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Research article

VOICE RELATED QUALITY OF LIFE IN INDIVIDUALS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) refers to lung diseases such as, Chronic Bronchitis, Chronic Asthma and Emphysema. These diseases are characterized by obstruction to airflow that interferes with normal breathing and they frequently co-exist. COPD can affect voice as respiration is a vital subsystem for voice production COPD that have a significant voice impairment which might further impact the quality of life. There are very few studies available in the voice literature on the assessment of quality of life in individuals with COPD. In this regard, the study aimed to assess the voice related quality of life in individuals with COPD and compare the findings with normal controls. **Methods:** 64 participants were considered for this present study under two groups (Group 1: individuals with COPD, Group 2: normal individuals). The voice disorder outcome profile (Voice-DOP), self-perceived severity of voice problem rating scale and the modified medical research council (MMRC) dyspnoea scale were the quality of life measures employed in this study. **Results:** There was statistically significant difference between the two groups on all the three measures at $p < 0.05$. Further, a positive correlation was found between all the three measures. **Conclusions:** These findings indicate that COPD has an impact on the individual's quality of life. This could be attributed to the voice deviations due to COPD itself or due to the effects of the medication that cause an impact the voice related quality of life in these individuals.

Key words: Voice Related Quality of life, Voice disorder outcome profile, Self-perceived severity of voice problem, Modified Medical Research Council dyspnoea rating scale, Chronic Obstructive Pulmonary Disease

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is an abnormality of the respiratory system in which the swelling and inflammation of the lining of the airway leads to airway obstruction due to narrowing of airway. This kind of inflammation stimulates the mucous (sputum) production excessively, which causes further obstruction in the airway. COPD is a broad term that covers several lung conditions which

include Chronic Bronchitis, Chronic Asthma and Emphysema¹.

COPD has various causes; one of the leading causes is smoking / consumption of tobacco. Further, environmental factors and genetic influences can also heighten a person's likelihood of acquiring COPD. Long-term exposure to lung irritants that damage the lungs and the airway as a result of air pollution,

occupational dusts, second-hand smoke and chemicals are some of the environmental factors.²Few might acquire COPD due to Heredity factors which include a history of childhood respiratory infections/COPD, while few others might develop COPD due to low levels of alpha-1 antitrypsin (AAT) which is also known as the “Lung Protector” is a protein made in the liver.

Few common symptoms of COPD are chronic cough, shortness of breath (dyspnoea), Xerostomia, frequent respiratory infections and dysphagia in severe cases. COPD can affect voice production and quality, directly - because it is associated with respiratory decline, and indirectly - as associated with concurrent symptoms or due to the side effects of medication. Voice problems in these individuals have been neglected and increased prominence is given to assessment and treatment of the respiratory problem, despite the fact that the respiratory system is the source for voice production. These respiratory conditions are known to cause adverse effects on voice production.

There are few studies available in the voice literature on individuals with asthma with very few studies that have focussed on the voice measures in COPD.³⁻⁵One such study was done by Shastry and Balasubramaniam⁶ where they studied the acoustic and perceptual parameters of voice in 14 individuals with COPD and compared the findings with the 14 normal individuals. The perceptual analysis was done using CAPE - V and Acoustic analysis was performed using CSL software. The results showed that there was a significant difference between the two groups on acoustic and perceptual measures. The COPD individuals had a lower fundamental frequency, increased pitch and amplitude perturbation measures. The frequency range, intensity range, SPI & NHR measures did not show any significant difference across the two groups (COPD & Normal Controls). Perceptual analysis results showed the presence of slight hoarse component. They reported that the respiratory obstruction resulted in inadequate breath support due to which there was increased aperiodicity in vocal fold vibration resulting in the above findings.⁶From this it is clear that individuals with COPD have a significant voice impairment hence this might further restrict the individual's activity and limit the individual's participation.

Hence there is a need to evaluate the quality of life in individuals with COPD.

