EFFECT OF PRANAYAMA IN THE MANAGEMENT OF STUTTERING

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DEDICATED

TO MY BELOVED AMMUMA, AMMA, ACHAN, SAYU & DEVU

Adve:shta sarvabhutanam mythra: karuna aeva cha.

Nirmamo nirahankaara: sam-dukh-sukh: kshami

Samthusht: satatam yogi yatatma dhrudnishchay:

Mayyarpit-mano-budhiryo mabhdakt: sa mae priy:

Non envious, friendly and compassionate, towards all beings, free from ideas of possession and ego consciousness, sympathetic in pain and pleasure, forgiving, always contented, contemplative, self-controlled, of firm conviction with his mind and intellect dedicated to me- such a devotee of Mine is dear to Me

– Srimad Bhagavad Gita.

CERTIFICATE

This is to certify that this dissertation entitled ***"Effect of Pranayama in the Management of Stuttering"*** is a bonafide work in part of fulfillment for the degree of Master of Science (Speech – Language Pathology) of the student Registration No: 07SLP001. This has been carried under the guidance of a faculty of this institute and has not been submitted earlier to any other university for the award of any diploma or degree.

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May, 2009

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CERTIFICATE

This is to certify that this dissertation entitled ***"Effect of Pranayam in the Management of Stuttering"*** has been prepared under my supervision & guidance. It is also certified that this dissertation has not been submitted earlier to any other university for the award of any diploma or degree.

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May, 2009

DECLARATION

This is to certify that this master's dissertation entitled "***Effect of Pranayama in the Management of Stuttering***" is the result of my own study under the guidance of Dr. Y. V. Geetha, Professor in Speech – Language Sciences, Department of Speech – Language Sciences, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier to any other university for the award of any degree or diploma.

Mysore **Registration No: 07SLP001**

May, 2009

DECLARATION

This is to certify that this master's dissertation entitled "***Effect of Pranayama in the Management of Stuttering***" is the result of my own study and has not been submitted earlier to any other university for the award of any degree or diploma.

Mysore **Registration No: 07SLP001**

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CHAPTER I

INTRODUCTION

It has been said that if one's tool is hammer, then everything looks like a nail. For example, if all we understand is physiology, then the only aspects of stuttering we may be willing to examine is the soma (i.e., the physiology). Conversely, if all we understand is psychology, then the only aspects of stuttering we may be willing to examine is the psyche (i.e.; the psychological). Human beings, however, reside at neither the somatic nor psychic poles. Instead; most people generally inhabit the large in-between temperate zones where elements of physiology and psychology jointly reside, interact and at times collide. Common-sense, however, tells us that most humans are composed of a complex mixture of soma and psyche.

Theories that have attempted to explain the causes of stuttering have often echoed the prevailing beliefs of the time. There have been frequent shifts in the view points about the etiological factors for the onset and development of stuttering from physiogenic to psychogenic and back and forth, ultimately to the combination of both. For example, in the mid 20th century there was a trend to believe that many diseases were psychosomatic in origin, that is, they were caused by psychological factors such as anxiety. Similar shifts in the focus of management issues in stuttering have been noticed over the decades.

Management of stuttering

Between the sometimes dark of adolescence and the relative light of infancy lies the childhood. During this period of dependence, in the day care centers the roots of stuttering grow and, for some, take a firm hold. Individuals who still stutter in the later years of high school and beyond qualify as adult people who stutter. While some will have received no formal therapy of any kind, most will have previously received partially to completely unsuccessful speech and language therapy in addition to a wide variety of other forms of remediation, for example, hypnotherapy, transcendental meditation, primal scream therapy, traditional forms of psychotherapy or psychoanalysis, pharmaceuticals, or specialized academic or vocational counseling. Adults who stutter can be helped; they can be assisted in learning how to speak more

fluently and leading lives that are more enjoyable, comfortable and productive on both personal and professional levels.

The contemporary treatment for stuttering can take widely differing forms, both in the emphases and the procedures used to bring about the alleviation of the problem. No one has developed an approach which can be applied to all who seek help. Most of the fluency management therapies involve a cluster of different components and is difficult to determine which are crucial to effective treatment. The classical means for determining the value of a component of therapy is to include it in experimental treatment and compare the outcome with that produced by treatment without the component.

1. Prolongation

Prolongation is one of the most commonly adopted procedures in the management of stuttering with fairly good treatment outcome. Prolongation of sounds to control spasms or induce fluency is involved in number of therapy techniques. Method such as rate control through continuous phonation, singing and others promote or require prolongation of speech sounds. It is an old technique. Whitten (1938) describes self use of prolongation as a part of symptom control program that includes attitude and personality readjustment procedures. Gifford (1940) made extensive use of prolongation in her therapy programs. There have been contemporary practitioners since then. Webster (1972) made extensive use of prolongation in his fluency shaping program and Mowrer's rate control program (Mowrer & Case, 1982) results in prolongation effects. The Schwartz's (1976) airflow program also involves prolongation to a significant degree. Prolongation may be applied to increase the duration of vowels and consonants within word boundaries or to function as a continuous phonation where word boundaries are reduced or eliminated.

2. Relaxation Therapies

As PWS were found to have varied degrees of anxiety or tension, relaxation therapies have often been combined with other procedures to alleviate anxiety. As stuttering therapies in the 1960s became more diverse, relaxation procedures were increased in use. Both in therapy and in research in related fields, there was

resurgence of interest in relaxation (Slorach, 1971). Dalton and Hardcastle (1977) expressed the opinion that relaxation, per se, was not effective. However, they recommended its inclusion as part of an overall remediation program. Many therapies that were not "relaxation programs" routinely included some form of it. Relaxation of some sort became involved in many of the fluency induction approaches, such as airflow (Shwartz, 1976), regulated breathing (Azrin & Nunn, 1974) and fluency shaping (Webster, 1979). The ability to relax, in whole or in part, is a basic component of most therapy methods (Crystal, 1980). Approaches to relaxation are multiple. In modern medicine there has been an explosion of chemical substances to relax the patient. Carbon dioxide therapy, which has been used as a technique, in most instances was the only or major treatment (Kent, 1961). Falck (1969) summarized the use of hypnosis and desensitization in stuttering and Wolpe (1960) commented favorably on the use of Yoga and transcendental meditation techniques in relaxation and desensitization programs. Relaxation has also been approached in a number of therapy methods by having the client concentrate on reducing tension in the respiratory-phonatory-articulatory systems. This may be taught on a whole system basis or concentrated on a very specific area, such as the jaw or the tongue. Progressive relaxation developed by Jacobson (1938), was a whole body relaxation that progressively moved through the muscle groups of the body until the client could be totally relaxed. Stuttering therapies today use both the total and partial relaxation programs in various combinations. Depending on the application, goals of relaxation may be following:

1. Indirect relaxation by teaching breathing, phonation or articulation procedures that relax those muscle groups.
2. Direct relaxation of tensions in the speech production mechanism so that speech efforts can be made from a relaxed state.
3. Direct relaxation of the body wherein the speech mechanism is only a part of the total organism.

3. Respiratory Management

Perkins (1979) focuses on speech act in his definition of stuttering as a "disco-ordination of phonation with articulation and respiration" and in his treatment program he works directly on achieving fluency through management of breath stream in order to initiate voice with a gentle onset and maintain airflow throughout the phase.

Respiration research and observation have been conducted for many years in stuttering consistently reporting anomalies. Murray (1932) stated that PWS had more variable breathing patterns, identifying 6 as compared to 2 for the PWS group. Weller (1941) in studying over hundred PWS, found disturbances such as rapid, shallow and irregular breathing and a predominance of abdominal breathing patterns. Schilling (1960) indicated that the quiet, non speech breathing of some PWS may show short spastic muscle contractions in the respiratory area.

Respiration therapy has had a long history. Application varies when airflow and breath control are secondary to a major technique or when the technique takes for granted the preliminary establishment of good breathing habits. Fiedler and Standop (1983) particularly cited speaking on inhalation, speaking on residual air and reverse and opposition breathing during speech efforts. Overstake (1979) states that a majority of the PWS have non-synchronized, quiet breathing patterns in which the even balance between duration and depth of inspiration and expiration is disturbed.

4. Yoga and Stuttering

Although the use of relaxation with the techniques for stuttering treatment is widely implemented, the use of Yoga one of the ancient Indian methods concerning regulation of breathing and management of anxiety has not been explored.

Yoga aims to improve people's inner tranquility and free them from fears and anxieties. Since it is known that stuttering includes an element of anxiety and fear, Yoga can help reduce this. Yoga, a science not less than 5000 years old has addressed a normal man to move towards higher states of harmony and peace both as an individual and also as a social being. Because of the rationale basis, the modern

medical system has replaced almost all the traditional systems of medicine in different parts of the globe. However, new widespread psychosomatic ailments and psychiatric problem are posing a great challenge to the modern medical system. It is here that yoga is making a vital contribution to the modern medical system. Extensive research on yoga therapy over the last few decades have brought out the usefulness of yoga in dealing with these ailments as an effective adjunct to medical management and also for long term rehabilitation.

Pranayama, one of the Yoga techniques, focuses on regulating breathing. Pranayama is derived from two Sanskrit words - Prana (life force) and Ayama (control). Therefore, in its broadest description, Prananyama would mean the control of the flow of life force. During breathing for Pranayama, inhalation (Puraka) stimulates the system and fills the lungs with fresh air; retention (Kumbhaka) raises the internal temperature and plays an important part in increasing the absorption of oxygen; exhalation (Rechak) causes the diaphragm to return to the original position and air full of toxins and impurities is forced out by the contraction of inter-costal muscles. These are the main components leading to Pranayama which massage the abdominal muscles and tone up the working of various organs of the body. Yoga appears to provide a comparable improvement in stress, anxiety and health status compared to relaxation (Smith, Hancock, Blake-Mortimer & Eckert, 2006).

Whether fluency can be improved with slow and controlled breathing, as Pranayama teaches, should be scientifically tested (Subramanian & Prabhu, 2005). Our respiratory system has the special feature that it is both voluntary and involuntary. This therefore is the right system by which we can move from voluntary to the involuntary system. By systematically regulating the speed and rhythm of breathing through voluntary nervous system, the autonomic function will also change. Pranayama is a process by which this can be brought about effectively.

There are no studies in either the Indian or the Western literature showing the effectiveness of Pranayama in stuttering therapy. A lot of people have benefited from the practice of Pranayama for various psychogenic and or physiogenic disorders and this preliminary attempt might throw some light on its efficacy in the management of ever alluding disorder of fluency – stuttering.

Need for the study

The classical means for determining the value of a component of therapy is to include it in experimental treatment and compare the outcome with that produced by treatment without the component. Thus, a treatment encompassing the traditional practice of Pranayama is to be determined to find its effectiveness as a treatment component in the treatment of stuttering. Also, considering the various benefits of Pranayama as mentioned below, it is important that its effect be studied.

1. Release of acute and chronic muscular tensions around the heart and digestive organs
2. Role in helping sufferers of respiratory illnesses such as asthma and emphysema to overcome the fear of shortness of breath
3. Role in increasing lung capacity, proper nervous stimulus to the cardio-vascular system, dramatic reduction in emotional and nervous anxiety
4. Improvement in detoxification with increased exchange of carbon dioxide and oxygen
5. Amplification of the auto immune system by increased distribution of energy to the endocrine system
6. Calming the mind and integration of the mental/physical balance, its contribution to both vitality and relaxation through this single practice

Aim of the study

The present study aims at studying the role of Pranayama in the treatment of stuttering and also its long term effect in comparison with a group which does not practice Pranayama. Yoga has been practiced in India for thousands of years for better control of mind and body. Pranayama being one of the yogic practices which is very effective in breath regulation and also control of anxiety and tension could be effective in the management of stuttering. The current experiment aims to investigate how it applies to stuttering.

Objectives of the study

1. To investigate whether Pranayama is more effective in the management of stuttering than the traditional prolongation technique when used in combination with it.

2. To study if the effect of Pranayama practices with prolongation when compared to prolongation alone as a treatment technique is maintained during the period after the termination of therapy.

3. To see if the severity of stuttering has any effect in the treatment out come with Pranayama.

CHAPTER II

REVIEW OF LITERATURE

Stuttering has attracted considerable interest for many centuries. Over a span of more than 2000 years many different ideas have been offered to explain its nature, cause and treatment. In spite of this, the disorder is still not very well understood (Wingate, 1976). Many theories have been proposed to explain the nature of stuttering.

"Stuttering is a baffling disorder for both clients and clinician. It is amazing that such an ancient universal and obvious human problem should defy precise description. Despite the countless scientific investigations the basic nature and cause of stuttering remain a mystery" (Emerick & Haffen, 1974). "Stuttering is primarily a puzzle, the pieces of which lie scattered on the tables of speech pathology, psychiatry, neurophysiology, genetics and many other disciples. At each of these tables workers have painstakingly managed to assemble a part of the puzzle, shouting "Eureka, while ignoring the pieces of their own or other tables which fail to fit" (Van Riper, 1971).

Wingate (1979) states that "most therapy methods have been developed on essentially empirical or pragmatic grounds. Many therapy methods exist independent of any particular theory".

Cause of stuttering

The history of stuttering, both theory and therapy, reflects a multi-dimensional problem that has repeatedly and successfully defied unidimensional solutions (Conture, 2001). Indeed the case histories of most people who stutter look very similar to those of people who don't stutter (Adams, 1993; Yairi, 1997). However, there would appear to be something that we might reasonably conclude about the causes of stuttering, given the large amount of research that has been conducted on this topic (Bloodstein, 1995). The more sources of theoretical input we receive, from as many different perspectives as possible, the greater the possibility that no relevant issue may be overlooked, although we can readily appreciate the sentiments of some (Smith & Webber,1988) that we may be suffering from a surfeit of perspectives relative to stuttering.

Certainly too many cooks spoil the broth status of stuttering theory and therapy makes for confusion for students in training, workers in the field, as well as the lay public. Disagreements for disagreement's sake are, to put it mildly, ludicrous. However it is only by offering different theories and therapies in the marketplace of ideas that the truth will emerge. Eventually, disagreements, not agreements, typically foster and encourage new insights into old problems and are part of the stuff from which progress is made.

History in stuttering therapy

Elridge and Rank (1968) state that the earliest known reference to stuttering dates back to about 2000 B.C. during the middle Egyptian dynasty. Greek and Roman references have been found. Many of them blamed malfunction of the tongue for the halts and distortions of the production. In the eighteenth century, Mendelssohn recommended slow rate. Erasmus Darwin proposed a system of easy attacks on articulated sounds and a number of authorities championed various rhythm techniques. Arnot, in the nineteenth century, advocated using a continuous "e" sound between each word and Hagerman suggested producing a continuous "n" before each syllable (Klingbeil, 1939). For a period of time intervention included surgery, popularized by the great German surgeon, Dieffenbach and many European surgeons busily transected muscles, removed wedges of lingual tissues and severed nerves. The popularity of these techniques in a pre-anesthesia and pre-antisepsis era waned rapidly as the post operative results failed to justify the pain and danger of the procedures. The metronomes apparent predecessor (muthonome) was used a century ago and many patented devices were developed, even to the extent of clamping silver tubes inside the mouth, metal plates across the palate and adjustable spring screws in leather collars that fit around the neck and put pressure on the larynx (Eldridge & Rank, 1968). Katz (1977) and Rieber (1977) describe a number of unusual devices used in the past, including one designed to keep the airway open even when the teeth were clenched and the tongue pressed against the roof of the mouth.

Over an extended time the treatment of stuttering has been varied. Methods have included holding pebbles in the mouth, blistering or deadening applications to the tongue, clenching teeth, speaking on inhalation, talking out of one side of the mouth, alternating hot and cold baths, sticking fingers in a light socket, eating raw

oysters and travelling to religious shrines (Gottlober, 1953). One can agree that, Van Riper (1971) was restrained when he observed that PWS have undergone "an almost incredible variety of treatments''. Ham (1986) lists more than two dozens of therapeutic techniques which are currently employed by speech therapists to treat PWS.

For stuttering treatment in particular, however a research-based or evidence-based orientation is only one of the prevailing orientations. Indeed stuttering might accurately be described as ahead of its time, not because of a widespread acceptance of EBP but because of widespread tension between research-based practice and tradition-based practice. Authors in EBP have discussed the recent development of tensions (Geyman, Deyo & Ramsey, 2000; Trinder, 2000), yet tension has been the norm for stuttering since at least the 1950s, when behavioral psychologists began investigating stuttering from a position and in a manner that were completely separate from the traditions that had by then already developed in the mainstream research and practice of speech language pathology in the United States (Martin & Siegal, 1966; Van Riper, 1973). The initial behavioral studies about reducing stuttering in children and adults (Martin & Berndt, 1970; Martin, Kuhl & Haroldson, 1972) and the very large literature that developed subsequently (Ingham, 1984) continue to function more as a source of interdisciplinary tension than as an evidence-base for practice, for many reasons (Ingham & Cordes, 1999).

a. Stuttering and Anxiety

Anxiety and its role in stuttering have been the source of considerable debate for generations for clinicians, especially for the psychologists. We can consider it in terms of cognition, behavior, physiology and related emotions. Definition is complex because of the interplay of the four areas just named and involvement of other states, such as fear, anger, excitement, sexual arousal and joy that overlap. Anger can function as a response and as a cause. Aspects of anxiety include phobias, obsessive-compulsive disorders and vague or generalized anxiety. State anxiety refers to concern, fear, anticipation and so on prior to and during a situation that is (or perceived to be) dangerous, threatening, embarrassing or otherwise negatively functional for the well being of the human organism. Trait anxiety is an ongoing functional state wherein the human organism perceives more threat and stress than

probably exists, is more susceptible to it when it occurs and reacts more strongly when under threat or stress (Speilberg, 1966, ‘72). Boland (1953) reported that PWS are higher in general (trait) and speech situations (state) anxiety than are PWNS.

