The Prevention of Vocal Hyperfunction in Singers.

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THE PREVENTION OF

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by

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To my dear wife, whose selfless concern for our daughter has made this study possible, my inadequate words of gratitude are expressed.

To Professor Paul Knowles, who supervised the presentation of the evidence found herein, I offer my profoundest appreciation.
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ABSTRACT

The human voice is considered unusual among musical instruments due to its powers of communication. Despite the ability to produce an apparent endless variety of emotions, the voice suffers from severe limitations of stamina, range, and vocal dynamics. Therefore, the correct usage of the singing voice is absolutely essential if a lengthy career is to be attained.

The condition of vocal hyperfunction, or a sound produced with excessive force, can drastically curtail a singer's career. Due to the extreme difficulty of eliminating existing vocal hyperfunction, it was determined that data should be collected which would aid in its prevention.

A survey of the literature pertaining to vocal hyperfunction in singers was undertaken. Subsequent research produced significant information regarding the dysfunctioning of the areas of posture for singing, the vocal attack, respiration for singing, vocal registration, and vocal resonance.

A careful analysis of the evidence which was presented resulted in the conclusion that only through a heightened awareness of the anatomical and physiological factors involved in phonation can techniques be formulated to prevent vocal hyperfunction.
The significance of this study is that it presents information which will enable singers to prevent vocal hyperfunction and thereby extend the length of their careers.

Another aspect of this work is that the same information may prove invaluable in any attempt to remove existing vocal hyperfunctions.

Singing techniques which are physiologically correct should receive the widest dissemination possible among those concerned with the excellence of the art of singing.
CHAPTER I

INTRODUCTION

The human voice is unique among musical instruments in regard to its expressive capabilities. Although the voice is noted for its ability to convey a variety of emotions, it is easily surpassed by other instruments in such categories as range, dynamic levels, and endurance. Consequently, the correct usage of the voice during the act of singing is of greatest importance if vocal longevity is to be attained.

Despite the importance of this fundamental fact, it has been determined that a great majority of singers are completely oblivious to the principles of proper vocal production and vocal hygiene.\(^1\) A disregard of these principles will result in a condition known as vocal hyperfunction, a sound produced with unusual force or excessive muscular tension.\(^2\) Evidence has been

\(^1\)Morton Cooper regards the lack of correct vocal hygiene as one of the main causes of voice failure in singers. See Cooper, Modern Techniques of Vocal Rehabilitation (Springfield: Charles C. Thomas, Publisher, 1973), pp. 126-127.

presented which demonstrates that vocal hyperfunction eventually culminates in vocal hypofunction, or weakness of the focal folds. The purpose of this study was to examine the causes of vocal hyperfunction in singers and to offer recommendations as to its prevention.

Vocal hyperfunction was defined at the outset of this report. However, ensuing chapters will further delineate the essence of hyperfunction and its effect on the main parameters of vocal production. These chapters include the hyperfunctioning of the mechanisms of posture for singing, respiration for singing, the vocal attack, vocal registration, and vocal resonance. Further study will provide suggestions for the prevention of hyperfunction of these dissimilar elements of vocal production.

The method of research is historical and analytical. The procedure used was the examination of other investigators' opinions as to the causes and results of improper voice usage in singers. Next, the physiological principles upon which correct vocal production should be based were examined to determine the most effective means of preventing conditions of vocal hyperfunction.

The significance of the study is represented by the following points:

1. Historical considerations of vocal hyperfunction and its effect on the singing voice should add greater awareness to modern attitudes of vocal production.

2. A more thorough understanding of the physiological factors involved with correct vocal production should enhance the learning process for both student and teacher.

3. Vocal techniques which are physiologically correct should be examined, evaluated, and emulated whenever possible.

4. Any study which results in a greater awareness of the art of singing and vocal performance is worthy of pursuit.

Throughout this study the location of musical pitches will be made according to the following reference:

![Fig. 1. Reference to Location of Pitches](image-url)
CHAPTER II

VOCAL HYPERFUNCTION

Definition

One of the best definitions of vocal hyperfunction is that by the noted laryngologist, Dr. Friedrich S. Brodnitz, who has stated:

Hyper and hypo are the Greek prefixes for "too much" and "too little." Hyperfunction of the voice means the use of too much muscular force-or of force at the wrong places-in the production of the voice. Hypofunction describes the weakness of the voice as the result of diminished power of the muscles of the vocal organs.

The value of this terminology lies in the fact that it explains the mechanisms of most vocal disturbances in a simple way. Hyper- and hypofunction are-in a vast majority of these cases-different stages of the same disorder. It begins with hyperfunction, the use of too much force. If this hyperfunction continues for some length of time, the involved muscles cannot stand the constant strain any longer and hypofunction sets in with progressive weakness of the voice.  

Another description of vocal hyperfunction has been offered by Oren L. Brown, who has written:

A basic problem with many students is doing too much, what is technically called hyperfunction. It's just simply overdoing in one way or another, either singing too loudly, too long, too low, or a combination. A singer is an athlete, and one has to know the potential of the individual to know if he's a

---

1 Brodnitz, *Keep Your Voice Healthy*, p. 171.
long-distance or a short-distance runner. The two types are different in their physical makeup.²

The devastating effects of hyperfunction have been noted by prominent singers, singing teachers, and laryngologists. The ultimate result of hyperfunction is a condition known variously as hypofunction, myasthenia laryngis, or phonasthenia. Dr. Chevalier Jackson has indicated:

Myasthenia laryngis is defined as disability of the phonatory muscles of the larynx. It has no relation to myasthenia gravis. It is a common ailment among persons who use the voice occupationally. Accurate statistical data are unobtainable because most of the cases are recorded as chronic laryngitis, which is a mucosal inflammation that may or may not coexist.³

Jackson has further noted:

One of the largest groups of cases includes professional voice-users. These persons are in every degree of the social scale-teachers, hucksters, train announcers, auctioneers, college professors, stump speakers, politicians, statesmen, ministers, clergymen, evangelists. The largest single group is singers.⁴


⁴Ibid.
From the amount of time spent in study of the art of singing, it would appear that singers would possess a certain knowledge of the proper use of the voice. However, this is not always the case. Morton Cooper has studied the habits of singers and has observed:

Singers are often oblivious to good vocal hygiene. They talk many hours a day in adverse circumstances (yelling in cars, talking above noise at rehearsal, or at parties), and irritate the vocal cords before they arrive for the presentation. Because they are singers, they have the feeling that they can talk continually without difficulty.5

A disregard of the principles of vocal hygiene, which includes proper resting of the vocal organ, may be just as destructive to the voice as improper singing. The singer should realize that the vocal muscles need a period of rest each day in order that the voice may retain its strength and durability. Regarding the necessity of resting the singing voice, Jackson has concluded:

Of those who start out with an ambition for a great career in vocal music probably more than 95 per cent never attain it, and most of the promising vocalists who fail do so because of myasthenia laryngis. The laryngeal muscles, especially the thyro-arytaenoidei, cannot stand the strain of the years and years of grueling daily practice necessary to reach the top in operatic and concert work.

---

Few persons realize that the possession of a good larynx does not make a great singer any more than possession of a genuine Stradivarius makes a great violinist. In either case no talent will obviate the necessity for a lifetime of daily hours of practice. To make matters worse most singers talk all the time they are not singing in performance or practice. The laryngeal muscles get no rest.6

Also noting the importance of vocal rest is Norman A. Punt, who has reported:

It may be necessary to emphasize time and time again that his profession involves vocal athletics, and that his laryngeal muscles deserve the same degree of care and consideration as is employed by the wise trainer of sportsmen or racehorses. If the performer could only visualize the amount of work he is asking his larynx to withstand, he would be amazed not at its eventual failure, but at its powers of endurance. It is hardly facetious to say that most artists need three larynges—one for professional purposes, one for social and domestic use, and a spare.7

From the information presented thus far, it would appear that the condition known as vocal hyperfunction may have devastating effects on the vocal organ, as it may result in the condition of hypofunction (myasthenia laryngis or phonasthenia). Regarding the effects of phonasthenia, Richard Luchsinger has

6 Jackson and Jackson, Diseases, p. 625

remarked:

When the irreparable vocal damage found in advanced cases of phonasthenia is considered, the emotional, financial, and professional failure in such unfortunate victims of faulty occupational guidance dramatically demonstrates the importance of vocational counselling in young persons aspiring to a vocal career. . . . If a suitably structured vocal organ and the necessary vocal talent are absent, aspiring students of vocal professions should be dissuaded from their unfounded hopes before it is too late to remedy the tragedy of phonasthenia and its repercussion on the patient's occupational success and personal happiness.8

Concerning the treatment of myasthenia laryngis, Henry J. Rubin has stated:

If vocal exhaustion is due to acute strain, resting the voice should suffice to restore it. Since myasthenia is usually the result of degenerative changes occurring from protracted abuse, age, or their combination, the condition is most often seen in older singers. The outlook for restoration of the voice to its previous level of proficiency is not good if there is no response to simple measures, because vocal faults have by this time become so much a part of the vocalist as to be unrecognizable or so ingrained as to be ineradicable. Eccentricity in vocal production is sometimes characteristic of competent singers just as unorthodox form is often seen in fine athletes, and attempts to effect changes in order to bring about conformity to accepted norms may do even more harm than good.9


Since the prognosis for recovery from vocal hyperfunction is guarded, it would seem that its prevention would be easier than any attempts at its removal. Also, mention must be made of the fact that very few laryngologists or speech therapists are qualified to aid in the removal of vocal hyperfunction in singers. Rubin has concurred:

It must be made clear at the outset that the laryngologist is not a voice teacher. While it would be ideal if he were at ease in the realm of the vocal artistry, his knowledge of vocal techniques and his over-all musical background are usually inadequate to permit critical evaluation of the singing voice on a professional level. A general comprehension of the problems that beset the singer is as much as can be expected of a physician whose training and daily routine are far removed from the maestro’s studio.¹⁰

Due to the fact that a cure for vocal hyperfunction may be virtually impossible to effect, it appears imperative that a singer possess a vocal technique which would not result in hyperfunction. Also, "... by knowing the pitfalls, one is not only better prepared to guide the healthy voice but is also in a better position to understand and guide those who come up with problems."¹¹ A thorough knowledge of the anatomy and physiology


of the vocal organ and its related components is an invaluable aid in the prevention of vocal hyperfunction.
CHAPTER III

THE ANATOMY OF PHONATION

Despite the fact that the primary function of the organs of the speech mechanism is not speech, but rather respiration and digestion, speech is still a highly important function of these organs. Being an extension of speech, singing utilizes basically the same mechanism but in a more highly refined manner. The organs of the speech mechanism are varied in number and function but are inter-related in regard to the phonatory function. An analysis of the more important individual sections of the system would appear beneficial in the understanding and prevention of vocal hyperfunction in singers.

The phonatory mechanism is made up of essentially two main parts: (1) a central or coordinating system located in the brain and (2) a peripheral (outer) portion consisting of the vocal (phonatory) system, an articulatory (word-shaping) mechanism, and a resonating system. Impulses are sent from the motor portion of the speech centers of the brain to the peripheral organs of phonation and are coordinated into a single, highly functional unit.
The Larynx

The larynx has been termed a biological and biosocial organ. Its biological actions include such acts as swallowing, aiding in respiration, keeping food from entering the lungs, aiding in lifting heavy objects, and aiding in the process of defecation. It is considered biosocial since it is the source of speech, an obvious social, communicative function.¹

The larynx consists of a network of cartilages, muscles, and ligaments bound together in an intricate, unique manner. There are nine cartilages of the larynx in number, three paired and three single. They are the thyroid cartilage, the cricoid, two arytenoid, two corniculate, two cuneiform, and the epiglottis.

The thyroid cartilage is the largest cartilage of the larynx. The prominent angle of the thyroid cartilage is caused by its two sections (laminae) being joined together at almost a ninety-degree angle. The vocal folds, two ligaments, are attached in front to the angle of the thyroid cartilage.

The cricoid cartilage, a smaller cartilage which supports the thyroid cartilage, is ring-shaped and higher in the rear than in the front. The lower cornu (horns) of the thyroid cartilage

cartilage are bound to facets on the side of the cricoid near the rear by means of the ceratocricoid ligaments. The upper cornu are attached to the lateral hyothyroid ligament which connects the thyroid cartilage with the hyoid bone. The middle cricothyroid ligament also attaches the two cartilages.

The epiglottis cartilage is covered by a thin membrane, the glossoepiglottic folds. The primary function of the epiglottis is to fold over the trachea during the act of swallowing, thus keeping food from entering the airways.

The paired arytenoid cartilages are the most important in the entire larynx for the purposes of speaking and singing. They are located on the rear part of the cricoid cartilage, where the posterior portion of the vocal folds are attached to the anterior part of each arytenoid cartilage. The arytenoids are pyramid-shaped cartilages having three surfaces, a base, and an apex. Other attachments of the arytenoids include the corniculate cartilages which aid in holding the arytenoids backward and medialward. The cuneiform cartilages are of secondary importance and are absent altogether in some individuals.

Also attached to the arytenoid cartilages are several important muscles which act as approximators of the vocal folds. These include the following:

1. Cricothyroids. These muscles have their origin at
the front and upper surface of the cricoid cartilage. The action of these muscles causes a downward tilting of the thyroid cartilage which in turn stretches the vocal folds, resulting in an increase in pitch.

