Establishing and Validating

ISOCHRONAL TONE STIMULATION TECHNIQUE

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To my friend

C E R T I F I C A T E

This is to certify that the diaaertation entitled "ESTABLISHING & VALIDATING ISOCHRONAL TONE STIMULATION TECHNIQUE" is the bonafide work in part fulfilment for M.Sc (Speech and Hearing), carrying 100 marks, of the student with Register Number 19

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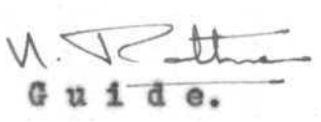
C E R T I F I C A T E

Thia is to certify that this disaertation has been prepared under my supervision and guidance.



G u i d e.

D E C L A R A T I O N

This dissertation is the result of my own study undertaken under the guidance of Dr. N. Rathna, Professor in Speech Pathology, All India Institute of Speech and Hearing, and hae not been submitted earlier at any University for any other Diploma or Degree.

Mysore,

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C O N T E N T S

L I S T O F T A B L E S

L I S T 0 F F I G U R E S

CHAPTER I

I N T R O D U C T I O N

> "The one faculty which sets man apart from all living organisms, which makes him unique ia his ability to communicate,using his vocal tones for social interaction."
>
> (Fisher, 1966, p. 3)

Fisher has listed the importance of voice in terms of its use in different situation*. According to her, voice becomes the very basic factor for speech.

> "Voice plays the musical accompaniment to apeech, rendering it tuneful, pleasing, audible or coherent, and is an essential feature of efficient communication by the spoken word." (Greene, p. 1)

Voice may be defined as a laryngeal tone which can be heard or measured.

Many people like Van Riper (1958), Greene (1964), Fisher (1966) have defined normalcy of voice which implies the same meaning as follows:

> "The normal voice should possess certain characteristics or pitch, loudness and quality, which make meaning clear, arouse the proper emotional response or ensure a pleasant tonal effect upon the hearer."
>
> (Berry & Eisenaon, 1962 p. 188)

The important parameters of voice are pitch, loudness and quality.

> "One of the most important or most conapicuous characteristics of speech is the voice quality of the speaker."
>
> (Nataraj, N.P., 1972).

When this voice becomes disordered its implication to communication is immense. A bizarre or harsh voice can be a serious handicap and embarrassment to the speaker, if he is aware of its repurcussions on hia audience. When the voice deteriorates or ia diaordered as a result of strain or pathology the whole personality suffers with it, giving rise to feelings of inadequacy and insecurity. No consideration of voice can omit the paychological and economical implications involved. Voice disorders in those who depend upon good speech for their livelihood, the teacher, salesman or singer, produce quite obvious anxieties on account of the serious professional and economic hazarda involved. Thus treatment of voice disorders become vital.

IMPORTANCE AND NEED FOR THE STUDY:

Many research Studies on voice diaorders and therapy techniques have been put forward, but none of them Seems to be satisfactory. According to Perkins (1958) many treatment techniques are the produce of arm-chair theorizing. (p. 832).

> "Most of the therapies of voice disorders are based on the belief that a person has an optimum pitch, at which the voice will be of a good quality and will have a maximum intern-sity with the least expenae of energy, and they concern themselves mainly with altering the habitual pitch level or making the case to use his optimum pitch."
>
> (Nataraj, N.P., 1972)

It ia often hypothesized that by making the case to use

his optimum pitch different types of voice disorders can be treated. Some of the studies substantiate this statement. Dorothy and Therman (1962, p. 14) in treating hypernasal cases found that when optimum pitch was below the habitual pitch and when the case was made to use his optimum pitch nasality decreased.

Wilson (1968) while discussing the treatment of hyperfunctional voice disorders says that a considerable improvement may be achieved by lowering the habitual pitch towards the optimum.

Lewis (1936), Appleman (1953) determined that a Change in the pitch towards optimum is associated with optimal adjustment in the resonator, thereby changing the quality of the voice.

Thus a review of literature en voice therapies also shows that almost in all kinds of voice therapies the therapist locates 'optimum' pitch level for the case and makes the case to use that pitch in his speech.

There sure several ways of locating optimum pitch advocated by different people and there is a lot of disagreement. Optimum pitch, some consider, is at the frequency one-fourth above the lower limit of the pitch range that a person caa produce, including falsetto. (Fairbanks (1960), Berry & Eiseneon, (1962). Some others consider thia as one-fifth from the lower of the pitch range.

Among the different procedures for finding optimum pitch, some of them have been mentioned here:

> "1. Finding the pitch at which increase in loudness occurs on the musical scale;
> 2. Finding the note one-third up from the basal tone;
> 3. Finding the tone at which the speaker experiences the greatest ease;
> 4. Considering the pitch at which the speaker coughs and laughs."
>
> (Hataraj, N.P., 1972)

It is obvious that the above methods are all subjective and have severe limitations. However, recently there has been an attempt to locate optimum pitch objectively and it was found to be successful. (Nataraj, M.P. 1972). So in this study optimum frequency found objectively is provided to different voice problems thereby correcting the voice.

There are many techniques, which facilitate in achieving the optimum pitch. For eg. sigh technique ( ), Humming ( ), Yawning ( ), Chewing method ( ), Rotating the head ( ), Changing the posture etc.

Perkins (1952) commenting on these techniques says

> "Unfortunately, such an abundance of procedure bespeaks dissatisfaction with results achieved as much as it attests to clinical ingenuity."

Correcting the voice is usually done by providing models. The model may be the therapist's voice, or voice of the case himself. The auditory model plays an important part in many of the techniques (Van Riper,

Rosenblith (1953), Fisher (1956), Hanley (1956))

Many cases fall to compare their voice with the model provided for many reasons. Clinical observation of these cases suggests that many of these cases may experience difficulty in singing a tune, matching a pitch or discriminating between pitches due to short auditory memory span. (Seashore (1938), Travis & Davis (1928), Kostern,(1958)).

In such cases it becomes necessary to provide additional clues such as tactile or visual clues. This is important especially in the hard of hearing cases. Many visible pitch devices have been constructed to correct the pitch (Loyne (1938),Dolonsky (1956) Anderaon (1960), Pickett (1963), Tjemlund (1964), Risberg (1963), Halbrook (1970)), Reports are all somewhat disappointing.

Some investigators like Leobort (1932), Leobell (1934), ZalioK (1948) provided information through the tactile modality. They have tried to correct voices problems by isochronal tones massage technique. However, no detailed data is available regarding the procedures and methodology they employed. The reason for including the term "masaege* and including the technique under the heading of physiotherapy, is not known. However, it is indicative that they were not using it as a 'model'.

The present study aims at developing and evaluating a clinical procedure for treating voice disorders based on the isochronal technique. This study is taken up to validate and to see what type of voice disorders may be benefited from this technique. This brief discussion, which is elaborated in the second Chapter, exposes the need for thie technique which helps to achieve the optimum frequency found objectively.

METHOD ANDRESULTS:

The present atudy is attempted to establish and validate the isochronal tone stimulation technique. A vibrator of the artificial larynx was modified to give tones of different frequencies. This was placed in the neck region of the case, the exact placement being adjusted to as to give the maximum loudness minimizing the direct auditory feedback. For every case, his or her optimum frequency was determined using an objective method of locating optimum pitch (Nataraj N.P. 1972). This optimum frequency waa given through the vibrator and the case was asked to match hie voioe to the tone. First, the vibrator was tuned to the case's habitual frequency. Then this was gradually lowered or increased depending upon the optimum frequency, at each stage the patient waa matching hia voice. The essential point was to achieve a synchrony between the laryageal tone to be produced and the tone through the vibrator. When the tones differ slightly (within 10 cps)

they result in beats. The case was instructed first to match for the appearance of the beats and then for the disappearance of beats, thus achieving the desired frequency at each stage till the optimum frequency of the case was achieved.

1. The human vocal tract follows physical laws.

2. In all voice disorders there will be significant difference (at least 40 Hz) between the habitual and optimum frequency.

3. In speakers with good voice habitual and optimum frequency will be same.

LIMITATIONS

1. Types of cases seen at the institute clinic during the time of this study were limted to voice problems such as puberphonia, nasality, hoarseness and aphonia. The validity of the procedure could not be established with other type of voice disorders.

2. Some cases could not be followed after treatment as they did not respond to repeated follow-up. Reliability and validity could not be established in these cases.

. HYPOTHESIS:

1. An improvement will be seen in different types of voice problems by changing the pitch thereby giving the optimum frequency.

2. This change can be brought out by the isochronal tone stimulation technique.

DEFINTIONS:

In the present study the following definitions have been used:

'OPTIMUM FREQUENCY' is that fundamental frequency of the vocal cords which gives maximum response of the vocal tract

$$OF = \frac{NF \times FFg}{NFg}$$

OF = Optimum Frequency;
NF = Natural Frequency;
FFg= Fundamental Frequency of the good voice
NFg= Natural Frequency of the good voice.

'HABITUAL FREQUENCY': This is the fundamental frequency measured with the help of a stroboscope when subject waa asked to phonate /a/, /i/ and /u/.

'ISOCHRONAL': Taking place (vibrating) in the same time, or at the same interval of time, with equal amplitude, as something else. (According to Oxford English Dictionary).

'ISOCHRONAL TONE STIMULATION TECHNIQUE': It is a technique for correcting voice by eliciting isochronal matching of the laryngeal tone to a selected tone produced by a vibrator.

CHAPTER II

REVIEW 0F LITERATURE

The act of speaking is a very specialized way of using the vocal mechaniam. This demands an interaction of the mechanics of respiration, phonation and resonance. According to Fischer, speakers with good voice are often those, who are using these vocal mechanisms optimally. The patient with a voice disorder uses his vocal mechanism in a faulty manner. It is this faulty use of vocal mechaisms which become the focus of all clinical attempts to correct his voice.

Perkins (1971, p. 280) while evaluating optimal phonation aays that the dominant criterion for the Speech Pathologiat ia vocal hygiene. An efficient voice achieves maximum acoustical output, flexibility and esthetic gratification with minimal effort. This is achieved when voice is produced effortlessly, therefore hyglenically. Perkins has given criteria for optimal voice but not for normal voice.

Our difficulties in understanding the human voice and its diaorders are complicated by our lack of common definition of what is normal voice and what ia a voice problem. There are thousands of different voices in the world about ua and there are many potential voices within

each of us. There is a wide range of voices accepted by the general public as normal. The Research Needs Sub Committee on problems of voice, ASHA - Johnaon(1959) indicated that the primary research need ia the field of voice is to attempt to answer the questions

What are the characteristics of normal voice? What are the acoustical and physiological determinants of good and poor speaking voices? Although many studies have been done to answer these questions, so far we have not been able to arrive at a satisfactory, commonly agreed answer.

According to Vinchara (1948) Mevosky (1952) any attempt to define voice normalcy represents clinical opinion store than objectively derived statements having professional agreement. Recently research studies are being done to correlate subjective attributes of ab-normality to objective measurements in terms of natural frequency, optimum frequency and pitch range.