Tension and associated neurological states tend to accompany anxiety. The autonomic and central nervous systems combine, primarily through limbic and reticular networks, to produce changes in the organism during stress. Respiration, heartbeat, vascular pressure, sweating, blood chemistry, muscle tonus and many other factors are changed by arousal states. Sherrard (1975) suggested that anxiety also changes the attention we pay to speech feedback (auditory, tactile and kinesthetic) increasing the tendency to correct errors, whereas Timmons and Bourdeu (1972) feel that anxiety may act as a catalyst in feed back disruptions.

The relationship between anxiety and stuttering is equivocal from both clinical and empirical perspectives. The study by Vinacour and Levin (2004) examined the relationship within the framework of the multi-dimensional interaction model of anxiety that includes an approach to general anxiety in specific situations. Ninety-four males aged 18-43, half disfluent speakers and half fluent speakers, completed two questionnaires: They used the Manual for the State-Trait Anxiety Inventory, a Self Evaluation Questionnaire (Spielberg, Gorsuch & Lushene, 1970) and the Speech Situation Checklist. In addition, after performing speech and non-speech tasks, participants evaluated their level of anxiety on a subjective scale labeled Task-Related Anxiety (TRA). The stuttering group was also evaluated for the level of severity of their stuttering. Findings indicated that trait anxiety was higher among people who stutter compared to fluent speakers, thus indicating that anxiety is a personality trait of people who stutter. State anxiety in social communication was higher among persons with severe stuttering as compared to persons with mild stuttering and fluent speakers. Thus, state anxiety is related to stuttering severity. The results are discussed in the frame of the multi-dimensional model of anxiety.

Alm (2004) provides a critical review of stuttering, emotion and heart rate during anticipatory anxiety. According to him persons who stutter often report that their stuttering is influenced by emotional reactions, yet the nature of such relation is still unclear. Psycho-physiological studies of stuttering have failed to find any major association between stuttering and the activity of the sympathetic nervous system. A

review of published studies of heart rate in relation to stressful speech situations indicate that adults who stutter tend to show a paradoxical reduction of heart rate compared to persons with no stuttering. Weber and Smith (1990) showed significant correlation between measures of sympathetic activity and speech dysfluency in person who stutter. Reduction of heart rate has also been observed in humans and mammals during anticipation of an unpleasant stimulus and is proposed to be an indication of anticipatory anxiety resulting in a "freezing response" with parasympathetic inhibition of the heart rate. It is suggested that speech-related anticipatory anxiety in persons who stutter is likely to be a secondary, conditioned reaction based on previous experiences of stuttering. A possible relation between the freezing point and stuttering was suggested by Peters and Guitar (1991). They proposed that the observed co-contractions of antagonistic muscles in the larynx and in articulatory structures in persons who stutter could be part of freezing response with the function of silencing vocal output. However, it is important to emphasize that emotional modulation of the severity of stuttering would not necessarily imply that emotional factors are the basic cause of stuttering. The main conclusions were that (a) anticipatory anxiety can result in co-activation of sympathetic and parasympathetic systems, with parasympathetic suppression of the heart rate; (b) many adults who stutter tend to react with anticipatory anxiety in stressful speech situation, with a relative decrease of heart rate; and (c) there are indications that this increase of anxiety usually is limited to speech-related situations and may reflect negative experiences of previous stuttering.

Anxiety has an effect on human performance, which is expressed in qualitative changes in performance and strong muscle activation (Denny & Smith, 1992; Peters, 1987; Stopol, 1954). Non-automatic actions that need attention can be harmed by anxiety (Hasher & Zacks, 1979). In the process of producing speech there are automatic factors such as semantic selection, syntax and phonology. However, the phonetic stage that plans articulation and the motor control are not automatic and require attention (Bock, 1982). All these factors can explain the relationship between anxiety and stuttering severity that was also found by Weber and Smith (1990).

b. Prolongation therapy

Prolongation may be applied to increase the duration of vowels and consonants within word boundaries or to function as a continuous phonation, where

word boundaries are reduced or eliminated. The techniques can be limited to the initial sounds or word or to all vowels in a word or include all consonants as well (by carrying over voicing from preceding sound. Vocal initiation time measures for PWS is slower than for PWNS (Metz, Conture & Caruso,1979) and that having to shift from non voicing to voicing in sound formation is positively related to stuttering (Adams & Reis, 1971). Stuttering also seems to occur more frequently after a pause (when voicing must be reinitiated) and when the sound initiating a word is followed by a voiced sound (Wall, Starkweather & Harris 1981). Prolongation tends to stabilize these variables to a greater degree, perhaps simplifying motor planning and switching.

Franck (1980) reported on a therapy program involving group instruction in prolongation with airflow and light consonant contact. The clients start at a 60-spm (syllables per minute) rate and progress in 30-spm increments. During three two hour sessions they are expected to reach 150 spm in conversational speech, also receiving practice in speech analysis and relaxation. Clients then move into groups of thirty and meet one and a half hours per week. They are allowed to continue for up to six months. The group sessions practice the five spm rates (60, 90, 120, 150 and 180), work on relaxation and perform varied speech activities. Those who are ready then move in, groups of fours, into a 60 hour, five day, intensive program with three clinicians per group to help. Starting at low spm rate, clients move through a rigorously demanding series of rate increases, where no disfluencies are allowed and self monitoring is stressed. Criteria are specific and applied strictly. The program according to the authors is very fatiguing to clinicians and requires staff availability, large therapy space and special equipment. However only 2% of the clients failed to complete the program.

The results of the prolongation therapy or the therapy utilizing prolongation have been variable. In comparison studies, Andrews (1974) reported that two years after dismissal PWS who received fluency reinforcement and prolongation training were maintaining better fluency than clients who received fluency reinforcement only. Frayne, Coates and Marriner (1977) used naïve listeners to judge ten PWS who had completed an Ingham and Andrew's type of program some six to eighteen months earlier. On the parameters used (rate, smoothness, hesitations and intonation), the listeners generally perceived PWS as normal speakers.

c. Stuttering and breathing

Sheehan in 1970 summarized a great many observations and research on respiration and seemed to accumulate the following information:

1. There is greater moment to moment variability in respiration in PWS during stuttering.
2. There is no coordination between thoracic and abdominal movements.
3. There is shallower breathing during troubled speech.
4. There is fixation of respiratory muscles during moments of stuttering.
5. There tend to be a sharp, rapid initial respiration.
6. There are stereotyped, prolonged inspiratory and expiratory patterns with shorter cycles superimposed as brief interruptions.
7. PWS vary among themselves, and there is no typical pattern, universal to all.

Murdoch, Killin and McCaul (1989) investigated the respiratory abilities of a group of seven PWS during performance of a variety of speech tasks by means of kinematic analysis carried out immediately prior to stuttering treatment, immediately following treatment and one month post treatment. Movements of the chest wall during both steady speech task (that is sustained vowels and syllable repetitions) and conversational speech were found to alter following treatment, the changes in respiratory function occurring in parallel to an improvement in stuttering. The majority of the PWS produced fewer abnormal movements of the chest wall following treatment. In addition, there was a tendency for the relative contribution of the abdomen to the reduction in lung volume during speech production to increase post treatment, possibly as a result of either a direct effect of the stuttering treatment employed or an indirect effect associated with a lower level of speech anxiety post treatment. Overall, the results suggest that the respiratory kinematic procedure is effective in monitoring of changes in respiratory patterns during speech production in the stuttering population. The potential of a kinematic technique as a biofeedback method to be used as an adjunct to traditional stuttering therapy procedures is highlighted.

The study by Denny and Smith (2000) examined whether PWS (N=10) differed from fluent speakers in relations between the neural control systems for speech and life support. They concluded that in some PWS the relations between respiratory controllers are atypical, but that high participation by the high frequency oscillation-producing circuitry in the brainstem during speech is not sufficient to disrupt fluency. MC-HFO (Maximum Coherence in the High Frequency Oscillations) is unique as an "index of a signature property" of the MRC (Metabolic Respiratory Controller) that may be non-invasively recorded in human subjects. An alternative approach to elucidating the role of respiratory control in stuttering is to test the hypothesis offered here: that some PWS may have MRCs that are unusually reactive to emotion and arousal, that they may also be less able to voluntarily control respiration for rapid rhythmic tasks and that such voluntary control will be voluntarily susceptible to the effects of heightened arousal. PWS, who appear from such tests to be at the extremes (high or low) of risk for respiratory related fluency breakdown, could then be tested for MC-HFO during speech breathing. If those previously identified as at risk for respiratory disruption showed relatively high MC-HFO during speech, the hypothesis that inappropriate contributions from the MRC contribute to stuttering would be further supported. The authors conclude that the relation between respiratory controls is atypical but the high participation by the HFO producing circuitry in the brainstem during speech is not sufficient to disrupt fluency.

Participants of stuttering treatment programs provide an opportunity to evaluate varying levels of fluency. Identifying physiologic correlates of altered fluency levels may lead to insights about mechanisms of speech disfluency. The study by Tasko, McClean and Runyan (2007) examined respiratory, orofacial, kinematic and acoustic measures in 35 PWS prior to and as they were completing a 1-month intensive stuttering treatment program. Participants showed a marked reduction in stuttering severity as they completed the treatment program. Coincident with reduced stuttering severity, participants increased the amplitude and duration of speech breaths, reduced rate of lung volume change during inspiration, reduced amplitude and speed of lip movements early in the test utterance, increased lip and jaw movement durations and reduced syllable rate. A multiple regression model that included two respiratory measures and one orofacial kinematic measure accounted for 62% of the variance in changes in stuttering severity. Finally, there was a weak but

significant tendency for speech of participants with the largest reductions in stuttering severity to be rated as more unnatural as they completed the treatment program.

(i) Respiration therapy

Gronhovd (1977) approached stuttering control through the management of Breathing, Rate, Airflow and Tension (BRAT). The client first was taught deep muscle relaxation while supine. Therapy went on to voiceless sigh vocalized sigh and counting progressively. During counting the client concentrated on maintaining

1. a smooth, moderately deep inhalation and a smooth, easy exhalation.
2. slow rate
3. uninterrupted airflow
4. relaxed state without excess tension
5. an easy glottal attack with a breathy voice
6. easy automatic production

The client then would move from counting to short responses and finally progress to monologues. Physical position now became semi-reclining and the cycle was repeated. The cycle was repeated again in the sitting position. Rate was increased from one to two syllables per second and work on quality, intonation and stress was added.

(ii) Regulated breathing

The regulated breathing approach (Azrin & Nunn, 1974) is based on earlier work of nervous habit elimination with fourteen PWS. In one two-hour session, PWS are brought through an extensive sequence. They are asked to remember and discuss the history and development of their stuttering, recalling and verbalizing unpleasant experiences. Stuttering behaviors are analyzed and an effort is made to develop awareness of stuttering. Also, a fear hierarchy that includes words and persons as well as situations, is developed to clarify precipitating factors in stuttering. Basic relaxation training is covered in various postures including self instruction. In speech control the PWS is taught when stuttering occurs or is anticipated, to stop, exhale deeply and slowly, inhale while consciously relaxing and consciously formulate the word to be spoken. The word should be uttered as soon as inhalation is complete, with

an emphatic delivery on the first syllable that carries over into the next few words. Initial efforts should be brief; expanding as practice improves ability. Desensitization is attempted through symbolic rehearsal and visualization of unpleasant situations while attempting relaxation. The new breathing pattern starts with reading, where the client has to pause, relax and breathe after every word. When this can be done consistently, the pause is shifted to every other word, then to every third word and so on. When necessary, cancellation can be used by saying the word a second time. The clinician works with the client to setup a careful plan for transfer and maintenance. Reminders, environmental familiars, finding new situation for speaking, seeking out feared situations and reports to the clinicians are among the methods used, along with telephone checks. Azrin and Nunn reported stuttering decrement in 90 to 99 percent range for a period of four months following the in-clinic procedures. They stated that the treatment, requiring a great deal of effort and motivation from the client was effective either for severe or for mild PWS. They felt that their approach would be more effective clinically than the programs in use at that time.

(iii) Airflow therapy

Schwartz's (1974) airflow therapy or passive airflow has received a disproportionate amount of attention for a procedure that involves very little that has not been practiced for several centuries. He insisted that stuttering is caused by and centered in the larynx and that the posterior cricoarytenoid muscle and an inhibited airway dialation reflex explain moments of stuttering. Schwartz (1974) suggested that stuttering basically is a strong ill-timed contraction of the posterior crico arytenoids (PCA) muscle as a result of sub glottal air pressure. He concluded that there is an Airway Dialation Reflex (ADR) along the length of the respiratory passage. In stuttering there is an inappropriate reflex response to stress where the ADR triggers a strong adduction response (laryngospasm). These stress reactions depend on seven categories of anxiety or stress stimuli – situation, sound or word, authority figures, uncertainty, physical factors, external influences and rapid rate (probably the most important). In his therapy Schwartz recommended five days of work (eight hours per day). The client practices daily for the next year in four fifteen minute periods. One minute of each solo session (twenty – eight minutes per week) is recorded on a cassette and mailed to the clinic for evaluation and feedback. A telephone 'hotline"

number is provided and recommendations for maintenance are discussed with the client. In therapy, the client seems to be asked to emit a prolonged, relaxed, audible sigh (passive sigh). This is produced immediately following inhalation so there is no intervening "set' or transition period between inhalation and exhalation. Then the client midway in the passive sigh, 'releases' a one syllable word without any interruption, change in tension or other alterations in the passive ongoing flow of air. Articulators are not present and should move into position during the airflow. The number of one syllable words is increased progressively on each breath and then turned into sentences. Syllables should be slowed (prolonged). Acquisition, then, is practice, error correction and private sessions described earlier.

Nathan, Robert and Sharmon (1974) investigated the regulated breathing method for controlling stuttering compared to a placebo-control method consisting of abbreviated de-sensitization training. The regulated breathing procedure, given to 21 PWS taught the speaker to breathe smoothly and deeply, to pause at natural juncturing points, to plan ahead for the content of the speech and to relax chest and neck muscles. Several general behavioral procedures were also used including relaxation training, self-correction for errors, social support, daily home practice and response awareness which are components of the general habit reversal procedure for diverse habits. Training was given in one or two sessions plus regular follow-up telephone calls. Daily self-recordings were obtained of the number of stuttering episodes during everyday speech, to determine the generalized effect of the treatment. The regulated breathing method reduced the reported stuttering episodes by 94% on the first day after training and by 97% during the fourth week and the three-month follow-up. The control procedure reduced reported stuttering only slightly (about 10%). The results indicate substantial effectiveness of the regulated-breathing method for reducing reported stuttering episodes in everyday speech as compared with an alternative treatment of equal duration.

Woods, Twohig, Fuqua and Hanley (2000) have reviewed Azrin and Nunn's (1974) Regulated Breathing treatment for stuttering and evaluated studies investigating the original procedure and its variations. This review demonstrates that both the original and simplified procedures reduce stuttering and increase speech rate. In addition to discussing the efficacy of the original procedure and simplifications, the

efficacy of regulated breathing was also compared to that of other treatments common in speech-language pathology. The regulated-breathing method reduced the reported stuttering episodes by 94% on the first day after training and by 97% during the fourth week and the three-month follow-up. The control procedure reduced the reported stuttering only slightly (about 10%). The results indicate substantial effectiveness of the regulated-breathing method for reducing reported stuttering episodes in everyday speech as compared with an alternative treatment of equal duration (Azrin, Nunn & Frantz, 1979). Very effective programs have been designed and developed to achieve this goal of developing self-control over anxiety (Craig, 1998). These include: learning how to control physical anxiety and tension associated with speech fears (towards relaxed speech), learning how to control anxious thoughts and feelings associated with stuttering (changing the way you think and talk), learning how to control anxiety through strengthening social skills and assertiveness (becoming a socially skilled speaker).

Furthermore, regulated breathing is more efficient than other successful treatment for stuttering. One of the treatment components of this includes relaxation training which emphasizes on assuming a relaxed posture with diaphragmatic breathing (slow, rhythmic and deep breathing - Watson & Skinner, 2004). According to Robert, Isabelle, Clude, Stella & Magli (1981) sixteen adult PWS were randomly assigned to one of two groups: awareness training plus regulated-breathing or Azrin and Nunn's regulated-breathing method only. Awareness training significantly reduced stuttering compared to the control procedure. But the most significant improvement appeared after introduction of the regulated-breathing method.

d. Yoga as a treatment modality for reduction of stress

Yoga is a practical discipline incorporating a wide variety of practices whose goal is the development of a state of mental and physical health, well-being, inner harmony and ultimately “a union of the human individual with the universal and transcendent existence”. These practices are believed to have originated in early civilization on the Indian subcontinent and have been practiced historically in India and throughout East Asia. Yoga techniques include the practice of meditation, regulation of respiration with a variety of breathing exercises and the practice of a number of physical exercises and postures in which the focus is more on isometric

exercise and stretching than on aerobic fitness. A general feature of these practices is their capability of inducing a coordinated psycho-physiological response, which is the antithesis of the stress response. This “Relaxation response” consists of a generalized reduction in both cognitive and somatic arousal as observed in the modified activity of the hypothalamic pituitary axis and the autonomic nervous system. There is no single standardized yoga practice format, nor is this likely or necessarily desirable in the future. Application of the interventions is equally varied, from individual practice to group sessions, from daily practice sessions to weekly sessions and from short duration to long duration sessions (Khalsa, 2004).

