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Brief Communication

Comunicação Breve

Tongue contour for /s/ and /ʃ/ in children with speech sound disorder

Contorno de língua dos sons /s/ e /ʃ/ em crianças com transtorno fonológico

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Keywords

Speech, language and hearing sciences
Child
Evaluation
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ABSTRACT

Purpose: To describe the tongue shape for /s/ and /ʃ/ sounds in three different groups of children with and without speech sound disorder. **Methods:** The six participants were divided into three groups: Group 1 — two typically developing children, Group 2 — two children with speech sound disorder presenting any other phonological processes but not the ones involving the production of the /ʃ/ and Group 3 — two children with speech sound disorder presenting any phonological processes associated to the presence of the phonological process of palatal fronting (these two children produced /ʃ/ as /s/) aged between 5 and 8 years old, all speakers of Brazilian Portuguese. The data were the words /'ʃavi/ (key) and /'sapu/ (frog). Tongue contour was individually traced for the five productions of each target word. **Results:** The analysis of the tongue contour pointed to evidences that both /s/ and /ʃ/ were produced using distinct tongue contours for G1 and G2. The production of these two groups was more stable than G3. The tongue contour for /s/ and /ʃ/ from the children in G3 was similar, indicating that their production was undifferentiated. **Conclusion:** The use of the ultrasound applied to the speech analysis was effective to confirm the perceptual analysis of the sound made by the speech-language pathologist.

Descritores

Fonoaudiologia
Criança
Avaliação
Transtornos da articulação
Ultrassonografia

RESUMO

Objetivo: Descrever o contorno de língua na produção dos sons /s/ e /ʃ/ em três grupos de sujeitos com e sem transtorno fonológico. **Métodos:** Os seis participantes foram separados em três grupos: Grupo 1 — duas crianças com desenvolvimento típico de fala e linguagem, Grupo 2 — duas crianças com transtorno fonológico apresentando processos fonológicos que não envolvessem a produção do /ʃ/ e Grupo 3 — duas crianças com transtorno fonológico apresentando processos fonológicos diversos e o de frontalização de palatal (as duas crianças produziam o /ʃ/ como /s/) com idade entre 5 e 8 anos, falantes do Português Brasileiro. As imagens do contorno da língua na produção dos sons-alvo inseridos nas palavras /'ʃavi/ e /'sapu/ foram analisadas. Cada criança repetiu cinco vezes cada palavra-alvo. **Resultados:** As crianças dos Grupos 1 e 2 apresentaram contorno de língua distinto para a produção do /s/ e do /ʃ/. Além disso, observou-se que a produção dessas crianças foi mais estável do que as do G3. A análise das imagens confirmou que a produção dos sons /s/ e /ʃ/ realizada pelas crianças do G3 foi indiferenciada. **Conclusão:** A análise das imagens ultrassonográficas feitas a partir da fala de crianças com transtorno fonológico foi eficaz para confirmar a análise perceptivo-auditiva feita pelo fonoaudiólogo.

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INTRODUCTION

Several studies show that ultrasound images of tongue contour, visualized during speech production, can be used for many purposes; however, the specific use of these images as complementary analytical tools to diagnose speech disorders (SD) is a recent topic in the literature.

The use of ultrasonography (USG) in analyses of tongue movements while producing sounds enables the visualization of tongue movements and tongue contours from the tip to the root in real time. Several studies have used USG to describe tongue movements while producing vowel sounds[1] and consonantal sounds such as /s/[2], /ʃ/[3], /t/[4], /k/[5], /l/[6], and /r/[7].

The maximum age for acquiring palatals in native speakers of Brazilian Portuguese is approximately 4 years and 6 months[8], but many children who are diagnosed with SD present difficulties to produce these sounds.

Therefore, the purpose of this study was to characterize the tongue contours observed in the /s/ and /ʃ/ sounds produced by children with and without SD.

