

# EFFECTIVENESS OF DIGITAL MANIPULATION OF THYROID CARTILAGE IN THE MANAGEMENT OF STUTTERING IN ADULTS

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## ABSTRACT

**OBJECTIVE:** To compare the effectiveness of digital manipulation of thyroid cartilage (DMT) with Fluency Shaping Therapy (FST) for the management of stuttering in adults.

**METHODS:** This randomized clinical trial was conducted in Speech-Therapy department of National Institute of Rehabilitation Medicine Islamabad. Twenty male adult patients were recruited in the current study through non-probability, convenience sampling. The participants were randomly allocated into two equal groups (n=10): DMT group & FST group. Scale of rating severity of stuttering was used to assess the severity level at baseline and after the completion of 24 training sessions. Three vowel approaches with four sets of 5-repetition each were performed for each vowel in DMT group. Training in FST group comprised of speech techniques like easy onset, prolongation of speech, continuous phonation and light articulatory contact in reading and conversation in three speaking situations (speaking with therapist, reading aloud and free conversation).

**RESULTS:** Mean age of the participants in DMT group was  $21.4 \pm 2.2$  years and FST group was  $20.9 \pm 3.2$  years. At baseline, there was no significant difference between DMT and FST groups regarding the severity of stuttering ( $5.3 \pm 0.94$  vs.  $5.6 \pm 0.96$ ;  $p=0.492$ ). As a result of 12 weeks of treatment, both groups demonstrated significant improvement ( $p<0.001$ ). There was no significant difference between the groups after intervention ( $4.6 \pm 1.26$  vs  $3.8 \pm 0.91$ ;  $p= 0.12$ ).

**CONCLUSION:** Both DMT and FST techniques are equally effective in the management of stuttering in adults. Further large scale studies on adults and children of both genders are needed to compare effectiveness of DMT and FST.

**KEY WORDS:** Stuttering (MeSH), Stammering (MeSH), Fluency shaping therapy (Non-MeSH), stuttering modifications therapy (Non-MeSH), Behavior therapy (MeSH), Laryngeal manipulation (Non-MeSH).

**THIS ARTICLE MAY BE CITED AS:** Khan N, Masood T, Awan WA. Effectiveness of digital manipulation of thyroid cartilage in the management of stuttering in adults. *Khyber Med Univ J* 2017; 9(1): 3-7.

## INTRODUCTION

Stuttering, also known as stammering is a common speech disorder during which the flow of speech is interrupted without the person's conscious awareness i.e. involuntarily through some symptoms known as core behavior.<sup>1</sup> These behaviors include blocking where-

in person forcefully closes the larynx hence stopping the air in the lungs. Patient will attempt to speak but voice will not come out. The patient exhibits repetitions such as "bababa" for ball and may repeat the sound, syllable, word and phrase. Prolongation of sound is also the part of core behavior among the children who are beginning to stutter.<sup>1,2</sup>

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Date Submitted: November 30, 2016

Date Revised: February 03, 2017

Date Accepted: February 05, 2017

Secondary behaviors are divided into two main classes known as avoidance behaviors and escape behaviors. Avoidance behaviors are substitutions, postponements as movements of hand timing to say a word. Escape behaviors are head nods, eye blinking, interjections of extra sounds such as 'uh'.<sup>2</sup> An adult stutterer who develops negative attitude reacts negatively to his disfluency such as avoidance, postpone, facial grimacing. The adult stutter derives these reactions from stuttering experiences.<sup>3</sup>

There is no study on the prevalence of stuttering available in Pakistan. However, prevalence of stuttering in adults is 1% in the United States of America. There is a high prevalence rate among males than females.<sup>1</sup> Stuttering usually manifests around the childhood between the ages of two and eight.<sup>4</sup> There is no consensus on the exact cause of stuttering although a number of theories have been proposed. These include cerebral dominance theory, biochemical and physiological theories, genetic theory, neurotic theory and conditional theory.<sup>5</sup> One study has shown that irregular laryngeal behaviors are the main characteristics which interrupt function of the speech and cause stuttering.<sup>6</sup>

