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# Influence of French Cued Speech exposure on consonant production in children with cochlear implants: an ultrasound study

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## CONTEXT & AIMS

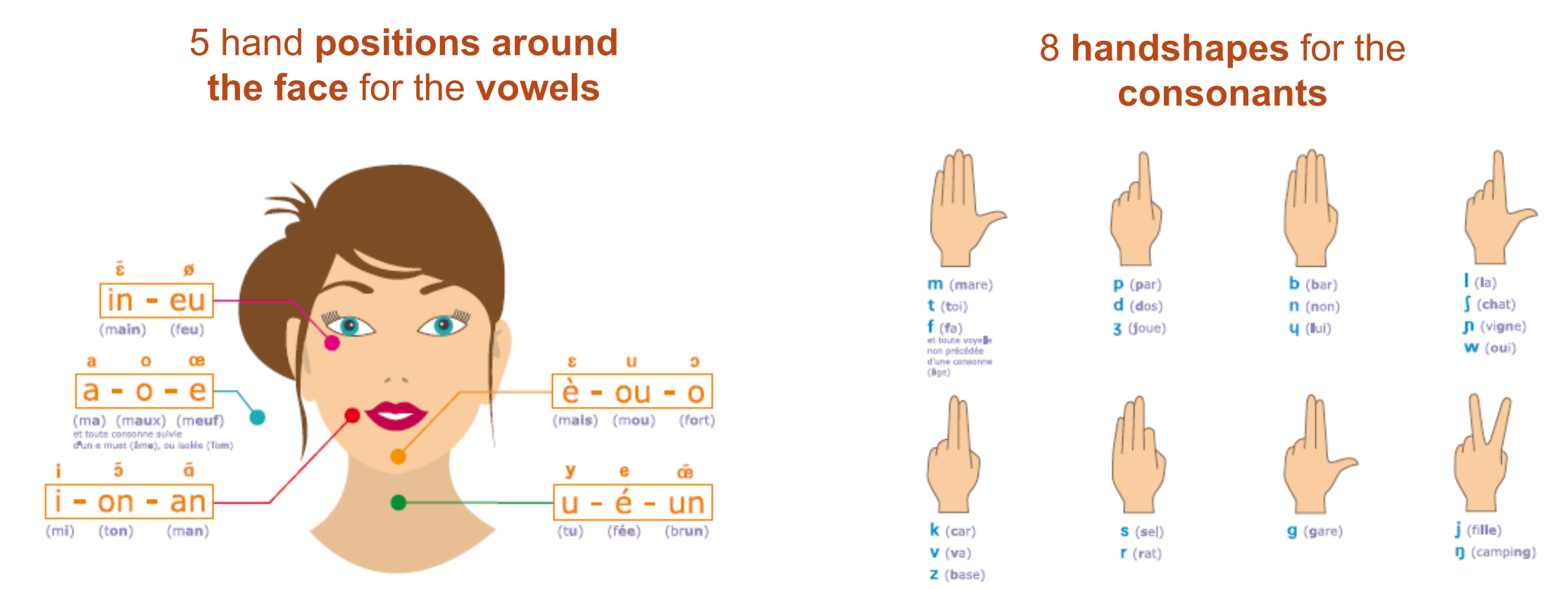
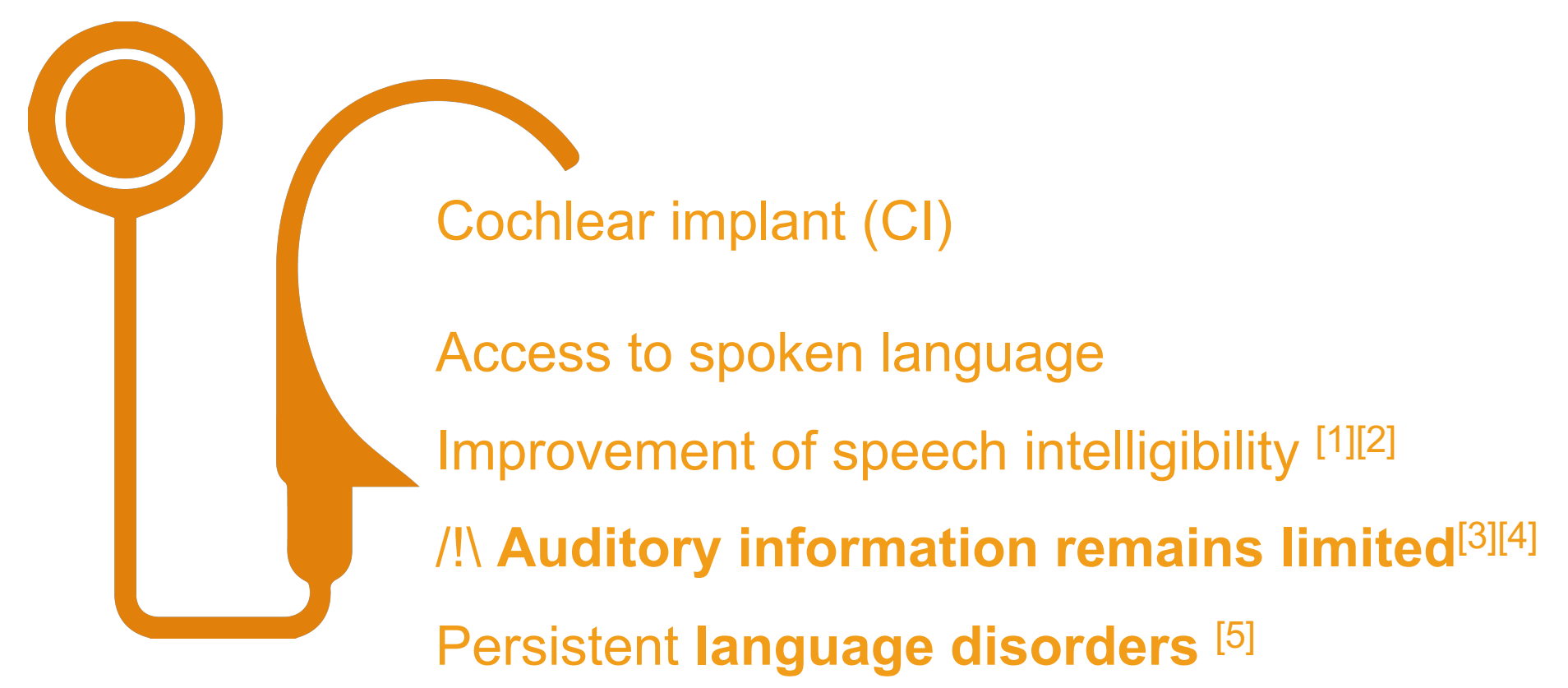


