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Immediate Effect of Semi Occluded Vocal Tract Exercise (SOVTE) on Voice Quality in Elderly Patients: A Case Report

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ABSTRACT

Dysphonia is a public health concern affecting communication, social functioning, and quality of life. It is particularly significant in older adults, who are already at higher risk of depression and social isolation. Further communication impairment can worsen these symptoms. As a result, treating dysphonia in older individuals is warranted and necessary. We reported a case of 85 years old male referred to our department with the changes in voice quality since 3-4 months. The acoustic perceptual and indirect laryngoscopy was performed which reveals the predominantly hoarse voice quality. We started with SOVT exercise and immediately after the SOVT exercise, a voice sample was recorded and analysed for six consecutive sessions. During six consecutive sessions of SOVT exercise, we observed a notable improvement in voice quality. Hence, our experience suggests that SOVT exercise can effectively treats dysphonia in the elderly population, with remarkable improvement in voice quality and underscores the challenges and limitations of voice therapy effectiveness for the elderly population. This case report provides the preliminary evidence and further studies are needed to establish its efficacy in large elderly clients with vocal fold pathologies.

Keywords: Elderly patient, Voice therapy, Maximum phonation time, Acoustic parameters, Semi-occluded vocal tract exercises (SOVTE)

INTRODUCTION

Voice disorder is said to have occurred when voice quality, pitch, and loudness differ or are inappropriate for an individual's age, gender, cultural background, or geographic location. Voice disorders affect different populations, including children, adults, and the elderly [9]. There are numerous articles available in both the geriatric and adult populations, but there are fewer articles in the geriatric population than in the adult population. Voice therapy in the elderly showed a diversity between the interventions, as well as in the methodology of application and evaluation of the proposed therapeutic models. Most of the studies use established methods, such as Vocal Function Exercises (VFE) [2] Semi occluded vocal tract exercise (SOVTE), Lee Silverman Voice Treatment (LSVT) [3], and PhoRTE [4]. Among these Semi-occluded vocal tract (SOVT) exercises using a straw or tube are a well-known method of treating voice disorders. The studies examining the effect of SOVTE included acoustic parameters of voice quality to assess

treatment effects in dysphonic patients and the effects of SOVT exercises on ageing have not been much explored. Consequently, we are presenting a case of an elderly population and the impact of SOVT exercise here.

CASE REPORT

An 85-year-old elderly male retired from income tax department, reported with a complaint of change in voice quality since 3-4 months. The patient reported of increased Voice breaks and tiredness after excessive voice usage. The Client reported that as the day progressed, his voice became worse. The subject had been taking blood pressure medication for more than ten years. No other associated problems were reported. The current study was explained and a signed written informed consent was obtained from the patient. The patient was from South India, in the state of Karnataka, and lived in Mangalore. He was having general stable health conditions and cognitive and motor conditions that allowed the evaluation and therapy procedures to be completed; no reported neurological problems; no previous laryngeal surgery; and no complaints of hearing loss that interfered with understanding of the instructions given during the assessments and therapy sessions.

INVESTIGATION

Two qualified Speech-Language Pathologist (SLP) and an Otorhinolaryngologist, carried out a detailed voice assessment. Two qualified SLPs who had experience in the area of voice disorders collected the case history details and performed the voice assessments. In the objective voice assessment, the sustained phonation of voice samples was obtained. The microphone was positioned laterally 5 cm away from the mouth of the participant, who remained seated in front of the examiner. Client was instructed to sustain phonation of the vowel /a/ as long as possible, keeping the comfortable pitch and intensity. The voice samples were recorded using Multi-Dimensional Voice Profile (Kay Elemetrics Corporation, Lincoln Park, NJ, USA) software in a sound treated room with a sampling frequency of 44.1 kHz with 16-bit quantization. A stopwatch was used to record the Maximum Phonation Time (MPT). The patient's voice was perceptually rated using GRBAS scale [G-Grade; R-Roughness; B-Breathiness'; A-Asthenia; S: Strain, rated on a 4-point scale]. The voice evaluation was performed for before after voice therapy and the results were analysed. In-direct laryngoscopy (IDL) revealed the presence of Chronic Laryngitis. No participation of false vocal cords during voice production was observed. From the case history, ENT findings and acoustic-perceptual voice assessments, the patient was diagnosed to have predominantly hoarse voice quality secondary to Chronic Laryngitis. Following medical treatment for the laryngitis, voice therapist was advised to the client.