According to Khalsa (2004), although yoga is historically a spiritual discipline, it has also been used clinically as a therapeutic intervention. A bibliometric analysis on the biomedical journal literature involving research on the clinical application of yoga has revealed an increase in publication frequency over the past 3 decades with a substantial and growing use of randomized controlled trials. Types of medical conditions have included psycho-pathological (e.g., depression, anxiety), cardiovascular (e.g. hyper-tension, heart disease), respiratory (e.g. asthma), diabetes and a variety of others. A majority of this research has been conducted by Indian investigators and published in Indian journals, particularly yoga specialty journals, although recent trends indicate increasing contributions from investigators in the U.S. and England. Yoga therapy is a relatively novel and emerging clinical discipline within the broad category of mind-body medicine, whose growth is consistent with the burgeoning popularity of yoga in the West and the increasing worldwide use of alternative medicine.

Considerable evidence exists for the place of mind body medicine in the treatment of anxiety disorders. Excessive anxiety is maladaptive. It is often considered to be the major component of unhealthy lifestyle that contributes significantly to the pathogenesis of not only psychiatric but also many other systemic disorders. Among the approaches to reduce the level of anxiety has been the search for healthy lifestyles. The aim of the study done by Gupta, Khera, Vempati, Sharma and Bijlani (2006) was to study the short-term impact of a comprehensive but brief lifestyle intervention, based on yoga, on anxiety levels in normal and diseased subjects. The subjects had history of hypertension, coronary artery disease, diabetes mellitus, obesity, psychiatric disorders (depression, anxiety and stress),

gastrointestinal problems (non ulcer dyspepsia, duodenal ulcers, irritable bowel disease, Crohn's disease, chronic constipation) and thyroid disorders (hyperthyroidism and hypothyroidism). The intervention consisted of asanas, Pranayama, relaxation techniques, group support, individualized advice and lectures and films on philosophy of yoga, the place of yoga in daily life, meditation, stress management, nutrition and knowledge about the illness. The outcome measures were anxiety scores, taken on the first and last day of the course. Anxiety scores, both state and trait anxiety were significantly reduced. Among the diseased subjects significant improvement was seen in the anxiety levels of patients with hypertension, coronary artery disease, obesity, cervical spondylitis and those with psychiatric disorders. The observations suggest that a short educational program for lifestyle modification and stress management leads to remarkable reduction in the anxiety scores within a period of 10 days.

The objective of the study by Smith, Hancock, Blake-Mortimer, Eckert (2007) was to compare yoga and relaxation as treatment modalities at 10 and 16 weeks from study baseline to determine if either of modality reduces stress, anxiety, blood pressure and improve quality of life. A randomized comparative trial was undertaken comparing yoga with relaxation. One hundred and thirty-one subjects with mild to moderate levels of stress were recruited from the community in South Australia. They used ten weekly 1-hour sessions of relaxation or Hatha Yoga. Changes in the State-Trait Personality Inventory sub-scale of anxiety, General Health Questionnaire and the Short Form-36 (SF-36) were observed. The SF-36 is a multi-purpose, short-form health survey with only 36 questions. It yields an 8-scale profile of functional health and well-being scores as well as psychometrically-based physical and mental health summary measures and a preference-based health utility index. Following the 10 week intervention, stress, anxiety and quality of life scores improved over time. Yoga was found to be as effective as relaxation in reducing stress, anxiety and improving health status on seven domains of the SF-36. The results showed that Yoga was more effective than relaxation in improving mental health. At the end of the 6 week follow-up period there were no differences between groups in levels of stress, anxiety and on five domains of the SF-36. Vitality, social function and mental health scores on the SF-36 were higher in the relaxation group during the follow-up period. The

conclusion of the study was that Yoga appears to provide a comparable improvement in stress, anxiety and health status compared to relaxation.

e. Yogic slow breathing practice (Pranayama) for stress control

Understanding and application of various respiratory practices is impeded by the many interacting physiological and psychological variables. Yoga techniques may offer insights into useful breathing practices and control of important variables. Kennedy (1990) in his study integrated relevant data from (a) the psycho-physiological/psychological literature, (b) the physiological/medical literature and (c) studies of yoga. The available data indicate that yogic slow breathing practices promote dominance of the parasympathetic system, can help control stress and can contribute to treatment programs for some chronic diseases. Basic research is needed on yogic rapid breathing and alternate nostril breathing techniques. Yogic claims about nasal airflow laterality and cognitive laterality have partial support. Psychological factors such as anxiety and distraction, as well as the physical details of breathing techniques are important variables in psycho physiological research on respiratory practices.

Deshpande (2006) in association with Louisville Pranayama Group (LPG) studied the effect of Pranayama on health benefits. A group of nineteen Louisville area residents volunteered for the study, who practiced Pranayama for three months. The selected health parameters were measured in a pathology laboratory. Eighteen of nineteen participants reported one or more of these benefits: a sense of calm, higher energy levels and increased stamina. Participants, who had problems with sleep, control over bowel movements, constipation, hyperactivity and snoring reported substantial improvement. Cholesterol and fasting sugar levels of a couple of participants had come down from higher than the upper limit of normal to lower than the same limit. General laboratory results indicated that not all individuals had benefited to the same extent. This is to be expected given the nonlinear nature of the human system. The benefits of Pranayama are very significant and it improves health. However who will derive which benefit and to what extent is unfortunately not predictable given the nonlinear nature of human system with each having their own unique natural variability and how they have evolved from birth to current age. That

said, judging by the mechanics of how these exercises are done gives reason for hope that a lot of ailments might be curable with Pranayama.

Stressed and tense individuals often are recommended to change the way they breathe. However, psycho-physiological effects of breathing instructions on respiration are rarely measured. Conrad, Muller, Doberenz, Kim, Meuret, Wollburg and Roth (2007) tested the immediate effects of short and simple breathing instructions in 13 people seeking treatment for panic disorder, 15 people complaining of daily tension and 15 controls. Participants underwent a 3-hour laboratory session during which instructions to direct attention to breathing and anti-hyperventilation instructions to breathe more slowly, shallowly, or both were given. Respiratory, cardiac and electro-dermal measures were recorded. The anti-hyperventilation instructions failed to raise end-tidal pCO_2 above initial baseline levels for any of the groups because changes in respiratory rate were compensated for by changes in tidal volume and vice versa. Paying attention to breathing significantly reduced respiratory rate and decreased tidal volume instability compared to the other instructions. Shallow breathing made all groups more anxious than did other instructions. Heart rate and skin conductance were not differentially affected by instructions. They concluded that simple and short instructions to alter breathing do not change respiratory or autonomic measures in the direction of relaxation, except for attention to breathing, which increases respiratory stability. To understand the results of breathing instructions for stress and anxiety management, respiration needs to be monitored physiologically.

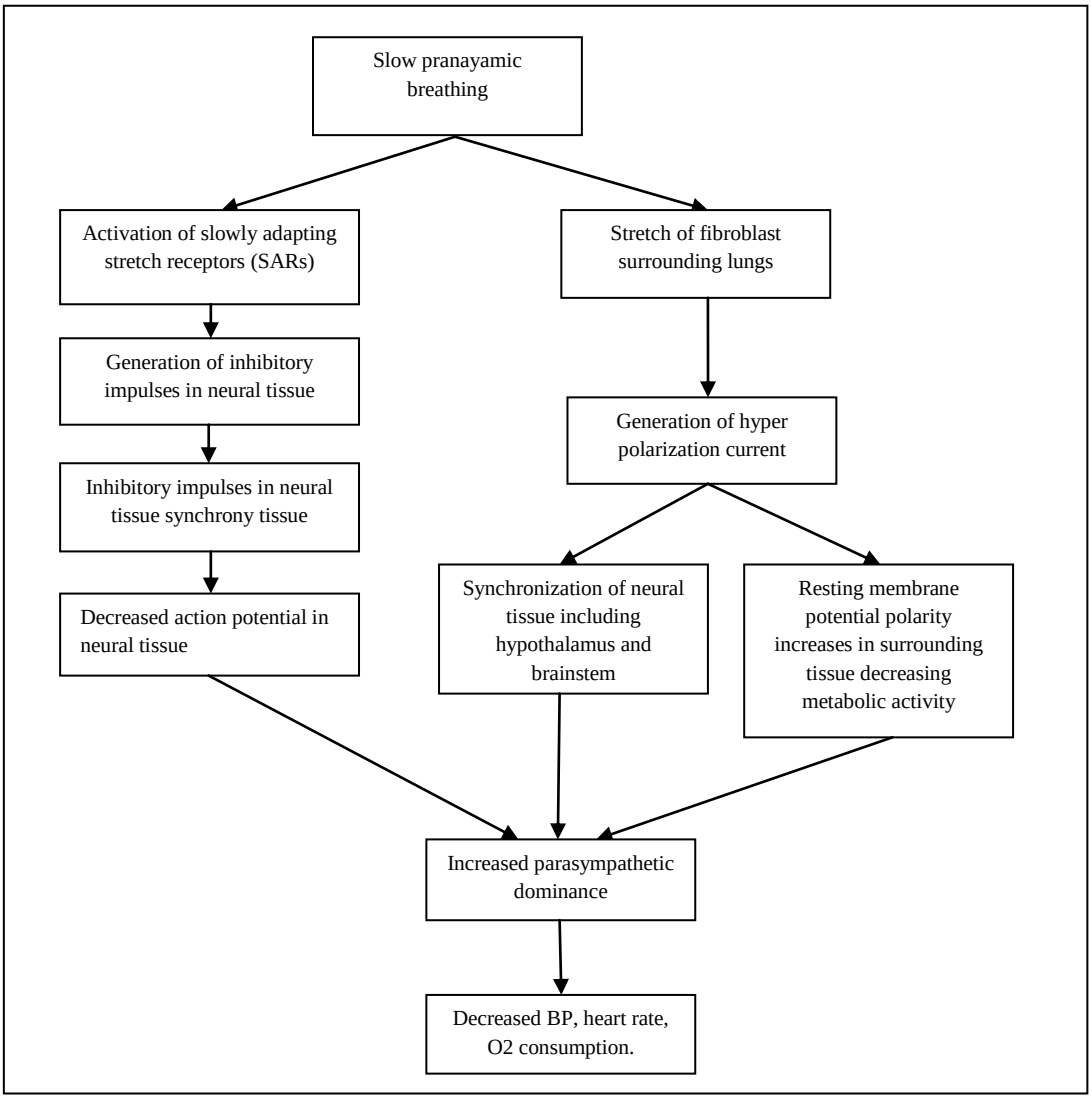

Figure 1: Physiology of long Pranayamic breathing: Neural Respiratory elements may provide a mechanism that explains how slow deep breathing shifts the autonomic nervous system.
(Reference: Jerath, R., Edry, J .W, Barnes, V. A. & Jerath, V., 2006, *Medical Hypothesis* www.science direct .com.)

According to Jerath, Edry, Barnes and Jerath (2006), Pranayamic breathing, defined as a manipulation of breath movement, has been shown to contribute to a physiologic response characterized by the presence of decreased oxygen consumption, decreased heart rate and decreased blood pressure, as well as increased theta wave amplitude in EEG recordings, increased parasympathetic activity accompanied by the experience of alertness and reinvigoration. The mechanism of how pranayamic breathing interacts with the nervous system affecting metabolism and autonomic

functions remains to be clearly understood. It is the authors' hypothesis that voluntary slow deep breathing functionally resets the autonomic nervous system through stretch induced inhibitory signals and hyper polarization currents propagated through both neural and non-neural tissue which synchronizes neural elements in the heart, lungs, limbic system and cortex. During inspiration, stretching of lung tissue produces inhibitory signals by action of slowly adapting stretch receptors (SARs) and hyper polarization current by action of fibroblasts. Both inhibitory impulses and hyper polarization current are known to synchronize neural elements leading to the modulation of the nervous system and decreased metabolic activity indicative of the parasympathetic state. The authors propose Pranayama's physiologic mechanism through a cellular and systems level perspective, involving both neural and non-neural elements. This theoretical description provides a common physiological mechanism underlying Pranayama and elucidates the role of the respiratory and cardiovascular system on modulating the autonomic nervous system. Along with facilitating the design of clinical breathing techniques for the treatment of autonomic nervous system and other disorders, slow pranayamic breathing generates inhibitory signals and hyperpolarizing current within neural and non-neural tissue by mechanically stretching tissues during breath inhalation and retention. It is likely that inhibitory impulses in cooperation with hyper polarization current initiates the synchronization of neural elements in the central nervous system, peripheral nervous system and surrounding tissues ultimately causing shifts in the autonomic balance towards parasympathetic dominance (Figure 1). Further experimental research of the cooperative cellular mechanisms of Pranayama is needed to confirm this theory.

The study by Telles and Desiraju (1991) was conducted to determine whether the yogic Ujjayi pranayamic type of breathing that involves sensory awareness and consciously controlled, extremely slow-rate breathing including at least a period of end-inspiration breath holding in each respiratory cycle would alter oxygen consumption or not. Ten males with long standing experience in Pranayama and volunteering to participate in the laboratory study were assessed. These subjects aged 28-59 years had normal health appropriate to their age. Since Kumbhak (timed breath holding) is considered as an important phase of the respiratory cycle in the Pranayama, they were categorized into two groups of five each, one group practicing the short Kumbhak varieties of Pranayama and the other the long Kumbhak varieties

of Pranayama. The duration of Kumbhak phase was on an average 22.2 percent of the respiratory cycle in the short Kumbhak group and 50.4 percent in the long Kumbhak group. The oxygen consumption was measured in test sessions using the closed circuit method of breathing oxygen through the Benedict-Roth Spiro meter. Each subject was tested in several repeat sessions. Values of oxygen consumption of the period of Pranayamic breathing and of post-pranayamic breathing period were compared to control value of oxygen consumption of the pre-pranayamic breathing period of each test session. The results revealed that the short Kumbhak Pranayamic breathing caused a statistically significant increase (52%) in the oxygen consumption (and metabolic rate) compared to the pre-pranayamic base-line period of breathing. In contrast to the above, the long Kumbhak Pranayamic breathing caused a statistically significant lowering (19%) of the oxygen consumption and metabolic rate.

According to Subbalakshmi, Saxena, Urmimala and D'Souza (2005), practice of Pranayama has been known to modulate cardiac autonomic status with an improvement in cardio-respiratory functions. Keeping this in view they designed the study to determine whether Nadi-shodana Pranayama practice for 20 minutes has any immediate effect on heart rate, systolic and diastolic blood pressure, peak expiratory flow rate, and simple problem solving ability. Ten normal healthy subjects of first year physiotherapy course volunteered for this study. They were aged between 17-20 years. Among them, five were females and five were males. They did not have any previous training in Pranayama. They were highly motivated to participate in this study program. Study procedures were done separately for each subject at the same time of the day between 4-5 PM. All the selected physiological parameters were measured before and after performing 'Nadi-shodhana Pranayam'. Two sets of controls were used in the matched subjects by allowing them to relax in a couch (A) or close their eyes with quiet breathing for 20 minutes. Following Nadi-shodhana Pranayama of 20 minutes, a significant decline in basal heart rate and systolic blood pressure was observed. Peak expiratory flow rate was significantly improved and the time taken for simple problem solving was significantly less following Pranayama practice. In contrast, both control subjects did not show any significant change in respiratory and cardiovascular parameters with 20 minutes practice. The study suggests that the 'Nadi-shodhana Pranayama' rapidly alters cardio-pulmonary responses and improves simple problem solving.

Stuttering as a speech disorder has been documented and treated in India since Vedic times (5000 BC-200 BC). Texts of Ayurveda (the ancient system of Indian medicine) contain references to medicines and yogic practices that help persons who stutter. Ancient Yoga practices as they apply to stuttering should be investigated too. Yoga has been practiced in India for thousands of years for better control of mind and body. Yoga aims to improve people's inner tranquility and free them from fears and anxieties. Since it is known that stuttering includes an element of anxiety and fear, Yoga can help reduce this. Pranayama, one of the Yoga techniques, focuses on regulating breathing. Whether fluency can be improved with slow and controlled breathing, as Pranayama teaches, should be scientifically tested.

Yoga and Pranayama have been practiced by many people including PWS, because of its wide applicability, be it in terms of general health or for specific health disorders. Also tremendous research is being carried out in the field of yoga. Considering the very many benefits of the ancient practice of Pranayama, its applicability in the field of stuttering needs to be investigated. There are no studies on the application of Pranayama as a treatment technique for stuttering. Hence this study attempts to find the effect of Pranayama in the management of stuttering.

