

Musical Instruments as an Aid in the Treatment of Muscle Defects and Perversions*

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I wish to say that this is not being given in the spirit of a cure-all for the treatment of perversions of the muscles of the face, but is merely to point out the way so that you may be stimulated to think in terms of these musical instruments, because you are constantly being confronted with problems which they involve. Consequently if I merely open the door, and you have an opportunity, through this open door, to look in and then investigate more thoroughly later at your convenience, I feel that we will be justified in giving this presentation.

In considering the use of wind musical instruments as an aid in the treatment of malocclusions of the teeth and in bringing about a normal condition of the facial musculature, it is necessary to classify the instruments according to the types of mouthpieces used in playing the various instruments, and to indicate the musculature used with each to produce the varieties of tone and pitch which are possible. For the purpose of convenience the following classification of instruments is established:

Class A

All instruments requiring a cup-shaped mouthpiece. In this class of instruments are the following, named in the order of increasing size of mouthpiece and instrument:

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|-----------------|--------------|
| 1. Trumpet | 6. Trombone |
| 2. Bugle | 7. Baritone |
| 3. Fleguel Horn | 8. Bass Horn |
| 4. French Horn | 9. Tuba |
| 5. Alto Horn | |

Cup-shaped mouthpieces are usually made of metal (some are bakelite, amber, etc.) and vary in depth and width of cup and width of brim according to the size of the instrument.

Class B

All instruments requiring a single reed clamped to a mouthpiece. In this class of instruments are the following, named in the order of increasing size of reed, mouthpiece and size of instrument:

- | | |
|---------------------------------|---------------------------|
| 1. E $\flat$ Clarinet | 6. C-Saxophones |
| 2. B $\flat$ A $\flat$ Clarinet | 7. B $\flat$ -Saxophones |
| 3. Alto Clarinet | 8. E $\flat$ -Saxophones' |
| 4. Bass Clarinet | 9. Bass Saxophones |
| 5. Double Bass Clarinet | |

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The single reed fits on the flat under surface of a mouthpiece made of wood, metal, hard rubber, bakelite or glass. The body, or barrel of the mouthpiece, is round and anterior to the body; the top surface tapers in a contoured fashion down to a thin edge. On the under surface is an opening, rectangular in shape, and distal to this opening is a smooth flat surface which receives the reed. A clamp around the body or barrel of the mouthpiece holds the reed firmly in position and allows it to vibrate over the rectangular opening when the lips and wind are applied.

Class C

All instruments requiring a double reed for a mouthpiece. In this class of instruments are the following, named in order of increasing size of reed and instrument :

- | | |
|-----------------|-------------------|
| 1. Oboe | 4. Contra-bassoon |
| 2. English Horn | 5. Sarusophone |
| 3. Bassoon | |

Double reed mouthpieces are made with two pieces of reed bound together at the posterior end with wire and binding cord and shaped to form a round opening which fits on a tube or crook. At the anterior portion is a broad carved and contoured surface which, with its fellow of the opposite side, forms an aperture, button-hole like in shape, through which the air is directed into the instrument.

Class D

All instruments having a hole or aperture in the head of the instrument for a mouthpiece. In this class are the piccolo and the flute, which is the larger.

Before discussing the musculature involved in playing the several classes of instruments, let us pause to consider the embouchure. The term, "embouchure," refers to the manner or method of applying the lips to the mouthpiece of an instrument. In the instrument classification herein established all those in a given class require the same embouchure, except for some slight modification due to the size of mouthpiece, the musculature being less tense for playing the larger than for the smaller ones. This is due to the fact that the lower tones of the larger instruments require a longer wave length of vibration.

The muscles involved in playing Class A instruments in the order of their importance are: orbicularis oris, caninus, triangularis, quadratus labii superioris, quadratus labii inferioris, zygomaticus, risorius, transversus menti, buccinator, masseter, platysma, supra and infra hyoid. The pyterygoideus externus move the lower jaw forward into playing position and the tongue, with its associated attachments, functions within the vault of the mouth and against the upper anterior teeth to start the tones. When the embouchure is placed against the mouthpiece there is contraction of the muscle fibers, causing the face to assume a tenseness, or strong musculature tonicity, and allowing a small aperture in the lips through which is directed the column of air into the instrument. For the higher tones the musculature is tensed more and for the lower notes it is tensed less.



