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The etiology of vocal nodules is of importance to many professionals. Although the literature on etiology is inconclusive, most investigators believe that vocal abuse is a significant factor. Problems of pitch, loudness, and quality, terms related to musical ability, are used in the definition of vocal abuse. The possibility that children with vocal nodules were poorer than normal children in musical ability was proposed.

The Seashore Measures of Musical Talents (SMMT) was administered to an experimental group of children with vocal nodules and their matched controls. All subjects ranged in age from 9 through 14 years and were in grades four through eight. In addition, an individual record was compiled on each child. This record contained information regarding the child's health history, onset and development of hoarseness, variables affecting hoarseness, and vocal use.

The results of the study revealed no statistically significant difference between the experimental and control groups on the SMMT, although the female nodule group had a somewhat higher mean than the male nodule group. On the tonal memory subtest, the experimental group scored better than their controls at all age levels, while the experimental group scored consistently, though not significantly lower on the loudness subtest. The individual record results supported the literature in suggesting that vocal abuse is related etiologically to vocal nodules, even though factors related to vocal usage were not delineated by a test of musical abilities.

A STUDY OF THE MUSICAL ABILITY OF CHILDREN WITH VOCAL NODULES

by

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CHAPTER I

INTRODUCTION

Vocal nodules are usually characterized by symptoms of hoarseness, breathiness, and improper pitch. Although the literature on etiology of vocal nodules is inconclusive, most investigators believe that vocal abuse is a significant factor. Problems of pitch, loudness, and quality, terms related to musical ability, are used in the definition of vocal abuse (Berry and Eisenson, 1956; Van Riper and Irwin, 1958; Wilson, 1961; West and Ansberry, 1968; Cooper, 1971). Therapeutic approaches for the remediation of vocal nodules and their symptoms usually include voice therapy. Most writers believe that the basic input modality in developing optimum phonation is the auditory system, particularly the patient's self hearing (Berry and Eisenson, 1956; Van Riper and Irwin, 1958; Wilson, 1961; Luchsinger and Arnold, 1965; West and Ansberry, 1968; Boone, 1971; Perkins, 1971). Assessment of the patient's listening skills is recommended for his listening abilities may be surprisingly deficient (Berry and Eisenson, 1956; Van Riper and Irwin, 1958; Boone, 1971).

Several studies have considered the listening skills of the voice defective population. A test of pitch and loudness discrimination was devised by Sant, Fisher, and Logemann (1971). The listening test consisted of five subtests: two pitch subtests and three loudness subtests. Subtest A required the subject to determine whether two pure tones were the same or different. Subtest B required a judgment of

which tone of a pair was higher. Subtest C, first of the three loudness subtests, required a same-different judgment of the loudness levels of pairs of sentences. In Subtest D, subjects were required to indicate which sentence of a pair was louder. In Subtest E, subjects were instructed to identify loudness levels (soft, medium, loud) of individual sentences. Four groups of subjects were tested on the five subtests: 1) thirty young adults (ages 18-30) and thirty children (ages 7-12) with normal voice quality and no vocal pathology; 2) thirty young adults (ages 18-30) and thirty children (ages 7-12) with abnormal vocal quality (some with laryngeal lesions of functional etiology). Results of the same-different subtests of pitch and loudness discrimination indicated that both normal groups (adults and children) were better able to discriminate between pitches and loudnesses than were the abnormal subject groups. Results of all other subtests indicated similar discriminatory ability in the normal and voice defective subject groups.

A few researchers have used subtests from the Seashore Measures of Musical Talents with voice defective patients. Eisenson, et al., (1958) used two Seashore subtests, pitch and loudness, with a sample of voice defective patients, finding the voice defectives to be significantly poorer in pitch discrimination than the control group or the Seashore standardization group. Davis and Boone (1967) administered the pitch and tonal memory subtests to thirty adult patients with hyperfunctional voice disorders and to thirty matched controls. No significant differences were found between the two groups on either subtest.

Little research has been done to evaluate the possible variables in the acquisition and treatment of vocal nodules in children. The

purpose of this study was to evaluate one such variable, musical ability, in children with a history of vocal nodules. It was hoped that such a study might provide information significant to a better understanding of the precipitation and development of vocal nodules.

CHAPTER II

REVIEW OF THE LITERATURE

Individuals with vocal nodules are the concern of many professionals. Major rehabilitation of these cases in the past has been the responsibility of the speech pathologist. Therapeutic management depends primarily upon etiological factors and vocal symptomatology in each individual situation. Yet, little systematic research has been done to define the etiology and symptomatology of vocal nodules or the efficacy of therapeutic regimes.

Definition of Vocal Nodules

Vocal nodules are variously known as laryngeal nodules, laryngeal nodes, corditis nodosa, singers' nodes, teachers' nodes, screamers' nodes (in children), parsons' nodes, and nodular laryngitis (Greene, 1957; Rubin and Lehrhoff, 1962). Benign lesions of the vocal cords, vocal nodules do not constitute a threat to life (Harris, 1948). A benign growth does not invade the surrounding tissues nor spread to other parts of the body. The disability caused is purely local (Brodnitz, 1957).

Nodules are typically located at the "junction of the anterior and middle third" of the cord (Ash and Swartz, 1944; Harris, 1948; Greene, 1957; Rubin and Lehrhoff, 1962; Gray, et al., 1965; Luchsinger and Arnold, 1965). This usual site of the nodules is in the region of the cords most active in the production of higher pitch where the mechanical strain is the greatest (Greene, 1957; Gray, et al., 1965;

Luchsinger and Arnold, 1965). However, New and Erich (1935) state that nodules have been found in the middle third of the cord.

Vocal nodules appear to be an ". . . epithelial alteration of the vocal cords in response to the irritation caused through exaggerated pressure of one cord against the other" (Froschels and Jellinek, 1941, p. 158). According to Arnold (1962), there are two major types of nodules: the reddish, soft, young nodule composed of normal squamous epithelium and the white, hard, mature nodule composed of thickened epithelium.

Various stages of nodular growth have been described by Ash and Swartz (1944). The fibroid stage is a low, rather firm pale not so sharply demarcated nodule. The polypoid is a more sharply demarcated, more or less pedunculated, translucent mass. The varicose is more colored from blood content, while the hyaline node is pale, quite firm, at times hard.

Incidence of Vocal Nodules

The literature concerned with incidence deals more with voice disorders in general than with vocal nodules in particular. Mills and Streit (1942) reported voice defects among 1.5 per cent of 4,685 children in the schools of Holyoke, Massachusetts. In the Madison, Wisconsin personal survey, Milisen (1971, p. 628) reported that ". . . out of a total of 10,033 children examined, 69 or 0.7 per cent were classified as functional voice cases, 30 or 0.3 per cent as structural voice cases, and one or .01 per cent as paralytic voice cases, giving a total of 1.0 per cent of voice defects in the population studied." A 1959 report of the American Speech and Hearing Association Committee on Legislation (ASHA, 1959) noted that .1 per cent

or ten school age children per 10,000 have serious voice defects. Pronovost (1951) reported that 7.8 per cent of the 87,288 individuals tested were defective in speech. Of the individuals having speech defects, 6.6 per cent of the population tested had voice defects. In a study of 32,000 school age children, Senturia and Wilson (1968) found that 1,962 or about 6 per cent of the children had voice defects. The results of an incidence study of chronic hoarseness among children (Baynes, 1966) indicated that 7.1 per cent of the 1,012 children who were tested demonstrated chronic hoarseness. White (1946) noted that 8 to 10 per cent of the New York City elementary school children had speech defects. Of these defects, hoarse voice was the most common.