2. Posterior Cricoarytenoids. These muscles have their origin at the rear of the cricoid cartilage. The action of these muscles causes the front part of the vocal process to rotate outward. This action in turn causes the arytenoids to tilt backward, causing the vocal ligaments to become tense.

3. Transverse Arytenoid. These muscles originate on the upper surface and outer border of each arytenoid. Their action closes the glottis (space between the vocal folds) by drawing the arytenoids together.

4. Oblique Arytenoid. These muscles originate at the base of the rear surface of the arytenoids. The action of these muscles stabilizes the arytenoids by drawing their tips together, causing the glottis to be closed.

5. Lateral Cricoarytenoid. These muscles originate at the upper border and on each side of the cricoid cartilage. This group of muscles is the antagonist of the posterior cricoarytenoids and aids in closing the glottis by creating a condition of tension in the vocal folds which in turn rotates the arytenoids inward.
6. External Thyroarytenoid. This muscle originates at the angle of the thyroid cartilage. The action of this muscle is to draw the arytenoid cartilages forward, thus relaxing the vocal ligaments. It also tilts the cricoid cartilage.

7. Vocalis Muscle. This muscle originates at the angle of the thyroid muscle. The action of this muscle is to draw the vocal process forward, thus relaxing the vocal ligaments.

The major ligaments and membranes of the larynx include the following:

1. Hyothyroid Membrane. This membrane connects the hyoid bone and the thyroid cartilage.

2. Cricotracheal Ligament. This ligament connects the cricoid cartilage and the trachea.

3. Conus Elasticus. The most important ligament within the larynx. It is the base upon which the muscular function of the vocal folds takes place.

4. Vocal Ligaments. These ligaments originate at the angle of the thyroid cartilage and extend to the vocal process of each arytenoid cartilage.

5. Aryepiglottic Folds. A fold of mucous membrane that forms the collar of the larynx.

6. Cricothyroid Ligament. This ligament unites the cricoid and the thyroid cartilages.
7. Corniculate Pharyngeal Ligament. This ligament unites the corniculate with the cricoid cartilage at the pharyngeal wall.

8. Hyoid Bone. Although the hyoid bone is not a ligament or membrane, it exerts considerable influence on the vocal folds through muscular connections.

The larynx is located in the middle of the upper part of the neck. Its length varies from approximately 36 mm in women to approximately 44 mm in men. The laryngeal cavity is divided into three sections: (1) subglottal (below the level of the vocal folds); (2) glottal (at the level of the vocal folds); and (3) supraglottal (above the level of the vocal folds).

The actual vocal fold is comprised of the vocal muscle (thyroarytenoideus) and the vocal ligament (ligamentum vocale). Phonation occurs when breath from below the vocal folds is released through the glottis. The sound produced is the result of pressure variations of the expiring air stream and not that of the vibrating vocal folds. The amount of sound produced at the level of the glottis is relatively insignificant, being considerably amplified by the supraglottic resonators, in particular the pharynx.

**The Pharynx**

The pharynx is a muscular tube which extends from the base
of the skull to the lower border of the cricoid cartilage. It is divided into three sections: (1) the laryngopharynx, which extends from the hyoid bone to the lower border of the cricoid cartilage; (2) the oropharynx, which extends from the hyoid bone to the soft palate; and (3) the nasopharynx, which extends from the soft palate to behind the nose. The pharynx is also connected to the auditory tube orifices, mouth, and esophagus.

The side and rear walls of the pharynx are formed mainly by the three constrictor muscles: (1) the inferior constrictor; (2) the middle constrictor; and (3) the superior constrictor. These three muscles are attached to a bony or cartilaginous base and sweep around, overlap, and join their antagonists with a fibrous bond. Other muscles, such as the tensor muscles, fill the gaps between the constrictor muscles, and have various functions including the strengthening of the pharyngeal wall and functioning in relation to the soft palate. The walls of the pharynx are lined with the same type of mucus as in the nasal cavities, the mouth, the auditory tubes, and the larynx.

The Neck

The lower portions of the jaw form the upper borders of the neck. All structures leading down from the pharynx and larynx into the chest lie in the frontal portion of the neck where they are surrounded by a muscular sheath. The vertebral
column marks the rear boundary of the neck. The platysma, a thin muscle, surrounds the front and side neck area. It extends from the lower part of the face to the upper parts of the chest and shoulders.

The bony-cartilaginous framework of the neck consists of the hyoid bone, thyroid membrane, thyroid cartilage, cricothyroid membrane, cricoid cartilage, and the trachea.

The esophagus, larynx, trachea, cervical blood vessels, and the important nerve trunk are all in the space enclosed by the platysma. The neck also encloses many important nodes, glands, and muscles.

The Esophagus

The esophagus is that portion of the alimentary canal that extends from the pharynx to the stomach. It has its origin at the lower border of the cricoid cartilage where it is continuous with the pharynx. This beginning is also its narrowest part. It extends downward in the chest and through the esophageal opening of the diaphragm all the way to its connection into the stomach.

The Thorax

The thorax is an osseo-cartilaginous cage, containing and protecting the major organs of circulation and respiration. It
is cone-shaped, narrow above and broad below, and somewhat flattened from front to rear.

The front of the thoracic cage is formed by the sternum (breast bone) and the costal (rib) cartilages. The rear of the thorax is formed by twelve thoracic vertebrae and the rear part of the ribs. The sides are convex. There are eleven intercostal spaces which are filled with the intercostal muscles and membranes. The diaphragm serves as the floor of the thorax and the apex of the abdominal cavity.

Some of the important organs which the thorax encloses include:

1. Lungs. The lungs are the main organs of respiration. They are two in number, each covered by a double layer of membrane (pleura) which forms a closed sac. The lungs are separated from each other by the heart and other fundamental organs. Although the lungs are highly elastic, they cannot exert any force apart from their elasticity. Each lung is conical in shape, has an apex, a base, three borders, and two surfaces. Also noteworthy is the fact that the interior surface of the lung is multiplied by the subdivision of the lung into air sacs, thereby exposing more red blood cells to oxygen. These air sacs are termed alveoli.

The lungs receive oxygen through the trachea, a short
cartilaginous and membranous tube extending from the lower part of the larynx to a point of division called the carina. From the carina it divides into a right and left main bronchus. The bronchus then continues into the lungs.

2. Diaphragm. The diaphragm is one of the main muscles employed during respiration. It is a dome-shaped muscular fibrous partition which separates the thoracic cavity from the abdominal cavity. The muscular fibers of the diaphragm originate from the rear section of the sternum, from the inner surfaces of the cartilages of the lower ribs, and from the vertebrae near the loins (lumbar vertebrae).

Other muscles of respiration include pectoralis major and pectoralis minor, which are rib raisers; latissimus dorsi, which are rib raisers; levatores costarum, which are rib raisers; serratus posterior inferior, a group of rib depressors; rectus abdominus, transverse abdominus, external oblique and internal oblique, muscles of exhalation; and the pelvic diaphragm, which forms a support for the viscera during inhalation.

Articulatory Organs

Articulation is the process whereby laryngeal vibration is transformed into speech. The organs of the mechanism of articu-
lation include:

1. Mouth. The mouth or oral cavity is considered the first segment of the alimentary canal. The oral cavity is joined to the pharynx at the rear. The roof of the oral cavity consists of the hard and soft palate

2. Lips. The lips are formed externally by the skin and internally by the mucous membrane. Between these two components are muscles, blood vessels, networks of veins, tissues, and glands. The fremulum is a small fold of mucous membrane that connects the inner surface of each lip with the gum

3. Gums. The gums consist of a dense, fibrous, tissue covered by a smooth mucous membrane containing blood vessels. The gums are connected to the vascular membrane (periosteum) of the alveolar process of the upper and lower jaws

4. Cheeks. The cheeks are similar in structure to the lips

5. Upper Jaw. The upper jaw is a box-shaped hollow bone which encloses the upper jaw (maxillary) sinuses. The upper jaw is closely related to the nose and cheek formation, tooth structures, and the hard palate

6. Lower Jaw. The lower jaw or mandible is the largest and strongest bone of the face. Its upper border contains cavities into which the teeth are affixed.

7. Tongue. The tongue is a large muscular organ located
in the floor of the mouth and ventral wall of the pharynx. It is divided into three sections: (1) base; (2) tip; and (3) dorsum (body)

8. Hard Palate. The hard palate forms approximately three-quarters of the roof of the mouth. It is formed by the palatine processes of the jaw bone.

9. Soft Palate. The soft palate is a moveable structure covered by mucosa and suspended from the rear border of the hard palate. The soft palate is united on the sides to the pharyngeal wall and also to the tongue by the palatine arches and pillars. The soft palate acts as a division of the pharyngeal and nasal cavities.

10. Nose. Although the nose or nasal cavity is not considered an articulatory mechanism, it assists in the formation of some consonants (m, n, and ng). It is connected to the oral cavity by means of the hard and soft palate.²

A detailed knowledge of the muscular processes involved in the singing act will enable a concerned voice teacher to formulate teaching procedures which can circumvent vocal hyperfunction. Illustrations of the more significant aspects of the laryngeal mechanism may be found in appendix A.

CHAPTER IV

HYPERFUNCTION OF THE MECHANISM OF POSTURE

Since proper posture is essential to proper respiration, great care must be taken to insure that no manifestations of postural dysfunction occur before or during the act of breathing and singing. The act of respiration, or, what singers term 'breath support,' has been recognized as being dependent upon proper posture. Regarding the importance of posture, Lucie Manen has stated:

A singer, like an instrumentalist, is dependent on a good instrument. Whilst instrumentalists can choose an instrument which they can test and which matches their artistic temperament in tone and technical range, the singer has no choice; his instrument is his own body. Instrumentalists can go on performing even in their old age, long after they have acquired artistic maturity, but the would-be singer must be aware that his career will be much shorter. The length of his career can, however, be extended provided he succeeds in preserving physical fitness. In order to achieve this he must learn to stand correctly, since the singer is usually required to perform in a standing manner.1

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It should be noted that opera singers are frequently required to perform in non-standing postures. Nevertheless, they must position their bodies so that the various components of the singing mechanism function in as normal a manner as possible.

A more specific statement concerning the importance of posture has been offered by William Vennard, who has observed:

> Before trying to play any instrument one should learn how to hold it. Vocally this means posture. The head, chest, and pelvis should be supported by the spine in such a way that they align themselves one under the other-head erect, chest high, pelvis tipped so that the "tail is tucked in." The position of the head should allow the jaw to be free, not pulled back into the throat. This liberates the organs in the neck. The high chest implies that the shoulders go back, but they should relax and be comfortable. There should be no straining like a soldier on parade. A certain amount of tonicity of the abdominal muscles will be needed to keep the pelvis upright, but there should not be so much that deep breathing is impossible. This aspect of posture should be ignored if it prevents abdominal breathing.2

The importance of correct posture and its relationship to respiration for singing cannot be overemphasized. Unless the posture of the singer is absolutely correct, proper breathing for singing is virtually impossible. In addition, any

postural malfunction may have debilitating effects on the body and the voice. Concerning the relationship of posture to that of breathing, Lowman and Young have concluded:

Faulty posture, therefore, very directly affects the integrity of the breathing process, for when the dorsal spine droops into a rounded or kyphotic position, the ribs are lowered, the diameters of the chest decrease, and normal tension cannot be built up in them. Anteriorly, as the ribs and sternum sag, the abdominal wall relaxes since these muscles cannot store up tension. Furthermore, the large suspensory ligament on the cervical fascia from the base of the neck which helps to hold the heart and lungs will sag. Thus, their position is lowered and the general slump of the upper trunk will reduce the efficiency of the whole respiratory action.  

On the basis of information presented, it would appear that correct posture can help preclude hyperfunction of the breathing mechanism by allowing more efficiency and energy in the process of respiration for singing. The main elements of postural hyperfunction include the following conditions:

1. An improper positioning of the pelvic basin, resulting in an abnormal protrusion of the abdominal cavity and general bodily fatigue.

2. An improper positioning of the head, either too far backward or too far forward, resulting in muscular constriction

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of the neck area

3. An improper positioning of the arms, usually behind the back, resulting in severe cramping of the thoracic cage

3. An improper positioning of the shoulders, resulting in excessive tension in the upper chest and neck area

5. An improper balancing of the body on the feet, resulting in a misalignment of the spinal column, resulting in general bodily fatigue

6. An improper carriage of the chest, either too high or too low, resulting in reduction of ease and efficiency of respiration.

The prevention of postural hyperfunction is best realized through a knowledge of the relationship of posture to that of breathing for singing. The correct posture for singing is that positioning of the body which encourages the maximum ease and efficiency of the breathing mechanism. However, at no time should a fixed position of the body be adopted, such action having an extremely negative effect on the voice. The correct positioning of the body for prevention of postural hyperfunction

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should include the following:

1. The chest must be held comfortably high at all times, so that the neck and throat areas receive no undue tension. Proper elevation of the chest reduces the strain on the neck muscles, assuring the correct action of the laryngeal musculature.

2. The head should not be tilted excessively forward or backward.

3. The shoulders should not be held stiffly backward in a military posture. A comfortable, slightly forward position of the shoulders allows for maximum freedom of movement of the upper torso.

