

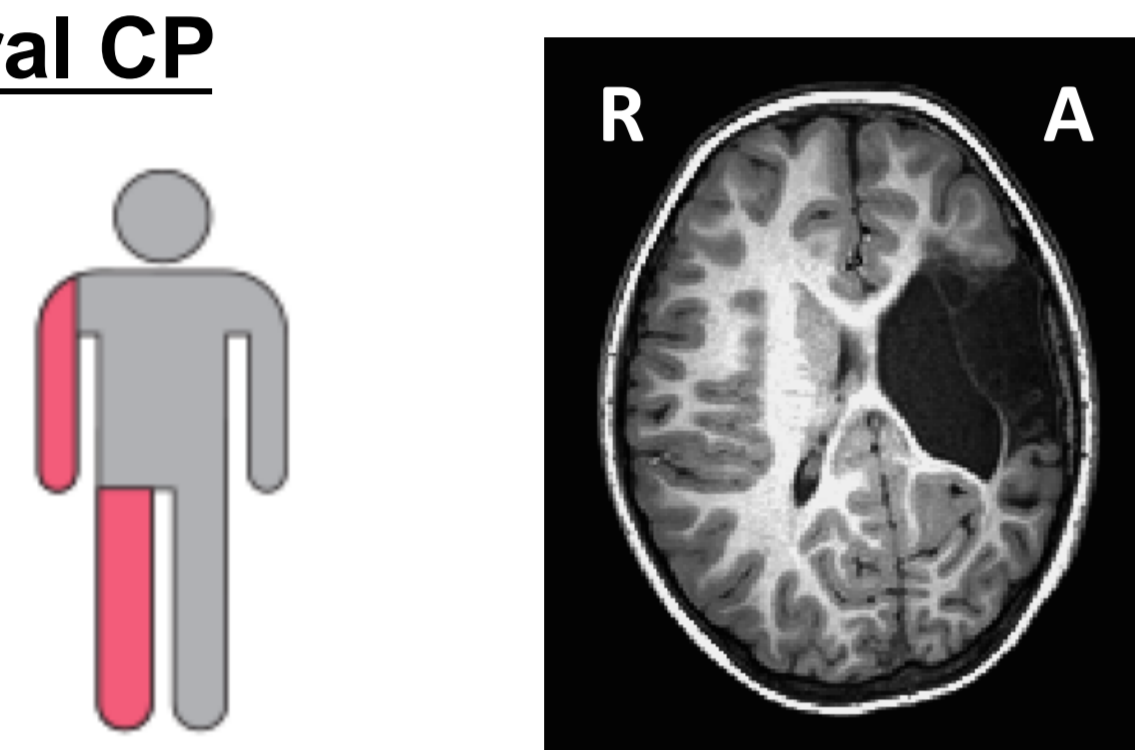
# The neuromuscular control of swallowing and speech in unilateral CP: overactivation and lack of specificity are overlapping traits

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## Introduction

- Swallowing and speech share many anatomical and physiological substrates [1-3]
- Disorders in these functions/systems frequently occur or co-occur in cerebral palsy (CP) [4,5]
- Empirical evidence of the relationship between these two functions and of their potential neural reorganization in CP, is sparse and/or contradictory [e.g., 3,6]
- Gap:** No systematic research on this neural reorganization in children with CP, prohibiting the identification of potential separate or cross-system neurophysiologic treatment targets
- Focus on Unilateral CP**



- Overall Aim:** to determine differences in the peripheral neurophysiological correlates of swallowing and speech between children with unilateral CP and TDC
- Hypothesis:** Children with UCP will exhibit increased neuromuscular activity (normalized amplitude) but reduced bilateral coordination (synchrony) across swallowing and speech tasks compared to TDC

## Methods

- Design:** Cross-sectional study
- Participants**
  - 16 children with UCP (10 male, age range: 7;2-12;2 years of age; GMFCS: I to II; MACS: I to III)
  - 16 TDC (10 male, age range: 7;6-12;2)
- Data collection**
  - Surface EMG of perilabial and submental muscles
  - Wireless sEMG sensors (Trigno Mini Sensors)
  - Data acquisition (LabChart 8, PowerLab 8/35)