Considering the incidence of voice disorders in persons with congenital clefts of the palate, Brooks and Shelton (1963) found that 10 per cent of their population of 76 cleft palate subjects had voice deviations such as hoarseness, breathiness, and inappropriate pitch. Takagi, et al., (1965), on the other hand, reported an incidence of voice problems other than nasality of only .6 per cent in his population studied at the Lancaster Cleft Palate Clinic.

The vocal nodule is believed to be the most common chronic benign laryngeal lesion (New and Erich, 1938; Fitz-Hugh, et al., 1958). Diagnosis of vocal nodules was made in 134, or 44 per cent of 300 cases of benign lesions of the vocal cord reviewed by Fitz-Hugh, Smith, and Chiong (1958). These figures correspond closely with New and Erich's findings (1938) of nodules occurring in 332, or 46 per cent of 772 cases of benign laryngeal lesions.

The results of the above investigations vary considerably. This variation, in part, stems from the different populations selected

for investigation as well as the investigators criteria for defining voice disorders.

Symptomatology of Vocal Nodules

Hoarseness, breathiness, and improper pitch are the most obvious vocal symptoms of the patient with vocal nodules (Greene, 1957; Brodnitz, 1958; Van Riper and Irwin, 1958; Wilson, 1961, 1962; Rubin and Lehrhoff, 1962; Luchsinger and Arnold, 1965; Johnson, et al., 1967; Moore, 1971). Vocal nodules prevent good closure of the cords making the infraglottal pressure inadequate (Van Riper and Irwin, 1958; Wilson, 1961; Gray, et al., 1965; Luchsinger and Arnold, 1965; Moore, 1971). Thus, a mechanical interference caused by the nodules may produce a breathy voice (Moore, 1971). The escaping air creates a turbulence which is the source of the defective sound. Though a large mass generally produces more breathiness, a vocal nodule that is hard and not compressible can cause a faulty voice even though it is quite small (West, 1938; Moore, 1971).

> The excessive effort needed to compensate often results in hoarseness and ventricular phonation. The vocal nodule also impedes the free vibration of one cord, and thus the usual symmetry of opening and closing is affected. The tone produced is often uncertain and irregular in pitch. In some instances diplophonia, or two-toned voice, occurs. The damping produced by the nodule also prevents the cord from being blown open with as much amplitude, hence producing a voice of low intensity (Van Riper and Irwin, 1958, p. 186).

A lowering of the voice pitch is often one of the beginning symptoms which accompanies hoarseness (Van Riper and Irwin, 1958; Wilson, 1961; Moore, 1971). Too high a pitch can also be related to the nodules. The presence of the vocal nodules lowers the fundamental frequency of the cords. Thus, in a compensatory action to overcome the

dysphonia, the individual speaks with increased loudness elevating his voice pitch as he does so (Van Riper and Irwin, 1958; Boone, 1971).

Nodules often interfere with or prevent the sustaining of a tone and cause the voice to crack or break (Rubin and Lehrhoff, 1962). The individual with vocal nodules may clear his throat excessively because of the sensation of a foreign body in the larynx (Greene, 1957; Brodnitz, 1958; Luchsinger and Arnold, 1965; Boone, 1971). Vocal fatigue resulting from prior hypertension of the laryngeal musculature is also characteristic of these individuals (Brodnitz, 1958; Rubin and Lehrhoff, 1962; Luchsinger and Arnold, 1965).

In summary, the literature emphasizes hoarseness, breathiness, and improper pitch as symptoms of vocal nodules. Of less importance in the literature are the following symptoms: vocal breaking and cracking, low intensity, excessive throat clearing, and vocal fatigue.

Etiology of Vocal Nodules

The literature on etiology, although scarce and repetitive, falls into four major groups: vocal abuse, physical causes, psychological causes, and mixed causes. The first group maintains that vocal abuse, prolonged vigorous use of the voice whether of continuity or loudness, is the most important factor in the development of vocal nodules (Harris, 1948; Greene, 1957; Alfaro, 1960; Moore, 1971).

Several investigators have stressed physical causes of vocal nodules. Zerffi (1935) suggested that much of the tension producing nodules occurs when individuals overuse during phonation the pharyngeal and cervical muscles that are needed primarily for deglutition. In reporting an investigation of vocal disorders in cleft palate children,

McWilliams, et al., (1969) stated that the presence of vocal nodules within the cleft palate population should alert clinicians to suspect an almost but not quite adequate velopharyngeal valving mechanism.

Other investigators have maintained that emotional or psychological disturbances can lead to the development of vocal nodules. Gray, et al., (1965, p. 188) thought that vocal nodules were the result of "pervasive anxiety." "This anxiety is manifested in emotional over-reaction to situations and misuse of the vocal apparatus due to psychological and physiological stress." The anxiety reaction initially is associated with isolated situations, but later becomes conditioned to a variety of stimuli. More conservatively, Aronson, et al., (1964) stated that it has not been proven conclusively that individuals with vocal disorders resulting from vocal abuse do not suffer from an etiologically significant psychiatric disturbance. Finally, Goodstein (1958, p. 364) concluded that ". . . little is known about personality as an etiological, consequential, or therapeutic factor in the disorders of voice."

Most writers concurred that an interaction of factors results in vocal nodules. Vocal abuse, and physical, psychological, and medical causes were discussed by several authorities. Defining vocal abuse as speaking with too great intensity and with lowered pitch, Berry and Eisenson (1956) estimated that vocal abuse accounts for 90 per cent of the nodule cases. Incidence is high among individuals suffering excessive emotional stress and those living within external environments of smoke, noise, or extreme changes in temperature. Colds, influenza, and excessive smoking are secondary factors related to the cause (Berry and Eisenson, 1956).

According to Brodnitz (1957 1958), general hyperfunctioning of the vocal organs, including the breathing mechanism and resonating cavities, results in vocal nodules. In addition to mechanical factors, psychological and emotional problems are related to the development of vocal nodules. Hormonal and metabolic imbalances and acute infections are medical problems influencing vocal behavior (Brodnitz, 1957, 1958). In addition to chronic mechanical irritation as a result of faulty or excessive vocal abuse, certain predisposing, precipitating and aggravating factors may cause vocal nodules (Arnold, 1962; Luchsinger and Arnold, 1965). Predisposing factors such as the general physical constitution, the constitution of the personality structure, and the local constitution of the vocal anatomy are possibly related to the development of nodules. Precipitating factors include allergies, hormonal imbalances, and emotional maladjustment. Finally, alcohol and tobacco are aggravating factors which may contribute to the growth of nodules.

Vocal abuse in the pre-adolescent population was defined by Wilson (1961, p. 19) as:

> . . . improper use of the voice as a result of too high pitch, excessive air pressure against the under surfaces of the bands, excessive talking, prolonged vigorous use of the voice such as screaming or shouting, abrupt initiation of tone, and production of strained sounds in play activity.

Wilson stated that vocal abuse places an enormous strain on the larynx which causes the nodules. Any emotional and medical problems may also be related factors (Wilson, 1962).