Fig. 1: Positions and handshapes of Cued French  
Source: <https://alpc.asso.fr>

### Research questions

- (1) **Relevance of the Mean Curvature Index (MCI) measure [9] for the characterization of stop production in children**
- (2) **Influence of Cued French on articulatory precision in children with cochlear implants: do children with cochlear implants have a better representation of speech sounds when they benefit from Cued French? Are their articulatory gestures more accurate? Are their lingual configurations comparable to those of children with typical development?**
- (3) **Impact of simultaneous speech and Cued French production on articulatory accuracy: does combining speech production with manual cues improve articulatory control in children with cochlear implants?**

## METHODS & PARTICIPANTS

### Task

Picture-naming task: word-initial consonants in vowel /a/ context (stops, nasals and sibilants)  
Ultrasound recording of lingual movement during production with or without simultaneous Cued French gesture production

### Participants

10 children from 52 to 137 months with typical hearing (mean=96;sd=25.7)  
4 children with cochlear implants, aged from 89 to 121 months, exposed to Cued French and able to use Cued French during speech production (mean=103.8;sd=11.8)

### Data processing and analysis: preliminary analysis restricted to stop consonants

Tongue shapes are extracted 30ms before burst using the SLURP software [11]  
Tongue curvatures are characterized with the MCI measure [10]

