A Comparative Study on Articulation Abilities of Turkish Children with Stuttering and Children with Typical Development

Abstract

This study aims to explore the relationship between articulation abilities and stuttering in Turkish children. The participants were 56 Turkish speaking, monolingual children with stuttering and 56 typically developing peers, aged between 3.0 and 8.11 years. A generalized linear model was used to assess between group differences with regard to articulation abilities, age and sex. The results revealed that the group effect (Wald $\chi^2(1) = 215.64, p < 0.001, \beta = 0.14$) and the sex effect (Wald $\chi^2(1) = 215.64, p = 0.001, \beta = 0.74$) was significant in all age groups. Girls who stutter performed significantly better compared to boys in the preschool age group on articulation abilities while there was no sex effect in the school age group. There was a correlation between family history of stuttering and articulation abilities ($r = 0.321, p = 0.001$) and, between time passed since the onset of stuttering and the articulation abilities ($r = 0.342, p = 0.001$) in the stuttering group. The correlation between stuttering severity and articulation abilities was not statistically significant ($r = 0.048, p = 0.928$). Findings of the study suggest that there are subtle differences between groups regarding articulation abilities increasing with age.

Keywords: Stuttering, Children, Articulation

Introduction

Developmental stuttering is a neurological disorder characterized by the disruption of normal fluency and flow of speech with repetition of sounds, syllables, words, prolongation of sounds or blocks. It typically starts in early childhood with the average age of onset between two and six years; the period in which language development is very rapid in children with typical development (Van Riper, 1982). The co-occurrence of stuttering onset and rapid growth in language abilities has been of interest to many researchers since the 1930s. Several aspects of language development of children with stuttering have been studied since then (Brown, 1937; Westby, 1974; Silverman & Williams, 1967; Wagovich & Bernstein Ratner, 2007). The studies investigating this relationship can be classified under five broad categories: a. phonological aspects, b. loci (location) of stuttering, c. language complexity, d. pragmatics, e. language skills (Yairi, 2012). Of these categories the most widely studied and reported differences are in...
phonological abilities. Articulation is defined as the physiological movements to produce speech sounds while phonology relies on how phonemes are organized to form words that change meaning (Crystal, 2011). In other words, articulation encompasses the motor systems to produce rapid, fine movements for planning the complex structures which are acquired by the phonological systems enabling one to identify phonemes and phonotactic rules of the language (Kuhl, 2004).

For example, children with stuttering (CWS) have been reported to have a high rate of concurrent phonological disorders (Paden, Yairi, & Ambrose, 1999), decreased performance in phonological encoding abilities (Melnick, Conture, & Ohde, 2003; Weber, 2008), stutter more on phonologically complex words (Howell, 2000) and exhibit more phonological processes than their normally fluent peers (Louko, Edwards, & Conture, 1990). Moreover, the most commonly associated communication disorder with stuttering is found to be disordered phonology (Ardt & Healy, 2001; Louko et al., 1990; Wolk et al., 1993; Yairi, 2007).

However, some contrary findings have also been reported. For instance, Yaruss, LaSalle and Conture (1998) did not find strong support for the relationship between phonology and stuttering in their study in which they have compared the performances of CWS with disordered phonology and typical phonology. According to their results, no significant differences were found between groups in terms of the frequency or duration of disfluencies, sound prolongation index, or measures of stuttering severity. Louko, Edwards and Conture (1990) also examined the phonological abilities of CWS with regard to phonological processes (e.g. cluster reduction, stopping, gliding) they made during conversational speech. The findings of this study revealed that children with more severe stuttering were not using a greater number of phonological processes than those with less severe stuttering. Nippold (2002) carried out a meta-analysis of 15 related studies and concluded that there is a weak relationship between phonology and stuttering.