Although a wide range of variations in voice can be considered normal, varying both with the preference of the listner and the speaker certain general criteria can be stated.

Van Wye (1936) proposed that

> "An ideal speaking voice should do the work allotted to it, as does any other efficient mechanism within a minimum expenditure of energy for a maximum of effect and esthetic gratification", (p.)

According to Eisenson (1953)

> "when the voice, through its significant deviation in pitch, loudness or quality or other basic attributes, consistently interferes with communication, draws unfavourable attention to itself, adversely affects the listner or the speaker or is inappropriate to the age, sex and perhaps the culture or class of the individual, or when faulty voice production creates physical or fanctional impairment of the vocal organ or system, then a voice disorder exists."

This is a definition which incorporates aspects of many other definitions.

Perkins (1957) — Normality of voice is based on three criteria -- Host important of these is Vocal hygiene. Others are: Pleasing pitch, Adequate loudness and sympathetic quality.

All these three definitions differ only in time, and in the wordings, but the content remains the came.

Many aathors who have defined normaley and abnormalcy of voice seem to be satisfied by implying that voice ia so variable that it cannot be measured (Van wye, Drecherg & Bragg)

> "Voice is a highly peraonal attribute. The characterlstics of the tone which make up the normal voice are not readily measurable. We cannot put into the scientific hopper so much of pitch or quality or loudness aad come out with the normal voice."
>
> (Berry & Eisenson)

This statement implies the voice field is not accessible to scientific investigation. This is dangerous because it may hamper the growth of

scientific knowledge regarding voice.

Voice may be defined as the laryngeal tone which can be heard or measured. The three basic parameters of a laryageal tone are: (1) Pitch; (2) Loudness (3) quality.

Pitch - is a psychological attribute of sound which referg to a place in the musical. It is basically related to frequency and partly to loudness. Perkins (1957) defines pitch purely physically as a measure of how rapidly the laryageal valve releasee bursts of subglottic pressure (p. 845).

Accoridng to these two definitions pitch becomes on one hand physical and on the other hand psychological.

In usual clinical practice terms such as habitual pitch, Model pitch, Optimum pitch are employed during voice evaluation. However in thie study the term 'Habitual frequency' and Optimum frequency' have been used. The reaaon for this is that we art dealing with the frequency aspect of the voice as mesured by the istruments, thereby avoiding the psychophysical notation.

Habitual Fitch: It is usually defined as the fundamental frequency used most often in everyday voice or as Fairbanks has described it,

"the central tendency of the pitches used".

Proceduresof finding out this frequency differs accord-ing to different people. In one method the patient is

asked to sing at various pitch levels and this is matched with Pitch Pipes. The pitch from which he starts and to which he returns is taken as the habitual pitch (Boone, 1971 p.90). In another method a speech stmple is recorded and ls fed to a speetrograph. The frequency which is lowest is taken as habitual pitch. (Boone 1971, p. 90).

Still some others have employed the stroboscope PAD Pitch Meter and FFI.

Optimum Pitch: — Fisher (1966) has given certain characteristics of optimum pitch which are still to be investigated scientifically.

1) It is the beat or moat favourable pitch far speaking, easiest to phonate and meet free of strain;

2) Optimum pitch has greater intensity.

3) Vocal folds being in a more elastic, more 'normal' state, is more responsive to the force of subglottic breath pressure. They can swing more widely apart and pull back together more quickly.

4) This provides effective variations in pitch for intonation.

Pitch range:- This extends from the lowest frequency a person can phonate to the highest frequency including falsetto. In this study when pitch range was investigated it was ta&en as the difference between the lowest and the highest frequency, the individual eam phonate.

Quality:- "This can he thought of as the psychological correlate of reasonance and timbre patterns. It is the subjective impression of the pattern of frequencies and relative intensities of complex vocal tone." (Hurphy, 1964, P. 23). This definition seems to be very ambiguous. The meaning of terms each as timbre patterns, vocal tone are aot explicit.

Many investigators, Hokyma (1967), Anthony (1967), Brookyl (1963) have consistently referred to the resonators as the chief, if not the sole determinant of voice quality.

Recent investigators however; suggest that quality may be determined by and in the larynx, not by the articulater - resonator adjustment. The articalatory movements not only as accessories to the laryngeal action.

The belief that personality characteristics, both normal and psychophysiological, are correlated with voice quality, has been tested experimentally by many Writers (Allport & Cantril (1934), Middleton (1939-40), Large (1956), Froeaohles (1960), starkweather (1964)). Some controversy remains, but in general Writers seen to agree that some such broad correlations do exist. Intuitively, one would agree with them, but the major obstacle in the way of reliable scientific statement has been the lack of any standard system of labelling the voice qualities concerned, and a related inability to attain more than a fairly crude quantification of

the voice quality variables which act as the experimental stimuli.

D.M. laver (1967) has tried to convey a general phonetic approach to the description of voice quality in the hope of facilitating interdisciplinary discussion.

Loudness:- "This is a psychological term discribe-ing the Magnitude of the effect of the sound upon the ear, both peripheral aad central" (Berry & Eisenason, 1959 p 193.) Variations in loudness is successive spoken syllables contribute to the emphasis in speech.

Mechanism of Voice production:

In order to explain voice production mainly two theories have been proposed:

Neurochronaxic theory: (Hygason ($950)

> "This theory has raised considerable controversy . . . But numerous researchers investigating the mechanism of voice produc-tion have shown that the claasic syoclastic or aerodynamic theory remains valid."
>
> (Nadoki Ve da et al p.47 1962)

The above statement seems to be true when we inspect the experiments by Koymox et-al (1971). The results of these experiments have contributed much to our understanding regarding the regulation of pitch and intensity. In their experiments a method for inducing live voices from adult doge under shallow anaathesia by uee of isoproterenos hydroehleride is reported. This method is useful for investigations of effect of a single variable, for example ^uat neural stimulation

Keeping constant snhglottic air pressure or vice versa. Vocal intensity in terms of Spl reading, pitch, airflow rate in reference to subglottic air pressure during phonation were investigated. Neural stimulation was measured and recorded simultaneously. Their conclusions support the aerodynamic theory of voice production.

We can conclude with considerable certainty from the results of the above experiments that mechanisms that control all the aapects of voice are bound tightly one within the other.

> "A change in pressure, must be countered by a change in thickness, affecting loudness and quality, or a change in both, affecting the entire vocal produce."
>
> (Perkins, 1957, p. 847).

According to pezrkins (1957, p. 847)

> "The dynamic balance once upset in this triad of laryngeal forces can only be restored by re-ordering all three factors in relation to each other'

Frastically this means that pitch, quality and loudness are interdedent; one cannot be altered without affecting the machanisms controlling others.

However, the variables should be considered separtately for purposes of research. From such experimentation May result information of great clinical significance.

Voice disorders as such pose many-sided problems. In stressing the implication of voice disordes Green says

> "Voice delineates the personality of the speaker as or more than the word he speaks ... when the voice deteriorates aa a result of strain or actual pathology the whole personality

> suffers with it, giving rise to feelings of inadequacy and insecurity. It may at least make him ill at ease in company and almost induce him to shun social contacts and to iaolate himself.'
>
> (Green, 1964 p.3)

This point seems to be exaggerated because there are some patients with voice problems who are well adjusted to themselves and to the environment.

Parcelo (1954 ' P.48) indicates that weakness of the voice as a consequence of excensive use can have psychological repercussions, which in turn lead to organic pathological changes.

The patient with a presenting vocal complaint usually shows syptoms related to the improper fuctioning of phonatory or resonance mechanisms.

> "These voice symptoms often appear to be related to specific abuse and for misuse of the vocal mechanisam, with or without development of laryngeal pathologies. Once the possible abuses and misuses of the vocal mechanisms are identified these symptoms can be eliminated or minimised by voice therapy thereby preventing further pathology to the vocal organs*.
>
> (Boone, 1971, p. 9)

Thus voice therapy given earlier may prevent further pathological changes: in the vocal mechanics:.

According to Eisner (1959) voice therapy to patients who exhibit strong emotional problems, will be accompanied by a reduction of symptoms.

Thus voice therapy becomes important.

TABLE I

Classification of Voice Disorders

M. Sokoloff I

Phonatory Problems due to hyperfunction	Phonatory Problems due to hypo function	Phonetary problems due to abnormal resonance
1	2	3
(a) Harsh voice	(a) Breathiness	(a) Hyperrhinolalia aperta
(b) Spastic dis-phonia	(b) Phonasthenia	(b) Hyperrhinolalia Clausa
(c) Hoarseness	(c) Hysterical aphobia	(c) Hyperrhinolalia
(d) Pubertal dysfunction of voice.		(d) Assimilation Nasality

Berry & Fisenaon, Paul Moore, Van Riper

Pitch	Loudness	Quality	
		Phonatory	Resonatory
(a) High	(a) too loud	(a) Aphonia	(a)Nasality
(b) Low	(b) too soft	(b) Breathiness	(b)Denasality
(c) Monotone	(c) No variations	(c) Dry hoarse-ness	
		(d) Wet hoarse-ness	
		(e) Rough voice	

III

John D.M. Laver

(a) Settings of the Larynx

Phonation types		
Phonation types	Pitch Ranges	Loudness Ranges
(a) Breathy	a! Very deep	a) Very soft
(b) Whispery	b) Deep	b) Soft
(c) Hoarse	e) Medium	e) Medium
(d)	(d) High	

TABLE I (eontd.)

(b) Settings of the supra laryngeal vocal tract

Longitudinal Modifications	Latitudinal Modification	Tension Nasalisation Modification	
a) Raised larynx voice:	(a) Tongue-raised and backed voice	(a) Metalic (b) Muffled voice	(a) Slightly pharynge-voice;
b) Lowered larynx voice			(b) Severely nasalised voice:
			(c) Moderately raised larynx voice

voice diaordeys have been classified in different manners by different authors as seen in Table I. (Paul Moore, p. 655, 1959; Berry & Eisenson; p.213, 1962: Marphy, p. 42, 1962; Greene 1964, p. 85. John B.H. Haver, p+ 43, 1969)

According to Albert (1962), this type of claasification system seems to be vague and unnecessary as it does net serve any purpose. Taking into consideration the therapeutic uses of this type of classification system he ia of the opinion that even though there are many vocal problems there does not seem to be a differential therapy for each problem.

Perkins (p. 837, 1957) says that

> "No isolated aspect of voice will be affected such as pitch or intensity alone. They are interrelated. A change in one implies a readjustment of the dynamics of the other two. Hence the primary concern of the speech therapist should not be with isolated disorder of pitch, or loudnees or anyone of the myriad deviations of quality, but rather should be with the whole voice in all of its aspects. Either it is produced correctly in each respect or the total production is faulty."