Voice related Quality of life measurement is the assessment of the overall outcome of the physical, mental, and social well-being of an individual as a result of a voice disorder. Currently, the voice related quality of life measures such as Voice disorder outcome profile⁷, Voice handicap index⁸ are available to assess the effect of voice on the individual's quality of life. Self-perceived severity of voice problem rating scale is a general parameter of the evaluation of subjective aspects regarding the voice problems. This is helpful in assessing the quality of life in individuals with voice abnormalities.

In a study done by Zeijger, Dejonckere and Wijnen the voice related quality of life was assessed using the Voice Handicap Index in 44 individuals with obstructive pulmonary disease. Each patient also filled in the MRC scale (Medical Research Council) a scale for subjective assessment of the severity of dyspnoea. Results of their study showed that globally the VHI-scores of patients with chronic lung disease are significantly higher than those of the normal controls.⁹ There was no significant difference between the median VHI score of asthma and COPD individuals. Further, no statistically significant correlation was found between the degree of impairment of the respiratory function as measured with the spirometric parameters - and the VHI-score. However, the correlation between MRC and VHI scores was found to be statistically significant.⁹

Similarly the present study was carried out with the intention of assessing the voice related quality of life in individuals with COPD. Hence this study was done using the voice disorder outcome profile and the self-perceived severity of the voice problem as these measures have been developed for the Indian population. Also, these have good validity and reliability. MMRC¹⁰ was also used in order to assess the self-perception of the breathlessness of the COPD individuals.

Need for the study: The respiratory system is considered to be the base for voice production. As COPD causes voice deviations, we have hypothesised that there would be an impact on the quality of life in these individuals. Hence, there was a need for analysis of voice related quality of life in these individuals so that a proper understanding about their voice problems can be obtained. Hence, we planned

to investigate the voice related quality of life measures in individuals with all types of COPD

Aim of the study: To assess the voice related quality of life in individuals with Chronic Obstructive Pulmonary Disease (COPD).

Objectives of the study: 1. To investigate the quality of life measures in individuals with COPD, 2. To compare the findings of quality of life measures in COPD individuals along with that of normal individuals.

MATERIALS AND METHODS

Participants: The 64 participants (30 females & 34 males) were divided into two groups. Group 1 consisted of 32 individuals between 25 to 75 years of age mean age = 43 years with the diagnosis of COPD. The diagnosis of COPD was done by an experienced physician in the field of pulmonary medicine based on the signs, symptoms and lung function tests. All the types of COPD were included in this group. Group 2 consisted of 32 age and gender matched normal controls. The exclusion criteria for both groups included a history of vocal abuse/misuse, professional voice users, history of surgery to the laryngeal structures/voice therapy hearing impairment and neurological problems affecting the voice production.

Materials:

1. Voice Disorder Outcome Profile (Voice-DOP)⁷: This is a reliable and valid tool to measure impact of voice disorder on the individual's quality of life in the Indian population in English & Kannada language.⁷ This profile consists of 32 questions each requiring a response from the participant on a visual analog scale of 100 mm undifferentiated line with the extreme left end marked as "never" and the extreme right end as "always". The questionnaire is used for self-assessment for quality of life ratings (Voice-DOP).⁷
2. Self - Perceived Severity of Voice Problem⁷: The individuals were asked to rate the severity of their voice problem along with the Voice-DOP. Self-Perceived Severity Rating is a single question and it is also based on a visual analog scale of 100 mm with the left extreme edge marked as "normal" and the right extreme as "severe".

3. Modified Medical Response Council dyspnoea scale: Modified Medical Research Council (MMRC) Dyspnoea Scale uses a simple rating system to gauge the patient's level of dyspnea.¹⁰ MMRC grading scale was also given to the participants which consists of 5 point rating scale that has to be rated based on the individuals self-perception from 0-4. The participants had to choose the Grade that best represents their condition.