The classical means for determining the value of a component of therapy is to include it in experimental treatment and compare the outcome with that produced by treatment without the component. Thus, a treatment encompassing the traditional practice of Pranayama is to be determined to find its effectiveness as a treatment component in the treatment of stuttering.

CHAPTER III

METHOD

Now that the tools for influencing the mind positively have assumed extensive application in a wide variety of illnesses, it is important to examine their efficacy. The present study aimed at evaluating the changes seen in stuttering in a group of PWS while completing a comprehensive but brief and simple Pranayama program along with prolongation (experimental group) as against a group which follow the traditional prolongation technique (control group).

A**. Subject selection criteria**:

The subjects were divided into two groups

Table 1: *Subjects distributed in the two groups*

	Group A	Group B
Number	5	4
Age (in years)	18 - 30	18 - 30
Gender	Males	Males
Severity	Moderate - Severe	Moderate - Severe

Group A (Experimental Group) – consisted of 5 persons with stuttering (PWS) who were males, trained with Pranayama as treatment program along with the prolongation treatment program.

Group B (Control Group) - consisting of 4 persons with stuttering (PWS) who were males, trained with only prolongation treatment. (Table 1)

Inclusion criteria

- The subjects should not have undergone speech therapy in the past or should have had a relapse after treatment, exhibiting more than moderate degree stuttering at the time of enrollment.
- They should not be practitioners of Yoga.

- All the participants of the study have to be diagnosed by qualified speech language pathologist as having moderate to severe stuttering, based on SSI.

B. Instrumentation/Materials:

The following materials were used for the study:

1. Stuttering severity instrument (SSI) developed by Glydon D. Riley (1972).
2. MP3 player (INVION-QBP38-IUS)
3. Treatment efficacy scale for fluency disorders (self rating) by Geetha, Sangeetha & Anjana (2007)– see appendix 1
4. Situational assessment checklist for PWS (self rating) – see appendix 2
5. RMS Helios 501(Recorders and Medicare Systems)
6. 300 word passage for reading in Kannada (Jayaram & Savithri, 1985). It incorporates all the phonemes in Kannada, with their respective frequency of occurrence
7. Set of questions for conversation included the following:

    - What is your name?
    - Which is your native place?
    - How old are you?
    - What are you doing?
    - What is your problem?

8. Specific topics given for obtaining narrative samples.

C. Procedure:

All the subjects were evaluated individually using the above tests during pre therapy, immediately after therapy and during one month post therapy follow up. Subject's written consent was taken before starting the program, after briefing about the technique adopted.

1. Perceptual assessment:

Subject's reading, spontaneous speech and conversation were recorded using an MP3 player. The recordings were subjected to offline perceptual analyses to rate the severity of dysflency. The reading sample of 300 word passage, monologue and conversation sample was recorded. Treatment efficacy scale for fluency disorders was used to find the efficacy of treatment. This is an unpublished project titled "Treatment efficacy and variables for stuttering management" (Geetha, Sangeetha & Anjana, 2007). This is a self report assessment procedure which included separate measures of frequency of stuttering, duration, secondary behaviors, confidence, avoidance behaviors, anxiety features, attitudinal changes, naturalness of speaking, listeners reaction, satisfaction with treatment, self monitoring skills, feeling about generalization and maintenance of fluency. A 5-point descriptive scale is used to allow the subject to show how often or how much each of the aspects apply. Situational assessment checklist for PWS was also employed which again the subjects had to rate on a five point scale (given in appendix 2). Subjects were assessed at the beginning (day 1), at the end (day 12) of the intervention and one month follow up after the 12 day treatment period.

The recorded speech samples of the subjects were subjected to perceptual rating by 5 qualified SLPs on a 3- point scale (3-good, 2-average and 1- poor). This rating was done for the parameters rate of speech, continuity, effort, stress and articulation. The post therapy speech samples of experimental and control group were randomized and given to five judges for perceptual evaluation and rating. This was to check the inter judge reliability in terms of therapy outcomes using the two techniques.

2. Aerodynamic measurements

Respiratory measurements included the measurement using RMS Helios 501(Recorders and Medicare Systems) - a window based program. The parameters recorded included, slow vital capacity (SVC) and maximum voluntary ventilation (MVV). SVC is the maximum volume of air that can be exhaled slowly after slow maximum inhalation, measured in liters. MVV is a measure of

the maximum amount of air that can be inhaled and exhaled in one minute and it is measured in liters/minute.

D. Therapy Program

a. Experimental Group

The treatment program consisted of an integrated package comprising teaching sessions and practice sessions using prolongation technique with Pranayama. It was administered in the form of a 12–day outpatient course, 45 minutes each day, spread over a period of four weeks, being interrupted by a 2–day weekend break. The course was given to a group of 5 patients individually who were randomly assigned to the experimental group.

A written consent was taken from the subjects willing to take part in the program. The patients were given a handout on Pranayama to reinforce what was discussed in the session regarding the practice and the nature of Pranayama. The subjects in the control group were provided with a write up on prolongation technique.

The Pranayamas taught included Vibhagiya Pranayama and Nadisuddi.

A detailed description of the Pranayamas is given below:

1. **Vibhagiya svasana (sectional breathing)**: This is a preparatory breathing practice for Pranayama. It corrects the wrong breathing pattern and increases the vital capacity of the lungs. It has four sections: It has 4 steps; each practiced 5 times in each session.
   a. **Abdominal (diaphragmatic) breathing**: Subjects were instructed to inhale deeply, slowly and continuously, noticing the abdomen bulging out and on exhalation, the abdomen drawn inward continuously and slowly.
   b. **Thoracic breathing**: Here the thorax is drawn inward and outward on exhalation and inhalation. Movements of the abdomen have to be avoided.
   c. **Clavicular breathing**: Here the shoulders are raised up and back on inhalation and released on exhalation. Movements of chest and abdomen have to be avoided.

d. Full yogic breathing: It is a combination of all the three sections of the sectional breathing practice. The inhalation and exhalation occur in the sequence of abdominal, thoracic and calvicular patterns.

2. Nadisuddi Pranayama: Practice involves six steps of Nadisuddi Pranayama which is repeated 9 times: (i). Closing the right nostril with the right thumb and exhaling completely through the (left) nostril (ii). Inhaling deeply through the same left nostril. (iii). Closing the left nostril with ring and little finger and releasing the right nostril (iv). Exhaling slowly and completely through the right nostril (v).Inhaling deeply through the same (right) nostril (vi). Closing the right nostril and exhaling through the left nostril.

The session involved practice for each of reading, conversation and monologue for the control group using the prolongation technique and for the experimental group, the session was divided to encompass Pranayamas before each of the activity. The session concluded with nadanusandana, which can be attributed to a vocal exercise. Nadanusandana encompassed the phonation of /a/, /u/ and /m/.

Therapy was scheduled for forty five minutes, thrice a week for 12 sessions spread over a period of 4 weeks. Subjects were treated individually. The teaching period of Pranayama to the experimental group required a period of three hours. This teaching was done using the "eight step method of teaching" in Yoga. This is generally the method considered while teaching Yoga to a group of individuals. The steps of this method have been appropriately adapted for teaching to an individual while the below described method is devised for teaching to a group.

1. Introducing to the name: introducing to the formal name of the Pranayama.
2. Demonstration: the clinician demonstrates how to do the Pranayama when the client will have to observe.
3. Explanation of benefits and limitations: the benefits of doing the Pranayama will be told and also they will be told regarding the conditions when not to do the Pranayama.

4. Practice by a group and its observation by the other group and vice versa.
5. Practice by both the groups (in a set-a set contains two groups and several sets are present).
6. Question and answer session: here the clients could come up with questions and discuss.
7. Highlighting the key points: the main points to be remembered will be highlighted
8. Practice by all the sets

b. Control Group

The treatment program comprised of teaching sessions and practice sessions using prolongation technique. It was administered in the form of a 12–day outpatient course, 45 minutes each day, spread over a period of four weeks, being interrupted by a 2–day weekend break. The course was given to a group of 4 patients individually who were randomly assigned to the control group.

The subjects were provided with a write up on prolongation technique. Prolongation technique was started initially with prolongation of initial syllable of the word when stuttered or when anticipated to stutter. Then generalization was done with monitoring and then moving on to generalization without monitoring.

The session timing was divided as follows. It was divided into three levels in each session. Therapy was recommended three days a week and practice of 45 minutes at home on all the days of week. There was an assessment after 12 sessions that was immediately after termination of therapy. A reassessment after one month after termination of treatment program also was implemented to ensure maintenance of the therapeutic benefits if any. Messages were sent to the client and phone calls made as reminders for the clients to practice during the one month break.

The various levels in which the time was evenly distributed to comprise the various activities of reading, conversation and monologue using the prolongation technique is mentioned in the control group which was followed every session and the various steps through which the client had to progress is also given. For the

experimental group also the various levels in which time was evenly distributed to encompass the Pranayama along with the activities of reading, conversation and monologue are mentioned.

Therapy procedure for the control group and experimental group

Control Group

Level 1: 15 minutes-reading

Level 2:15 minutes-conversation

Level 3:15 minutes-monologue

The prolongation technique:

Step 1: prolongation of all the syllables

Step 2: prolongation of initial syllable of the word when stuttered or when anticipated to stutter.

Step3: generalization with monitoring

Step 4: generalization without monitoring

Experimental Group

Level 1: time period of 14 minutes

Sectional breathing (5 rounds) – 5 minutes and reading - 9 minutes = total 14 minutes

Level 2: time period of 14 minutes

Nadisuddi (9 rounds) - 5minutes and conversation - 9 minutes = total 14 minutes

Level 3: time period of 14 minutes

Nadisuddi (9 rounds) - 5 minutes and monologue - 9 minutes = total 14 minutes

3 minutes –vocal exercise by phonation of /a/, /u /and /m/. The treatment involved the prolongation technique on various tasks after the breathing exercise. The steps of the control group were incorporated in the experimental group.

CHAPTER IV

RESULTS AND DISCUSSION

The present study was aimed at finding difference if any was present in the therapy programs using prolonged speech which constituted the control group when compared to prolonged speech in combination with Pranayama which constituted the experimental group in the treatment of stuttering. The study also aimed at answering the research question related to the long term effect of the treatment program. The two groups of PWS who underwent treatment were assessed based on Stuttering Severity Instrument (SSI), Treatment efficacy scale for fluency disorders, Situational assessment checklist for stuttering, perceptual evaluation by judges and aerodynamic evaluations before therapy (PT), post therapy (PoT) & FU (1 month post therapy follow up). Results of these assessments are discussed under different headings below.

I. Perceptual assessment:

a. Stuttering severity instrument (SSI):

Subject's reading, spontaneous speech and conversation were recorded using an MP3 player. The recordings were subjected to offline perceptual analyses to rate the severity of dysflency on SSI. All the subjects in the experimental & control groups were assessed on SSI during pre therapy; post therapy & 1 month follow up after therapy. Since the sample size was small in each group, a non-parametric test, Mann-Whitney U test was used to analyze. Mann-Whitney U test showed no significant difference between the groups in all parameters at 0.05 level of significance. Further, Friedman test was done to find if a significant difference existed between conditions and if there was any significant difference, Wilcoxons signed rank test was used to find the pairs of conditions for which there was significant difference within the group.

As seen in Table 2, in the pre therapy condition, 80% of PWS in the experimental group had moderate stuttering, 20% had severe stuttering. In the control group, 75% had moderate stuttering and 25% had severe stuttering. In the post therapy condition, 60% of PWS in experimental group had very mild stuttering and 40% had mild stuttering. In the control group, 50% of the PWS had very mild stuttering and 50% of PWS had moderate stuttering. In the one month post therapy condition, 60%

had very mild stuttering and 40% had mild stuttering in the experimental group. In the control group, 25% had very mild stuttering, 25% had moderate stuttering and 50% had mild stuttering.

Table 2: *The severity of disfluencies*

Groups	Pre therapy		Post therapy		FU	
	SSI Score	Severity	SSI Score	Severity	SSI Score	Severity
E - 1	24.00	Moderate	16.00	Very mild	13.00	Very mild
E - 2	22.00	Moderate	14.00	Very mild	18.00	Mild
E - 3	22.00	Moderate	10.00	Very mild	12.00	Very Mild
E - 4	37.00	Very Severe	21.00	Mild	21.00	Mild
E - 5	27.00	Moderate	19.00	Mild	13.00	Very Mild
C - 1	23.00	Moderate	6.00	Very mild	8.00	Very Mild
C - 2	26.00	Moderate	13.00	Very mild	17.00	Mild
C - 3	33.00	Severe	26.00	Moderate	23.00	Moderate
C - 4	30.00	Moderate	22.00	Moderate	15.00	Mild

In the experimental group, three subjects had moderate and one had very severe stuttering in the pre therapy condition. It reduced to mild and very mild severity in post therapy condition. In the one month follow up, one of the subjects increased in severity from very mild to mild and one subject decreased in severity from mild to very mild. However, the other subjects maintained the severity in the follow up condition.

In the control group, three subjects had moderate and one had severe degree of stuttering respectively. The moderate degree had reduced to very mild severity. The severe degree had reduced to moderate and a moderate degree remained in the same severity in the post therapy condition. Two of the severity remained the same in the follow up condition. One increased in severity from very mild to mild and another decreased in severity from moderate to mild.

Thus in experimental group, all the subjects decreased in severity in the post therapy condition and in follow up maintenance was observed in all the subjects except two where one increased and another decreased in severity. In the control group, one subject did not show improvement in severity in the post therapy condition. However, in the follow up condition, similar to experimental group, one subject showed increase and other decrease in severity.

1) Frequency scores of SSI:

Table 3: *Mean and SD for SSI Frequency scores*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	14.60	3.28	16.00	2.82
PoT	10.20	2.38	8.00	4.24
FU	8.40	2.88	10.00	4.08

[PT = Pre therapy condition, PoT = Post therapy condition, FU = Follow Up (1 month post therapy follow up)]

There is no much difference in the SSI Frequency scores in the three conditions of pre therapy, post therapy and follow up (Table 3 and Figure 2). The mean score for the frequency of stuttering in the pre therapy condition for the experimental group is 14.6 (SD = 3.28) and that of the control group is 16.00 (SD = 2.82). The average score for frequency in the post therapy condition of the experimental group is 10.20 (SD= 2.3) and that of the control group is 8.00 (SD = 4.24). However, there was no much difference in the frequency score in the three conditions. The mean for the experimental group in the one month post therapy condition is 8.40 (SD = 2.88) and that of the control group is 10.00 (SD = 4.08). Further Friedman test was done to find if there was significant difference between the conditions for both the groups. The results show that significant difference exists for the various parameters for the experimental group [χ^2 (2) = 8.40, $p<0.05$] and there exists no significant difference for the control group [χ^2 (2) = 4.50, $p>0.05$]. Wilcoxons signed rank test revealed the pairs of conditions in the experimental group for which significant difference existed at 0.1 level of significance. They are pre therapy - post therapy and pre therapy - 1 month post therapy follow up conditions.

The mean score of experimental group is higher in the pre therapy condition when compared to post therapy condition. The mean score of experimental group is higher in the post therapy condition and lower in the 1 month post therapy follow up condition. The mean score of the control group is lower than experimental group in the post therapy condition but higher in follow up condition.

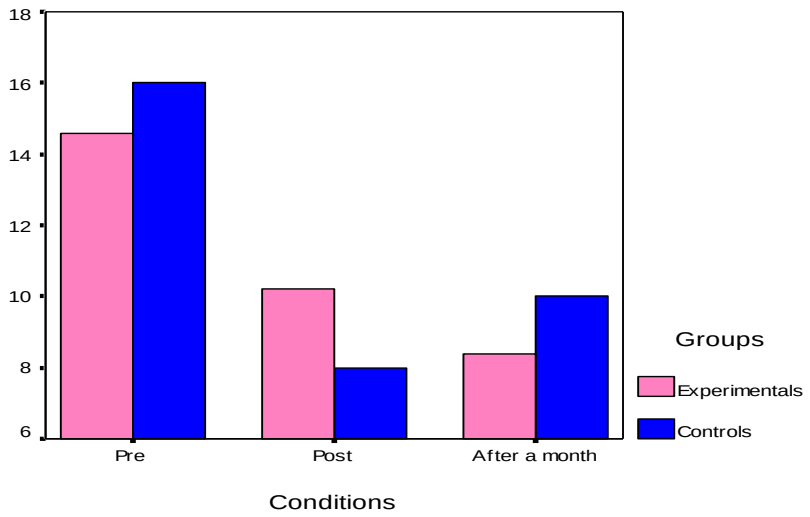

Figure 2: The mean ratings of SSI frequency for the three conditions

2) Duration scores of SSI:

Table 4: *Mean and SD for SSI Duration scores*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	4.00	1.73	3.50	1.00
PoT	2.20	1.09	2.75	1.25
FU	1.60	0.89	2.75	1.25

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

From Table 4 and Figure 3 it can be seen that there is no much difference in the scores between the two groups for the duration scores in SSI. The mean obtained for the experimental and control groups are 4.00 (SD = 1.73), 3.50 (SD = 1.00) in the pre therapy condition; 2.20 (SD = 1.09), 2.75 (SD = 1.25) in the post therapy condition and 1.60 (SD = 0.89), 2.75 (SD = 1.25) in the one month post therapy condition.