Classification of quality disorder such as breathiness, harshness, metallic, gluttaral etc. are somewhat difficult to clarify through written description.

Murphy (1964) states in reference to voice quality description

> * . . . all of these terms are commonly used in referring to vocal characteristics.

> Not the least of our problems is that of attempting to describe in writing . . . individual terms. The terminology used in the classification is largely a language of metaphor."

According to these views voice disorders classified under the heading of pitch, londness and quality loose its meaning. A lowpitched voice may be soft in loudness and hoarse or breathy in quality.

Attempts have been made to treat different voice disorders such as hoarseness, nasality and pitch problems solely by changing the pitch. Williamson (1944) Masnemar (1952)

Based an these and on the statements that the three parameters (pitch leadness, quality) are interdependent, and on the results of therapy implying the rationale that all voice disorders can be corrected by modifying the pitch, it may be possible to look at all voice problems as factors of pitch disorders.

The practice of voice therapy may be described briefly la the following fashion. Until about 1930, indvididuals with vocal defects were helped primarily by three groups of specialists. Among these were a few laryngologists who became interested in voice training in addition to the medical treatment of their patients. Singing teachers and teachers who had a background in dramatics and elocution were the other group who treated and trained th* vocally handicapped.

The majority of these workers, especially the

teachers and the singing experts had little or no training in scientific methods or is research methodology or in experimental work. In their approach they attempted to create a close personal relationship between "Pupil and teacher" in which the teacher served as the voice model and emphasised vocal techniques consisting predominantly of many drills and exercises. These drills were focussed upon the specific parts of the speaking system, each aa the diaphragm, jaw, throat or upon specific fuctional such as controlled breathing, pushing etc (Smith, Raublcheck, Barrows).

In recent decades voice and speech behaviours have become increasingly desirable subjects for scientific experimentation and analysis. We discern an increasing concern with instrumentation, strict methodology and statistical analysis (Murphy).

Among the principles of voice therapy techniques, a great variety of approaches are to be found. Perusal of the older literature, such aa the studies by Flatan (1932), Cutamann (1924), stern (1929), Froeschela(1952), to mention but a few, reveals a great wealth of information regarding the older techniques of vocal rehabilitation.

In a majority of those voice techniques emphasis was em giving the patient a good idea of what was wanted.

"Therapies of vocal disorders have plagued speech pathologists more because we have known

> better what is wrong with a voice thab how to make it right. Two approaches have prevailed. On one side, clinicians have worked with segmental elements that they could identify, mainly pitch and loudness. This approach hae the merit of specificity. ... On the other side has been a holistic approach to treatment. Brodnitz (1965), Murphy (1964), for example stress that voice must be rehabilitated in relation to the needs of the whole person. These approaches differ in emphasis. They are not Mutually exclusive, clinicians working either holistically or sequentially manipulate whatever vocal behaviour they can control (usually pitch) and observe changes in other aspects of voice (loudness and quality'. To this and Van Riper and Irwin's (1958) feed back theory of therapy applies." (Perkins 1971, p.394)

Perkins (1937) 'p.871) objecting to the mechanical approach says:

> "A clinician can so easily utilize a parely mechanical approach and think that he is staking rapid progress. That is, he can analyse the voice for the habitual and optimum frequency levels, compare the two, and then use objective techniques to increase or decrease the frequency. We object to this approach, not because it is too easy, but because it diverts the therapist from his proper goal, the achievement of vocal efficiency. Generally it ia more rewarding for theraputic purposes to view a devient pitch as a concommitant rather than causal factor. Hence we are inclined to favour a subjective approach."

This statement is in contradiction with the statement made by Perkins earlier.

> "Dimensions of the oral and pharyngeal cavities are probably altered when a modification is effected in quality, pitch, or in loudness. May we aot conclude, then, that a resonator adjustment intended to accommodate pitch, for instance, would also have a significant effect both on the quality and loudness; or similarly, that an adjustment for quality would influence loudness and pitch just as one

for loudness would modity pitch and quality? Thus in so far resonance is concerned, the treatment of one aspect of the voice is tantamount to the treatment of them all."

The contradiction becomes all the more evident when we take into account his frequent assertion that all the three parameters are inter-related.

Luchsinger classifies voice therapies under three groups:

I --- Physical therapy;

II --- Treatment of disorders of phonic respiration;

III — Medicinal,

Physical Therapy: - Various forms of physiotherapy in the form ef heat, infra red light, dia-thermy, electrical stimulation with several types of currents, vibration messgae and so forth were claimed to be as effective in paralytic conditions of the larynx as they are elsewhere Ln the body.

(a) Laryngeal Manipulations — Two types of compression are employed. Forntal and Lateral.

Frontal pressure exerted on the thyroid cartilage during phonation approximates the two cords, decreases meal cord tension, counteracts the tension of the cricothyroid muscles and thus lowers the pitch. This is known as Gutzaann's pressure test, and is claimed ta be highly successful in the treatment of the developmental falsette voice.

Lateral compression of the thyroid wings approximates the vocal cords, narrow the width of the glottis, contributes to vocal cord tension, aad thus raises the pitch and

clarity of the phonated tone. Various compression neckbands have been reported to be devised combine pressure with electrical stimulation.

(b) Electrical stimulation: When a mild electric current, applied across the larynx, is turned on, vocal pitch suddenly jumps higher. This is called on effect. When the current ia interrupted, pitch jumps a few tones lover – off effect. The normal teat results are altered by laryngeal myopathy in that the pitch raise of the on effect, and the pitch descent of the off effect,May be exaggerated or inverted. Properly selected electrical stimulation promotes nervous recovery whenever possible, counteract Maacular atrophy, noat important it stimulates adjacent healthy muscles to increased compensatory activity. Bat so far research in the field of physic therapy have failed to show why many patients with laryageal pathology have not shown any appreciable improvement on the application of these techaiques:

(c) Activation of elementary laryngeal functions: Another approach has been proposed by Jroeeehels (1935) and accepted by his collaborators, notably, Brodnitz (1961) and Weiss (1932). This is tha method known as "pushing exercises". The flexed arms are elevated to the chest and vigorously pushed down. At the same time, the patient phonates single syllables.

This method aims at activation of the primitive, protective sphincter action of laryngeal closure.

Physical effort such as pushing leads to narrowing of the laryngeal vestibule. The purpose of the pushing exercises is regression to the more primitive level of laryngeal function.

From the view point of vocal physiology, the establishment of a vicarious regression to a lower functional level of phonation is not a goal of vocal rehabilitation.

(d) Auditory training;

(e) Psychotherapy.

II - Treatment of disorders of Phonic respiration.

(a) Breathing therapy:- One of the advocates of breathing therapy ia Hosbauer (1921, 1948). This exercise aims at the systematic prolongation of phonatlon time. The ratio between inspiration and expiration was regulated by a timing device. Another method used was walking while humming. Two steps indicate the time of inspiration, while the following 10 or 12 steps time the humming expiration.

(b) Active relaxation therapy:- This was deveLeped by Pause (1954). This method is based on the principle that under normal conditions any type of tension is followed by release. But tensions, stresses may amount without subsequent intervening releases. The respiratory and laryngeal musculature react with a

forced manner of breathing and a squeezed type of phonation. Relaxation therapy aims at the correction of ex* cessive paychic and neuromuacular tension.

(c) The Chewing method: - Originated by Froeschles (1952) - advocated as a non-specific relaxation method in the treatment of all those voice disorders in which the functional disturbance predominates, It is based on the fact that the organs uaed for speech were originally developed for the primary purposes of breathing and eating and are much more resistant to disease. Patient is instructed to make loud chewing movements while he mumbles certain words. Subsequently, the amount of chewing movement is reduced until the patient merely imagines that he is chewing while talking.

(d) The Yawning method:- Proposed by Lancau in 1952. Yawning represents a prolonged and deepened inspiration with maximal widening of the upper airways.

(e) Autogenous training:- (Sehultz, (1953)), has developed a payohotheraputic method hawed on the paychological and physiological phenomena aaaociated with hypnosis, which he calls autogenous training.

A majority of the expertment a n d upsaying recovery depends upon the severity of the problem. Another factor concerning laryngeal manipulations ia that we do not yet have a definite idea about the type of cases which would benefit by thia techniques.

III - Medicinal treatment

A general outline of medicinal treatments of voice and speech disorders may be summarized ae follows: Antibiotics are uaed whenever it is a matter of eradicating Infection, Antihlataainies to reduce allergic edema. In paralytic conditions certain components of the Vitamin B group promote nervous recovery. Hemopoietic minerals and vitamin supplements stimulate restitution from the stress: Psychoenergizers to ameliorate the depressive reaction, tranquilizers help the patient to regain his balance and reduce tension. It is helpful to supplement vocal rehabilitation by means of vegetotyopic drugs. They either depress the overatimulated portion of the autonomous nervous system or stimulate the other portion, which appears to be in a state of exhaustion.

Much of the voice therapy cited above is a process of experimentation with the individual's voice. Ascertaining the habitual pitch level, altering it toward an arbitrary level and checking the effects on overall voice usage ae a function of changes in intensity, and pitch consume most of the early phases of voice therapy. A major focus is centered on the discovery of the new voice.

There are many facilitating techniques. The most frequently uaed vocal techniques in voice disorders are tabulated by Murphy. (Table II)

TABLE II

MOST FREQUENTLY USED VOCAL TECHNIQUES
in
FUNCTIONAL VOICE DISORDERS

Determine and establish optimal Pitch range

Alter loudness level

Alter loud staccato tones

Relax musculature or reduce tension

Increase muscle tenaioa

Develop soft, clear vocal attack

Increase balanced resonance

Inereaee size of mouth opening

Lower the tongue

Move the tongue forward

Increase Pitch range

Increase vocal variety ia Pitch

Increase vocal variety in loudness

Improve articulation ability

loud-sign technique

Singing

Humming

Yawning

locating "best" vowel and fanning out

Eliminate vocal abuse

Vocal reat

Increase kinesthetic awareness

Alter rate of speech

pushing exercise

contd.

TABLE II (Contd.)

Chewing method	Brodwltz & Proeschels , Archieves of Otolaryngology Chicago, M (1954)560-564
Muscle training;	
External Manipulation of vocal mechanism	
Velopharyngeal control	
Blowing exercises	
Oral pressure build up and release	
Correct abnormal poaturea	
Imitating voices of others	
Coughing, throat clearing, grunting	
Negative practice	
speaking against background noise	
Alter respiratory patterns	
Carry over new voice to life situations	
Psychotherapy	
Auditory techniques: self listening; sound discrimination; matching and comparing voices in quality, loudness and pitch; imitating	

Perkins (1972) commenting on these vocal techniques says that

> "Unfortunately, such an abudance of procedures be speaks dissatisfaction with results achieved aa much as it attests to clinical ingenuity. There is no common criteria for selecting a technique from this plethora of tactics which are claimed to be most effective. Chances are that all have worked well with some clinician for some time for some patient. What few reports of clinical results are available offer limited help; they are based on small samples of patients with widely varied problems, treated with diverse combination of techniques under uncontrolled conditions and evaluated by much disparate criteria as improvement in laryngeal pathology to improvement in vocal tone. tacking firm evidence, up to this time we had no alternative but to rely on clinical judgment without a clear rationale for achieving an ambiguously defined goal".

