EFFECT OF THE SERUM UPON THE BLOOD-COUNT.

In cases experiencing good effects of the serum, there is invariably an increase in the percentage of young lymphocytes of the blood. I have found no exception to this rule. On the other hand, in rapidly declining tuberculous cases, I have observed a progressive decrease in the percentage of young lymphocytes.

I have found no exception to this rule. From my own experience it seems to be the case that the more advanced the disease the lower the percentage of young cells.

Furthermore, it has been established beyond a doubt that the lymphatic system has much to do with cell genesis. Hence, since one of the first effects observed from the serum is an enlargement of the lymphatic glands in the region of the injected area, we infer that the serum in some manner increases the functional activity of these glands. I have also observed, from a weekly blood-count in tuberculous cases under the serum, that there has been an increase in the percentage of young cells in cases making improvement.

If we delay a diagnosis until bacilli make their appearance in the sputum, I am convinced that much valuable time is lost. All must agree that one of the chief points of importance in the study of tuberculosis is an early diagnosis. No serious consequence can follow a mistake made on the side of extreme precaution, while on the other hand, a mistake following an imperfect examination, or treating lightly the small signs of early beginnings, is always serious. I make it a rule to use the tuberculin test in all suspicious cases in which bacilli can not be found, before beginning treatment.

205-206 Jackson Block.

VALUE OF MUSCLE TRAINING IN TREATMENT OF VOCAL DEFECTS.

BY G. HUDSON MAKUEN, M.D.

Professor of Defects of Speech in the Philadelphia Polyclinic and College for Graduates in Medicine; Laryngologist to St. Mary's Hospital and the Frederick Douglas Memorial Hospital.
PHILADELPHIA.

At the last meeting of this Section, I had the pleasure of reporting five cases of falsetto voice in the male and their successful treatment by means of direct muscle training. As considerable interest was manifested in the subject, I thought it might be well at this time to give a brief outline of the method employed, suggesting some conditions in which it may be indicated and explaining somewhat in detail its practical application.

Whatever may be the remote causes of vocal defects, the direct cause is always a faulty musculature in the vocal mechanism. The method of training hitherto used to correct this faulty musculature has been for the most part an indirect one. It has been an effort to develop the muscles through the medium of approximately correct tones, and the method of direct muscle training, independently of voice, has played but little if any part in the process.

This fact is probably a natural consequence of the popular opinion that the vocal or laryngeal muscles are essentially involuntary, and that they can not be brought under the domain of the will, and of that still more fallacious and popular belief that voluntary effort on the part of these muscles, even if it were possible, would be inconsistent with artistic vocalization. While it is true that the intrinsic muscles of the larynx are for the most part involuntary, we have found that the extrinsic mus-

cles may be brought under direct control of the will, and, that the intrinsic muscles may be controlled to some extent indirectly by means of voluntary extrinsic effort. This volitional control should be abandoned as soon as its object, nervimascular development and harmony of nervimascular action, has been accomplished; and there will follow a speedy return to the normal automatic action, with all the machinery of voice in a much improved, if not quite perfect, condition. The framework of the larynx is composed of irregularly shaped cartilages articulating at their several points of contact by means of freely movable joints. Those muscles having their attachments only to these cartilages, and whose function it is to assist in the regulation of their relative positions, are called intrinsic muscles; and those running from the cartilages to various points without the larynx are called extrinsic muscles.

The study of intrinsic laryngeal action has been made possible by the introduction of the laryngoscope, and we are all familiar with the diagnostic points of intralaryngeal muscular defection as reflected in the mirror, but how little attention has been given to the action of the larger extrinsic muscles that are more easily studied and equally important in the production of voice.

The action of these latter muscles affects the voice in two ways: 1, by determining the position of the larynx to the adjacent structures; and 2, by determining the position of certain important parts of the larynx in their relation to other parts. The importance of a correct position of the larynx during phonation can not be overestimated, and although opinions differ somewhat on this point, it is probably true that this position should be one of close approximation to the spine, with the posterior surface or plate of the cricoid cartilage fixed against the fifth cervical vertebra.

