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ORIGINAL RESEARCH



The effect of tele-speech therapy on treatment of stuttering

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ABSTRACT

Purpose: The aim of this study was to evaluate the effect of tele-speech therapy on the recovery of patients with a stutter.

Methods: This research was an interventional study conducted on the patients visiting two rehabilitation centres. In this study, patients with a stutter participated in the tele-speech therapy sessions *via* Skype. Stuttering Severity Instrument-Fourth Edition was used to determine the severity of stutter before and after the intervention.

Results: The results showed a significant difference in the mean scores of stuttering severity before and after tele-speech therapy ($p = 0.001$). Our findings showed a mean reduction of 13.8% in stuttering scores. More than half of the patients (56.6%) reported a “high” and “very high” satisfaction with this treatment method.

Conclusions: Tele-speech therapy is an effective way for the treatment of stuttering patients irrespective of their age, gender, and educational background. This method can improve patient’s speech and reduce stuttering.

ARTICLE HISTORY

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KEYWORDS

Stuttering; speech therapy; skype; tele-rehabilitation; videoconferencing

► IMPLICATIONS FOR REHABILITATION

- Tele-rehabilitation is an effective way to treat stuttering.
- Tele-speech therapy can be implemented for any group of stuttering patients.
- Participants were satisfied with the tele-rehabilitation intervention.
- Tele-speech therapy accelerates the treatment process.
- Tele-speech therapy eliminates patient travels to speech therapies.

Introduction

Today, telemedicine is profoundly used as a means for the remote interaction of patients with healthcare providers with the goal of providing better access to the providers, reducing medical costs, preventing unnecessary patients referrals to healthcare centres, reducing waiting time for appointments and improving patient care [1]. One of the important telemedicine subspecialties is tele-rehabilitation, which provides services to disabled patients by utilising telecommunication technologies; and minimises distance, time and cost barriers for delivery of care [2].

Early treatment of speech and language disorders increases the chance of improving communication skills in patients. According to the Scientific Secretary of the 12th Conference of Speech Therapy, 5–6% of the Iranian population suffer from speech disorders, among which stutter with 0.7 prevalence is a common disorder [3]. Access to appropriate treatment is not provided to all these patients due to unavailability and lack of providers such as speech-language pathologists in some regions, the high cost of transferring patients, patients travel fatigue, and long rehabilitation process [4]. Tele-speech therapy can be an effective alternative when a speech therapist is not available [5]. In Iran, different languages with different dialects and accents are spoken. In the field of speech therapy, in order to provide optimal service,

the full conformity of the language and accent of therapist and patient is essential. For example, an Azeri-language patient needs a therapist who speaks the same language but this therapist may not be available in the patient’s region [6]. The use of technology as a facilitator provides the possibility of communication with a speech therapist [7] and offers fair access to this type of service for all patients [4]. Although access to the technology in Iran is not comparable to most of the countries across the globe, a previous study in Iran showed that the applied infrastructure for the treatment of stutter is appropriate [8]. In this study, the participants sometimes experienced a delay in displaying videos due to a low Internet connection, however, repeated use of the infrastructure during the treatment led to more satisfaction [8].

Video conferencing is a good and suitable tool for providing auditory, verbal and visual interaction between the provider and the person who requires speech therapy [9]. Studies in this area have pointed to the impact of utilising this technology on the recovery of patients with a speech disorder, among which Palsbo’s study [10] showed that functional communication of patients *via* videoconferencing is equal to their face-to-face encounter. Brennan [11] in a study confirmed the effectiveness of using videoconferencing by speech-language pathologists (SLP) for the treatment of speech disorders in people with brain injury. Mashima et al. study [12] showed that there were no difference in

the treatment outcomes between the group receiving in-person treatment and the group receiving the treatment through video-conferencing, and the participants in both groups showed improvement in all outcomes. In Sicotte's study [13], the treatment of stuttering children and adolescents through tele-speech therapy were successful so that their stuttering severity decreased from 13–36% before the treatment to 2–26% after the treatment, and participants were satisfied with this method of the treatment. These studies provided strong evidence for the effectiveness of telemedicine and the usefulness of tele-speech therapy. Despite the efficacy and cost-effectiveness of telemedicine methods, to our knowledge, no study has used the Stuttering Severity Instrument tool for the standard evaluation of stuttering to determine the effect of tele-therapy. The aim of this study was to evaluate the recovery rate of patients with stutter using tele-speech therapy interventions.

