Original Article

https://doi.org/10.1590/2317-6431-2018-2012

Audiology Communication Research
ISSN 2317-6431

Relationship between auditory-perceptual and self-assessment measures in patients with multiple sclerosis

Relação entre medidas perceptivo-auditivas e de autoavaliação em pacientes com esclerose múltipla

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ABSTRACT

Purpose: To determine the relationships between auditory-perceptual and self-assessment measures in patients with multiple sclerosis with and without vocal complaints. **Methods:** Eighteen subjects diagnosed with multiple sclerosis, including 12 women and 6 men aged between 21 to 67 years, participated in the study. A brief anamnesis, the Voice Symptom Scale and the Living with Dysarthria questionnaire were completed, followed by recording of the sustained /ɛ/ vowel. The overall severity of vocal deviation and the degrees of roughness, breathiness, strain and instability were assessed by three speech therapists using a 100-mm visual analogue scale. **Results:** Patients with multiple sclerosis and vocal complaints had higher Total (p= 0.026) and Limitation (p= 0.042) scores on the Voice Symptom Scale and on sections one (p= 0.041), four (p= 0.030) and ten (p= 0.050) of the Living with Dysarthria questionnaire. Strong positive correlations were found between the Total and Limitation scores of the Voice Symptom Scale and the scores of sections one, four and nine of the Living with Dysarthria questionnaire. **Conclusion:** Patients with multiple sclerosis and vocal complaints have higher frequencies of symptom occurrence and emotional and speech effects. No relationship was found between auditory-perceptual and self-assessment measures in patients with multiple sclerosis. However, the scores on the two self-assessment instruments used are strongly correlated.

Keywords: Multiplus sclerosis; Voice; Voice quality; Voice disorder; Self-assessment

RESUMO

Objetivo: Verificar se existe relação entre medidas perceptivo-auditivas e de autoavaliação em pacientes portadores de esclerose múltipla com e sem queixa vocal. **Métodos:** Participaram 18 sujeitos com diagnóstico de esclerose múltipla, com idade entre 21 e 67 anos, sendo 12 mulheres e 6 homens. Foram aplicadas uma breve anamnese, a Escala de Sintomas Vocais e o protocolo Vivendo com Disartria, seguida da gravação da vogal /ɛ/ sustentada. A intensidade do desvio vocal e os graus de rugosidade, soprosidade, tensão e instabilidade foram avaliados por três fonoaudiólogos, utilizando-se uma escala analógico visual de 100 mm. **Resultados:** Os pacientes com esclerose múltipla com queixa vocal apresentaram maiores escores no Total (p= 0,026) e na Limitação (p= 0,042) da Escala de Sintomas Vocais; na section um (p= 0,041), section quatro (p= 0,030) e section dez (p= 0,050) do Vivendo com Disartria. Houve correlação positiva forte entre os escores da Escala de Sintomas Vocais Total e Limitação e os escores da section um, quatro e nove do Vivendo com Disartria. **Conclusão:** Pacientes com esclerose múltipla com queixa vocal possuem maior frequência de ocorrência de sintomas e de impactos emocionais e na fala. Não há relação entre as medidas perceptivo-auditivas e de autoavaliação em pacientes portadores de esclerose múltipla. No entanto, os escores dos dois instrumentos de autoavaliação utilizados são fortemente correlacionados.

Palavras-chave: Esclerose múltipla; Voz; Qualidade da voz; Distúrbio de voz; Autoavaliação

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Conflict of interests: No.
Authors' contribution: All authors were responsible for the preparation of the manuscript. LWL was responsible for the orientation of the research; MMA and MHM were responsible for data analysis and review of the manuscript; ILBL was responsible for collecting the data.

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Received: April 22, 2018; **Accepted:** August 14, 2018

INTRODUCTION

Multiple sclerosis (MS) is a chronic, inflammatory, demyelinating, autoimmune, neurological disease that alters central nervous system (CNS) functioning, causing motor and cognitive disabilities[1].