Mr. John Howard, in his excellent book on "The Physiology of Artistic Singing," has shown that this laryngeal fixation is necessary for two important reasons: 1, it renders possible the tilting of the thyroid on the cricoid cartilage, for cord-stretching purposes; and 2, it furnishes the medium for the transmission of laryngeal vibrations through the spinal column to all portions of the body. Mr. Howard has also shown that the region of the fifth cervical vertebra, because of its comparative freedom from muscular padding and the forward convexity of the spine at this point, is particularly well adapted for contact with the larynx. Against the anterior surfaces of this vertebra the cricoid plate may be held firmly, and on it as a base, the thyroid and arytenoid cartilages may be moved with great accuracy and precision. The tilting of the thyroid cartilage is also almost wholly the result of extrinsic effort, and the degree of the movement may be determined both by observing the character of the voice and by direct ocular and tactile inspection.

Perfect extrinsic action, therefore, would result: 1, in a correct and fixed position of the cricoid cartilage; 2, in an accurate adjustment of the thyroid for every tone, and 3, in a favorable position and action of certain movable structures in the region of the pharynx—notably, the soft palate and tongue, to which these muscles are attached and of which they form a part.

It follows, on the other hand, that a faulty extrinsic action would result: 1, in the displacement of the larynx, either upward, downward or forward, removing it from its normal point of contact with the spine and impairing vocal resonance; 2, in an irregular and inaccurate thyroid tilting, interfering with the evenness of tone and accuracy of pitch; and 3, in a strained and un-

*Presented to the Section on Laryngology and Otology, at the Fiftieth Annual Meeting of the American Medical Association, held at Columbus, Ohio, June 6-9, 1899.

natural position of the palate, tongue, and lower jaw, interfering with resonance of tone and precision of articulation.

When, therefore, a voice lacks resonance, it is owing in part, at least, to a faulty position both of the larynx and of the aforementioned movable portions of the pharynx; and when the tone lacks evenness, and there is some uncertainty as to pitch, we may look for imperfect movements of the thyroid cartilage and a faulty action of those intrinsic muscles that control the vocal bands—which latter faulty action, as well as the imperfect thyroid tilting, depends directly on defective extrinsic musculature.

Now, having shown that some of the most serious defects of voice, whether it be for speech or song, are dependent entirely on a faulty action of the extrinsic muscles, it remains to consider how this faulty action may best be diagnosed and corrected. One object in the presentation of this paper is to offer a plea for an accurate diagnosis in defects of voice and direct muscle training as a means of treatment; to show that this method is possible and how it may be more rational and scientific than the one hitherto employed. In the first place, we must know the anatomy and physiology of the larynx and pharynx, the attachments of all the muscles, both intrinsic and extrinsic and the effect of the contraction of these muscles not only on the larynx, but on the resultant voice.

To carry the principle into the treatment of minor defects of voice and into the finer points of vocal culture, one would have to be an expert vocalist as well as a physiologist; but in the treatment of gross defects, such as come under the observation of the physician, the knowledge of vocal technic is not so essential. It is sufficient, having recognized the defect, to be able to determine on what condition of the larynx such a defect must depend, and furthermore, what faulty extrinsic muscular action can bring about this condition.

For instance, if we find a thin piping voice in a male, such as in my reported cases, we know we have impaired resonance and we look for laryngeal displacement; and as the pitch is too high, this displacement must be upward and away from the point of the greatest convexity of the spine.

In one of my cases, on examination externally, with the collar removed, the larynx was found to be nearly an inch above its normal position and resting on a thick cushion of muscles. There was a marked overaction of what may be called the levator laryngei muscles, which not only pulled the larynx upward, thus disconnecting it from the spine and destroying the resonance, but also assisted in tilting the thyroid forward, thus increasing the tension of the vocal bands and raising the pitch to a most unnatural key.

If, on the other hand, we have a lack of evenness of tone, we shall always find an irregular and spasmodic action of the thyroid tilting muscles, affecting also, as I have indicated above, the action of the intrinsic muscles controlling the vocal bands. Even the articulation of both the speaking and singing voice is greatly impaired also by a faulty action of the extrinsic laryngeal muscles, for the reason that some of the important muscles of articulation, the palatopharyngei for instance, and the hyoglossus and geniohyoglossus, have their lower attachments to the larynx.