TREATMENT PROCEDURE

The client was given the SOVTE technique, which involves using a

1) Straw with and without phonation.
2) Phonation with humming and pitch glide phonation. [11]

After detailed assessment, the client had their baseline measurements taken before the initiation of voice therapy session. Participant was assessed on acoustic parameters using MDVP software and MPT measurements were taken, as well as sustained phonation of /a/ vowel was used for perceptual voice rating using the GRBAS Scale. Once the baseline was taken the client performed all steps mentioned in the protocol, with an average duration of 10 minutes Counted by a stopwatch After the client has completed 10 minutes of SOVTE exercise, Post therapy acoustic parameters was measured using MDVP software and perceptual parameters was measured using GRBAS Perceptual rating Scale.

OUTCOME AND FOLLOW UP

We started with the SOVT voice therapy protocol as mentioned above for the 6 consecutive days. The results of paired sample t-test showed no significant difference ($p>0.05$) between the pre-test versus post-test scores in average fundamental frequency, highest fundamental frequency, and lowest fundamental frequency. Shimmer (%), shimmer (db), amplitude perturbation quotient (APQ), pitch perturbation quotient (PPQ), Relative amplitude perturbation (RAP), smoothed pitch perturbation quotient (sPPQ), fundamental frequency variation (vF0), variation in amplitude (vAm).

In addition, there was a significant difference observed between pre-test and post-test scores for Jitter [t (4) =.974, p = 0.04] and PPQ [t (4) = 3.577, p = 0.02] and Harmonic to noise ratio (HNR) [t (4) =-2.799, p = 0.04].

The findings of our study suggest that there was change observed (insignificantly) in the acoustic analysis where the fundamental frequency of voice decreased from 301.26 Hz to 277.66 Hz and the lowest and highest fundamental frequency moved towards normalcy for male voice. As a result of voice therapy, the NHR value decreased (insignificantly) and the HNR value increased (significantly) (Refer Figure 6 & 7).

Results of the perceptual assessments using GRBAS scale revealed an improvement in overall grade and roughness, but not in other parameters such as breathiness, asthenia, and strain (Refer Figure 8).

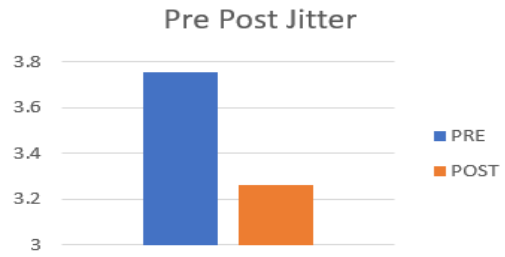

Fig 1. Jitter values before and after voice therapy.

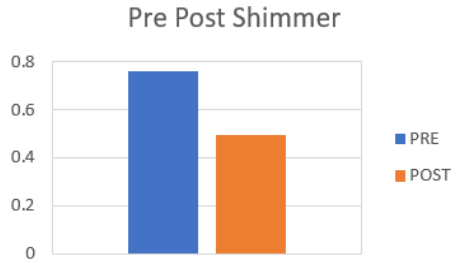

Fig 2. Jitter values before and after voice therapy.

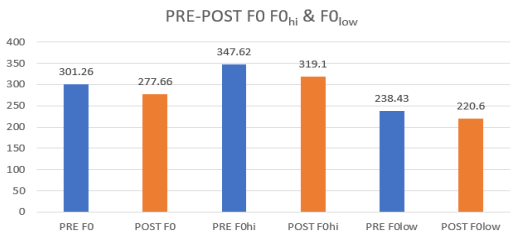

Fig 3. Fundamental frequency (F0), high (F0hi) and low (F0low), before and after voice therapy.