Patients with MS show a wide variety of signs and symptoms and usually nonlinear progression, varying between periods of worsened and improved symptoms[1]. MS symptoms include changes in gross and fine motor skills (such as mobility problems, muscle fatigue, dysarthria and dysphagia)[2], sensory abnormalities (vision problems)[3], cognitive impairment (learning, memory and verbal fluency)[4,5] and emotional changes (mood swings, depression, apathy, anxiety and stress)[4].

Among these symptoms, fatigue is one of the most common and affects the functional capacity of the subject both physically and cognitively, with negative implications for activities of daily living, work, socialization and memory, among others[5-7].

Regarding voice and speech difficulties, patients with MS may show articulatory changes, hypernasality, excessive or reduced pitch variation, breathiness, hoarseness and impaired loudness control, which are typical signs of dysarthria[8,9].

In neurological diseases, voice symptoms are among the early-onset manifestations. In a study on patients with MS, 70% of the subjects showed vocal symptoms associated with each other and with the disease, which occurs because neurological control of the voice is quite refined and involves several regions of the central nervous system[10]. In addition, dysarthria due to neurological diseases may compromise the communication skills and functioning of individuals and their participation in communication tasks, leading to psychological and social impacts[9,10].

Therefore, voice assessment is an important part of oral communication assessment protocols for dysarthria, including auditory-perceptual evaluation of voice quality, acoustic voice analysis and voice self-assessment[9,10]. Combined analysis of the resultant data by clinicians may provide a clearer view of altered vocal parameters and the impact of voice changes on the lives of patients.

Self-assessment instruments are designed to assess the impact of voice problems on specific populations and age groups[11,12], voice use under specific occupational conditions[13,14] or specific conditions of voice disorders[9,15,16].

Among these instruments, the Living with Dysarthria (LWD) questionnaire, which has been translated and culturally adapted to Brazilian Portuguese[9,15], assesses the impact of dysarthria on the communication abilities of patients with neurological conditions compromising voice and speech. The LWD questionnaire contains 50 questions divided into 10 sections, which are scored on a six-point Likert scale.

The Voice Symptom Scale (VoiSS) is an instrument routinely used to assess the frequencies of vocal symptoms in patients with some type of voice-related complaint[17]. This scale is considered the most robust voice self-assessment instrument in terms of psychometric properties. The VoiSS contains 30 questions addressing physical, communication and emotional symptoms, and its possible answers are "never", "occasionally", "some of the time", "most of the time" and "always" as rated on a five-point Likert scale (zero to four)[17].

Therefore, considering the importance of understanding the interrelation between auditory-perceptual and self-assessment parameters in individuals with voice disorders of neurological origin, the objective of this study is to determine the relationship between auditory-perceptual measures and VoiSS and LWD scores among patients with MS with and without vocal complaints.

METHODS

This is an observational, descriptive, cross-sectional study, which was evaluated and approved by the Human Research Ethics Committee, Health Sciences Center, Federal University of Paraíba (Universidade Federal da Paraíba – UFPB) under number 52492/12. Ethical standards were met during all procedures.

Before initiating data collection, the state MS association was visited to contact its members and inform them about the study procedures and objectives. Then, the individuals interested and available to participate in the study completed a form including their full names and contact telephone numbers, as well as an informed consent form. Subsequently, the subjects were contacted by telephone to schedule a time for data collection.

The following eligibility criteria for participation in the study were established: a medical diagnosis of MS and the absence of other (cognitive or motor) comorbidities preventing voice data collection and questionnaire administration procedures. Patient complaints or a diagnosis of voice and speech changes were not considered eligibility criteria but rather criteria for subject allocation to the groups with and without vocal complaints.

Thus, the resulting convenience sample consisted of 18 subjects with ages ranging from 21 to 67 years (with a mean age of 43 years), including 12 women and six men.