Procedure: The study was carried out in the Department of Audiology and Speech Language Pathology, Kasturba medical college hospital, Attavar, Mangalore. This study followed a comparative cross sectional study design, with the Nonrandom Convenient Sampling procedure. Ethical approval was received from Manipal University's Institutional human research ethics committee. The participants were comfortably seated and details regarding the assessment procedures were explained and assessment began only after obtaining the written consent from the participants. The Voice Disorder Outcome Profile, Self - Perceived Severity of Voice Problem and MMRC were the scales employed to assess the quality of life in this present study. The clients were given the questionnaire for self-assessment for quality of life ratings (Voice-DOP). The subjects had to rate their responses to each of the 32 questions under 3 domains (physical, emotional and functional) on a visual analog scale which is a 100-mm undifferentiated line with the left extreme edge marked as "never" and the right extreme as "always". Along with the Voice-DOP, the individuals were also being asked to rate the severity of their voice disorder as per the self-perceived severity of the voice problem in the same manner with the left extreme edge marked as "normal" and the right extreme as "severe." The subjects were asked to fill the questionnaire without any assistance from the clinician. In addition to these two measures the MMRC grading scale was also given to the individual which is a 5 point grading system with scores from 0-4. The participants were instructed in detail to fill in each rating scale and instructions was repeated whenever requires and clarification was sought as and when necessary.

Data Analysis: The filled questionnaire was scored based on the distance (mm) measured from the left extreme end of the scale to the mark made by the

individual for each question of all the 3 domains. The total Voice-DOP score was obtained by summing the scores of all three domains (physical, emotional & functional). The total Voice-DOP score for an individual could be a maximum of 3200 (there are 32 items with 100 as a maximum for each item) and a minimum of 0. The self-perceived severity scale was scored in the same manner like that of the voice-DOP where the distance (mm) measured from the left extreme end of the scale to the mark made by the individual for his/her self-perceived severity of the voice impairment. Thus, a maximum score for self-perceived severity was 100 and the minimum score possible was 0. The MMRC is a 5 point rating scale and the grade is chosen by the patients themselves based on the description that represents their condition and tabulated for analysis.

Statistical analysis: The self-perceived severity ratings as well as the Voice – DOP ratings of the subjects of both groups were compared using

Independent-samples t-test. The Mann Whitney U test was employed to compare the MMRC Dyspnoea rating between the groups. The Spearman's correlation statistic was administered to check for the association between the MMRC rating, self-perceived severity rating and the voice DOP rating. Statistical analysis was done using the statistical package SPSS, version 17.0 at $p < 0.05$ considered as significant.

RESULTS

The responses were analysed for the voice related quality of life and self-perceived severity of the voice problem. The mean and standard deviation for each domain was calculated for both the groups (Table 1). As observed from the table, the COPD group had higher mean scores on the voice disorder outcome profile and self-perceived severity of the voice problem rating scale in comparison to the normal group.

Table 1: Descriptive statistics for voice related quality of life measures for both the groups

Voice related quality of life measures	COPD	Normal	T value	P value
Physical	272.1±194.7	0.6 ± 3.8	7.8	0.000
Emotional	101.9 ± 144.9	0.0 ± 0.0	3.9	0.000
Functional – Job	19.9 ± 33.1	0.0± 0.0	3.4	0.000
Functional Daily Communication	58.6 ± 76.1	0.0 ± 0.0	4.3	0.000
Functional Social Communication	13.0 ± 29.9	0.0± 0.0	2.4	0.000
Total QOL score	465.6 ± 381.2	0.6± 3.8	6.8	0.000
Self -perceived severity of the voice problem	31.1± 20.5	0.3± 1.7	8.4	0.000

The statistical analysis using Independent-samples t-test revealed a significant difference between the two groups for voice disorder outcome profile and the self-perceived severity of the voice problem rating scale with the COPD group having significantly higher scores at $p < 0.05$. The Independent-samples t-test showed that the COPD group had higher scores on voice disorder outcome profile for the Physical Domain at $t(62) = 7.88, p = 0.00$, Emotional Domain at $t(62) = 3.97, p = 0.00$, Functional Domain (Job Related) at $t(62) = 3.40, p = 0.001$, functional domain (Daily Communication) at $t(62) = 4.35, p = 0.00$, functional domain (Social Communication) at $t(62) = 2.45, p = 0.017$ in comparison to the normal controls. The Total QOL score was also significantly higher in the COPD group at $t(62) = 6.899, p = 0.00$