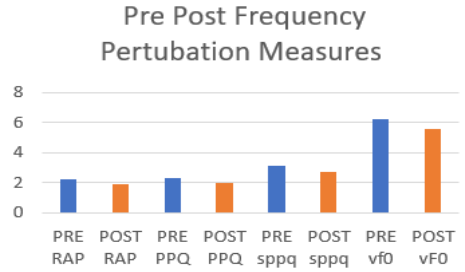

Fig 4. Frequency perturbation measures before and after voice therapy.

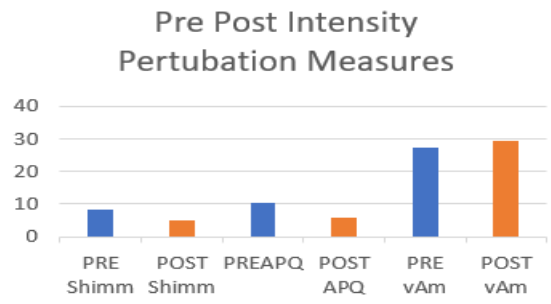

Fig 5. Intensity perturbation measures before and after voice therapy.

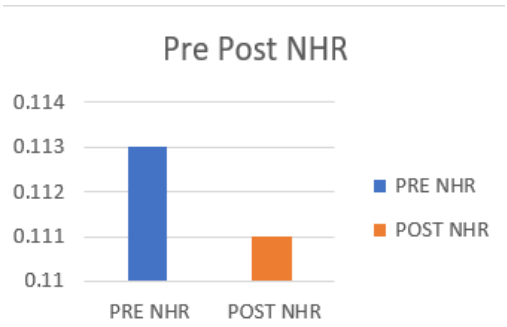

Figure 6. Noise-to-harmonic ratio (NHR) before and after voice therapy.

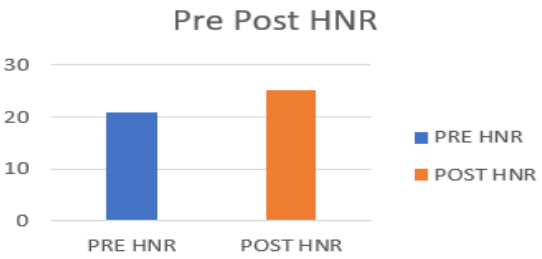

Figure 7. Harmonic-to-noise ratio (HNR) before and after voice therapy.

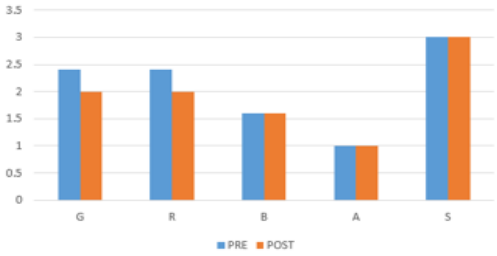

Figure 8. GRBAS score before and after voice therapy.

Parameters	***Mean***		***SD***		***P value***
	Pre	***Post***	***Pre***	***Post***	
Average Fundamental Frequency (MF0)	*301.265*	*277.666*	*28.23*	*26.43*	*.157*
Highest Fundamental Frequency (FHi)	*347.62*	*319.1*	*24.6*	*24.9*	*.077*
Lowest Fundamental Frequency (Flo)	*238.43*	*220.6*	*46.8*	*50.9*	*.600*
Jitt (%)	*3.7552*	*3.263*	*.4652*	*.4571*	*.047**
Shim (%)	*8.1454*	*5.026*	*5.116*	*1.181*	*.218*
ShdB	*.7598*	*.4956*	*.4874*	*.1460*	*.226*
RAP	*2.1994*	*1.9022*	*.278*	*.270*	*.050*
PPQ	*2.3302*	*1.972*	*.319*	*.283*	*.023**
sPPQ	*3.0892*	*2.732*	*1.30*	*.626*	*.617*
vF0	*6.2112*	*5.5514*	*4.9758*	*1.4698*	*.808*
APQ	*10.4036*	*5.7492*	*7.8744*	*1.9535*	*.728*
vAm	*27.5994*	*29.383*	*8.2437*	*11.705*	*.225*
NHR	*0.113*	*0.111*	*.025*	*.011*	*.910*
HNR	*20.94*	*25.13*	*3.43*	*3.09*	*0.04**

