RESEARCH ARTICLE

EFFICACY OF DIGITAL MANIPULATION OF THYROID CARTILAGE, FLUENCY SHAPING THERAPY AND COMBINATION OF BOTH IN TREATMENT OF STUTTERING SEVERITY: A RANDOMIZED CLINICAL TRIAL

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ABSTRACT

Background: The stuttering is manifested by disruption in normal speech flow and fluency that also disturbs social and emotional wellbeing. There is immediate need of rehabilitation for the improvement of fluency and reduce the severity of stuttering. **Objective:** To compare the digital manipulation of thyroid cartilage (DMTC), fluency shaping therapy (FST) and combination of DMTC and FST for improving severity in stuttering patients. **Material and Method**: A randomized clinical trial was conducted at National Institute of Rehabilitation Medicine. The patients were enrolled through non-probability, convenient sampling technique. The participants were randomly allocated into three equal groups (n=10): DMTC group, FST group and combination of both. The Scale of Rating Severity of Stuttering (SRSS) was used to assess the severity level at baseline, 2nd week, 4th week, 8th week and 12th week of intervention. **Results:** The mean age of DMTC, FST and combination group was, 22.25 ±3.33 years, 21.65±3.36 and 21.35±3.76 years respectively. Friedman with post hoc test revealed significant improvement ($p<0.05$) in all groups but combination group had showed better outcome than single DMTC and FST intervention. A Kruskal-Wallis H test showed that there was no significant difference ($p\geq0.05$) among DMTC, FST and Combination group from baseline to 8th weeks of training, but significant difference {$X^2(2) = 5.897$, $p<0.014$} was observed after 12th week of training among the groups. The post hoc test showed that the combination group was more significantly improved as compared to DMTC group {MR=9.10 ver. MR=17.71, $p=0.012$} but not significant difference between difference between combination and FST group ($p=0.317$) as well as DMTC and FST group ($p=0.619$) regarding severity of stuttering. **Conclusion**: It is concluded that combination of digital manipulation of thyroid cartilage and fluency shaping therapy were more beneficial for improving fluency in stuttering patients.

Key words: Digital manipulation therapy, fluency shaping therapy, stammering, stuttering.

INTRODUCTION

Fluent speech is defined as the ability to talk with continuity, at sustained rate and without effort. However, stuttering is manifested by disruption in normal speech flow and fluency that also disturbs social and emotional wellbeing. The pathophysiology and etiology of the stuttering is still poorly defined. It is assumed that the speech characteristics of stuttering is the result of atypical mechanism of brain occurred due to genetics and environmental variables[1]. It usually presents with repetitions, speech block and prolongation of sounds and syllables. The stuttering affects approximately 5% of all children and typically presents between 3-6 years of age and it recovers in early years of life. Stuttering persists after puberty in 1% of general population. It is more prevalent in males as compared to females; with a male to female ratio is 4:1[2].

Stuttering affects many aspects of daily life activity. Many people express their thoughts, beliefs and ideas through verbal communication. When speaking is a challenge, even the ability to introduce one also becomes difficult. Many stutterers feel embarrassment, anger, frustration and sometimes feel ashamed due to their stuttering[3]. The stammerer adopted secondary behaviours that include escape and avoidance behaviour: substitution of words, starters, postponements, anti-expectancy, and circumlocution[4]. In escape behaviour, blinking of eyes, shaking movements of head and jaws are used as techniques to reduce the severity of stuttering[5,6]. While, in avoidance behaviours patient inhibit stuttering through substitutions, postponements as moving hand to say a word[6].

The treatment of stuttering is still a challenge for speech-language pathologist[7]. There are different treatment approaches have been used such as pharmacological, fluency shaping therapy and digital manipulation technique. Fluency shaping therapy consists of retraining of speech components such as stress-free onset, soft

articulatory interaction, prolonged speech and continuous phonation[8]. Fluency shaping improves the fluency by altering prosody of speech such as tempo and rhythm, breathing techniques and easy onset of speech[9]. Digital manipulation and compression of larynx where light pressure is applied on the thyroid cartilage downward with a finger to hold the larynx down and prevent it from moving upward during phonation[10].

There is immediate need of rehabilitation for the improvement of fluency and reduce the severity of stuttering. Therefore this study was conducted to find the best treatment option for stuttering. Many studies have been conducted to determine the effectiveness of fluency shaping therapy (FST) and very less literature was found on effectiveness of digital manipulation of thyroid (DMTC) cartilage. However, in this study effectiveness of FST and DMTC was evaluated along with the combination of FST and DMTC in adults.

