REACHING GOALS WITH LIMITED MEANS: AN ULTRASOUND STUDY OF SPEECH PRODUCED BY CHILDREN WITH MYOTONIC DYSTROPHY

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INTRODUCTION

Speech production entails appropriately timed contractions of facial and other muscles. Type 1 myotonic dystrophy (DM1) or Steinert's disease, a neurodegenerative disease that causes muscle weakness and difficulties in muscle relaxation after contraction, frequently affects orofacial articulatory dynamics (Harper, 2001). The effects are particularly severe in children diagnosed with DM1 (Guirnaraes, Suazo, and Nagahashi, 2010; Sjögreen, Lohmander, and Kiliaridis, 2011). Even though they have a limited range of lip, jaw, and tongue movements compared to typically-developing children, those children can produce some vowels and consonants with good intelligibility scores, especially when they are required to speak clearly. How do they compensate for their limited motor control abilities? To investigate the different strategies used to reach phonemic goals, we conducted a study of vowels and consonants produced by children with DM1.

METHOD

We recruited fourteen 6- to 14-year-old French-speaking children diagnosed with DM1 and 14 aged-matched typically developing children. They were asked to produce repetitions of CV syllables where C was a consonant (/b d m n/) and V was a vowel (/i a u/) in two conditions: clear speech and conversational speech. A synchronized ultrasound, motion tracking system (Optotrak), and audio recording system was used to track lip and jaw displacements as well as tongue shape and position. Duration and formant values were also extracted. The Euclidean distances between vowels, in the formant space, were measured. Differences in lip and tongue contrasts between vowels were also calculated and the effects of speaker group, speaking condition, and phoneme, was measured through mixed models..

RESULTS AND DISCUSSION

The vowel contrasts in the formant space were reduced in children with Steinert disease compared to the control children. Different patterns of articulatory contrasts were observed among the children, with some children using more tongue contrasts than lip contrasts. Children with DM1 increased articulatory lip contrasts to a greater extent than tongue contrasts in the clear speech condition compared to the conversational speech condition. These results suggest that children with DM1 produce highly efficient compensatory strategies to make up for their muscular deficits.

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