4. The spine should be inclined slightly forward.

5. The pelvis must be tucked in and up, providing the necessary support for the abdominal organs which will be pushed downward by the diaphragm upon inhalation by the singer.

6. The legs must not be locked at the knees or circulation will be impaired, resulting in faintness or rigidity of appearance.

7. The hands and arms should be completely relaxed, with the elbows away from the ribs.

Proper posture is the foundation of the singing voice. The prevention of hyperfunction in this area is an invaluable aid in the prevention of additional phonatory hyperfunctions.
CHAPTER V

HYPERFUNCTION OF RESPIRATION FOR SINGING

Although breathing for the purpose of singing is one of the most complex physical acts the vocal artist must master, at no time should the method of breathing being used interfere with normal respiration for the life-sustaining process. In regard to the purpose of respiration in man, Luchsinger has noted:

Breathing is one of the cardinal functions of terrestrial organisms. In its primary purpose it serves the metabolic gas exchange. During inspiration oxygen is inhaled into the lungs to be absorbed by the hemoglobin system of the red blood cells (erythrocytes), which float through the capillaries around the tiny air sacs (alveoli) of the terminal bronchial ramifications. At the same time, carbon dioxide leaves the red blood cells and passes into the alveoli to be exhaled during the following expiration.¹

The main organs of respiration are the lungs, which are enclosed within a delicate membraneous sac, the pleura, on each side. A slight space, the pleural space, located between the pleurae and the thorax, is filled with a slight amount of fluid. Despite the small volume of fluid surrounding the pleurae, the acts of inspiration (inhalation) and expiration

¹Luchsinger and Arnold, Voice-Speech-Language, p. 3.
(exhalation) are determined wholly by pressure changes within this space. Due to the enclosure of the lungs, the air pressure within them is very responsive to force exerted upon it by the action of the thoracic cage and the abdominal diaphragm.

The amount of air that can be inhaled or exhaled during relatively quiet breathing (about 500 cc or 1 pint) is termed the tidal breath. The amount of air that can be inhaled in addition to the tidal breath (about 1600 cc or 3 pints) is termed the complemental breath. The amount of air that may be exhaled in addition to the tidal breath (about 1600 cc or 3 pints) is termed the supplemental breath. The vital capacity is the total amount of breath that can be exhaled after a forced inhalation. The total of complemental, tidal, and supplemental breath is about 3700 cc or 7 to 8 pints. Residual breath is that which remains in the lungs after exhalation. It cannot be removed unless the lungs are punctured.

The thoracic cage is extremely flexible, being under the influence of several major parts of the respiratory mechanism.

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3Summarized from Vennard, Singing, p. 244.
Noting the movement of the thoracic cage, Appleman has written:

Inspiration and expiration for living or for singing are wholly dependent upon the movement of the thoracic cage. During inspiration, the cage moves in three directions simultaneously: vertically, antero-posteriorly, and transversely. Atmospheric pressure of 15 pounds per square inch at sea level is being exerted constantly upon the body. Differences between the outside air and the air within the respiratory system are constantly being adjusted by the cage movement. Any movement of the thoracic cage is followed by a corresponding movement of the lungs. If the thoracic cavity is enlarged by movement of the ribs, cartilages, and the diaphragm, the capacity of the pleural cavity increases. This act lowers the pressure within the lungs, and air rushes in from outside the body. As the capacity of the thoracic cage is decreased, the pleural cavity is put under pressure and the air is expelled.

In the process of respiration, the importance of the diaphragm cannot be overemphasized. Rogers has stated that "... the diaphragm is the most important single respiratory muscle." While the diaphragm is the most important inspiratory muscle, it should be noted that it contains no muscles capable of raising itself upward, thus creating pressure to force air from the lungs. In regard to the diaphragm as an inspiratory muscle, Corbelita J. Astraquillo has concluded:

The diaphragm is a muscle of inhalation; its pull is downward and it cannot exert force upward in the normal man. It is without a doubt that the

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4Appleman, Science of Vocal Pedagogy, p. 28

5Rogers, Elementary Human Physiology, p. 148.
diaphragm is the most important single muscle of breathing. It is the only unpaired muscle of respiration. The action of the diaphragm pulls the central tendon downward and forward, and this in turn increases the diameter of the thoracic cavity. This action results in an increase in volume and a decrease within the thorax.6

Before a discussion of the muscles which push the diaphragm upward can take place, the phenomenon of muscular antagonism must be examined. Astraquillo has also stated:

The principle of muscular antagonism is a fixed theory in muscular action in man. It may be stated as follows: For every muscle or group of muscles exerting force in one direction, another muscle or group of muscles exert force in the opposite direction. Similarly, if there is one muscle group active in inhalation, there must be another group active in exhalation.7

The diaphragm receives its activation from the powerful abdominal muscles which are located below it. In reference to these muscles, Richard Miller has stated that "...these muscle pairs include the external oblique, the internal oblique, the transversus abdominis, and the rectus abdominis. They compress


7Ibid.
the abdomen and support the viscera." In other words, the action of the muscles of exhalation is to push the stomach wall inward, thus driving the diaphragm upward, and forcing air from the lungs. Illustrations of the muscles of exhalation can be found in appendix B.

Breathing for singing should proceed in a manner free of excessive tension in any part of the singing mechanism. Manuel Garcia II has given an excellent summary of the breathing process for singing. He has indicated:

The lungs should be lowered without any jerk, and the chest regularly and slowly raised. This double movement enlarges the compass or circumference of the lungs; first, at their base, and subsequently throughout their whole extent, leaving them full liberty to expand, until they are completely filled with air . . . .

Of course the mechanical action of expiration is precisely the reverse of inspiration, consisting simply in effecting a gentle, gradual pressure of the thorax and diaphragm on the lungs, when charged with air; for if the movements of the ribs and of the diaphragm were to take place suddenly, they would cause the air to escape all at once.

Hyperfunction of the breathing mechanism is a problem not

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limited to beginning students. The singer who utilizes his breathing mechanism correctly is in the minority. There have even been famous opera singers who had gross errors in their breathing techniques. An inappropriate technique of breathing may serve a singer quite well for a brief period of time. However, cumulative damage to the voice will eventually result. In such singers, the vocal folds appear normal upon laryngoscopic examination but still the larynx must employ excessive effort to offset the deficiency of respiration. Continued misuse of the laryngeal muscles results in chronic fatigue and leads to complaints of throat pain.10

One of the most noticeable hyperfunctions of breathing in singers occurs during inhalation. Some singers are of the impression that each inhalation should inflate the lungs to the maximum regardless of the length of phrase to be sung. Such excessive movements of the lungs during this type of inhalation quickly damage the voice and lead to fatigue and exhaustion of the entire body. Exaggerated inhalation of air is not only deleterious to the voice but may also result in dizziness caused by hyperventilation. Only a few excessively deep breaths are required to produce hyperventilation, resulting in a change of the pH

balance of the blood.  

Results of research into breathing for singing have demonstrated that a relatively small amount of tidal air (2 to 3 pints or 1500 cc) is sufficient to sing the longest musical phrase.  

In regard to the improper consumption of air by some singers, Brodnitz has noted:

. . . Depth of breathing as such is no virtue as far as phonation is concerned. I like to reiterate Morell Mackenzie's statement that in good speaking and singing the minimum is the optimum. Of course this statement has to be taken with a grain of salt. When the fault lies in extreme shallowness of respiratory excursions, stimulation of better breathing habits will benefit phonatory strength and duration as well. But, by and large, the goal of respiratory training is not so much development of the vital capacity as it is development of the ability to produce good and powerful sounds with a minimum of air.  

The most important factor regarding air consumption is the manner in which it is utilized during the act of singing. An artistic management of the breath, one that produces a maximum vocal sound with a minimum of breath pressure, is far more important than the amount of air consumed.

Another very noticeable hyperfunction of breathing is a

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12 Le Chant, pp. 18-19.

13 The Hygiene of the Voice Organs, cited by Brodnitz, Vocal Rehabilitation, p. 103.
type of respiration known as clavicular breathing. During correct inspiration, the clavicles or collar bones should move only minimally in conjunction with the ribs and the upper abdominal wall. However, with clavicular breathing, the entire thoracic cavity and the clavicles are raised with each inspiration. The danger of this mode of breathing is that the neck muscles may become quite tense, as they are connected to the muscles of the thoracic cage. During exhalation, the chest, clavicles, and the ribs must collapse so that air may escape from the lungs. During subsequent inhalations, the chest, clavicles, and ribs must be repositioned, resulting in great fatigue to the body. In addition to creating extreme tension in the neck, clavicular breathing creates a negative appearance for the singer, is very noisy, and resembles breathing during a violent physical activity. Ideally, the inhalation for singing should be silent.14

Clavicular breathing may also disrupt the functions of the resonating tract by creating tensions of the neck and throat that have a direct influence on the vocal tone. With tension in the neck region, the resonating area of the pharynx is under less direct control, and the larynx is held at a higher level. Also, since the singer is incapable of inhaling a sufficient amount of air with just the upper part of the chest, more frequent

breaths are required to sustain the vocal tone. As a result of the shallow breaths, the singer is incapable of sustaining long phrases, and the overall effect of his musical artistry is extremely negative.\textsuperscript{15} Clavicular breathing has been excellently termed "... the breath of exhaustion."\textsuperscript{16}

The type of breathing that is most in accord with natural function of the body is a combination of thoracic and abdominal breathing. Concerning this particular manner of breathing, Brodnitz has remarked:

As we have seen, the active control of the stage of exhalation—the phase of speaking and singing—is controlled by the abdominal muscles while the diaphragm gradually relaxes. What the singer "feels" when he puts his hands on his upper abdomen is the slow contraction of the abdominal muscles. The diaphragm cannot be felt. In addition, it lacks the sense of position. For all these reasons the term abdominal breathing would be more appropriate and should be used.

Thoracic and abdominal breathing should work together in coordinated function. Animals, children, and adults who are not spoiled by civilization breathe in this manner. The greatest extent of respiratory movements is normally found in the lower part of the chest and the upper part of the abdomen.\textsuperscript{17}

When singing, "... the student must keep in mind that

\textsuperscript{15}Appleman, \textit{Science of Vocal Pedagogy}, p. 12.


\textsuperscript{17}Brodnitz, \textit{Vocal Rehabilitation}, p. 12.
when a capacity breath is taken, the diaphragm is already at its lowest position. Any force against it must come from below, pressing upward.\textsuperscript{18}

From evidence which has been presented, it has been established that the muscles below the diaphragm are the prime force governing exhalation. It is the upward and inward pressure of the abdominal muscles which forces the diaphragm upward, driving air from the lungs. Despite evidence that this is a recognized scientific and medical fact, many singers appear to be confused as to the true nature of the diaphragm and the abdominal muscles. Consequently, these same singers demonstrate one of the most frequently encountered breathing hyperfunctions, reverse breathing.

During normal exhalation for singing, the abdominal wall gradually contracts, raising the diaphragm, and forcing the air from the lungs. Some singers, in an attempt to delay the process of exhalation, make the mistake of letting the abdomen protrude or push out during the act of singing. If the singer attempts to keep the diaphragm down during the act of singing, the pressure within the lungs will drop. Only through a contraction of the chest muscles may such a singer increase the pressure that is required for production of the voice. Unfortunately,

the contraction of the chest wall creates much too high a pressure within the lungs, resulting in a breathy tone quality and subsequent hyperfunctioning of the vocal folds. The great physical effort involved in attempting to maintain a downward position of the diaphragm constricts the vessels in the chest and heart, inhibiting the flow of blood returning to the heart and lungs. It must not be forgotten that the aorta and the inferior vena cava pass through the diaphragm by way of the central tendon. The interruption of the blood supply may be seen in the reddened face of the singer and also in the swollen vessels and muscles of his neck. Since fluoroscopic evidence has confirmed that the upward movement of the diaphragm cannot be halted voluntarily, it would appear that a singer should not make a downward press on the diaphragm as the singing act proceeds. In addition, if the singer suffers from undiagnosed high blood pressure or heart disease, reverse breathing could prove fatal.

Since the outward push of the abdominal wall in reverse breathing is identical to that of other primary functions of the body, the hyperfunctioning of the abdominal wall will result in an activation of the primitive sphincter mechanism of the larynx, leading to a debilitating hyperfunction of the vocal folds. Con-

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cerning the strength of the laryngeal sphincter, Brodnitz has observed:

... The larynx is primarily a sphincter. It is first observed in the amphibians as a protection to the lungs against water entering on immersion; it then is adapted to other functions that require intrathoracic pressure, such as heavy work with the forelimbs, coughing, bowel evacuation, and vomiting...

It is possible that the evolutionary youth of the vocal functions makes them more vulnerable than the primary ones that have stood the test of millions of years through the mammalian ascendency.²¹

Activation of the laryngeal sphincter causes the vocal folds and their mucous membranes to become highly inflamed. Prolonged irritation of the vocal folds will result in such conditions as nodules, polyps, and vocal fold hemorrhages.²²

From data which have been offered, it has been established that hyperfunction of the breathing mechanism represents a pathological usage of the breath. The prevention of hyperfunction of the breathing mechanism is possible only through the establishment and maintenance of a system of breathing that is in accordance with the natural functions of the organs of respiration. Breathing for singing should be based upon the following principles:

²¹Brodnitz, Vocal Rehabilitation, p. 9.
1. Breathing for singing is dependent upon proper posture. If the thoracic cage is allowed to collapse, the integrity and proper positioning of the diaphragm cannot be maintained since it is attached to the ribs by a peripheral band of adhesion.