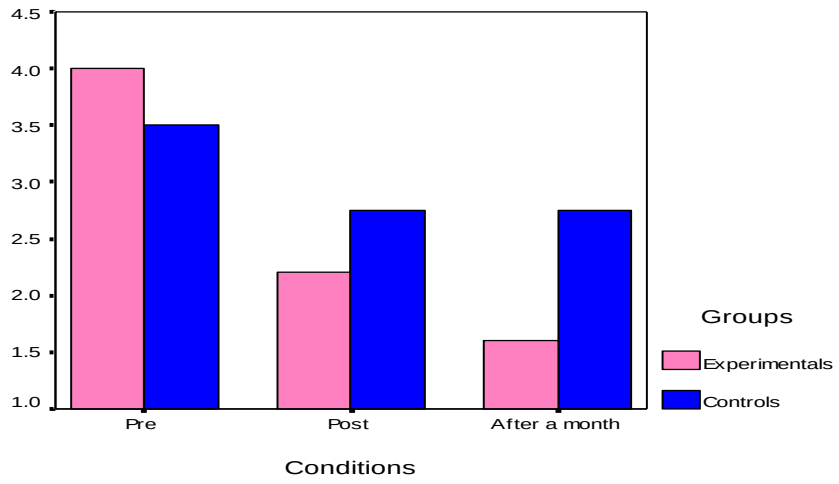

Figure 3: The mean ratings of the duration scores of SSI for the various conditions

The Friedman test results showed that there was significant difference between the conditions individually in the experimental [χ^2 (2) = 9.33, p<0.05] and not for the control group [χ^2 (2) = 1.00, p>0.05]. Wilcoxons signed rank test was further done to find the pairs of conditions for which the significance existed. The results show that pre therapy - post therapy and post therapy - 1 month post therapy follow up are the pairs of conditions for which significant difference is there at p< 0.05 level of significance in the experimental group.

The mean score for the pre therapy condition is slightly higher for the experimental group and the mean scores for post therapy and 1 month post therapy follow up conditions are slightly lower for the experimental group.

3) Physical concomitant scores in SSI:

From Table 5 and Figure 4 it can be seen that there is no much difference in the scores between the two groups for the physical concomitant in SSI. PWS in the experimental group has a mean score of 7.80 (SD = 2.38) and those in the control group has a mean score of 8.5 (SD = 4.93) in the pre therapy condition. There exists no significant difference in the scores. For the post therapy scores the mean is 3.80 (SD = 2.77) for the experimental group and 6.00 (SD =3.65) for the control group. The mean for the experimental group is 2.8 (SD =3.03) and that for the control group is 3.00 (SD = 1.15) in the 1 month post therapy follow up condition. Friedman test was done to find whether significant difference existed between the conditions individually in the groups. Results reveals significant difference within in the

experimental [χ^2 (2) = 9.33, $p<0.05$] and the control group [χ^2 (2) = 6.61, $p<0.05$]. Wilcoxons signed rank test was further done to find the pairs of conditions for which the significance existed. The results show that pre therapy - post therapy and pre therapy - 1 month post therapy are the pairs for which significant difference is present at $p< 0.05$ level of significance in the experimental group. In the control group, the pairs of conditions for which there exists difference at 0.1 level of significance are pre therapy - 1 month post therapy follow up conditions. The mean scores are lower for the experimental group in the pre therapy; post therapy and 1 month post therapy follow up conditions.

Table 5: *Mean and SD scores for SSI Physical concomitant scores*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	7.80	2.38	8.50	4.93
PoT	3.80	2.77	6.00	3.65
FU	2.80	3.03	3.00	1.15

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

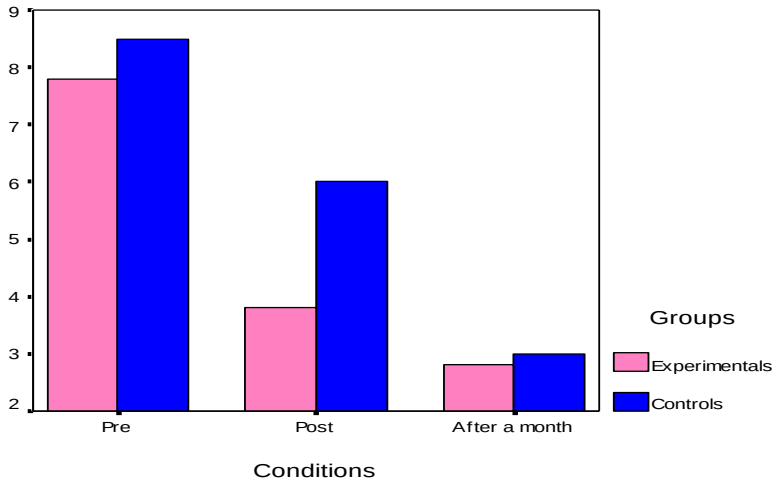

Figure 4: The mean ratings of the physical concomitant scores of SSI for the various conditions.

3) Total scores of SSI

From the mean and standard deviation obtained (Table 6 and Figure 5) it is clear that there is no significant difference in total scores on SSI. The mean score in the pre therapy condition is 26.40 (SD = 6.26) and that of the control group is 28.00 (SD = 4.39). The mean total scores of SSI in the post therapy condition of the experimental group is 16.00 (SD = 4.30) and that of the control group is 16.75 (SD = 8.99). However, there is no much difference. The mean for the experimental group in the 1 month post therapy follow up condition is 15.40 (SD = 3.91) and that of the control group is 15.75 (SD = 6.18).

Table 6: *Mean and SD fort total scores of SSI*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	26.40	6.26	28.00	4.39
PoT	16.00	4.30	16.75	8.99
FU	15.40	3.91	15.75	6.18

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

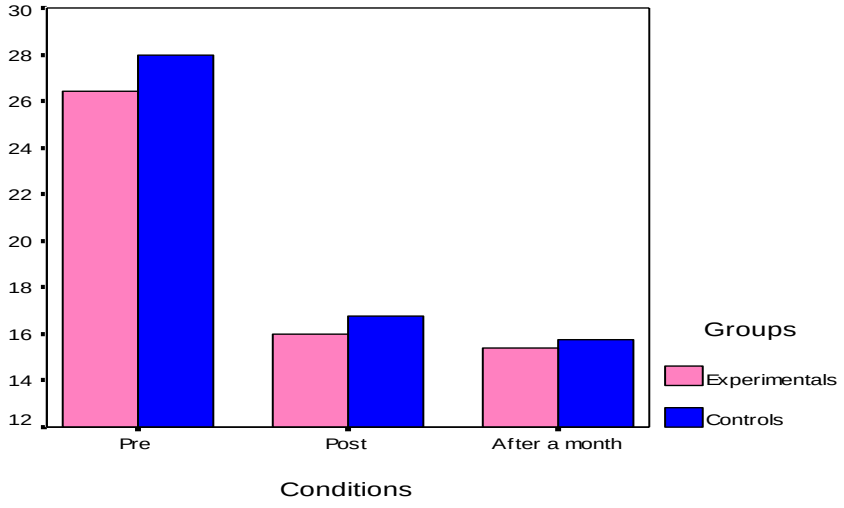

Figure 5: The mean scores of SSI is plotted for the three conditions

Results revealed significant difference in the experimental [χ^2 (2) = 7.89, $p<0.05$] group and not in the conditions within the control group [χ^2 (2) = 6.00, $p>0.05$]. Wilcoxons signed rank test was further done to find the pairs of conditions for which the significance existed. The results show that pre therapy - post therapy and pre therapy - 1 month post therapy follow up are the pairs for which significant difference is present at $p< 0.05$ level of significance in the experimental group. In the control group, there exists no significant difference. The mean scores are slightly better for the experimental group in the pre therapy; post therapy and 1 month post therapy follow up conditions.

This is partly in consonance with the study by Blomgren, Roy, Callister and Merrill (2005), who compared treatment out come using Intensive Stuttering Modification Therapy -A Multidimensional Assessment of Treatment Outcomes. There was an improvement in SSI scores in the post therapy condition and not six months post treatment. Here nineteen adults who stutter participated in a 3-week intensive stuttering modification treatment program (the Successful Stuttering Management Program [SSMP]). A series of 14 fluency and affective-based measures were assessed before treatment, immediately after treatment and 6 months after treatment. Measures included stuttering frequency [the Stuttering Severity Instrument for Children and Adults, Third Edition (SSI-3)]; a self-rating of stuttering severity; the Perceptions of Stuttering Inventory (PSI); the Locus of Control of Behavior Scale; the Beck Depression Inventory; the Multi component Anxiety Inventory IV (MCAI-IV); and the State-Trait Anxiety Inventory. Statistically significant improvements were observed on 4 of the total 14 measures immediately following treatment and on 4 measures at 6 months post treatment. Statistically significant improvements observed immediately post treatment included scores on the SSI and the Struggle, Avoidance, and Expectancy subscales of the PSI. Sustained statistically significant improvements at 6 months post treatment were observed only on client-reported perceptions of stuttering (the Avoidance and Expectancy subscales of the PSI) and 2 specific affective functioning measures (the Psychic and Somatic Anxiety subscales of the MCAI-IV). The SSMP generated some anxiolytic effects but was ineffective in producing durable reductions of core stuttering behaviors, such as stuttering frequency and severity.

b. Treatment efficacy scale for fluency disorders was used to find the efficacy of treatment.

Treatment efficacy scale for fluency disorders was used to find the efficacy of treatment. This is a rating scale prepared as an unpublished project titled 'Treatment efficacy and variables for stuttering management' (Geetha, Sangeetha & Anjana, 2007). This is a self report assessment procedure which included separate measures of frequency of stuttering, duration, secondary behaviors, confidence, avoidance behaviors, anxiety features, attitudinal changes, naturalness of speaking, listeners reaction, satisfaction with treatment, self monitoring skills, feeling about generalization and maintenance of fluency. A 5- point descriptive scale is used to allow the subject to show how often or how much each of the aspects applies (given in appendix A). The scores are from 1 to 5, where 1 is for more severe condition and five for the less severe condition.

1) Frequency of stuttering: From the mean and standard deviation obtained (Table 7, Figures 8 and 9), it is clear that there is no significant difference in the frequency of stuttering in the treatment efficacy scale.

Table 7: *Mean and SD scores for frequency scores in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	1.60	0.89	1.00	0.00
PoT	2.00	1.73	1.50	1.00
FU	3.00	1.87	2.00	0.81

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

The mean score for the frequency of stuttering in the pre therapy condition for the experimental group was 1.6 (SD = 0.89) and that of the control group was 1.0 (SD = 0.00). The average score for frequency in the post therapy condition of the experimental group was 2.00 (SD = 1.73) and that of the control group was 1.5 (SD = 1.00). The mean for the experimental group in the 1 month post therapy follow up condition was 3.00 (SD = 1.87) and that of the control group was 2.00 (SD = 0.81).

However, there is no much difference between the various conditions. Further, Friedman test was done to find if there is significant difference between the conditions for both the groups individually. The results show that no significant difference exist for the various parameters for the experimental group [χ^2 (2) = 4.76, p>0.05] and for the control group [χ^2 (2) = 4.66, p>0.05]. However, the mean scores were higher for the experimental group for all the three conditions.

2) Duration of stuttering: It is evident from Table 8 and Figures 8 and 9, that PWS in the experimental group had a mean score of 2.20 (SD = 1.09) and those in the control group had a mean score of 1.75 (SD = 0.50) in the pre therapy condition. There exists no significant difference in the scores. For the post therapy condition, the mean is 3.20 (SD = 1.09) for the experimental group and 3.50 (SD = 0.57) for the control group respectively. The mean for the experimental group is 3.8 (SD = 0.44) and that of the control group is 4.00 (SD = 1.41) in the 1 month post therapy follow up condition. The results of Friedman test revealed that there exists no significant difference in the experimental group [χ^2 (2) = 4.76, p>0.05] and there exists a significant difference in the conditions within the control group [χ^2 (2) = 6.53, p<0.05]. The pairs of conditions are pre therapy – post therapy and pre therapy – 1 month post therapy follow up conditions. The mean scores are higher for the experimental group in the pre therapy condition and the scores are lower for experimental group in the post therapy and 1 month post therapy follow up condition.

Table 8: *Mean and SD for duration scores in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.20	1.09	1.75	0.50
PoT	3.20	1.09	3.50	0.57
FU	3.80	0.44	4.00	1.41

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

3) Secondary Behavior: From Table 9, Figures 8 and 9, it is seen that in the pre therapy condition, the PWS in the experimental group had a mean score of 2.20 (SD = 1.30) and the control group had a mean of 2.25 (SD = 0.95). In the post therapy

condition, the average was 3.80 (SD = 0.83) for the experimental group and 3.50 (SD = 1.29) for the control group. The results of 1 month post therapy follow up condition revealed that the mean was 4.00 (SD = 1.00) for the experimental group and 4.00 (SD = 0.81) for the control group. There exists no significant difference between the two groups in the three conditions.

Table 9: *Mean and SD for secondary behaviors scores in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.20	1.30	2.25	0.95
PoT	3.80	0.83	3.50	1.29
FU	4.00	1.00	4.00	0.81

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

Further, the results of the Friedman test revealed that there exists no significant difference for the different conditions within the experimental [χ^2 (2) = 5.76, p>0.05] and control groups [χ^2 (2) = 4.133, p>0.05]. The mean scores are lower for the experimental group in the pre therapy condition and higher for experimental group in post therapy condition. However, in the 1 month post therapy follow up condition, the scores remain same in both the groups.

4) Confidence in speaking: From the mean and standard deviation obtained (Table 10, Figures 8 and 9), it is clear that there is no significant difference in confidence in speaking in the treatment efficacy scale. The average score for the confidence in speaking of PWS in the pre therapy condition was 2.8 (SD = 1.30) in the experimental group and that of the control group was 2.25 (SD = 0.95). The mean score for confidence in the post therapy condition for the experimental group was 3.8 (SD = 0.83) and that of the control group was 3.5 (SD = 1.00). The mean for the experimental group in the 1 month post therapy follow up condition was 4.00 (SD = 1.00) and that of the control group was 3.75 (SD = 0.95). Further Friedman test was done to find if there was significant difference between the conditions for both the groups. The results show that there is no significant difference for the various parameters for the

experimental group [χ^2 (2) = 4.66, p>0.05] and for the control group [χ^2 (2) = 4.308, p>0.05]. The mean scores are better for the experimental group in all the three conditions. This suggests that the prolongation technique used in combination with the Pranayama would have boosted the confidence in the PWS who participated in the program though to a small extent better than the control group.

Table 10: *Mean and SD for confidence in speaking in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.80	1.30	2.25	0.95
PoT	3.80	0.83	3.50	1.00
FU	4.00	1.00	3.75	0.95

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

5) Avoidance behaviors: The average obtained for the experimental and control groups are 2.40 (SD = 1.67), 2.2.5 (SD = 0.95) in the pre therapy condition; 4.20 (SD = 0.83), 4.00 (SD = 0.81) in the post therapy condition; 4.6 (SD = 0.54), 4.25 (SD = 0.50) in the 1 month post therapy follow up condition (Table 11, Figures 8 and 9).

Table 11: *Mean and SD for avoidance behaviors in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.40	1.67	2.25	0.95
PoT	4.20	0.83	4.00	0.81
FU	4.60	0.54	4.25	0.50

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

The Friedman test results show that there is significant difference between the conditions individually in both the experimental [χ^2 (2) = 6.61, p<0.05] and control groups [χ^2 (2) = 7.53, p<0.05]. Wilcoxons signed rank test was further done to find the pairs of conditions for which the significance existed. The results show that pre therapy - 1 month post therapy follow up is the pair for which significant difference is

there at 0.1 level of significance in the experimental group. In the control group, the pairs of conditions for which there exists difference at 0.1 level of significance are pre therapy - post therapy and pre therapy - 1 month post therapy follow up conditions respectively. The scores are slightly higher for the experimental group in all the three conditions when compared to the control group for which the scores are slightly lower.

The article by Maguire, Riley and Riley (2003) describes the Subjective Screening of Stuttering (SSS): research edition that is designed to quantify the selected self-reports of people who stutter (PWS) prior to, during, and following their treatment. The three areas screened by the SSS are perceived stuttering severity, the level of internal or external locus of control and reported word or situation avoidance. Each of the areas has two or three items rated for three audiences on a one to nine rating scale. Other available measures were reviewed and the need for a single instrument that provides quantified screening of each of the areas was recognized. Results of a research project using the SSS with 16 PWS indicated that percent of syllables stuttered correlated with stuttering severity (r=0.75) and with locus of control (r=0.43) but did not correlate with avoidance. These results were interpreted to indicate a need for other types of therapy following the experimental treatment studied. The present study however does not support this study since a significant difference between the conditions have been observed in parameter of avoidance.

6) Anxiety features: From Table 12, Figures 8 and 9, it can be seen that when PWS in the experimental group had a mean score of 2.80 (SD = 1.09), those in the control group had a mean score of 1.75 (SD = 0.95) in the pre therapy condition. There exists no significant difference in the scores. For the post therapy the average was 3.80 (SD = 0.83) for the experimental group and 4.00 (SD = 0.81) for the control group respectively. The average for the experimental group was 4.20 (SD = 0.83) and that of the control group was 4.25 (SD = 0.50) in the 1 month post therapy follow up condition.