Several authorities considered vocal abuse, physical and psychological factors to be contributory to the etiology of nodules. Froschels and Jellinek (1941) stated that vocal abuse is a direct cause

of vocal nodules and is sometimes complicated by the use of muscles not normally used in speaking. This hyperfunctioning or faulty use of the laryngeal mechanism is highly associated with "disagreeable emotions." The patient may develop an anxiety neurosis or morbid attention to his voice, especially if he is a singer (Froschels and Jellinek, 1941). Ballenger (1969) maintained that vocal abuse of hyperkinetic individuals is the single most precipitating factor causing nodules.

West and Ansberry (1968) and Cooper (1971) discussed vocal abuse, misuse, and medical problems as direct causes of nodules. Vocal nodules do not occur because of overuse or excessive use of the voice but from misuse and abuse of the voice (West and Ansberry, 1968; Cooper, 1971). "Vocal misuse is the use of inappropriate pitch level and pitch range, tone focus, quality, volume, breath support, and possibly rate, either singly or in combination" (Cooper, 1971, p. 586). "No amount of vigorous vocalization can damage the edges of the vocal folds if the voice is properly used" (West and Ansberry, 1968, p. 216). Secondary factors related to the misuse of the voice are colds, allergies, sinusitis, postnasal drip, and smoking (West and Ansberry, 1968; Cooper, 1971).

Van Riper and Irwin (1958) discussed vocal abuse and physical factors as the cause of nodules. The cause of nodules is vocal strain which is due to over-use of the voice, improper pitch, intensity levels, and breathing patterns. The habitual use of the extrinsic muscles of the larynx during loud phonation is a physical problem related to the vocal strain causing nodules.

According to Rubin and Lehrhoff (1962) vocal abuse and psychological problems are of importance in the etiology of vocal nodules.

Rubin and Lehrhoff suggested that there are cases of vocal abuse alone such as the singer who places impossible demands upon his voice. Yet, many cases of vocal abuse have psychological overtones resulting from emotional tension.

In summary, the literature concerning the etiology of vocal nodules is inconclusive. However, many writers reviewed believe that vocal abuse is one of the most outstanding factors in the etiology of vocal nodules. The use of the term "vocal abuse" depends on the individual writer. "Vocal strain," "misuse," "prolonged vigorous use," are terms used by numerous writers in defining vocal abuse. Other writers mentioned pitch, loudness, quality, and other terms related to musical abilities in describing vocal abuse. Secondary to vocal abuse, emotional, physical, psychological and medical problems were cited in the literature.

Therapy for Vocal Nodules

The literature is divided concerning the therapeutic approaches in the rehabilitation of patients with vocal nodules. Each group reviewed in the etiological literature has its own view of the causation of vocal nodules. And thus, each group also presented its individual method of treatment. The first group maintained that surgery is the proper therapeutic approach. A number of laryngologists use surgical treatment alone for the intervention of vocal nodules (Cooper, 1971). According to Harris (1948) surgical removal is the only treatment of vocal nodules in most instances. Harris is pessimistic about the effects of therapy on large nodes, yet declares that deep removal of nodules will permanently damage the voice and lead to hoarseness. Several suggestions for better operative techniques were discussed (Harris, 1948).

Other writers included surgery and/or vocal rest in the initial stages of therapy. Brodnitz (1958) maintained that surgical removal is necessary in the majority of benign lesions of the cords. Large, fully matured nodes of long standing should be surgically removed (Van Riper and Irwin, 1958; Luchsinger and Arnold, 1965). All unilateral afflictions, all lesions in adults middle age or older, and all polyps with any localization on the cords should be surgically removed (Luchsinger and Arnold, 1965). Luchsinger and Arnold (1965) added that under no circumstances should children have nodules removed surgically.

Brodnitz (1958), Boone (1971), and Perkins (1971) stated that a short period of vocal rest should be observed immediately after surgery. Disagreeing, O'Neil and McGee (1962) considered an immediate moderate degree of vocal activity to be a form of physical therapy, speeding the healing process. Prolonged vocal rest imposes a severe emotional strain on the patient and has the undesired side effect of weakening muscle tone; but, it does relieve vocal abuse during the period of laryngeal recovery (Brodnitz, 1958; Perkins, 1971).

Several writers consider entertainers to be within a special catagory when considering surgery and voice rest. Luchsinger and Arnold (1965, p. 185) defined vocal rest as ". . . abstinence from all those professional vocal efforts which lead to nodules, and reduction of normal speaking to a minimal amount." Voice rest with no surgery or vocal training is recommended for singers with vocal nodules. Therapy is indicated only when a faulty vocal technique is being used (Luchsinger and Arnold, 1965). Disagreeing, Brodnitz (1958) stated that surgery or not, complete retraining of the techniques of singing and of the voice mechanism is necessary. Taking a "middle of the road"

opinion, Rubin and Lehrhoff (1962) suggested that entertainers require absolute voice rest or surgical removal of the nodules without vocal retraining if these individuals do not suffer from reoccurrences of vocal disturbances.

"Vocal rest may constitute sole therapy or it may merely be the initial stage in the overall program of vocal rehabilitation" (Rubin and Lehrhoff, 1962, p. 156). When there is a possibility the nodule might resolve without surgery, vocal rest should be a therapeutic policy (Rubin and Lehrhoff, 1962). Small nodules seem to respond readily to voice rest or voice training (Froschels and Jellinek, 1941; Berry and Eisenson, 1956; Greene, 1957; Brodnitz, 1958; Van Riper and Irwin, 1958; Wilson, 1961; O'Neil and McGee, 1962; Luchsinger and Arnold, 1965). In some instances where vocal rest and therapy fail, surgery is the only means left to restore the vocal cord anatomically (Wilson, 1961; Rubin and Lehrhoff, 1962).

During vocal rest several authorities believe that whispering should not be permitted (Berry and Eisenson, 1956; Brodnitz, 1958). Whispering is impractical and emotionally traumatic (Luchsinger and Arnold, 1965). While others believe whispering to be harmless when the patient could use his voice by speaking quietly (Greene, 1957; West and Ansberry, 1968). Rubin and Lehrhoff (1962) recommended "atraumatic whispering" when words are formed by the lips during simple exhalation, which allows for minimal cordal activity.

Gray, et al., (1965) investigated a psychotherapeutic approach to voice therapy described as an emphasis on deconditioning the patient's anxiety and tensions by using the behavior approach of reciprocal inhibition. No breathing or phonating exercises were

mentioned. When the anxiety state became minimized through relaxation, the patient automatically assumed a more acceptable method of vocalization.

The third group indicated that a total approach plan for vocal rehabilitation must include all possible means of influencing the variety of factors that form the basis of a given voice disturbance (Brodnitz, 1958; Luchsinger and Arnold, 1965). Brodnitz included psychological counseling, drug therapy, physical therapy and voice therapy in his therapy approach. Psychological counseling is used only when the emotional problems related to the etiology of the vocal dysfunction need counseling sessions. Medication, such as tranquilizers, may be necessary to produce a favorable emotional atmosphere and relaxation of physical tensions. Physical therapy which might include harmonic vibration, a form of massage, and a weak faradic current, can be used to facilitate relaxation, firm tones, and accurate pitch. The use of chewing movements is a valuable voice therapy tool to relieve excessive tensions in the throat, tongue, and soft palate (Brodnitz, 1958).

Luchsinger and Arnold (1965) listed separately their therapeutic measures for children and adults. Parent counseling, psychotherapeutic habilitation, and voice therapy are basic in voice rehabilitation of children. Parent counseling is needed to fully explain how unfavorable the vocal habit of screaming is for the child. Psychotherapy with the child should achieve a better adjusted less aggressive personality. The objective of vocal training is to teach the physical difference between screaming and effective vocalization.