Methods

This interventional and descriptive-analytic study evaluated the recovery rate in adults with stutter using tele-speech therapy interventions. This study was conducted in 2017 and confirmed by the Research Ethics Committee of Kerman University of Medical Sciences (IRQ.Kmu.REC. 1396 1085).

The study population consisted of patients admitted to two rehabilitation centres affiliated with Jahrom Social Welfare Bureau. Jahrom is a city located in South of Iran with a population of 141,634 people. No sampling method was used and all 30 patients admitted over a 3-month period were invited for tele-speech therapy *via* Skype. Patients older than 14 years who announced their consent to participate in the study were included. Exclusion criteria composed of being younger than 14 years, a stuttering frequency less than 2% of syllables stuttered, lack of consent to participate in the study, having a major illness or accompanying disorders that necessitate patient referral, and previous treatment of speech-restructuring over the past 6 months. At the time of the study, all participants had been suffering from developmental stuttering from childhood, of whom 29 participants had the history of stuttering therapy.

At first, the consent forms were completed by the participants. Subsequently, a speech-language pathologist determined the severity of stuttering for each participant using Stuttering Severity Instrument-Fourth Edition (SSI-4) [14]. The severity of stuttering is one of the most common criteria that can be used in clinical and research activities to study the effects of speech therapy methods on stuttering and to judge the progression of recovery from stuttering. The reliability of the Persian version of this instrument was confirmed in a study by Tahmasebi et al. [15]. SSI-4 assesses the stuttering severity in four areas of speech behaviour: frequency, duration, physical concomitants, and naturalness. The frequency is the percentage of syllables stuttered (%SS) and is scored on a scale of 2–18. The duration is the average length of three longest stuttering events, which is scored on a scale of 4–17. In order to measure physical concomitants, four types of these behaviours are independently scored on a scale of 0–5 and the total score is defined on a scale of 0–20. The overall score for stuttering is between 0 and 56. The average percentage of syllables stuttered (%SS) is obtained from the sum of two samples of spoken and reading assignments divided by the number of samples. The naturalness of speech is scored on a 9-point scale from “speech seems quite natural” with a score of 1 to “speech seems totally abnormal” with a score of 9 [14].

The participants attended the tele-speech therapy sessions (lasting about 45 min) in two rehabilitation centres. A speech-language pathologist based on the status of each patient and the severity of stuttering determined the number of required treatment sessions. This had an average of 15 sessions. Sessions were held on a weekly basis by a speech-language pathologist using video conferencing *via* Skype. The same pathologist holds all the treatment session. The treatment method used in this study was the Camperdown Programme. The Camperdown Programme is a speech restructuring programme for stuttering adults. The programme consists of four stages of teaching treatment components, the conveyance of natural speech without stuttering in the treatment environment, the transmission of natural speech without stuttering in everyday situations, and the maintenance [16,17].

After completion of the treatment sessions, a stuttering severity instrument (SSI-4) was performed by the speech-language pathologist for the participants and their scores were recorded. Finally, the results of stuttering scores before and after intervention were entered into SPSS 19. In order to investigate a change in the stuttering severity, the pre-test and post-test scores were compared using the paired samples *t*-test.

A Point-biserial correlation coefficient test was used to examine the relationship between gender and stuttering severity, syllables stuttered, and naturalness of speech. The Spearman Correlation Coefficient test was also used to examine the relationship between the education level and stuttering severity, syllables stuttered, and naturalness of speech after the intervention. Finally, the Pearson Correlation Coefficient test was used to examine the relationship between age and stuttering severity, syllables stuttered, and naturalness of speech.

After completion of the therapeutic sessions, the participants' satisfaction with the tele-speech therapy programme was measured based on a 5-point Likert scale from “not at all satisfied” = 1 to “extremely satisfied” = 5.

Results

In total, all patients admitted to the rehabilitation centres (100%) received tele-speech therapy. The participants consisted of 56.7% male and 43.3% female with a mean age of 23.23 (SD = ± 6.39) ranging from 14 to 39. More than half of them (56.6%) had no college education and most of those with a college education (36.7%) had undergraduate degrees.

Table 1 summarises the results of frequency, duration, physical concomitants, overall score, the average syllables stuttered, the naturalness of speech and stuttering severity of the participants before and after receiving tele-speech therapy. The results showed that all 30 participants had recovery progression in their stuttering. The stuttering severity of 76.92% of the participants with severe ($n=8$) and very severe stuttering ($n=5$) was reduced to mild and very mild.