Clark et al. (2013) cited inconsistent reports pertaining to articulatory functions in CWS. Some reports indicate articulation differences ranging from subtle to overt between CWS and children who do not stutter (CWNS) (Pellowski et al., 2001). Their findings were statistically significant but were not thought to be clinically significant. In contrast, it has also been reported that articulation disorders are more prevalent among CWS compared to CWNS and these differences represent clinically significant articulation disorders (Blood et al., 2003). Clark et al. (2013) also reports that these studies, like most of the other related studies, did not compare the phonological processes these two groups used because of methodological constraints.

In Turkey, research concerning the articulation abilities of CWS is limited (Horozoğlu, 2013; Vatan, 2009; Kazanoğlu, 2008) and to our knowledge there is no study exploring the articulation abilities of this group using a standardized test. Thus the aim of this study was to explore the relationship between articulation abilities and stuttering in Turkish speaking children between the ages of 3.0 and 8.11 years using the standardized perceptual measures of articulation and phonology test (Topbaş, 2006). We hypothesized that there would be statistically significant differences between the performance of preschool-age and school age CWS and CWNS on SST articulation subtest scores and that the performance of CWS in this test would be poorer than CWNS. The second hypothesis is that the two groups' performance on SST articulation subtest will be different with regard to age and sex. Lastly, we aimed to examine the impact of family history of stuttering, time passed since the onset of stuttering and stuttering severity on the articulation ability in the group of children with stuttering.

Method

Participants
Participants of this study were recruited from referrals to the Onokuz Mayis University Hospital, Speech and Language Therapy Clinic between December 2017 and May 2018 with the complaint of stuttering. All of the participants were diagnosed by the authors of the study. The diagnosis of stuttering was made based on a detailed clinical interview and the type and frequency of stuttering at the first
session. Participants consisted of 56 (40 boys, 16 girls) Turkish-speaking, monolingual children with stuttering (CWS) aged between 41-104 months ($M=75.42; SD=18.09$) and 56 (40 boys, 16 girls) their age, sex- and educational status-matched typically developing peers (CWNS) aged between 40-100 months ($M=74.41; SD=17.72$). All subjects were native speakers of Turkish and had no history of any neurological, psychiatric or hearing disorder. None of the participants had received any therapy for stuttering or any other speech/language or learning problem. The sample was divided into two; preschool age group (including children aged from 3.0 to 5.11 years inclusive) and school age group (children aged from 6.0 to 8.11 years) for the purpose of analysis. Detailed demographic characteristics can be seen in Table 1.

Approval of the Ethical Committee of Ondokuz Mayis University was obtained for the study. Written informed consents of all the participants were gathered.

**Instruments**

**Turkish Articulation and Phonology Test (SST)**

The SST is a reliable and validated tool for assessing the articulatory and phonological abilities of children with typical development and children with speech sound disorders. The tool consists of three subtests which are assessment of articulation, auditory discrimination and phonological process analysis. In the study, we used only articulation subtest of SST. Articulation subtest (SET) is a picture naming-task and contains 93 pictures. This subtest was used to examine the participants’ articulatory competence with speech sounds (Topbaş, 2006).

**Percentage of Stuttered Syllables**

A speech language pathologist (one of the authors) recorded the spontaneous speech samples of CWS. The speech samples were gathered in the first session for each child. The main topics of the conversations were daily routines, the things they like, or they are good at and their favorite books, movies etc. Stuttering criteria was defined as the exhibition of three or more stuttering-like disfluencies (SLD). SLD included sound or syllable repetitions, audible and inaudible sound prolongations or whole word repetitions) per 100 words of the conversational speech taken from the first 300 words of the sample as described by Conture (2001). Percentage of stuttered syllables was obtained by taking the percentage of stuttered syllables to total syllables produced.

**Procedure**

Articulation sub-test (SET) was administered to all children who participated in the study. Participants’ speech sound articulation performances were evaluated with the standard scores on the norm-referenced Articulation sub-test of the SST. Speech samples of the children were transcribed according to International Phonetic Alphabet (IPA).

**Statistical Analyses**

A generalized linear model method (Nelder & Wedderburn, 1972) was used to assess between-group differences with regard to Articulation subtest scores, age and sex.