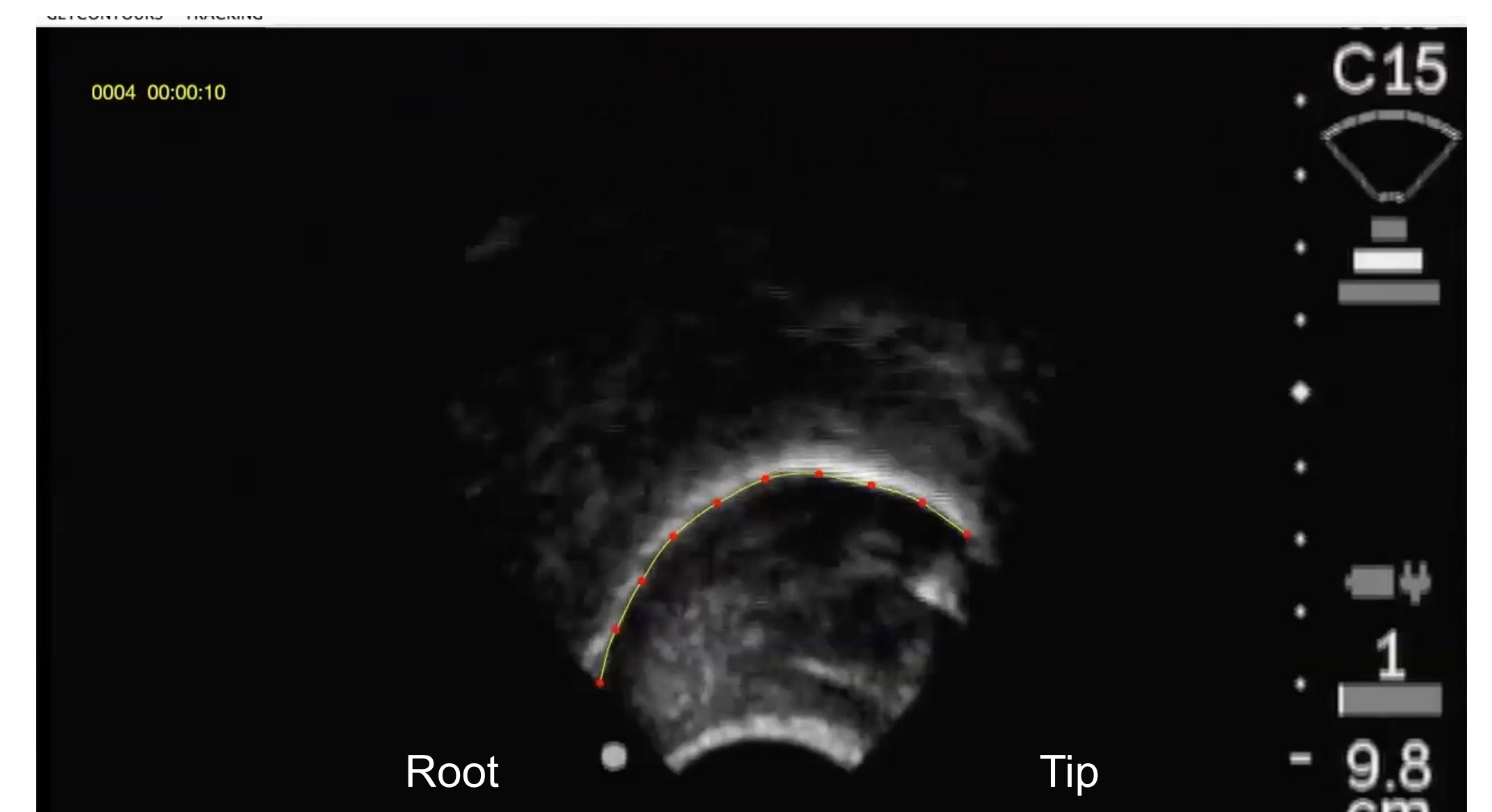


Fig. 2: SLURP software tracking tongue shapes during the production of the sentence /selekaʒot/ by a child with cochlear implants who is simultaneously cueing

## PRELIMINARY RESULTS

### Tongue curvature

Mean curvature index (MCI) seems well-adapted to the description of children stop production

- /t/ and /k/ are well distinguished in both normal hearing children and children with cochlear implants
- MCI measures are consistent with those of Dawson et al. (2015) [10]: higher curvature for dorsal /k/ than coronal /t/ stops

