

## **Measuring and visualizing volumetric changes before and after 10-day biofeedback therapy in patients with synkinetic facial palsy using 3D video recordings**

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**Introduction:** The severity of facial palsy is typically assessed using grading systems based on 2D image analysis [1]. Thus, the full range of facial features, especially depth information, is neglected. The present study employed 3D video-based methods to measure volume disparities during dynamic facial movements [2], [3], overcoming prior limitations. In addition, impacted areas were highlighted on the scan for an intuitive visualization.

**Material & Methods:** 35 patients (25-72 years; 28 female) with unilateral chronic synkinetic facial palsy were recorded with the 3dMD face system (3dMD LCC, Georgia, USA) at the beginning and end of 10-day biofeedback therapy focused on more symmetric facial expressions. The patients mimicked a happy facial expression four times, each recording lasting 6.5 seconds, totaling 280 videos. We used the *Curvature of Radial Curves (CORC)* [2] as a dense face descriptor and followed our previous method [3] to estimate the volume changes.

**Results:** We found a reduced volume difference between contralateral and paretic side during the happy expression at therapy beginning ( $13.73 \pm 10.0 \text{ mm}^3$ ) and end ( $12.79 \pm 10.3 \text{ mm}^3$ ). The neutral face remained unchanged in the ranges of  $11.77$ - $12.07 \text{ mm}^3$ . This indicated a lower asymmetry during movements after therapy and could be used as an objective measurement during training for a successful therapy.

**Conclusions:** Our data-driven method enables tracking and visualizing volume disparities between the paretic and contralateral sides. We reduce human bias during evaluation, personalize treatment, and shift 2D image assessments of facial palsy to dynamic 4D evaluations.

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**References:** [1] J. Lou, H. Yu, and F.-Y. Wang, "A Review on Automated Facial Nerve Function Assessment From Visual Face Capture," *IEEE Trans. Neural Syst. Rehabil. Eng.*, vol. 28, no. 2, pp. 488–497, Feb. 2020, doi: 10.1109/TNSRE.2019.2961244.

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**FP.TU.03 Otology 7**