The difference in Articulation subtest scores was tested by generalized estimating equations (GEE) (Liang & Zeger, 1986) analysis with sex and group variables were included as covariants.

| Table 1. Demographic characteristics of the CWS subjects and the CWNS controls. All ages are given in months. |
|---|---|---|---|---|---|---|---|---|---|
|        | Overall Group | Preschool Age Group | School Age Group |        |
|        | Mean age | SD | Range | Mean age | SD | Range | Mean age | SD | Range |
| CWS    | 75.4 | 18.1 | 41-104 | 56.7 | 9.1 | 41-68 | 87.8 | 10.0 | 72-104 |
| CWNS   | 74.4 | 17.1 | 40-100 | 55.7 | 8.6 | 40-69 | 86.5 | 9.5 | 72-100 |
Results

A generalized linear model was used to assess between group differences with regard to Articulation subtest scores, age and sex (Table 2).

As can be seen in the Table 2, the results revealed that the group effect (Wald $\chi^2 (1) = 215.64, p < 0.001, \beta = 0.14$) and the sex effect (Wald $\chi^2 (1) = 215.64, p = 0.001, \beta = 0.74$) was significant in all age groups. When between group differences were stratified by age (pre-school and school age groups), a significant effect was found for both group (Wald $\chi^2 (1) = 51.75, p < 0.001, \beta = 0.34$) and sex (Wald $\chi^2 (1) = 51.75, p = 0.013, \beta = 0.70$) variables in the pre-school period. The effect of the group variable (Wald $\chi^2 (1) = 93.51, p < 0.001, \beta = 0.03$) was also significant in the school-age period while sex was not a significant factor (Wald $\chi^2 (1) = 93.51, p = 0.197, \beta = 0.82$).

Correlations between stuttering severity, time passed since the onset of stuttering, reported family history of stuttering and SET was examined (Table 3).

As can be seen in Table 3, a Pearson product-moment correlation was performed to determine the relationship between stuttering severity, time passed since the onset of stuttering, reported family history of stuttering and Articulation subtest scores. There was a moderate, positive correlation between family history of stuttering and Articulation subtest scores in the stuttering group ($r = 0.321, p = 0.001$) and the correlation between stuttering severity and Articulation subtest scores was not statistically correlated ($r = 0.048, p = 0.928$). The correlation between time passed since the onset of stuttering and the Articulation subtest scores was moderate positive ($r = 0.342, p = 0.001$).

Table 2. Descriptive and inferential statistics related to the SST-SET score.

<table>
<thead>
<tr>
<th></th>
<th>Between Group Differences</th>
<th>Between-Group Differences Stratified by Age</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>All ages</td>
<td>Preschool</td>
</tr>
<tr>
<td></td>
<td>CWNS</td>
<td>CWS</td>
</tr>
<tr>
<td>N</td>
<td>56</td>
<td>56</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
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<tr>
<td>Male</td>
<td>40</td>
<td>40</td>
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<tr>
<td>Female</td>
<td>16</td>
<td>16</td>
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<tr>
<td>SST</td>
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<tr>
<td>Descriptive Statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>7.75 (1.1)</td>
<td>1.1 (0.2)</td>
</tr>
<tr>
<td>Inferential Statistics</td>
<td></td>
<td></td>
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<tr>
<td>EM (SEE)</td>
<td>7.75 (0.4)</td>
<td>1.1 (0.1)</td>
</tr>
<tr>
<td>Wald $\chi^2$(df)</td>
<td>215.64 (1)</td>
<td>51.75 (1)</td>
</tr>
<tr>
<td>p (sex)</td>
<td>0.001</td>
<td>0.013</td>
</tr>
<tr>
<td>j (sex)</td>
<td>0.74</td>
<td>0.70</td>
</tr>
<tr>
<td>p (group)</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>j (group)</td>
<td>0.14</td>
<td>0.34</td>
</tr>
</tbody>
</table>

SST - Turkish Articulation and Phonology Test

Table 3. Pearson product-moment correlations between stuttering severity, time passed since the onset of stuttering, reported family history of stuttering and Articulation subtest scores