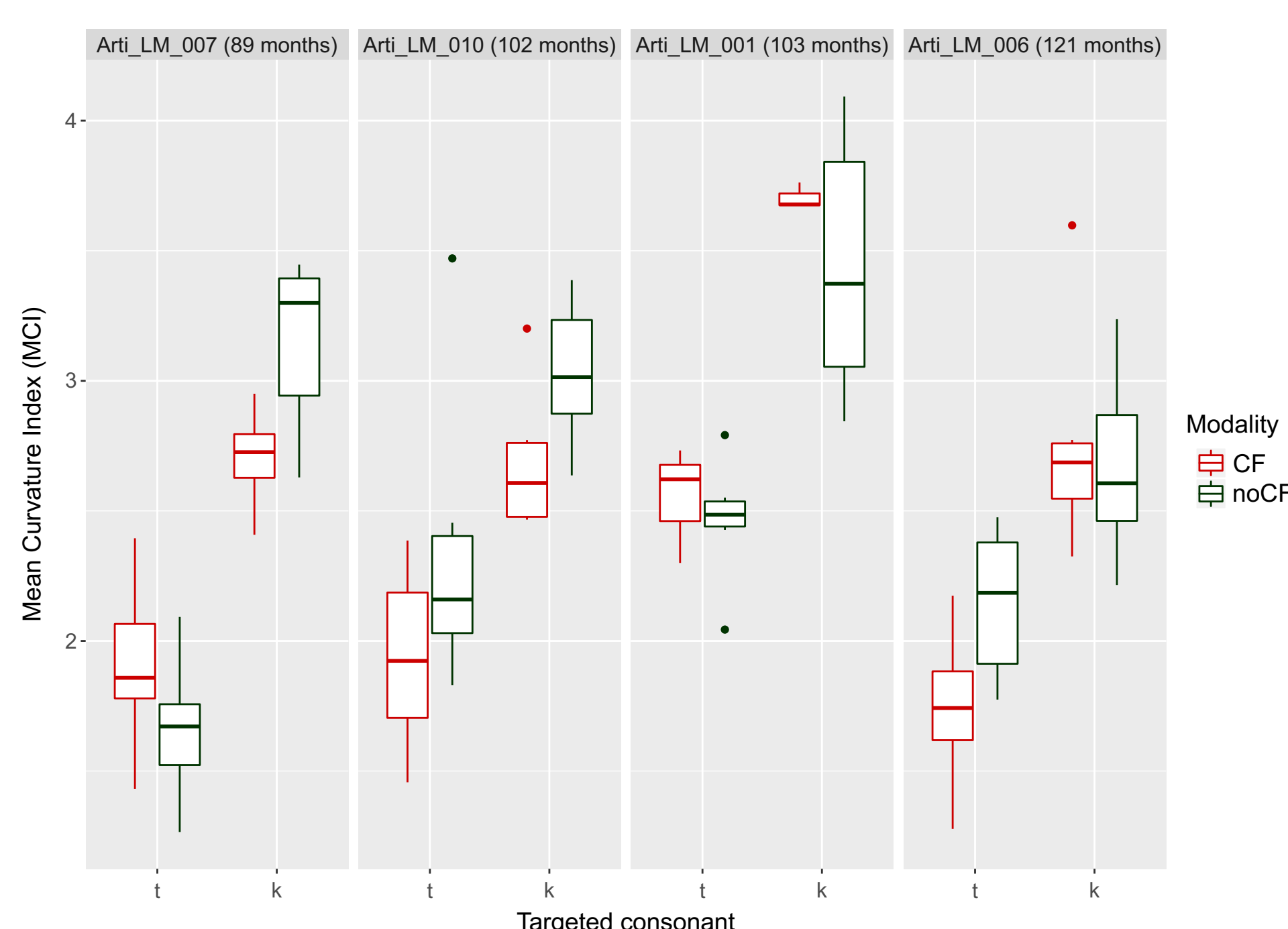


Fig. 3: Mean curvature index (MCI) for /t/ and /k/ in children with cochlear implants