Table 12: *Mean and SD for anxiety features in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.80	1.09	1.75	0.95
PoT	3.80	0.83	4.00	0.81
FU	4.20	0.83	4.25	0.50

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

The results of Friedman test done to find whether significant difference existed between the conditions individually in the groups reveals that there exists significant difference within the experimental [χ^2 (2) = 7.53,$p<0.05$] and control group [χ^2 (2) = 7.53,$p<0.05$]. Wilcoxons signed rank test was further done to find the pairs of conditions for which the significance existed. The results show that pre therapy - post therapy and pre therapy - 1 month post therapy follow up are the pairs of conditions for which significant difference is there at $p< 0.05$ level of significance in the experimental group. In the control group, the pairs of conditions for which there exists difference at 0.1 level of significance are pre therapy - post therapy and pre therapy - 1 month post therapy follow up conditions respectively. Higher mean scores are obtained for the experimental group in pre therapy condition and lower in the post therapy and 1 month post therapy condition.

7) Attitudinal changes: From Table 13, Figure 8 and 9 it can be noted that in the pre therapy condition, the PWS had a mean score of 2.00 (SD = 1.73), the control group had an mean of 1.75 (SD = 1.50). In the post therapy condition, the average was 4.60 (SD = 0.54) for the experimental group and 4.25 (SD = 0.95) for the control group. The results of the one month post therapy condition reveals that the mean was 4.20 (SD = 0.83) for the experimental group and 4.00 (SD = 0.81) for the control group. There exists no significant difference between the two groups in the three conditions.

Table 13: *Mean and SD for attitudinal changes in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.00	1.73	1.75	1.50
PoT	4.60	0.54	4.25	0.95
FU	4.20	0.83	4.00	0.81

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

Further, the results of the Friedman test revealed that there exists significant difference for the different conditions within both the experimental [χ^2 (2) = 6.53, $p<0.05$] and control groups [χ^2 (2) = 6.50, $p<0.05$]. Wilcoxons signed rank test shows that pre therapy - post therapy conditions and the pre therapy - 1 month post therapy follow up conditions are the pairs of conditions for which significant difference is present at 0.1 level of significance in both the experimental and control groups.

The study by Guitar (1978) discussed about the attitude change and long term outcome in stuttering therapy. Previous research has indicated that attitude change generally follows behavior change in operant stuttering therapy programs. This study sought to examine the long term therapy outcome of PWS whose communication attitudes were not substantially normalized after fluency establishment and generalization. Post transfer attitude scores of 20 PWS were used to classify them into one of two groups: those whose communication attitudes had been modified to show less abnormality than the mean level for normal speakers and those whose attitudes had not. The present study has also assessed the attitude of PWS and the results revealed a significant difference in the different conditions in attitudinal changes. Follow-up interviews with the 20 PWS one year later indicated that those whose post transfer attitudes were not substantially normalized stuttered significantly more. The mean scores are higher for the experimental group than the scores of the control group for attitudinal changes in the treatment efficacy scale. The findings of the current study could be attributed to the positive attitude feeling which consists in Pranayama.

8) Naturalness of speaking:

In the pre therapy condition, the PWS had a mean score of 2.60 (SD = 1.14), the control group had an average of 2.25 (SD = 1.25). In the post therapy condition,

the average was 3.60 (SD = 0.89) for the experimental group and 3.75 (SD = 0.95) for the control group. The results of the one month post therapy condition reveals that the mean was 4.40 (SD = 0.89) for the experimental group and 3.75 (SD = 0.50) for the control group respectively. There exists no significant difference between the two groups in the three conditions (Table 14, Figure 8 and 9). Further, the results of the Friedman test revealed no significant difference for the different conditions within the experimental [χ^2 (2) = 7.60, p>0.05] and control groups [χ^2 (2) = 5.69, p>0.05].

Table 14: *Mean and SD for naturalness in speaking in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.60	1.14	2.25	1.25
PoT	3.60	0.89	3.75	0.95
FU	4.40	0.89	3.75	0.50

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

The study by Ingham and Onslow (1985) describes two studies that illustrate the utility of listener ratings of speech naturalness for measuring and modifying speech naturalness during a stuttering therapy program. The program involved 5 adolescent PWS who were receiving an intensive treatment incorporating a prolonged speech procedure. In Study A, the clinician used a 9-point rating scale to score the speech naturalness of 1-rain speaking samples each PWS made at intervals over the course of the program. The results demonstrated predictable trends in speech naturalness during the program, but they also showed that natural sounding speech is not a predictable outcome of a procedure that removes stuttering, controls speaking rate and exposes clients to transfer procedures. In Study B, 3 of the 5 PWS participated in single subject experiments partway through their therapy program. These experiments were designed to assess the effect of regular feedback of speech naturalness ratings on the stutterer's spontaneous speech. The results showed that each subject's speech naturalness ratings could be modified toward a target level of speech naturalness. In the present study, the naturalness scores are better for the experimental group than the control group. The higher scores of the experimental group could be

attributed to the therapy program which is used which takes into account the breathing coordination and the relaxation aspect.

9) Listeners reaction: The mean score for the experimental group was 2.20 (SD = 1.64) and for control group was 2.75 (SD = 0.95) in the pre therapy condition; that of the post therapy condition was 3.80 (SD = 0.83) for the experimental and 4.75 (SD = 0.50) for the control group and in the 1 month post therapy follow up condition it was 4.60 (SD = 0.54) for the experimental group and 4.50 (SD = 0.57) for the control group as seen in Table 15, Figures 8 and 9.

Table 15: *Mean and SD for listener's reactions in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.20	1.64	2.75	0.95
PoT	3.80	0.83	4.75	0.50
FU	4.60	0.54	4.50	0.57

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

Further the results of Friedman test showed a significant difference of [χ^2 (2) = 7.6, $p<0.05$] and [$\chi^2(2) = 6.50$, $p<0.05$] in the experimental and control groups respectively. Wilcoxons signed rank test revealed pre therapy - post therapy and pre therapy - 1 month post therapy follow up conditions to be the pairs for which significant difference existed in the experimental group and pre therapy - 1 month post therapy follow up conditions in the control group. In the pre therapy condition, the scores are lower for the experimental group, in post therapy condition, the scores are lower for experimental group and in 1 month post therapy follow up condition, scores are higher for experimental group. This suggests that in the long term the listeners reaction has improved better for PWS who was in the experimental group. However, the difference is very slight.

10) Satisfaction with treatment:

Table 16: *Mean and SD for satisfaction with treatment in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	0.00	0.00	0.75	1.50
PoT	3.60	1.14	3.50	0.57
FU	4.20	0.44	4.25	0.50

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

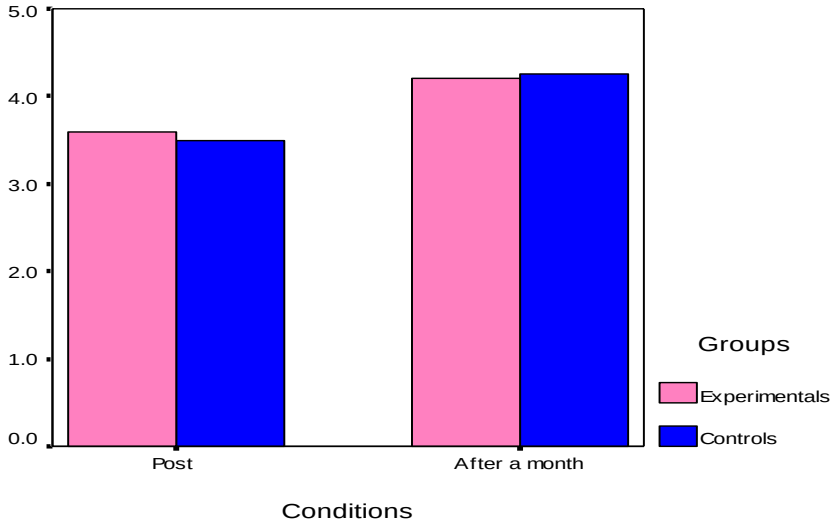

Figure 6: Mean ratings of satisfaction on the treatment efficacy scale for the three conditions

The mean satisfaction scores obtained for the experimental and control groups were 0.00 (SD = 0.00), 0.75 (SD = 1.50) in the pre therapy condition; 3.60 (SD = 1.14), 3.50 (SD = 0.57) in the post therapy condition; 4.20 (SD = 0.44), 4.25 (SD = 0.50) in the 1 month post therapy follow up condition (Table 16 and Figure 6). The Friedman test results show that there is significant difference between the conditions individually in both the experimental [χ^2 (2) = 8.31, $p<0.05$] and for the control group [χ^2 (2) = 7.00, $p<0.05$]. Wilcoxons signed rank test was further done to find the pairs of conditions for which the significance existed. The results revealed that pre therapy - post therapy and pre therapy - 1 month post therapy follow up are the pairs of conditions for which significant difference is there at $p< 0.05$ level of significance in

the experimental group. In the control group, the pairs of conditions for which there exists difference at 0.1 level of significance are pre therapy - 1 month post therapy follow up condition.

11) Self Monitoring skills: PWS in the experimental group had a mean score of 2.80 (SD = 1.64) and those in the control group had a mean score of 2.00 (SD = 1.41) in the pre therapy condition. There exists no significant difference in the scores. For the post therapy the average was 3.60 (SD = 0.89) for the experimental group and 3.50 (SD = 1.29) for the control group. The average for the experimental group was 4.20 (SD = 0.83) and that for the control group was 4.00 (SD = 0.81) in the 1 month post therapy follow up condition. The results of Friedman test done to find whether significant difference existed between the conditions individually in the groups revealed that no significant difference exist in the experimental [χ^2 (2) = 3.84, p>0.05] and the control group [χ^2 (2) = 4.66, p>0.05] (Table17, Figures 8 and 9).

Table 17: *Mean and SD scores for self monitoring skills in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.80	1.64	2.00	1.41
PoT	3.60	0.89	3.50	1.29
FU	4.20	0.83	4.00	0.81

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

The scores of the experimental group are slightly higher for all the three conditions of pre therapy, post therapy and 1 month post therapy conditions for the self monitoring skills of the treatment efficacy scale.

12) Feeling about generalization and maintenance of fluency: From Table 18 and Figures 8 and 9 it can be seen that PWS in the experimental group had a mean score of 2.80 (SD = 1.48), and those in the control group had a mean score of 1.75 (SD = 0.50) in the pre therapy condition. There exists no significant difference in the scores. The mean for the experimental group was 3.80 (SD = 1.64) and that of the control group was 3.75 (SD = 0.95) in the post therapy condition. For 1 month post therapy

follow up condition, the mean was 3.80 (SD = 0.83) for the experimental group and 3.75 (SD = 0.95) for the control group. The results of the Friedman test done to find whether significant difference existed between the conditions individually in the groups revealed that there exists no significant difference in the experimental [χ^2 (2) = 0.87, p>0.05] group. A significant difference in the conditions within the control group [χ^2 (2) = 8.00, p<0.05] was obtained. Wilcoxons signed rank test was further done to find the pairs of conditions for which the significance existed. In the control group, the pairs of conditions for which there exists difference at 0.1 level of significance were pre therapy - post therapy and pre therapy - 1 month post therapy follow up conditions respectively. In feeling about generalization and maintenance of fluency, the mean scores of the experimental group are slightly higher for the experimental group than the control group. This could be attributed to the therapy program rendered to the experimental group.

Table 18: *Mean and SD for maintenance and generalization in the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.80	1.48	1.75	0.50
PoT	3.80	1.64	3.75	0.95
FU	3.80	0.83	3.75	0.95

[PT = Pre therapy condition, PoT = Post therapy condition, FU = Follow Up (1 month post therapy follow up)]

13) Total scores of the treatment efficacy scale for stuttering: The mean scores for the experimental group was 27.40 (SD = 15.78) and for control group was 21.75 (SD = 7.67) in the pre therapy condition; that of the post therapy condition was 43.80 (SD = 8.25) for the experimental and 43.50 (SD = 7.93) for the control group and in the 1 month post therapy follow up condition was 49.2 (SD = 6.26) for the experimental and 47.00 (SD = 5.59) for the control groups (Table 19 and Figure 7). Further the results of Friedman test showed that there exists a significant difference of [χ^2 (2) = 8.4, p<0.05] and [χ^2 (2) = 6.50, p<0.05] in the experimental and control groups respectively. Pre therapy - post therapy ; pre therapy - 1 month post therapy follow up were the pairs of conditions for which significant difference existed in the

experimental group at p< 0.05 level of significance and pre therapy - post therapy and pre therapy - 1 month post therapy conditions in the control group at 0.1 level of significance according to Wilcoxons test. The mean scores of experimental group are higher for the three conditions of pre therapy; post therapy and 1 month post therapy follow up when compared to the mean scores of the control group.

Table 19: *Mean and SD scores of total scores of the treatment efficacy scale*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	27.40	15.78	21.75	7.67
PoT	43.80	8.25	43.50	7.93
FU	49.20	6.26	47.00	5.59

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

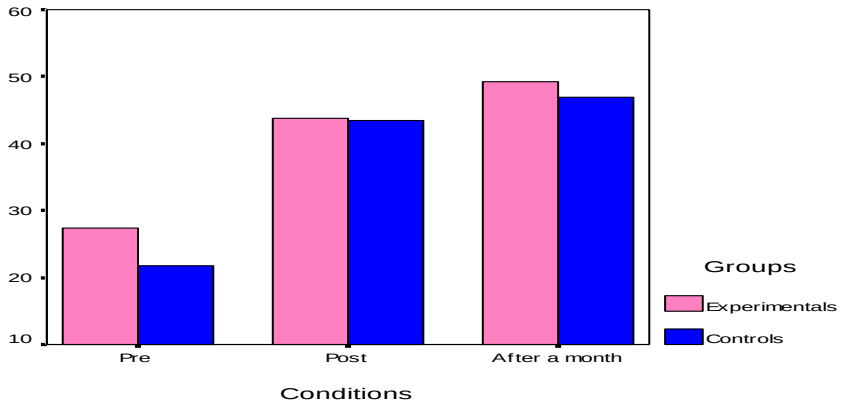

Figure 7: Mean ratings on the treatment efficacy scale in the three conditions for the two groups.

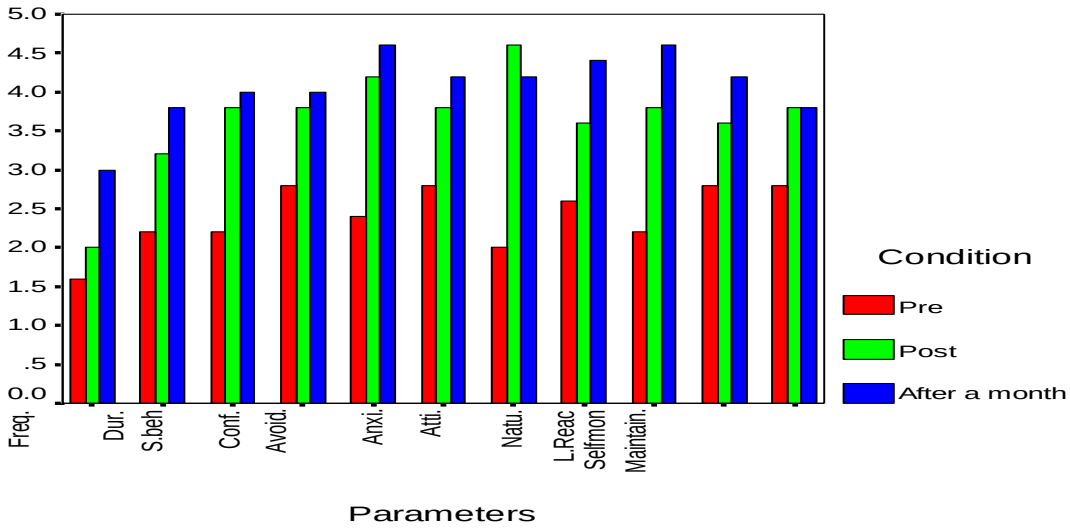

Figure 8: Mean ratings on various parameters of the treatment efficacy scale for the experimental group

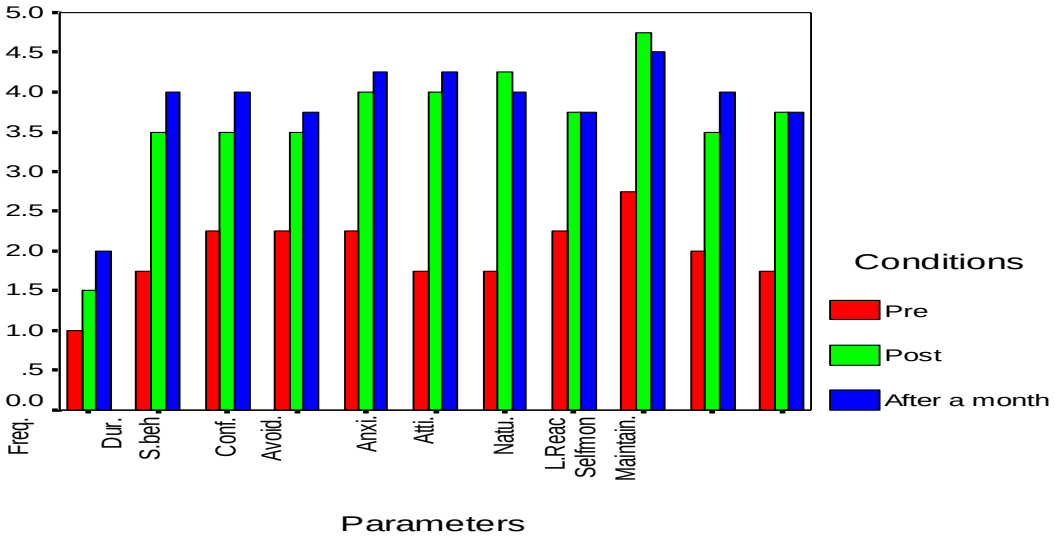

Figure 9: Mean ratings on various parameters of the treatment efficacy scale for the control group

[Freq = Frequency of stuttering; Dur = Duration of stuttering; S.beh = Secondary Behaviors; Conf = Confidence in Speaking; Avoid = Avoidance Features; Anxi = Anxiety Features; Atti = Attitudinal Changes; Natu = Naturalness of Speaking; L.Reac = Listeners Reaction to speech ; Selfmon = Self monitoring Skills ; Maintain = Feeling about generalization and maintenance about fluency; Pre = Pre therapy; Post = Post therapy; After a month = A month after post therapy]

c. Inter judge reliability for the perceptual evaluation by judges

The recorded speech samples of the subjects were subjected to perceptual rating by 5 qualified SLPs on a 3- point scale (3-good, 2-average and 1- poor). The post therapy speech samples of experimental and control group were randomized and given to five judges for perceptual evaluation and rating.