### Tasks (random order of each domain)

Swallowing Domain	Speech Domain
5ml thin liquid	2 syllable words
10ml thin liquid	4 syllable words
5cc pudding	Short sentences

Increasing complexity

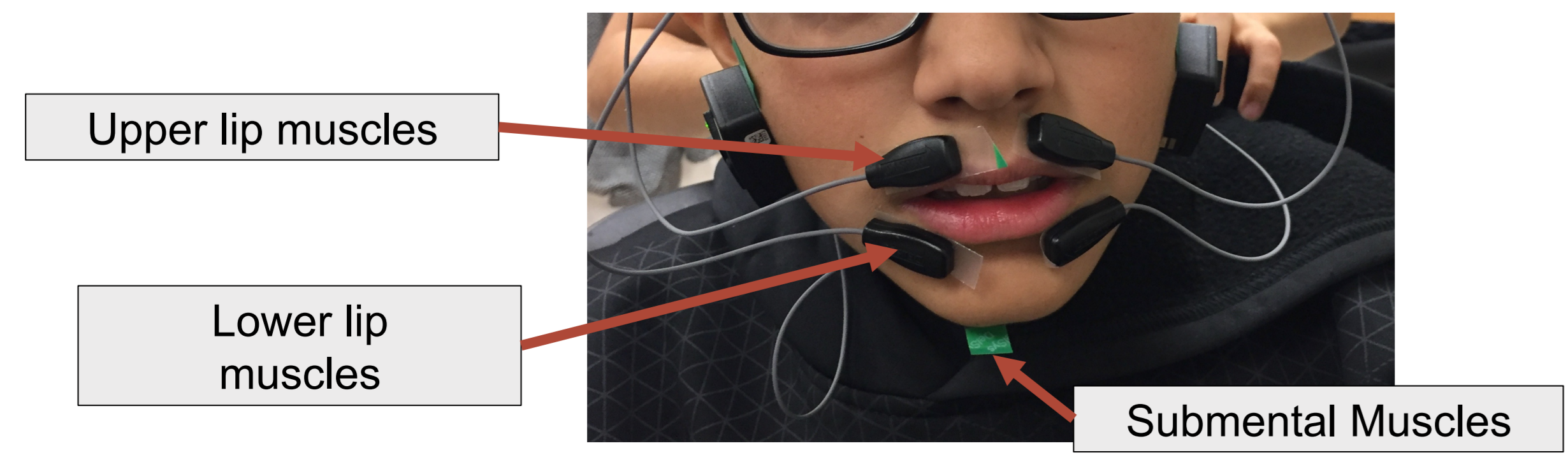


Figure 1: Electrodes placements in perilabial and submental muscles

## Methods (cont.)

- Outcome measures**
  - Normalized mean amplitude (area under curve normalized to MVC task)
  - Bilateral synchrony (zero lag cross-correlation coefficient computed between EMG envelopes from muscle pairs)
- Statistical analysis**
  - Linear mixed effect models comparing group/side (TDC, UCP unaffected, UCP affected), muscle group (submental, upper lip, lower lip), and task

## Results

- Normalized Mean Amplitude**
  - Children with UCP (both affected and unaffected sides) had significantly higher normalized mean amplitude across all tasks & muscle groups ( $F(2, 157) = 6.73, p = 0.0016$ ) than TDC, as seen in Figure 2.