Data were collected at the Voice Laboratory, UFPB. Initially, a brief anamnesis was completed, including personal data and a binary (yes/no) question regarding the presence of vocal complaints at the time of data collection or in the last six months. Of the 18 participants, 12 (66.7%) had vocal complaints, whereas six (33.3%) reported no complaints.

Subsequently, the VoiSS and LWD questionnaire were administered. The items in each domain were summed to calculate the overall scores.

The participants' voices were recorded in a sound-treated booth, with background noise lower than a 50-dB sound pressure level (SPL), which was assessed using a digital sound level meter. A Sennheiser E835 cardioid unidirectional microphone was used, which was mounted on a microphone stand and coupled to a Dell desktop computer using a Behringer U-Phoria UMC 204 audio interface and the software FonoView (CTS Informática). The sampling rate was 44.100 Hz, thus preserving most voice signal data. For recording, the microphone was placed at a mean distance of 10 cm from the labial commissure.

To record the voice, the subject was asked to emit a sustained vowel sound, /ɛ/, at a comfortable, self-selected frequency and intensity. Data collection sessions, including VoiSS and LWD questionnaire administration and voice recording, lasted 60 minutes on average.

After collecting the data, the voices were edited in the software Sound Forge version 10.0, and the two initial and final seconds of the vowel were removed due to greater irregularity in these stretches, while a minimum time of three seconds of data was preserved for each emission. The data were normalized in the "normalize" control of the Sound Forge software in peak level mode to standardize the audio output between -6 and 6 decibels.

The auditory-perceptual voice analysis was performed using a visual analogue scale (VAS) ranging from zero to 100 mm to assess the severity of vocal deviation (the overall degree, OD) and the degrees of roughness (DR), breathiness (DB), strain (DS) and instability (GI). A score closer to zero corresponds to less vocal deviation, and a score closer to 100 corresponds to greater voice changes. Three speech therapists specialized in voice with over 10 years of experience in auditory-perceptual evaluation performed this assessment.

Before the auditory-perceptual evaluation, 16 anchor stimuli of the sustained vowel /ɛ/ were used to train the judges, including four samples from vocally healthy individuals, four samples from subjects with mild vocal deviation, four samples from individuals with mild-to-moderate vocal deviation and four samples from individuals with severe vocal deviation. Two files of male voices and two files of female voices were available for each degree of vocal deviation. The judges were asked to listen to the anchor stimuli immediately before analyzing the voices collected in this study. All samples selected for this training were previously analyzed by speech therapists experienced in voice analysis and were routinely used for auditory-perceptual training and as anchor stimuli at the study Laboratory.

For the auditory-perceptual evaluation, each sustained vowel phonation was presented to the judges three times using a speaker at a self-reported comfortable intensity. Then, they judged the OD of vocal deviation and the DR, DB, DS and GI.

Together with the 18 voices collected in this study, 10% of the samples were randomly repeated to analyze intrarater reliability using Cohen's kappa coefficient. Thus, the data from the auditory-perceptual evaluation of the judge with the highest intrarater reliability – a Cohen's kappa coefficient of 0.80, which indicates good agreement – were used. Subsequently, a numerical scale (NS) and the VAS were matched, with degree one (0-35.5 mm) corresponding to normal variability of voice quality (NVVQ), degree two (35.6-50.5 mm) corresponding to mild-to-moderate deviation, degree three (50.6-90.5 mm) corresponding to moderate deviation and degree four (90.6-100 mm) corresponding to severe deviation[18].

The Kruskal-Wallis test was used to compare the auditory-perceptual and self-assessment variables between the patients with MS with and without vocal complaints.

Pearson correlations were used to determine the correlation between the severity of vocal deviation and VoiSS scores to assess whether the variables change together and the extent of such changes. The correlation coefficient ranges from -1 to 1, with negative values indicating that the variables vary inversely proportionally and positive values indicating that they vary proportionally.