Some of the therapy techniques listed are found to be inadequate on the following grounds. For example, the chewing method originated by Froeschlea (1952) has been advocated as a mere specific relaxation method. It la baaed oa the assumption that the organs used for speech were originally developed for the primary purposes of breathing and eating.

Luchsinger commenting on this says

> "This theory cannot bridge the anatomic facts of otor brain organisation. Masticatory movements are localized at the base of the pre-central convolution. This center alone is not adequate for either the learning or retention of speech and language. It is known from aphasiologic research that the centers of expressive and receptive language are suffi-ciently remote from the masticatory center. Aphasia does not interfere with chewing and eating."

Thus even the physiologic basic for the chewing method ia questionable.

Concerning breathing exerciees as a form of vocal therapy Mary (1969) says that (i) very rarely breathing problems are seen and (11) norms for normal breathing patterns for speech purposes have not been established.

Coaaenting on the technique of relaxation Brodnitz (1967, p. 325) says

> "It would be desirable to avoid the term "relaxation" altogether. This term creates an image of passive inaction, of slackness of muscles. No one can establish carry-over from a passive inactivity promoted in the name of relaxation to the competitive pursuits of daily life.No one can build a therapeutic bridge over the deep gap that separates relaxed passivity from the high-gear action of the use of voice in speaking.*

The same comment holds good for the "Chewing approach" to the treatment of hyperfunctional voice disorders.

> "Fundamental to many procedures employed in vocal training is the belief that for each person there is an optimum or natural pitch level at which the human vocal apparatus operates with the greatest efficiency."
>
> (Thurman, 1958)

Van Riper and Irwin (1968) in explaining MIDVAS (the principles of voice therapy) say that after making variation, the case should be asked to produce the 'Optimum pitch' level and suggest

> "Find your optimum pitch by counting up from the lowest possible note to one-third of total range." (p-13).

Wilson (1968) in treating hyper functional voice problems has written that considerable improvement may be achieved by lowering the habitual pitch toward optimum.

Lewis (1936) and Appelman (1953) found that a change in the pitch toward optimum is associated with optimal adjustment in the resonator thereby changing the quality.

Fisher (1966) while treating Pitch problems says that optimum pitch is the best pitch for speaking. She gave the following instructions before therapy

1. "If your modal pitch is less than optimum pitch, learn to use optimum as your modal pitch, Otherise, you will have glottal fry or strain when you try to force the pitch below the lower limit of your range".
2. "If modal pitch is two notes above optimum you might have difficulty reaching a note an octave higher for strong emphasis. Also, you will not use resonance effectively for quality and strength of tone if your modal pitch is several notes away from optimum." (p. 173)

Williamson (1944), in his study of cases of hoarse voice, concluded that the principal cause of the trouble was tension resulting from speaking at a level far below optimum pitch.

Sawyer (1955), in his research on efficient and inefficient voice production in male subjects with low pitched voices found that inefficiency was invariably associated with an increased frequency.

(Functional voice disorders - p.870)

Tissue & Steer (1937), Talley (1931) Lanse (1938) observed that when pitch was changed quality as well as intensity readjustments occurred.

Thus the review of literature on voice therapy shows that there is a great need for finding optimum frequency as it is so frequently used in treating voice problems.

Many investigators each as Vaa Riper (1954), Anderson (194%), West et al (1947) Pairbaake (1940) have given techniques for finding out the optimum pitch. It ia obvious that these methods of locating the optimum pitch are all subjective and have severe limitations.

Recently there has been an attempt to locate the optimum pitch objectively and it waa found to be successful (Nataraj 1972).

In apite of many techniques available to elicit optimum pitch or deaired pitch some times some cases fail to achieve the target for many reaaons. Clinical observations of patients with hyperfnnctional voice problems suggest that many of these patients may experience difficulty in singing a tune, matching a pitch or discriminating between pitehea (Seashore, l938; Travis and Davis 1928; Hanley, 1956, Eiaeneon Keapein 1953). Studies suggest clinical groups to be significantly poorer in pitch discrimination than the control groups. But experiments by Demaris S. Davis (1967) do not support this.

In much cases it becoms neccessary to provide additional clues such as tactile than mere auditory information. This is important especially ia the hard of hearing cases with high pitched voice. A review of

literature in this area shows that many studies have been done in changing the pitch in the hard of hearing by giving clues such as visual as in FLORIDA (Halbrok.A 1970) or tactual as in VOCODER (T.M. Pickett 1963). Many visible pitch displays (Kyne 1938 Plant 1960)have been constructed which display time and pitch in two dismen-tions, thus converting time sequences of pitch into spatial distributions of visible patterns (Rolansky, 1955; Anderson 1960; Tseinlund, 1964, Riaberg 1968).

Boothyard and Mary DeeRer constructed a visible pitch device around certain components of Grason-Stadler series modulas programing equiment. Using this device, 60 profoundly deaf childern and some children with voice disorders were given a pitch matching task involving the generation of fundmental frequency at three different levels. The performance of the children were generally poor, very few of them having the necessary voluntary control of pitch.

Jemen C. Moore and Anthony Herbrook (1971) Cross and Lane (1962), Roll (1968) Crawford (1970) conditoned pitch utterances using differential reinforcement ae tbe subjects matched and hummed with a series of lights. They called this operant manipulation of vocal pitch.

Reports of the application of visible pitch devices are somewhat disappointing. While it has been shown that deaf children and patients with voice disorders can learn pitch control using visible feed back, it has not been

demonstrated that this is the best modality for pitch control or for the acquisition of correct pitch. Also it has not been shown that the visible pitch device can achieve results in pitch control more rapidly than alternative methods.

The present study is an attempt to provide Optimum frequency by the isochronal tone stimulation method. A Russian Voice Physician Malutin (1897, 1924) was the first to state the principle of improving phonation through application to the larynx of a mechanical vibration of the same frequency as that af the vocal tone. This has been exclusively studies by H. Gutzmann (1911-1924). Numerous instruments have been devised for this purpose. In America (Briput 1932-1933) constructed a simple model for the application of the isochronal massage technique, which seems to have been widely used a few decades ago.

Loebell's (1931) suggested the use of ordinary audiometric bone conduction vibrator for this purpose. For many reasons this was not used. One of the reasons was that audiometers are restricted to the octave or semioctave bat not continued frequency. Others who used this technique were Platau (1929), Tuchalnger (1944), Schilling (1932), Stern (1929), aad Tarneeud (1941).

However the name tone masaage is not suggestive of physiotherapy and the procedure they have given just

suggests the application of different tones to the larynx though a suitable vibrator. So, the name isochronal stiamlation is used here.

Principle and physiological bases for the study

The Volnntary production of voids is dependent upon precise integration of many involuntary phonatory reflex systems. Amongst these phonatory reflexes, those driven from laryngeal mechano receptors are of major importance. Theae receptors are capable of responding to mechanical stimuli. Laryageal Phonatory reflexes are of three varieties:

(a) Laryngeal mucosal mechanoreceptors producing occlusive reflexes.

(b) Articular mechanoreceptors, producing phasic tuning reflexes;

(c) Myotatic mechanoreceptors producing tonic tuning reflexes.

Kirchner & wyke (1965)

Studies elsewhere on human subjects (Buchtal, 1959; Jaraborg -Anderson 1964) have shown pre-phonatory tuning of the laryngeal musculature, and it is the principal contribution to speech made by the neuro-logical mechanisms involved in the voluntary control of pitch, through the cerebro laryngeal system. Finally, once the tone is felt, further adjustments are made (both voluntarily and reflexively) in response to acoustic monitoring of the subject's own vocal performance.

(Barry WyRe p. 3. 1967)

Isochronal stimulation is based on the princile of applying a mechanical stiumli thorugh tactitle channel to the larynx in order to correct the pitch. The essential point is to achieve a harmonic relationship between these impluses the lazyngeal tone to be produced. When the two vibrations differ slightly (10 cycles) in phase and frequency they result in beats. Apart from being audible these beats can be felt as a peculiarly unpleasant sensation as reported by cases or they can be seen on an oscilloscope.

> "As soon as the beats appear the cerebro laxyngeal mechanism begins to adjust the vocal card vibrations until union is achieved."
>
> (Luchsinger, p.143 1965).

CHAPTER III

Test room: One of the rooms in the electronics laboratory of the Institute was seed. The noise analysis of the room was as follows:
(The reading were taken on different days using a SPL meter

Table III

Noise analysis of the test room

No. of readings	1	2	3	4	5
A	35	33	28	35	35
B	40	38	25	35	30
C	40	42	35	40	42

Part A - finding out the optimum frequency for females between the age range 20-25 years.

This experiment was done to find out the optimum frequency range of the vocal tract ia females with good voice, age range between 20 to 25 years. It was expected that there would be a relationship between the natural frequency of the vocal tract and the fundamental frequency of the voice. It was presumed that the voices judged as good have a fundamental frequency which is optimum. It was also preresumed that the voices judged

as good have a fundamental frequency which is optimum. It was also presumed that the relationship between the fundamental frequency of the vocal tract is consistent among speakers with good voice and when the fundamental frequency is so sleected for any individual that the relationship between it and the natural frequency of the vocal tract is the same as that in the "good" voices. We would have selected the optimum frequency far that Individual. These presumptions have already been tested on males between the age range 20 to 25 years by Nataraj (1972). The present study was necessary to find the relationship in females between the age range 20 - 25 years.

Subjects: - Three senior speech pathologists rated 10 females students of the Institute between the age range 20 - 25 years as having good voices. These students were taken as subjects for the experiment.

1) B.F.O (B & K No. Type 1022)
2) level recorder (B & K No. 2305)
3) A.F.A. - (B & K No. 2107)
4) Probe speaker (Ear Phone Dan Aid N 58/21)
5) Condenser microphone
6) Hearing aid test box (Type 4217)
7) Measuring amplifier (B & K Type 4207)

- B -

1) Stroboacope unit (B & K 3o. 5066)
2) Tachometer (B & K No.5527)
3) SPL Meter with octave filter set (B & K No. 1203 & 1613)

These instruments were arranged as shown in Block diagrams one and two.

The BFO was mechanically coupled to the level rocordor using a shaft. This made it possible to scan the frequency range 100 H_2 to 5KH_2 To obtain a constant acoustic output a compressor voltage was provided to the BFO by using a measuring amplifier and a condensor microphone coupled with a speaker(similar to the probe speaker fixed to the stand) kept in the anechoic chamber of the hearing aid text box. The probe speaker and the condensor microphone which were connected to A.F.A., were fixed on a plastic board, which was in turn fixed on a transverse microphone stand. The probe speaker was fitted along aide of the condenaor microphone such that when it was introduced into the oral cavity the condenser microphone was exactly at the opening of the mouth.

