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Exercises for the Development of the Muscles of the Face, with a View to Increasing Their Functional Activity.

By ALFRED PAUL ROGERS, D.D.S., Boston, Mass.

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THE study of the human face is intensely fascinating. The least attentive of us at times enjoys observing and speculating on faces, in a more or less thoughtful way, during those moments when the mind is unconcerned with other interests. Unconsciously, sometimes, we are classifying them as strong or weak, attractive or unattractive; and usually this observation occurs without giving much thought to the factors responsible for the various conditions.

The ordinary observer, if he speculates at all upon the faces which he sees, is apt to hold the mental condition of the subject of his observation responsible in a large degree for the strength, weakness, or peculiarities of development. Many children have been hastily judged to be defective when this judgment has been based upon the undeveloped countenance sometimes typified by the open mouth and the toneless muscles. This may be because the observer has been so engrossed by other things that he has neglected to study the face from a physiological and anatomical standpoint. Possibly he has allowed himself to base his easy judgment upon the assumption that psychologic influences are responsible for some developments to him otherwise unexplainable. His common knowledge of the fundamental functions of the human face has been too limited to permit satisfactory judgment.

As a profession, the anatomical and physiological study of the deeper parts of the face have absorbed our attention almost to the complete exclusion of the more superficial. The alterations that are sometimes effected in facial contour have aroused in us, at times, a high degree of satisfaction, yet many of these changes in outline do not carry with them the guarantee that an establishment of function in general has been attained.

It is a simple matter for us to produce these pleasing outward changes, and it is a temptation to us sometimes to become flattered by such easy conquest. These changes are often brought about by those who employ the most unscientific methods, and the apparent ease with which results of this nature are obtained conduces to a weakness in the system of practice generally. Many of these changes are but temporary, and do not carry with them the establishment of complete function.

The narrowness of our view is by no means surprising, since we started not many years ago as orthodontists—literally speaking, "tooth-straighteners." Although this science has grown broadly until physiological and biological considerations of the parts immediately adjacent to the teeth have been deeply studied, there is yet room for a greater broadening of our conception.

Some of our profession still in their mental conception linger near the narrow horizon furnished by the teeth alone, and make their plans with reference only to those non-functional organs. I am reminded in this connection of a most excellent paper written recently by Dr. A. LeRoy Johnson, setting forth the biological reason why we must consider more thoroughly the surrounding tissues in their relation to the teeth, and clearly showing us which tissues are to be considered functional and which are not to be so regarded.

The present attempt on my part is an endeavor to elucidate some of the difficulties furnished by the abnormal condition and behavior of the soft tissues of the face—stumblingblocks which have annoyed us greatly at times, often hindering us in our conscientious efforts toward attainment of the best results. This paper is given as the result of a perhaps dilatory awakening after some years of thought and experience growing out of an active practice. The observations here noted are possibly not entirely scientific. They may be considered the results of both empiricism and method—not so entirely the result of method as perhaps they would have been had there been time for a more systematic tabulation of observations and facts.

The orthodontist has handicapped himself in the past by trying to gain results solely through his own efforts instead of pointing the way to personal self-improvement by the patient, ignoring the physiological forces which work under the direction of the mind in stimulating functional activity of the various organs which are essential to his complete success. We have not employed sufficiently such a useful instrumentality. We have allowed ourselves to become baffled by the weakness of unused or improperly used forces of the soft tissues of the face.

IMPORTANCE OF PROPER MUSCLE FUNCTION IN THE CORRECTION OF MALOCCLUSION.

My reason, then, for bringing before you the subject of facial muscles and their culture is the very special one that I share, first, the belief that the culture of the muscles of mastication and the so-called muscles of expression is of paramount importance when considered in relation to their influence upon the developing bony structure beneath them. The successful treatment of many cases of malocclusion is dependent upon an understanding of the muscular tissues of the face and the development of their functional activity. Strong, well-controlled muscles are valuable in the maintenance of occlusion when it has been established. Muscle training is the best and most rational means for overcoming various facial muscular habits, such, for instance, as that of mouth-breathing. Another reason why I am glad to read this paper is that opportunity is given me to present to you a method for the culture of these muscles and for the encouragement of their normal functioning. All that I shall say to you has been verified by my personal experience in practice, and I can assure you that seldom has anything given me quite so much satisfaction, and promised so much for the future treatment, as the development of the muscular tissues of the face in conjunction with a certain simplicity

of mechanical construction employed for the stimulation of the other tissues.

In fact, viewing the practice of orthodontia from the standpoint which I now do, exclusion of some of our methods will be found essential, and the employment of more simple mechanical devices substituted in their stead. The old and crude conception of orthodontia which permits the orthodontist to admit that he is a regulator of teeth, and that his chief reliance lies in the expansion arch and ligatures, has no place in the plan of procedure that is designed to fit in with the practice based upon the development of normal functions of all the facial organs. This form of appliance hinders the developing influence of many of these muscles. It is a frequent producer of dangerous and long-enduring muscular habits. It rather discourages the performance of the normal activity of the muscles within the radius of its influence. If you will turn to your textbooks on Orthodontia and study the illustrations of the expansion arch and ligatures you can readily make your comparisons. It will not be long, I believe, before the expansion arch will be used only infrequently. Something like this attitude is bound to become general when deeper study is made into the possibilities of development attending systematic efforts along rational lines of functional development.

Many facial maldevelopments in common with other bodily abnormalities are due to improper and feeble functioning from early childhood. There are many cases offering a definite resistance to the orthodontist in securing desired results. You have seen dozens of children mouth-breathers who have been operated upon by skilled surgeons and orthodontists, and who are still mouth-breathers, with untrained muscles of respiration, unused facial muscles, with weak wills in relation to these organs. These are things we need to think and talk about, in order to become, in the quickest way, of the most use to our patients.

From the orthodontist's standpoint the muscles of expression are much more than the name implies, for they are the muscles which, if not properly developed, are apt to give evidence of lack of facial harmony. They are the muscles which, if not under proper nervous control, are likely to assume various forms and abnormalities in action, resulting in malformation of the fragile osseous structure of the face in young and growing children. My observation teaches me that uncultured muscles are apt to be the ones that assume unhealthy habits. It is certainly true that uncultured muscles lack tone, and in lacking tone they do not respond to normal stimuli with the same degree of activity and precision that is found in those that are under proper control. Moreover, it is well for us to remember that muscles tend to stay in the position in which they do their greatest and hardest work. I have seen distorted parts become permanently so, by the habitual tension of one small muscle.

If you will turn again to the textbooks on Anatomy and Physiology you will find some interesting chapters on myology and physiology of muscular tissue, and you will note with greater interest and a broader understanding the marvelous functional system here developed, and capable of serving us as an ally instead of an enemy.

PHYSIOLOGY OF MUSCULAR TISSUE.

Before entering into the consideration of the practical application of the views which I am to present to you it is logical for us to review briefly some physiological facts. We learn that the movements of various parts and organs of the body are brought about by a special histological structure, and possess the special function of contracting in length under the influence of a proper stimulus. Our study is based solely upon the small group of skeletal muscles whose structural arrangement and mechanical action are based upon a common plan, and are to be understood as being chiefly masticatory and facial. The cells of which these skeletal muscles are composed are long, narrow, and striated. They differ somewhat from the structure of other

muscles of the body, and in differing in structure they differ in function. The principal difference is that the striated muscle is under direct control of the central nervous system.

A typical skeletal muscle consists of a fleshy mass enveloped in a membranous aponeurosis or fascia, and provided at its end attachments with tendinous connections to either the bone or cartilage, or, as in the case of the myoides, to fascia and skin. Each one of these muscles is made up of a number of fasciculi, arranged in such a way as to give form corresponding to the function of that particular muscle.

These bundles of small fibers are held together by a delicate connective tissue called the perimysium, continuous with the surrounding fascia which incloses the muscles. Each smaller bundle is composed of a number of narrow elongated muscle cells or fibers held together by a still more delicate connective tissue *i.e.* the perimysium internum. This delicate membrane is in turn connected with the smaller cells of the muscle, and also with the external perimysium. Thus it will be seen that muscles are highly organized even when considered in connection with muscular tissue alone, and that they are essentially organized as the agents of motor activity when nervous, vascular, and lymphatic systems are considered.