Trumpet



Tuba



Fig. 1.—Examples of Class A instruments and a typical case of malocclusion where these instruments can be used beneficially. Picture at left shows mouthpiece in playing position.

Those cases of malocclusion presenting a general hypotonicity of facial musculature and flabby lips, as found in Class II, Division I, and Class I cases having protruding upper incisors, will be benefited by the use of Class A instruments. Where a short hypotoned upper lip, a flabby lower lip and a protrusive tongue are present, the use of the trumpet will help to strengthen

the lips and cause the tongue to confine its action within a definite area and develop it into a more pointed muscular organ, reducing it from its broad flat protrusive shape. Usually associated with these cases is at least a tendency to mouth-breathing. Therefore, the deep regular breathing required to provide sufficient air for playing this instrument will improve the breathing function, thereby stimulating narrow and constricted nasal passages to develop into normal size and contour to allow a free passage of air.

The area of the lips which comes in contact with the mouthpiece will feel a stimulating effect from the tension, thus causing freer and fuller flow of blood to the musculature. By the continued use of this instrument hypotoned tissue will develop a normal tonicity and short flabby lips will be lengthened and take on a new contour. When hypotonicity is extreme, the mouth very large, and the lips extremely bulky, then Class A instruments, requiring a larger mouthpiece, can be used to advantage.

The application of the embouchure to Class B instruments requires the mouthpiece to be placed partly in the mouth and between the lips. The upper lip touches the top surface while the lower forms a cushion for the reed. The muscles involved in using this class of instruments are the same as for Class A, except the order of importance and the pressure exerted by them is different. Those muscles having the chief function in producing the proper playing tension are the orbicularis oris, triangularis, quadratus labii inferioris, platysma, supra and infra hyoid group, buccinator and risorius.

The most valuable use for these instruments is in Class III malocclusion. By the action of the musculature in forming the embouchure we have an anterior restraining force which tends to prevent the mandible from protruding. Supplementing this action, the tongue is raised from the floor of the mouth during the act of tonguing the instrument, and there is a general stimulation to the tissue of the lower lip and a slight tension of the upper lip. There are several types of malocclusion where this class of instruments should not be used. They are all Class I cases having protruding upper anterior teeth, all Class II, Division I, and, because of the anterior restraining force acting on the mandible, all Class II, Division II cases.

The embouchure is formed for Class C instruments by placing the double reed between the lips, the upper and lower lip each forming a cushion. By increasing or lessening the tension of both lips the varieties of pitch are controlled. The buccinator, orbicularis oris, caninus and triangularis are the most important muscles in playing these instruments. This class of instruments can be used with any type of malocclusion without complicating the condition because there is no strong tension involved. To stimulate hypotoned tissue, to elongate and retrude the lips and for the general stimulating effect this class is excellent.

Some patients' lips are extremely flabby and lacking in muscle tonus, and associated with this is a characteristic curl or protrusion of the lips, the upper turning upward and outward and the lower turning downward and outward. There is an extensive exposure of the inner surface or mucosa of the lips, and usually they are badly chapped and cracked. The patient, in an attempt to relieve this condition, repeatedly moistens them by sucking the exposed surface, and thus, aggravates the irritation. In cases presenting this condition, Class C instruments provide an effective agent to help correct this abnormal-



Clarinet



Bass Clarinet



Fig. 2.—Examples of Class B instruments and a typical case of malocclusion where these instruments can be used beneficially.

ity, for the playing position of the lips requires that they be turned or curled inward over the incisal edges of the teeth. With the lips in this position and receiving the tensing action necessary to produce the varieties of tone, they will be greatly benefited, and after consistent practice for a reasonable time the curl or protrusion of the lips will disappear.

Applying the embouchure to Class D instruments requires rolling the

lower lip over the side of the head of the instrument and causing the edge to form a straight line well across the hole. The upper lip is stretched downward until it forms a small aperture through which the air is directed into the instrument. By increasing or lessening the tension of the upper lip the varieties of tone are produced. The muscles of most importance in playing Class D instruments are the orbicularis oris, triangularis and risorius. This class of instruments is especially valuable in those cases where there is a short upper lip and a strong mentalis muscle habit, or a protruding of the lower lip. To play these instruments necessitates that the lower lip be kept inactive while the upper lip is being stretched or drawn downward. In Class I and Class III malocclusions, presenting short upper lips and unruly mentalis action, Class D instruments are useful, but in both divisions of Class II cases they should be avoided.

