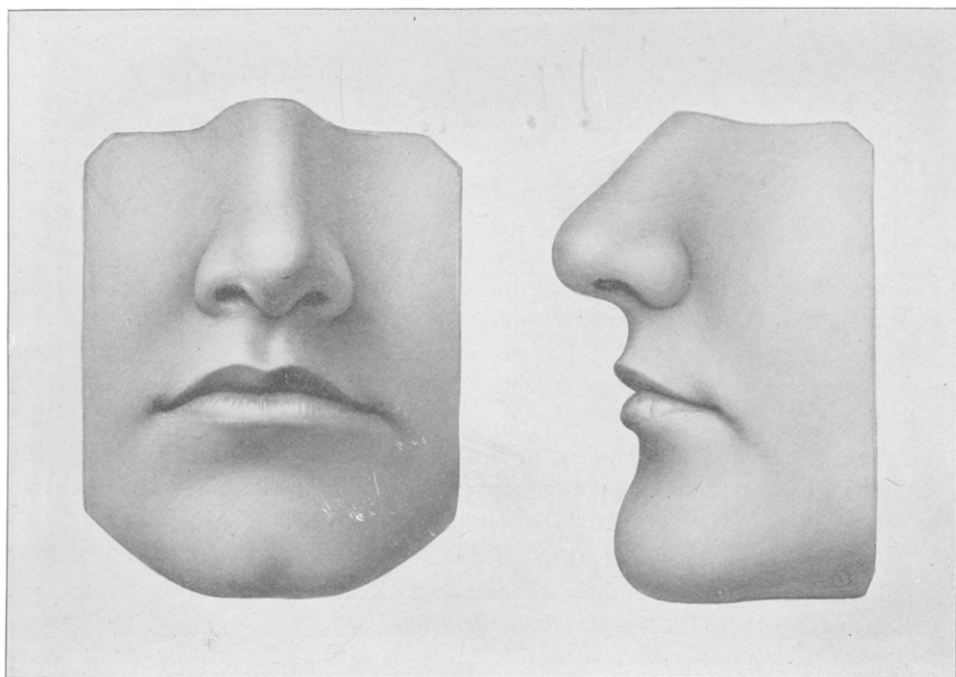
Fig. 10.

*Malformation of the jaws and alveolar processes* are fortunately less frequent. They constitute the most difficult lesions with which we have to deal and present a variety of facial modifications. In some of the younger patients with large lips the latter may continue normal functions (Fig. 9); in others, the deformity is so extreme as to involve a number of features so extensively that full correction becomes impossible.

The relation of the *stomion*, or lip line, to the occlusal plane, varies widely among individuals; and in patients presenting dentofacial deformities extreme modifications may occasionally be observed (Fig. 10). All orthodontists of experience have undoubtedly observed this, but thus far it has not been described.

**In conclusion**, the author offers a very brief consideration of the main facial modifications in *complex neutroclusion*.

Linguoversion of the maxillary incisors is a common complication and results in an easily recognized malrelation of the upper lip (Fig. 11). A thorough