It is interesting for our purpose to note how generously each muscle is supplied with nerve tissue, which, after entering the substance of the muscle, separates into smaller and smaller branches until ultimately it terminates in small fibers in each muscle cell.

Now, we have seen that the muscles may be regarded as organs endowed with particular properties; that being supplied with nerve tissue they are designed for definite movement in response to some stimulus, and that there is every reason to believe that the purpose of nature was to effect co-ordination of action through the elaborate though delicate nerve supply.

Muscles in their physiological condition require for their maintenance and their activity a very large amount of nutritive material, since they are in a measure heat-producing organs. There is a certain amount of breaking down and rebuilding, and thus the lymphatic system is found as intricate and complete as the other systems. The lymph capillaries relate to the muscle fibers as does the nerve tissue, and give off short transverse branches which immediately break off in the capillary network surrounding the muscle fibers. It will be seen that they are admirably constructed for the work of repair and waste. The nutritive material passes through the capillary wall into the lymph space through the sarcolemma where it comes into the living tissue. The waste products pass first into the lymph, then into the blood stream, whence they are carried away by the eliminating organs.

The physiologist tells us that the properties of the muscles are their irritability, contractility, elasticity, and tonicity. It will not be necessary for us to study these properties, for we know their significance in a general way, but it will be interesting for us to make reference to the mode of muscle stimulation in order to complete our conception of what muscles are, what they are for, and how they can best be kept in normal condition.

The stimuli are furnished by action of the nerve impulses transmitted by nerves from the central system to the muscles. Each muscle impulse is a normal physiologic stimulus, and is under direct control of the will.

Muscle culture, then, by its very nature is also mental culture, because it calls forth repeated efforts of the will, and the exercise of the function of the brain and the function of the muscle is, I believe, mutually beneficial.

Prof. F. Stanley Hall, an investigator of unusual merit, says: "The muscles are in a most intimate and peculiar sense the organs of the will. They have built all the roads, cities, and machines in the world, written all the books, spoken all the words, and in fact have done everything that man has accomplished with matter. If they are undeveloped, or

grow relaxed and flabby, the dreadful chasm between good intentions and their execution is liable to appear and widen. Character might, in a sense, be defined as a plexus of motor habits." Is not this testimony of a man whose life has been spent in investigation full of significance for us?

Doubtless any one of you can recall to mind certain patients whose facial muscles are so flabby and inert that it is difficult to define one muscle from another. In my investigation of this subject I have discovered many faces in which pronounced malocclusion exists where there is little control of various groups of muscles. I have found many patients who are unable upon command to throw any considerable effort into the masseter muscles. Others I have found who are unable to control the pterygoid muscles upon the first few attempts, but after repeated efforts are able to operate, at will, both of these groups. It has further been found that groups of muscles which have not been subjugated to the control of the central nervous powers as they should, fail to give evidence of their complete development. In some instances they even cease to respond to mental stimuli save after repeated and prolonged effort.

The motor activities with which we are most concerned should be performed with exactness and precision of both mind and muscle. The hands of a pianist or violinist show excellent examples of a high degree of muscle culture. Many have an erroneous idea that the muscles become excessively large under continuous stimulation, but each muscle or muscle group has imposed upon it its limitation in strength and size. It is, therefore, not to be supposed that all men can develop muscles to compare with those of a Samson, but it is true that all muscles under a sufficient degree of normal stimulation, providing the health of the individual is sufficient, can be developed into strong and efficient organs.

We can readily understand that the motor efficiency of the parts of the body upon which we are directing our attention depends upon the ability of our patients to gradually attain the faculty of directing mental stimuli in sufficient amounts to effect their development. It is because of the law of mental growth known as repetition that the orthodontist realizes his greatest encouragement regarding this phase of his work—*because the things that are done from choice tend to become spontaneous if often repeated.* Therefore, the ability of the muscles to continue the performance of their full functions after repeated efforts of the will is assured by their educated state. It is well known that the growth and strength of the alveolar tissue depends upon proper function. If we can by this means increase the strength and life of this tissue, the teeth will have a stronger environment and a prolonged usefulness.

In the process of the realization of our ambition along these lines we shall meet with many discouraging and seemingly well-nigh unsurmountable difficulties, but we must be fully mindful that nothing of such importance can develop rapidly and at the same time accurately. Many youths will pass from under our care not much affected by our ministrations and advice, but on the other hand many of them will realize that the development of the functions of the face can be only a blessing to them.

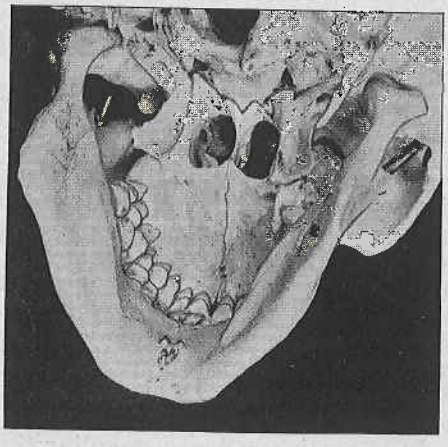
In suggesting and recommending this form of investigation I want to say emphatically that it will be well for us to proceed with caution. I do not know that in this paper it will be possible for me to point out all the dangers, since I may not know them all, but it is possible for me to point out the seriousness of the undertaking and to urge careful consideration and study before attempts are made to develop functional activity of any tissue in which we are interested.

The student of this work must be conversant with physiology. He must be always on the watch against the establishment of harmful habits. He must be careful not to overstimulate long-unused muscles. He must be careful not to expect great results from little effort.

RELATION OF MUSCULAR FUNCTION TO MOUTH-BREATHING.

It is my belief drawn from experience that the great problem of curing or overcoming the habit of mouth-breathing is through the exercise of muscular function. We are all perfectly familiar with cases operated upon by the rhinologist where the removal of the nasal obstruction, adenoids, and tonsils has not been followed by the beneficial results promised. In the case of individuals who have failed to receive the hoped-for results the muscles will be found to lack tone

FIG. 1.



and development. Proper, systematic exercise alone will be found to do more than any other thing to produce harmonious development.

I am reminded of one particularly hopeless case in which I have been fortunate enough to stimulate the patient's interest to the degree that she is following my instructions faithfully, and with excellent results. During a long period of acquaintance I had never once observed this child with her mouth closed, but after a few months of conscientious effort on the part of mother and child we are delighted to find the vicious habit disappearing, and a fine symmetrical facial contour developing.

Another case of persistent open bite, caused by lack of tone of the facial muscles, particularly the orbicularis oris, where mechanical retention failed to give complete satisfaction, has now remained satisfactorily closed after the muscles of the mouth were developed sufficiently to act as a balance to the forces behind.

We shall find when we turn to the needs of our patients that our work is confined chiefly to a group of small muscles, and must therefore differ in some degree from the methods that would be used to develop those of the other parts of the body. In general it will be noticed that the muscles of mastication and those of expression have been used only moderately by our patients, and our first lesson must be to learn not to overstimulate them.

It has been my custom in beginning with a new patient to insist that the exercise be done at stated intervals and under the supervision of an older person who has been carefully instructed. More patience is required in some cases than in others. It will soon be learned that the control of motor life in the tissues of the face will in a large measure overcome the so common tendency to bolting their food without proper mastication. In my personal work with patients I deem it one of the essentials first to strengthen the muscles of mastication, in order that whenever occasion requires they may be used more vigorously, thus still further increasing their usefulness in that their capacity for hard work has been greatly increased.

CONSIDERATION OF THE VARIOUS MUSCLE GROUPS.