Various treatment options have been used for the management of stuttering such as pharmacological intervention,<sup>7</sup> fluency shaping therapy (FST)<sup>8</sup> and stuttering modification techniques.<sup>9</sup> Fluency training program was introduced during 1960's and 1970's in which different methods were used to enhance the fluency. They relied mostly on the past fluency

enhancing methods such as prolongation of sounds, slow speech, continuous phonation, rhythm or airflow.<sup>10</sup>

FST is initiated with slow speech, working out of soft voice onset and continuous phonation, light articulatory contact and prolonged speech.<sup>8</sup> FST reduces severity of stuttering to less than 1% of stuttered syllables by modifying speech prosody, tempo, and rhythm, breathing techniques and soft onset of speech.<sup>11</sup> FST regularizes basal ganglia activity, reduces over-activity of right cerebral hemisphere and normalizes the left cerebral hemisphere activity.<sup>12</sup>

Stuttering modification therapies have focused on combination of procedures such as increasing acceptance of one's stuttering, desensitization to stuttering, motoric techniques to reduce the tension associated with stuttering movements.<sup>9</sup> Another method is Lutzmanns pressure test which can also be used as a therapy in which patient is taught to produce low pitch voice where thyroid prominence is pressed slightly by the finger downwards or backwards. This technique relaxes the vocal cord tension and produces a low pitch voice.<sup>13</sup>

Digital manipulation of thyroid cartilage (DMT) or laryngeal massage is applied through pressing on selected areas of the larynx.<sup>14</sup> In DMT technique, light pressure is applied on the thyroid cartilage anteriorly to push thyroid cartilage back slightly thereby decreasing the tension in vocal folds and severity of stuttering.<sup>15</sup>

Measurement of treatment result should include core behaviors and secondary behaviors such as percentage of word stutter, relevant tension, duration of disfluncies; pattern of disfluency and associated movements of body.<sup>16</sup> Scale for rating severity of stuttering is a reliable and valid tool for the measurement of severity of stuttering which rates the severity of stuttering on a scale of 0 to 7 wherein "0" signifies absence of stuttering and "7" corresponds to very severe stuttering.<sup>17</sup>

DMT is cost effective and easy technique for the person with stuttering. Patient can learn and apply this technique himself at home. Therefore, this study was designed to investigate the effectiveness of digital manipulation of thyroid cartilage as compared to fluency shaping therapy for the management of stuttering.

## METHODS

This randomized clinical trial was conducted at National Institute of Rehabilitation Medicine, Islamabad, Pakistan. Twenty male patients were recruited through non-probability, convenience sampling and randomly assigned to two equal groups (N=10); Digital Manipulation of Thyroid (DMT) and Fluency Shaping Therapy (FST). DMT group received digital manipulation of thyroid cartilage while FST group was treated with slow speech, soft voice onset and continuous phonation, light articulatory contact with prolonged speech.

In this study, 18-30 years old males with developmental stuttering were included, while those with language disorders or neurological stuttering / cluttering were excluded. The scale for rating severity of stuttering is a subjective measurement tool used to assess the level of stuttering within the range of (0=no stuttering) to (7=very severe -stuttering).

The study was conducted after approval from the ethics review committee of the National Institute of Rehabilitation Medicine. All participants provided written, signed consent before participation in the study which was conducted according to research guidelines of Pakistan Medical Research Council.

Stuttering was measured on percentage of stuttered word (SRSS) in three speaking situations (speaking with therapist, reading aloud, and free conversation). Three hundred words were selected for each context.

Assessments were carried out at baseline and after 12 weeks of intervention.

Independent samples t test was used to compare the groups at baseline and after rehabilitation. Within-group analyses were performed with paired samples t test. Statistical significance was set at p-value less than 0.05. The data was analyzed through SPSS v. 20.

### *Treatment protocol for DMT*

In this technique light finger pressure was applied on the thyroid cartilage downwards to push thyroid cartilage back slightly while the patient uttered the vowel. During the first 15 sessions, therapy was provided by the speech therapist only while in the remaining 9 sessions patients self-administered the techniques as well. Detailed description of the DMT treatment protocol is presented in Table I.

### *Treatment protocol for FST Group*

FST session comprised of speech techniques such as prolongation of sounds, easy onset, continuous phonation, in reading and conversation in three speaking situations (speaking with therapist, reading aloud, and free conversation) [Table II].

