

# Ataxia espinocerebelar: análise perceptivo-auditiva e acústica da fala em três casos\*\*\*\*\*

## Spinocerebellar ataxia: perceptual and acoustic analysis of speech in three cases

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### Abstract

Background: dysarthrias are commonly found in patients with spinocerebellar ataxias (SCA). Aim: to characterize perceptual and acoustic features of speech in three patients with spinocerebellar ataxia and to verify the presence of similar features among these patients. Method: speech samples of two males with SCA3 and one male with SCA2 were obtained. Both perceptual and acoustic analyses were done. Results: It was observed strain-strangled and breathiness phonation, vocal instability, increased noise-to-harmonics ratio and low alternate motion rate (AMR) and speech rate in all three patients. Deviated resonance and s/z ratio were also observed. Conclusion: phonatory disorders and altered temporal patterns of speech seem to be typical in dysarthric patients with spinocerebellar ataxia.

**Key Words:** Dysarthria; Spinocerebellar Ataxias; Speech Production Measurement; Speech Acoustics.

### Resumo

Tema: a disartria é freqüentemente descrita como característica marcante dentre as diversas manifestações clínicas das ataxias espinocerebelares (AEC). Objetivo: caracterizar as alterações perceptivo-auditivas e acústicas da fala de três pacientes com ataxia espinocerebelar e verificar a presença de manifestações comuns entre os casos. Método: amostras de fala de dois homens com AEC-3 e de um com AEC-2 foram coletadas e analisadas acústica e perceptivamente. Resultados: foi identificada voz tensa e soprosa, instabilidade vocal, aumento da proporção ruído-harmônico, redução da diadococinesia oral de sílabas alternadas e redução da velocidade da fala nos três indivíduos, além de desvios ressonanciais e da relação s/z. Conclusão: manifestações fonatórias e dos padrões temporais da fala parecem ser características de pacientes disártricos com ataxia espinocerebelar.

**Palavras-Chave:** Disartria; Ataxias Espinocerebelares; Medida da Produção da Fala; Acústica da Fala.

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## Introduction

Spinocerebellar ataxias (SCAs) are a heterogeneous group of progressive ataxic disorders with autosomal dominant heredity. Of the 30 identified types of SCA, types 2 and 3 are the most prevalent<sup>1-3</sup>.

Among the clinical manifestations of the disease, dysarthria is a marked characteristic and may present a range of speech impairments<sup>4,5</sup>. Given that identifying the characteristic manifestations in SCA patients can aid diagnosis and follow up<sup>6-8</sup>, the present study sought to: characterize the perceptual and acoustic features of speech in three patients with SCA, and to identify manifestations that were common to these three cases.

## Methods

This study was approved by the Research Ethics Committee of the Federal University of São Paulo (UNIFESP N°0708/06).

### Participants

Three male patients diagnosed with SCA (SCA-3- cases 1 and 2; SCA-2- case 3) recruited from the UNIFESP took part in the study. The mean age of patients was 32,6 years (SD=13,6 years) and mean time since SCA onset was 5 years (SD=2,6 years).

## Materials

The following equipment was used to record the speech samples: a Cyber Acoustics model AC-100 microphone, a Toshiba L25 Notebook, and the Sound Forge 4.5 program. Acoustic analysis was performed using the Praat 4.4.13 program.

## Procedures

The speech samples were recorded using tasks of sustained emission for /a/, /s/ and /z/, number counting, oral diadochokinesia, sentence and word repetition, text reading and spontaneous speech. Four speech therapists carried out perceptive-auditory assessments independently. The parameters assessed included: voice quality, loudness, pitch, vocal attack, voice stability and resonance. The degree of compromise was measured for each parameter on a 100mm analog-visual scale, and means were calculated. Speech intelligibility measures were also calculated by transcription.

The following measures were obtained on acoustic analysis: fundamental frequency, perturbation and noise and temporal measures.

## Results

The results found are depicted in Chart 1, where altered parameters in the three cases are highlighted. The means for degree of compromise are shown in brackets.

CHART 1. Results of the perceptual and acoustic analyses of speech.

Parameters	Case 1 SCA-3	Case 2 SCA-3	Case 3 SCA-2
voice quality	hoarseness (28) breathiness (27) strain-strangle (18)	breathiness (73) strain-strangle (71) tremulous (57)	roughness (48) breathiness (29) strain-strangle (21)
<i>loudness</i>	reduced (29)	reduced (38)	normal
<i>pitch</i>	normal	high (32)	low (19)
vocal attack	isocronic	hard attack (54)	isocronic
vocal stability	instability (12)	instability (82)	instability (18)
resonance	hyponasality (26)	mixed nasality (76)	hypernasality (19)
speech intelligibility (%)			
sentences	99	64↓	100
words	89↓	46↓	93
fundamental frequency (Hz)	106	144	107
<i>jitter</i> (%)	0,17	0,33	0,36
<i>shimmer</i> (%)	1,74	5,39↑	7,92↑
noise-to-harmonics ratio	0,064↑	0,164↑	0,457↑
sustained phonation vowel (seconds)			
	12	7↓	15
s/z ratio	0,6↓	0,7↓	2,1↑
oral diadochokinesis (syllables/second)			
/pa/, /ta/ e /ka/	3,4↓	1,8↓	4,8↓
/pataka/	6,8	2,4↓	5,8
speech rate (words/minute)	134*	32↓	75↓

↓ reduced; ↑ increase

\*Reduction compensated by the increase of speech rate in segments

## Discussion

The presence of tense and breathy voice, vocal instability, increased noise-to-harmonics ratio, reduced oral diadochokinesia of alternate syllables, and lower speech rate were observed with different degrees of compromise. Deviations in resonance and the s/z ratio were also observed in all subjects despite the different patterns found. Variability in dysarthria manifestations were observed even among the same subtypes of the disease.

Previous studies involving speakers with SCA also reported the occurrence of tense and unstable voice<sup>7</sup> as well as a lower diadochokinetic rates<sup>6,7</sup> and speech rates<sup>7,8</sup>.

## Conclusion

In spite of the differences evidenced, phonatory manifestations and altered temporal standards of speech were common to all three cases, appearing to be characteristics of dysarthric patients with SCA.

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