As I have said, the normal action of the laryngeal muscles is automatic, and in the use of the normal voice in speech and song, there is little, if any, volitional control. This is as it should be, but when for any reason the

normal automatic action becomes impaired, the surest, speediest, and most scientific method in many cases would seem to be to establish a correct action under volitional control for purposes of nervimascular development and accurate co-ordination, and to continue this volitional exercise until the normal automatic action be re-established. Moreover, in the production of voice, all the laryngeal and pharyngeal muscles are in action, and vocal defects are quite as often the result of hypokinesia—too little action—as of hyperkinesia—too much action. The condition is similar to that of the eye, known as heterophoria, and the treatment should be along the same lines.

If, in our attempt to restore laryngeal balance, we are able by voluntary effort, independently of voice, to develop the weak, inactive muscle or pair of muscles, and thus make it of equal strength with the opposing muscles, we shall unquestionably remove the defect. The following are some of the muscles that I have found to be defective in action and subject to training by this method: the omohyoid, sternohyoid, sternothyroid—all depressor muscles; and the palatopharyngei, stylopharyngei, digastric, stylohyoid, geniohyoid and the hyoglossus—all levator muscles.

These muscles may be brought under direct control of the will either collectively or in pairs. There is a bodily sensation for the contraction of each one of these pairs of muscles, and one for the contraction of all of them combined. The sensation for the contraction of the depressor muscles of the larynx may be experienced by an effort to first fix the position of the clavicles and then to shorten the distance between them and the larynx without crowding with the tongue from above. The inner borders of the sternohyoid muscles may be easily felt by a finger placed in the suprasternal notch, and an effort to draw these borders together will cause an independent contraction of the muscles. A frequently-repeated effort of this kind will soon bring about the desired voluntary contraction, and when this is once accomplished, the development is only a question of time and practice.

The omohyoid is also a muscle over which voluntary control may be easily acquired. The patient is instructed to pull the shoulders backward and downward, thus making this muscle taut; and then with a finger placed on its posterior belly immediately behind the clavicle, to rock the head from side to side, when the movement of the muscle will be felt by the finger. In this way the sensation of its action may be appreciated and a voluntary control of the muscles, one on either side, may be acquired. The action of the stylohyoid may be controlled in the following manner: Grip the hyoid bone with the thumb and index finger at the junction of its body with the greater cornua, where the attachments of these muscles will be found, and then, with an effort to swallow, the muscles will be brought into action and will be distinctly felt under the thumb and finger. If we combine with the effort to swallow a slight sniffing of air through the nose, we shall eliminate, in part at least, the action of the palatopharyngei and get the independent action of the stylohyoid muscles. We then continue this independent action until it has been brought under complete control of the will. In a similar manner all the extrinsic muscles of the larynx may be controlled and developed, and I would suggest this direct muscle training as a valuable and scientific method, not only for the treatment of vocal and speech defects, but also for the training of the voice for singing or speaking.

DISCUSSION.

DR. J. HOMER COULTER, Chicago—I believe the doctor's paper

practically controverts and contradicts much that has been said and written as to voice culture and voice production. He has thoroughly demonstrated a fact which the throat photographs I had hoped to show you to-day would demonstrate to be absolutely true, namely, that the extrinsic muscles are of great importance in producing the resonant and tone qualities of voice, and in giving character to the voice. I am thoroughly convinced from my experiments in photography during phonation, that we have heretofore overestimated the importance of the true vocal cords in the function of voice production, and to as great an extent have correspondingly underestimated the part played by the extrinsic laryngeal muscles. Not that there can not be and is not in many cases voice production without the intervention of these muscles, but to produce a clear, penetrating, resonant and maintained tone such muscles are necessary.

RELATION OF THE NASAL AND ACCESSORY CAVITIES AND DENTAL LESIONS.*

BY D. BRADEN KYLE, M.D.

PHILADELPHIA.

The abnormal and pathologic conditions of the teeth causing nasal obstruction and disturbance may be considered under: 1. Nasal or antral irregularities with secondary lesions of the teeth. 2. Irregularities in formation of the alveolar process, allowing the teeth to penetrate into the antral or nasal cavities, thus permitting the extension of diseased processes.

There is an important relation between stomatology and rhinology. The entire superior maxilla, both as to formation and structure, is dependent on and controlled by nasal lesions in early childhood while the facial bones are flexible and of partly cartilaginous union. Mouth-breathing, particularly during sleep, through increased external pressure both by the air—the internal resistance being lessened—and by the muscular action in attempts at nasal breathing, contracts the arch, causes irregularity in the teeth and a characteristic droop to the nose. The nasal orifice thus narrowed persists even after the cause of the mouth-breathing is removed and the degree of benefit expected by such removal may thus not be realized.