We are led now to a brief consideration of the muscle groups. Pictures of these from Gray's and Cunningham's Anatomies will be thrown upon the screen. Those which we shall first consider are the ones in which, for logical reasons, we are most interested, namely, the pterygoid, masseter, and temporal muscles. Later we shall refer to the muscles of expression, which consist of the levators labii, depressors labii, and zygomaticus muscles. The platysma myoides will be

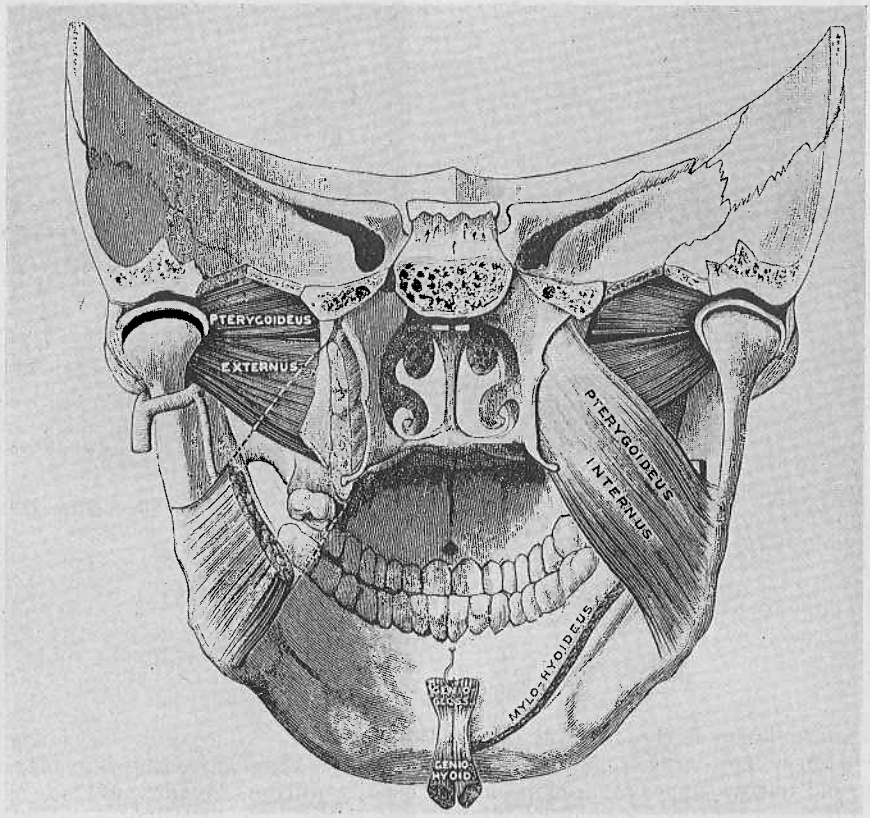
given separate consideration, which it is of considerable importance to our work that they should receive.

MUSCLES OF MASTICATION.

The interesting thing about the muscles of mastication will be found not only in their shape, but in their attachments. The pterygoid muscles are particularly interesting to us from this standpoint, as they will be seen to be attached to points of great advantage when their function, the control of the mandible, is considered. In order to gain a true conception of their relations we will make a brief study of the under surface of the human skull.

It is well to notice (see Fig. 1) the relation between the pterygoid fossa and the plates and the head of the condyle between which some of these small fibers are stretched; also the relation between the external plates and the inner angle of the ramus, where other fibers are stretched. It will be readily recognized that if from early childhood the activity of these muscles has been hampered on account of distal position of the mandible, one of the first duties of the orthodontist, in undertaking treatment of class II cases, is to direct sufficient stimulation to these muscles to accustom them to the altered position which they will assume when the mandible occupies its normal position. It may be well at this point for me to emphasize the importance of the early exercise of these muscles in

FIG. 2.

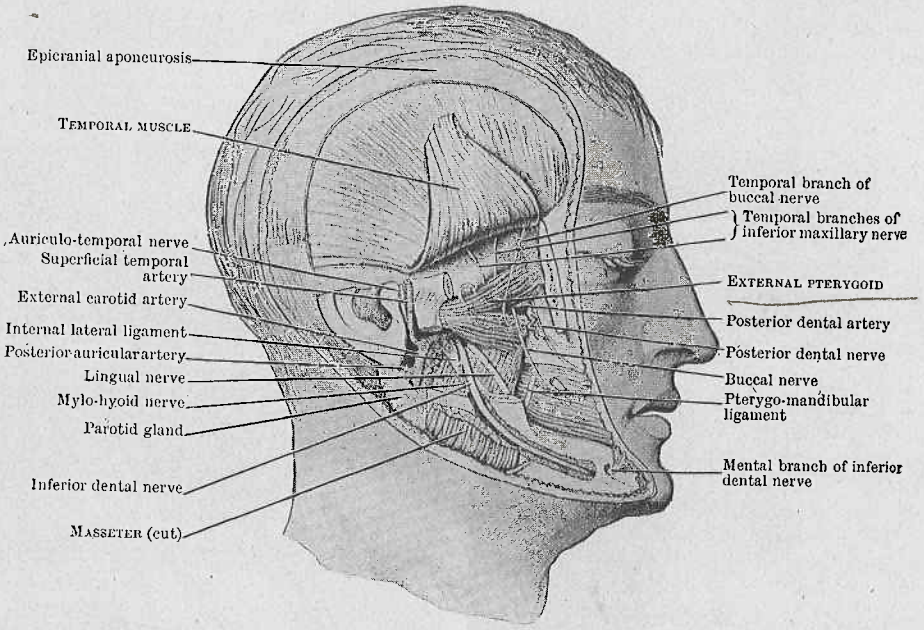


cases where it is required. This is true even where intermaxillary elastics are proposed, or where inclined planes upon the anterior teeth are contemplated. Particularly is this necessary when we contemplate the changes that take place in the glenoid fossa as the child grows to maturity. (Fig. 2.)

You have all experienced, in treating younger cases, the voluntary shifting of the mandible upon the removal of the interference frequently caused by an abnormal narrow upper arch, or perhaps the interference of upper lateral incisors in lingual position. This voluntary change does not take place so readily in older children for the reason that the glenoid fossa has become of such shape as to discourage the pterygoid muscles in overcoming the handicap. I am also reminded that frequently we see cases under treatment where two or three elastics are attached to teeth on each side of the mouth in order to correct a distal occlusion. This practice brings tremendous strain, through the apparatus, on the molars and incisors, and according to my experience is not good treatment.

It seems to me that it is much safer when possible to train these muscles through exercise so that the proper position of the mandible is more readily taken when opportunity is given to it. It not only relieves strain upon the teeth, but avoids many other complications.

FIG. 3.



It is not to be supposed that I advocate the entire abandonment of intermaxillary elastics during the present state of our experience. These still remain valuable adjuncts, and it will be a long time, I think, before we shall entirely discard them. Their use, however, should be carefully studied and the application made as light as possible.

The exercise of the pterygoid muscles previous to the application of inclined planes on the anterior teeth I have found of great service, as the mandible may be readily trained to take the forward position, thus avoiding the strain which is

usually heaped upon the incisors when this form of apparatus is placed upon them without taking this precaution.

Fig. 3 gives a very comprehensive view of the external pterygoid muscles, showing the direction of their fibers and emphasizing the importance of the observations I have just made. It will be seen that these muscles may be regarded as the intermaxillary elastics of nature, and I think you will agree with me that when they are trained to perform their function accurately and well they may be expected to furnish a guarantee of unusual merit for the permanence of our treatment.

FIG. 4.

EXERCISES FOR THE MUSCLES OF MASTICATION.

The exercise for these muscles consists in throwing the mandible forward as shown in Fig. 4. The patient requiring this form of exercise is instructed to throw the mandible forward as far as possible, or until the lower anterior teeth are placed in labial occlusion to the uppers; it is held there for ten seconds and then slightly relaxed. The effort is then repeated as many times as the nature of the case requires. In some cases this will at first be found impossible, but after practice the work becomes easy. This form of exercise is usually prescribed in cases of distal occlusion, and the operator must here be careful in his diagnosis.

FIG. 5.

The liability in overstimulating these muscles in the very young will be obvious

to any of you who have thought at all upon this subject. Very little of this exercise is sufficient in the case of some, while in others it is almost impossible to overdo it. Still further efforts are made for some patients, as shown in Fig. 5. In this instance there is a combination of a posture exercise of unusual merit, and the pterygoid exercise. The patient is directed, after taking the position here

FIG. 6.

FIG. 7.