**Fig. 11.****Fig. 12.**



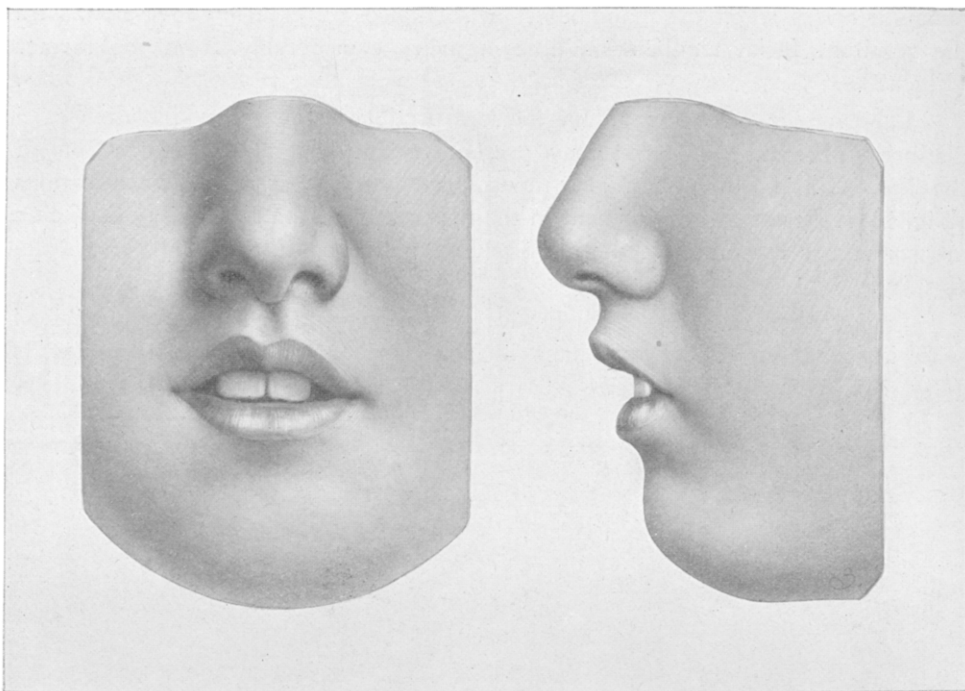


Fig. 13.

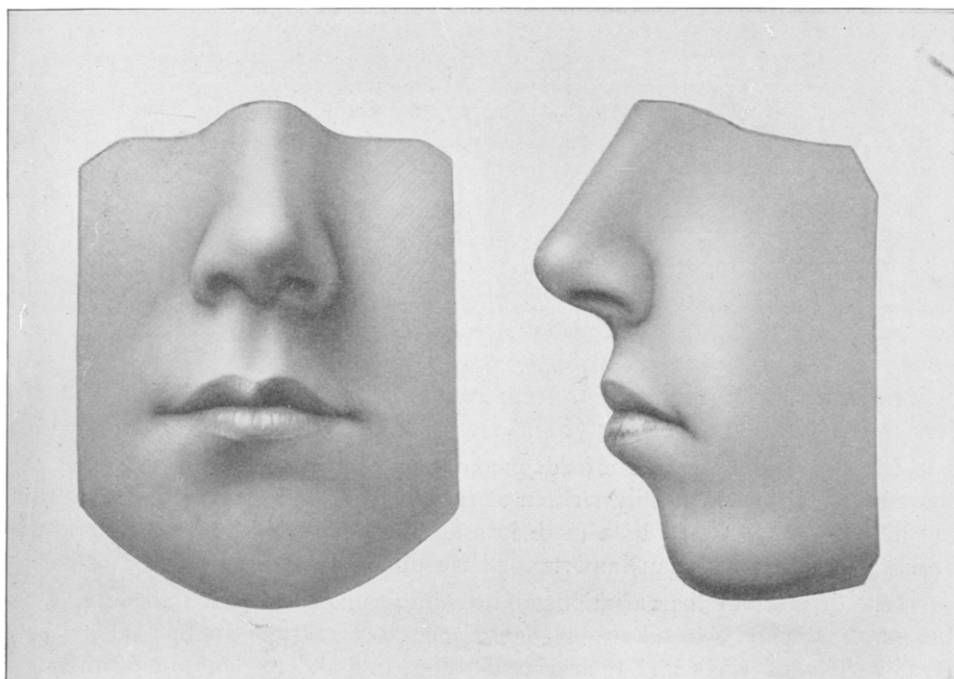


Fig. 14.

study of this modification will reveal many striking deviations. A further complication arises when the mandibular incisors also erupt in linguoversion, with the resultant facial modification differing very considerably from the former (Fig. 12).

Labioversion of the maxillary incisors produces a facial modification of a distinctly different type, and may present malfunction and malformation of the lips. Nasal obstruction and mouth-breathing are common complications (Fig. 13). Arrest of development in the upper lip and the receding type of chin are sometimes combined in the same patient and constitute a very serious deformity.

Labioversion of the mandibular incisors is very rare, but when combined with labioversion of the maxillary incisors a prognathic facial type results (Fig. 14).