As all domains had a higher score in the COPD group. The Independent-samples t-test also indicated that the self-perceived severity of the voice rating was significantly higher in the COPD group in comparison to the normal group at $t(62) = 8.478, p = 0.00$ also which suggests that these individuals have a reduced voice related quality of life. The mean and standard deviation for MMRC was calculated for both groups. The COPD group had a higher mean grade (*Mean* = 2.21, *SD* = 0.90) than the normal group (*Mean* = 0.00, *SD* = 00.0).

The Mann Whitney U Test was performed to check for the significant differences in MMRC across the groups. Results revealed that there were statistically significant differences between the groups with the COPD group having a higher grade compared to the

normal group at $z = -7.407$, $p = 0.00$, suggestive of an increased breathlessness in the COPD group.

Correlation between the Voice-related quality of life measures and MMRC: The COPD Group had higher values on the voice related quality of life measures (Voice- DOP and self- perceived severity of voice problem) as well as the MMRC dyspnoea rating scale. Therefore, this study investigated the association between these measures to know if the level of dyspnoea correlated with the severity of voice problem and the quality of life. For this purpose a series of Spearman's rank correlation coefficient was employed. A two-tailed test of significance indicated that there was a significant positive relationship between the voice – DOP and the self-perceived severity of voice problem at $r_s (64) = 0.967$, $p = 0.00$ (Figure 1). However, a similar two tailed test of significance also revealed a positive relationship between the voice –DOP and the MMRC dyspnoea rating scale at $r_s (64) = 0.964$, $p = 0.00$ (Figure 2). Further, the MMRC dyspnoea rating scale also showed a positive correlation that was significant with the self-perceived severity of voice rating at $r_s (64) = 0.961$, $p = 0.00$ (Fig 3).

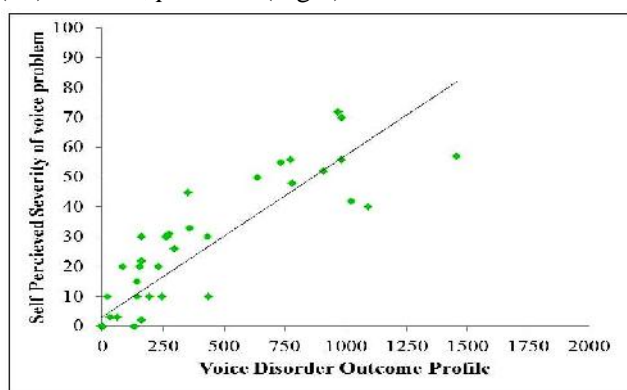


Fig 1: Scatter plot representing association between Voice-DOP and Self-perceived severity of voice problem

