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Modulation of event-related potentials associated with orofacial skin stretch during speech production.

Introduction
Modulation of sensory event-related potentials occurs before or during voluntary movement. For speech, the amplitude of auditory cortical potentials is reduced during speech production, the so-called speech induced suppression. However, it is unknown whether somatosensory processing is also suppressed during speech production. The current study addressed this question by examining whether somatosensory event-related potentials (ERPs) associated with facial skin deformation are induced only in a vowel task, which is expected to re-train the lip in the following movement, but not in "r".

Method
Participants: 10 native speakers of American English (right-handed).
Task: (1) Speech utterances: /a/, /i/, /u/ (sustain the vowel sounds for 2 s) and (2) Posturing (hold a posture similar to the speech movement. For speech, the amplitude of auditory cortical potentials is reduced during speech production, the so-called speech induced suppression. Although the current stimulation associated with facial skin deformation is not able to elicit such short-latency evoked potentials, it can induce consistently ERPs with negative peak around 100 ms and positive peak around 200 ms on the mid-sagittal frontal area, like auditory evoked response. The observed attenuation may reflect not a peripheral level of processing, but cortical level of somatosensory processing.

Procedure: Displacements of facial skin deformation were measured using electromyographic/ (North Medical Inc., Wave).
Participants: 5 native speakers of American English.
Task: The same tasks in each task, including speaking manner and utterances and speaking manner [F (2,45) = 0.017, p > .90].
Stimulation: The same somatosensory stimulation as in the main test was applied in all trials
Results: There was no reliable difference in displacement of facial skin across all tasks including speaking manner and utterances and speaking manner [F (2,45) = 0.017, p > .90].
Discussion
It is hypothesized that an attenuation ("gating") of the transmission of somatosensory afferent inputs in the nervous system during movement can be controlled based on the movement pattern. This is consistent with the current results that the "gating" associated with facial skin deformation was induced only in a vowel task, which is expected to re-train the lip in the following movement. However, it is important to note that the observed attenuation may reflect not a peripheral level of processing, but cortical level of somatosensory processing.

Results
Global Field Power

- The first peak of GFP was suppressed during both voicing and posturing tasks for /u/ [F(2,45) = 3.763, p < 0.05]
- The change was observed in ERP at Fz [F(2,45) = 4.731, p < 0.05], but not at Cz [F(2,45) = 0.285, p > 0.20].

- (2) The ERP amplitudes in voicing were more suppressed than the ones in posturing in comparison with control condition [F(2,45) = 4.043, p = 0.05 at Fz; F(2,45) = 5.303, p < 0.05 at Cz].
- (3) There was no reliable interaction between speech utterances and speaking manner [F(2,45) = 0.017, p > .90 in GFP].

- The current somatosensory stimulation was applied in constant manner across imposed tasks in terms of the amplitude of facial skin deformation.

Summary
(1) We found evidence for relatively short latency (around 150 ms) gating of somatosensory input during speech.
(2) The global sensitivity of somatosensory ERP associated with facial skin deformation changes according to the task utterances, suggesting that somatosensory system may be modulated differently relative to phonetic identity.
(3) Voicing induced a greater suppression than posturing in individual electrodes (Cz and Fz), suggesting that sensory suppression may be more influential when sensorimotor system is active.
(4) Somatosensory suppression mechanism is reflected in both somatosensory and auditory modalities associated with speech production.

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