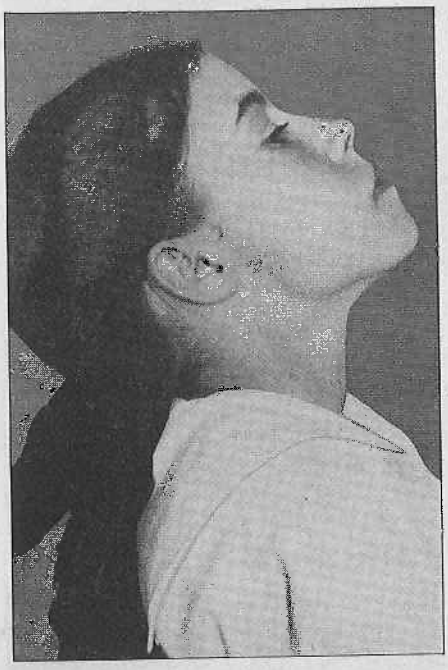
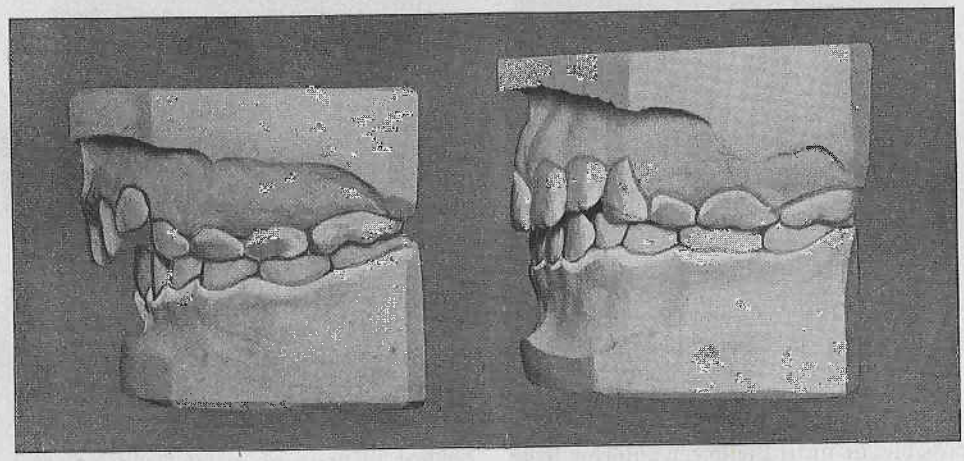


FIG. 8.



illustrated, to stretch the point of the chin upward as far as possible, bringing vigorous strain upon the platysma myoides. Fig. 6 represents a child in great need of the exercise for the pterygoid muscles first, and all the other muscles of the face when occlusion has been established, or during the process of its establishment. Fig. 7 represents the same child undergoing the exercise of the pterygoid muscles.

and relaxing the groups of muscles shown in Fig. 9.

In many cases it will be found that the ability to contract these muscles is very slight indeed, but after a few months' practice the operator is gratified to find greatly increased tone and improved control, as is shown by the ability to contract and relax the muscles. All efforts must be made with great concentration, and must be complete in their

FIG. 9.

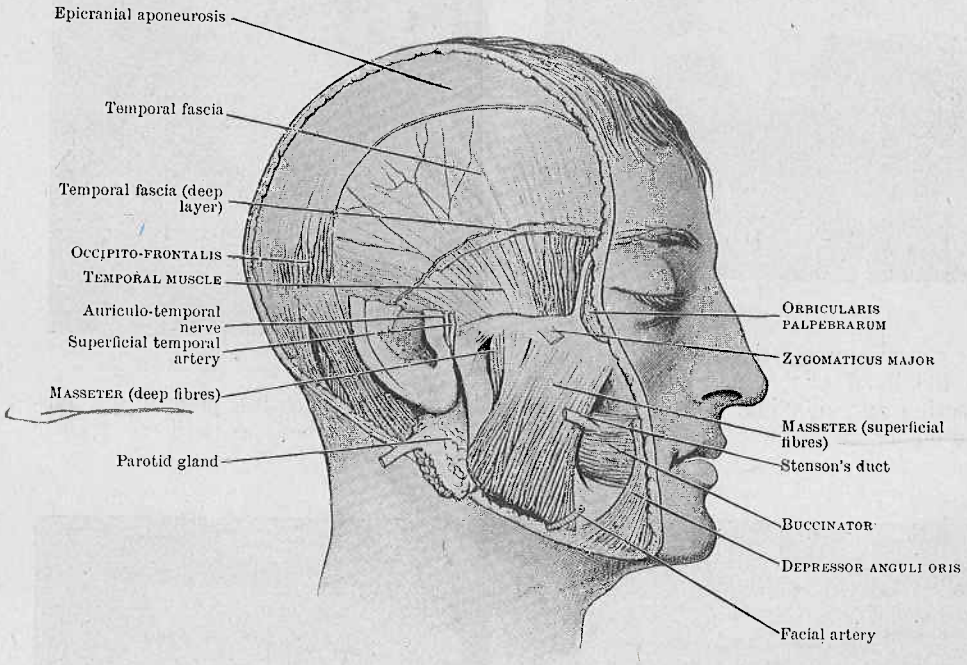


Fig. 8 gives an example of the improved condition after a few months of this exercise in a case of class II. The only apparatus used in this instance was the upper lingual wire, through whose instrumentality the interference of a narrowed arch was removed. After the ability to place the teeth in proper relation had been acquired, the patient had another exercise added—that of the temporal and masseter muscles. This exercise consists of holding the teeth firmly in occlusion and alternately contracting relaxation and their contraction. The ability to completely relax these muscles between each impulse is important to secure, as muscles exercised in this manner, for physiological reasons, grow stronger much more quickly.

Fig. 10 shows a child in the act of stimulating these groups. The position of the fingers is useful in the beginning, in teaching the child to detect the movements.

Fig. 11 shows a form of exercise for these muscles which may be given when

it is not wise to place the teeth in occlusion, and is used sometimes in anticipation of the exercise just described. It is performed by directing the child to pit

FIG. 10.

the muscles of mastication against those of the hand and arm, alternately contracting and relaxing.

Fig. 12 illustrates a case of a child ten years of age, who was suffering from lingual occlusion of the upper bicuspids and molars. By the use of the lingual wire the upper arch was expanded until the lingual occlusion was disposed of. When this point of development was reached, as will be readily understood, the condition of the open bite was much exaggerated, and this is when the patient was instructed in the use of

FIG. 11.

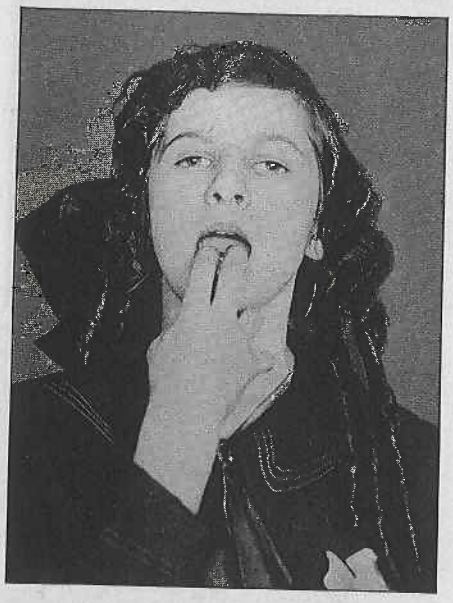
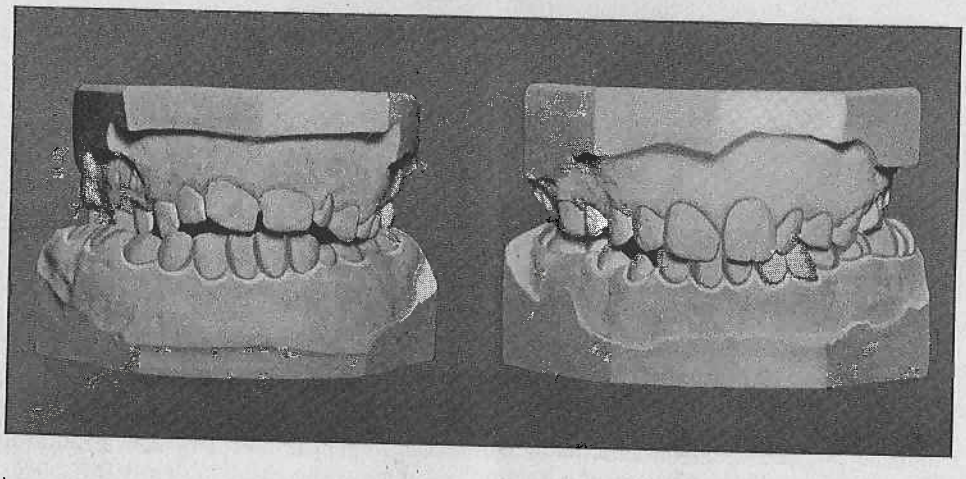