2. The diaphragm is a muscle of inhalation, not exhalation. As the singing act commences, the singer should make no attempt to hold the diaphragm down. As long as the chest is held comfortably high, the diaphragm will provide a natural, correct antagonistic resistance to the upward pressure of the abdominal wall. The coordination of the abdominal muscles and the intercostal rib muscles supplies the control needed to govern the expiration of the breath during singing.

3. The inhalation of a great amount of air by the singer is not only unnecessary but also damaging to the voice. The singer should remember that it is not the amount of air inhaled that is important but rather the artistic management of it that should be the ultimate goal of any concept of breath control. Breath emission should be as minimal as possible.

4. At no time should the abdominal wall become stiff or tense, such action merely serving to transfer hyperfunction from one area (abdominal muscles) to another (laryngeal muscles).

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24 Ibid., p. 33.
5. Singing should be regarded as a muscular exercise since it makes special demands on the breathing muscles. The constant use of the breathing muscles in singing will tend to strengthen them. Fields has argued that "... breathing will improve as voice production improves, and vice versa, since the two are reciprocal or simultaneous functions of the vocal art." Any form of physical exercise which strengthens the abdominal muscles and lungs will invariably result in improvement to the singing voice. However, any form of physical exercise that is harmful to the vocal organs should not be attempted.

The teaching of correct breathing for singing should be a simple matter once the teacher has grasped the physiological importance of not disturbing the natural functions of the organs of respiration. Brown has provided a remarkably concise statement regarding the teaching of breathing for singing. He has remarked:

In singing, one has to interrupt one's natural rhythm in order to have a supply of air at a specific time indicated by the notation. A student should explore how he takes air in during the natural cycle and learn to duplicate this process at will. Once the air is in the lungs, it will go out by itself if it is not held. A natural expiration of air will supply the necessary energy to produce tone and the desirable level of pressure. If a student has good posture and lets air in and out in a natural way,

24Ibid., p. 33.
he will develop a sense of producing tone without strain, and the voice itself will develop and grow in singing.  

CHAPTER VI

HYPERFUNCTION OF THE VOCAL ATTACK

The vocal folds are located within the framework of the larynx at the top of the trachea, and function as a valve to retain the breath supply as long as it is needed. This valve consists of two different sets of muscles, the false vocal folds (ventricular bands or superior folds) and the true vocal folds (inferior folds). During the act of singing, the false vocal folds should function only to assist the true vocal folds in closing the valve against the flow of the breath. Vibration of the false vocal folds during singing represents a pathological use of the voice.¹

The vocal attack "... is the start, onset, or inception of tone."² Richard Miller has noted that the act of "... skillfully coordinating the pressure of the breath with the proper


degree of tension within the vocal valve produces the clear, crisp, initial sound which characterizes the good attack.\textsuperscript{3} If the breath pressure and the vocal musculature do not synchronize perfectly upon attack, the delicate vocal folds will suffer severe trauma, resulting in an extremely harsh vocal quality. In describing the relationship of the breath and the laryngeal musculature, Vennard has concluded:

There are two acts which must synchronize in attacking a vowel. The interarytenoid muscles must close the glottis (with cooperation from other laryngeal muscles) and the breath must flow. If the two acts synchronize perfectly, we have the perfect simultaneous attack, or instantaneous attack, as it is sometimes called.\textsuperscript{4}

The importance of a particular breath flow factor, the Bernoulli Effect, upon the vocal attack, cannot be overemphasized. The Bernoulli Effect has been defined as "... suction produced by the fact that air in motion has less density or pressure than air that is not in motion."\textsuperscript{5} The Bernoulli Effect is extremely significant to the vocal attack, since it demonstrates that the vocal folds may be brought partially together merely by the flow of air between them. At the same time that the breath is flowing between the vocal folds, the interarytenoid

\textsuperscript{3}Richard Miller, Techniques of Singing, p. 1.

\textsuperscript{4}Vennard, Singing, p. 42.

\textsuperscript{5}Ibid.
muscles are closing the glottis. When the vocal muscles are almost touching, the Bernoulli Effect creates suction, which in turn causes them to start vibrating before the arytenoid cartilages achieve complete closure. After the approximation of the cartilages, the flow of air sucks the glottis shut, stopping the cycle momentarily, allowing the cycle to repeat.6

Concerning the influence of the Bernoulli Effect on glottal closure, Janwillem van den Berg has stated:

. . . The closure of the glottis is thus brought about by three basic factors: (1) the decrease of the subglottic pressure due to the escape of subglottic air, (2) the tension of the vocal folds, which causes them to become shorter, (3) the sucking effect of the escaping air, which is largest at the places with largest velocity of air.7

The Bernoulli Effect has received sufficient scientific documentation to establish its importance to the act of singing. However, the optimal application of the Bernoulli Effect is directly related to the singer's control of the breath flow through the glottis. An insufficient flow of air through the vocal folds will not produce the necessary suction to close the glottis and consequently, the singer may substitute incorrect muscular pressures within the larynx to achieve the closure.

6Ibid.

Conversely, a breath flow rate which is too high will produce too much suction, resulting in over-adduction of the vocal folds, and causing irritation to the laryngeal tissue. The optimal flow of the breath, which is the amount required to produce maximum efficiency of the vocal organ, creates the proper suction of the vocal folds, thereby utilizing the Bernoulli Effect to the greatest possible extent.

The ideal attack, which is also known as the soft attack or the coup de glotte (stroke of the glottis), emphasizes the breath aspect (the Bernoulli Effect) rather than the myoelastic (muscular) factor. Also, the soft attack is considered far less fatiguing to the voice than the hard attack (glottal shock or glottal plosive).

The hard attack represents a hyperfunctional use of the vocal folds during the onset of singing. In this form of vocal attack, the glottis closes completely before the breath flow commences and is then blown apart by the ensuing breath pressure. Christy has mentioned that the hard attack "... is characterized by an ugly, explosive 'shock of the glottis' as the vocal folds open suddenly and violently to release pent-up breath pressure." 8

8Christy, Expressive Singing, p. 53.
It has been demonstrated that the hard attack also results in a significant reduction of the Bernoulli Effect. Vennard has determined:

If the glottis closes first, and the breath pressure is applied, the vibration will begin with an explosion of air as the pressure overcomes the muscular tension. The Bernoulli Effect will then become a part of the process, it is true, but too late.9

Research has demonstrated that hyperfunction at the level of the glottis (vocal attack) represents one of the most damaging uses of the vocal folds.10 If the hyperfunction of the vocal attack becomes extreme, not only will the vocal folds be damaged, but also the primordial sphincter mechanism of laryngeal function will be activated, and the laryngeal function will regress to a more primitive level of vital protection.11

The prevention of hyperfunction of the vocal attack may be accomplished through an attack which utilizes an imaginary

9Vennard, Singing, p. 42.
aspirate (h sound) at the onset of phonation. With this type of
attack, the air flow commences approximately one-quarter of a
second before the tone commences, sucking the vocal folds to-
gether and ensuring no damage to their delicate tissues.\textsuperscript{12} The
singer does not have to actually produce an audible aspirate,
since the mental concept of the aspirate is all that is required
to start the flow of air through the glottis before the vocal
folds actually touch. If the aspirate is heard, it is indicative
of a waste of breath.

However, since hyperfunction at the level of the glottis
is characterized by an excessively forceful squeezing together
of the vocal folds, a severe case of hyperfunction may receive
considerable benefit by producing a deliberately breathy initial
tone and then allowing the vocal folds to readjust the necessary
tension required to produce a clear sound. The benefit of the
breathy attack is that the vocal folds do not adduct completely
and hence do not rub together creating irritation of the tissues.
Once the hyperfunction has been corrected, the singer must learn
to provide the simultaneous coordination of the breath flow with
that of the required glottal tension in order to produce an
initial sound which is not breathy.

\textsuperscript{12}William Vennard and Nobuhiko Isshiki, "Coup de Glotte: A
Misunderstood Expression," The NATS Bulletin 20 (February 1964):
15-18.
Another excellent means for preventing hyperfunction of the vocal attack is a technique known as the yawn-sign, a combination of a yawn and a sigh. The throat is opened as in a yawn, and, at the same time, the breath is released as in a sigh. It should be emphasized that only the first stage of a yawn should be imitated by the singer, as the final stage of the yawn produces excessive tension within the throat. Since yawning and sighing are both inherent reflexes in man, they do not have to be consciously relearned by the singer.

The procedure of initiating the vocal attack with a light hum which subsequently merges into a vowel sound has also been recommended as a means of achieving the correct attack. However, in order for the hum technique to be fully effective, it must be produced with the teeth apart and the throat as open as when singing.

One of the most significant approaches to the elimination of the hard vocal attack is that of the chewing method originated by Dr. Emil Foreschels. It is Froeschels' assumption that speech in man developed from chewing, and that chewing and phonation are roughly identical functions. Froeschels has concluded that "...it is apparent that the same set of muscles, innervated


by the same nerves, is used in chewing and speaking. Since we can talk and chew at the same time, the two functions must be identical.\textsuperscript{15}

The application of the chewing method to the singing voice has received careful analysis by several noted speech and voice therapists who have found it to be an excellent technique for preventing hyperfunction of the vocal attack.\textsuperscript{16} When this particular method is utilized, the singer first produces exaggerated movements of the organs of chewing without any vocal sound. The next step is to use the singing voice while producing the chewing movements. Once the act of singing while chewing has been mastered, the singer eliminates actual chewing movements and only imagines them. If the technique has been performed correctly, the hard attack will be circumvented, and the voice will function in a normal manner. Noting the positive influence of the chewing method on the singing voice, Brodnitz has written:

\textit{By using the motions of chewing for voice production, we transfer the undisturbed muscular teamwork of chewing to the motion of voice speech by appealing to an inborn automatic function. In doing this, we not only reduce hyperfunctional tension}


of the resonator but also improve, at the same time, vocal cord functions ... 17

From a study of the evidence presented, it may be determined that the prevention of hyperfunction of the vocal attack is imperative if the singer is to avoid damage to the vocal folds. Additionally, only through the use of the proper attack can the singer achieve the maximum potential of his voice. While all of the techniques described in the preceding paragraphs are sufficient to prevent or eliminate hyperfunction of the vocal attack, it should be remembered that any use of a breathy attack is only a temporary expedient. The singer must develop an attack in which the breath flow factor and the glottal tension are simultaneously coordinated, resulting in a firm, crisp onset of tone.

The entire act of singing is dependent upon a correct attack. The singer who achieves a correct attack begins the act of singing without any hyperfunction of the vocal folds.

17 Brodnitz, Vocal Rehabilitation, p. 97.
CHAPTER VII

HYPERFUNCTION OF VOCAL REGISTRATION

Hyperfunction of the mechanism of vocal registration is undoubtedly the most common of all the various vocal dysfunctions. In order to fully understand the hyperfunctioning of the vocal registers, it is first necessary to review some of the literature pertaining to the historical concept of vocal registers. Only through such a detailed study of the phenomenon of vocal registration may the knowledge to prevent hyperfunctioning of the vocal registers be acquired.

One of the most severe limitations of the voice is the physiological adjustment of the vocal folds known as registers, a term borrowed from organ terminology. Concerning the origin of the term register, Cornelius L. Reid has observed:

The expression "vocal register" is a derivative and was originally employed by organists to describe the many changes of quality caused by setting up different "stop" combinations. When the vocal organs were discovered to be capable of making sounds of diverse qualities, it seemed natural to refer to each group as a vocal "register." Like the organ, the vocal registers appeared to owe their peculiar and distinguishing characteristics to a special type of mechanical action.¹

For centuries, singers have been concerned with vocal registers. Pier Francesco Tosi, a famous voice teacher of the eighteenth century, named three vocal registers: voce di petto (chest voice); voce di testa (head voice); and falsetto (effeminate voice). These early names for the registers imply that the singers and teachers were very aware of sympathetic vibrations occurring in various regions of the body in relationship to the different registers. Another voice teacher of the eighteenth century, Giovanni Battista Mancini, designated only two registers, chest and head, the latter also known as falsetto. The use of the term falsetto inferred the effeminate use of the male voice since it is conceded that eighteenth century vocal instruction was concerned mainly with the castrato voice.

Manuel Garcia II, a famous singing teacher of the nineteenth century and the inventor of the laryngoscope (a device for viewing the interior of the larynx), was the first to observe the different physiological adjustments of the vocal folds in relation to the registers. He remarked:

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By the word register, is to be understood a series of consecutive and homogeneous sounds produced by the same mechanical means, and differing essentially from other sounds originating in mechanical means of a different kind; hence it follows, that all the sounds belonging to the same register are of the same quality and nature, however great the modifications of quality and power, they may undergo.\(^4\)

Garcia named the various registers he observed to be chest, falsetto, and head in both men and women. His usage of the term falsetto did not imply the effeminate sound of the male voice; rather it applied to the middle range of all voices. The term head voice was used to denote what contemporary vocal pedagogues and voice scientists describe as falsetto (effeminate voice).\(^5\)

Still another advocate of the three-register-theory was Mathilde Marchesi, a student of Garcia, who confined her teaching exclusively to female voices. In regard to the number of registers in women, she has stated:

> I most emphatically maintain that the female voice possesses three registers, and not two, and I strongly impress upon my pupils this undeniable fact, which moreover their own experiences teaches them after a few lessons.

