

Testing the sensitivity of the Dorsum Excursion Index for comparing typically developing speech and cleft speech characteristics

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Background

- Speakers with cleft lip and palate (CLP) may overuse the tongue dorsum as compensation for velopharyngeal insufficiency.
- The Dorsum Excursion Index (DEI) was designed to quantify articulatory overuse of the tongue dorsum.
- A higher DEI indicates higher tongue dorsum elevation.^[1]
- Its sensitivity to different places of articulation (POA) has been validated in typical adult speech.^[2]
- There are no studies testing its sensitivity in the speech of typically developing children or children with CLP.

AIMS

- Test DEI's sensitivity in detecting differences between places of articulation in typical and cleft speech.
- Test hypothesis that children with CPL overuse the tongue dorsum compared to TD children.

Participants

Group	• Children with Cleft Palate and/or lip ^[3]
n	• 24
Age	• 5;8 to 12;10

Group	• Typically Developing children ^[3]
n	• 28
Age	• 3;7 to 12;2

METHOD

- CPL: 10 tokens of /k, t, s, ſ/ in an /aCa/ environment
- TD: 1 token of /k, t, s, ſ/ in an /aCa/ environment
- Synchronised audio and ultrasound data at 100 frames per second.
- A fan-shaped grid (origin at probe centre) giving 42 radial sectors
- Annotations at the point of maximal lingual gesture
- Export of DEI (= d/n, see Figure 1)

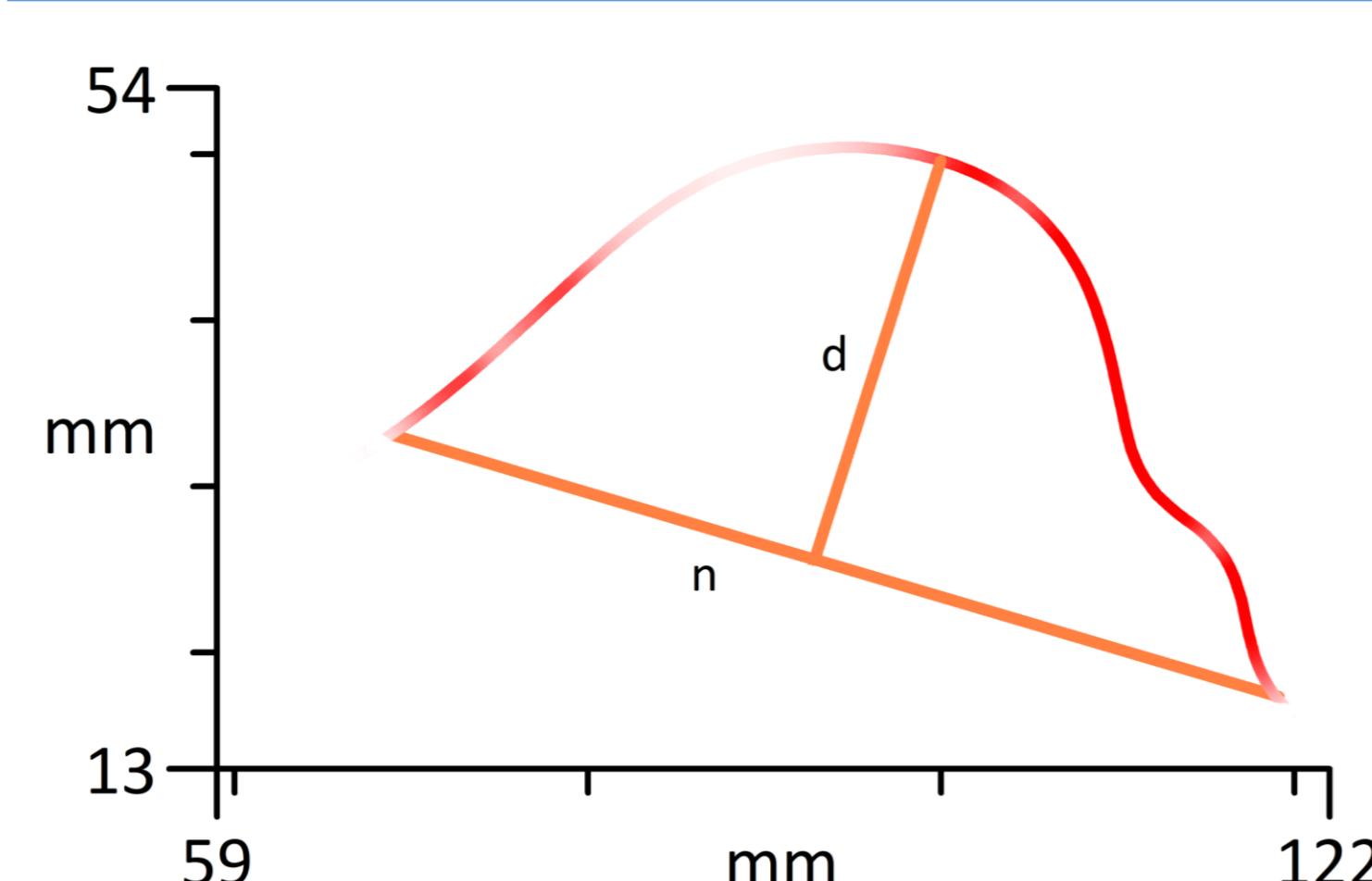


Figure 1. $DEI = d/n$ where n connects the left and right end of midsagittal tongue spline and d is perpendicular to n 's midpoint.