It is quite evident that the use of wind musical instruments can be most beneficial in those cases presenting hypotonicity. However, it must not be assumed that cases of hypertonicity could not receive some benefit from their use or where hypertonicity is present that the use of instruments must be discontinued. If the class of instrument used is not contradicted for the particular class of malocclusion under question then there is not much danger of complications developing. Of course, the patient must be kept under close observation until all question of doubt is removed.

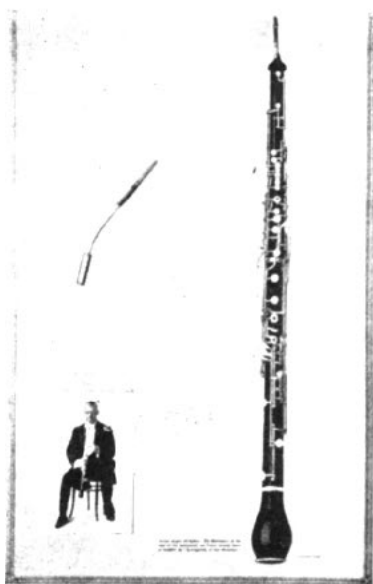
These instruments can be used to assist in the retention of cases. However, here again we must be certain that the instrument used is not contradicted. Should the patient desire to play a wind instrument, after the appliance has been removed then, in order to avoid complications, the orthodontist should be consulted.

Before closing this brief consideration of wind musical instruments, some thought should be expressed regarding the most important one of all, the human voice. Although the voice cannot be considered a wind musical instrument in the mechanical sense, yet it is in reality the most perfect of the wind instruments. No man-made musical instrument can compare with the human voice in complexity and delicacy of structure. The vocal organs form a complex wind instrument consisting of an air chamber, the lungs, a vibrating mechanism, the vocal cords, and set of reinforcing resonance cavities. From the anatomist's standpoint the vocal organs consist of four parts:

1. The lungs, together with the bones by which they are enclosed, and the muscles which fill and empty them.
2. The larynx and its appendages.
3. The resonating cavities, the trachea, pharynx, mouth, and the cavities of the nose and head.
4. The organs of articulation, the tongue, lips and teeth.

It is generally accepted by vocal scientists that each portion of the vocal mechanism has only one correct mode of operation. Each of these organs performs a different function in the production of useful and beautiful sounds.

Two apposed sets of muscles are concerned in the operations of breathing, those which respectively fill and empty the lungs. The action of inspiration consists of an expansion of the chest cavity, which by increasing its cubical capacity, draws air in from the outside to fill what otherwise would be a vacuum. The chest cavity is conical in shape, its base being formed by the



English Horn



Bassoon



Fig. 3.—Examples of Class C instruments and a typical case of malocclusion where these instruments can be used beneficially. Note the heavy protruding and curled lips.

diaphragm and its sides and apex by the ribs, sternum and intercostal muscles. Broadly speaking, there are two distinct forms of muscular action by which the chest cavity can be expanded in inspiration. One is the sinking of the base of the chest cavity; the other is the broadening of the chest by raising the ribs. In the judgment of most competent investigators the best form of breathing combines the two actions just referred to.

In the action of expiration, following the taking of a full breath, two sets of muscles are involved. These are: first, the abdominal muscles, which push the diaphragm back to its original position; second, the muscles which lower the ribs (the intercostals and some of the external abdominal muscles). A highly important feature of correct breathing is the control of expiration. In the first place all the expired air must be converted into tone, and none allowed to escape uncontrolled. Second, the vocal cords must not be exposed to the full force of an expiratory blast as they are too small and weak to withstand this pressure without strain and injury. It is generally held that this economy of breath can be secured without strain on the vocal cords, only by opposing the action of the inspiratory muscles to the action of the muscles of expiration. Instead of allowing the inspiratory muscles to relax completely at the beginning of the expiration, these muscles are to be held on tension throughout the expiration. By this means both the force and the speed of the expiration can be regulated at will, no undue pressure is exerted on the vocal cords, and the tone is prolonged steadily and evenly so long as the expiration lasts.