METHODS

This study was approved by the ethics committee of the School of Medicine at Universidade de São Paulo (Protocol N # 276/13). All parents and legal guardians signed the informed consent form.

Six children participated in this study, four with diagnosed SD and two without speech and language alterations. The inclusion criteria for the children with SD were the following: speech errors on the ABFW child language test[8], absence of difficulties in other language areas[9], normal audiometry results, and no history of speech and language intervention. The inclusion criteria for the group of children without SD were as follows: absence of speech errors and difficulties in other language areas[9], normal audiometry results, and no history of speech and language intervention.

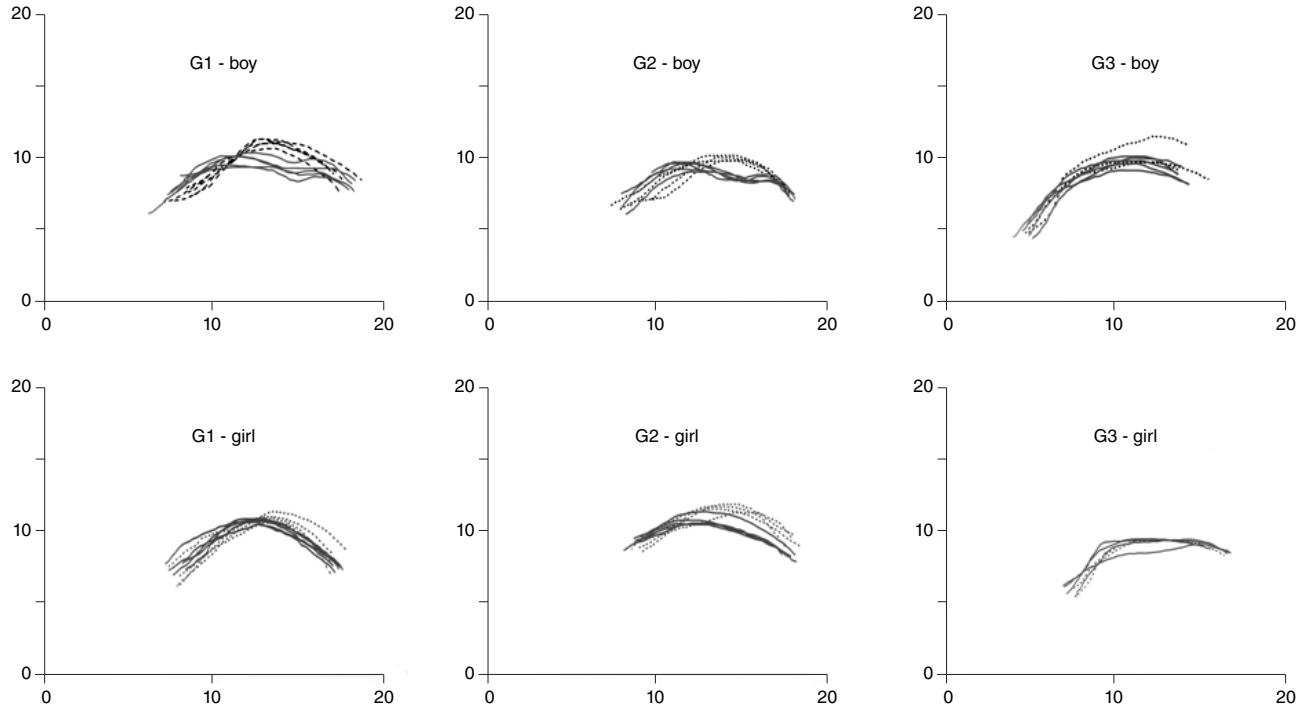
Six participants were divided into three groups: Group 1 (G1) comprised two children (a boy aged 7 years 10 months and a girl aged 8 years 3 months) undergoing typical speech and language development; Group 2 (G2) comprised two children (a boy aged 6 years 2 months and a girl aged 5 years and 9 months) with SD who used different phonological processes that did not involve the production of the palatal /ʃ/; and Group 3 (G3) comprised two children (a boy aged 7 years and a girl aged 7 years 2 months) who presented the palatal fronting phonological process (both children produced /ʃ/ as /s/).