METHODOLOGY

A single blinded, randomized clinical trial was conducted at National Institute of Rehabilitation Medicine (NIRM) Islamabad, Pakistan. The study was initiated was after taking approval from authorities. The informed consent was developed according to Declaration of Helsinki and was taken from all study participants. The inclusion criteria was males aged between 18-30 years, and had developmental stuttering disorder measured on Stuttering Severity Rating scale, and the exclusion criteria included patients having language disorder, neurological stuttering and cluttering, hearing impairment, cognitive insufficiency, and who had unwillingness to participate in the study

The participants were recruited through non-probability convenient sampling technique and randomization was done through toss and coin method. It was single-blinded study; patients were kept blind to the other given treatments.

A total n=33 subjects were evaluated for participation in study. Of which n=30 patients fulfilled the inclusion criteria and were recruited. The participants were randomly and equally divided (n=10 in each group) into Digital Manipulation of Thyroid Cartilage (DMTC) group, Fluency Shaping Therapy group (FST) and combination of DMTC and FST. The n=3 patients of DMTC group and n=2 patients from FST group could not continue the treatment sessions due to some personal issues. (Figure 1)

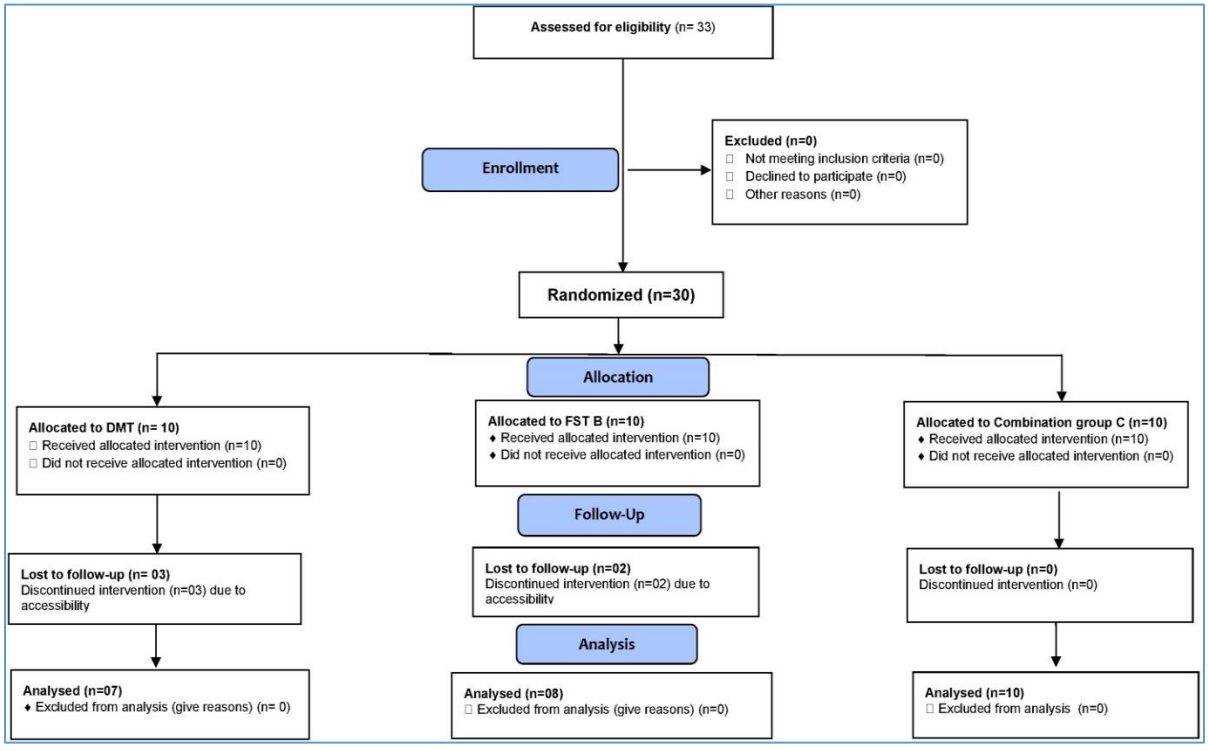

Figure 1: CONSORT diagram

In digital manipulation of thyroid cartilage technique, thyroid cartilage is given gentle pressure downward with a finger in order to hold the larynx down so that it does not go up while phonation. FST group included speech techniques such as prolongation of sounds, easy onset, and continuous phonation, in three speaking situations (speaking with therapist, reading aloud, and free conversation). A total of 24 sessions were given to each patient, the first 15 sessions were provided by the speech therapist while the remaining 9 sessions were self-administered i.e. patient performed on their own. The detailed description of the DMTC and FST treatment protocol is presented in Table 1.