The three registers of the female voice are the Chest, the Medium, and the Head. I use the term Medium, and not Falsetto (the word used for the middle register by some teachers of singing), firstly because the word Medium (middle) precisely and log-


\(^5\)Ibid., p. 9.
ically explains the position that this register occupies in the compass of the voice, and secondly, to avoid all confusion that might be caused by the term Falsetto, which belongs exclusively to men's voices.6

The three-register concept has not been the only doctrine promulgated concerning the number of registers in the human voice. The two-register theory has also received extensive investigation from vocal scientists and pedagogues. Concerning early writings on the two-register theory, Vennard has observed:

(Philip) Duey mentions over a score of writers in the Golden Age who recognized two registers. Caccini, Cerone, and Rognoni preferred chest and Della Valle, falsetto, but most of them felt that both were necessary and the transition (between registers) should be made as smoothly as possible. Terminology was inconsistent, but the heavy register was called: chest, voce di petto and voce piena; and the light: head, falsetto, voca di testa, voce finta, and Fistelstimme. Special mention should be made of the fact that in 1767 Petri recognized the overlapping of the ranges of the two voices by at least a fifth, and in 1803 Mengozzi recommended the practice of going from one register to the other on the same pitch.7

In the twentieth century, two of the more prominent advo-


cates of the two-register theory were Douglas Stanley and William

Vennard: Stanley has indicated:

> There are two groups of muscles which stretch the vocal cords and hold them in tension against the pressure of the breath: (1) the crico-thyroid muscles, and (2) the arytenoid muscles.

Since there are two, and only two, groups of muscles in the larynx, there are two, and only two registers. As will be shown later, the registration action pertains to the control of intensity—not to pitch ranges.

Stanley's statement regarding registration is a considerable oversimplification since the larynx contains more than two groups of muscles. The two-register theory offered by Vennard appears to be more plausible. He has suggested:

> Between the idealistic concept of "one register" (or "no registers," or "each tone is its own register") and the realistic concept of "three" (or more), there is an hypothesis of "two registers," that may be an oversimplification but which offers a rationale for explaining the multiple voices and how they may be combined in one. Baldly stated it is that every voice has a potential of roughly two octaves of "light mechanism" and two octaves of "heavy." These compasses overlap by one octave; that is, one octave can be sung in either laryngeal adjustment. In this area ("find the middle voice") it is possible to achieve a production that combines the best properties of both (voix mixte).

Extensive research into the subject of vocal registers has

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9 Vennard, Singing, p. 73.
been reported by Large, Ruth, van den Berg, and Vennard, among others.\textsuperscript{10}

The results of the research concerning the area of vocal registration have yielded much data but relatively little agreement among the different investigators. From a survey of some of the literature on these various tests, it would appear that there is a consensus regarding the term register, but a divergence of opinion regarding the actual number of registers present in any given voice. Current concepts of registration stress a mixture of muscular adjustments of the vocal folds, variable air flow rates, variable positioning of the larynx, and invariable behavior of the laws of harmonics.\textsuperscript{11}

The registers of the human voice are caused by different muscular adjustments and vibrations of the vocal folds. If the muscular factors involved are emphasized, the registration is said to be heavy. Other terms for this particular mode of registration include chest voice or chest register. In this particular register, the vocal folds are quite thick.


\textsuperscript{11}Ibid.
since the thyroarytenoid muscles are contracting and the cico-
thyroid muscles are relaxing. The glottis closes completely with
each vibration.

If the aerodynamic factors involved with registration are
emphasized, the registration is said to be light. Other terms
for this type of registration include head voice or head regis-
ter. Since the cricothyroid muscles predominate in this form
of registration, the thyroarytenoid muscles are relatively pas-
sive, allowing great longitudinal tension to be placed on the
vocal folds and subsequently raising the frequency of the sung
pitch. It has been established that the cricothyroid muscles
are the chief tensors of the vocal folds. The glottis opens
increasingly in the head register.

If the thyroarytenoid muscles relax completely, the regis-
tration that results is termed the falsetto register in male
singers and as the 'whistle' register in female singers. The
incomplete closure of the glottis is very characteristic of
this register.

The middle register, or voix mixte (mixed voice), is an
intermediate register between the heavy and the light, and is
produced with an almost equal balance of tension between the

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12 Daniel John Cunningham, Cunningham's Textbook of Anatomy,
10th ed., edited by G. J. Romanes (London: Oxford University
cricothyroid and thyroarytenoid muscles. The glottis may either open increasingly or close completely depending on the frequency of the sung pitch.

The relationship of registration to the area of the voice known as the passaggio (passage), or point of transition from one register to another, has been of great concern to singers and teachers for centuries. Weldon Whitlock has argued that "The passaggio, or break of the voice, is one of the problems which has confronted singers and teachers from the very dawn of the Art, and the Bel Canto teachers discussed it at length in their books."13

The areas of transition for the various voice classifications have been studied by voice scientists and established as to the lower and upper limits of the middle register, the two particular areas where the greatest change of registration takes place. With slight variation for the various voices, these points of transition are as follows:

The lower and upper limits of the middle register scatter around the following values: male voices—bass d (147 cps) and d1 (294 cps), baritone e (165 cps) and e1 (330 cps), tenor f (175 cps) and f1 (349 cps); female voices—contralto d1 (294 cps) and d2 (587 cps), mezzo-soprano e1 (330 cps) and e2 (659 cps), soprano f1 (349 cps) and f2 (698 cps). It can be seen that the register transitions are situated slightly higher in the lighter voice types. Moreover, in female voices all analogous vocal phenomena are found an octave higher than in the male voice. This is called

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"octave phenomenon."\textsuperscript{14}

Hyperfunction of the mechanism of registration occurs when one particular register is forced beyond its normal point of transition. This action is extremely damaging since each particular register represents a different type of vocal fold vibration, caused by a similar approximation of the vocal folds for a definite pitch range.

Noting the necessity for proper transitioning of the registers, Berton Coffin has warned:

High notes are built by the correct register adjustment to the upper notes.

Those who attempt to sing a fundamental pitch continually at the top of a register or above the limits of a register are courting disaster. Furthermore, the "gear shifts" of registers must be automated and hidden for a prolonged career.\textsuperscript{15}

It appears that regardless of the point of transition (\textit{passaggio}) in any voice, the registration must change for the singer to avoid hyperfunction of the vocal registers. The quality of voice produced by the singer is an accurate determinant as to changes in the vocal registers. Regarding the use of vocal quality


\textsuperscript{15} Berton Coffin, "The Relationship of Phonation and Resonation," \textit{The NATS Bulletin} 31 (February/March 1975): 41.
as a criterion of incorrect usage of the registers, Brown has indicated:

. . . If a voice sounds in the middle of its range the same way that it does in its lower tones, we are sure to have found a cause for strain. So also in the top voice as compared with the middle. Strain is evidenced when any lower qualities are carried too high.  

The forcing upward of the lower, heavier, register may completely obliterate the middle register and cause divergence of the registers. Morell Mackenzie has stated that "... If in the attempt to develop the voice, a register, i.e., a particular mode of production, is forced beyond its natural limits in a given individual, the result is likely to be serious injury to the vocal organs. . . ."  

Since the upper register of the voice can be sung to the bottom of the singing range without damaging the vocal folds, the prevention of hyperfunction of the registers is directly related to preventing the lower register from encroaching upon the middle and top registers. Only through a balance of the registers can such a hyperfunction be prevented and an even vocal scale

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attained. Describing the effect of registration on the vocal scale, Whitlock has remarked:

I am convinced that one of the greatest stumbling blocks in working out this problem is the unwillingness of the singer to admit that a change of production must take place. We hear so much about the even scale that we lose sight of the fact that we get this balance only through the change from one register to another, and through the equal development of the two sets of muscles.18

It is an established physiological fact that the vocal folds will be severely damaged if the lower registration is maintained as the pitch ascends. In addition, sounds of the upper voice which are produced with the mechanism of the lower voice have the quality of a yell or a scream. The nature of the vocal folds is such that the two extremes of registration, the heavy and the light, are produced by different muscular balances of the thyro-arytenoid and cricothyroid muscles. If either set of muscles becomes strained due to transitional violations, the voice will 'break' or 'crack' as the transition of registers occurs.

The prevention of hyperfunction of the mechanism of vocal registration can be easily accomplished by the development of the voix mixte, a register of great flexibility and versatility. As previously noted by Vennard, each extreme register, used independently, has an approximate range of two octaves. Between

these two registers, the voix mixte overlaps for approximately one octave.

Since this register contains elements of the two extreme registers, it is possible to migrate to either register without noticeable 'breaks.' As the mixed register is properly developed, the area of overlap will increase and the singer will be able to negotiate the transition quite freely to any desired register.\(^\text{19}\)

It has been observed that "... a free voice is able to change registration (the balance of the laryngeal musculature) noticeably without interrupting the tone."\(^\text{20}\)

Control of the vocal registers is uniquely related to a proper use of dynamic levels in the voice. Voice scientists have reported that the correct use of dynamic levels aids the registration change through any passaggio. Luchsinger and Arnold have reported:

Many authors agree that loud phonation of a given tone shifts its register mechanism to the type of the next lower register. Conversely, soft intonation tends to raise the mechanism to the next higher type.\(^\text{21}\)

By carefully controlling the dynamic levels, the singer is able to manipulate the vocal registers and prevent any hyperfunction

\(^{19}\) Vennard, *Singing*, p. 73.


of the mechanism of registration.

At this point, the crucial relationship of the breath to the vocal registers should be noted. As the vocal production changes from a heavier register to a lighter one, the intensity of sound will be significantly reduced if the breath pressure does not increase. Therefore, the singer must supply a greater air-flow rate at the point of register transition to keep the volume of sound constant. This extra surge of breath has been excellently described as "... the lift of the breath."\textsuperscript{22}

For centuries, the use of messa di voce (crescendo and decrescendo on a single note) has been a technique used by singers for effecting the transition from one register to another without an audible 'break' (abrupt change of vocal mechanism). Reid has studied the use of messa di voce by the early Italian singers, and has concluded:

The excessive use of the messa di voce or swelled tone by early Italians was a persistent attempt to join the two registers.

As the early Italians always considered the art of singing to mean an absolute control over dynamics and an ability to swell and to diminish the intensity of the tone, the inference is plain that the registers are to be joined by swelling from piano to forte.

In the advanced stages of training, the performance of the messa di voce must be practiced continuously until there is an exact matching of both quality and intensity at each point of transition (passaggio).

\textsuperscript{22}Witherspoon, \textit{Singing}, p. 90.
After this technique has been mastered the break disappears. . . .

The value of the *messa di voce* technique is that it enables the singer to vary the mass of the vocal folds through the control of vocal dynamics. Scientific research has demonstrated that the use of the *messa di voce* method develops the ability to control the "... amplitude of the vibrations of the vocal folds through the alterations of their length, tension, mass, and elasticity." Mastery of the *messa di voce* is truly mastery of the registers.

Another excellent means of facilitating the transition between vocal registers and preventing hyperfunction is the technique of 'covering.' The essence of this particular technique consists of a slight lowering of the larynx below its normal resting position and a widening of the supraglottal resonators.

The yawn technique, previously described in chapter VI, is the easiest means of obtaining the proper position of the larynx. Under no circumstances should the larynx be forcibly depressed,

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as this action will create a hyperfunctioning of the laryngeal depressor musculature.

Appleman has investigated the relationship of the positioning of the larynx to that of the various register transitions, and has noted:

. . . Perhaps the most significant physical alteration to be sensed by the male singer as he "passes" or "bridges" into the upper voice or by the female singer as she passes downward into the lower voice is the lowering of the larynx and the narrowing of the vestibule (collar of the larynx) which determines the phonemic characteristics of the uttered sound.26

In addition to aiding in the transition of the registers, covering prevents damage to the vocal folds by reducing muscular tension on the vocal ligaments.

The use of the auxiliary registers, the falsetto register in men, and the 'whistle' register in women, should be fully developed as they provide valuable exercise for the entire muscular system of the larynx. Not only does the use of these registers develop the higher notes of the voice, but they also make the notes of the middle register easier to sing. Only through the proper development and utilization of all the different vocal registers can a singer create the illusion of a single register uninterrupted by 'breaks' or abrupt changes of vocal quality.

Hyperfunction of the vocal registers is preventable only

if the singer acknowledges the existence of the various vocal registers. Despite abundant scientific verification of the vocal registers, many singers use only the lower, heavier mechanism throughout the entire compass of the voice. Such an action creates extreme hyperfunction of the vocal registers, prevents the correct development of the upper range, and ultimately results in damage to the vocal folds.

Prevention of hyperfunction of the vocal registers can be achieved through proper laryngeal positioning, control of the vocal dynamics, practice of the messa di voce technique, or a combination of all these elements.