Considered acoustically, the voice is a wind instrument of the reed class. It differs from other wind instruments in that it is capable of producing a wider range of pitches, covering more than three octaves in many cases, by the operation of a single pair of reeds. Also there is a wide range of tone qualities through the combined action of its reed mechanism and its resonating cavities. The resonating cavities of the voice are the chest, mouth, pharynx, the nasal passages, and sphenoid, ethmoid and frontal sinuses. The mastery of these cavities is essential to the scientific management of the voice.

One of the most striking facts regarding the voice is this: If the voice is correctly used, it is benefited by exercise and improves steadily year after year in power, beauty and facility of execution. On the other hand, when the voice is wrongly used, exercise has the opposite effect. One general trouble at the bottom of all throat ailments which follow the wrong use of the vocal organs is a state of muscular strain suffered by the delicate muscles of the larynx. When the voice is correctly used, each muscle of the larynx exerts exactly the right degree of effort in its contraction. On the other hand, incorrect tone production always involves an excessive expenditure of effort on the laryngeal muscles, so that the throat is in a state of muscular stiffness in which all the muscles are contracted with more than their normal and appropriate degree of effort.

From the foregoing brief outline of the use of the voice it can be noted that undue tenseness and inharmonious action of the musculature of the throat and associated parts are detrimental to desirable tone production. Because of this, those who desire to sing must train all of the anatomical structures involved in voice production to acquire normal tonicity and harmonious inter-relationship. The muscles of the face cannot be in a hypertoned condition, for if they are there will be an abnormal tightness of the throat which will prevent desirable voice production. From this we can deduct that when hypertonicity of facial, supra and infra hyoid musculature is present, vocal training under a competent teacher will have a beneficial influence in reducing this condition. It should not be assumed that all hypertonicity will be overcome or that the patient will become a satisfactory singer. The main purpose is to



Flute

Piccolo



Fig. 4.—Example of Class D instruments and a typical case of malocclusion where these instruments can be used beneficially.

cause, as far as possible, less tense musculature and a harmonious interaction of the hypertrophic tissues.

The regular daily practice of singing is a highly beneficial form of physical exercise. All the muscles of the abdomen and thorax are strengthened by this exercise, the lungs are developed to their greatest normal capacity, and the habit is formed of breathing at all times in the most healthful manner. Both the circulation and digestion share in the benefits derived from regular vocal

practice, and the general health reflects the advantages incident to a proper performance of these most important bodily functions. An erect and graceful bearing, with well poised head and shoulders, and firm, elastic step can be secured through the correct practice of singing.

Conclusion

In conclusion, let us review the four classes of instruments and note particularly that the mouthpiece is the distinguishing factor :

Class A—Cup-shaped mouthpieces

Class B—Single reed mouthpieces

Class C—Double reed mouthpieces

Class D—Hole or aperture mouthpieces

Next, let us reconsider the indications and counter-indications for using these instruments with cases of malocclusion :

Class A instruments are indicated in hypotoned cases of Class II, Division I cases, and Class I cases having protruding upper incisors. This class of instruments is contraindicated in Class II, Division II, cases and also complicated Class I cases.

Class B instruments are indicated in Class III cases and are contraindicated in all Class I cases having protruding upper anterior teeth, and all Class II, Division I, and Class II, Division II, cases.

Class C instruments are indicated in all cases presenting a hypotonicity and requiring general stimulating and muscle toning effect. It is especially valuable where the lips are short, flabby, and roll away from the teeth. There are no particular contraindications except in some complicated Class I cases.

Class D instruments are indicated in Class I and Class III cases presenting short upper lips and unruly mentalis action. In both divisions of Class II and complicated cases of Class I they are contraindicated.

The use of the voice is especially beneficial in all cases where hypertonicity is present because singing requires that all the facial muscles, as well as those of the throat and chest, be under delicate control. There are no contraindications.

It should not be assumed that the use of the instruments referred to will correct all the complicated involvements of muscle habits and perversions. This paper is given that it may guide the orthodontist in closer observation of his patients, and that he may know what instruments can be permitted and those which will delay or destroy what he has accomplished or is trying to develop ; also that he may have a definite muscle control technic working for him during the patient's absence. In these days when parents do not give the fullest possible cooperation in following up their child's muscle exercises, it is a source of comfort to know that he is practicing definite muscle exercises under the supervision of a competent instructor of a suitable musical instrument.

One final word is necessary. All those who profess to be musical instructors are not qualified. Therefore, in referring your patients for musical instruction try to select a teacher who by training and experience is qualified, for harm can result from the use of improper methods.

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