Timing differences in articulation between single and geminate voiceless stop consonants: An analysis of cine-MRI data

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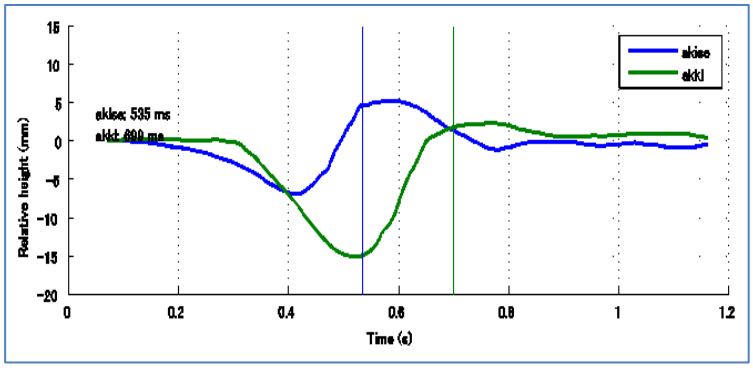
Laryngeal and supralaryngeal articulators coordinately work to produce speech sounds. In order to study differences in supralaryngeal manifestations of consonants, we compared the tongue movement during /akise/ and /akki/ using the fast scanning techniques of MRI movies [1]. The result showed that the tongue displacement starts later in /kk/ than in /k/ for all of the five speakers of Tokyo Japanese. The timing difference varies from 26 ms to 164 ms (103 ms on average). The result suggests that Japanese actively differentiate supralaryngeal articulation according to the contrast of single and geminate consonants. This agrees to Lofqvist (2007) in that the speed of the tongue movement decreased during the long consonant [2]. These results seemingly contradict our previous study in which the tongue displacement starts earlier in voiceless consonant /k/ than in voices cognate /g/ [3]. Coordination of the oral and laryngeal manifestations of /k/, /kk/ and /g/, as well as, the duration of the preceding vowel among these consonants will be discussed.

Example of a movie frame.



Example of the trajectories of tongue-peak movement of /akise/ and /akki/

References

[1] S. Masaki, M. K. Tiede, K. Honda, Y. Shimada, I. Fujimoto, Y. Nakamura, and N. Ninomiya, “MRI-based speech production study using a synchronized sampling method," J. Acoust. Soc. Jpn. (E), 20(5), 375-379 (1999).

[2] A. Löfquvist, “Tongue movement kinematics in long and short Japanese consonants,” J. Acoust. Soc. Am. Volume 122, Issue 1, pp. 512-518 (2007).

[3] M. Fujimoto, T. Kitamura, H. Hatano, and I. Fujimoto, “Timing differences in articulation between voiced and voiceless stop consonants: An analysis of cine-MRI data,” Inteespeech 2013. 955-958 (2013)