Acknowledgements

This study was funded by Action Medical Research, GN2544, by EPSRC's Healthcare Partnerships Programme, grant number EP/I027696/1, and by the Chief Scientist Office TCS/20/02. Thank you to the participants and to the Speech and Language Therapists who collected the data.

KEY FINDINGS

- In **children with CPL** DEI distinguishes /ʃ/ vs /k/ and /ʃ/ vs /t/, but not /ʃ/ vs /s/./
- In **TD children** DEI distinguishes /ʃ/ vs /k/ but not /ʃ/ vs /s/ or /t/.
- The difference between /ʃ/ and /k/ is smaller in **children with CPL** than in **TD children** (no difference between /t/ and /s/).
- Velar fronting** is observed in 7 children with CPL (see Figure 3); no changes when excluded.
- DEI distinguished most reliably **postalveolar** from **velar** place of articulation.

DEI by Diagnosis and Consonant

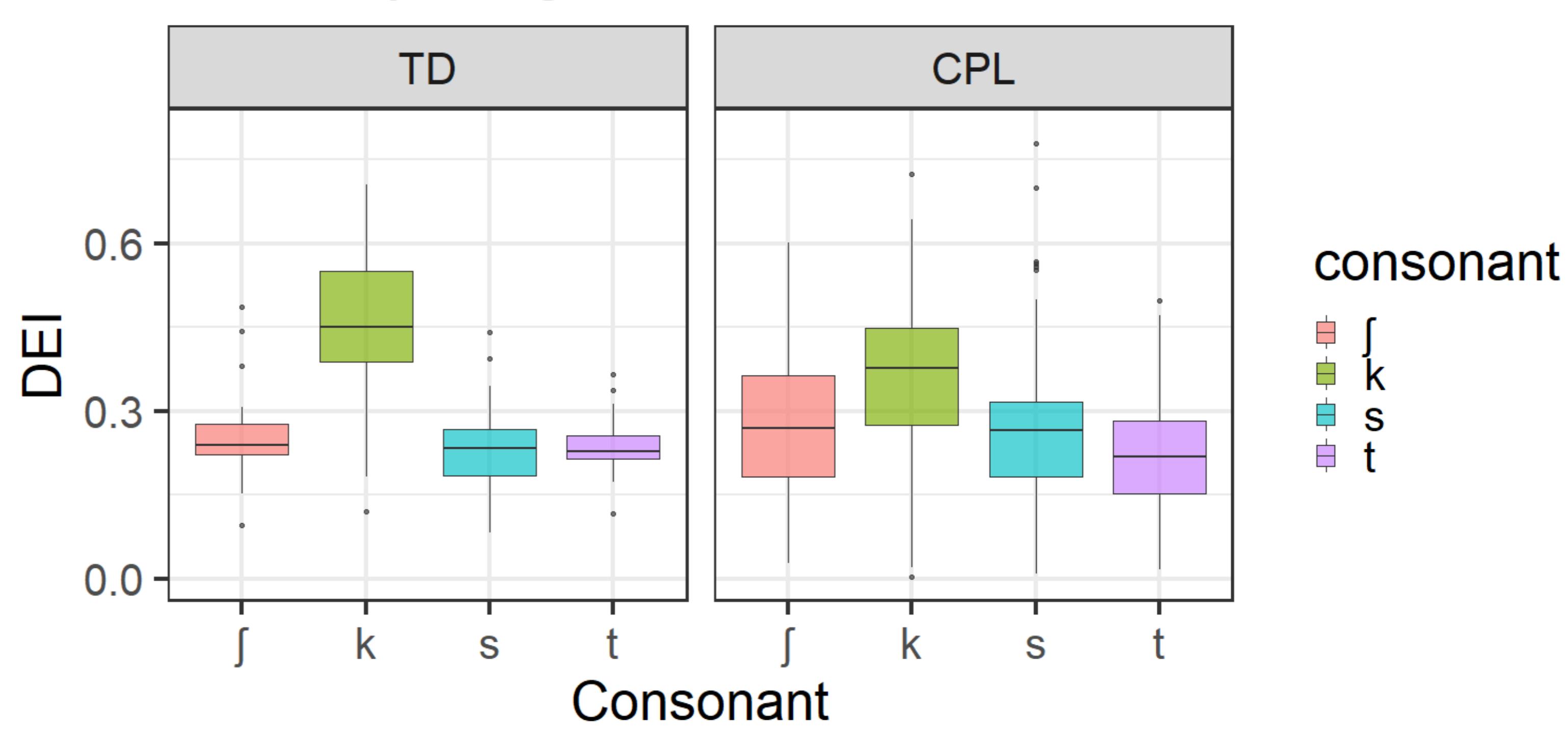


Figure 2. Model summary of the interaction between consonant and diagnosis on DEI.