Training with adults includes electrotherapy, promotion of the audio-vocal feedback mechanism, and psychotherapy, as indicated (Luchsinger and Arnold, 1965).

A fourth group maintained that psychological counseling and voice therapy are most important factors in vocal rehabilitation (Froschels and Jellinek, 1941; Rubin and Lehrhoff, 1962). Therapy should aim at reestablishing normal phonation and at removing the neurotic attitude of the patient (Froschels and Jellinek, 1941). The patient with vocal nodules may need to seek psychiatric consultation to resolve emotional problems (Rubin and Lehrhoff, 1962). Vocal therapy includes establishing and maintaining optimal patterns of breathing, relaxation, pitch and vocal attack. The pitch usually needs lowering. But, most important, pitch should be right for each individual's particular voice. A soft vocal attack can be accomplished by having the patient use an aspirate initiation of tone (Rubin and Lehrhoff, 1962). The chewing method is a fast and efficient manner of treatment (Froschels, 1943). This method reduces the general hyperfunction of the vocal mechanism thereby facilitating the optimum efficiency of the laryngeal mechanism. The use of the chewing movements with motion of the tongue, is a very valuable tool in overcoming excessive tension in the throat, tongue, and soft palate (Froschels, 1943).

The majority of writers believe voice therapy to be essential to the rehabilitation of patients with vocal nodules (Berry and Eisenson, 1956; Greene, 1957; Van Riper and Irwin, 1958; Wilson, 1961; Boone, 1971; Perkins, 1971). Vocal therapy should include the facilitation of vocal hygiene and general bodily relaxation; training of proper vocal attack, proper breathing, and proper pitch (Greene, 1957;

Berry and Eisenson, 1958; Van Riper and Irwin, 1958); the use of new melody patterns; and changing the focus of energy from the chest, larynx, and neck to the front of the mouth (Berry and Eisenson, 1958). During the voice training of children, the elimination of vocal abuse and proper training of pitch, loudness and quality are stressed (Wilson, 1961, 1966). The child must be told that abusive vocal practices are harmful to him. Pitch and Loudness training must be done on three gross levels only. The pitch levels used are too high, too low and middle. The loudness levels used are too loud, too soft and middle. Quality training involves training for discrimination of quality so that the child uses improved methods of phonation to obtain better quality. Additional factors to be considered are relaxation, correct breathing patterns, good posture, and rate of speaking (Wilson, 1966). Boone (1971) includes the reducing of vocal abuse and the demonstrating of correct vocal techniques as vocal reeducation for children with vocal nodules. In adult reeducation appropriate loudness, pitch and quality are obtained using a voice therapy facilitating technique. A voice therapy facilitating technique is a technique which enables the patient to produce his best voice. Twenty of these techniques are described and an example of each one is also given. The therapist should choose the one or more techniques which produce the best results for the individual patient (Boone, 1971).

The use of operant conditioning techniques with positive reinforcement to increase the occurrences of a constriction free response is recommended by Perkins (1971). A group of simple objective procedures for altering vocal production holistically toward an optimum balance are organized into a system of alternative sequences. These

alternative sequences which include (1) pulsated vocal mode, (2) soft breathy phonation, and (3) chewing, are organized within the framework of operant behavior therapy to establish and strengthen optimum functioning in the clinic, and to insure its carry-over into normal daily life.

Changing the pitch (usually lowering) is the most important therapeutic measure for vocal reeducation (West, 1938; West and Ansberry, 1968). "A pitch must be selected that affords relief from friction at the points affected and will allow the patient to phonate easily" (West and Ansberry, 1968, p. 217).

The literature is divided concerning the therapeutic approaches in the rehabilitation of patients with vocal nodules. Surgery, vocal rest, psychotherapy, and voice therapy were discussed. Most writers included voice therapy within their regimen of rehabilitation for patients with vocal nodules.

In summary, vocal nodules are defined as benign growths of the vocal folds typically located at the "junction of the anterior and middle third" of the cord. The nodules are generally bilateral occurring exactly opposite each other. Incidence studies are inconclusive. The literature on symptomatology emphasizes hoarseness, breathiness, and improper pitch as symtoms of vocal nodules. Although the literature on etiology of vocal nodules is inconclusive, most investigators believe that vocal abuse is one of the most outstanding factors in the cause of vocal nodules. Therapeutic approaches for the remediation of vocal nodules and their symptoms usually include voice therapy.

CHAPTER III

PROCEDURES

Although the literature concerning the etiology of vocal nodules is inconclusive, most speech pathologists and physicians concur that vocal abuse is a significant factor. Vocal abuse is variously described, including errors in pitch, loudness, and quality. These terms also refer to various musical abilities. Therefore, this study was designed to investigate the musical abilities of children with a history of vocal nodules. The subjects, instrumentation, and procedure will be discussed below.

Subjects

The experimental group consisted of ten children ranging in grade levels four through eight according to Seashore's standardization of the measures. Six subjects were male and four were female. One female was Negro. All other subjects were Caucasian. Each child had been diagnosed with vocal nodules by an otolaryngologist. The sources from which the experimental population was drawn included the University of North Carolina at Greensboro Speech and Hearing Center, the Charlotte Speech and Hearing Center, the Guilford County Public Health Department, and the private patients of Dr. L. L. Patseavourus. Ten control subjects with no history of vocal nodules were matched to the experimental group according to age, grade, sex, and race. The control group was selected by asking each experimental subject to bring his best friend of the same age, grade, sex, and race. To

qualify as a subject in either the experimental or control group, each subject was required to pass a pure-tone audiometric screening test at 15 db. (ISO) bilaterally for the frequencies 250-8000 Hz. One child to be included in the experimental group did not pass the screening test and was not included in this experiment. Three control subjects--one being of the wrong grade, another failing the hearing test, and the third child with an articulation problem--were also dropped. Therefore, three children selected from the Greensboro Public Schools were matched according to the above criteria to three experimental subjects.

Testing Procedures

Individual Record

Researchers have considered medical problems and vocal abuse as possible etiology of vocal nodules. Therefore an individual record was kept on each experimental subject. Information regarding the subject's health history, the onset and development of hoarseness, variables affecting hoarseness, and vocal history was elicited in a parent interview. Additional sections of the record provided space for identification information, results of the hearing test, and the name and address of each matched control.

Equipment

A tape recording was made of the Seashore Measures of Musical Talents (SMMT). The directions from the test manual to be read prior to each subtest were included on the test tape. Practice portions of each subtest were recorded according to the directions within the test manual. The tape was presented to the subjects by means of a Roberts Model 770X tape recorder through Realistic, Nova 10 headphones. A

Koss T5 Stereophone switcher box enabled the examiner to present the recorded tests to two subjects simultaneously.

The SMMT is composed of six subtests: pitch, loudness, rhythm, time, timbre, and tonal memory. Seashore (1960) has standardized each subtest for older children--fourth through eighth grades--and adults. A description of each subtest can be found in the Appendix, pages 43-44.

Berry and Eisenson (1956), Davis and Boone (1967), and Boone (1971) recommend the use of the SMMT in the diagnosing of voice cases. Berry and Eisenson (1956) and Davis and Boone (1967) state that the SMMT subtests of pitch and tonal memory can determine the patient's abilities in pitch discrimination and tonal memory. Boone (1971) feels that the SMMT pitch subtest can be used to determine a baseline of how well a patient can make pitch discriminations.