A mastery of the vocal registers is necessary if a singing career of any great length is to be attained. The control of the registers not only permits easy access to all vocal ranges, but it also enables the singer to create the exact interpretative effects desired by any particular composer.
CHAPTER VIII

HYPERFUNCTION OF VOCAL RESONANCE

Hyperfunction of vocal resonance occurs when the musculature of the resonating tract of the human voice is incorrectly used, resulting in a resistance between the fundamental tone generated by the vocal folds and the supraglottal resonators. The gravity of this specific hyperfunction may be demonstrated by the fact that any malfunctioning of the musculature of the resonating system results in a less than optimal amplification of the basic laryngeal vocal tone. However, if the musculature is used correctly the resonators can be most favorably utilized, allowing the vocal folds to produce a maximum of sound with a minimum of effort. Before a study of the hyperfunction of vocal resonance can be undertaken, it is necessary to review some of the more pertinent factors pertaining to the origin and development of vocal resonance.

Concerning the phenomenon of vocal resonance, Appleman has stated:

Resonance occurs when a resonator is in tune with its vibrator—when compression from the sound source coincides with compressions from the resonator and when the rarefactions from the sound source coincide with rarefactions of the resonator. The characteristic tendency of a resonator is to amplify or

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reinforce those tones with which it is compatible and to dampen or eliminate those tones with which it is not compatible. Thus, the quality of a vocalized tone depends upon those partials passed (reinforced) by the resonating system.1

The vocal folds, the primary vibrator of the vocal sound, produce a very faint, fundamental vibration, which can then be amplified by the entire resonating network. The main resonators of the human voice, the oral cavity, the pharynx, the nasal cavity, the larynx, and the trachea, have been previously described in chapter III. Illustrations of the resonators may be found in appendix C.

The study of the formation of vowel sounds and their relationship to the vocal resonators has intrigued vocal scientists and physicists for centuries. The findings of these diligent researchers have culminated in four important theories pertaining to resonance and the creation of vowel sounds. These theories are:

1. The Willis-Hermann-Scripture Theory (Transient or Inharmonic Theory). According to this theory, it is argued that with each opening of the glottis, a puff of air is released into the resonating tract, which sets the air already contained therein into vibration. The periodic repetition of this vibration and its ultimate release from the tract produces the vowel

1Appleman, Science of Vocal Pedagogy, p. 117.
2. The Fixed Pitch or Formant Theory of vowel sounds.

This theory is very closely related to the Willis-Hermann-Scrip-
ture Theory of vocal resonance. In reference to the Formant
Theory, Vennard has noted:

... some part of the instrument will have a fixed
pitch, which by sympathetic resonance will augment
whatever partial in the tone is in tune with it. This
part of the instrument, and also the frequency band in
which the exaggerated partials will be found are called
the formant.3

3. The Wheatstone-Helmholtz Theory (Steady State or Har-
monic Theory). According to this theory, it is supposed that
the fundamental tone generated at the vocal folds produces a
complex sound wave containing a large number of partials. The
resonating cavities reinforce those partials which are closest
to the frequencies of the various cavities, while the other
partials are weakened. The result of this process is a vowel.4

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2 Summarized from Tsutomu Chiba, The Vowel: Its Nature and
and C. A. Taylor, The Physics of Musical Sounds (New York:

3 Vennard, Singing, p. 125.

4 Chiba, The Vowel, pp. 51-52.
4. The Relative Pitch Theory of vowel sounds. This theory is related to the Wheatstone-Helmholtz Theory of vocal resonance. The essence of this theory is that "... the strong partials of a tone will always be in the same relation to the fundamental."\(^5\)

Concerning the seeming divergence of opinion pertaining to the nature of vocal resonance and vowel formation, Taylor has observed:

\[\ldots\text{It seems likely that in fact these theories are just two ways of looking at the same thing. It can be shown that the puffs produced by the vocal cords (folds) are regularly spaced in time, in other words their wave form resembles a square wave, and it can be seen that a "complex wave form containing a large number of harmonics" is a possible frequency-space description of a regular succession of puffs in time space.}\(^6\]

Regardless of the theory of resonance and vowel formation one subscribes to, it can be demonstrated that the function of the resonating tract is to strengthen the primary sound originated by the vocal folds.

One of the greatest problems faced by the singer is the extreme variability of the resonating tract. Concerning the configuration of the vocal resonators, Brodnitz has remarked:

\(^5\)Vennard, Singing, p. 239.

\(^6\)Taylor, Physics of Musical Sounds, p. 177.
The human resonator is unique because of the great variability both in the form of the resonator and in the rigidity of its walls. The form of the supraglottic air spaces, which act as resonators, is extremely complex. The narrow portal of entry into the larynx, the wider opening of the pharynx, the large cavity of the mouth, and the complicated air spaces of the nasal cavities combine to form a resonator of great complexity.  

The proper combining of these varied resonators can result in a single, highly efficient, coupled system. Regarding the importance of cavity coupling, Appleman has stated:

A coupled system is composed of a generator and any number of resonators that could vibrate independently if they were not joined together. If any part of the coupled system is set into vibration, another part of the system will be forced to vibrate. The second resonator modifies the vibration of the first. If a third resonator is added, it will exert a periodic force upon the other two, thus modifying the total system.  

Appleman has further concluded that "... whether a system is tightly coupled or loosely coupled depends upon the degree of constriction at the orifices which join such a system."  

It should be noted that there are three variables which may significantly change the coupling of the vocal tract: the

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7 Brodnitz, Vocal Rehabilitation, p. 32.

8 Voice Science, cited by Appleman, Science of Vocal Pedagogy, p. 128

9 Appleman, Science of Vocal Pedagogy, p. 128
jaw (mouth opening), the base of the tongue, and the tip of the tongue. The incorrect utilization of any of these factors will result in hyperfunction of vocal resonance.

While a proper mouth opening enhances resonance, an improper mouth opening adversely affects the size and shape of the oral cavity. A most noticeable hyperfunction of vocal resonance occurs when the mouth is insufficiently opened during the act of singing. This action results in the lips and tongue being the sole determinants of articulation, since they receive no assistance from the jaw in adjusting the oral cavity. In addition, the expiring sound waves will not receive full amplification in a restricted oral cavity. Garcia has observed that "... if the teeth be too nearly closed, the voice will assume a grating character, somewhat like the effect produced by singing through a comb."

Conversely, an excessively opened mouth also results in hyperfunction of vocal resonance. Garcia has again noted:

It is generally believed that the more we open our mouth, the more easily and powerfully can sounds be emitted: but this is quite a mistake. Too large a separation of the jaws tightens the pharynx, and consequently stops all vibration of the voice; de-

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11Boone, Voice Therapy, p. 44.

12Garcia, Art of Singing, p. 10.
priving the pharynx of its vault-like resonant form.\textsuperscript{13}

The proper mouth opening not only prevents hyperfunction of vocal resonance, but also results in a more pleasant expression of the singer's face. For centuries, it has been taught that the proper mouth position for singing can be achieved by opening the mouth as when one smiles in a natural, spontaneous manner.\textsuperscript{14} This mouth position is also similar to that which is experienced at the beginning of a yawn. A certain amount of lip movement is necessary for clear articulation of the vowels and consonants. However, the lips should not be excessively rounded or protruded, as this action will result in a muffled tone quality and an unpleasant facial expression.

In order for the mouth and the pharynx to function as a single, coupled cavity, the tongue must be placed well forward, with the tip of the tongue gently touching the lower teeth. The body of the tongue should assume a relaxed position on the floor of the oral cavity, neither excessively arched or flattened. While it is necessary for the tongue to rise and fall when articulating the different consonants, it should return to its normal, relaxed position whenever phonating vowels.

\textsuperscript{13}Ibid.

Perhaps the most significant hyperfunction of vocal resonance occurs when the tongue is improperly positioned within the oral cavity, causing the buccopharyngeal cavity (a coupled cavity composed of the mouth and the pharynx) to function as two separate cavities, rather than as a single unit. Hyperfunction of the buccopharyngeal cavity takes place when either the base of the tongue is retracted downward into the pharynx or the tip of the tongue is lifted upward and backward. Both of these actions result in a serious constriction of the buccopharyngeal cavity, depress the hyoid bone, and force the vibrating vocal folds to slightly abduct, preventing glottal closure. Additionally, the epiglottis is pushed against the vocal folds, causing irritation of the delicate tissue. Garcia has remarked that "... whenever the tongue rises or swells at its base, it drives back the epiglottis on the column of ascending air and causes the voice to be emitted with a guttural, choked sound."\(^{15}\) The proper placement of the tongue is sufficient to insure maximum utilization of the buccopharyngeal cavity and to prevent a hyperfunction of vocal resonance.

Another dysfunction of vocal resonance happens when the singer attempts to place the pharyngeal cavity into a fixed posture in hopes of increasing the laryngopharyngeal resonance.

\(^{15}\) Garcia, *Art of Singing*, p. 10.
Noting this particular type of resonance hyperfunction and its prevention, Cooper has concluded:

Most patients with voice disorders incur vocal misuse by emphasizing or stressing laryngopharyngeal resonance which results in pharyngeal and laryngeal tensions. These tensions cause the patient to experience negative sensory and auditory vocal symptoms. Too much tone focus in the laryngopharynx results in a gutteral voice; too much tone focus in the oropharynx results in a flat, colorless, or denasal voice; too much tone focus in the nasopharynx results in a nasal voice.

Correct tone focus is the balance of oral and nasal resonance with some laryngeal resonance. This tone placement is achieved by focusing or directing the tone to the "mask" (an area which includes the bridge and sides of the nose down to and around the lips). Laryngopharyngeal resonance is natural and need not be emphasized.16

It has been determined by physicists and acousticians that increasing the size of a resonator will not acoustically improve it. Miller, citing Robert M. Taylor, has observed:

Larger than optimum diameters show almost no increase in frequency. Therefore, beyond comfortably open constrictions or conductivity passages between the resonating cavities, there is no point in making the connecting channels larger.17

Any attempt to maintain a fixed, widened position of the pharyngeal musculature will result in a hyperfunction of vocal resonance and a distorted type of articulation.


The prevention of this particular resonance hyperfunction may be facilitated by the following techniques:

1. An emphasis on a correct tonal focus (oronasolaryngopharyngeal resonance)\(^{18}\)

2. The use of mouth and throat positions similar to those employed during normal speech patterns.

The elimination of this hyperfunction will result in a more relaxed, flexible condition of the throat musculature and improve the clarity of articulation. Regarding the necessity for a throat posture which permits rapid changes, Miller has observed:

The interrelationships of the resonating cavities must be properly maintained in order to supply the correct resonance factors for a given sound. To aver, . . . that one basic, enlarged pharyngeal posture should constantly prevail, is to preclude the quick, resonating adjustments necessitated by pitch and general articulation.\(^{19}\)

In the prevention of hyperfunction of vocal resonance, careful attention must be given to the positioning of the larynx during the act of singing. It has been noted that the correct placement of the larynx produces an extra formant, the 'singing formant' (located between 2500 and 3000 Hz or cycles per second), in the harmonic series. This formant is located between the frequencies of the normal third (2500 Hz) and fourth

\(^{18}\)Credit for the origination of this term is due Morton Cooper. See Cooper, Techniques of Rehabilitation, p. 21.

\(^{19}\)Richard Miller, Techniques of Singing, p. 70.
(3500 Hz) formants. The presence of this added formant is characteristic of all outstanding voices. Pertaining to the origin of the 'singing formant,' Sundberg has stated:

... the acoustics of the vocal tract when the larynx is lowered are compatible with the generation of just such an extra formant. It can be calculated that if the area of the outlet of the larynx into the pharynx is less than one-sixth of the area of the cross section of the pharynx, then the larynx is acoustically mismatched with the rest of the vocal tract; it has a resonance frequency of its own, largely independent of the remainder of the tract. The one-sixth condition is likely to be met when the larynx is lowered, because the lowering tends to expand the bottom of the pharynx.

The 'singing formant' is extremely valuable to the singer since it provides considerable amplification of the fundamental glottal sound. Also since, "... it is generated by reasonable effects alone, it calls for no extra vocal effort; the singer achieves audibility without having to generate extra air pressure."

If the larynx is allowed to rise or fall excessively, hyperfunction of vocal resonance will ensue. Whenever the larynx is depressed below the position assumed during the initial stage of a yawn, negative tensions are created in the laryngo-

21 Ibid., p. 87.
22 Ibid, p. 89
pharyngeal musculature. These strained conditions result in a muffled tone quality, a distorted articulation of vowels and consonants, and the prevention of the 'singing formant.' Concerning the deleterious effects of the depressed larynx technique, Miller has cautioned:

Breath can be taken so as to entail varying degrees of laryngeal descent. Most persons experience some slight laryngeal descent in increased breath activity; the larynx may indeed lower slightly with inspiration, but it never reaches the low position urged in depressed laryngeal technique . . . In the normal breath cycle, the larynx is not retained in one depressed location by the application of muscular pressure. Although stabilized, some flexibility of movement must be allowed in the formation of vowel sounds. "Anchororing" the larynx to one immutable low position interferes with its normal function. Nor must the larynx be allowed to rise and fall with pitch changes or with register transitions.

Prevention of the depressed laryngeal technique can be accomplished through the cultivation of a stabilized laryngeal position (one which permits a minimal upward and downward movement). The observation of the larynx during the act of speech reveals that some laryngeal movement is necessary for the process of articulation.