DEI by CPL participant and consonant

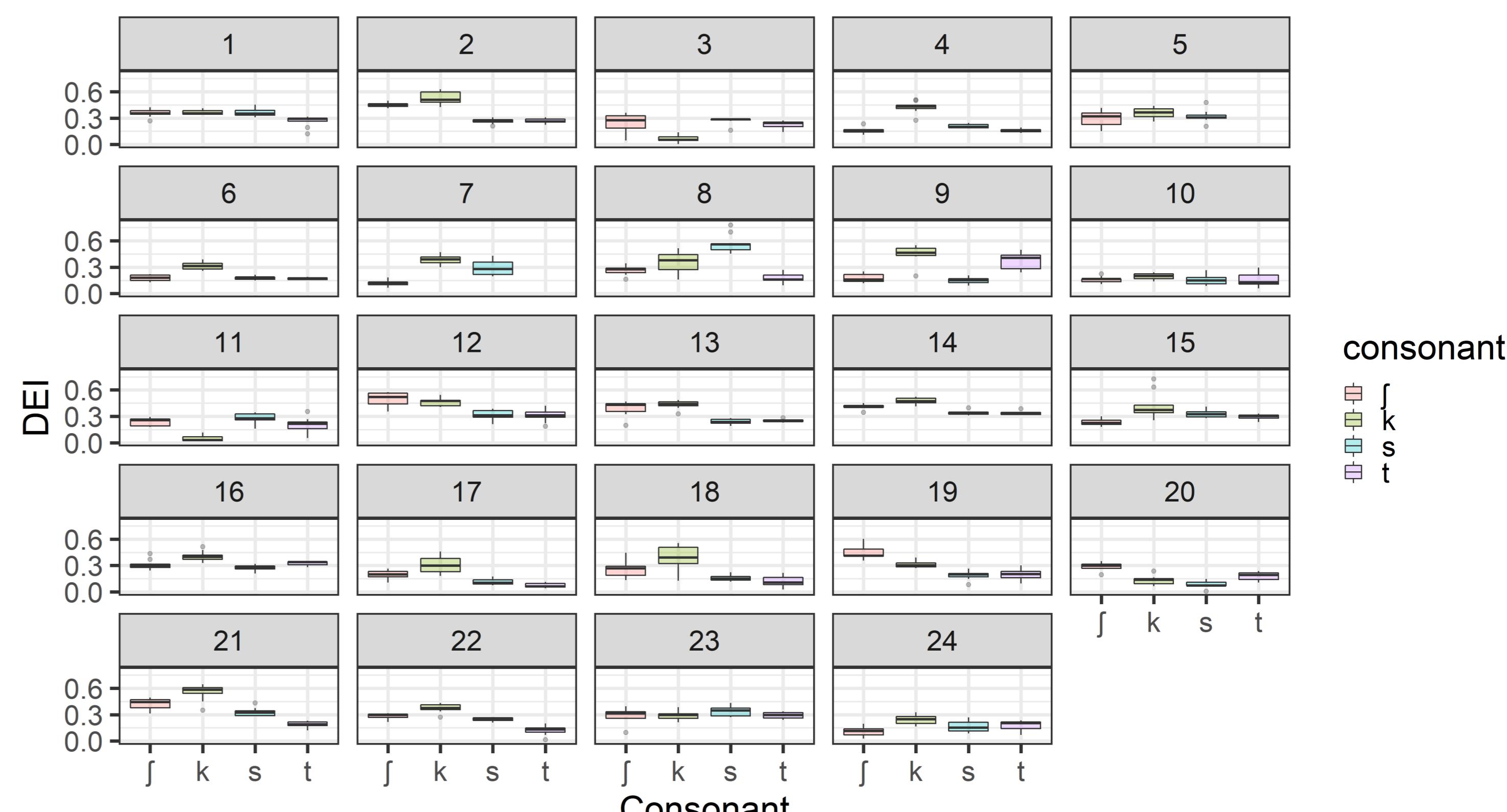


Figure 3. DEI per consonant for each of the 24 participants with cleft palate and/or lip

References

- [1] Zharkova, N. (2013a). Using Ultrasound to Quantify Tongue Shape and Movement Characteristics. *The Cleft Palate-Craniofacial Journal*, 50(1), 76–81. <https://doi.org/10.1597/11-196>
- [2] Zharkova, N. (2013b). A normative-speaker validation study of two indices developed to quantify tongue dorsum activity from midsagittal tongue shapes. *Clinical Linguistics & Phonetics*, 27(6–7), 484–496. <https://doi.org/10.3109/02699206.2013.778903>
- [3] Eshky, A., Ribeiro, M. S., Cleland, J., Richmond, K., Roxburgh, Z., Scobie, J., & Wrench, A. (2018). UltraSuite: A Repository of Ultrasound and Acoustic Data from Child Speech Therapy Sessions. *INTERSPEECH 2018: Proceedings of the 19th Annual Conference of the International Speech Communication Association (ISCA)*, 1888–1892.