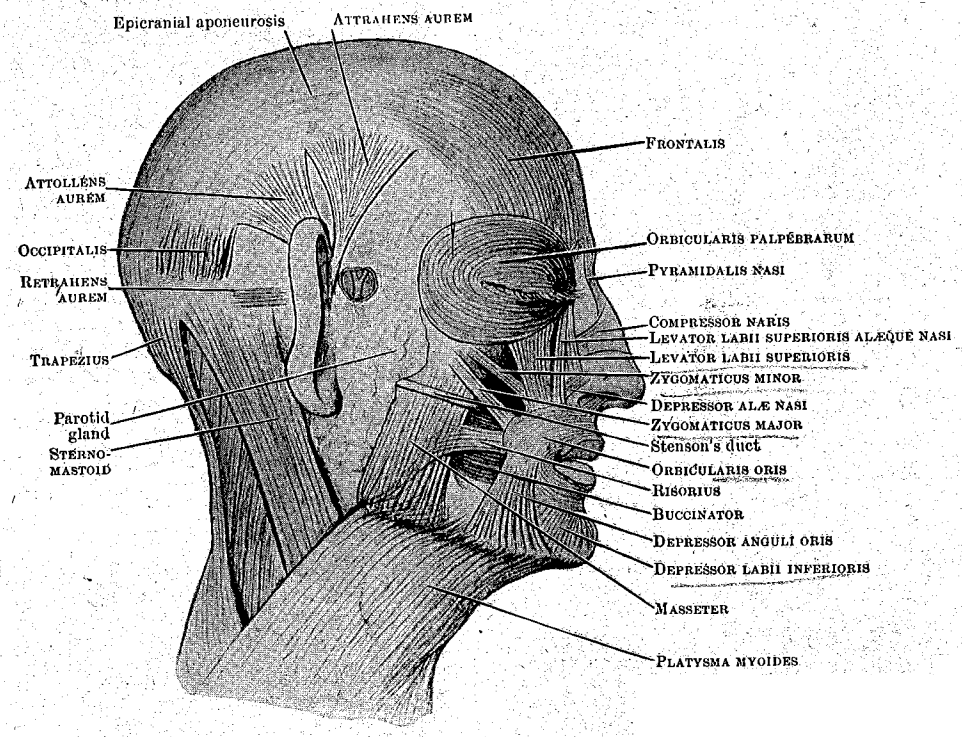
FIG. 12.



the exercise of the temporal and masseter muscles.

The figure on the right represents the same case a few months later, showing the correction of the open bite brought about solely by this means. The child's ability to masticate has been wonderfully improved, and it may be said in passing that the high degree of nervous irritability present at the start has largely disappeared, and the child shows a generally improved physical condition.

FIG. 13.



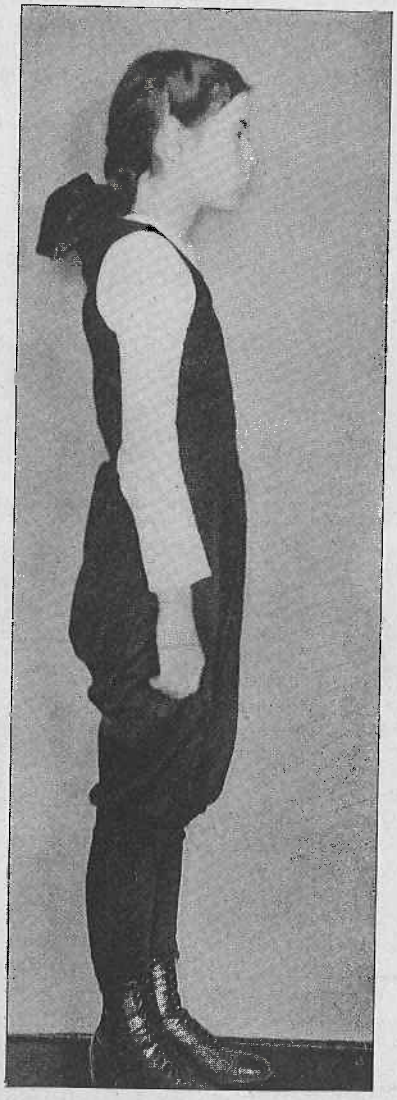
MUSCLES OF EXPRESSION.

Fig. 13 gives a general view of the lesser groups of muscles, but none the less important to the orthodontist. They consist of the levator labii, depressor labii, zygomaticus, orbicularis oris, and platysma myoides. The names of some of these muscles indicate their function and are perfectly well known. If they lack tone, or are not under control of the nervous system, they are the muscles which are most apt to place perplexing problems before the orthodontist.

Most of these muscles are in some way attached to the orbicularis oris, and when we have a general lack of tone in all these muscles there is sure to be lack of balance betweem them and the inner forces, such as the tongue. There are numerous exercises which can be used for stimulation of these groups, but it is not my purpose in this paper to deal particularly with these exercises. It might be well, however, for us to direct our attention to the orbicularis oris. Many of us, no doubt, have had difficulty in retaining the upper incisors in correct position. It is necessary, frequently, to apply retaining apparatus to effect this purpose, but if, in the meantime, this muscle has not become strengthened, in case it originally lacked tone, upon the removal of the re-

taining apparatus the incisors again become protuded. I have several cases in my practice where better results have been obtained in cases of this character without any retaining apparatus at all. One particularly obstinate case yielded to treatment applied for the strengthening of the orbicularis oris muscle.

FIG. 14.



A valuable exercise I have found for strengthening this muscle consists in pitting the strength of the thumb and first finger, or two first fingers, against the contractile forces of this muscle. Care must be taken in the performance of this exercise not to stretch but rather to contract the muscle around the slightly separated fingers. Thus ensues a contest of strength between the orbicularis oris and the muscles of the fingers. The contracted orbicularis oris can be readily seen during the exercise.

EXERCISE FOR GENERAL FACIAL DEVELOPMENT.

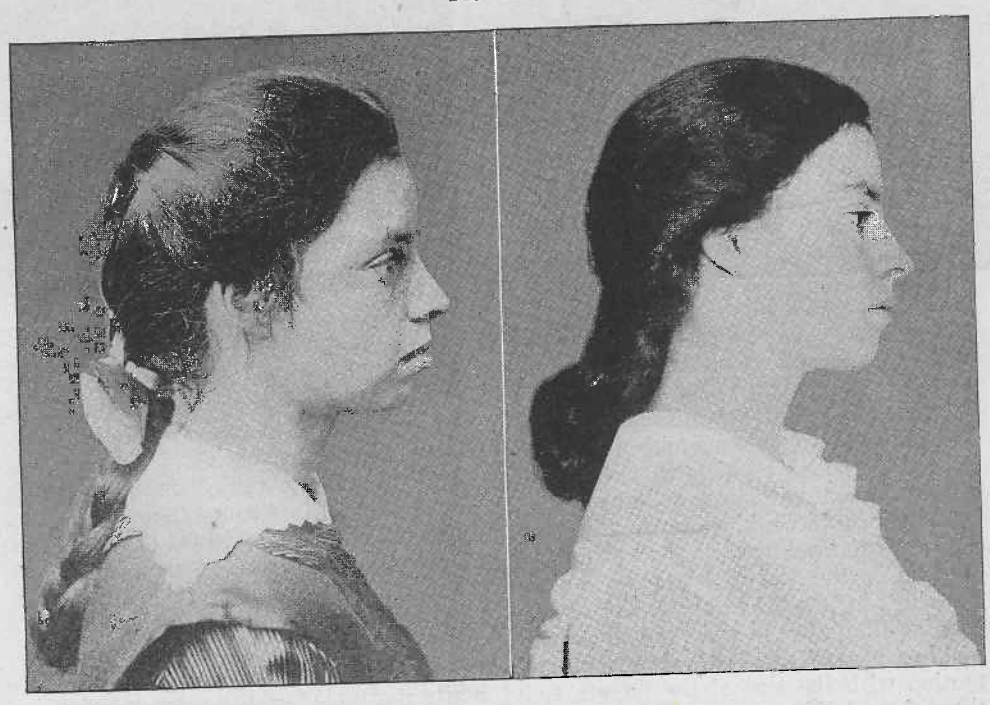
It is frequently found necessary to prescribe a tonic exercise which I have termed the exercise for general facial development. This exercise influences not only the orbicularis oris, but also the buccinator and all the small ribbon muscles which enter into combination with the orbicularis oris. It consists in the use of warm water at a temperature which is bearable to the mucous membrane of the mouth and in which has been dissolved a small portion of bicarbonate of soda. The patient is directed to take a sip of this solution closing the teeth firmly in position, and with great energy forcing the liquid from the lingual cavity into the buccal. The exercise is usually performed five times morning and night. The patient is directed to continue each exercise until the muscles are slightly fatigued. A not unpleasant aching sensation is the indicator of the successful effort. The heated liquid adds a distinct advantage to this exercise as it has a tendency to dilate the bloodvessels, thus producing a more copious supply of nutritive material. At the termination of this exercise the face will be found to glow with warmth.