Several investigators have found specific subtests from the SMMT useful as a research tool in relating musical ability to speech functions and disorders. Travis and Davis (1927) administered the pitch, loudness, and tonal memory tests to three groups of superior, average, and defective speakers. The defective speakers were subdivided into a functional group and an organic group. The functional group did more poorly than the organic group and the defective group as a whole presented the lowest scores on each of the three SMMT subtests. Gilkinson (1943) found little relationship between speech skill and SMMT scores with regard to normal speakers when general criteria of speech skill were employed.

A few researchers have used the SMMT with voice defective patients. Eisenson, et al., (1958) used two SMMT subtests, pitch and loudness, with a sample of voice defective patients, finding the voice

defectives to be significantly poorer in pitch discrimination than the control group or the SMMT standardization group. Davis and Boone (1967) administered the pitch and tonal memory subtests to thirty adult patients with hyperfunctional voice disorders and to thirty matched controls. No significant differences were found between the two groups on either subtest.

Subject Tasks

Testing took place in well lighted, comfortable therapy rooms at the University of North Carolina at Greensboro and at the Charlotte Speech and Hearing Center. A table, three chairs, and all testing instruments were situated within the room (see Figure 1, page 23). There were no noise disturbances in the testing room or in adjacent areas allowing for a quiet testing environment.

The subjects were tested in groups of two. Headphones were adjusted for each subject to his most comfortable fit. The digit counter on the tape recorder was set at zero so that the test tape could be visually monitored. General testing instructions were presented free field.

> This is a test to measure some aspects of ability to hear sounds which occur in music, speech, and many practical activities. The test will be played on this recorder and you are to put your answers on the special papers that are now to be distributed (Seashore, et al., 1960, p. 4).

An IBM answer sheet and two pencils with erasers were given to each subject. Required information--name, address, grade, etc.--was written in the spaces provided (see Appendix, pages 45-46). The system of marking the answer sheets was explained thoroughly in the next section of the taped instructions. The tape continued with the standardized instructions for the first subtest.

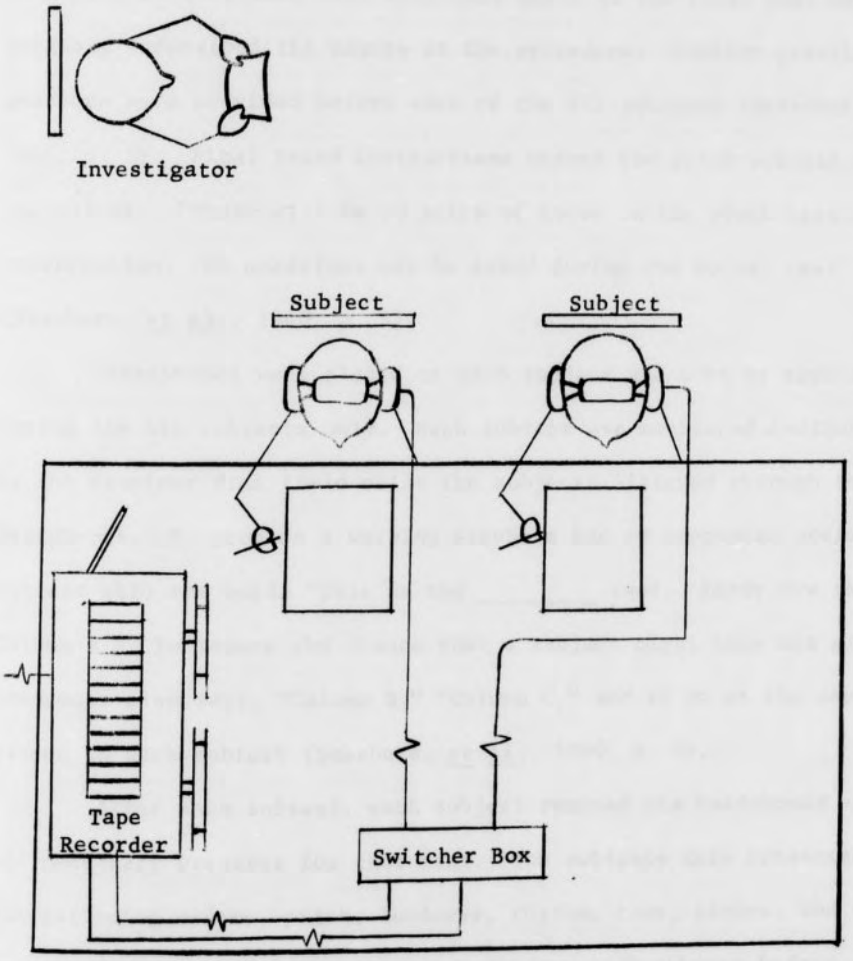

Fig. 1. Schematic Representation of Test Circumstance

Preliminary practice was given demonstrating easy as well as difficult steps. The subjects were allowed to speak in competitive reaction during the practice. Each subject was asked to respond at every trial, guessing in case of uncertainty. The demonstration and the answering of questions were continued until it was clear that both subjects understood the nature of the procedure. Similar practice sessions were provided before each of the six subtests (Seashore, et al., 1960, p. 5). Final taped instructions before the pitch subtest were as follows: "There will be 50 pairs of notes in the pitch test without interruption. No questions may be asked during the actual test" (Seashore, et al., 1960, p. 5).

Headphones were placed on each subject and worn by each subject during the six subtests only. Each subtest was monitored auditorially by the examiner free field while the subjects listened through their headphones. To provide a warning Seashore had an announcer preface each subtest with the words "This is the _____ test. Ready now for Column A." To reduce the chance that a subject might lose his place, the announcer also says, "Column B," "Column C," and so on at the appropriate places in each subtest (Seashore, et al., 1960, p. 5).

After each subtest, each subject removed his headphones and made all necessary erasures for that test. The subtests were presented in the following order: pitch, loudness, rhythm, time, timbre, and tonal memory. The taped instructions presented to each subject before each of the subtests can be found in the Appendix, pages 47-48. After the third subtest a fifteen to twenty minute break allowed the subjects to rest.

Scoring

The raw score for each subject was the number of correct responses for each of the six subtests. The raw scores were converted to percentile equivalents by using the tables provided in the manual of directions for administering the subtests. Norms for the SMMT are provided in terms of per cent of correct responses.

CHAPTER IV

RESULTS AND DISCUSSION

Data on ten subjects with vocal nodules and their matched controls were obtained in order to determine and quantify their musical abilities. The Seashore Measures of Musical Talents (SMMT) was administered to each subject. In addition, an individual record was kept on each experimental subject. Information regarding the subject's health history, the onset and development of hoarseness, variables affecting hoarseness, and vocal use was elicited. These data, thus obtained, are presented and discussed in this chapter .

Test Results

The results of the study revealed no significant difference between the experimental and control groups regarding musical abilities. A summary of the mean scores, standard deviations, and t-ratios is presented in Table 1, page 27.

There were six males and four females comprising each group studied. Although no statistically significant difference was revealed when comparing the male/female means of the SMMT, it was interesting that the female nodule group had a somewhat higher mean than the male nodule group (see Table 2, page 28).