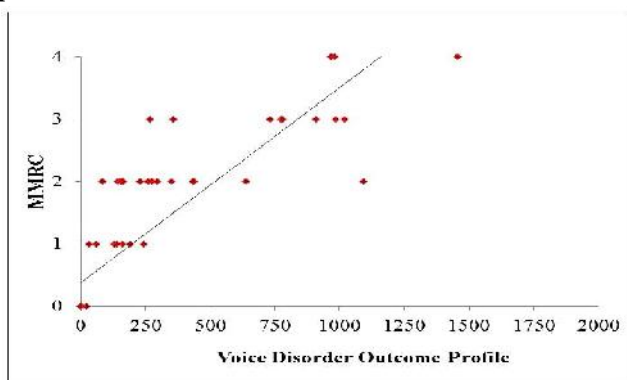


Fig 2: Scatter plot representing association between Voice – DOP and MMRC

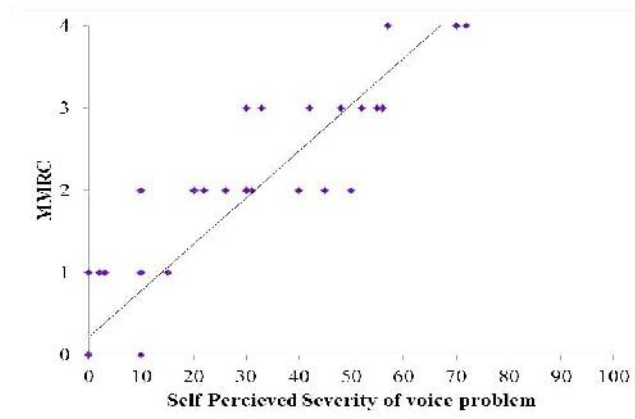


Fig 3: Scatter plot representing association between MMRC and Self-Perceived Severity of voice problem

These findings indicate that the individuals with higher rating on the MMRC dyspnoea scale had an increased voice–DOP score along with higher perceived severity of the voice problem. All the above findings indicate that COPD has a significant impact on the voice related quality of life.

DISCUSSION

It is well known that the respiratory system serves as the source for voice production. Hence a deviancy in the anatomical or physiological aspect of the respiratory system can have an undesirable effect on voice production. Therefore, the present study was carried out with the aim of assessing the voice related quality of life in individuals with COPD. For this purpose the quality of life measures (Voice-DOP, self-perceived severity of voice problem and MMRC) were measured in individuals with COPD and the findings were compared with that of the normal population.

Voice Disorder Outcome Profile: The present study showed that the COPD individuals had a higher score on this measure compared to a normal population suggestive of an impaired voice related quality of life in the COPD individuals. Further, the results of the present study also revealed a statistically significant difference between the groups on the all the domains. Physical domain assesses the problems concerning the voice output and voice usage due to the impact of the voice disorder. The COPD group had a significant impact of a mild to moderate degree on the physical domain while normal group had no impact on physical domain. The self-perception of the physical domain indicates that the voice impairment also correlates well with the findings of Shastri and

Balasubramaniam who reported abnormal acoustic and perceptual parameters in individuals with COPD.⁶ This is attributed to the impact of the respiratory abnormality on the laryngeal behaviour that has also been reported in many studies done on individuals with COPD,^{3,4,5} thus resulting in the restricted vocal behaviour due to which the overall Quality of life is compromised in the individuals with COPD. Further, the above findings may also be attributed to the fact that individuals with COPD have abnormal speech, breathing patterns^{11,12} resulting in the abnormality in voice.

Emotional domain assesses the problems concerning the psychological impact of the voice problems on the individuals. The COPD group had a mild impact on the emotional domain while the normal group had no impact on the emotional domain. This finding specifies that the voice impairment resulting from COPD may have resulted in a small impact on the personality and self-esteem of the individual. The COPD also impacted the individuals concern and emotional response. However the impact was not as high as was present in the physical domain. This finding was similar to the findings obtained by Zeiger where in the emotional impact of the voice problem in individuals with COPD is present but to a mild degree.⁹

Functional Domain mainly assess the self-perception of the impact of the voice problem on the participation in daily routine activities, job related activities as well as on an individual's ability to socialise. The COPD group had a slight impact on the functional domain when compared to the normal group where there was no impact. This is due to the impact of the COPD on the voice making it difficult to communicate for purpose of daily communication, job related aspects and social communication. The results also showed that the daily communication and job related aspect of the functional domain had a higher impact than the social communication part of the functional domain. Similar findings were obtained by Zeijger, Dejonckere & Wijnen in their study on individuals with chronic lung disease.⁹ The greater impact of the voice problem on the functional domain pertaining to the daily activities and job related activities is due to the greater frequency of voice usage during the daily activities and job-related activities due to which the individuals with COPD frequently encounter difficulty compared to social

communication aspect of the functional domain. All these findings shows that the individuals having COPD most often have voice abnormalities due to which there is further limitation in activities and participation restriction.