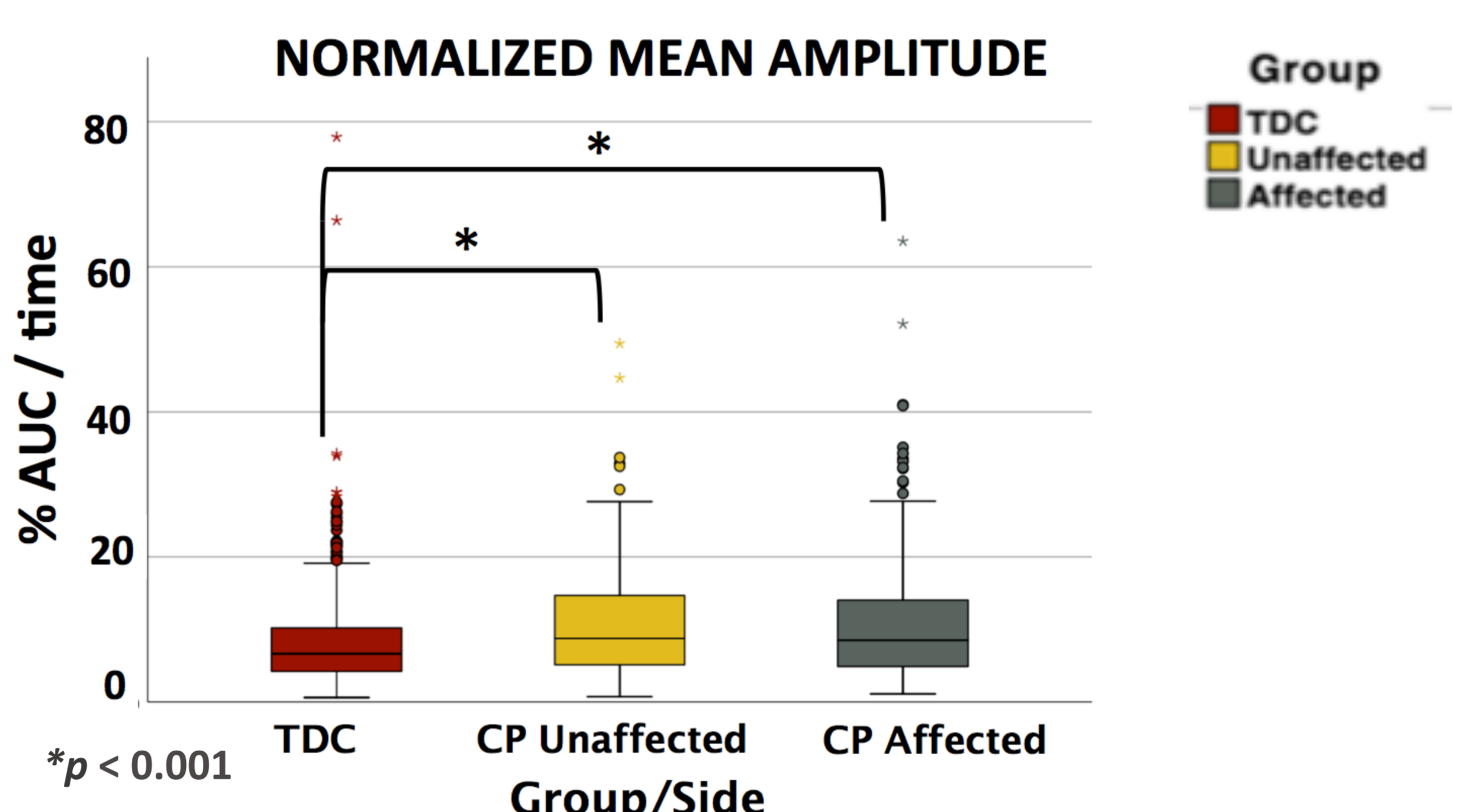


Figure 2: Normalized mean amplitude by group/side

- Post hoc analysis showed differences within the submental and lower lip muscles activation, as seen in Figure 3.