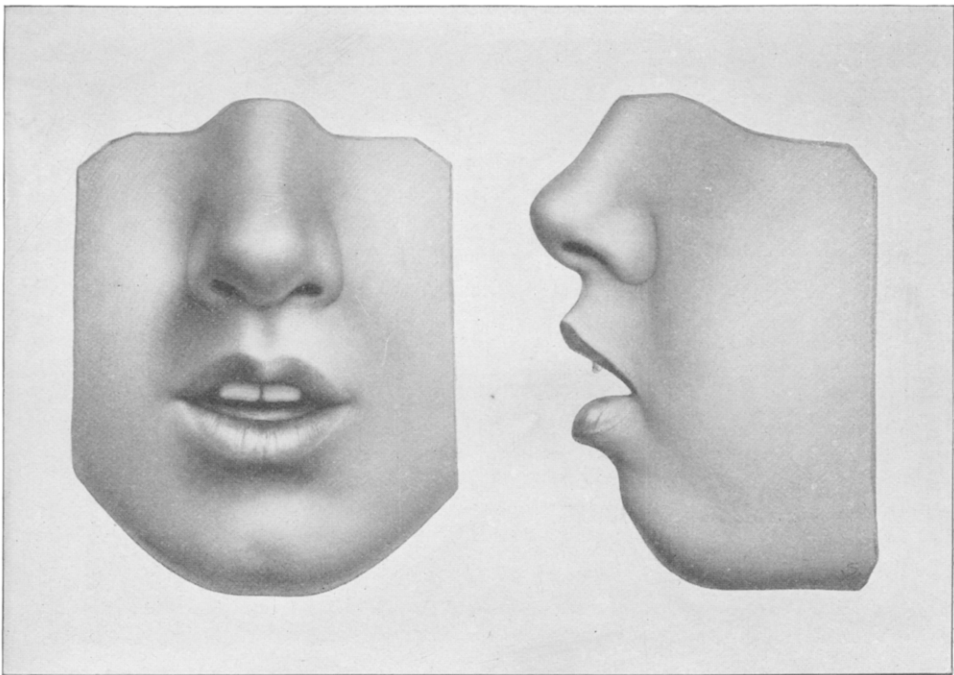


Fig. 15.

Infraversion of the anterior teeth results in a facial modification that differs from any of the foregoing (Fig. 15).

I have given the subject of this paper a great deal of consideration, but this short sketch has been hastily written at the last moment, and amid other pressing duties. It is offered as a mere introductory study in the hope that it will arouse your interest in an important phase of our work.

One or more of the variations and modifications enumerated above may occur in practically every kind of dentofacial deformity. They combine in a great variety of ways and their classification, and the recognition of their sequence and relative significance, is a task for the future.

## DISCUSSION

*Dr. A. C. Gifford, Oshkosh, Wis.*—I believe we can consider ourselves fortunate in having Dr. Lischer bring this subject before us, as I know the majority here have not placed enough importance upon facial art in orthodontics.

One must first be an artist and second have made an extensive study of the variations of facial outline to classify the modifications found in these days of intermarriage of races. This brings about the alteration of head form to such an extent that we find very few true to type features. This intermarriage of races and modern civilization seem to have created a law for each individual, therefore, any fixed type can not now be established as was the case in the time when the Greek face of Apollo Belvedere was the basis or standard. The pleasing physique of our American Indian, with its fine balance, can no longer be found, as it has also succumbed to modern civilization.

Dr. Rogers, of Boston, controls the facial malformations by exercise to develop the muscles and their attachments. He has shown that the muscles of expression and mastication can be developed to the extent of correcting modified features. Dr. Angle has said that the best balance, harmony, and proportions of the mouth in relation to the other features, requires a full complement of teeth, and that each shall occupy its normal position.

There is that stage in the life of a person which shows many modifications and variations, that is, from the time the first temporary teeth are lost until the permanent canines have fully erupted. The features depend almost wholly upon the normal eruption of the teeth, if the face is to develop into the greatest harmony.

*The President.*—This is a very important paper and the author has brought out a great many points that we should be very much interested in, and I think the paper should be freely discussed. It is now open for general discussion.

*Dr. E. G. Weeks, Saginaw, Mich.*—I would like to ask Dr. Lischer one question. What does he do with those cases of short upper lip in adult patients, illustrations of which he has shown, and how does he correct them?