In this study, correlation coefficients were classified as follows: 0.1 to 0.3, a weak correlation; 0.4 to 0.6, a moderate correlation; and greater than 0.7, a strong correlation between the variables[19].

The significance level adopted was a p value ≤ 5% for all tests. The software Statistica version 6.0 was used for the analysis.

RESULTS

Based on the data from the auditory-perceptual analysis of the participants' voices, four subjects (22.2%) showed normal variability in voice quality (NVVQ), 11 (61.1%) subjects showed mild-to-moderate deviation, and three subjects (16.7%) showed moderate deviation. Of the 14 participants with voice quality deviations, roughness predominated in eight subjects (57.1%), followed by instability (n= 3, 21.4%) and strain (n= 2, 14.3%).

The mean values of the auditory-perceptual and self-assessment measures were assessed in the group of patients with MS regardless of vocal complaints (Chart 1).

The auditory-perceptual and self-assessment measures were compared between the groups with and without vocal complaints. The results showed that the patients with MS and vocal complaints had higher VoiSS Limitation (VoiSS-L; p= 0.042) and VoiSS Total (VoiSS-T; p= 0.026) scores, as well as higher LWD - section one (p= 0.041), LWD - section four (p= 0.030) and LWD - section ten (p= 0.050) scores (Table 1).

Chart 1. The mean and standard deviation of the auditory-perceptual evaluation of vocal quality and the Voice Symptom Scale and Living with Dysarthria questionnaire scores of the participants with and without vocal complaints

Variable	Group without complaints		Group with complaints	
	Mean	SD	Mean	SD
GG	35.33	11.62	44.66	7.32
GR	31.66	11.46	42.66	7.04
GB	13.91	12.00	32.04	11.93
GS	33.83	12.54	30.41	14.34
GI	21.66	15.57	30.50	17.83
VoiSS-T	12.50	13.05	34.83	20.03
VoiSS-L	5.00	6.69	16.17	11.34
VoiSS-E	1.66	3.20	8.66	8.94
VoiSS-P	5.83	4.26	9.91	5.75
LWD – Section 1	9.83	7.910	16.42	5.869
LWD – Section 2	16.83	9.04	13.00	6.23
LWD – Section 3	14.83	11.23	13.66	8.18
LWD – Section 4	9.00	4.56	15.58	5.91
LWD – Section 5	8.50	6.44	10.91	6.35
LWD – Section 6	8.50	5.08	10.66	6.59
LWD – Section 7	9.66	7.89	11.83	8.41
LWD – Section 8	13.16	10.60	17.83	7.30
LWD – Section 9	10.00	5.62	14.83	5.71
LWD – Section 10	10.50	6.97	17.25	6.34

Subtitle: VoiSS = Voice Symptom Scale; LWD = Living with Dysarthria questionnaire; GG = General grade; GR = Degree of roughness; GB = Degree of breathiness; GS = Degree of strain; GI = Degree of instability; T = Total; L = Limitation; P = Physical; E = Emotional

Table 1. Comparison of voice parameters between the groups with and without vocal complaints

Variable	Group without complaints		Group with complaints		p value
	Mean	SD	Mean	SD	
GB	13.9167	12.00174	32.0417	11.93059	0.041*
VoiSS-T	12.50	13.05	34.83	20.03	0.013*
VoiSS-L	5.00	6.69	16.17	11.34	0.024*
LWD – Section 1	9.83	7.910	16.42	5.869	0.041*
LWD – Section 4	9.00	4.56	15.58	5.91	0.030*
LWD – Section 10	10.50	6.97	17.25	6.34	0.050*

*Significant values (p ≤ 0.05) – Kruskal-Wallis Test

Subtitle: SD = Standard deviation; GB = Degree of breathiness; VoiSS = Voice Symptom Scale; T = Total; L = Limitation; LWD = Living with Dysarthria questionnaire

Subsequently, the correlations between the OD and the VoiSS and LWD scores were analyzed. Strong positive correlations were observed between the VoiSS-T and VoiSS-L scores, between the scores of sections one and four of the LWD and between the VoiSS-T and LWD - section nine scores (Table 2).