Table 2 shows the mean and standard deviation of patients' scores related to the average syllables stuttered (%SS), the naturalness of the individual's speech, the overall scores of the test and its components (frequency, duration, and physical concomitants) before and after the tele-speech therapy intervention. The results showed a decline in the mean scores of patients tests and their components (frequency, duration, and physical concomitants) after the tele-speech therapy intervention compared to the pre-intervention stage. The mean of average percent syllables stuttered decreased in the post-test phase compared to the pre-

Table 1. Frequency, duration, physical concomitants, overall score, average syllables stuttered (%SS), naturalness of speech, and stuttering severity of the participants before and after receiving tele-speech therapy.

Participant	Stuttering frequency score		Duration score		Physical concomitants score		Overall score		The average percent syllables stuttered (%SS)		Naturalness of the individual's speech		Severity	
	*Pre	*Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	11	5	12	10	7	5	30	20	5.4	2.3	1	2	Moderate	Mild
2	14	5	12	4	8	2	34	11	10.36	1.7	2	2	Very severe	Very mild
3	15	8	6	4	9	4	30	16	12.09	3.18	1	4	Moderate	Very mild
4	15	13	8	8	13	9	36	30	12.4	8.75	1	2	Severe	Moderate
5	18	4	8	4	12	4	38	12	25.6	1.12	2	4	Very severe	Very mild
6	13	1.25	10	2	5	2	28	5.25	9	0.62	2	3	Moderate	Very mild
7	18	5	12	4	13	4	43	13	31.25	1.5	1	3	Very severe	Very mild
8	9	5	4	2	5	4	18	11	3.55	2.15	1	1	Mild	Very mild
9	14	6	10	6	8	6	32	18	9.1	3.4	1	3	Severe	Mild
10	17	13	8	6	11	9	36	28	18.65	10.65	1	1	Severe	Moderate
11	11	6	2	2	12	10	25	18	5.45	1.7	1	1	Moderate	Mild
12	11	3	6	4	9	6	26	13	5.15	1.1	3	2	Moderate	Very mild
13	15	4	6	2	9	4	30	10	14.6	1.5	1	2	Moderate	Very mild
14	17	13	12	10	11	11	40	34	21.95	11.5	1	2	Very severe	Severe
15	14	9	10	8	8	7	32	24	10.85	3.65	3	2	Severe	Mild
16	14	2	2	2	2	0	18	4	9.94	0.3	1	1	Mild	Very mild
17	12	0	2	0	0	0	14	0	6.77	0	1	1	Very mild	.
18	12	6	12	6	8	7	32	19	7.18	1.91	3	2	Severe	Mild
19	6	4	2	2	4	4	12	10	1.8	1.62	1	1	Very mild	Very mild
20	9	0	2	0	2	0	13	0	3.8	0	3	2	Very mild	.
21	4	0	2	0	7	0	13	0	1.62	0	2	2	Very mild	.
22	10	6	4	2	5	2	19	10	4.35	2.23	1	2	Mild	Very mild
23	14	9	6	2	6	2	26	13	9.84	3.54	2	2	Moderate	Very mild
24	12	7	8	4	6	4	26	15	7.01	2.64	1	2	Moderate	Very mild
25	13	9	10	6	9	4	32	19	7.65	3.42	2	2	Severe	Mild
26	12	4	10	4	12	6	34	14	7.74	1.85	1	3	Severe	Very mild
27	10	3	4	2	11	5	25	10	4.81	1	1	3	Moderate	Very mild
28	13	7	12	4	11	7	36	18	10.56	2.45	2	3	Severe	Mild
29	9	4	6	2	7	4	22	10	4.02	1.27	1	2	Mild	Very mild
30	14	9	10	4	13	5	37	18	12.54	3.85	2	3	Very severe	Mild

*Pre: Before telespeech therapy.

†Post: After telespeech therapy.

. No stuttering.

Table 2. The mean and standard deviation of patients' scores related to the average percent syllables stuttered (%SS), the naturalness of speech, and overall scores of the test and its components (frequency, latency and physical symptoms) before and after the tele-speech therapy interventions.

Variable	Before intervention	After intervention
	Mean (SD)	Mean (SD)
The average percent syllables stuttered (%SS)	9.83 (6.86)	2.69 (2.82)
Naturalness of the individual's speech	1.53 (0.73)	2.17 (0.83)
Overall Score	27.9 (8.58)	14.10 (8.25)
Subcategory		
Stuttering frequency	12.53 (3.24)	5.67 (3.59)
Duration	7.26 (3.65)	3.86 (2.67)
Physical concomitants	8.10 (3.48)	4.56 (2.92)

Table 3. The difference between the mean scores of stuttering severity, syllables stuttered and naturalness of speech in pre and post-test according to the results of Paired samples *t*-test.