Table 1: Intervention protocol DMTC, FST & combination therapy group

Digital Manipulation of Thyroid Cartilage (DMTC)	Total sessions	24
	Length of a session	15 - 20minutes
	Frequency of sessions	Twice a week
	Number of sets	4/vowel
	Repetition of vowel per set	5
	Total repetitions in each session	60
	Vowel prolongation	5 to 8 second
	Rest between repetitions	5 second
	Rest between sets	10 second
	Overview of session	5 minutes
Fluency Shaping Therapy (FST)	Total sessions	24
	Length of each session	30 minutes
	Frequency of sessions	Twice in week
	Reading Task	80 short sentences
	Free conversation on any topic	5 minutes
	Talking to Therapist with specific method	5 minutes
	Overview of session	5 minutes
Combination Therapy Group (DMT+FST)	Same treatment protocol as DMTC and FST	45 Minutes

The data was collected at baseline, during, and after the intervention. The general demographics questionnaire including age, gender, and family history, number of sibling, family structure, socioeconomic level, and onset of stuttering was obtained at baseline. Scale for Rating Severity of Stuttering (SRSS) is a reliable and valid tool to measure speech- related severity of stuttering. It has a score range from 0 to 7, 0 score means absence of stuttering and 7 means very severe stuttering. [11]

The study has both aspects of within group and between group comparisons. The intervention period for each patient was three months and data was collected at baseline, after 2^{th}, 4^{th}, 8^{th}, and 12^{th} weeks. The Shapiro–Wilk test for normality was applied that showed that data was not normally distributed so non-parametric test was applied. For within the group comparison, Friedman Test with Wilcoxon Signed-Rank Test for post hoc analysis was used. The Kruskal-Wallis H test with post hoc analysis was used for groups' comparison. The results of study were presented as frequency, percentages, mean±SD, mean rank, Z-score, median (IQR), and p-values. The level of significance was set at $p<0.05$. The data was analyzed through SPSS version 21.

RESULTS

The mean age of DMTC, FST and combination group was, 22.25 ±3.33 years, 21.65±3.36 and 21.35±3.76 years respectively. The mean birth order in DMTC group was 2.80±1.67, FST group was 3.80±2.16 and combination group was 3.25± 1.99.63.33%. Patients experienced onset of stuttering between the ages of 2 to 4 years in DMTC (23.33%), FST (15.00%) and combination group (25.00%) whereas remaining started stuttering between the ages of 5 to 7 years in DMTC (10%), FST (18.33%) and combination groups (8.33%).

In DMTC group severity of stuttering along with its individual items including frequency, duration and secondary symptoms reduced significantly throughout the treatment duration $\{X^2(4) = 21.524,$

(p<0.001)}. The post hoc tests revealed significant improvement from 2nd- 4th week (p= 0.01) but there was no significant improvement (p≥0.05) from 4th to 12th week of training. The results also showed that severity of stuttering score was reduced significantly throughout the intervention, from 0-12 weeks (p<0.001). There was an overall statistically significant improvement {$X^2(4)$ =28.00, (p<0.001)} from baseline to 12wks of rehabilitation in FST group. The post hoc test showed significant improvement from 2nd week to 4th week, but onward no significant improvement observed (p≥0.05).The combination group also showed that severity of stuttering was reduced significantly throughout the treatment duration {$X^2(4)$=35.558, p<0.001)}. The post hoc tests showed significant improvement from 2nd week to 4th week (p=0.01) and from 8th week to 12th week (p=0.002) of training. (Table 2)

Table 2: With-in group changes (DMTC, FST and Combination group)

	DMTC Group (n=7)				FST Group (n=8)				DMT + FST (n=10)			
	Median (IQR)	MR	Z-Score	p-value	Median (IQR)	MR	Z-Score	p-value	Median (IQR)	MR	Z-Score	p-value
0 week	5(2)	5.50	0.000	1.00[a]	5(2)	4.50	-2.236	0.25[a]	5(1)	5.50	-2.828	0.05[a]
2nd week	4 (2)	5.50	-3.464	0.01*	4(2)	4.50	-3.051	0.02*[b]	4(1)	4.50	-3.357	0.01*[b]
4th week	4 (1)	4.0	-1.00	.317[c]	4 (1)	4.50	-2.82	0.05[c]	4(1)	5.50	-1.633	1.02[c]
8th week	4(1)	4.0	-.000	1.00[d]	4(1.25)	4.50	1.732	0.83[d]	4(1)	5.50	-3.162	0.002**[d]
12th week	4(1)	4.0	-	0.00***[e]	3(1.25)	4.50	-	0.00***[e]	3(1)	5.50	-	0.00***[e]