DISCUSSION

Dysarthria is one of the main symptoms of MS and affects the quality of life of these patients[20]. In terms of voice quality, mild-to-moderate deviation is generally observed, including roughness, breathiness and strain components[21].

In the present study, of the 18 subjects with MS, 12 had vocal complaints at the time of data collection or in the last six months, and 14 showed voice quality deviation as identified in the auditory-perceptual analysis. Regardless of vocal complaints, the patients showed mild-to-moderate vocal deviation (38.66±13.84), with the roughness component predominating.

In the vocal deviation analysis, although only the DR values were above the cut-off point on the VAS for the group with vocal complaints, DB was the only auditory-perceptual measure that could differentiate the two study groups. The decelerated electrical impulse propagation resulting from the demyelination process that occurs in MS may cause changes in synchronization and frequency stability between vibratory cycles, which may explain the roughness present in the voices of the patients studied[22].

A study[23] on patients with MS found that 23 of 27 subjects showed incomplete glottal closure (observed on visual laryngeal examination) and that the asthenia and breathiness scores of the Grade, Roughness, Breathiness, Asthenia, Strain (GRBAS) scale prevailed among these individuals. Breathiness is generally related to inefficient glottal closure, which is commonly found in MS[20,21]. In addition, the respiratory functioning of these patients is impaired and characterized by respiratory muscle weakness and decreased lung volume, which may decrease the subglottal pressure, thus limiting glottal resistance. Therefore, the presence of breathiness is an important differentiating parameter for patients with MS with and without vocal complaints.

A significant number of patients with MS experience voice problems[20]. Although most patients report vocal complaints, these complaints are not always recorded and are more common in more advanced disease stages[24]. Vocal symptoms ultimately become trivial compared with the patients' concern regarding other symptoms, such as mobility problems, urinary incontinence and sexual dysfunction, which have a greater impact on quality of life at the beginning of the disease[21].

Patients with MS rarely refer to specific voice changes, such as hoarseness and hypernasality, and instead more frequently refer to the effectiveness of communication in social activities. Therefore, we must understand the relationship between the vocal characteristics of these patients and the self-perceived impact on communication[10].

Neurological speech disorders can be easily observed objectively using parameters such as sustained vowel time, the number of syllables per second and speech intelligibility, among others. Subjective analysis, however, is more complex because it addresses internal issues of subjects and therefore their quality of life. Accordingly, self-assessment questionnaires, such as the LWD questionnaire and VoiSS, are very important to quantify the impact of dysphonia on quality of life[15,25].

In general, the patients with MS had a total score of 131.61 points on the LWD questionnaire. A comparison between this score and those presented in a study[9] on different motor speech disorders shows that patients with MS have a higher total LWD score than patients with amyotrophic lateral sclerosis (ALS) with predominantly appendicular symptoms and a lower LWD score than patients with myasthenia gravis, laryngeal dystonia, Parkinson's disease, essential vocal tremor and ALS with predominantly bulbar symptoms.

Therefore, the results show that although vocal complaints and vocal deviation are prevalent among patients with MS, voice and speech changes are not considerably self-reported or highlighted by this group because the patients place greater emphasis on other symptoms within the symptom complex of MS, such as overall mobility problems, sensory abnormalities and emotional changes[3-7]. Accordingly, awareness of voice and speech changes must be increased in this population considering the negative impacts of these difficulties on quality of life and participation in social activities[20].

The scores for the domains VoiSS-T, VoiSS-L, LWD - section one, LWD - section four and LWD - section ten were able to differentiate the groups with and without vocal complaints. Furthermore, a strong positive correlation was identified between these scores.