Variable	Stage	Mean	SD	Mean difference	<i>t</i>	<i>p</i> -Value
Overall score	Before interventions	27.9	8.58	13.79	11.88	0.001
	After interventions	14.10	8.25			
The average percent syllables stuttered (%SS)	Before interventions	9.83	6.86	7.13	6.26	0.001
	After interventions	2.69	2.82			
Naturalness of the individual's speech	Before interventions	1.53	0.73	-0.63	-3.35	0.002
	After interventions	2.17	0.83			

Table 4. Matrix of correlation between research variables, and participants age, gender and education.

Variable	Overall score			The average percent syllables stuttered (%SS)			Naturalness of the individual's speech		
	Correlation	Sig	Bonferroni correction	Correlation	Sig	Bonferroni correction	Correlation	Sig	Bonferroni correction
Age	0.11	0.56	0.23	-0.03	0.86	0.28	-0.13	0.46	0.36
Gender	0.14	0.34	0.84	0.17	0.26	0.51	0.16	0.36	0.36
Education	-0.10	0.60	0.8	-0.26	0.16	0.14	0.10	0.60	0.6

test phase, and the mean scores of speech naturalness increased after the tele-speech therapy intervention.

The results of paired sample *t*-test showed that the average stuttering score of the participants significantly decreased from 27.9 in the pre-test to 14.10 in the post-test ($p < 0.001$). The mean of the syllable stuttered variable significantly declined from 9.83 in the pre-test to 2.69 in the post-test phase ($p < 0.001$). The mean scores related to the naturalness of the individuals' speech significantly increased from 1.53 in the pre-test to 2.17 in the post-test phase ($p < 0.01$) (Table 3).

Our results showed that there was no significant relationship between the participants age and stuttering severity, the mean percentage syllables stuttered and the naturalness of speech ($p > 0.05$). The results of the Point-biserial correlation coefficient showed that there was no significant relationship between the participants' gender and the above-mentioned variables ($p > 0.05$). Also, the results of the Spearman Correlation Coefficient showed that there was no significant relationship between educational degree and stuttering severity, mean percentage syllables stuttered and naturalness of speech ($p > 0.05$) measured after the intervention (Table 4). To decrease the likelihood of incorrectly rejecting a null hypothesis, the Bonferroni correlation test was performed. Our results showed that there was no significant relationship between demographic characteristics of the participants (including age, gender, and educational degree), and stuttering severity, mean percentage syllables stuttered and naturalness of speech ($p > 0.05$) (Table 4).

Figure 1 shows patients satisfaction with tele-speech therapy. More than half of the patients reported high and very high satisfaction ($n = 17$, 56.6%) with the tele-speech therapy.

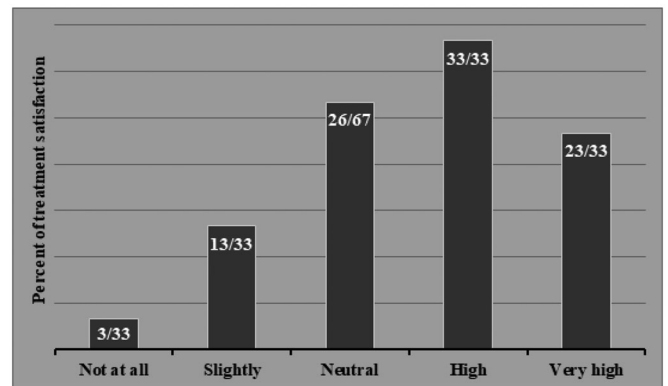


Figure 1. Participants satisfaction with the tele-speech therapy intervention.

Discussion

The results of this study showed a significant difference in the mean score of stuttering severity of patients before and after tele-speech therapy. Hence, tele-speech therapy is an effective method for the treatment of stuttering patients and it can improve patients' speech. Our findings showed a mean reduction of 13.8% in the stuttering severity.

The results of various studies showed that tele-speech therapy can improve the speech of patients [4,18,19]. Similar to our results, in Sicotte et al. study [13] the speech conditions of all patients were improved and their stuttering severity decreased from 13% to 36% before treatment to 2–26% after treatment. Bridgman [20] confirmed the success and feasibility of the Lidcombe care plan for children via a webcam and showed that it

can be just as effective as the care plan in the clinic. Carey et al. [18] in their study used the Camperdown plan for treatment of three adolescents using a webcam. The average of their stuttering reduction before treatment till entering to maintenance stage was 83%, showing the effectiveness of this method. Our study also confirmed the effectiveness of the Camperdown care plan by webcam. The effectiveness of this type of tele-therapy plan in adults was also evaluated by another study, and it has been shown that this treatment method can be as effective as face-to-face treatment [21]. Kully [22], in his research, considered inter-active videoconferencing to provide follow-up services to adults with stuttering as a telecare solution.