Calibaration of the instruments:

1. The A.F.A. and Spl meter were calibrated using a a piatonphone (According to the procedure given in the B & K Manual 2203,1613)
2. B.F.O. was calibrated using the A.F.A. (B & K manual 1022)
3. Tachometer of the atroboscope was calibrated using B.F.O.
4. Frequency response of the condenser microphone was flat.

Procedure:

Step 1 - Instrctions to the subjects:

"We are trying to find out the resonance characteristics of your vocal tract. You are required to open your mouth

and keep it in /a/ position. Please sit so that the probe speaker is inside your mouth without touching any part of your mouth. The tip of your nose should touch the board(the position was demonstrated for some subjects). Be relaxed. Maintain this position while the tone is on."

Step - 2:-

The base line of the speaker was determined by coupling the probe speaker to the condenser microphone (connected to the A.F.A). frequencies ranging from 100 Hz to 5KHz were scanned on the B.F.O and the response of the speaker was recorded on the level recorder This gave the intensity level at different frequencies without any resonator. This was taken as the base line.

Step-3:-

The subject was asked to sit on a chair comfortably and her mouth position was adjusted around the probe speaker in the central vowel /a/ position.

Step - 4:-

The sweeping frequencies 100 Hz to 5 KHz were introduced and the response of the vocal tract in terms of increases in intensity was recorded on the calibrated

paper of the level recorder automatically.

Part B – Finding the fundamental frequency:

Subjects: - Same as in Part 'A'

Equipement: - Listed as in part 'B'

Procedure:

Step 1 - Instructions:

"In this experiment we are trying to find out the pitch you normally use, while talking. Sit comfortably and phonate /a/ as susal until I ask you to stop. Do not try to change the pitch from your ususal one."

Step 2:

The subjects were asked to phonate the vowel /a/ until the needle in the technometer showed a steady value. Thia value was taken as the fundamental frequency of the subject's voice.

A significant increment in intensity at a particular frequency for each good voice was observed under experiment 1, Part A. This was taken as the natural frequency of the vocal tract. There was a constant relationship between the fundamental fraquency of the vocal tract, where the peak was observed. The relationship observed was 1 : 5. In other words, the fifth harmonic of the fundamental frequency coincided with the natural frequency of the vocal tract.

Experiment - 2

Part A - Pinding out the habitual frequency:

Subjects:- Thrityfive cases with different voice problems as judged by trained speech pathologists were taken for this experiment. Subjects were examined by Otolaryngologists, Paychologists, Speech pathologists and if it were necessary by physicians for any organic probems apart from the voice problem (Cleft palate Paralysis of the vocal cords and others). Details about age, sex and type of voice problem are given in table -4.

TABLE IV - Distribution of cases

Type of voice disorder	Age-range in years	Number of	
		Males	Females
1. Puberphonia	16-35	15	5 +1
2. Nasality	18-23	1	2
3. Hoarseness	16-42	4	1
4. Aphonia (Hysterical)	25-35	2	1
5. Spastic dysphonia			0
6. High pitched voice (with hg. lose)	43 15-20		2

Equipment: - As in Experiment 1, Part -B.

Procedure: - Step - 1.

Instructions to the cases: same as in experiment 1 Part-B. In addition to this, the cases were instructed in the following way:

"After I record the reading for /a/ say/i/ and /u/ in your usual way"

Step - 2:

Fundamental freqencies of each case for each vowel were found out. Three readings for each vowel were taken. The reading which occurred most frequently (model) in the nine readings was considered as the habitual frequency of the case.

Part B

Finding the optimum frequency:

For each case natural frequency and the fundamental frequency was located for /a/, /i/ and /u/ using the same procedure as in Experiment 1.

For females the relationship found ot (1:5) was used to calculate optimum frequency. For males between the age range 20-25 the realationship established was 1:8 (Nataraj, 1972). This relatonship was used for age range between 16-42 and for these norms range could not be established due to nonavailability of good voices. He formula used to arrive at the optimum frequency was as follows:-

$$\text{Optimum frequancy for males:} \quad \frac{\text{Natural frequency of vocal tract in /a/ position}}{8}$$

$$\text{Optimum frequency for females:} \quad \frac{\text{Natural frequency of vocal tract in /a/ position}}{5}$$

Part C

Establishing the isochronal stimulation technique:

Subjects: The cases as in Table IV.

1) B.F.O.
2) Artificial larynx
(Western Electric System, BELL)

The electro artificial larynx was modified for the purpose of this experiment by disconnecting the components other than the vibrator. The vibrator was connected to the output of the BFO to get the desired frequency. Electrical impedance between the artificial larynx vibrator and the BFO was matched. The vibrator of the artificial larynx was chosen because the impendance of the vibrator and that of the muscles of the neck region are said to be matched.( )

The instruments were arranged as shown in Block diagram 3.

Calibration:

To see whether the vibrator was giving the desired frequency or not, the signal from the vibrator was fed to the stroboscope. The fundamental frequency shown by the tachometer and the frequency given through the vibrator were found to be the same.

To detect the presence of beats when the two frequencies differed slightly the cathode ray oscilloscope was employed. Beats were observed when the two frequencies were within 10 Hz of each other.

PROCEDURE FOR THERAPY

Step- 1:

Instruction to the case:

"A tone will be given through the vibrator. Hold the vibrator tight where I place it. Now say /a/. Vary your pitch till you get beats, and than vary it again till you get as exact match where the beats disappear. Try for the appearance and then for the disappearance of the beats as I vary the tone. As you feel now, if you do not match, you will hear beats. This is an indication that you have come very near the tone but not matching exactly."

The instructions were expalined to some cases by repeated demonstrations till it was evidnet that they understood the procedure.

Step - 2:

(a)The vibrator was so placed so as to give maximum loudness and minimum director auditory feed back

(b) Case phonated habitual frequency.

{c) The vibrator was tuned te the habitual frequency and this tone wasted.

(d) The beats were demonstrated by varying the tone silghtly.

(e) Case method her phonation and the vibrator frequency for the disappearance of beats.

(f) Frequency was slightly varied either in 50 Hz or 10 Hz steps depending on the case. Case matched for the appearance of beats, then matched for its disappearnace.

(g) Frequency of the vibrator was still decreased or increased toward optimum frequency, case matching his voice.

(h) Case was reinforced verbally, at each step when aha matched her phonation to that of vibrator frequency. Case was also reinforced by the disappearance of beats.

(i) Thus optimum frequency was achieved by progressive approximation.

(j) Case practised the vowel /a/ continuously for five seconds at optimum frequency.

(k) From /a/ case practised other vowels.

(1) Prolongation time for each vowel was decreased gradually until it reached normal phonation time.

(m) Simple words starting from each vowel were practised. Different consonant vowel combinations were practised.

(n) Case read from a book for five minutes, talked in sentences with proper stress, and intonation pattern of their language, sang, if they could, maintaining optimum frequency.

Some cases skipped (i) stage because as they achieved optimum frequency they started talking in sentences maintaining the optimum.

Finally the cases were discharged after re-evaluation and follow up advice by a senior speech pathologist.