The higher number of vocal symptoms in the group with complaints is related to the patients' self-evaluation of the impact of MS on their oral communication. One of the clinical characteristics of MS is dysarthria, which causes changes in the voice and speech production mechanisms and may affect respiration, phonation, resonance, articulation and prosody[10].

Table 2. Correlation between the severity of vocal deviation and scores on the Voice Symptom Scale and the Living with Dysarthria questionnaire for individuals with multiple sclerosis

Variable	GG		VoiSS-T		VoiSS-L		VoiSS-E		VoiSS-P	
	Correlation	p value	Correlation	p value	Correlation	p value	Correlation	p value	Correlation	p value
LWD – T	0.037	0.885	0.631	0.005*	0.610	0.007*	0.514	0.029*	0.368	0.133*
LWD – Section 1	-0.154	0.541	0.719	0.001*	0.758	0.000*	0.550	0.018*	0.339	0.169
LWD – Section 4	0.082	0.748	0.778	0.000*	0.700	0.002*	0.612	0.007*	0.611	0.007*
LWD – Section 5	-0.191	0.448	0.572	0.013*	0.478	0.045*	0.559	0.016*	0.341	0.166
LWD – Section 8	0.291	0.242	0.618	0.006*	0.533	0.023*	0.490	0.039*	0.503	0.033*
LWD – Section 9	0.071	0.778	0.708	0.001*	0.654	0.003*	0.562	0.015*	0.336	0.034*
LWD – Section 10	-0.100	0.693	0.573	0.013*	0.553	0.017*	0.473	0.047*	0.173	0.500

*Significant values ($p \leq 0.05$) – Pearson correlation

Subtitle: GG = General grade; VoiSS = Voice Symptom Scale; T = Total; L = Limitation; P = Physical; E = Emotional; LWD = Living with Dysarthria questionnaire

Thus, the patients with vocal complaints have more difficulties with vocal production due to the neurological manifestations of MS, thus increasing the perception of additional vocal symptoms.

The score for the VoiSS-L domain differentiated the groups with and without vocal complaints, indicating that patients with MS with vocal complaints experience more functional limitations in using their voices in daily communication.

Functioning is a term that encompasses the relationship between distinct, interrelated components, such as body function, body structure, activity and participation and environmental factors[26]. The findings of this study show that reported voice changes – body function – limit the functioning of patients with MS.

The relationship between the VoiSS-L scores and vocal complaints may be explained by the fact that patients with MS show symptoms of dysarthria more frequently[8,9]. Such symptoms may impair vocal efficiency, requiring greater effort for vocal production and therefore potentially limiting the use of the voice, which may explain the relationship found between the presence of vocal complaints in MS patients and the self-reported impact on the VoiSS-L domain[16,27].

Section one of the LWD questionnaire addresses communication problems related to the speech production mechanism experienced by patients. This section includes items such as "I often run out of air when I talk", "I often sound hoarse", "my speech is slow", "my speech is slurred" and "I often need to repeat what I have said because people do not understand me". The results indicate that patients with MS with vocal complaints experience more difficulties in voice and speech production.

The items in section one of the LWD questionnaire are related to dysarthria manifestations in this population, including articulatory changes, hypernasality, excessive or reduced pitch variation, breathiness, hoarseness and impaired loudness control[8,9]. Notably, not all patients with MS show these speech alterations, and the level of communication impairment may vary according to, for example, the cooccurrence of other neurological manifestations[4], which explains the difference in the scores on section one of the LWD questionnaire between the groups with and without vocal complaints.

Section four of the LWD questionnaire refers to the effects of the subjects' mode of communication on their emotions and self-image. This section includes items such as "my speech difficulties worsen when I am angry or sad", "my speech difficulties negatively affect my self-image" and " I worry about my speech difficulties". Thus, the ability of scores on section four of the LWD questionnaire to differentiate patients with and without vocal complaints indicates that the presence of voice and speech changes in patients with MS has an emotional impact on their lives.