Our study confirmed the results of previous studies that tele-speech therapy can successfully resolve stuttering problems with a high rate of patient satisfaction. Therefore, given the effectiveness of this therapeutic method, in terms of increasing access to speech therapists who is familiar with the language and dialect of the patients, it can be used as an appropriate alternative to face-to-face treatment. This method can also save patients time and money. According to Statista in April 2019, Iran has the highest number of the Internet users in the Middle East and 62.7 million individuals use the Internet [23]. Therefore the basic infrastructure for providing tele-practice is accessible for most individuals. However, when the patient has no access to the required infrastructure, tele-speech therapy can be provided in rehabilitation clinics that have no specialised therapists in this regard.

In the present study, there was no significant relationship between demographic characteristics of the participants (including age, gender, and educational degree), and stuttering severity, mean percentage syllables stuttered and naturalness of speech. Therefore, stuttering characteristics (i.e., stuttering severity/percent of syllables stuttered/naturalness) are not influenced by demographic characteristics.

Unlike previous studies that investigated the effectiveness of tele-speech therapy on a limited number of patients [4,9,13,24–30], we included all adult patients admitted to two rehabilitation centres to improve the generalizability of the results. Moreover, we did not charge the patients for receiving treatment during the study period, to encourage all patients to participate in the study. In addition, in contrast to other studies that focussed on percent of syllables stuttered and naturalness of speech for evaluating the outcome of treatment [18,25,31], in this study, the fourth version of the SSI tool was used, which evaluates all aspects of the disorder including frequency, duration, physical concomitants, and naturalness of speech. A recent systematic review on seven studies about tele-practice treatment of stuttering done by McGill showed that tele-practice appears to be a promising method for treatment of stuttering using the Camperdown Programme (applied in two studies), Lidcombe Programme (applied in two studies), and the integrated approaches [32].

The present study was a first attempt to investigate the effect of tele-speech therapy on patients with speech disorders in Iran. It is expected that the results of this study would result in the widespread use of this method in countries with the dispersed population speaking in a large number of dialects and accents.

One of the limitations of this study was the concern of the patients and their families to use Skype. To overcome this limitation, the researchers taught the participants how to use Skype. Another limitation of this study was patients' absence at some of the pre-planned therapeutic sessions, which wasted time of the researchers and the therapists due to the follow-up process and making new appointments. Due to the limited timeframe of the

study, we could not evaluate the fourth phase of the Camperdown plan (the maintenance stage). We recommend that future studies address the fourth phase of the Camperdown plan and examine the effectiveness of this treatment method on the maintenance stage of the speech.

In this study, the tele-speech therapy method has improved the speech of all participants indicating the effectiveness of this method for accelerating the treatment process as well as eliminating patient travels to speech therapies, and finally reducing costs. Tele-speech therapy brings many potential capabilities and significant long-term benefits to the healthcare system, especially in a large country such as Iran with a dispersed population. It facilitates the equal distribution of health staff and services in all areas of the countries. Tailoring tele-speech therapy interventions based on the common speech disorders in a region can improve the efficiency of the provided treatments. Since introducing new interventions such as tele-speech therapy may raise the rate of resistance in providers, it is essential to ensure the readiness of providers and healthcare centres before tele-speech therapy intervention.

Conclusions

Tele-speech therapy effectively improves the speech of patients with stuttering and reduces the stuttering severity of patients. Beside the effectiveness of this therapeutic method, the majority of patients were satisfied with this method. Due to the uneven distribution of speech therapists in many countries like Iran, the use of tele-speech therapy can improve patients' access to effective treatment without the need to travel. It is recommended that health policymakers, the ministry of health authorities, budget allocation officials, and health system managers make the critical decisions and take serious actions to implement tele-speech therapy for patients who have no face-to-face access to this service.

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Ethical approval

To observe the ethical considerations, the Research Ethics' Committee of Kerman University of Medical Sciences approved the study (Ethical code: IR.KMU.REC.1396.1085).

Informed consent

The researcher asked the participants to complete the written informed consent forms. Moreover, they were also ensured about the confidentiality of their personal information. For patients younger than 16 year old, parents or legal guardians gave their consents. The study objective was explained to this group of patients in presence of their parents and when both patients and parents were agreed on the participation in the study, the form was signed by the parents.

Disclosure statement

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