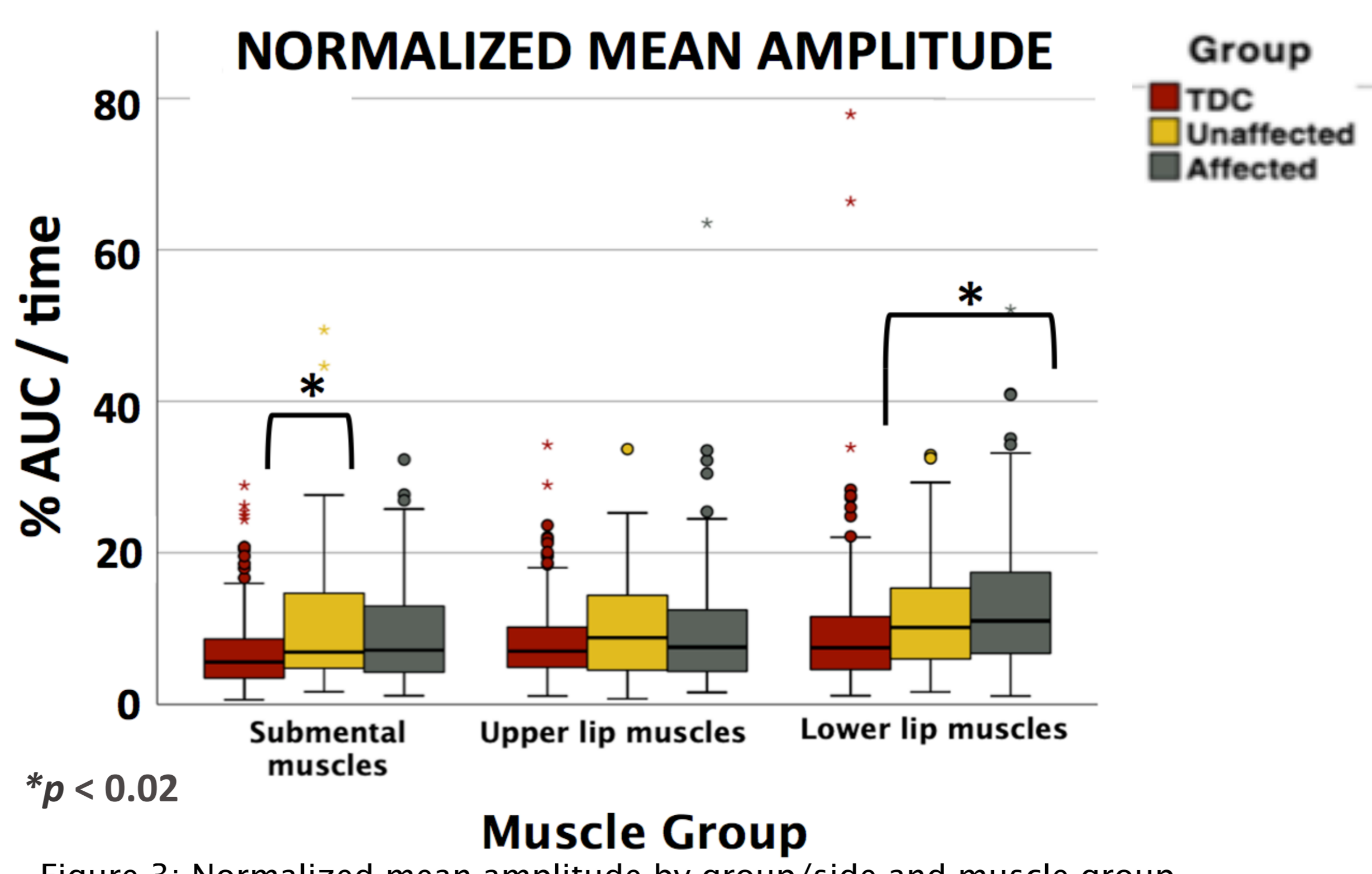


Figure 3: Normalized mean amplitude by group/side and muscle group

## Results (cont.)

- Bilateral synchrony**
  - No differences were seen between groups ( $F(2, 176) = 3.22, p = 0.0743$ ), as seen in Figure 4.