*Dr. Milo Hellman, New York City.*—It is very difficult to follow attentively the reading of a paper of this sort and discuss it in an intelligent manner, but I would like to say a few words touching upon one or two points.

In the first place, I would say that Dr. Lischer ought to be a little easier in expounding these theories because many of them have been contradicted in recent investigations. It is true, they have been accepted by many anthropologists, but recently biologists and ethnologists have not shown any disposition to accept them *in toto*. We ought, therefore, to hesitate before making statements of a definite and positive character.

The point Dr. Lischer mentioned with reference to the ascending ramus, that it is a structure due to habit or to function—

*Dr. Lischer.*—To diet.

*Dr. Hellman.*—remains to be proved. The various races prove definite racial characteristics with reference to the ascending ramus. We have an extremely short and broad ramus in the Eskimo, while we have a long, narrow, comparatively delicate and graceful ramus in the American Indian. The anthropoids show a very broad ramus resembling that of the Eskimo, and our primitive predecessors show similar characteristics to those of the Eskimo and the anthropoids; so that it may be an evolutionary characteristic and not a functional acquisition. I am rather more inclined to attribute it to evolutionary processes.

The relationship between the width of the face and the width of the skull may be found to be dealt with in an interesting manner by Mr. L. R. Sullivan of the American Museum of Natural History of New York in an article on the subject of "Physical Anthropology and Orthodontia" to which he has devoted a good deal of study. It was published in the *Dental Cosmos*, April, 1918, and is of great interest to those acquainted with the subject of anthropology. He bases his deductions on very noteworthy evidence.

As to the face itself, I wish to recommend a very good paper written by Prof. Wm. K. Gregory of the Columbia University, N. Y., on the "Evolution of the Human Face." In that paper he goes through the entire evolutionary process, bringing forward some very interesting evidence bearing on this topic. He presents not only the evolution of the bony struc-

tures, but also the correlative development of the nervous and muscular systems of the head and face, laying some stress on the evolution of the special senses.

I would strongly advise those who are interested in this subject to look up the article of Professor Wm. K. Gregory of Columbia University on the "Evolution of the Human Face," *American Museum Journal*, October, 1917. An abstract of that paper was printed in a recent issue of the *Dental Cosmos*.

*Dr. Martin Dewey, Chicago, Ill.*—I was very glad to hear Dr. Lischer make a distinction between variation and modification. Environment has much to do with modifications. As regards certain variations in facial development and certain modifications, one must make a careful analysis to see which is which, to determine what has been congenital and what has been the result of environment. Under the head of modifications, you have to consider such conditions as may arise as the result of abnormal development from various sources, and then the other modifications which will be influenced by use. For instance, as regards the short upper lip it may be the result of disuse. One will find it almost always associated with mouth-breathing. We find the thickened lower lip which may be the result of irritation produced by the lip resting against the upper teeth.

In the different varieties and shapes of the mandible, in the development of the chin, we find the chin is claimed by some comparative anatomists to be the result of the development of the organs of speech, because man has a better development of the chin than anthropoids. In certain cases the development of the chin is associated with malocclusions; it may be that the under development is the result of the abnormal use of certain muscles rather than a variation. We find the extreme difference in the development of the mandible in distoclusion as compared with mesioclusion. In the mouth-breather you have a receding chin, while in the normal individual you have a well-developed mandible and a more or less prominent chin. As a result of that, we must not lose sight of the fact that function plays a very important part in the development of the lips, and in the size and shape of the lips, which may be changed by various muscular efforts as shown in a paper presented by Dr. Rogers before the American Society of Orthodontists last year.

In regard to macrodontic, mesodontic, and microdontic races there is no question that the human family can be classified according to the size of the teeth; but again, we have to be very careful in considering that in connection with our patients because a macrodontic condition will resemble one with tooth development of normal size where the rest of the face is not developed. Because the individual presents seemingly macrodontic teeth, there is no reason why he had large tooth germs when born. We have small jaws in many cases because the conditions which produce underdevelopment of the jaw will not cause a lack of development in the size of the teeth. The conditions which influence the supporting structures will not influence the size of the teeth because the latter was worked out before the individual was born. As soon as the enamel organ is formed the size of the teeth is established but the size of the jaw is not determined, and consequently, if anything interferes with the development of the jaws, we may have a patient with seemingly too large teeth for the face.