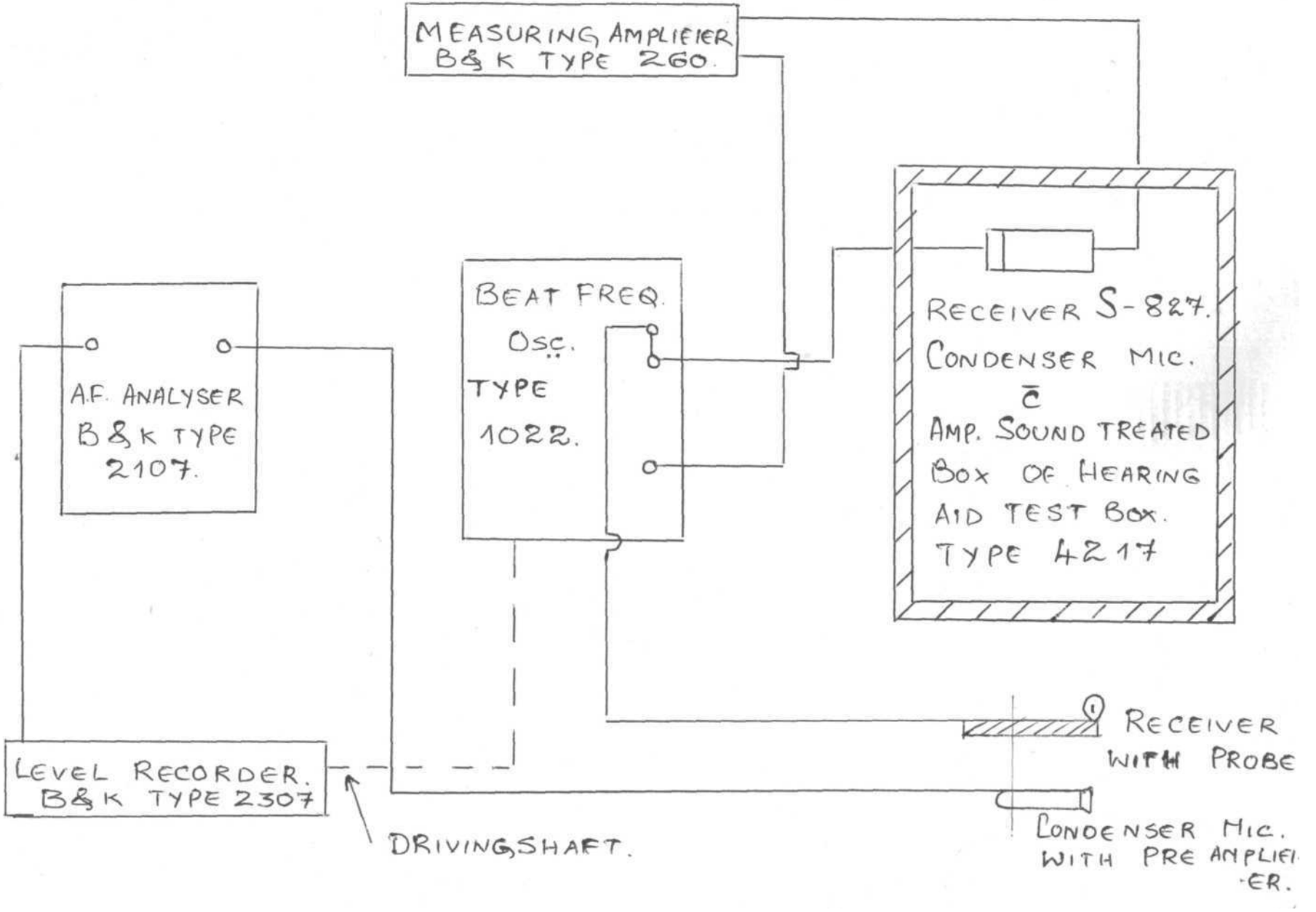
Part - D

Establishing the validity of the technique

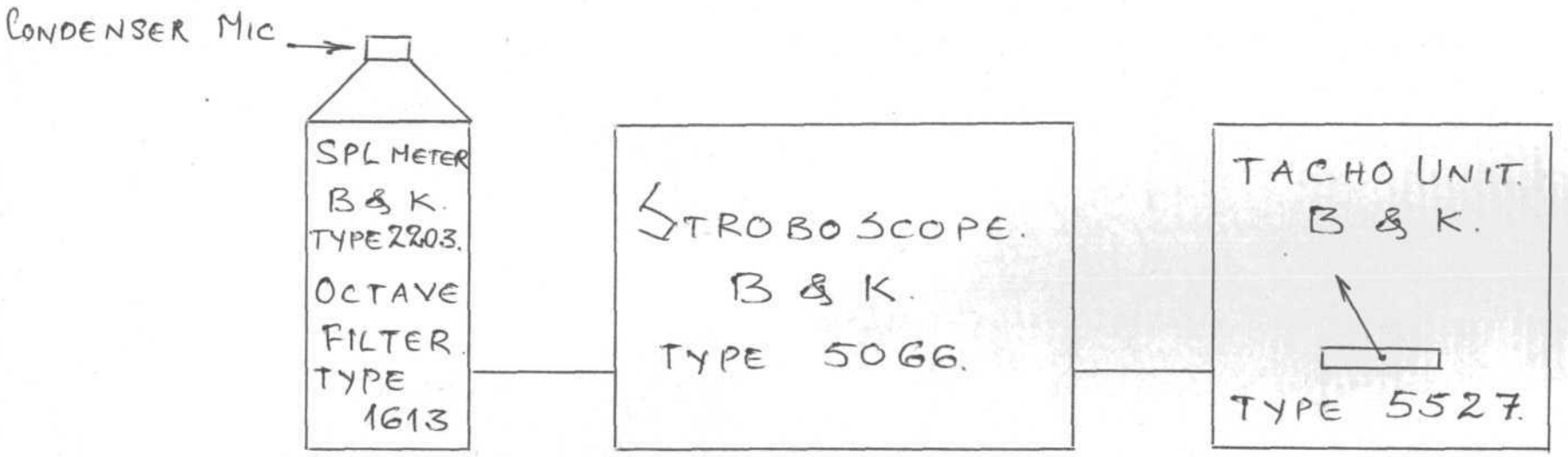
Follow up cards were seat to the dicharged cases, once in a month to know whether the subjects were using the new voice gives at the clinic or aot. All of them reported that they wre using new voice. All the local cases and some outside Mysore City were re-evalated for the consistency in their optimum usage by strobo-scopic measurements. All the cases were using optimum frequency consistently.

In addition to this, before discharging cases they were evaluated by senior speech pathologists for their subjective impression about the new voice, All of them agreed that the voice was good.

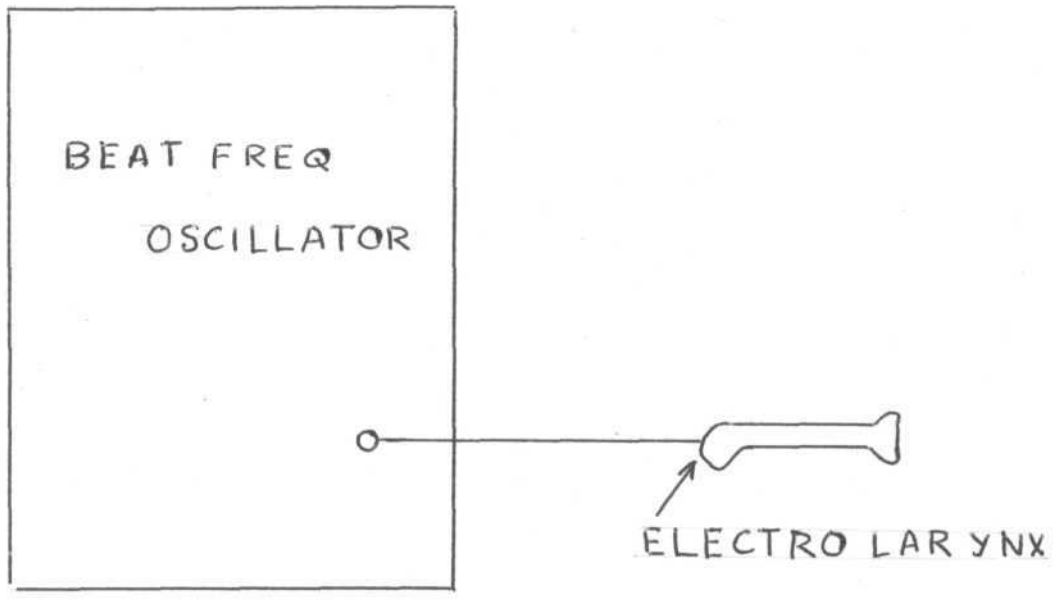
BLOCK DIAGRAM - 1



BLOCK DIAGRAM-2



BLOCK DIAGRAM - 3



CHAPTER IV

RESULTS AND DISCUSSION

Experiment 1 A and B

These involved finding the fundamental frequency of the voice and the natural frequency of the vocal tract in good voices. This was necessary for the purpose of locating the optimum frequency.

Stiumlating the vocal tract in the position /a/ with an external sound source with tones of frequency ranging from 100 to 5KHz gave a clearly discriminated and observable increment in intensity at a particular frequency for each subject. There were other peaks which were less prominent. The fundamental frequencies of the good voices ranging between 205 Hz to 260 Hz. There was a constant relationship between the fundamental frequency (Fo) and resonance peak which was identified as the natural frequency of the vocal tract (Nf) for that position.

TABLE V
Realationship between Fo and Nf

No.	Fo	Nf	Relationship
1	205	1025	5
2	250	1250	5
3	240	1200	5
4	230	1150	5
5	220	1100	5
6	240	1200	5
7	245	1225	5
8	235	1175	5
9	240	1200	5
10	260	1300	5

The relationship was consistent among the subjects and this weas 1:5. This consistency in realationship supported the earlier study on males between the age range 20-25 years where the realationship was 1:8.

Experiment 2: A, B and C

Finding habitual, optimum frequency and iscochronal stiumation therapy.

1) Puberphonia-- All the 20 cases 14 males and 6 females received therapy. Table VI shows their age, optimum (Cp, Fr.) and habitual (Hb.Fr) frequency

TABLE VI

Females				Males			
No.	Age	Hb. Fr.	Op. Fr.	No.	Age	Hb.Fr.	Op. Fr.
1	18	140	225	1	16	290	170
2	19	200	255	2	17	260	165
3	20	180	230	3	18	220	135
4	20	210	255	4	19	200	130
5	21	140	225	5	19	250	150
6	25	180	220	6	20	135	90
				7	21	240	140
				8	21	200	140
				9	22	165	135
				10	22	210	140
				11	22	220	130
				12	24	170	130
				13	32	240	150
				14	35	200	160

The frequency range before therapy (Fr.R.Bt) and
The frequency range after therapy (Fr. R. At) are shown in Table VII

TABLE VII

Females			Males		
Age	Fr. R. Bt	Fr. R. At	Age	Fr. R. Bt	Fr. R. At
21	150-400 Hz	150-650 Hz	21	130-250 Hz	110-370
20	110-510 Hz	110-650	20	200-350	100-460

Results:

The habitual frequency of females were below the optimum frequency in all cases. In males the habitual frequency was above the optimum frequency in all cases. All the cases except one female case was discharged with good voices. The undischarged case achieved optimum freqency but failed to generalize outside the clinic. This case was also irregular in attending therapy. The minimum difference seen between the optimum frequency and the habitual frequency was 30 Hz.

Investigation of frequency range in some cases showed that the frequency range was extended to higher frequencies after therapy.

In all the cases of puberphonia isochronal tone stimulation worked well.

Nasality:

There were three cases out of which two were females. Both female cases had cleft palate and had undergone aurgery. Case S. had undergone aurgery thrice but without any sucess. There was a wide gap.

In case M. surgery was successfully done to close the gap but nasality was still present. The third case had no organic anamely her did he has any articulation defect. Both female cases presented misarticulations.

Two interestin features were found in case S. The vowel/a/ was normal with prosthesis. The vowal /i/ remained nasal both with and without prosthesis. Table VIII gives the data.

TABLE VIII
Females

S.	Age	Hb.Fr. with Pros-thesis	Hb. Fr. without pros-thesis	Op. Fr. with Pros-thesis	Op. Fr. without Pros-thesis	Fr.R.Bt	Fr.R.At
1	18	280	280	220		200-300	200-350
2	20	380	360	240	260	200-450	200-500

Males

Age	Hb. Fr.	Op. Fr.	Fr.R.Bt	Fr.R.At
20	170	130	115-400	100-450

In contrast topurberphonia all the three cases had their optimum requencies below the habitual frequencies.

Another intersting feature seen was, in all the three cases nasality was found to increase above optimum frequency up to a point, then it disappeared at still higher frequency. The presence and absence of nasality

in the male and female cases are seen in Table IX

TABLE IX

Presence and absence of nasality in the male and famales cases:

Males Females

Optimum Frequency	Habitual Frequency	Nasality Judgment	Optimum Frequency	Habitual Frequency	Nasality Judgment
130	130	Absent	240	200	Absent
	150	present		250	Absent
	170	present		300	Present
	200	present		350	Present
	250	present		380	Present
	300	absent		400	Present
	110	absent		450	Absent
				500	Absent

The other case had patterns similer to the female case.

Nasality was found to disappear in all the three cases at optimum frequency. After 14 sessions of threrapy Case S. get a job which had been earlier refused to her on account of her voice problem. Case M was transferred for articulation therapy after she was able to phonate all the vowels, and non nasal consonante without nasality case. N. did not show any generalization although he could talk with the therapist both in therapy and out of its without nasality. This case was also transferred to another therapiet for generalization.

Isochronal sound stimulation technique was found to work with problems of nasality.

There were 4 cases hearseness, all males. In three cases etiology was vocal cord paralysis. The other case was a boy of 16 years with no known organic pathology.

Table X

No.	Age	Hb. Fr.	Op. Fr.
1	31	90	125
2	42	90	150
3	38	100	140
4	16	90	150

In all the cases irrespective of their ages habitual frequency was below the optimum frequency. They all achieved optimum frequency. Two discontinued therapy in the middle, out of which one case reported on follow up that he had recovered his original voice. The other case did not respond in epite of repeated attempts at follow up. The remaining two cases were discharged with good voices. Again in all the four cases hearseness was not seen at optimum frequency. Inochronal tone stimulation worked satisfactorily with hearse cases also.

Breatiness

One case of breathiness was given therapy for 8 sessions.