[a]0 week ver. week 2nd, [b]week 2nd ver. 4th week ,[c]4th week ver. week 8th, [d]8th week ver. 12th week
Significance level: p<0.05, p<0.01**, p<0.001****

A Kruskal-Wallis H test showed that there was no significant difference (p≥0.05) among DMTC, FST and Combination group from baseline to 8th weeks of training, but significant difference {$X^2(2)$ =5.897, p<0.014} was observed after 12th week of training among the groups. The post hoc test showed that the combination group was more significantly improved as compared to DMTC group {MR=9.10 ver. MR=17.71, p=0.012} but not significant difference between difference between combination and FST group {MR=9.10 ver. MR=11, p=0.317} as well as DMTC and FST group {MR=11 ver. MR=17.71, p=619} regarding severity of stuttering. (Table 3)

Table 3: Comparison among groups (DMTC, FST & combination therapy)

	DMT (n=7)		FST (n=8)		DMT + FST (n=10)		$X^2(2)$	p-value
	Median(IQR)	MR	Median(IQR)	MR	Median(IQR)	MR		
0 week	5(2)	18.25	5(2)	12.69	5(1)	15.80	2.984	0.225
2nd week	4 (2)	18.00	4(2)	12.88	4(1)	12.30	3.429	0.180
4th week	4 (1)	13.71	4 (1)	13.38	4(1)	12.20	.259	0.879
8th week	4(1)	17.29	4(1.25)	11.00	4(1)	11.60	4.504	0.105
12th week	4(1)	17.71	3(1.25)	11.00	3(1)	9.10	5.897	0.014*

Significance level: p<0.05, p<0.01**, p<0.001****

DISCUSSION

The findings of the current study showed that the DMTC, FST and combination group significantly improved stuttering symptoms. Combination group proved to be more effective, as compared to DMTC and FST alone, in improving fluency and reducing severity of stuttering. Current study showed significant improvement in severity of stuttering in DMTC group which is in coherence with the previous (including core behaviours and secondary behaviours such as the percentage of word stuttered, duration of dis-fluency, and associated movements of body throughout the treatment) case study conducted in Pakistan. In a case study DMTC was established to investigate the effectiveness of an adult stutterer. A 21-year-old male was treated with digital manipulation of

larynx twice per week and after 12 sessions of treatment, patient showed improvement and the severity of stuttering was reduced measured on SRSS. The results concluded that DMTC was an effective technique to decrease in the severity of stuttering and improve in laryngeal movement[12]. The improvement noted after DMTC is laryngeal manual therapy that lowered straight up movement of the larynx in the vocal tract which improves quality of voice, and decrease distress of vocal region. Also, the rate of recurrence and severity of vocal region distress was significantly reduced[13].

Current study also indicated that FST group was effective for reducing severity of stuttering. The efficacy of FST in enhancing fluency and decreasing stuttering has also been supported by literature. However, the researcher has suggested that the further studies may be conducted to establish clarity about its usefulness[14]. A Previous study carried out in Egypt to explore whether the fluency shaping therapy was effective or not. The results indicated a remarkable decline in stuttering and rise in fluency of the patient. The result also established the fact that the fluency shaping therapy was instrumental in curing stuttering[1]. The FST improves bad feelings, obstructive attitudes or stuttering related nervousness in stuttering patients[15,16].

In a recent study, both DMTC and FST techniques were used in combination and more significant improvement was found in the management of stuttering in adults. Combination of DMTC, FST is novel treatment option for reducing the severity of stuttering. No study is available for the effectiveness of combination of both for the management of stuttering. However, it is evident from literature that FST in combination with other treatment option is proved to be more beneficial[17]. Findings of current study are fairly reliable with previous studies in literature which report that the digital manipulation of thyroid cartilage and fluency shaping therapy are effective techniques to reduce the severity of stuttering[18,19]. Therefore, suggested that DMTC and FST would reduce the severity of stuttering, however the combination of both would remarkably reduce the severity of stuttering than single alone.

It was a single centred study and sample size was not large enough of generalize the data due to loss of follow ups. The study was single blinded, assessing and treating therapist were same, which may bias the results.

CONCLUSION

It is concluded on the basis of result that combination of digital manipulation of thyroid cartilage and fluency shaping therapy was better than digital manipulation of thyroid cartilage or fluency shaping therapy alone. Different treatment options and their combination should be administered in future studies while considering the confounding factors.

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