After the diagnosis, all the children underwent an USG (Mindray 6600 attached to the software Articulate Assistant Advanced) performed in an acoustically treated room. The ultrasound helmet[10] was adjusted individually, allowing for a better positioning of the endocavity transducer used to collect the speech samples.

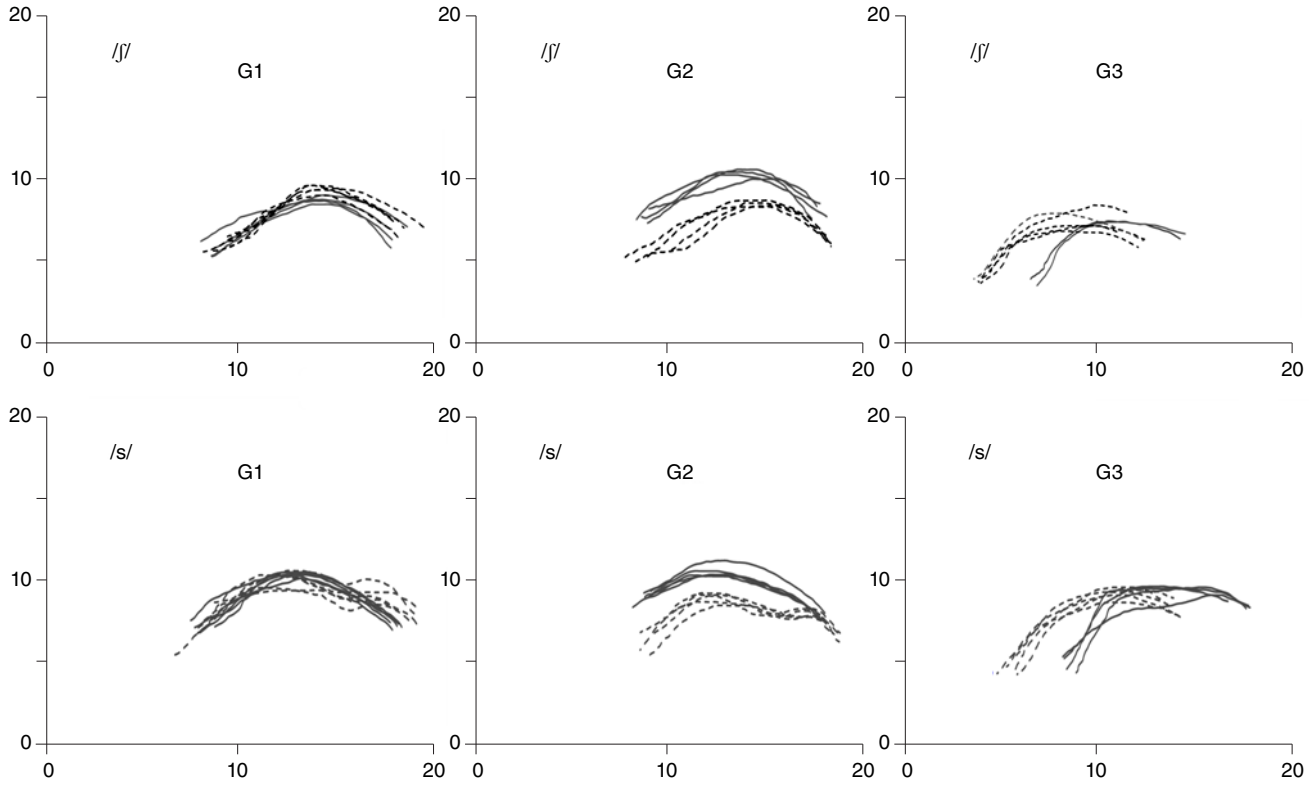
The children were positioned facing a computer, where they were required to name the images /'ʃavi/ (key) and /'sapu/ (frog) five times. Each tongue contour was traced manually, based on the sagittal images obtained through the USG, totalizing 30 analyses of the /ʃ/ sound and 30 of the /s/ sound.