The elevation of the larynx during the act of singing is also considered a significant hyperfunction of vocal resonance. In addition to reducing the size of the laryngopharyngeal cavity, elevation of the larynx produces a squeezing of the

23 Richard Miller, Techniques of Singing, p. 92.
vocal folds against the hyoid bone. This action will ultimately culminate in damage to the vocal folds. Noting the adverse effects of the elevated larynx, Vennard has stated:

In most animals, and in most untrained singers, phonation is always initiated with a general tightening process and an elevation of the larynx. This is aided slightly by the upward breath pressure in the trachea. But the tone produced is poor. It could be recognized by a stone deaf observer simply by the throat tension which accompanies it. While all our authorities offer explanations why extrinsic tension is an instinctive way of stretching the vocal folds, none says it is artistic.24

The hyperfunction of the elevated larynx is preventable through the use of the yawn-sigh technique, which has been described in chapter VI.

A hyperfunctioning of the musculature of the soft palate will also result in an abuse of vocal resonance. The soft palate, a partition which divides the pharyngeal and nasal cavities, is connected to the pharyngeal wall and to the tongue by means of the pillars of the fauces and the palatine arches (the arch of the pillars of the fauces). The degree of tension in the soft palate determines how effectively the nasopharyngeal resonating cavity will be utilized. The nasopharynx is used as a fixed resonator in the production of the nasal consonants (m, n, and ng) and the French nasal vowel sounds. It should

24Vennard, Singing, p. 108.
be remembered that a certain amount of nasopharyngeal resonance is required in order to achieve the desired blend of oronasolaryngopharyngeal resonance.

Hyperfunction of vocal resonance will occur if the musculature of the soft palate is either too tense or too flaccid. If the soft palate is arched excessively, the pillars of the fauces will narrow, and constriction of the throat cavity is inevitable.

Conversely, if the soft palate is too relaxed, the voice will assume an objectionable nasal twang. It has also been discovered that excessive nasality weakens the 'singing formant.' Vennard has observed that "... The singer who uses too much nasality is probably going to the extreme in relaxation, and it is no coincidence that his tone becomes breathy at the same time." 25

The prevention of hyperfunction of the muscles of the palate is very difficult to achieve. It is only through the correct degree of tension in these muscles that hyperfunction of vocal resonance can be prevented. The muscles of the soft palate must be sufficiently tensed to prevent nasality, yet they must also be somewhat relaxed in order to allow a slight degree of resonation within the nasopharyngeal cavity. A proper balancing of the musculature of the soft palate is an assurance

25Ibid., p. 117.
of a balance of vocal resonance.

Another direct influence on any hyperfunction of vocal resonance is the vocal vibrato. In describing the vocal vibrato, Wilmer T. Bartholomew has remarked:

... It is a periodic and fairly even variation of the tone, occurring normally about six or seven times a second, and usually involving the frequency, the amplitude, and the vibration form. In other words, these three attributes go through a cycle of variation six or seven times a second. The frequency may vary as much as through a band a semitone wide, and at times more, while the amplitude of the vibration may vary to an astonishing degree.26

The vocal vibrato is one of the most important determinants of vocal resonance. Punt has declared:

This factor is the vibrato variation of intensity, pitch, and probably harmonics that is an essential in the production of a pleasing note. It is very rapid (about six to seven times a second), even, and present in all pleasing voices ... At this speed it is not appreciated as a variation in pitch, intensity, and harmonics (it is not to be confused with the slower and ugly wobble or with the tremolo) but probably as a pleasant 'richness' of tone.27

In addition to adding a ringing quality to the voice, the vibrato also provides a valuable rest for the muscles of the larynx. The relationship of the vibrato to ease of singing has been noted by several authorities, most prominently Reid, who


27 Punt, Singer's and Actor's Throat, p. 27.
The third feature of the vibrato is found in its contribution to ease in singing. To stand still, completely motionless, for any length of time is considerably more difficult and fatiguing than it is to move freely. The opposed muscular system responsible for a condition of body 'tone' demands a constant release and pickup of tension to avoid tiring. Engineers acknowledge this principle when constructing a large bridge or building by making allowance for sway and 'give' in order to eliminate the strain engendered by absolute rigidity.  

It has been shown that the presence of the vibrato substantially assists in the production of vocal resonance. Conversely, any hyperfunction of the vocal vibrato will result in a hyperfunction of vocal resonance. One of the most pronounced hyperfunctions of the vibrato is that of tones without vibrato, or what is termed 'straight tones.' Vennard has offered:

"The quality of tone without vibrato is usually "dull," or at greater volume, "spread." There is never enough power or buoyancy to make the "2800" overtone ('singing formant') sound, unless so much strain is developed that it sounds continuously, which is rare, but equally unpleasant. This on-and-off quality of the highest partials of a tone with good vibrato is what gives it is (sic) living, human sound."  

Tones produced without vibrato are aesthetically unacceptable since they have the quality of a yell or a scream. Ad-

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29Vennard, Singing, p. 205.
ditionally, the lack of a vibrato inhibits the production of the 'singing formant,' and results in premature vocal fatigue.

The prevention of this hyperfunction can be accomplished by increasing the singer's awareness of the desired vibrato rate. Since scientific research has demonstrated that a singer can control the vibrato rate solely by auditory monitoring, the acquisition of this vital aural skill may be facilitated by the use of the tape recorder.30

Two other hyperfunctions of the vocal vibrato, the tremolo or 'bleat' (vibrato rate of more than seven per second), and the 'wobble' (vibrato rate of less than five per second), do not present as great an obstruction to the formation of vocal resonance as does the 'straight tone.' However, since both of these vibrato rates are considered undesirable, they should be normalized in order to achieve maximum efficiency of the vocal organ.

In dealing with any hyperfunction of the vibrato, careful attention must be directed to the abdominal muscles to insure their normal functioning. The 'wobble' and the tremolo are directly linked to the technique of reverse breathing which has been described in chapter V. The correct, inward contraction

of the abdominal muscles is necessary to produce the subtle alterations of the expiring breath stream which are heard as the normal vibrato.

Finally, in the development of vocal resonance, one of the most useful techniques is that of 'vowel modification' while a full report on this method is beyond the scope of this document, the essence of this technique consists of the modification of the sung vowel, so that an optimal vocal resonance may be achieved. The modification may be slight (retaining the identity of the vowel sound), or it may be extreme (substituting one vowel sound for another). Nevertheless, any substitution of vowels must be done with extreme care or a distortion of articulation and phonation will ensue.

The phenomenon of vocal resonance is worthy of study by any serious singer. While it is impossible to directly 'place' or 'focus' a tone, it is possible to adjust the resonating tract so that sympathetic vibrations are felt in different portions of the body. Hence, the usage of such terms as 'head resonance,' 'palate resonance,' 'chest resonance,' and 'mask resonance' are of inestimable value to the vocal pedagogue in the teaching of vocal resonance. The prevention of hyperfunction of the resonating tract is a guarantee that the fundamental sound of the

31 For a further analysis of the technique of 'vowel modification,' see Appleman, Science of Vocal Pedagogy, pp. 216-384, and Coffin, Sounds of Singing, pp. 51-121.
larynx will receive maximum amplification.
Summary

Throughout this report, it has been observed that the act of singing is a highly complex psycho-motor activity, requiring extreme concentration and expert muscular coordination from the singer. Hyperfunction of the singing voice is a condition which is characterized by the presence of excessive or incorrect muscular force. If hyperfunction is not corrected, it will eventually culminate in the malaise known as hypofunction, which is marked by a gross weakness of the vocal fold musculature and a breathy, weak voice.

Since few laryngologists, singing teachers, or speech therapists are qualified to formulate techniques successful in removing vocal hyperfunction, it seems that its prevention offers a more logical approach to both singer and teacher. It should also be noted that once the laryngeal muscles are damaged, the prognosis for a complete recovery of the singing voice is extremely guarded.

Although poor vocal hygiene is a contributing factor to some types of vocal hyperfunction, improper singing techniques
represent the greatest cause of this ailment. Only through the acquisition of a greater knowledge of the anatomical and physiological factors pertaining to singing can techniques be developed that will prevent vocal hyperfunction.

The importance of correct posture to the singing act cannot be overemphasized. Since the functioning of the respiratory system is intricately linked to the positioning of the body, it follows that any hyperfunction of posture will cause an inefficiency of the breathing mechanism and also create a tendency to bodily fatigue.

It should be noted that the correct posture for singing is that carriage of the body which promotes ease and efficiency of the breathing mechanism. The body should maintain an attitude of flexibility and poise. At no time should a fixed position of the body be adopted. Such an action tends to create a static, rigid appearance and results in severe fatigue to the entire body.

The most noticeable hyperfunction of posture occurs when the thoracic cage is allowed to collapse during the act of singing. This action not only presents a negative impression of the singer to the audience, but it also hinders the functioning of the diaphragm. Since the diaphragm is connected to the ribs by a peripheral band of adhesion, it is imperative that
the chest remain comfortably high so that the diaphragm may act as the antagonist of the abdominal muscles of exhalation.

Evidence has been presented which has confirmed that the diaphragm is a muscle of inhalation, not exhalation. The powerful abdominal muscles (external oblique, internal oblique, transversus abdominis, and rectus abdominis) are the main forces which govern exhalation. The action of these muscles is to push the stomach wall inward, thus driving the diaphragm upward, and forcing air from the lungs.

Nevertheless, it has been determined that there are a shockingly large number of singers who allow the abdominal muscles to press outward (reverse breathing) as the act of singing commences. Data have been presented in this report which corroborate that this type of breathing results in an irregular ascent of the diaphragm, an irregular vibrato, an activation of the primitive sphincter mechanism of the larynx, and physical damage to the tissue of the vocal folds.

The prevention of hyperfunction of breathing for singing should be accomplished by teaching a system of breathing that combines abdominal and thoracic respiration. Under no circumstances should clavicular breathing be taught, as it engenders additional hyperfunctions of the musculature of the shoulders and neck. The amount of air inhaled is not nearly as important as is the manner in which it is managed. The singer's goal
should be to achieve a maximum of sound with a minimum of air pressure.

The vocal attack, which is the beginning of the act of singing, is an area requiring special attention in order to avoid hyperfunction. By skillfully coordinating the flow of breath with the correct degree of vocal fold tension, the singer is able to achieve a firm onset of phonation, with no ensuing damage to the folds.

A specific breath-flow factor, the Bernoulli Effect, has a significant application to the act of singing, as it demonstrates that the vocal folds may be brought partially together merely by the flow of air between them. This aerodynamic aspect of singing not only prevents a hyperfunction of the vocal attack, but it is also extremely useful in removing any pre-existing dysfunctions of the onset of phonation.

Hyperfunction of the vocal attack occurs when the glottis closes completely before the air flow commences. With the vocal folds tightly adducted, a great burst of air is required to blow them apart in order to achieve phonation. This action is particularly devastating to the laryngeal tissue, and is one of the most prominent causes of vocal nodules.

Prevention of hyperfunction of the vocal attack is facilitated by the use of an imaginary aspirate at the onset of singing. The imaginary aspirate (h sound) insures the flow of air
between the vocal folds approximately one-quarter of a second before the tone commences, sucking the folds together and assuring no damage to the laryngeal valve.

Other techniques for the prevention of hyperfunction of the vocal attack include the yawn-sigh procedure and the chewing method. The yawn-sigh is a combination of a yawn and a sigh, while the chewing method mimics the process of mastication. Both of these techniques are quite successful in preventing hyperfunction of the attack, as they utilize inborn reflexes in the singer.

The use of a deliberately breathy attack is also of considerable benefit to the singer whose attack is marked by an excessively forceful squeezing together of the vocal folds. The advantage offered by the breathy attack is that the folds do not completely adduct, and hence do not produce any friction. However, once the existing hyperfunction has been corrected, the singer must achieve the simultaneous coordination of the breath flow with that of the proper degree of glottal tension in order to produce an initial sound which is not breathy.

The hyperfunction of the vocal registers has been determined to be one of the most commonly abused facets of the art of singing. The term register was originally borrowed from organ terminology, and was the name given to the differing
groups of vocal quality in the human voice. In modern usage, a vocal register is a series of similar sounds produced by the same adjustment of the vocal musculature.

For centuries, the number and location of the different registers has been a controversial subject. Nevertheless, it is now generally agreed that the human voice possesses three registers: a heavy, a light, and a middle or mixed register.

The heavy register (chest voice or chest register) is characterized by the extreme activity and dominance of the thyroarytenoid muscles. Laryngoscopic evidence has revealed that in this particular register the vocal folds appear to be quite thick, and that the glottis closes completely with each vibration.

The light register (head voice or head register) is distinguished by the contraction of the cricothyroid muscles, the tensing and elongation of the vocal folds, and an increasingly open glottis. In this register, the thyroarytenoid muscles are relatively inactive, permitting the stretching of the vocal fold musculature.

The middle register (mixed voice or voix mixte) is located between the heavy and light registers, and is created by an almost equal sharing of tension between the cricothyroid and thyroarytenoid muscles. Depending upon the frequency of the
pitch being sung, the glottis may appear either open or completely closed.

The auxiliary registers, the *falsetto* register in men and the 'whistle' register in women, are produced when the thyro-arytenoid muscles are totally relaxed. Both of these registers are marked by an incomplete closure of the glottis.

During the development of this report, it was noted that scientific research has firmly established that there is an area of transition (*passaggio*) between each register where a change of vocal registration results when the heavy mechanism is forced upward beyond its normal point of transition. It should be noted that it is quite harmless for the lighter mechanism to be used in any part of the vocal range.