THE PLATYSMA MYOIDES.

The platysma myoides muscle is one which to my mind is of great importance when considering the correction of faults in the facial muscular development. This muscle has no bony attachments, but is inserted in the fascia and skin of

FIG. 15.

FIG. 16.



the pectoral and deltoid muscles of the chest and upper shoulder at one end, and at its facial extremity is inserted by many fibers into the orbicularis oris and some of the other muscles upon or near their entrance into the orbicularis oris. It will then be seen that, if this muscle is contracted in its length by improper posture of the patient, it has a tendency to stretch the weakened muscles of the face in directions which bring gentle but harmful pressure upon the fragile bony structure of the child's face.

The exercise for this muscle is found in the general posture exercise illustrated in Fig. 5, which consists in having the patient stand with feet together, hips slightly thrown back, then directing the child, with head thrown back, to look straight to the zenith, at the same time drawing in the abdominal wall, and, turning the palms of the hands outward, making a slow and positive stretching motion with the tips of the fingers and the point of the chin.

The child is then directed to relax somewhat, bringing the head and arms to erect position—then repeating the impulse. This exercise is done at first a few times in the morning upon arising, and a few times before retiring, and is increased until the child is able to do it from sixty to one hundred times a day. It is important in this exercise that the child be not allowed to curve the vertebræ so that the back represents much concavity. To avoid this the child is directed, when drawing in the abdominal wall, to tighten at the same time the muscles of the buttocks.

Fig. 14 shows a subject much in need of this kind of treatment, and one in which one month of faithful practice has shown most gratifying results.

In Fig. 15 the profile on the left shows a child with slight distal occlusion. It will be noticed that the muscles around the mouth are poorly developed, and evidently not under proper nervous control. The picture on the right shows this same

FIG. 17.

patient after completion of the treatment and having now very satisfactory muscular development. The figure on the right also shows the improved contour and the more normal nervous control of the muscles of the face. This patient has developed an unusually fine set of masticatory muscles, whereas when the case was started these muscles showed very little development.

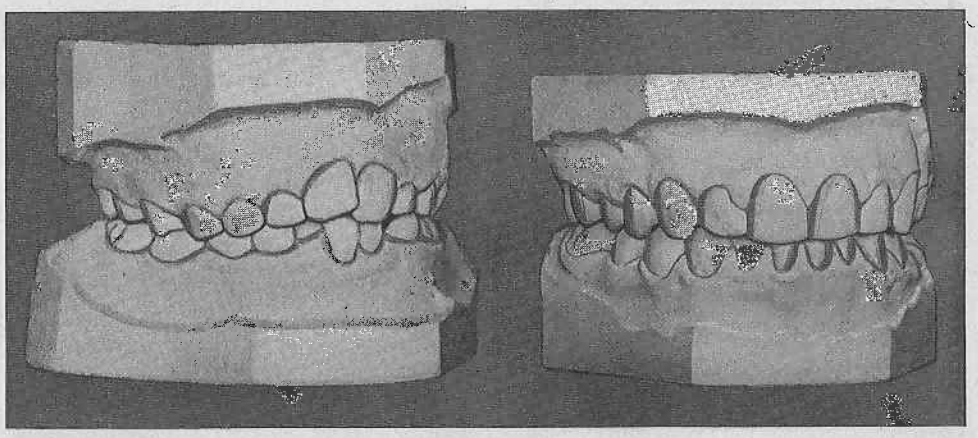
Fig. 16 on the left illustrates the facial contour of a child who was treated for several years by a careful orthodontist. Repeated efforts at retention were of no avail until after I placed the child under carefully prescribed exercises. It will be interesting, I am sure, for you to know that there is no recurrence of the protrusion of the upper and lower incisors, although there has been no mechanical appliance in the mouth for their retention.

I should like to direct your attention to one or two points in this child's face which cannot fail to be of interest. If we look at the region of the masseter muscle, in the picture on the left we notice that it is not well defined—that at the symphysis there is a flattening and puckering of the tissue. It will also be apparent that great lack of tone is evident in the orbicularis oris muscle. In the picture on the right will be seen the well-defined masseter muscles. The nervous contraction of the muscles at the point of the chin has disappeared, and the orbicularis oris has assumed a much more normal appearance. The figure on the right shows the profile a few months later, and after exercise for general development had been practiced. The points to which I would call your attention are again the masseter region, the lower surface of the mandible, the lips, and then the face in general.

It is impossible for me to describe the improvement in the character of the muscular tissue between the periods represented by these two pictures. At present, the feeling of health and strength shows a marked contrast between the feeling of flabbiness and inertia which was so noticeable upon a digital examination when treatment was begun. Fig. 17 shows the front view of this child, and gives us a very good idea of the value of the exercise for the orbicularis oris. It will be noticed that this muscle seems much firmer—we might speak of it as having been condensed, the aperture being considerably smaller.

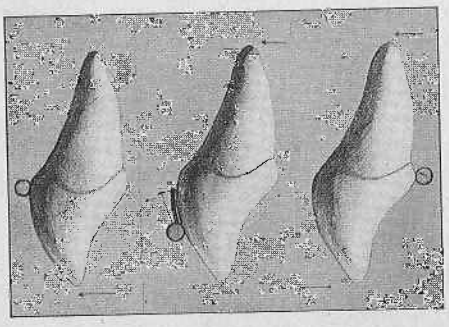
The case illustrated in Fig. 18 is one which calls for the development of the facial muscles, and represents a class with which we are all dealing daily. This treatment consists of general ex-

FIG. 18.



pansion of both arches by means of the junior pin-and-tube appliance on the upper and the lingual wire on the lower. After sufficient expansion was obtained to assure unhampered eruption of the per-

FIG. 19.

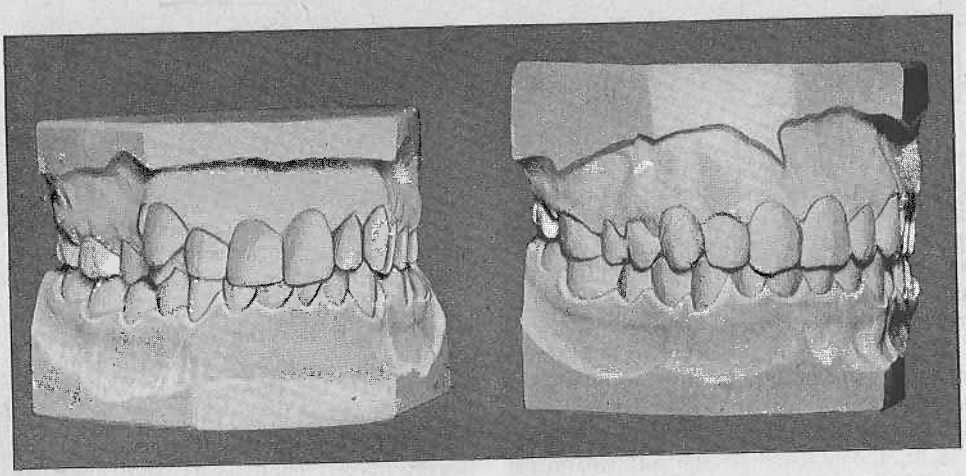


manent teeth, the child was instructed in the exercise of the masseter and temporal muscles. The upper junior pin-and-tube appliance was then removed. The lower lingual wire alone remains to preserve the development. No attempts whatever were made to correct the individual positions of the upper incisors. They gradually assumed their correct positions under the activity of normal function increased by the muscles of mastication. I offer this case as an example of many others treated in like manner.