Dr. Lischer called attention to the inharmonious conditions which may arise in connection with one type of face and one type of cranium and skull. That hardly looks possible because we find existing types and variations in animals where the variation occurs as a result of inherited conditions, and it has reference to types. For instance, the offspring will take the characteristics from one parent or from the other parent, or there may be a blending of the two. If, for instance, the offspring takes the cranial type of one parent and takes the facial type of the same parent, there will not be a mixing up of these different types of faces and craniums any more than mixing up other parts of anatomic structures. But there is no question that there is as close a relation existing between modifications of the face as influenced by malocclusions; and modifications in the shape of the face as influenced by function. We have different shapes of the lips as inherited conditions which can be exemplified again by considering the lips as you find them in the negro, and the upper lip which you find in the Irish races which is so well portrayed by artists. Often the short lip is not because of the inherited condition, but because of

lack of function, and so we have to be careful to give more study to this phase of the subject before we make a diagnosis depending on what is the result of variation and what is modification, and what is lack of function.

*Dr. Max C. Ernst, St. Paul, Minn.*—It is always interesting to listen to a paper by Dr. Lischer, and that is one of the reasons I am here today.

As he was reading his paper I was reminded of an incident in St. Paul. I was attending a meeting of the Ramsey County Medical Society and was sitting near the secretary. A paper was read and the secretary said to me, "That must have been a very fine paper, but I didn't understand a thing about it." (Laughter.)

I shall look forward with a great deal of pleasure to the publication of Dr. Lischer's paper, so that we can all read it very carefully and see its true merit. I hope the slides will be published in connection with the paper.

If Dr. Lischer got his paper up hurriedly, I suppose most of us ought to be very glad he didn't put much time on it.

*Dr. George F. Burke, Detroit, Mich.*—I hope when the essayist closes the discussion he will discourse on the subject of suitable exercise for the undevelopment of the lips.

A great many thoughtful men in this special field think that Dr. Rogers presented a subject that has a great deal of merit in it, and a great many men have obtained considerable out of his papers and illustrations, but it seems to me, he would have rendered a much more valuable service in what he has done if he could have presented his technic with the method. His technic could have been presented to great advantage, and it would have been of tremendous educational value to the profession—at least to those who feel that there is merit in this whole proposition of muscle exercises. It is pitiful in the extreme, after having moved a tooth into normal occlusion, particularly in severe cases of distocclusion, to find the upper lip is still short and undeveloped.

I would like to ask Dr. Lischer whether in his opinion a systematic form of exercises will to a considerable degree increase the functional activity of these parts.

*Dr. Lischer (closing).*—Dr. Weeks and Dr. Burke spoke about the short upper lip and what I did in such cases. I do not want to convey the idea of presenting some new remedy. I merely wanted to call your attention to some observations I have made and to some of the difficulties that have confronted me in my experience. Up to a very recent time I did not think anything could be done for deformed lips except by surgical operation, as outlined in the work by Kolle, of New York. Of course, the suggestions of Dr. Rogers, of Boston, are very encouraging, and I hope will lead to something very definite. I understand he is to present a paper before the American Society of Orthodontists next week; so that we shall probably get further instruction along this line. That offers a ray of hope for dealing with some of these modifications.

Dr. Hellman intimated that some of the theories advocated by anthropologists are of questionable value, and Dr. Dewey spoke about the theory of disharmonism. These have been current in anthropologic literature, which shows that anthropologists have recognized these facts. I do not care what theory you favor as to the cause of a particular variation or modification, but the fact is that it exists, and we have to deal with it.

The point to which I wanted to call attention in my paper, and I had to do it briefly, is that up to the present time most of us have looked upon these facial modifications as *by-products*, which we frequently claim to be able to correct; but we do not study them in a thorough manner, though it is clearly one of our duties. I photograph every patient that applies for treatment, and it is astonishing to note the many surprises such photographs reveal if they are indexed and properly classified. You will notice modifications from time to time that hitherto escaped your attention. It is a good thing to record them in black and white on paper.

If any of you want to take up this work, I shall be glad to help you while you are in our city.

So far as muscular exercises are concerned, I have nothing new to offer.