

# Reliability of Pterygoid Muscle Measurement on Standard T1-weighted Brain MRI in Stroke

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## Background

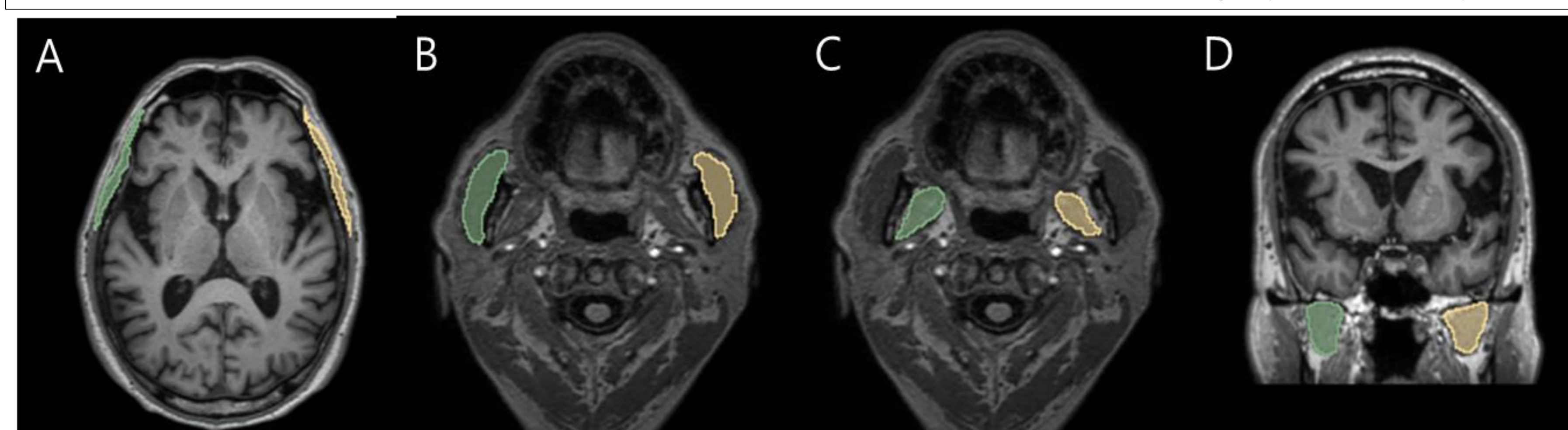
- Craniofacial muscle morphology** has been suggested as a potential imaging biomarker for sarcopenia and dysphagia in patients after stroke.
- This study investigated the **interrater reliability** of craniofacial muscle measurements, including the pterygoid muscle, obtained from **standard T1-weighted brain magnetic resonance imaging (MRI)** in older adults with stroke.