Fig. 19 illustrates the positions taken by the various forms of appliances—the expansion arch, pin-and-tube appliance, and lingual wire. It will be seen from study of this diagram that the arrows indicate the tendency toward the movement under use of each of the three different systems. The pin-and-tube appliance has its advantage over the expansion arch in that it has compensating force which may be used in the correction of the apical position of the teeth. The lingual wire has great advantage when cases under treatment are to receive the full value of functional exercise. The movements of the teeth, of course, must be very slow, and the activity of the muscles increased as much as possible.

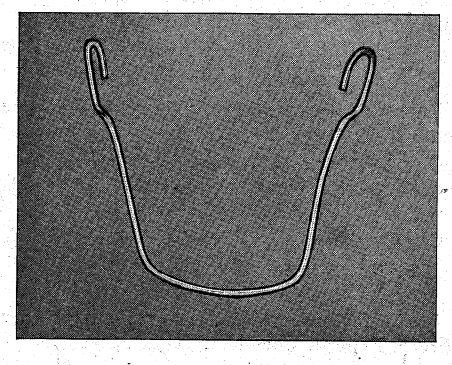
It will be seen that those muscles which come in contact with the labial and buccal surfaces of the teeth are unhampered in their normal influence upon the teeth themselves; and in this manner apical development is secured. The proper use of the lingual wire, supplemented, as suggested before, by activity of the muscles, has in my practice given little evidence of the tendency to tip the teeth. Of course, if the forces that are applied are unbalanced, or in other words, if the force of the lingual wire

FIG. 20.



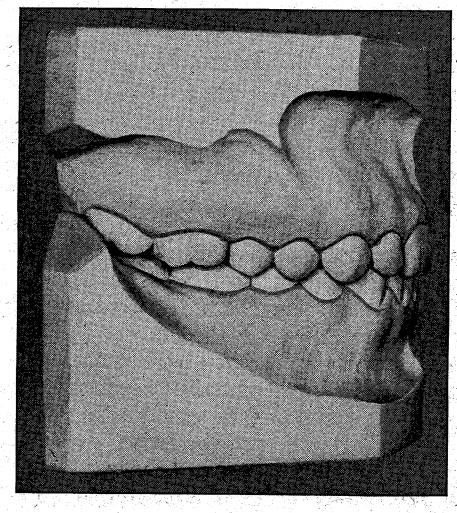
is so great as to overcome the influence of the muscles, tipping may be expected; but the essential thing is to proceed so slowly that the influence of the muscles

FIG. 21.



is not overcome. These methods are particularly applicable to the young, but may in older cases be used with considerable success. This may be seen in Fig. 20,

FIG. 22.

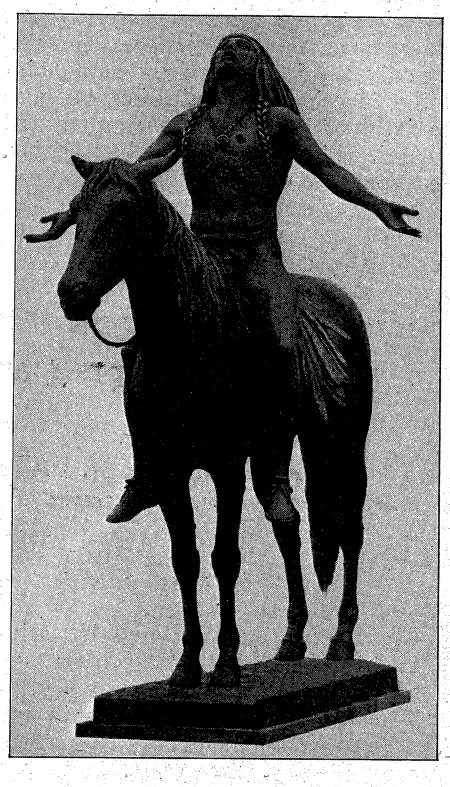


where the case of a child fourteen years of age was corrected with the use of lingual wires alone, together with a fair degree of exercise.

Fig. 21 illustrates the lingual wire familiar to all of us, but deserving more study and attention by the profession in general. Its simplicity and cleanliness alone should recommend it to more universal study and use.

Fig. 22 shows the anatomical area over which the muscles have their primary influence, and it seems to me a regrettable fact that orthodontists in general find it necessary to fill this space with unyielding and irritating appliances such

FIG. 23.



as so frequently are seen in the employment of expansion arches and ligatures. I should not wish to be understood as suggesting that the usefulness of the expansion arch has entirely disappeared, but I do make the assertion that its usefulness is limited, and is becoming more so.

I am ever reminded in my efforts for my patients that the mission of the orthodontist is not merely that of the "tooth-

straightener," but he must be a developer of the bony tissue which forms the framework for the organs of mastication; that his mission is not to stop when he has placed the teeth in some kind of occlusion; that it is his duty, in order to perform his work well, to strengthen all surrounding tissue that has to do directly or indirectly with the development of the face.

Our guardianship of little children is not complete until we, as orthodontists, gain a broad conception of the scope of our science, and minister to the young under our care until their faces represent not only the ideal from the standpoint of the function of mastication, but also the ideal of perfection in contour and strength which it is their right to enjoy. We cannot do better in reflecting upon our professional work than to keep in mind the physical perfection of primitive man, as illustrated in Fig. 23, Cyrus E. Dallin's "Appeal to the Great Spirit." While we do not turn to him for ideals in many things, yet we cannot escape from him when we seek the ideal of physical strength and endurance.

BIBLIOGRAPHY.

FREDERIC BOGUE NOYES. "Dental Histology and Embryology."

G. STANLEY HALL. "Adolescence."

D. J. CUNNINGHAM. "Textbook of Anatomy."

GRAY'S Anatomy.

520 BEACON ST.

[See also *Discussion*, as reported under "Proceedings of Societies," this issue.]

Careful Technique the Greatest Factor in the Construction of Full Upper and Lower Dentures.

By ALEXANDER H. PATERSON, D.D.S., Baltimore, Md.,

PROFESSOR OF TECHNICS, UNIVERSITY OF MARYLAND, DENTAL DEPARTMENT, BALTIMORE.

(Read before Maryland State Dental Society, Baltimore, June 6, 1918.)

I CLAIM no credit for anything original in this essay. What I am presenting at this time I have gained from reading, from observation in my practice, and through Dr. Hall's instructions for the past three years.

I am often reminded of a statement made by my professor in physics during my early school days, to the effect that the simplest way of doing things is usually the last to be discovered or made use of. So, at last, after all the various investigators in dental prosthesis have practically exhausted all sources in hunting for the truth, Hall brings forth for the profession a system of prosthetic dentistry extremely simple and comprehensive, and yet practical and scientific.

My object this evening is to prove to you that much of the technique given to the profession in past years, and considered absolutely necessary by many of the investigators for the successful construction of full upper and lower dentures, is to a large extent unnecessary.

It is now sixty years or more since Dr. Bonwill through an exhaustive study of several thousand skulls discovered that a line drawn from the center of one condyle to the center of the other measures approximately four inches, and a line drawn from this same center of the condyle on each side to the median line at the point where the inferior central incisors touch at their incisal edges is also approximately four inches. It is

we would not have to describe the cases. Just show him the record, and he will do the rest. He is interested in the mouth at the age at which it came to you, and not in the outcome. All that is necessary is to accord him the privilege of having free access to our collections of models, and furnish him with the data of age, height, and weight. That would be sufficient to assist him to establish quite a series of records.

Dr. Ferris' motion was carried.