## RESULTS

The mean age of the participants in DMT group was  $21.40 \pm 2.22$  years and FST group was  $20.90 \pm 3.24$ . Both groups were similar in terms of duration of the stuttering symptoms. Mean birth order in DMT group was  $2.60 \pm 1.57$  and where in FST Group was  $3.80 \pm 2.25$ . The mean number of sibling in DMT group was  $5.50 \pm 1.58$  and FST group was  $6.00 \pm 2.21$ . There was no significant difference in baseline characteristics of study participants ( $p \geq 0.05$ ). The primary languages practiced by the participants in both groups are provided in Table III.

Seventy percent of the patients experienced the onset of stuttering between the ages of 2 to 6 years while remaining started it between the ages of 6 to 12 years in both groups.

At baseline, there was no significant difference between DMT and FST

**TABLE I: DIGITAL MANIPULATION OF THYROID CARTILAGE TREATMENT PROTOCOL**

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

**TABLE II: FLUENCY SHAPING THERAPY TREATMENT PROTOCOL**

Total sessions	24
Length of each session	30 minutes
Frequency of sessions	Twice a 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

**TABLE III: PRIMARY LANGUAGES IN TWO GROUPS**

		Groups		Total
		Digital Manipulation of Thyroid Cartilage	Fluency Shaping Therapy	
Primary language	Urdu	2	1	3
	Punjabi	4	3	7
	Pashto	3	4	7
	Saraiki	1	2	3
Total		10	10	20

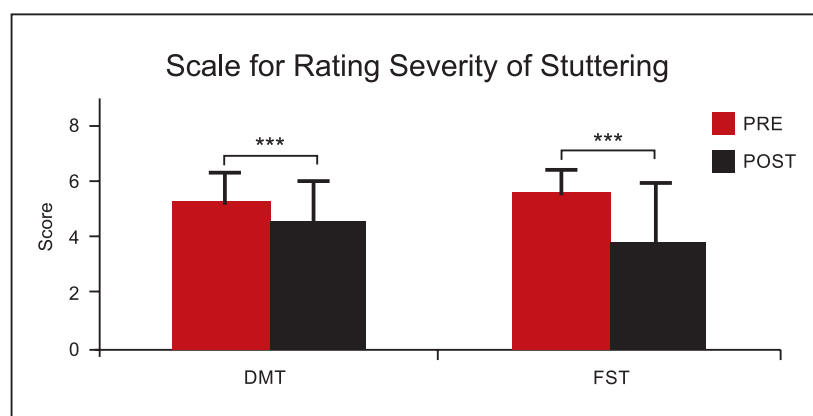


Figure 1: Comparison between Digital Manipulation of Thyroid cartilage (DMT) and Fluency Shaping Therapy (FST) (Before and after Intervention) \*\*\* (p < 0.001)

groups regarding the severity of stuttering ( $5.3 \pm 0.94$  vs.  $5.6 \pm 0.96$ ;  $p = 0.492$ ). Paired t-test was used to see changes within the group which showed that as a result of 12 weeks of treatment, both groups demonstrated significant improvement ( $p < 0.001$ ) (Figure 1). Independent samples t-test was used to compare both groups after 12-week intervention and results showed that there was no significant difference between DMT and FST groups regarding the severity of stuttering ( $4.6 \pm 1.26$  vs  $3.8 \pm 0.91$ ;  $p = 0.12$ ).

## DISCUSSION

The purpose of this study was to investigate the effectiveness of digital manipulation of thyroid cartilage as compared to fluency shaping therapy in adults for the management of stuttering. The current study has shown that both DMT and FST are significantly effective techniques for the management of stuttering ( $p < 0.001$ ). There was no significant difference between both groups regarding severity of stuttering at the baseline and both groups demonstrated significant improvement after the 12 weeks of treatment.