Dysarthria affects the communication of individuals with MS and has a negative impact on their quality of life[20], causing, for example, emotional changes, which are not necessarily correlated with the presence of physical symptoms or the severity of vocal deviation. The emotional impact of a voice disorder is affected by cultural and psychosocial variables, such as personal and environmental characteristics. Moreover, the relationship between emotional aspects and physical symptoms of a speech disorder may be bidirectional because emotional characteristics may cause secondary voice changes[27,28].

Section ten of the LWD refers to "how subjects perceive changes in their speech and the possibility to alter their mode of speaking". This section includes items such as "I believe that my speech can be changed", "I explain my communication difficulties to other people", "I try to express myself in another way when I am not understood", "I take a break and rest a little when I notice that I am not being understood" and "I do not speak if I think that making myself understood will be difficult".

Limited speech intelligibility may have a critical impact on communication skills and may compromise participation in professional and social activities[15]. The results in this study show that patients with MS with vocal complaints can perceive and express their vocal difficulties based on the impact that they have on their mode of communication.

Sections eight, nine and ten of the LWD questionnaire had the highest mean scores at 16, 28 and 15 points, respectively, accounting for 50% or more of the total score of each section. In other words, subjects notice greater difficulties with these issues, identifying factors that contribute to changes in their communication. Conversely, the other sections, which are related to physical and functional parameters of communication, had a smaller impact.

The analysis of the VoiSS showed that the scores for the VoiSS-T, VoiSS-L and VoiSS-Physical domains were within the normal ranges[14,28] (lower than the cut-off points of 16, 11.5 and 6.5, respectively) in the group without vocal complaints. This finding underlines the sensitivity of this questionnaire in identifying patients with vocal complaints, even in cases with a neurological etiology.

The mean total scores on the VoiSS and LWD questionnaire for the individuals with vocal complaints were higher than the cut-off points set for these instruments. However, the analysis of the relationship between these scores and the OD showed no correlation between the self-assessment measures and the OD. In the study by Padovani[9], the total scores on the LWD questionnaire were not correlated with the degree of deviation of dysarthria or auditory-perceptual and acoustic variables. The same result was found when correlating the Voice Handicap Index (VHI) questionnaire with the auditory-perceptual analysis in patients with MS, thus indicating that a patient's perception does not always correspond with the clinician's perception of the severity of vocal deviation[20].

The results show that vocal deviation will not always be the factor with the greatest impact on quality of life; instead, the symptoms that vocal deviation causes and how they affect the social and communicative lives of individuals with MS are more relevant. Measuring the severity of vocal deviation is important, but the result may not reveal the entire spectrum of an individual's experiences. Even when voice quality deviation is not severe, individuals with a neurological voice disorder have high levels of anxiety and stress in their communication-related activities of daily living due to the possible unpredictability of voice and speech performance at all times and the inability to control phonation during a conversation[29].

In addition, Perceived Control Theory[30] indicates that individuals with control over events in their own lives have higher levels of satisfaction and happiness. Therefore, subjects' control and understanding of the determinants of events in their lives are related to motivation, competence, performance, emotional health (well-being, self-esteem and depression, among others) and coping strategies.

Individuals with MS may lose the ability to control their vocal production due to either voice instability or possible difficulties that the interlocutor may have understanding the message. Thus, these individuals cannot predict the voice quality

that will be produced at a specific time, which physically and mentally limits communication. A greater feeling of limitation experienced by individuals corresponds to a lower ability to predict communicative performance and lower levels of satisfaction and happiness.

CONCLUSION

No relationship was found between auditory-perceptual and self-assessment measures in patients with MS. However, the scores on both self-assessment instruments used are strongly correlated. Patients with MS and vocal complaints have a higher frequencies of vocal symptoms, emotional changes and communication problems related to the speech production mechanism.

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