Dr. F. L. Stanton, New York. I would like to move that a committee be appointed to standardize the record forms so they may be easily distributed, and the data be gotten in proper form.

Dr. Bernard Weinberger, New York. That was what I referred to when I discussed the President's Address this morning. We should cover not only this field, but take men like Hrdlicka, or Mr. Sullivan or some of those other men at the museum, and see if we cannot get the records broad enough to cover all they want, because there are other questions they are investigating at the same time.

Dr. Stanton's motion was carried.

The President. We all deeply appreciate the courtesy and the point of view of Mr. Spier in bringing this matter to us, and realize it is a labor of love, as our activity in regard to this subject must needs be, and we have a fellow-feeling for him.

A vote of thanks was tendered to Mr. Spier.

Dr. ALFRED P. ROGERS of Boston, Mass., then read a paper entitled "Exercises for the Development of the Muscles of the Face, with a View to Increasing their Functional Activity."

[This paper is printed in full at page 857 of the present issue of the DENTAL COSMOS.]

DISCUSSION.

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Dr. A. L. Johnson, Springfield, Mass. Does Dr. Rogers find it advisable to use the whole system of exercise in all cases?

Dr. Rogers. No. In class II the pterygoid and posture exercises; in class I the exercises for the general development of the face; in class III the muscles worked in the opposite direction. The entire system is an effort of the will, and it is a wonderful help if you can coordinate the mind and the muscle. We know of the athlete who can control any set of muscles at will. Anyone who undertakes this kind of work should be able to perform the exercise himself. There is not a thing I have taught my patients to do that I cannot do myself, and I do not attempt to instruct a patient in any exercise unless I know I can do it myself.

Dr. Julius Minez, Newark, N. J. What success has Dr. Rogers had with the short upper lip in class II cases?

Dr. Rogers. The lip can be changed in shape. One of those cases, which I referred to as a persistent mouth-breather, is showing a great deal of improvement in lip form. It is not so much a short upper lip as the contour of the mouth in general, and its habits.

Dr. C. A. Hawley, Washington, D. C. I have seldom listened to a paper that shows as much good sense and careful observation and experience as this one. It occurs to me that it affords practically the only solution of the retention problem. It refers to what I think we all believe is the etiology of malocclusion, the lack of function, that is, in the majority of cases. Unless in the end, after our mechanical work, we can restore something near the normal function of the teeth and the muscles surrounding them, retention is almost hopeless. We have all had cases, and it is unnecessary to go over them, where mechanical retention has failed. They recur again and again, and there is no time when we can remove the retention and say the case is finished and the teeth will stay.

I have had no experience whatever in these exercises, so I cannot discuss the paper in detail. It has often occurred to me that it is possible to change the food habits of people in our civilized state. I think I referred to that in an address about 1908. If we can change

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the food habits of the child and aid it by these muscle exercises, I think there is hope, and the results Dr. Rogers has had are, to say the least, extremely encouraging.

There is another tendency shown in Dr. Rogers' work which is extremely gratifying, and conforms to my later experience, and that is, the tendency toward simpler appliances. The whole paper impresses me more than anything I have heard in a long time. It is along lines that are going to be more and more successful in the future.

Dr. H. E. Kelsey, Baltimore, Md. I do not think I have sufficient experience along these lines to discuss the paper, but I cannot let the occasion go by without expressing my appreciation and obligation to Dr. Rogers. I believe this paper marks an epoch in orthodontia. A man I had not seen for some years said to me this morning that he did not know what orthodontists needed, but he said we needed something. We need this; it may not be all we need, but it is a great step in the right direction. The great change in the faces Dr. Rogers showed us was more significant and pronounced than anything I have seen in any similar cases. It is not alone that the protrusions were corrected and the profile was improved, but it seemed that almost every bone in the face had been altered, and strengthening harmony given to the whole head.

As Dr. Hawley has said, we have had cases where retention seemed hopeless, and we have had other cases where we thought we secured wonderful results, estimating exactly the time at which we could take our retention off. Those were undoubtedly the cases where function was fully restored. Those where the retention fails are those in which the function has not been restored. I know of no paper that has stimulated me so much, for a long time, as this one by Dr. Rogers.

Dr. A. Leroy Johnson, Springfield, Mass. I believe that Dr. Rogers' paper is a distinct contribution to a real science of orthodontia. An orthodontia which concerns itself with nothing more than the mere movement of the teeth, by means of appliances cemented to them, has not much of an excuse for being. There is one thing that occurred to me during the reading of the paper, that is, the necessity of evolving scientific tests to distinguish definitely the different natures of these cases; also the need of instruments which will indicate progress made in the training the essayist has outlined in his paper.

Dr. H. C. Ferris, New York. I want to compliment Dr. Rogers on the beautiful presentation of this scientific subject. A few years ago I presented to you a little rubber exerciser, and it was generally scoffed at, and very little attention was given to what was termed a "rubber rope." With that rubber exerciser I have been accomplishing the development of the muscles of the face and mastication by systematic exercises. In class II cases I instruct the child to roll forward on the rubber rope, and in class III to roll backward and bite as hard as possible a definite number of times at regular intervals on teeth which are under orthodontic pressure. For the orbicularis oris I have the child learn to whistle, and keep the fingers out of the mouth, as I found that a dangerous practice. Dr. Rogers has anticipated a report of my work, but has done the subject justice, and I congratulate him.

In reference to Dr. Hawley's idea of dietetics, I want to predict that the question of salivary analysis will eventually direct the dietetics of our patients. Through this means I am directing the diet and controlling the general physical condition of my patients in sustaining the tone of the alimentary canal and eliminating many of its acute and chronic diseases.

I am delighted to have heard this paper, and I hope it will have far-reaching influence.

Dr. G. W. Grieve, Toronto, Canada. I would like to add my word of commendation to the paper Dr. Rogers presented. One phase of it pleased me particularly, and that was the exercises which would tone the orbicularis oris muscle. We have all seen many patients with that terribly inert condition of that muscle

which almost makes us decline to attempt to treat the case. That particular point was very pleasing to me, and I am much encouraged now to take on those cases that I did not like the appearance of before.

Dr. J. V. Mershon, Philadelphia, Pa. I cannot let this occasion go by without expressing my appreciation of the work of Dr. Rogers. I hope he will carry it farther. I am reminded of a few records I have made in my own cases of the connection between mal-development of the bones of the face, which is sufficient to produce malocclusion, and the general mal-development of the whole child. I have made this statement on other occasions, and think if the men of this organization were to make a careful analysis of their patients, and obtain the history of their cases, they would find that where there is malocclusion to any extent we have many defects in the muscles and bones in the other parts of the body. I was hoping Dr. Rogers, in closing his paper, would express his conclusion a little differently; that he would have said orthodontia not only embraces the moving of the teeth in their relative relations to each other, but that all the organs and all the tissues of the mouth must be restored to their normal function.

Another important item which Dr. Rogers touched on, but with which he did not go quite as far as I would have liked to see him, was in expressing himself in regard to the various appliances. We have a large variety of appliances which are now in general use, but I think the ideal appliance is one which interferes the least with the normal functions of the tissues and organs of the mouth.

Dr. J. A. Gorman, New Orleans, La. Dr. Rogers has given us something that will doubtless fill a long-felt want. I should like to see him perform those exercises for us, so that we could get a better idea of the movements of the muscles, especially in the exercise of the orbicularis oris.

The President. I had a sort of kindergarten course with Dr. Rogers about a month ago, which rather opened my eyes. In fact, I was rather stunned at the scope it presented to my mind at the time. I think perhaps Dr. Rogers felt I was not as enthusiastic as he would have wished, but I have thought of it a good deal since that time, and have been ready for another step in this matter. I have enjoyed the paper today, even more that the rest of you, I am sure, unless you have had the privilege of hearing this matter spoken of before.

Dr. Rogers (closing the discussion). I want to thank you all for the very kind way in which you have received my paper. There is much more that I might tell you, but I do not want to speak too soon. I want to be positive of the things I do for my own patients. There will be more interesting results to come later.

The meeting then adjourned to 10 o'clock Tuesday morning, the Monday evening session being devoted to an informal dinner for the members and their guests, including the ladies.

(To be continued.)