Modelamento da fluência com o uso da eletromiografia de superfície: estudo piloto*****

Fluency shaping with surface electromyography: a pilot study

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Abstract

Background: the use of a technological resource in fluency promotion. Aim: to verify the effectiveness of a stuttering treatment based on the use of surface electromyography (SEMG) exclusively. Method: participants were four stuttering adults of both genders. Assessment, pre and post-treatment, consisted of a speech gathering session and the analyses of the rest tension and of the reaction time for speech. Treatment consisted of twelve twenty minute training sessions monitored by SEMG. Results: there was a statistically significant reduction in the number of stuttering-like disfluencies (p = 0.094) and in the number of other disfluencies (p = 0.014). The other parameters, as well as differences in the electromyographic measurements, did not present significant variation. Conclusion: SEMG proved to be effective in the reduction of stuttering, with no need of association to other techniques.
Key Words: Electromyography; Stuttering; Methods.

Resumo

Tema: utilização de recursos tecnológicos para promoção da fluência. Objetivo: verificar a efetividade de um tratamento para gagueira baseado exclusivamente no uso da eletromiografia de superfície (EMGS). Método: participaram desse estudo quatro adultos gagos de ambos os sexos. A avaliação pré e pós-tratamento consistiu de uma sessão para coleta de amostra de fala, análise da tensão muscular de repouso e do tempo de reação para fala. O tratamento consistiu de 12 sessões de 20 minutos, monitoradas pela EMGS. Resultados: observou-se redução estatisticamente significante das disfluências gagas e comuns. Os demais parâmetros, bem como a variação dos dados eletromiográficos, não apresentaram variação estatisticamente significante. Conclusão: a EMGS mostrou-se eficaz na redução da gagueira, sem a necessidade de associação com outras técnicas de promoção da fluência.
Palavras-Chave: Eletromiografia; Gagueira; Métodos.

Introduction

Nowadays several authors suggest that speech disruptions in stuttering occur due to a deficit in speech motor control, or due to a poor interaction between speech motor control and emotional, linguistic, cognitive and metabolic aspects 1-5.

Given the need to prove the effectiveness of any type of treatment, i.e. evidence based practice 6, researchers and clinicians have extensively discussed the design and methodology of researches that involve the treatment of stuttering 7-13.

Based on studies that point that excessive muscle tension in parts of the body related to the production of speech and the presence of inadequate movements could be factors responsible for stuttering, a few authors suggest that surface electromyography, associated to other fluency promotion techniques, can significantly improve the speech of individuals who stutter 14-18.

For this reason, the purpose of the present study was to verify the effectiveness of surface electromyography (SEMG) exclusively in the treatment of stuttering (with no association to any other fluency promotion technique).

Method

Selection and assessment process followed the appropriate ethical procedures: approval by the Institution's Ethical Committee (CAPPesq HCFMUSP no. 1021/03) and signature of the consent form by each participant.

Participants

Participants of this research were four adults (mean age 27:2 years), three males and one female, diagnosed as developmental stutterers and who presented no history of neurological, hearing, cognitive or visual deficits and no history of any communication disorders.

The diagnosis of stuttering was based on the assessment of the Fluency Profile 19 and the classification of stuttering severity. In order to be included in the research, participants had to present at least a mild stuttering according to the Stuttering Severity

Instrument - SSI-3 20. All of the participants were submitted to the same treatment program.

Material

Speech samples, gathered for diagnosis purposes and for treatment control, were recorded on a digital camera and analyzed according to the Fluency Profile Protocol 19 and the SSI-3 20.

A surface electromyography equipment, with four independent channels, was used for assessment and biofeedback. This equipment has an analogical/digital conversion (RMS - Root Mean Square). Electromyographic signal was captured through surface disposable electrodes - Medtrace Mini Ag/AgCl (diameter of 10mm).

The adopted Fluency Promotion Program (FPP) was that proposed by Andrade 21 - only the last part of each session of the original program was used, consisting of specific fluency enhancing techniques such as negative practice, smooth speech, speech timing and speech flexibility. Treatment was monitored through EMGS (biofeedback) as proposed by Sassi 22.

Procedure

Participants of this research were submitted to: one 50 minute session for pre-treatment assessment - Fluency Profile; stuttering severity and SEMG testing (muscle rest tension and speech reaction time); twelve 20 minute weekly sessions of fluency enhancing techniques associated to biofeedback (FPP-SEMG); one 50 minute session for post-treatment assessment - Fluency Profile; stuttering severity and SEMG testing (muscle rest tension and speech reaction time).

FPP-SEMG is based on the learning and application of specific techniques for the reduction of speech disruptions. This therapeutic program is structured in four blocks with three sessions each, with progressive levels of complexity. Participants went through the whole therapeutic program independently of their performance in each isolated therapy session. Biofeedback was used in all therapy sessions so that

participants could monitor their performance.

Electromyographic testing consisted of:

. muscle rest tension - each participant was instructed to remain the more relaxed as possible for 1 minute. After that, five seconds of muscle activity was recorded;

. speech reaction time - each participant was instructed to repeat the phrase "Barco na água" (boat on water) 15 as soon as they heard the sound sign - a high pitched bip - indicating the start of the chronometer.

Only fluent productions, without disruptions, were accepted. The start of muscle activity recording coincided with the start of the chronometer. Only fluent utterances were accepted.

Muscle activity was captured by disposable electrodes fixed in the middle portion of the inferior perioral region (inferior orbicularis oris), 2mm below the free margin of the lip 23.

Electromyographic analysis

The gathered data were quantified in mean root square (RMS) by the signal gathering and processing program and expressed in microvolts (uV).

Results

For the statistical analyses of the data the Paired T-Test was used with a significance level of 10%.

. regarding the parameters assessed by the Fluency Profile Protocol, a statistically significant reduction in the number of stuttering-like disfluencies and also in the number of other disfluencies was observed. No variation was obtained for the other parameters. The reduction of stuttering-like disfluencies suggests that the participants learned to recognize cues of muscle tension - of the muscles involved in speech - permitting the effective application of the techniques used to control muscle contraction during the

production of speech and therefore were able to present a speech that was more fluent. With the reduction in the number of stuttering-like disfluencies, participants presented a more comfortable speech, being able to produce the word that was originally processed and therefore having no need for substitutions. When produced in excess substitutions can overload the linguistic system, causing an unbalance of the other processes involved in speech production. This more comfortable speech is reflected by the decrease in the number of other disfluencies.
. as for stuttering severity, three participants presented reduction of two indexes of severity and only one of the participants presented no variation. The reduction in stuttering severity is directly associated to the reduction in the number of stuttering-like disfluencies (frequency of speech disruptions).
. electromyographic testing (muscle rest tension and speech reaction time) did not present statistically significant variations.

Contradicting findings of the literature 24-25, participants did not present high muscle activity at the rest position in pre-treatment testing. Speech reaction time also did not vary when comparing pre and post treatment results. This non-variation (reaction time did not decrease) suggests the impact of poor timing over the motor system (motor processing). This can be one of the possible explanations, according to several authors, for the occurrence of stuttering.

Conclusion

SEMG demonstrated to be an effective instrument for the reduction of stuttering, having no need for association with other fluency promotion techniques (e.g. coordination between breathing and speaking). The reduction in the time used for therapy sessions - from 50 minutes (original FPP) to 20 minutes (FPP-SEMG) - makes treatment more dynamic. Results are observed in a shorter period of time enabling the treatment of a larger number of individuals. However, follow-up is necessary (control assessments) in order to monitor possible relapse.

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