Self-perceived severity of the voice problem: This particular scale assesses the individual's self-perception of the degree of voice abnormality/impairment. Results revealed a statistically significant difference across the two groups where the COPD group had higher ratings ranging from a mild to moderate degree while the normal group had no perceived voice problems. These findings are also in accordance with the findings obtained from the physical domain on voice disorder outcome profile from this present study. The findings are also in line with findings reported by Zeijger, Dejonckere & Wijnen where they found a significant impact of voice problems in individuals with chronic lung disease on the physical domain.⁹ These findings are in line with findings reported by Shastry and Balasubramaniam⁶. This finding could be attributed to the respiratory insufficiency where in the chronic lung disease restricts the source required for voice production thus leading to an abnormality in the functioning of the phonatory system that further affects the voice quality observed in individuals with COPD. Similarly the abnormal speech breathing patterns could also be the reason for the abnormal voice^{11, 12}. Further the voice problem is such that the individuals themselves are able to perceive the voice abnormality.

MMRC scale: This particular scale assess the individual's self-perception about his dysnoea. The results revealed that the individuals of the COPD group had statistically significant higher grades when compared to the normal group. This shows that all individuals with COPD had breathlessness. In the present study, it was observed that all individuals with COPD had a score greater than two (indicating that they had breathlessness after walking long on a levelled ground at their own pace) while all normal individuals scored 0 (indicating no breathing difficulty). The higher score is due to the presence of the reduced breath support due to the presence of the obstructive pulmonary disease leading to the increased MMRC score. There was no significant gender differences observed for scores on this rating scale.

Correlation between the voice related quality of life measures and the MMRC scale: On clinical observation of the raw scores, it was found that the individuals with a higher score on MMRC scale had a greater impact on the overall voice related quality of life. The statistical analysis also revealed that there was a positive relationship between the voice – DOP measure, self-perceived severity rating as well as the MMRC grades. This means to say that the higher level of breathing difficulty an individual exhibits, he is at higher risk of having an impaired voice related quality of life. This finding is interesting as it clearly shows the relationship between the breathing problem, the severity of the voice problem caused due to COPD and its impact on the quality of life of the individual. Zeiger, Dejonckere & Wijnen in their study on individuals with obstructive pulmonary disease also reported a similar finding where they reported significant correlation between the MRC scale and VHI.⁹ However, observation of raw data showed that a few individuals with very mild form of COPD had scores near to normal population indicating that all individuals with COPD may not have an equal degree of impaired voice related quality of life.

The result of the present study provided an insight about effect of COPD on the Voice related quality of life. This brings the need for voice intervention in this population so that quality of life may be improved. The findings from this study will also guide us in planning a good voice intervention program for these individuals so that their problems specific to each domain (physical emotional & functional) can be appropriately addressed.

CONCLUSION

The present study aimed at assessing the voice related quality of life. Voice Disorder Outcome Profile, Self-Perceived Severity of Voice Problem rating scale and MMRC dyspnoea rating scale. The results disclosed significant difference across the groups with the Voice Disorder Outcome Profile, Self-Perceived Severity of Voice Problem ratings and the MMRC scores being higher in the COPD individuals in comparison to the normal controls indicative of a reduced quality of life. Further, statistical analysis revealed a positive correlation between the three voice related quality of life measures which showed that the more severe dyspnoea the individual

exhibited, greater was the severity of the voice problems and more is the negative impact on the quality of life. All these findings indicate that the COPD affects the respiratory capacity of the individual which further causes voice problems that impacts the overall activity and participation of the individual. The findings of this study will help us in planning a good intervention program for these individuals so that their problems can be appropriately addressed. Further research can also be done to analyse the impact of the COPD types as well as the severities of COPD on the quality of life so that a clearer understanding about their impact on the voices can be obtained. Further studies should address the efficacy of the various voice treatment approaches in individuals with COPD.

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Conflicts of interest: Nil

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