The prevention of hyperfunction of the vocal registers is related to the development of the *voix mixte*, a register which is created by a delicate balance of the cricothyroid and thyroarytenoid muscles. Since it contains elements of the two extreme registers, it is possible to migrate to any register without causing a hyperfunction.

It has also been demonstrated in this report that an adroit control of dynamic levels facilitates the transition between the registers. A loud phonation of a given tone alters the vibrating mass of the vocal folds and produces the mechanism of the heavy
voice. A soft phonation of the same note will produce the mechanism of the light voice. When the lower mechanism changes to the light production, an extra surge of breath pressure is required to keep the volume of sound constant. The classic technique of the messa di voce (swelling of the voice) is an excellent tool for the full development of the registers.

The technique of 'covering' was also investigated and was found to be an extremely valuable procedure for the prevention of hyperfunction of the vocal registers. A lowered laryngeal position and enlarged supraglottal resonators are very characteristic of 'covering.' The yawn-sigh technique is the means for determining the proper degree of laryngeal depression.

It was also reported that the use of the subsidiary registers, the falsetto in men and the 'whistle' in women, should be developed. These registers are of great aid in the development of the upper range of all singers.

Were it not for the complex supraglottal resonating tract, the primary sound generated by the vocal folds would be drastically weak. Resonance is the phenomenon that results when a resonator and a vibrator are in synchronous oscillation with each other. The nature of a resonator is to amplify or strengthen those harmonics with which it is compatible and to mute or weaken those with which it is incompatible.
One of the most severe problems faced by the singer is the adjusting of the various resonators so that an optimal amplification of the primary sound of the larynx is achieved. It is possible for two or more independent resonating cavities to be combined (coupled) so that they function as a single unit, resulting in a noticeable increase in resonance.

The efficiency of cavity-coupling depends upon the degree of constriction between the independent resonators. It was demonstrated that there are three, highly variable components of the phonatory mechanism which may alter the relationships of the different resonators: (1) the mouth opening (jaw position); (2) the base of the tongue; and (3) the tip of the tongue. Hyperfunction of any of these elements will produce a hyperfunction of vocal resonance.

It has been proven that the degree of the mouth opening is critical to the achievement of vocal resonance. If the mouth is not opened widely enough, the expiring sound waves will not receive their maximum amplification, and the larynx will be positioned too high in the neck, resulting in a shortening of the resonating tract.

Conversely, if the mouth is opened too widely, the tension engendered in the walls of the throat (pharynx) will create a constriction of the resonating network. Additionally, an
excessively-opened mouth is aesthetically displeasing. A mouth position which is similar to a yawn or a natural smile will prevent the hyperfunctions of the oral cavity.

Under no circumstances should any part of the tongue be retracted into the pharyngeal cavity. This action results in a severe cramping of the buccopharyngeal cavity, depresses the hyoid bone, and forces the vibrating vocal folds to abduct slightly. Furthermore, the retracted tongue position creates a muffled vocal quality.

Research has demonstrated that any attempt to maintain a fixed position of the pharyngeal cavity will prove futile. It is also detrimental to clarity of articulation, correct intonation, and formation of resonance. The ideal resonance, oronasolaryngopharyngeal, is achieved by a flexible, balanced positioning of all resonators.

Based upon data submitted in this investigation, it was determined that the correct placement of the larynx produces an extra harmonic (the 'singing formant') in the overtone series. This added formant is characteristic of all outstanding voices and can be produced only by the lowering of the larynx. Also, since the formant is generated by resonance effects alone, it involves no additional effort on the part of the singer.

The proper positioning of the larynx can be achieved through
the use of the yawn-sigh technique. It must be added that excessive lowering or raising of the larynx will drastically alter the shape of the resonating tube and result in hyperfunction of vocal resonance. While the larynx must demonstrate some movement during the articulation of consonants, it should remain in a comfortably low, stabilized position during the phonation of vowels.

Hyperfunction of vocal resonance may also occur when a tension of the soft palate musculature is incorrectly adjusted. If it is too flaccid, an objectionable 'twangy' quality will be produced; if it is too tense, the pillars of the fauces will narrow, and the throat cavity will be squeezed.

The prevention of this hyperfunction is admittedly very difficult. The muscles of the soft palate must be sufficiently arched to prevent nasality, yet they must also be somewhat relaxed in order to allow resonation within the nasopharyngeal cavity. An emphasis upon sensations experienced during normal speech is of invaluable aid in the development of the proper balance of the muscles of the soft palate.

Evidence was also presented which demonstrated that the vocal vibrato is one of the most important determinants of resonance. The vibrato is a constant variation of intensity, pitch, and harmonics. An analysis of the mechanics of the
vibrato revealed that it provides an invaluable rest for the laryngeal musculature during the act of singing.

Hyperfunction of the vibrato ensues whenever the rate of vibrato deviates from the accepted norm of six to seven times per second. The three dysfunctions of the vibrato are: (1) the 'straight tone' (no vibrato); (2) the 'wobble' (vibrato rate of less than five per second); and (3) the tremolo or 'bleat' (vibrato rate greater than seven per second).

The prevention of this hyperfunction can be accomplished solely by auditory monitoring on the part of the singer. Careful attention should be paid also to the muscles of exhalation to insure that they are contracting in the proper manner and not merely protruding (reverse breathing).

Finally, vowel modification was determined to be an excellent procedure for increasing vocal resonance. The essence of this technique consists of the modification of the vowel being sung, so that an optimal resonance is achieved. Extreme care must be taken with the modification to insure that no distortion of articulation or phonation results.

Conclusions

As a result of data provided in this report, it may be concluded that vocal hyperfunction is a condition which may
drastically damage the vocal folds and result in a shortened career. The causes of vocal hyperfunction in singers were examined and recommendations were made as to its prevention. The opinions of vocal pedagogues, scientists, and investigators were reviewed to determine the causes and results of improper voice usage. Also, the physiological and anatomical principles upon which singing should be based were investigated to ascertain the most effective means of preventing or hopefully removing any existing manifestations of vocal hyperfunction in singers.

It was also decided that if vocal hyperfunction was left uncorrected, a condition of hypofunction or a weakness of the vocal muscles would ensue. Evidence was presented which proved the extreme difficulty of removing any pre-existing hyperfunctions. Therefore, the prevention of vocal hyperfunction in singers was deemed more appropriate than attempts at its removal. The causes of the various hyperfunctions in singers were studied and suggestions were made for their prevention.

A review of the literature concerning the structure of posture for singing clearly established the influence of the correct carriage of the body on the efficiency of respiration for singing. It was concluded that any dysfunction of posture would have a negative effect on the act of singing. For a complete list of recommendations regarding postural attitudes for
singing, the reader is referred to chapter IV, Hyperfunction of the Mechanism of Posture.

A study of the process of breathing for singing revealed that this was an area in which several noticeable hyperfunctions regularly happened. A perusal of the literature pertaining to the anatomical and physiological details of breathing for singing indicated that the most efficient method of respiration is a combination of thoracic and abdominal breathing.

It was further shown that the diaphragm is only a muscle of inhalation, and that the abdominal muscles are the true forces which govern exhalation. The pressure exerted by these muscles should be inward and upward, forcing the diaphragm upward and subsequently forcing air from the lungs.

Despite the fact that scientific and medical research has firmly established the actions of the diaphragm and the abdominal muscles, it was demonstrated that one of the most commonly encountered hyperfunctions of breathing for singing is that of reverse breathing. This style of respiration is characterized by a gross, outward pressure of the abdominal wall during the act of singing. It was further concluded that this pattern of breathing is totally ineffective, activates the laryngeal sphincter, and produces a profound irritation of the tissue of the vocal folds. Recommendations were made to insure the proper
functioning of the muscles of inhalation and exhalation. A detailed study of the prevention of hyperfunction for respiration may be found in chapter V.

During the course of the report, additional data were presented concerning the prevention of hyperfunction of the vocal attack. A study of evidence pertaining to the vocal attack resulted in the conclusion that the onset of phonation must be free of any hyperfunction in order for the vocal folds to avoid any traumas.

Evidence was presented which demonstrated that the correct, soft attack involves a delicate coordination of the breath flow and glottal tension. Hyperfunction of the vocal attack ensues when the vocal folds close the glottis before the air flow begins. Since the glottis can be opened only by excessive air pressure in this case, it was shown that organic damage (nodes, polyps, and contact ulcers) will result from the improper, hard attack.

Therefore, a study was made of the application of the Bernoulli Effect to singing in hopes of preventing hyperfunction of the attack. Data were offered which indicated that the suction produced by the Bernoulli Effect could vibrate the vocal folds without need of glottal closure, thus preventing a hyperfunction of the attack. The use of the imaginary aspirate
was recommended to insure that the breath flow began before the vocal folds started to adduct.

Other devices for the prevention of hyperfunction of the attack were offered by this writer. These included the yawn-sigh technique and the chewing method. The reader is directed to chapter VI for an analysis of the efficacy of these techniques.

In the development of this report, documentation was produced which demonstrated the existence and nature of vocal registers. Historical concepts of registration, as well as the anatomical and physiological considerations which produce the registers, received a detailed inquiry. It was decided that the voice possesses three registers: a heavy, a light, and a middle or mixed register.

Hyperfunction of vocal registration is a condition which results when the lower register is forced beyond its scientifically-determined boundaries. Points of transition between the various registers received careful scrutiny and recommendations were made for facilitating the necessary changing of registers. Additionally, procedures were detailed for preventing the abuse of the lower mechanism.

The phenomenon of vocal resonance provided some of the most interesting research for this writer. The main theories pertaining to the formation of resonance and vowels were ab-
stracted in order to fully understand the importance of vocal resonance.

Next, a survey of the factors responsible for the optimal production of vocal resonance was undertaken. The results of this examination indicated that the complexity of the human resonating tract is one of the most severe challenges faced by the singer. It was determined that the control of the entire resonating network depends upon the degree of constriction between the different resonators. Three variables, the mouth (jaw), the base of the tongue, and the tip of the tongue were shown to be highly significant factors in the development of vocal resonance.

It was proven conclusively that the hyperfunction of any of these determinants could negatively influence the formation of vocal resonance. Specific techniques were offered to insure the proper functioning of all the resonators and to prevent hyperfunction of vocal resonance.

**Recommendations**

It has been noted that the presence of vocal hyperfunction is a serious obstruction to the healthy functioning of the singing voice. However, vocal hyperfunction may be prevented by the use of singing techniques which are based upon a thorough knowledge of anatomy and physiology.
It is further the recommendation of this writer that every serious singer or teacher of singing avail themselves of the necessary information required to prevent vocal hyperfunction.

Also, it is the desire of this writer that the results of this study receive the greatest dissemination possible. The data contained herein are not only useful in the prevention of the vocal hyperfunction but may also be of considerable benefit in the removal of any existing hyperfunctions.

A correctly produced voice is an almost certain guarantee of an extended career for the professional voice user.
BIBLIOGRAPHY

Books


**Periodicals**


APPENDIX A

THE LARYNX
a) NORMAL LARYNX INSPIRATION

b) NORMAL LARYNX PHONATION

AFTER KLEIN, J.J., 1967
ACTION OF ARYTENOIDEUS MUSCLE

ACTION OF VOCALIS AND THYRO-ARYTENOID MUSCLES

AFTER KLEIN, J.J., 1967
ACTION OF POSTERIOR CRICOARYTENOID MUSCLES

ACTION OF LATERAL CRICOARYTENOID MUSCLES

AFTER KLEIN, J.J., 1967
INTRINSIC MUSCLES OF THE LARYNX

AFTER KLEIN, J.J., 1967
INTRINSIC MUSCLES OF THE LARYNX

AFTER KLEIN, J.J., 1967
Cricoid, arytenoid and corniculate cartilages, viewed from in front.

RECTUS ABDOMINUS AND TRANSVERSE ABDOMINUS  
EXTERNAL OBLIQUE  
INTERNAL OBLIQUE  

AFTER APPELMAN, D.R., 1967  

MUSCLES OF EXHALATION
APPENDIX C

THE MAIN RESONATORS
OF THE VOICE
THE MAIN RESONATORS OF THE VOICE

AFTER KLEIN, J.J., 1967
VITA

George Antolik III was born April 10, 1946 in Baton Rouge, Louisiana, where he graduated from Robert E. Lee High School in 1964. He enrolled at Louisiana State University, Baton Rouge, Louisiana, in June of that same year and received a Bachelor of Music degree in vocal performance in January of 1969.

In April 1969 he entered the United States Air Force, from which he was Honorably Discharged in August 1972.

His graduate studies began at Louisiana State University in August 1972, and he received a Master of Music Degree in vocal performance in May of 1974. Work toward the Doctor of Philosophy Degree was begun in June of 1974.

In August of 1974, he was appointed Instructor of Music at University of Arkansas at Little Rock, Little Rock, Arkansas. He was promoted to Assistant Professor of Music in May of 1977. He was on leave of absence from June 1977 through August 1978, satisfying residence requirements for his degree. He has been Minister of Music at Winfield United Methodist Church from October of 1974.

In 1973 he was married to Martha Elaine Harp of Birmingham, Alabama. A daughter, Rebecca Claire, was born in December of 1976.

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EXAMINATION AND THESIS REPORT

Candidate: George Antolik, III

Major Field: Music

Title of Thesis: The Prevention of Vocal Hyperfunction in Singers

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

EXAMINATION AND THESIS REPORT

Date of Examination:

June 23, 1978