## Methods

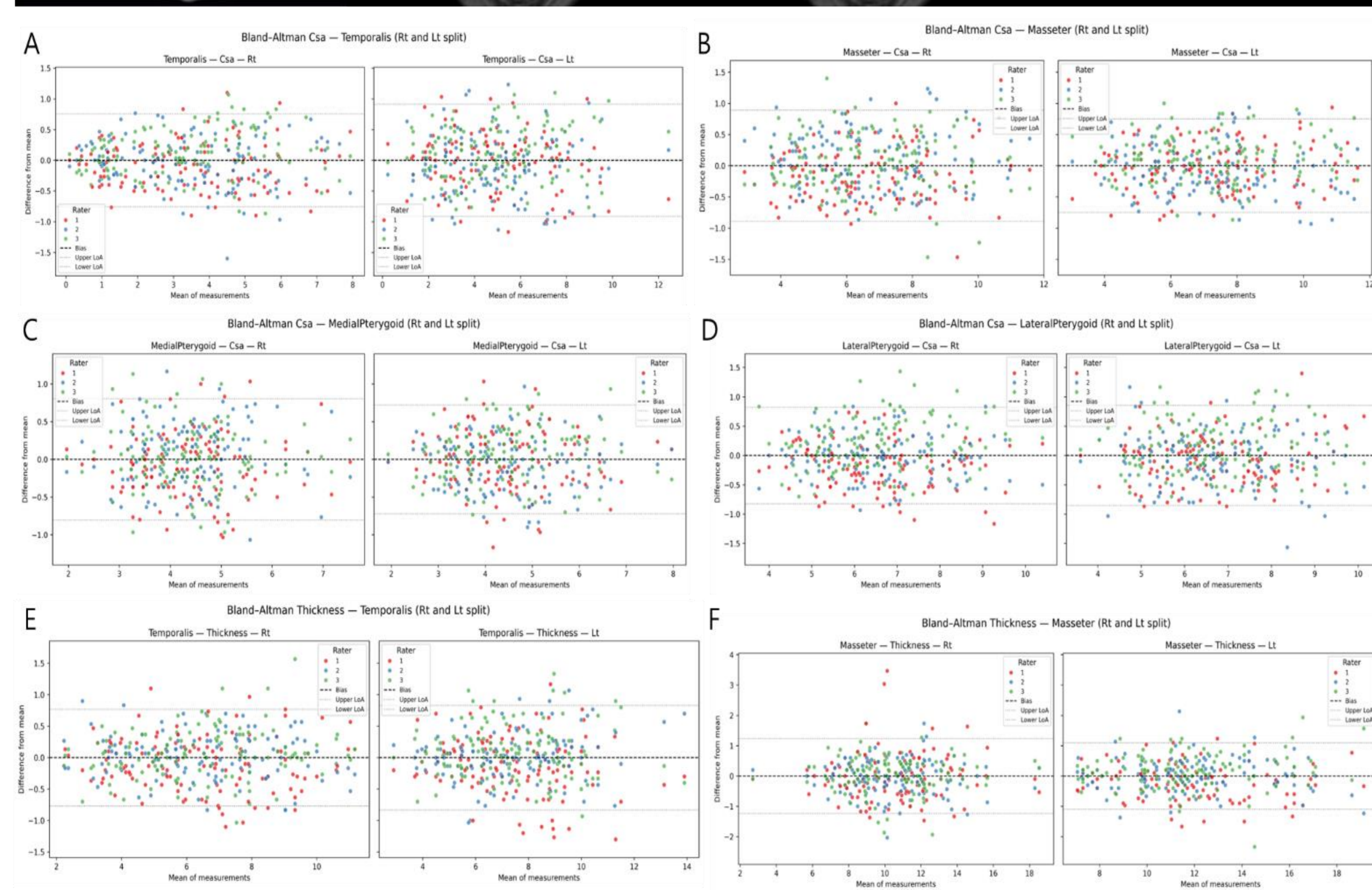
- Sixty-six post-stroke patients (age  $\geq 65$  years) who underwent standard brain MRI on 3.0-T scanners were included and analyzed. T1-weighted sequences were obtained (TR/TE = 6/3 ms, slice thickness 1 mm, FOV 250 × 250 mm).
- Craniofacial muscle measurements were performed on **T1-weighted images using 3D Slicer (v5.8.1) by three independent raters**, ensuring blinded and standardized assessment.
- Eight bilateral craniofacial muscle parameters were evaluated, including **temporalis and masseter thickness and cross-sectional area (CSA)**, as well as **medial and lateral pterygoid CSA**, based on predefined anatomical reference levels.
- When muscle boundaries were indistinct, three-dimensional reconstruction techniques were applied to improve segmentation accuracy and measurement reliability. Each parameter was measured three times on both sides (bilaterally) to minimize measurement variability and enhance reproducibility.
- Inter-rater reliability** was assessed using **extended Bland-Altman analysis and intraclass correlation coefficients (ICCs)**, with results reported alongside 95% confidence intervals.

## Results

- Extended Bland-Altman analyses demonstrated minimal systematic bias with narrow limits of agreement.
- All measurements achieved excellent inter-rater reliability** on T1-weighted sequences: temporalis thickness ICC=0.94 (95%CI: 0.91-0.97), masseter thickness 0.95 (0.92-0.97), temporalis CSA 0.92 (0.88-0.95), masseter CSA 0.93 (0.89-0.96), medial pterygoid CSA 0.90 (0.86-0.94), and lateral pterygoid CSA 0.91 (0.87-0.95).
- All values exceeded the threshold for excellent reliability (ICC>0.90).



**Figure 1.** MRI-based measurement protocol for craniofacial muscle assessment in stroke patients (A) temporalis (B) Masseter (C) Medial pterygoid (D) Lateral pterygoid



**Figure 2.** Bland-Altman plots showing agreement between raters for craniofacial muscle measurements

- (A) Temporalis cross-sectional area (CSA),  
 (B) Masseter CSA  
 (C) Medial pterygoid CSA  
 (D) Lateral pterygoid CSA  
 (E) Temporalis thickness  
 (F) Masseter thickness

Each panel displays separate plots for right (Rt) and left (Lt) measurements. The solid horizontal line represents the mean difference between raters, and the dashed lines indicate the 95% limits of agreement ( $\pm 1.96$  SD). Different colors represent individual raters.

## Conclusion

Craniofacial muscle measurements derived from **standard T1-weighted brain MRI** show **excellent inter-rater reliability across three independent raters**, without additional imaging sequences. This supports their use in multicenter studies and their potential utility for clinical assessment and risk stratification related to post-stroke sarcopenia and dysphagia.