RESULTS

In all three groups, tongue contours of the individuals are displayed by gender (Figure 1) and sound (Figure 2). Their tongue root is on the left and the tongue tip to the right of the images.



Caption: dotted line = production /ʃ/; continuous line = production /s/
Figure 1. Images of the production of the /ʃ/ and /s/ sounds, superimposed according to gender



Caption: dotted line = boys; continuous line = girls
Figure 2. Images superimposed according to the /ʃ/ and /s/ sounds

DISCUSSION

This study presents an initial analysis of the /ʃ/ and /s/ sounds produced by children with and without SD. In the qualitative analyses conducted, we considered intraspeaker variation, gender, and the images of tongue contour.

The production of the /s/ sound in G1 was more stable, and we also observed flatter tongue positioning. In articulatory terms, the /s/ sound produced by the boy in G2 was similar to that produced by the children in G1, whereas the girl in G2 produced the same sound while her dorsum of the tongue was in a high position, thus presenting a tongue contour that was different than that of the boy in G2 and the children in G1. The /s/ sound produced by the children in G3 presented a tongue configuration that was different than the sound produced by the children in the other two groups. The girl's tongue was positioned in an anterior region of her mouth, and both the girl and the boy placed their tongue in a higher position within the mouth.

As it occurred with the production of the /s/ sound, we did not observe any differences in the /ʃ/ sound produced by the children in G1: the /ʃ/ sound was produced with the tongue tip lowered toward the floor of the mouth and with the dorsum raised. The two children in G2 produced the /ʃ/ in a similar manner to G1, although we verified that the girl's tongue was higher than the boy's (as it also happened in the production of the /s/). On the other hand, we verified that the two children in G3, who produced /ʃ/ as /s/ in all repetitions of the words, had their tongues flat in their mouths, with a slight elevation of the dorsum of the tongue.

We observed a variation in the sounds produced by the participants during the five repetitions requested[11]. The four children with SD, regardless of gender and presence of the phonological process of palatal fronting, produced the target sounds with more variation than those without speech and language alterations. In G1, the girl's production of both target sounds was more stable than the boy's. However, it is worth highlighting that the boy's tongue contour differentiated more markedly the production of the /s/ sound from that of the /ʃ/ sound. It is possible to say that, although the perceptive-auditory classification indicates that both the girl and the boy in G1 produced the /s/ and /ʃ/ sounds differently, the boy's tongue position shows that he differentiated the articulatory gestures more precisely in each production. The production of the target sounds by the children in G2 was similar to that by the children in G1; however, in this case, the girl differentiated the articulatory gestures better while producing the sounds in question. We did not observe any differences in the production of the sounds by the children in G3, which shows that these individuals did not differentiate the articulatory gestures required to produce the /s/ and /ʃ/ sounds.

CONCLUSION

Our analysis showed evidence that the /s/ and /ʃ/ sounds were produced with different tongue postures, which allowed for a better identification of these sounds. The tongue contours observed in the production of the /s/ and /ʃ/ sounds by the children with SD who presented palatal fronting were similar, thus reinforcing the lack of differentiation of the articulatory sounds that are necessary for the production of these sounds. Therefore, we conclude that the use of ultrasound images applied to the analysis of speech was effective to confirm the speech pathologist's perceptive-auditory judgment of the sounds.

**HFW, DTF, and LOPN participated equally in all the stages of production of this manuscript, namely literature review, analysis of ultrasound images, discussion of data, and writing the final version of this manuscript; DTF was responsible for collecting speech data.*

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