The ages of the subjects ranged from nine to fourteen years, with a mean age of eleven years. Mean scores on the SMMT for each age level of the experimental and control groups were computed. The children with nodules scored consistently, though not significantly

TABLE 1

TESTING THE SIGNIFICANCE OF THE DIFFERENCES BETWEEN MEANS OF CHILDREN WITH VOCAL NODULES (E) AND THEIR MATCHED PAIRS (C) ON THE SEASHORE MEASURES OF MUSICAL TALENTS

		Mean	SD	T
Total Score				
Nodules	E	197.2	22.05	.230
No Nodules	C	195.8	19.90	
Subtests				
Pitch	E	37.0	8.13	1.102
	C	34.0	5.96	
Loudness	E	38.7	4.81	1.130
	C	41.1	5.72	
Rhythm	E	25.3	3.20	.225
	C	25.0	3.05	
Time	E	34.9	5.11	.558
	C	36.1	6.04	
Timbre	E	41.9	8.79	.436
	C	40.8	4.21	
Tonal Memory	E	21.3	5.68	2.134
	C	18.6	4.90	

$P_{.05} = 2.262$ $P_{.01} = 3.250$

TABLE 2

MEAN SCORES ON THE SEASHORE MEASURES OF MUSICAL TALENTS OF MALE AND FEMALE SUBJECTS WITH AND WITHOUT VOCAL NODULES

	Male	Female
Nodules	193.00	203.50
No Nodules	195.83	195.75

lower on the loudness subtest, while the inverse was true when comparing the means of the tonal memory subtest. On the tonal memory test, the experimental group scored better than their controls at all age levels.

Individual Record Results

The individual record forms were used to obtain and organize information pertaining to each subject's health, medication, and vocal histories. This information was judged by the investigator to be positive or negative for each experimental subject. A positive medical history was characterized by frequent colds and sore throats, allergies, and other upper respiratory infections. Any child taking medication prescribed by a doctor was considered to have a positive medication history. A positive vocal history revealed excessive screaming, crying, loud talking, singing, etc. according to the parents.

Health Histories

Of the ten experimental subjects in this study, six had positive histories of upper respiratory infections. Included in these six were three subjects whose respiratory infections were said to be unrelated to the onset of hoarseness. For example, the individual records revealed subjects 5 and 8 as having allergies and frequent sinus problems. Subject 3 had chronic colds as an infant and an allergy to pollen. In addition, subject 3 has a history of adenoiditis with an adenoidectomy at the age of six.

Subjects 7, 1, and 9 had positive medical histories at the time of the onset of hoarseness. Subject 7 had tonsilitis at the age of five with a tonsilectomy at the age of six. She had chronic sore throats and colds between the ages of eight and nine, the age of the onset of hoarseness. Subject 1 also had frequent sore throats at the

age of eight when hoarseness first became noticeable. Subject 9 had chronic colds and laryngitis during the period when hoarseness began. Therefore, of the ten subjects in the experimental group, six subjects or 60 per cent of the sample had a positive history of upper respiratory infections. Three of the subjects reportedly had respiratory infections which appeared to be related to the onset of hoarseness.

Medication Histories

Three of the subjects who had experienced upper respiratory infections had taken prescribed medications. For example, subject 7 took Dimetapp during her frequent sore throats and colds. Subject 3 had taken Triaminic for allergy and was, at the time of the study, taking Dexadrine for hyperactivity. Subject 5 reportedly was taking injections for allergy, but his mother could not remember the specific medication. In summary, both subjects who were said to have allergies were taking a prescribed medication. However, only one of the subjects who had had chronic colds and sore throats had taken a prescribed medication.

Vocal Histories

All of the experimental subjects had a history of vocal abuse according to the parents. Two subjects, 7 and 10, reportedly cried excessively during infancy. The mothers of eight subjects--1, 3, 4, 5, 7, 8, 9, and 10--stated that their children were much more talkative and noisy than other children. All but one child, subject 6, reportedly yelled excessively while playing with other children out of doors. The mothers of 2, 4, 6, 7, and 9 reported frequent singing prior to the diagnosis of vocal nodules.

In summary, there was no statistically significant difference between the experimental and control groups on the SMMT. However, the female nodule group had a somewhat higher mean than the male nodule group. Analysis by age revealed that the experimental group scored lower than their matched controls on the loudness subtest, while the experimental group scored better than their controls at all age levels on the tonal memory subtest. The individual record forms revealed that six of the ten subjects had a history of upper respiratory infections and that three of these six had infections at the time of the onset of hoarseness. Two of the subjects had taken medication for allergies and only one subject had taken prescribed medications to control infections. All ten experimental subjects had a history of excessive vocal usage, according to their parents.

Discussion

While there were no significant findings in this study, the tendency of children with nodules to score lower on loudness tasks is of interest. Vocal abuse described by Berry and Eisenson (1956) is speaking with too great intensity. The tendency of the children with nodules to have poor loudness discrimination coupled with reported excessive vocal usage suggests a relationship between the two observations. It may be that because loudness perception is poor, the children talk loudly without being aware of their behavior. Conversely, it may be that their loud talking, for whatever reason, impairs their perception of loudness.

The health history of the subjects studied appears to be etiologically significant. Six of the experimental subjects had a

positive history of upper respiratory infections. Excessive use of the voice while the cords are inflamed may contribute to the development of vocal nodules. In a compensatory action to overcome the dysphonia, the individual may speak with increased loudness (Van Riper and Irwin, 1958; Boone, 1971). Moreover, recurrent or habitual use of the extrinsic muscles of the larynx increases even more the vocal strain thought to be associated with nodules (Van Riper and Irwin, 1958).

Increase in intensity tends to also raise pitch. Improper pitch may be a secondary factor related to inappropriate loudness. If an individual has been talking with exceeding loudness, then he would probably be less aware of his hyperfunctional use of the entire vocal mechanism, as well as a gradual elevation in pitch. Further investigation of loudness perception, kinesthetic as well as auditory, in persons with vocal nodules would be of benefit in determining its etiological significance.

CHAPTER V

SUMMARY AND CONCLUSIONS

The etiology of vocal nodules is of interest to speech pathologists. Although the literature on the etiology of vocal nodules is inconclusive, most investigators believe that vocal abuse is a significant factor. Problems of pitch, loudness, and quality (terms related to musical ability) are used in the definition of vocal abuse. Previous studies (Eisenson, et al., 1958; Davis and Boone, 1967) have investigated pitch, loudness, and tonal memory abilities of adult subjects with voice disorders. Persons with voice disorders were found to be significantly poorer in pitch discrimination than normals; no other differences were found. The musical abilities of children with voice disorders have not been evaluated.

The purpose of this study was to investigate musical ability in children with a history of vocal nodules. It was hoped that such a study might provide information significant to a better understanding of the precipitation and development of vocal nodules.

The Seashore Measures of Musical Talents (SMMT) was administered to an experimental group of children with vocal nodules and their matched controls with no history of vocal nodules. Each subject was required to pass a pure-tone audiometric screening test at 15 db. (ISO) bilaterally for the frequencies 250-8000 Hz. to qualify as a subject in either the experimental or control group. In addition, an individual record was

compiled of each experimental subject's health history, the onset and development of hoarseness, variables affecting hoarseness, and vocal use.

Analysis of the data yielded the following results:

1. There was no statistically significant difference between the experimental and control groups on the SMMT.

2. The female nodule group had a somewhat higher mean than the male nodule group.

3. On the tonal memory subtest, the experimental group scored better (not statistically significant) than their controls at all age levels.

4. The experimental group scored consistently, though not significantly, lower on the loudness subtest.

5. The individual record results supported the literature in suggesting that vocal abuse is related etiologically to vocal nodules.

Interpretations of the differences between the experimental and control groups and the relationships of loudness and excessive vocal use to the development of nodules were discussed. Suggestions for further research were made.