One study has shown that irregular laryngeal behaviors are the main characteristics which interrupt function of the speech and cause stuttering.<sup>6</sup> Another study has suggested that spasmodic dysphonia is an over-contraction of muscles during speaking and this symptom has described as laryngeal stutter. Stuttering has similar features of spasmodic dysphonia such as presence of severe contraction of larynx which block airflow.<sup>18</sup>

Fluency shaping therapy is also an effective technique for the management of stuttering. But in this technique patient has to speak in specific method such as prolongation of speech and continuous phonation etc in every speaking situation.<sup>8</sup> Whereas in DMT patient speaks on natural way and patient do not have to prolong the speech etc.<sup>14,15</sup>

Fluency shaping therapies regularize basal ganglia activity, reduce over-activity of right hemisphere and normalize the left hemisphere activity.<sup>12</sup> Functional magnetic resonance imaging (fMRI) study reports association between activity in the basal ganglia and severity of stuttering and shows that this activity is modified by fluency shaping therapy and reflects improvement in speech production.<sup>19</sup> Another neuroimaging study have expressed persistent developmental stuttering may be linked with a defect in white matter of left-hemispheric speech area. Fluency shaping therapy reorganizes neuronal communication between the left sided speech motor execution, motor planning and temporal areas.<sup>11</sup>

One case study has been reported in Pakistan on the effects of digital manipulation of thyroid cartilage for the management of stuttering. A 21 year's old male with severe stuttering was treated with digital manipulation of larynx. Scale for Rating Severity of Stuttering was used for pre and post assessment. At the baseline score of severity of stuttering on Scale of rating severity of stuttering (SRSS) was 6 –severe stuttering, after the 12 sessions of treatment patient showed improvement and score of severity of stuttering was 3–mild to moderate stuttering on SRSS. The results indicated that DMT was effective technique to improve laryngeal movement thus reducing the severity of stuttering.<sup>16</sup>

This study is related to Mathieson et al because Laryngeal Manual Therapy (LMT) was used for the management of muscle tension dysphonia where the harshness of vocal tract distress is main characteristic of characteristic of Muscle Tension Dysphonia (MTD), on the other side irregular laryngeal behaviors is main characteristic and cause of stuttering. In both conditions cause is related to vocal tract dysfunction. Secondly the procedure of treatment is same in both condition i.e. the vertical downward movement of the larynx in the vocal tract by DMT leads to improved quality

of voice and reduced vocal tract distress consequently reduce frequency and harshness of vocal tract.<sup>20</sup>

Current study has observed that two patients in DMT group have not shown significant improvement on rating severity of stuttering. They showed improvement but within the category. Frequency of stuttering at the baseline was 50% and after 12 weeks of treatment frequency of stuttering was 36% but this improvement did not change category and remained on same category of (SRSS-7; very severe stuttering). Another patient who was on SRSS-6 (severe- stuttering) his frequency of stuttering before the therapy was 20% and after the therapy frequency of stuttering was reduced to 16%. This treatment showed improvement but patient remained in the same category.

At the baseline both groups were same regarding the severity of stuttering ( $5.3 \pm 0.94$  vs.  $5.6 \pm 0.96$ ;  $p = 0.492$ ) after 12 week of treatment both groups exhibited improvement on the scale for rating severity of stuttering. On the other hand, all patients in FST group have shown improvement on rating severity of stuttering and got promoted to a lower category on the scale for rating severity of stuttering. However, the two groups are statistically similar after the rehabilitation period but DMT is cost effective, time effective, easy technique compared to fluency shaping therapy. Patient can learn this technique and can apply at home or elsewhere. When patient applies this technique at home his hospital visits will automatically be reduced and this will decrease the financial burden on the patients.

## CONCLUSION

Both DMT and FST were equally effective techniques for the management of stuttering in adults. However, DMT is an easy technique and patient can learn and apply this technique at home or anywhere. It can be performed at low cost, and patient will speak in natural way rather than using specific method.

## LIMITATION & RECOMMENDATIONS

The major limitation of the current study was that the sample size of the patients was very small for an interventional study. Secondly study subjects were only adult males' hence its effectiveness in females and children has to be established. Further large scale studies on adults and children of both genders are needed to compare effectiveness of DMT and FST in the management of stuttering. It is recommended that patient must be properly trained before its application.

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#### CONFLICT OF INTEREST

Authors declared no conflict of interest

#### GRANT SUPPORT AND FINANCIAL DISCLOSURE

NIL

#### AUTHORS' CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

**NK:** Concept & study design, acquisition analysis and interpretation of data, Drafting the manuscript, final approval of the version to be published

**TM:** Acquisition of data, Drafting the manuscript, final approval of the version to be published

**WAA:** Acquisition of data, critical revision, Drafting the manuscript, final approval of the version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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