Table 20: *Reliability scores for the various parameters*

Reliability	Scores
Rate	0.83
Continuity	0.87
Effort	0.76
Stress	0.81
Articulation	0.87

Table 21: *Mean and SD for 5 judges on perceptual evaluation for various parameters for two groups*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
Rate	1.72	0.43	1.95	0.86
Continuity	1.68	0.22	1.75	0.77
Effort	2.04	0.26	1.75	0.59
Stress	2.00	0.70	2.10	0.50
Articulation	2.36	0.62	1.70	0.41

Reliability was checked for the judgments made by 5 judges for the parameters rate, continuity, effort, stress and articulation for both the groups. The judgment was made by 5-SLPs by listening to the recorded sample of the post therapy condition. They had to rate it on a 3-point rating scale; 1- poor, 2- average; 3- good. Reliability coefficient α was calculated. The results show that there is good reliability obtained for all the parameters (Table 20).

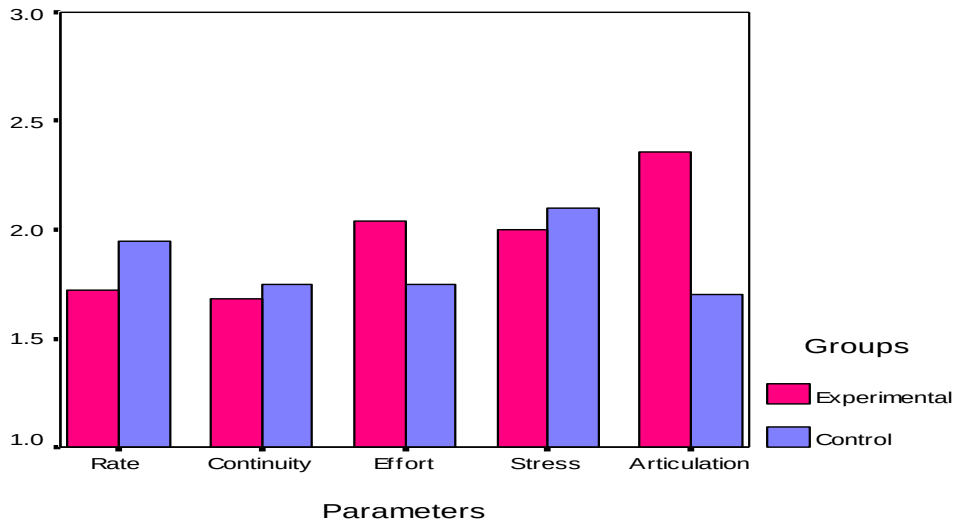

Figure 10: Mean perceptual ratings for the various parameters as evaluated by five judges.

d. Situational assessment

Situational assessment checklist for PWS was also employed which again the subjects had to rate on a five point scale (given in Appendix B). Subjects were assessed at the beginning (day 1), at the end (day 12) of the intervention and one month follow up after the 12 day treatment period. The mean scores are lower for the experimental group in the pre therapy and 1 month post therapy follow up condition and the mean scores are higher for the experimental group in the post therapy condition

Table 22: *Mean and SD scores for total of various parameters of situational assessment checklist*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	54.80	19.07	68.75	15.39
PoT	37.00	11.81	32.00	12.96
FU	28.40	8.96	31.75	8.01

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

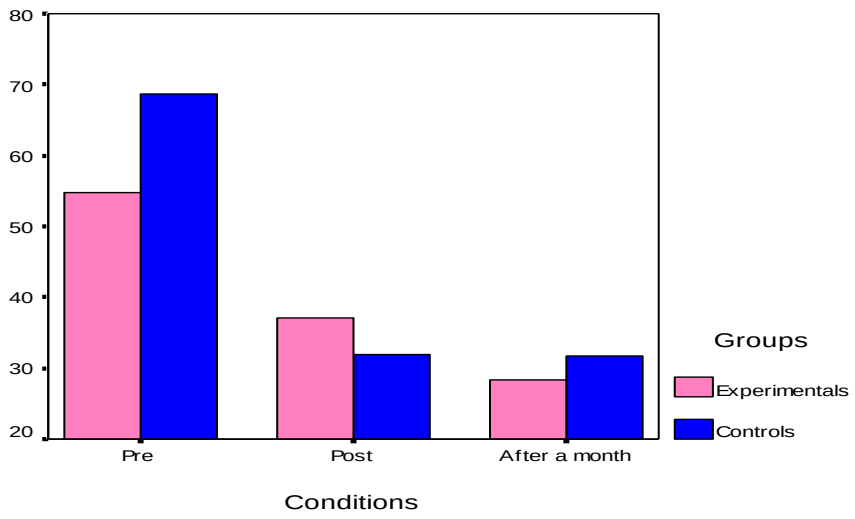

Figure 11: The mean ratings of the situational assessment checklist for the three conditions

As seen in Table 22 and Figure 10, PWS in the experimental group had a mean score of 54.80 (SD = 19.07) and those in the control group had a mean score of 68.75 (SD = 15.39) in the pre therapy condition. The average scores are higher for the experimental group. There exists no significant difference in the scores. The average for the experimental group was 37.00 (SD = 11.81) and that of the control group was 32.00 (SD = 12.96) in the post therapy condition (Table 22). For the 1 month post therapy follow up condition the average was 28.40(SD = 8.96) for the experimental group and 31.75(SD = 8.01) for the control group. The results of the Friedman test done to find whether significant difference existed between the conditions individually in the groups revealed no significant difference in the experimental [χ^2 (2) = 8.4, $p>0.05$] and there exists a significant difference in the conditions within the control group [χ^2 (2) = 6.5, $p<0.05$]. Wilcoxons signed rank test was further done to find the pairs of conditions for which the significance existed. In the experimental group pre therapy - post therapy and pre therapy - 1 month post therapy conditions were the conditions having significant difference at $p<0.05$ level of significance. In the control group, the pairs of conditions for which there existed a significant difference were pre therapy - post therapy and pre therapy - one month post therapy conditions at 0.1 level of significance.

2. Aerodynamic measurements

Aerodynamic measurements were done during pre therapy, post therapy and 1 month post therapy follow up condition to see if there is any differences in the experimental and control groups. Respiratory measurements included the measurement using RMS Helios 501 - a window based program. The parameters recorded included, slow vital capacity (SVC) and maximum voluntary ventilation (MVV).

1. Slow Vital Capacity (SVC): From the mean and standard deviation obtained (Table 23 and Figure 11), it is clear that there is no significant difference for the SVC. The average score for SVC in the pre therapy condition was 2.65 (SD = 0.95) and that of the control group was 2.14 (SD = 0.53). The average score for SVC in the post therapy condition of the experimental group was 2.68 (SD=0.87) and that of the control group was 2.03 (SD = 0.32). However, there is no much difference. The mean for the experimental group in the 1 month post therapy follow up condition was 2.98 (SD = 0.70) and that of the control group was 2.72 (SD = 0.71). Further Friedman test was done to find if there is significant difference between the conditions for both the groups. The results show that there is no significant difference existing for the various parameters of the experimental group [χ^2 (2) = 1.20, p>0.05] and for the control group [χ^2 (2) = 3.60, p>0.05].

Table 23: *Mean and SD scores of SVC*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	2.65	0.95	2.14	0.53
PoT	2.68	0.87	2.03	0.32
FU	2.98	0.70	2.72	0.71

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

There is no much difference in the mean SVC scores for either the experimental or the control group for the three conditions of pre therapy, post therapy and one month post therapy follow up.

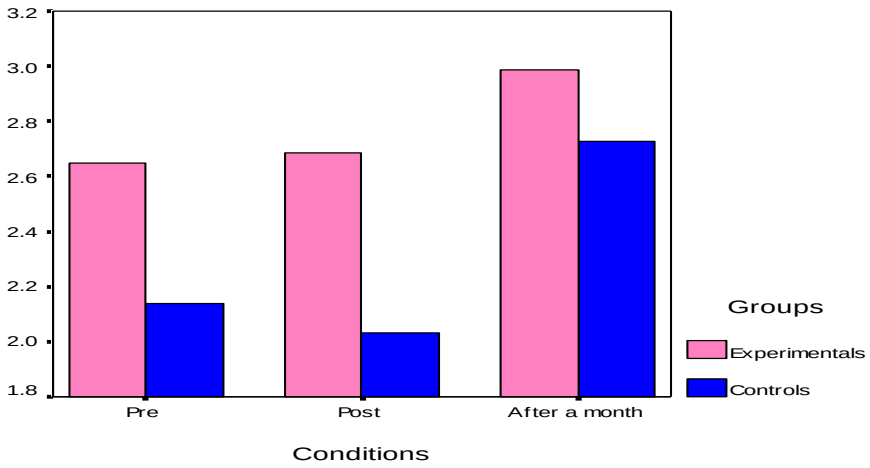

Figure 12: The mean scores of the SVC measurements for the three conditions.

2. Expiratory Reserve Volume (ERV):

Table 24: *Mean and SD scores of ERV*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	0.78	0.41	0.63	0.40
PoT	0.71	0.19	0.48	0.27
FU	0.84	0.32	1.80	1.25

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

In the pre therapy condition, PWS had a mean score of 0.78 (SD = 0.41) and for the control group it was of 0.63 (SD = 0.40). In the post therapy condition, the average was 0.71 (SD = 0.19) for the experimental group and 0.48 (SD = 0.27) for the control group. The results of 1 month post therapy follow up condition revealed that the mean was 0.84 (SD = 0.32) for the experimental group and 1.80 (SD = 1.25) for the control group.

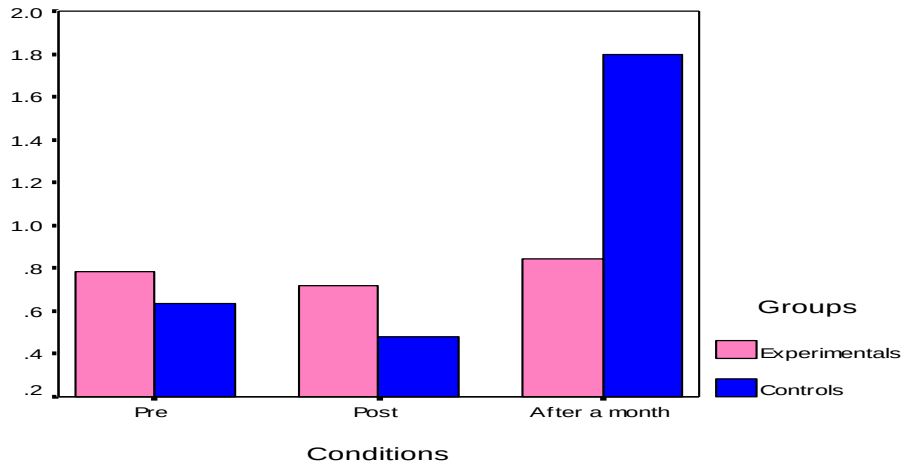

Figure 13: The mean of the ERV measurements for the three conditions

There exists no significant difference between the two groups in the three conditions (Table 24 and Figure 13). Further, the results of the Friedman test revealed no significant difference for the different conditions within these groups in both the experimental [χ^2 (2) = 2.80, p>0.05] and control groups [χ^2 (2) = 4.13, p>0.05]. The mean scores of the experimental group are slightly higher for all the three conditions than the control group.

3. Inspiratory Reserve Volume (IRV):

Table 25: *Mean and SD scores for IRV*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	1.39	0.86	0.52	0.34
PoT	1.26	0.93	0.55	0.34
FU	0.81	0.34	0.80	0.87

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

PWS in the experimental group had a mean score of 1.39 (SD = 0.86) and those in the control group had a mean score of 0.52 (SD = 0.34) in the pre therapy condition. There existed no significant difference in the scores. For the post therapy the mean was 1.26 (SD = 0.93) for the experimental group and 0.55 (SD = 0.34) for the control group. The average for the experimental group was 0.81 (SD = 0.34) and that

of the control group was 0.80 (SD = 0.87) in the 1 month post therapy condition (Table 25 and Figure 14). The results of Friedman test revealed no significant difference within the experimental [χ^2 (2) = 2.21, p>0.05] condition and a significant difference in the conditions within the control group [χ^2 (2) =0.40, p<0.05].

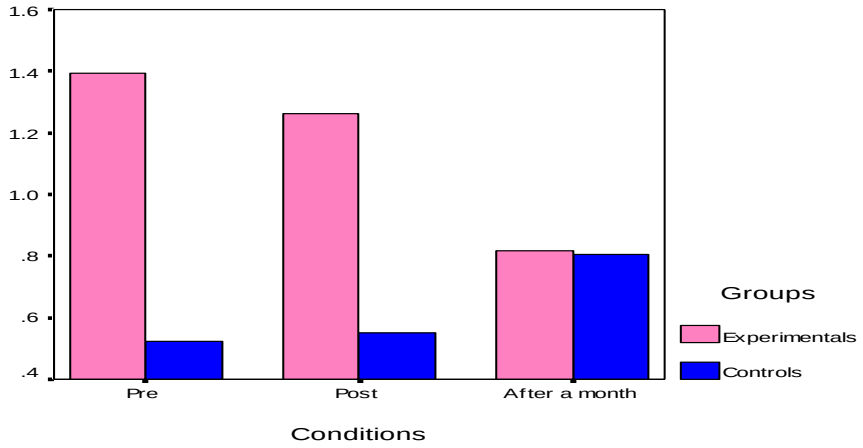

Figure 14: The mean ratings of the IRV measurements for the three conditions.

The IRV scores are better for the experimental group than the control group for the three conditions of pre therapy, post therapy and 1 month post therapy follow up conditions.

4. Tidal Volume (VT):

Table 26: *Mean and SD scores for SVT*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	0.58	0.34	0.38	0.24
PoT	0.66	0.31	0.68	0.15
FU	0.79	0.33	0.85	0.40

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

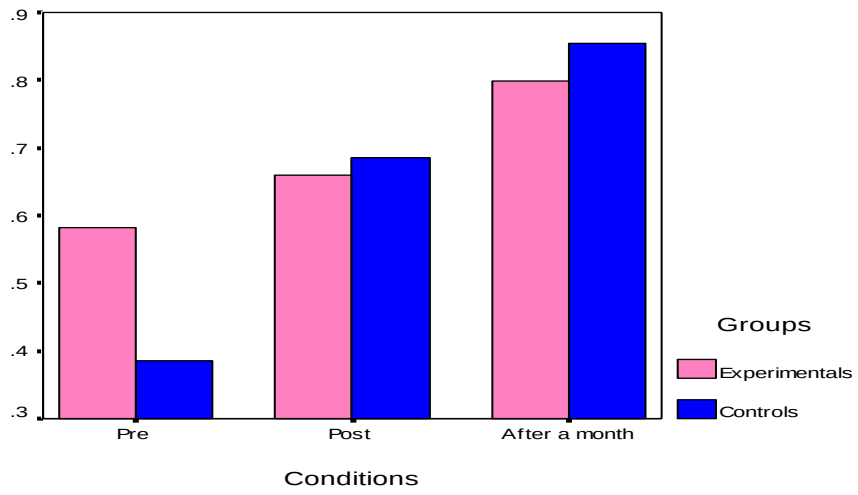

Figure 15: The mean values of the tidal volume measures in the three conditions.

The mean tidal volume scores in the pre therapy condition were 0.58 (SD = 0.34) and 0.38 (SD = 0.24) for the experimental and control groups (Table 25 and Figure 15). The mean for the post therapy condition was 0.66 (SD = 0.31) for the experimental group and 0.68 (SD = 0.15) for the control group (Table 26 and Figure 15). The average of the one month post therapy condition was 0.79 (SD = 0.33) and that of the control group was 0.85 (SD = 0.40). There is no much difference in the mean scores of the tidal volume for the two groups for the three conditions.