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APPENDIX

INTRODUCTORY LETTER

Date

Dear

A study is being conducted at the University of North Carolina at Greensboro in an attempt to improve treatment methods for children with voice disorders. As your child previously obtained services at (the Speech and Hearing Center, the Health Department, from Dr. L. L. Patseavouras), your names are listed in (our, their, his) files. Therefore, we are contacting you in the hope that you would be willing to participate.

The study is designed to measure musical ability of children with vocal nodules. We would like for you to bring your child to the Speech Clinic for a single visit. On that day, you and your child will need to be here for approximately one hour. During that time, you will be asked a few questions about your child's medical history and speech therapy. Then, the Seashore Measures of Musical Talents will be administered to your child. The results of the test will be considered confidential material and your child's identity will not be revealed.

It is our hope that this study may benefit children with vocal disorders. Your participation would be an extremely helpful contribution and would be sincerely appreciated. You will be contacted by telephone within the next week. If you have any questions please feel free to call us at the Speech Clinic, 379-5939. Thank you very much for your help.

Very truly yours,

Jeannine A. Mashburn

Mariana Newton, Ph. D.
Assistant Professor of
Speech Pathology

INDIVIDUAL RECORD

I. IDENTIFICATION

Name: _____ Sex: _____
Age: _____ Date: _____
Birthdate: _____ Referred by: _____
Address: _____ Examiner: _____
Parents: _____ Telephone: _____

II. MEDICAL HISTORY

Chronic Colds: _____ Chronic sinusitis: _____
Scarlet fever: _____ Pneumonia: _____
Diptheria: _____ Rheumatic fever: _____
Whooping cough: _____ Influenza: _____
Allergies: _____ Tonsillitis: _____
Frequent sore throats: _____
What is your child's present state of health? _____
_____
Is your child on any medication? _____
_____

III. INFORMATION CONCERNING NODULES

Bilateral: _____ Other Laryngeal anomalies:
Unilateral: _____ _____
Treatment: Surgery: _____
_____ Date: _____
Physician: _____ _____
Therapy: _____ Dates: _____
Emphasis during therapy: _____
_____
Therapist: _____

IV. VOCAL HISTORY

When and under what circumstances did you first notice your child's voice problem?

Did the voice problem come on gradually or suddenly?

What do you think caused the problem?

Has the problem decreased or increased since it began?
Describe:

What time of the day is your child's voice best? Worse?

Does the problem vary with the season of the year or the weather?

Does the problem vary with the amount of talking that your child does?

Does the problem vary with any other conditions?

Is your child's voice similar to some other person's in your family? Whose?

Do you know of any speech disorders in your family?

Amount and kind of vocal usage: As an infant, did your child cry or scream a lot? _____ Is your child very talkative or noisy? _____ Does your child yell excessively on the playground or in competitive sports? _____ Does your child sing in a choir? _____ What activities does your child participate in which involve loud or continuous talking? _____

_____

V. HEARING

Results of pure-tone screening test:

VI. MATCHED CONTROL

Name: _____ Sex: _____

Address: _____ Birthdate: _____

Phone: _____ Age: _____

SUMMARY DESCRIPTION OF THE SIX SUBTESTS OF THE SEASHORE MEASURES OF MUSICAL TALENTS[1]

PITCH. In the test of the sense of pitch, 50 pairs of tones are presented. In each pair the listener is to determine whether the second tone is higher or lower in pitch than the first. The stimuli were derived from a beat-frequency oscillator through a circuit producing pure tones lacking in harmonics and overtones. The tones are at about 500 cycles and have a duration of .6 second each. Frequency differences between the tones in the pairs are as follows:

Item Numbers	Differences in Cycles
1-5	17
6-12	12
13-22	8
23-32	5
33-40	4
41-45	3
46-50	2

LOUDNESS. Fifty pairs of tones are presented. The subject is to indicate for each pair whether the second tone is stronger or weaker than the first. Stimuli were derived from the same apparatus that was used for the pitch test, but the frequency was held constant at 440 cycles. Intensity differences between the tones in the pairs are as follows:

Item Numbers	Differences in Decibels
1-5	4.0
6-10	2.5
11-20	2.0
21-30	1.5
31-40	1.0
41-50	0.5

RHYTHM. Thirty pairs of rhythmic patterns comprise the sense of rhythm test. The subject is to indicate whether the two patterns in each pair are the same or different. The source of the stimuli was a beat-frequency oscillator set at 500 cycles. Tempo is constant at the rate of 92 quarter notes per minute. The first ten items contain patterns of 5 notes in 2/4 time; the next ten, patterns of 6 notes in 3/4 time; and the last ten, patterns of 7 notes in 4/4 time.

---

[1]This summary description was quoted directly from the Manual of Instructions and Interpretations for the SMMT.

TIME. The test of the sense of time consists of 50 pairs of tones of different durations. The subject is to determine whether the second tone is longer or shorter than the first. The source for the stimuli was the oscillator used in the pitch test. The duration of the tones was controlled automatically by a tape timing device for which the tape had been prepared with a predetermined schedule of time intervals. The frequency of the tones was held constant at 440 cycles. Differences in duration between the tones in pairs are as follows:

Item Numbers	Differences in Seconds
1-5	.30
6-10	.20
11-20	.15
21-30	.125
31-40	.10
41-45	.075
46-50	.05

TIMBRE. The purpose of the timbre test is to measure ability to discriminate between complex sounds which differ only in harmonic structure. It consists of 50 pairs of tones; in each pair the subject is to judge whether the tones are the same or different in timbre or tone quality. The tones were produced with a special generator. Each tone is made up of a fundamental component, whose frequency is 180 cycles, and its first five overtones. Tonal structure is varied by reciprocal alteration in the intensities of the third and fourth harmonics. The following table shows the amounts by which the intensities of the third and fourth harmonics in variable tones differ from their levels in the standard tone:

Item Numbers	Decibel Increase in 4th Harmonic	Decibel Decrease in 3d Harmonic
1-10	10.0	9.6
11-20	8.5	4.0
21-30	7.0	2.4
31-40	5.5	1.2
41-50	4.0	0.7

TONAL MEMORY. This test has 30 pairs of tonal sequences consisting of 10 items each of three-, four-, and five-tone spans. In each pair one note is different in the two sequences, and the subject is to identify which note it is by number. A Hammond organ was used as the stimulus source. The 18 chromatic steps upward from middle C were used. Tempo was carefully controlled, and intensity is essentially constant.

SEASHORE MEASURES OF MUSICAL TALENTS

(1939 REVISION)

SERIES A

For each test, place your answers one below another in column A until that is filled, then down column B, and so on.

PITCH

	A	B	C	D	E
1	H L	H L	H L	H L	H L
2	H L	H L	H L	H L	H L
3	H L	H L	H L	H L	H L
4	H L	H L	H L	H L	H L
5	H L	H L	H L	H L	H L
6	H L	H L	H L	H L	H L
7	H L	H L	H L	H L	H L
8	H L	H L	H L	H L	H L
9	H L	H L	H L	H L	H L
10					

RHYTHM

	A	B	C
1	S D	S D	S D
2	S D	S D	S D
3	S D	S D	S D
4	S D	S D	S D
5	S D	S D	S D
6	S D	S D	S D
7	S D	S D	S D
8	S D	S D	S D
9	S D	S D	S D
10			

Be sure your marks are heavy and black.
Erase completely any answer you wish to change.