Table 1: Comparison of MDVP Parameters before and after therapy

DISCUSSION

Following six consecutive voice therapy sessions using SOVTE, the client underwent a pre-post evaluation each day and it was found that the client's jitter and shimmer values was found to be (perturbation measures) decreased. This indicates a more stable voice with less variation in pitch andloudness. As a result, this implies that SOVTE has a positive effect on individuals. However, the average F0 was reduced from 301.26 Hz to 277.66 Hz and the trend was moving closer to normal frequency range after treatment. Furthermore, there was a decrease in the highest fundamental frequency (HiF0) and lowest fundamental frequency (LowF0). The mean NHR value was also found to be decreased in post-

therapy sessions, while the HNR value was found to be increased. This lower NHR and a higher HNR *indicate superior (good) voice quality*. The improvement in acoustic parameters reveals reduced vocal instability, which is caused by age-related changes. In the mentioned case, the cycle-to-cycle fundamental frequency (RAP, PPQ, sPPQ, vf0) and amplitude (Shim db.), APQ, vAm) values have been decreased post therapy, suggesting better maintenance of periodic vibration. The use of semi-occluded vocal tract exercises is effective in voice treatment, since it enhances interaction between the source (vocal fold vibration) and the filter (resonant organs). It has been also shown that such interactions can boost the power, effectiveness, and efficiency of voice communication [12]. Therefore, it can lead to better voice production with a lower phonation threshold pressure [13] and an enhanced skewing of the glottis flow waveform (rapid flow cessation) [13, 14]. In a study conducted by Guzman et al. [15], semi-occluded vocal tract therapy, such as tube or straw phonation, was found to improve vocal efficiency and economy. Hence, we can confirm the immediate effect of SOVTE to aid in the rhythmic vibration of vocal folds in geriatric case with dysphonia. Perceptual measures using the GRBAS Scale indicate a difference in overall grade and roughness when compared to other perceptual parameters. Whereas parameters like breathiness, asthenia, and strain are unaffected, this could be assumed due to bowing and atrophy of the vocal fold and glottic chink in older people [6]. The results of this study confirm earlier research, which found that strain and breathiness asthenia in older people's voices (Above 70 years of age) did not significantly alter with voice therapy [16]. This aligns with conclusion that age-related changes in vocal function can hinder the effectiveness of therapeutic interventions aimed at improving voice quality in older adults. Therefore, while voice therapy remains a valuable tool in addressing vocal disorders across various age groups, its impact appears to diminish as individuals advance in age, potentially due to age-related physiological changes affecting vocal resilience and responsiveness to treatment.

It is also recognised that the present study has several limitations, Firstly, the study involved a limited number of subjects, which can affect the generalizability of the findings to a broader population seeking similar treatments. Additionally, the duration of the intervention might not have been sufficient to fully capture the long-term effects or potential benefits of voice therapy in geriatric individuals. Future studies should integrate advanced auditory perceptual evaluations of voice with sophisticated visual examinations of the larynx, such as videostroboscopy and high-speed videoendoscopy, to achieve a more precise assessment of vocal fold dynamics.

CONCLUSION

This study provides the preliminary evidence of the immediate effect of Semi-occluded vocal tract exercise on acoustic and perceptual parameters in elderly patient with dysphonia. The study's findings indicate that voice therapy may have limited effectiveness in improving vocal capabilities among geriatric populations, primarily due to the natural effects of aging on the voice. As individuals age, physiological changes such as vocal fold atrophy, decreased muscle tone, and increased stiffness can compromise vocal function. These age-related factors can make it challenging for voice therapy interventions to achieve significant improvements in vocal quality, particularly in addressing issues like strain, breathiness, and overall vocal endurance. Therefore, while voice therapy remains a valuable treatment option, clinicians and researchers should consider age-specific factors and potentially adapt therapeutic approaches to better meet the needs of older adults experiencing voice-related challenges.

Based on qualitative and quantitative measures, this case study found positive immediate effect in using SOVTE in elder subject's vocal behaviour before and after therapy. The long-term effect of the same

can be studied in future. Hence, more studies are warranted to establish the efficacy of SOVTE among elderly clients with vocal fold pathologies.

Declaration by Authors
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Conflict of Interest: The authors declare no conflict of interest.

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