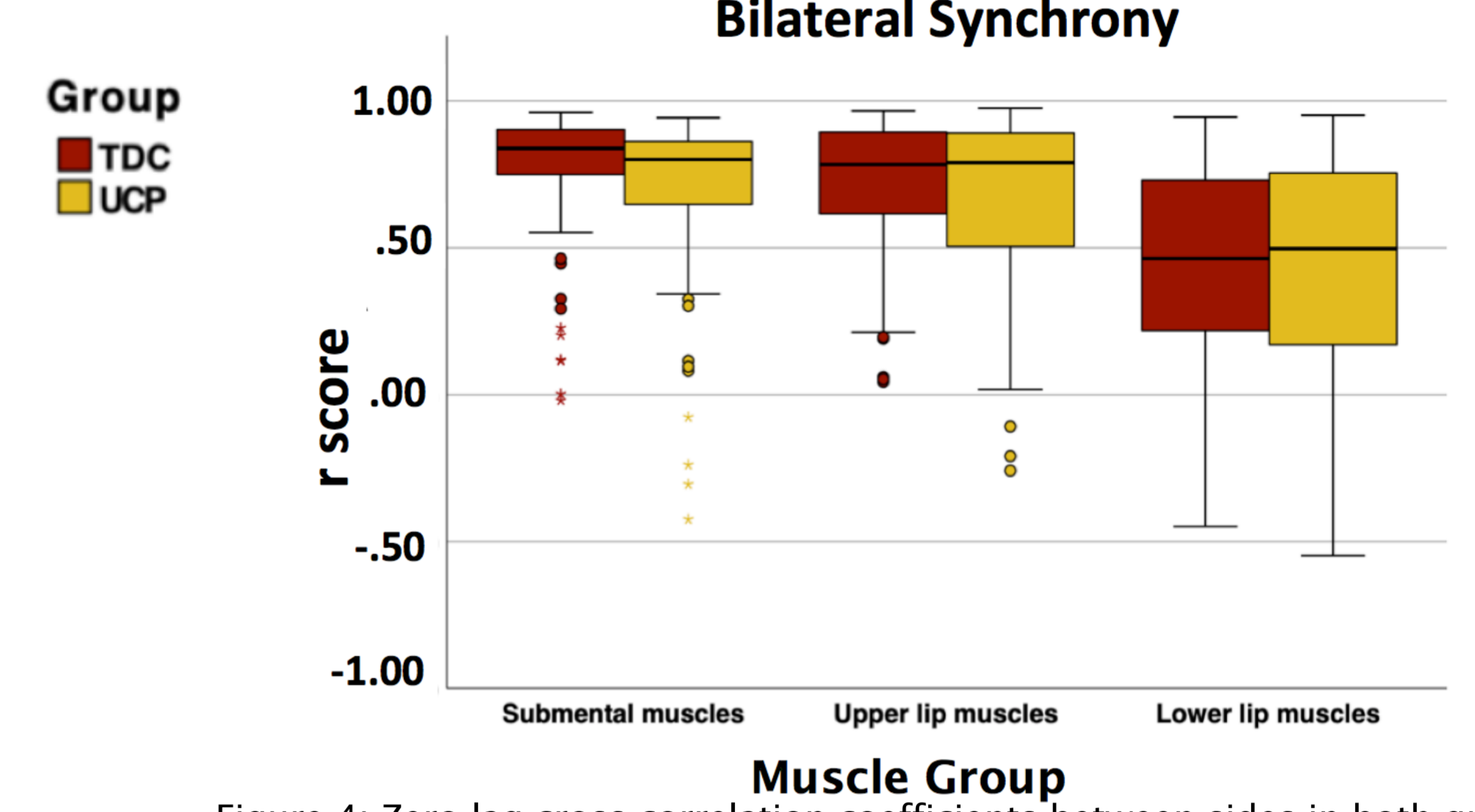


Figure 4: Zero lag cross-correlation coefficients between sides in both groups

## Discussion

- Children with UCP exhibit **neuromuscular overactivation** of the submental and perilabial muscles during both swallowing and speech
- Findings in agreement with prior studies showing increased muscular activity compared to healthy controls in other muscle groups [7,8]
- This suggests these children require more neuromuscular effort and **have less specific neural commands** driving these functions
- First insights on potential neuromuscular treatment targets for this population**

### Limitations & Future Directions

- Relatively small sample size
- Part of larger study
- Correlations/predictions with behavioral and neuroimaging data

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