<table>
<thead>
<tr>
<th></th>
<th>Stuttering severity</th>
<th>Time passed since the onset of stuttering</th>
<th>Reported family history of stuttering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articulation subtest</td>
<td>.048</td>
<td>.342*</td>
<td>.321*</td>
</tr>
</tbody>
</table>
Discussion

The purposes of this study were to: examine the articulation abilities of CWS with a standardized test and to examine the impact of age, sex, family history of stuttering, time passed since the onset of stuttering and stuttering severity on articulation ability. We found that Articulation subtest scores were significantly different between CWS and CWNS in both preschool and school age groups and that the scores of CWS were lower than their typically developing peers. Girls who stutter performed significantly better compared to boys in the preschool age group on SST while there was no sex effect in the school age group.

Findings of this study build upon the results of previous studies suggesting that there are subtle differences between CWS and typically developing children with regard to articulation abilities (St. Louis & Hinzman, 1988; Anderson & Conture, 2000; Pellowski et al., 2001). The gap between CWS and their age and sex matched peers with regard to articulation ability was larger in the school age group compared to the preschool age group. Deviation from the norm also increased with age, time passed since the onset of stuttering and family history of stuttering. These findings are consistent with Ryan’s findings (1992, 2001) suggesting that residual speech sound errors can be more frequent among CWS at school age compared to their age and sex matched peers with typical development. In his study, he found no significant difference between the two preschool-ages groups but 25% of the sample who stuttered received therapy to correct their residual speech sound errors such as distortions of liquids or fricatives, while none of the children in the control group had any need for therapy.

Although the relationship between stuttering and phonological and/or articulation is multifaceted, subtle differences between groups, increasing with age and stuttering severity, may reflect a communication pressure increasing with awareness, as proposed by Bloodstein (1995) or greater demands than the children’s capacities making communication more demanding and difficult (Starkweaather, Gottwald, & Halfond, 1990). Guitar (1998) and Conture (2001) suggested that some additional speech and language processing errors may contribute to reduced capacities for speech motor control and language formulation, which are both key elements of fluent speech. The findings of this study regarding duration after onset of stuttering and the reports of genetic history of stuttering increasing with Articulation subtest scores also supports these hypotheses.

The effect of sex on the articulation ability of stuttering was found between groups at preschool ages while no significant effect was found in the school age period. The sex distribution in this study was 1:2.5 (girls:boys) which is higher than reported in the literature and 68% of the girls were between the ages of 3-5. So the preponderance of girls in the preschool group may have confounded the true effect of sex on Articulation subtest scores, since it is known that girls tend to exhibit stronger articulation abilities than boys (Gümüş et al., 2016).

There are a number of limitations of this study. One major limitation is measuring articulation and phonological abilities with only one aspect. Even if stuttering and phonology share some common neurobiological traits of a more fragile speech encoding and language production system, as proposed by Ludlow, Siren & Zikira (1997), standardized articulation and phonology tests are not able to measure these abilities directly yet. Although there are many advantages of using standardized articulation tests, most of them lack the power to be able to detect subtle and subclinical phonological abilities. Another limitation of this study was not using a language test as a covariate to phonological ability. It would also be expected that language ability would also predict stuttering severity and controlling for this variable would establish the unique contribution of phonological abilities on stuttering. The study could also be strengthened by the inclusion of reaction times of the participants while completing the SST, as proposed by Melnick et al. (2003). These investigators have suggested a possible link between speed or temporal aspects of speech processing, planning or production and stuttering. Using only one measure of outcome for the articulation ability, the SST, is another limitation. Limitations of the scale itself or related problems could have also impacted the data of the study.
Finally, further long-term follow-up studies are needed to assess the prognosis of phonological abilities in CWS. These studies should also focus on the question of whether children who recovered spontaneously show a different pattern of phonological profile compared to children who persisted in stuttering. Future research is needed to expand upon these results and improve our understanding of the relation between phonological abilities and stuttering within this population.

References