Whatever the cause, obstruction to nasal breathing in children and irregularity in development of the accessory cavities are usually found associated. Generally, bad nutrition, lack of vascular stimulation in the nose may be contributing causes. Cryer has demonstrated the great variation in size and shape of the antrum from a little larger than a pea to three times the usual size and extending under the floor of the nose.

Irruption of teeth into the nose or antrum, or diseased teeth affecting either cavity may be etiologic factors in many cases hitherto obscure. The period after birth up to the time when osseous union occurs is the proper time to correct nasal irregularities and deformities. Possibly the most important causes to be corrected are deflection of the septum and enlargement of the pharyngeal tonsil; the lymphatic temperament is to be considered in making a prognosis in the latter class of cases. Pressure on the face at birth, or placing the child in the same position for weeks, may be the starting-point of facial irregularity.

Irregularly placed teeth usually show a precedent nasal obstruction. This may have been removed or, in the case of the pharyngeal tonsil, may have atrophied in adult life, yet the altered contour of the face and maldevelopment of the upper jaw persists. Thumb-sucking causes a characteristic alteration in the superior maxilla and floor of the nose along the lines of the foregoing.

The failure, in mouth-breathers, for the upper jaw, ill developed to properly fit with the lower jaw whose development has not been interfered with, is noticeable, and the staring, open-mouthed countenance is partly due to the fact that the masseter muscles have been trained to allow the jaw to hang open instead of holding it closed, a position that persists even after perfect nasal breathing has been established.

I have seen several cases of pericementitis or phagedenic pericementitis of the upper incisor teeth separated by thin laminae of bone, from a nasal obstructive lesion directly over them. The most plausible explanation of this is that the collection of secretion and irritation consequent on nasal obstruction has affected the underlying root and has forced the tooth down, thus bringing it out of the line of teeth into greater prominence. Now add a uric acid diathesis and there are present all the factors necessary to produce this condition. If instead of some general involvement, such as has been mentioned, the local irritation is kept up, there will be found at the root of the tooth new connective tissue which contracts and continues the pressure and irritation on the tooth with consequent pericementitis and sinus formation. Irregularities of the septum, especially spurs or ridges low down, are the nasal lesions most likely to affect the teeth. This is well illustrated by six cases. The first, a young woman of 18 years, with nasal obstruction, had an elongated incisor tooth, immediately under the nasal lesion, from which there was a pus-like discharge. Five other cases emphasized the fact that the tooth directly in the line of the obstruction and irritation was the only one affected. The reverse of this condition has been observed in a few cases, the nasal and antral lesion being due to extension from diseased teeth by continuity and contiguity of structure. Burchard of Philadelphia reports a case of alveolar abscess of a central incisor, with discharge from one nostril simulating ozena. He calls attention to the fact that the incisor foramen just behind the incisor teeth accounts for the pointing of these abscesses into the nose.

Irregularities in the formation of the accessory cavities will cause irregularity in the upper arch, and predispose to dental lesions as well as nasal disease. This is due not only to the nasal obstruction, but to the circulation in the nasal mucosa by the feeble air-current. Occlusion of the entire nasopharynx has also caused an irregular and malformed upper arch, the roots of the teeth almost penetrating into the nose.

The normal openings into the antrum vary in position and abnormal communication with other sinuses, particularly the frontal, and often prevent a cure by the mere draining of the antrum alone. The great variation of size, position and shape of the antrum, the thickness of the walls which thin with age, the presence of septa make definite rules as to puncture and transillumination impossible. Irruption of teeth into the antrum also shows an irregularity in development. A case was shown to me by Dr. M. H. Cryer of Philadelphia, in which, through an opening drilled into the cavity, we could distinctly make out an irrupted wisdom tooth. Similarly the teeth may irrupt into the nose, as MacCoy has shown, and may account for many of the peculiar neuralgias and apparently incurable catarrhs.

So in ozena, which in reality is only a symptom, the odor may come from a diseased tooth causing accumulation of gas into the antrum, with consequent escape into the nasal cavity, to which latter source the whole of the trouble is wrongly attributed. In the *International Medical Magazine* for December, 1898, I reported five

*Presented to the Section on Laryngology and Otology, at the Fiftieth Annual Meeting of the American Medical Association, held at Columbus, Ohio, June 6-9, 1899.