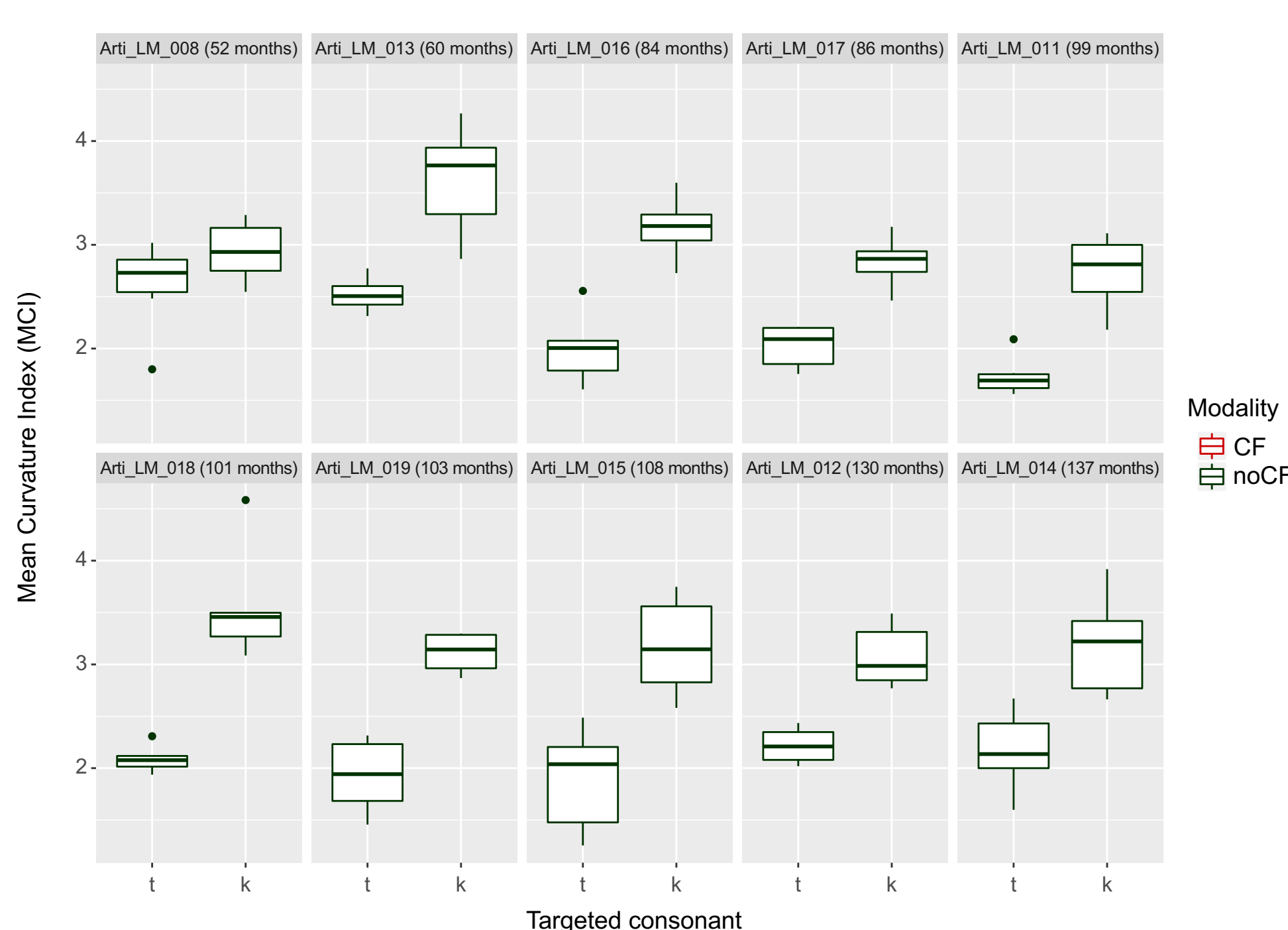


Fig. 4: Mean curvature index (MCI) for /t/ and /k/ in children with normal hearing

## DISCUSSION & PERSPECTIVES

### Discussion

- **MCI seems applicable** to tongue shape description during coronal and dorsal stop production in children
- Children with cochlear implants and exposed to Cued French display **similar tongue curvature patterns to their hearing peers**
- Children with cochlear implants and exposed to Cued French **produce clear articulatory distinction between dorsal and coronal stop and the addition of the hand does not interfere with their production**

### Perspectives

- Comparison with children with cochlear implants and never exposed to Cued French
- Analysis of fricative (/ʃ/ vs /s/) and nasal (/n/ vs /ɲ/) consonants: confrontation of articulatory measures with acoustic characterization for all consonants (formant transition, spectral moments, formant values)

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