Age	Sex	Hb. Fr.	Op. Fr.
19	Female	290	220

This case achieved optimum frequency but breathiness did not disappear. However, when the vibrator tuned at optimum frequency was in place, the quality of the output was good. Even when the case phonated isochronally with the vibrator the quality was judged as good. But when the case phonated independently there was breathiness even though our measurements indicated that that voice was optimum. This case was changed over to other techniques of voice therapy. At the time of writing the quality of her voice had not improved.

The isochronal tone stimualtion technique helped to achieve optimum frequency but did not lead to the disappearance of breathiness

Spastic dysphonia

No.	Age	Sex	Nb Fr	Op.Fr.
1	42	Male	180	140

This case after six sessions of therapy showed improvement. When he was able to read to for five minutes without any problem in his voice he discotinued therapy. Case reported improvement immediately after the therapy session, but afterwards failed to maintain the improvement outside.

No	Age	Sex	Hb. Fr	Op.Fr.
1	18	Female	340	220
2	20	Female	390	260
3	16	Male	240	130

In all the three cases the habitual frequency was higher than the optimum frquency. These cases took a with the vibrator to situmation where they had to phonate without the vibrator. Even after acheiving optimum frequency at all vowels they insisited upon having the vibrator. The number of sessions varied from four to fourteen.

All the three cases were discharged with good voices. The isochronal tone stimulation technique is an easy and effective one, especially in the hard of hearing cases.

Aphasis with sphonia

Mr. G. aged 32, was therapy for four sessions to elicit voice. He was albe to phonate at the first session itself. Before he was assiged to another therapist he was able to phonate all the vowels and the bilabial consonante.

Hysterical Aphonia

Two cases were put under isochronal tone situmlation techique. Mr. U aged 19 got his voice in one

session and he was discharged on the same day. The other case Mrs. P. took four sessions to get her voice. She refused to talk to the members of her family except. her husband. She had voice therapy before in the Institute one year ago when she lost her voice for the first time. She regained her voice following therapy but lost it again. Follow up reports indicate there is no problem with her voice for the last six months.

D I S C U S S I O N

The isochronal tone stimulation techinque helped in all cases to change the habitual frqeuency. All the 35 cases were able to achieve optimum frequency. The number of sessions taken to achieve this varied from one to fourteen sessions. This techique seems to be useful for routine use in the clinic, especially with the hard of hearing cases and puberphonics.

In all the cases there was a clear change in quality and loudness when they were phonating at optimum frequency However, in the case of breathiness the presence of breathiness when she was phonating independently of the tone from the vibator cannot be explained easily. The observation that change in quality was noticed when she was phonating with the vibrator frequency may be due to the fact that the vibrator frequency was masking the case's breathiness. The ccase has refused to undergo indirect laryngoscopy. It is not clear if there

is an underlying organic condition that precludes 3 good voice without organic intervention.

The possible explanation for the disappearance of nasality and hoareeness may be that at optimum frequency the chambers of the mouth, throat and cheat have relatively high potential for the resonance of the laryngeal tone. The quality of voice mainly depends upon the relative intensities of the partials; which ie determined by the vocal cord vibration (the F.F. & the Partials) and resonance (which intensifies some of the harmonica and clamps out certain other partials). Thus the production of normal voice or abnormal voice depends on the mode and rate ef vocal cord vibration and the physiological conditions, shape and size of the resonators. In other words, problems of quality, disappear at optimum-frequency because the tone complex that is produced by the vocal corda may be coinciding with the frequencies of the resonators to give maximum loudness and normal voice.

In case S. with nasality the vowel /a/ was normal without prosthesis but nasal with prosthesis. This might be because the proatheia tended to divide the combined oral and nasal cavities into two markedly disproportionate cavities, thus producing the resonator or resonatore which would respond to frequency areas contributing to nasality. Without the prosthesia there wae almost a single cavity. This assumption seems to be supported by Hixon (1949).

In both the female cases of nasality the vowel /a/ was less nasal when compared to /i/. This might be due to the fact that /a/ requires a larger mouth opening then /i/. The vowel /i/ reduces the size of the mouth opening thus affecting adversely the critical point of clousre of the nasaopharynx. The results as given in table IX show nasality disappeared when the habitual frequency was lowered. This goes against the Dorothy Sherman and Fred Goodwin (1951) study. They concluded that lowering pitch level was not to be routinely applied as as technique for reducing hypernasality in the voices of males and females. They also said raising pitch level had no important effect upon the degree of perceived nasality in the voices of males and females speakers. This is again in contradiction with the present finding that raising the frequency above the optimum frequency upto a point raised the degree of preceived nasality though further raising did result in the absence of nasality.

The absence of nasality in the two female cases at 250 cps contraadicts Curtis (1942) who concluded that nasalization of vowels are accompanined by a reinforcement of certain low ferquencies typically centering around 200-250 cps. There frequencies for the most part, are not reinforced in the non-nasal vowels. It may however be observed that in our male case masality was present at 170 to 250 cps. This is as may he predicted from the Curtis Study.

The fact that nasality was present around 250 cps. and above in the male case and absent in the two female cases questions the fasility of atributing perceived nasality to reisforcement of a particular frequency range. The cavity sises may also have to be taken into account. The difference in the cavities between male and female speakers amy explain the present data. It may also be hypothesized that the fundamental frequencies should also be taken into account to explain nasality, because the same cavities exhibited nasality at some frequencies and no nasality at others.

Therefore nasality may be a phonatory problem or a resontory problem or it may be a combination of both.

The finding reported by Kanter (1947) that is, patients with wide, unrepaired clefts in the hard and soft palates seem, sujbectively at least, to have less neasality than some patients whose palates, though repaired, are functionally inadequate, agrees with our cases also. Case S. with a wide cleft had less nasality than case. M. whose palate was repaired.

The spastic dysphonic case also achieved optimum frequency and voice was good. It was felt that if the case had continued therapy generalization would also have been possible. This indicates that even spastic dyaphonia is amenable to symtomatic therapy.

The results obtained supported the hypothosis made

earlier.

1. A change in pitch can be brought about by iaochronal tone stimulation technique. It partially supports the second hypothesis.
2. All voice disorders can be treated by changing the piten. So, the secondhypothesis slightly modified ae "a majority of the voice disorders can be treated by changing the pitch" may be accepted.

For all the 34 cases with different voice problems therapy given wan the same (changing habitual frequency and providing optimum frequency). So from this observation, with considerable certainty we can conclude that the voice problems studied under this technique can be grouped under the one heading of "Frequency Problems". In accepting such a stand, more importance is given to the therapy than to the etiology or to the nature of the voice problem.

However before it can be stated with confidence that all voice problems are basically frequency problems more studies are needed and on larger populations. We can only say now that differential therapy may not be needed for the kinds of problems studied presently.

In the cases of hysterical aphonia this seems to be very useful. The number of sessions needed was very few, one in one case and four in the difficult case. In these cases isochronal tone stimulation technique worked as a placebo.

Another advantage of this techique stems from the fact that the therapist's role in minimised. Once. the case understood the porocedure and the target frequency, self-therapy takes over.

It can be hypothesized from the minimum difference seen between the habitual frequency and the optimum frequency, that in individuale with voice problems there will be at least a 30 Hz difference between habitual frequency and optimum frequency. If this hypothesis is tested by studies of normal and abnormal voices at information gained may help indetifying borderline voice problem cases also.

CHAPTER V

SUMMARY AND CONCLUSIONS

The common factor in a majority of these voice therapies ie that they aim at changing the pitch and focus their attention on achieving an optimum pitch.

A review of the literature on the methods of locating optimum pitch, which is an important step in most of the voice therapies shows that a majority of these are subjective. The methods of eliciting optimum pitch are also subjective and have their limitations.

out of the limitations of the present voice improving techniques, and the belief that a majority of the voice disorders can be treated by changing the pitch thereby providing optimum frequency and a felt need for a technique which provided a better model than mere auditory or visual, arouse this technique of isochronal tone stimulation. The present study evolved techniques of voice therapy by isochronal stimulation and tested its usefulness in 35 cases with a variety of voice problems.

It was hypothesised that it would be possible to correct all voice disorders by changing the pitch and that this change could be brought about by the ieochronal

tone stimulation technique.

As a part of the study it was also necessary to arrive at a relationship between the fundamental frequency of the vocal cords and the natural frequency of the vocal tract in good voices in the age range of 20 to 25 years. A definite and consistent relationship of 5 : 1 was found between the natural frequency of the vocal tract in the /a/ position and the fundamental frequency (in the /a/ position) of the good voices. This relationship was used to establish optimum frequencies of the cases under study on the assumption that the good voices had a fundamental frequency which was optimum. 35 cases with different voice problems were selected for therapy. Habitual frequency and optimum frequency was recorded for each case before therapy started. Out of 35, 20 were jpaberphonics, – 14 males and 6 females – 4 with hoarse voice – all males, 3 with nasality -- 2 females and one male, 1 female case of breathiness, 1 male spastic dyphonic, 2 hysterial aphonies –both females – 1 male with aphosia and aphonia, and 3 cases of hearing loss with high pitched voices - two of whom were females.

Instruments for the isochronal tone stimulation technique were a B.F.O. and the vibrator of an artificial larynx, connected to the B.F.O. The vibrator was kept at the neck region tuned to the case's habitual frequency first. . Cases were instructed to match their

voice to the frequency of the vibrator. Next the vibrator frequency was changed toward optimum frequency step by step following the progressive approximation technique. During this matching procedure cases were guided by the appearance and disappearance of tests.

All the cases achieved optimum frequency. In cases of nasality and hoarseness there was a change in quality at optimum frequency, One case who was diagnosed as having breathiness did achieve optimum frequency but did not achieve a good voice. Cases were discharged with good voices.

This method wae validated by re-teating name of the discharged cases for their optimum frequency usage. This and follow up indicated that the improvement had been maintained.

C 0 N C L U S I 0 N S

1. Isochronal tone etimulation technique was found to be useful in a majority of voice disorders.

2. By changing pitch and by providing optimum frequency voice problems auch as puberphonia, nasality, hoarseness, spastic dysphonia can be treated.

3. This is a good technique for treating hysterical aphonics.

4. Nasality may be either a phonatory or a reaonatory problem. It may also be a combination of the two.

Recommendations for further research:

1. The relationship between the natural frequency and the fundamental frequency in all age groups needs to be established. This may facilitate providing correct ' optimum frequency for all cases.

2.A comparative study of this technique with other techniques of voice therapy and with other types of feed back needs to be undertaken.

3. Studying the distance between habitual frequency and the optimum frequency in voices which are subjectively judged as abnormal may help in correlating objective measures and subjective judgment.

4. Replication of the study in all voice disorders and on larger groups will help making more confident generalisations.

L i m i t a t i o n s

1. It is felt that the optimum frequency established for all the cases may not be in fact optimum frequency although when the cases achieved the frequency given the voices were judged as good. This was because the relationship now available is for the age group 20-25 in both males and females. Relationship for other groups ie not available and it is possible that it may be different.

