INTRODUCTION

Speech sound disorders of unknown origin (SSDUO) are considered as an output disorder, characterized by incorrect articulation of mostly consonantal speech-sounds; also formant transitions, however, a nonegmental parameter, appear incomplete or acoustically incorrect, suggesting poor control of coarticulation between vocalic and consonantal gestures.

GOAL OF THE STUDY

• To determine whether, to what extent and in what aspects, coarticulatory effects between vocalic and consonantal gestures are affected by SSDUO and deviate from implementation of normal production patterns by children in typical development (TD) at same age stages

• To identify acoustic characteristics in SSDUO speech, that might be used to better specify an acoustic typology of SSDUO and as time markers for the time course of SSDUO.

Such markers could help us improve our understanding of the etiology of SSDUO, and to highlight deficits in the underlying mechanisms of speech motor control typical of SSDUO.

METHODS

Subjects and assessment tests

16 Italian-speaking children were selected, referred, diagnosed and tested at the Center for Research and Therapy of Stuttering and Voice and Speech Disorders (Centro ricerca e cura della balbuzie e disturbi della voce e del linguaggio, or CRC), Rome, Italy.

4 children diagnosed with SSDUO, and 4 children in typical development, were selected at two age stages: childhood (4-6 years) and school age (7-12 years), for a total of 16 children (Table 1).

Children diagnosed with SSDUO, based on a battery of tests for language assessment (Peabody receptive language test for syntactic and lexical components, Rustioni screening test, Boston naming test, and TVI morph-syntactic expressive language test) and for articulatory evaluation (Fussi-Cantagallo).

Measurements and data analysis

• Extent of movement of the tongue body to achieve vowel targets, both in vertical (represented by F1) and in horizontal dimension (F2), F1 and F2 values calculated for vowels [i, u, a], in SSDUO and TD children speech

• Extent and rate of tongue advancement combined in the F2 slope index measure, representing adequacy of intra- and cross-syllabic vocalic/consonantal gestures coordination.

Slope index was defined as the absolute mean F2 slope in Hz/ms (Kent et al., 1989; 1991), obtained by dividing transition extent (Hz) by transition duration (msec). The transition extent was obtained by measuring on a wideband spectrogram, the change in frequency (Hz) between the lowest and highest point of the transition slope. Transition duration (in msec) was calculated as the difference between the point of offset and onset of the transitions.

Slope index calculated for V1C2 and C2V2 transitions, and compared for SSDUO vs. TD children at same age stages. Corpus was elicited, 1 time per child.

RESULTS

F1 and F2 values for vowels [a] [i] and [u] produced by SSDUO vs. TD children at each age stage, have been compared, for the measures of implementation of tongue body movements in the vertical and horizontal dimensions, respectively: t-tests results (Table 2) showed that only vowels [i] and [u] in different consonantal contexts, as produced by children at school-age, differed between SSDUO and TD pronunciations (see Fig. 1 a and b).

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DISCUSSION AND CONCLUSIONS

• Differences in SSDUO vs. TD children’s production of vocalic gestures, emerge at the school age period for the implementation of [i] and [u]: at this age, SSDUO children’s pronunciations of the extreme vowels [i] and [u] start differing from the age normal realizations.

• F2 slope index showed lower values for the SSDUO children, than in normals, indicating overall weaker and slower tongue movement and reduced range of articulatory motion, in SSDUO children (Kent et al., 1991; Ferrand, 2007).

Results might support use of a training task to increase speed in production of transitional portions of sequences including stops in context of [i] and [u] vowels, especially across syllables. Such contextual repetitions may facilitate acquisition of control of spatiotemporal coordination of articulatory gestures within disyllabic words and improve accuracy in production of stops in non-homorganic vocalic contexts.