There is no much difference between the groups in the three conditions. The results of Friedman test shows no significant difference between the groups in the experimental condition [χ^2 (2) = 0.73, $p>0.05$] and in the control condition there existed a significant difference [χ^2 (2) = 6.50, $p<0.05$]. The pairs of conditions found to have significant difference from the Wilcoxons signed rank test were between pre therapy - post therapy and pre therapy - 1 month post therapy follow up at 0.1 level of significance.

The study by Story & Alphonso (1996) compared the pre and post treatment measurements of kinematics of fluent speech of PWS. The study reports changes in acoustic, respiratory, laryngeal and articulatory kinematics of 3 males who stutter, following participation in a version of the Hollins Precision Fluency Shaping Program. Two non stuttering controls received no treatment. Subjects repeated phrases of the form "He see CVC again" at self-selected slow, normal, and fast speaking rates. For experimental subjects, acoustic duration of the phrases increased significantly in 7 out

of 9 comparisons of before and after-treatment conditions, whereas controls decreased the duration of the phrases in 4 out of 6 comparisons of measurements made over approximately the time interval during which the experimental group received treatment. The experimental group increased inspiratory volume for 7 out of 9 conditions and average expiratory flow significantly for all conditions, whereas the controls decreased both. The experimental group prolonged laryngeal opening in 6 of 7 comparisons, but only 3 of the increases were significant. Lip and jaw movements for consonants were significantly reduced in amplitude for the experimental group for 30 of 36 measures. The direction of change for laryngeal and upper articulator measures was mixed for controls. These results show that behavioral treatment can produce significant changes in the fluent speech of persons who stutter with respect to respiration, laryngeal valving and articulation.

5. Maximum Voluntary Ventilation (MVV): The mean obtained for the experimental and control groups were 55.00 (SD = 40.49), 36.25 (SD = 6.94) in the pre therapy condition; 51.00 (SD = 16.43), 47.00 (SD = 10.09) in the post therapy condition; 38.40 (SD = 11.14), 57.50 (SD = 6.13) in the 1 month post therapy follow up condition (Table 27). This shows significant difference between the two groups in the pre therapy and one month post therapy conditions. The scores for the experimental group were lower than that for the control group.

Table 27: *Mean and SD scores of MVV*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	55.00	40.49	36.25	6.94
PoT	51.00	16.43	47.00	10.09
FU	38.40	11.14	57.50	6.13

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

The Friedman test results showed no significant difference between the conditions individually in the experimental group [χ^2 (2) = 3.60, $p>0.05$] and for the control group a significant difference [χ^2 (2) = 7.60, $p<0.05$] was seen. Wilcoxons signed rank test was further done to find the pairs of conditions for which the

significance existed. The results show that pre therapy - post therapy and pre therapy - one month post therapy were the pairs of conditions for which significant difference was there at 0.1 level of significance in the control group.

There was difference in the scores on the parameters of MVV between the two groups were MVV is better for the control group in the post therapy condition. MRF in the pre therapy condition is higher for the experimental group. There is no difference in scores for the other parameters between the two groups.

Table 28: *Mean and SD scores of MRF*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	46.66	29.70	25.57	3.03
PoT	44.56	15.35	31.69	8.75
FU	32.28	16.16	32.88	3.38

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

The mean obtained for the experimental and control groups were 46.66 (SD = 29.70), 25.57 (SD = 3.03) in the pre therapy condition; 44.56 (SD = 15.35), 31.69 (SD = 8.75) in the post therapy condition; 32.28 (SD = 16.16), 32.88 (SD = 3.38) in the 1 month post therapy follow up condition respectively (Table 28). There is no significant difference between the two groups in the three conditions. The Friedman test results showed no significant difference between the conditions individually in both the experimental group [χ^2 (2) = 2.80, $p>0.05$] and for the control group a significant difference [χ^2 (2) = 4.50, $p<0.05$] was seen.

From Table 29 it can be seen that the mean obtained for the experimental and control groups were 1.13 (SD = 0.49), 1.55 (SD = 0.17) in the pre therapy condition; 1.15 (SD = 0.55), 1.65 (SD = 0.26) in the post therapy condition; 1.35 (SD = 0.68), 1.84 (SD = 0.12) in the 1 month post therapy follow up condition respectively.

Table 29: *Mean and SD scores of MVT*

Parameters	Experimental group		Control group	
	Mean	SD	Mean	SD
PT	1.13	0.49	1.55	0.17
PoT	1.15	0.55	1.65	0.26
FU	1.35	0.68	1.84	0.12

[PT = Pre therapy condition, PoT = Post therapy condition,
FU = Follow Up (1 month post therapy follow up)]

The Friedman test results showed no significant difference between the conditions individually in the experimental group [χ^2 (2) = 1.20, $p>0.05$] and for the control group a significant difference [χ^2 (2) = 6.50, $p<0.05$] was seen. Further, Wilcoxons test was done to find the pairs of conditions for which significant difference existed. The results revealed post therapy - 1 month post therapy follow up and pre therapy - 1 month post therapy follow up to be the pairs of conditions.

It can be seen that there was no significant difference between the two groups for the perceptual evaluations done. However, within the experimental and control groups there was significant difference in the parameters of SSI. The results of the Treatment efficacy scale for Fluency Disorders showed parameters to have significant difference within the experimental and control groups. The inter judge reliability was however good. The situational assessment checklist also showed significant difference within the various conditions. The aerodynamic evaluations showed that for the parameters; MVT = MVV maneuver tidal volume, significant difference was present. MRF scores in the pre therapy condition were higher for the experimental group. MVV scores were lower in the experimental group in 1 month post therapy follow up and higher in the pre therapy and post therapy conditions.

CHAPTER V

SUMMARY AND CONCLUSION

The present study was mainly aimed at investigating whether traditional prolongation technique when used in combination with Pranayama (experimental condition) would be more effective in the management of stuttering than the prolongation technique (control condition) when used alone. It was also aimed to study if the effect of Pranayama practiced with prolongation when compared to prolongation alone as a treatment technique has a long term effect on the maintenance of fluency.

PWS considered in the study were randomly distributed to the treatment programs of prolongation technique (control group) and prolongation technique with Pranayama (experimental group). Pranayama is a Sanskrit word meaning "lengthening of the prana or breath". The word is composed of two Sanskrit words, Prana, life force, or vital energy, particularly, the breath, and "āyāma", to suspend or restrain. Pranayama, which has established its wide implication in various fields, has been considered in the present study to find its implication in the management of stuttering. The experimental group involving Pranayama consisted of five subjects and the control group which did not include Pranayama consisted of four subjects. Each of the subjects fell in moderate to very severe degree range of severity.

The study focused on finding the outcomes in the various evaluations using Stuttering Severity instrument (SSI) developed by Glydon D. Riley (1980), Treatment efficacy scale for fluency disorders (self rating) by Geetha, Sangeetha and Anjana (2007), Situational assessment checklist for PWS (self rating), aerodynamic measures using RMS Helios 501 for both the treatment groups of PWS, during the pre therapy, post therapy and one month post therapy follow up condition.

Appropriate statistical analysis was done and the results of the study can be concluded as follows:

Conclusions

- It can be concluded from the study that there was no significant difference between the two groups for the perceptual measures.
- However, within the experimental group significant difference was obtained for the parameters of frequency, duration and total scores of SSI for the experimental group and for physical concomitant scores significance was obtained within both the groups.
- The results of the Treatment efficacy scale for fluency disorders showed significance for the parameters duration and generalization and maintenance within the control group alone.
- No significant difference was obtained within the experimental group for any of the parameters of treatment efficacy scale. The parameters which did not have any significance within any of the groups were frequency, confidence in speaking, self monitoring and naturalness of speaking.
- The parameters avoidance, anxiety, attitudinal changes, listener's reaction, satisfaction, and total scores of treatment efficacy scale showed significance within both experimental and control groups.
- The inter judge reliability was good for all the fluency parameters rated.
- The situational assessment checklist showed significant difference within the control group and not experimental group.
- In the aerodynamic measurement, MVV was better for the control group and SVC did not show much significance between the groups.
- Out of the 12 parameters considered for perceptual evaluation, 6 parameters (avoidance, anxiety, attitudinal changes, listener's reaction, satisfaction, and physical concomitant) had significance within the group for which Pranayama was used in combination with the prolongation technique (experimental group).

- The objective of finding the role of treatment program in maintenance of fluency reveals that in all parameters for which significant difference was obtained, the significance was also found in the one month post therapy when compared with pre therapy in the experimental and control groups.

- When considering the post therapy assessments the parameters for which significance was obtained for the in the 1 month post therapy conditions were duration scores in SSI for the experimental group and MVT (MVV manual tidal volume) for the control group.

The attempt to find if the severity of stuttering has any effect in the treatment outcome with Pranayama revels that in post therapy condition, 60% of PWS in experimental group had very mild stuttering and 40% had mild stuttering. In the control group, 50% of the PWS had very mild stuttering and 50% of PWS had moderate stuttering. In the one month post therapy condition, 60% had very mild stuttering and 40% had mild stuttering in the experimental group. In the control group, 25% had very mild stuttering, 25% had moderate stuttering and 50% had mild stuttering.

Implications

The present study throws light on the fact that Pranayama, a widely practiced exercise could be encompassed in the speech therapy program for individuals with stuttering.

With further research in this area, it may be helpful to find new techniques in the field of stuttering therapy which may prove to be helpful in the self monitoring, boosting of confidence, secondary behaviors and frequency of stuttering.

Limitations of the study

- Limitation of subject availability was the major drawback of the study because of time constraints. There were drop outs in the subjects selected for the experimental and control groups which limited the total number of subjects.
- Due to ethical issues, Pranayama alone was not tried in the experimental group subjects.

- Follow up was attempted after only one month post therapy due to time constraints.
- The perceptual assessments provided subjective information, and it might have yielded considerably different results if other problem statements had been included.
- The subjects and the programs differed in a number of ways which make comparison of their relative effects more difficult. In spite of these factors, subject perceptions indicated that speech fluency change was a prominent feature of success for Pranayama with prolongation technique than the prolongation technique alone. Although circumstances contributing to this difference cannot be clearly specified, alterations in the treatment programs, the intervals of assessment and combinations of treatment programs could be made to determine whether the result will be an increase in its effects upon speech change.

Future direction

Pranayama used in combination takes into consideration various aspects of relaxation and coordination of breathing. The dynamic roles of Pranayama in the experiences of those who stutter provided by results suggest that such practice is only part of the solution. Although such experiences might impose immediate control over stuttering in an atypical environment, and even restore the positive feelings associated with control of stuttered speech, their ability to achieve more than that needs to be explored by giving a lapse of more months after therapy termination. Also the aspects of tension, anxiety and the breath coordination and respiratory measurements during speech in the pre therapy condition, post therapy and months after termination of therapy needs to be explored in detail on a large group in more controlled conditions. Such evidence based practice is the need of the hour for the successful implementation of treatment procedures for communication disorders in general and stuttering in particular. It is also interesting to see the effects of Pranayama in the management of stuttering with regard to different subgroups in terms of severity, age, gender, presence of associated anxiety and other factors on a larger population.

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Appendix A

Treatment Efficacy Scale For Fluency Disorders

Name: No: Age/Sex: Date:

Ph.No: e-mail i.d: Adress:

Clinician: Supervisor:

GENERAL INFORMATION

1. How many therapy sessions did you take at AIISH? 1: <5; 2: 5-10; 3:10-20; 4: 20-30; 5: >30
2. What were the therapy techniques taught to you?
3. Which technique did you find most effective?
4. Has therapy helped you control your stuttering? 1: No; 2: Yes
5. After therapy how is your stuttering? 1: increased; 2: Same; 3: Decreased
6. How much do you stutter now? (1: 0%; 2: 5-10%; 3: 10-25%; 4: 25-50%; 5: 50-75%; 6: > 75%)
7. How do you rate your stuttering severity when you first visited us?
   1: Severe; 2: Moderately Severe; 3: Moderate; 4: Mild; 5: Very Mild
8. Have you taken any other treatment for your stuttering? 1: Yes; 2: No. If Yes, specify
9. Do you think you can improve some more by taking our help again? 1: No; 2. Yes
10. Has your attitude toward stuttering changed since you attended therapy at AIISH? 1: No; 2: Yes

I. FREQUENCY OF STUTTERING

1. I have problems in speaking very often, more than three times a day
2. I face the problem at least two or three times a day
3. I face the problem more than five times per week on an average
4. I face the problem two to three times a week
5. I face the problem occasionally once or twice in a week or two

II. DURATION OF STUTTERING

1. Often I get stuck during my speech for a long time
2. I get stuck on particular sounds or words for more than five to ten seconds
3. I get stuck for long duration occasionally during speech
4. I get stuck occasionally for very short durations
5. I do not ever get stuck in my speech for any perceptible duration now

III. SECONDARY BEHAVIOURS

1. My secondary behaviours are severe and painful to look at
2. My secondary behaviours are very distracting
3. My secondary behaviours are distracting
4. My secondary behaviours are not noticeable unless looking for
5. I do not have any secondary behaviours now

IV. CONFIDENCE IN SPEAKING

1. I'm not at all confident while speaking
2. Most of the time I'm not confidant while speaking
3. There are some situations where I am not confidant while speaking
4. I am confidant to speak in most situations
5. I am confidant to face any situation

V. AVOIDANCE BEHAVIOURS

1. I avoid speaking situation everytime I possibly can
2. I try to avoid a speaking situation most of the time
3. I try not to avoid a situation, but sometimes avoid it
4. I don't try to avoid any speaking situation, but sometimes I feel like doing so
5. I never try to avoid any speaking situation

VI. ANXIETY FEATURES

1. I feel extremely tensed/ scared and anxious whenever I have to speak

2. I feel tensed/scared and anxious in most of the situations when I have to speak
3. I get tensed/scared in some situations and in others I am able to speak easily
4. I get anxious only on few words, but can keep myself calm in most of the situations
5. I remain calm and relaxed in all speaking situations

VII. ATTITUDINAL CHANGES

1. I feel very inferior to others because of my speech
2. I have come to terms with my problem but still feel low most of the time
3. I tell myself that I am not inferior but sometimes cannot help feeling so
4. I have begun to realize I'm not inferior to anybody
5. I have understood my problem well and I know I'm not inferior to anybody

VIII. NATURALNESS OF SPEAKING

1. My speech is very unnatural/monotonous most of the time
2. My speech is unnatural in most situations
3. My speech is unnatural in some situations
4. My speech sounds natural in most situations
5. My speech sounds natural in almost all situations

IX. LISTNERS REACTION TO YOUR SPEECH

1. I feel all listeners are very impatient toward my speech
2. Most listeners laugh at me and tease/comment on my speech
3. I feel most listeners are sympathetic and complete the sentences for me
4. I perceive suble reactions from the listeners to my speech sometimes
5. I do not notice any negative reactions to my speech from the listeners now

X. SATISFACTION WITH TREATMENT

1. I am dissatisfied; therapy offered did not satisfy me at all
2. Treatment was not satisfactory and not of much help
3. Treatment has helped reduced my problem to a small extent
4. Treatment was good, has helped me reduce my problem to a large extent
5. Treatment was excellent, has helped me completely overcome my problem

XI. SELF MONITORING SKILLS

1. I am not able to monitor my speech fluency at all
2. I am not able to control my stuttering in most situations
3. I can monitor my speech fluency in most situations
4. I am able to monitor my speech except in occasional situations
5. I am able to monitor and control my speech always

XII. FEELING ABOUT MAINTENANCE AND GENERALIZATION OF FLUENCY

1. I do not feel adequate to maintain my fluency and I am worried about relapse
2. I feel I can maintain my fluency with regular guidance from the therapist
3. I feel I can maintain my fluency with periodic guidance from therapist
4. I feel I can maintain my fluency with occasional guidance from the therapist
5. I feel confidant that I can always maintain my fluency without further guidance.

Remarks: P. S: Can you come for another evaluation? (Yes/No)

Appendix B

Situational Assessment Checklist for Stutterers

Please answer the following questions by putting a mark among the options

[0 – Nil; 1 – Very Less; 3 – More; 4 – Too much] 0 1 2 3 4

1. While speaking to friends
2. While speaking to parents
3. While speaking to siblings
4. While speaking to young children
5. While speaking to class mates/ colleagues
6. While speaking to teachers/ officers/boss
7. While speaking to strangers
8. While speaking to people of opposite sex
9. While speaking alone
10. While speaking simultaneously in a group
11. While speaking or discussing in a group
12. While addressing a small group
13. While addressing a large group
14. While singing or reciting songs or poems
15. While speaking to people in the market/railway station/bus
16. While reading loudly alone
17. While reading loudly in front of others
18. While answering questions in the classroom or work spot
19. While speaking your mother tongue
20. While speaking a language which you are not competent
21. While initiating a sentence
22. In the middle of a sentence

23. While enacting a role in a play or drama
24. While facing an interview
25. While speaking over a telephone
26. Teaching/demonstrating in a group
27. Arguing a point in a group
28. Asking/giving directions
29. When excited or happy
30. When anxious, scared, nervous or tensed.