2. It is possible that there might have been some amount of auditory information available to the cases. This may not be a serious limitation because of the presence of beats and apparent discomfort felt with the beats. This gives sufficient evidence that in fact isochronal matching takes place.

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A P P E N D I X - I

AUDIO FREQUENCY ANALYZES

Type 2107 is an AC operated audio frequency analyser of the constant percentage band width type. It has been designed especially as a narrow band sound and vibration analyzer, bat may be uaed for any kind of frequency analysis and distortion measurement within the specified frequency range. It is supplied with the weighting new works for the sound level measurements 'A', 'B' and 'C the characteristics of which are recommended in the IEC publication.

The instrument is supplied with an output switch, by means of which the rectifier and meter circuit can be switched to measure either the peak, the arithmetic average or the true RMS value of the input signal to enable easy and accurate meter reading for both high and low frequency signals two different standardized meter damping characteristics can be selected.

STROBOSCOPE

The motion analyzer type 5066 is designed for use ia observing and measuring periodic mechanical phenomena. It is useful for observing the functioning of the larynx and many other complicated mechanisms.

TACHO UNIT

With the additional Tacho-unit 5527 the number of input pulses, as received by the stroboacope from some kind of triggering device, is measured and indicated in

The Tacho-unit is connected to the stroboscope by a cable from the "output" socket, the sawtooth signal from which is in exact synchronism with the input pulaea fed to the stroboscope.

The unit obtains the necessary current supply via a second cable from the strotoscope. This gives a direct reading of fundamental frequency of voice.

SOUND LEVEL METER

The SPL meter type 1203 is an instrument designed for out door use as well as for precise laboratory measurements. It is portable and battery driven. This is usually used in conjunction with a suitable filter set (i.s.w.) in a load of 6 - 60 - 600 - 6000 r.

The 1022 may be swept continuously through ita frequency range by an external motor drive. If it ia driven by the level recorder 2305 it can also be automatically synchronized with frequency calibrated paper.

Remote control facilities are provided to start and stop the scanning and the oscillator and for instance to lift the pen on the level recorder when the oscillator is sweeping outside the frequency range of interest.

LEVEL RECORDER

The level recorder B & K Type 2505 has been designed for accurate recording of signal levels in the frequency range of 2 Hz - 200 KHz. Typical fields of application are the recording of frequency response characteristics, reverberation decay curves, noise and vibration levels and spectrograms. Recordings can be made by means of ink on frequency calibrated paper by different speeds. The operation of the recorder is based upon the servo principle* Special provision has been made to obtain recording for different ranges of voltage variations by employing different range potentiometer.

MEASURING AMPLIFIER

The 2607 measuring amplifier is capable of an extensive range of sound vibration and voltage measurements used with one of the B & K Condenser microphones and a suitable preamplifier, the 2607 becomes a precision sound level meter Type 1613. This covers the range 18 to 134 dB and this covers most sound levels which need to be measured. All three weighting networks (A, B & C) and a means for connecting external filter circuits for further shaping of the frequency characteristics are included.

CONDENSER MICROPHONE

This was designed for long term stability and high

accuracy. Particular care has been taken to make it insensitive to variations in ambient conditions such as temperature, pressure and relative humidity. A source follower stage has been introduced between the microphone and the input amplifier.

PROBE SPEAKER

This was a part of Dan-aid hearing aid Type 58/21.

HEAT FREQUENCY OSCILLATOR

The BFO type 1022 is a precision signal generator. It covers the range 20 to 20 K and is designed for acoustical vibrational and electrical measurements. The output attenuator has a range of 100 dB in 10 dB steps and the output impedance can be varied to give maximum power. It is basically a wide range measuring amplifier for linear as well as logarithmic operation and includes true RMS and peak rectifier circuits. A display meter with interchangeable meter scales on which the range setting to automatically indicated facilitates the direct calibration of the 2607 for SPL, acceleration and vertage measurements.

Amongst other features are mains or battery operation, overload indicators on input and output sections. This contains frequency weighting networks A, B & C as well as the D net work. For frequency analysis this may be used with level recorder for which both DC and AC outputs are available on the 2607.

HEARING AID TEST BOX

The hearing aid test box type 4217 consists of a miniature anechoic enclosure with a built in loudspeaker and a transitorized oscillator and amplifier section with the B. & K. precision SPL Meter and 1" condenser microphone the set up is complete and ready for measurements.

For more information B.& K. Manuals may be referred.

A P P E N D I X - I I

CASE HISTORIES OF SELECTED CASES

1. Case: Mr. P. No. 6694 Age:30 years
Complaint: Female voice. Diagnosis - Puberphonia
Age of onset - From the age of 16 years.
ENT: Audiology; Psychology Report: NAD.
Optimum frequency: 160, Habitual frequency: 220
No. of Sessions: 6.

Previous therapy with results: 1½ months voice therapy by a speech pathologist without any improvement.

Discharge Note: Case was discharged with a good voice after re-evaluation by a senior speech pathologist.

Follow up: Case res onded to our monthly follow up. Wrote letters informing us that his voice was good and he reported in person on 27-3-73. His new habitual frequency was checked and was found to be his optimum.

2. Case: Mr. K.K. #o. 6263 Age: 28 years
Complaint: High Pitch Voice. Diagnosis: Puberphonia
Age of onset: since 12 years. Date of Admission:19-9-72
ENT: Audiology: Psychology Report: NAD
Optimum frequency: 150. Habitual frequency: 240
No. of Sessions: 3. Previous treatment: Nil relevant.

Discharge Note: Discharged with a good voice.

Follow up: Responded to follow up. He had no problem with his voice.

3. Case: Miss. S. No. 6113 Age: 21 years

Complaint: Speech and voice problem;

Diagnosis: Cleft palate speech, nasality;

Date of Admission: 30-8-1972;

Age of onset: Case reported that she noticed the problem at the age of 18 years when she had been to a job interview, where the interviewer made a remark about her voice. Mother reported that she noticed the cleft at birth.

Medical history: Post natal history: Polio attack with high fever at the age of one year.

ENT: Post alveolor cleft.

Previous treatment: Surgery three times: (i) at three months; (ii) at one year; (iii) 9 years. Surgery of the palate was not successful; there was a wide cleft.

Orthodontic report: Recommended a prosthesis, case followed this.

Speech evaluation: Nasality on all the vowels except /a/ without prosthesis. With prosthesis /a/ was also nasal. Misarticulation.

Voice evaluation: Optimum frequency without prosthesis: 240; with prosthesis: 260. Habitual frequency: without prosthesis: 360; with prosthesis: 380. No. of Sessions: 14. Therapy started with prosthesis.

Discharge Note: Therapy terminated following the disappearance of nasality on all vowels and non-nasal consonants as the case got a job and she could not come for therapy.

4. Case: Mr. K. Age: 19 years. No.
Date of Admission: 16-9-1971;
Complaint: Nasality and monotone;
Age of onset: Problem noticed at the age of 15 years;
ENT: No organic pathology;
Speech: Normal.
Voice evaluation: Habitual frequency: 170
Optimum frequency: 130
No. of Sessions: 12.
Result: No nasality in the running speech in clinical situation. No generalization. Case was handed over to another therapist*

5. Case: Mr. M. Age: 34 years, Date of Admissionil2-6-72
Complaint: Voice problem. Diagnosis: Hoarse voice;
Age of onset: one and half months before reporting
History: Case reported that he suffered from for 1½ months. He also reported that he used to drink heavily and prior to the onset of the voice problem he was drunk. Case reported no change in voice since the attack.
ENT: Right vocal cord paralysis.
Audiological: Bilateral mild high frequency loss.
Previous treatment: Had been to many doctors and took many drugs.

Voice evaluation: Habitual frequency: 90
Optimum frequency 150 Hz

Result: Case discontinued therapy at the stage where he was able to phonate /a/ at optimum frequency without hoarseness.

Followup: Reported that he had recovered the original voice. It is not clear which original voice he referred to.

6. Case: Miss.V. Age: 19 years; Date of admission:18-7-72

Complaint: Voice problem. Diagnosis: Breathiness with, high pitch voice.

Recognition of the Problem: She became aware of the voice problem one year prior to reporting when others drew her attention to it*

ENT: Indirect laryngoscopy revealed. No abnormality. However,she was advised to undergo direct laryngoscopy for any possible organic pathology. As the case was not willing to undergo direct laryngoscopy voice therapy started.

Voice evaluation: Habitual frequency: 290
Optimum frequency: 220

No. of sessions: Eight.

Result: Case achieved optimum frequency in three sessions but there was no change in voice quality. Breathinesa did not disappear. Isochronal tone stimulation technique was stopped. Case counselled to undergo direct laryngoscopy during the holidays.

Case: Mr. B. Age: 43 years. No. 8018. Date of admission: 20-3-73. Complaint: Voice Problem.

Diagnosis: Spastic dysphonia.

Age of onset: When he was 25 years;

Previous therapy: Consulted many doctors and psychologists. Psychotherapy abreaction and other treatment have not been useful.

ENT: NAD

Psychological report: Provisional diagnosis. A case with reactive depression on the neurotic dimension built over masturbation predominant. Sexual area to be explored. Intellectually normal. High degree of neuroticism, associated with high degree of introversion.

No. of sessions: 6

Result: After three sessions there was a remarkable improvement in speech. Re was able to maintain the optimum frequency where the spastic component disappeared in the clinical situation. He firmly believed that the cause for his voice problem waa purely psychological. He reported improvement in voice immediately after therapy, but not afterwards. He discontinued therapy. (He is a priest by profession)

8. Case: Mr. U. Age: 20 years; Date of admission:18-10-72.

No. 6377. Complaint: No voice.

Diagnosis: Hysterical aphonia;

History: The case reported that one month before reporting he lost his voice. He had high fever and cough.

Age of onset: 19 years of age.

ENT : NAD.

Psychological report: Hysterical features present.
Voice evaluation: Normal voice.
While coughing and clearing throat.
No. of Sessions: one.
Discharge Note: Discharged with good voice.
Follow up report: Three months fallow up revealed that he has maintained the optimum voice.

9. Case: Mr. 3. Age: 32, No. 8012, Date of Registration: 17-3-73. Problem: No speech;
Diagnosis: Aphasia with Aphonia.
Age of onset: At 31½ years;
Previous treatment: Medical treatment for a month after attack.
Diagnosis at the hospital: Antero septal myocardial infarction with right sided hemiplegia and aphasia.
ENT: NAD Neurological - Aphasia (expressive) with Right sided hemiplegia.
Speech evaluation: On aphasic test comprehension was better than expression,
Result: First session - could phonate the vowel /a/, /i/ and /u/. However difficulties in transition from one vowel to the other, and in articulating all sounds except bilabials were noticed. The case was given to another therapist for speech therapy after he was able co communicate using his voice.