LOUDNESS

	A	B	C	D	E
1	S W	S W	S W	S W	S W
2	S W	S W	S W	S W	S W
3	S W	S W	S W	S W	S W
4	S W	S W	S W	S W	S W
5	S W	S W	S W	S W	S W
6	S W	S W	S W	S W	S W
7	S W	S W	S W	S W	S W
8	S W	S W	S W	S W	S W
9	S W	S W	S W	S W	S W
10					

	SCORE	PERCENTILE
PITCH		
LOUDNESS		
RHYTHM		
TIME		
TIMBRE		
TONAL MEMORY		
NORMS USED		

NAME _____ (LAST) _____ (FIRST)

PLACE _____ (SCHOOL OR COMPANY) _____ CITY _____

DATE _____ AGE _____ (YEARS) (MONTHS) SEX _____ (M OR F)

LAST SCHOOL GRADE COMPLETED _____

$ PERCENTILE	PITCH	LOUDNESS	RHYTHM	TIME	TIMBRE	TONAL MEMORY
95						
90						
80						
75						
70						
60						
50						
40						
30						
25						
20						
10						
5						
1						

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For each test, place your answers one below another in column A until that is filled, then down column B, and so on.

TIME

	A		B		C		D		E	
	L	S	L	S	L	S	L	S	L	S
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

TONAL MEMORY

	A			C					
	1	2	3	1	2	3	4	5	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

	B			
	1	2	3	4
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

SCORE	
TIME	
TIMBRE	
TONAL MEMORY	

Be sure your marks are heavy and black.
Erase completely any answer you wish to change.

TIMBRE

	A		B		C		D		E	
	S	D	S	D	S	D	S	D	S	D
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

TAPED INSTRUCTIONS FOR THE SIX SUBTESTS OF THE SEASHORE MEASURES OF MUSICAL TALENTS[1]

PITCH. "The first test measures your sense of Pitch. You will hear two tones, one right after the other. The second tone is either higher or lower in pitch than the first. Find the section of the answer sheet labeled 'Pitch.' You are to make a mark under the letter H on the answer sheet if the second tone is higher than the first; but mark under the L if the second tone is lower. Answer every time; if you are not sure, guess. Now we shall listen to a few practice notes. Do not mark any answers for these. Just see that you understand what you are to do. Ask any questions you want to during the practice."

LOUDNESS. "The next part tests your sense of Loudness. You will hear two tones which differ in loudness or strength. If the second is stronger, you should make a mark under the letter S for that item in the section of your answer sheet labeled 'Loudness.' If the second tone of the pair is weaker, make the mark between the dotted lines under the letter W. There are 50 pairs in this test. There is always a difference; if you are not sure, guess."

RHYTHM. "The next part is a measure of sense of Rhythm. You will hear two rhythmic patterns, one right after the other. The second is either the same as the first or different from it. If they are the same, you should blacken the space under the letter S for that item in the section of your answer sheet labeled 'Rhythm.' If the two patterns are different, mark the space under the letter D. There are only 30 pairs of patterns in this test. You are to decide whether the rhythm in each pair is the same or different. Now listen to a few practice items, but do not make any marks on your papers for these."

TIME. "Turn over your answer sheet. The section you are to mark for the next test is on the other side of the answer sheet. The next part tests your sense of Time. You will hear two tones which are different in length. If the second tone is longer than the first, you should blacken the space under the letter L for that item in the section of the answer sheet labeled 'Time.' If the second tone is shorter than the first, mark the space under the letter S for that item. There is always a difference; if you are not sure, guess. There will be 50 pairs of tones on this test. Now listen to a few practice items to see how they go, but do not make any marks for these on your papers."

TIMBRE. "The next part measures your sense of Timbre or tonal quality. You will hear two tones that are either the same or different in timbre. If they are the same, you are to blacken the space under the letter S for that item in the section of the answer sheet labeled 'Timbre.' If the second tone is different from the first, mark the space under the letter D. There are 50 pairs of tones in this test. You are to decide

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[1]These taped instructions were quoted directly from the Manual of Instructions and Interpretations for the SMMT.

whether the two tones have the same tonal quality or not and mark your papers for same or different. Now listen to a few practice items to see how they go, but do not mark your papers for these."

TONAL MEMORY. "The next part is a test of Tonal Memory. In each trial you will hear a short series of notes played twice. In the second playing, one note is changed. You are to decide which note is changed; the first, the second, the third, and so on, and blacken the space under that number in the section of the answer sheet labeled 'Tonal Memory.' There is always some note in the second playing that is different from the corresponding note in the first playing. As you hear the notes in each set, count them silently to yourself, one, two, three, etc., so that you can identify the note that is changed. There are 30 sets of tones in this test. Now listen to a few practice sets, but do not mark your papers for these."

TABLE 3

RAW SCORES AND PERCENTILES FOR EXPERIMENTAL AND CONTROL GROUPS ON THE SIX SUBTESTS OF THE SEASHORE MEASURES OF MUSICAL TALENTS

Subjects		Pitch		Loudness		Rhythm		Time		Timbre		Tonal Memory	
		RS	%	RS	%	RS	%	RS	%	RS	%	RS	%
Nodules	1	25	22	43	82	27	91	37	81	50	99	19	69
	2	29	38	36	43	26	83	30	40	50	99	12	30
	3	32	52	36	43	19	18	31	45	35	79	15	47
	4	45	98	38	53	29	99	36	76	49	99	29	99
	5	45	93	43	76	24	48	40	85	49	99	27	88
	6	29	21	34	23	25	60	28	11	42	92	16	26
	7	34	39	38	41	29	97	40	85	29	13	21	53
	8	43	85	49	99	22	28	39	80	27	7	23	66
	9	42	81	35	26	24	48	28	11	41	88	25	77
	10	47	98	35	26	28	91	40	85	47	99	26	83
No Nodules	11	35	65	35	38	24	64	30	40	41	98	12	30
	12	41	89	47	98	30	99	39	89	45	99	15	53
	13	22	12	29	19	23	53	33	57	37	86	12	30
	14	38	79	40	63	20	24	38	85	45	99	23	86
	15	41	75	44	81	26	72	43	96	47	99	24	71
	16	30	24	46	93	25	60	24	2	42	92	20	47
	17	30	24	43	76	29	97	41	89	38	71	18	36
	18	31	27	47	96	23	38	34	43	42	92	15	22
	19	38	59	41	61	27	83	43	96	34	44	25	77
	20	36	49	39	47	23	38	36	59	37	66	22	59

RS = raw score % = percentile

TABLE 4

IDENTIFICATION AND HISTORY INFORMATION FOR
EXPERIMENTAL AND CONTROL GROUPS

Subjects		Identification			History		
		Sex	Age	Grade	Health	Medication	Vocal
Nodules	1	Male	10	4	+	-	+
	2	Male	10	4	-	-	+
	3	Male	9	4	+	+	+
	4	Female	10	5	-	-	+
	5	Male	11	6	+	+	+
	6	Female	11	6	-	-	+
	7	Female	11	6	+	+	+
	8	Male	12	6	+	-	+
	9	Male	12	6	+	-	+
	10	Female	14	8	-	-	+
No Nodules	11	Male	10	4			
	12	Male	10	4			
	13	Male	9	4			
	14	Female	10	5			
	15	Male	11	6			
	16	Female	11	6			
	17	Female	11	6			
	18	Male	12	6			
	19	Male	12	6			
	20	Female	14	8			