Improved Facial Expressivity in a Patient With Idiopathic Parkinson's Disease Following Expiratory Muscle-Strength Treatment

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BACKGROUND

Parkinson's disease (PD) is a degenerative neurological disease currently affecting half a million to one million people in the United States.

Though PD is classified as a movement disorder, its symptoms are not only physically debilitating but also psychologically and interpersonally debilitating (including increased prevalence of depression, apathy and reduced facial expression) (Fahn, 2003).

Expiratory muscle-strength treatment (EMST) is being evaluated as a therapy for improving respiratory muscle strength in patients with Parkinson's disease (PD; Sapienza, 2004), but the effect of this training on flexibility of the facial muscles has not been examined.

We observed dramatic improvements in facial muscle movement in a patient with reduced facial expressivity secondary to idiopathic PD following one month of therapy.

METHODS

Participant

The participant was a 58-year old female with a ten-year history of idiopathic PD who was at Hoehn-Yahr Stage 3 (on medication) during the evaluation. Her motor Unified Parkinson's Disease Rating Scale score was 28.

Mood Measures

Beck Depression Inventory (BDI)
State Trait Anxiety Inventory (STAI)

Expiratory Muscle Strength Training

Treatment involved exhaling into a spring-loaded valve until maximum expiratory pressure was assessed.

Subject training with the respiratory trainer

The patient then practiced this expiratory exercise at 75% of their maximum pressure for four weeks. This included five respiratory sets per day, five days per week.

Copies of this poster can be found at www.phhp.ufl.edu/cogneuro

FACIAL MOVEMENT ANALYSIS

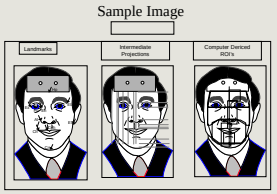
The participant was tested for facial movement prior to treatment and after four weeks of treatment.

Videotaping and Digitizing Frames

Facial movement was assessed quantitatively. For each expression the initial 40 video frames were captured, digitized, and saved on a computer. Each digitized frame was 30 ms in duration and represented a 640 X 480 pixel array at 256 levels of gray.

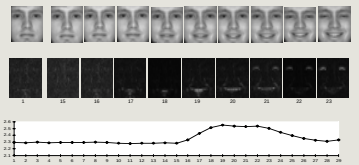
Landmarking the Face

Sixteen anatomic landmarks on the face were placed on the 1st frame of an expression sequence. Custom software in PV-Wave (CHEES) used these land-marks to automatically compute geographic boundaries or regions of interest (ROIs) that were applied to all images of a particular expression.



Computing Movement Change (Entropy)

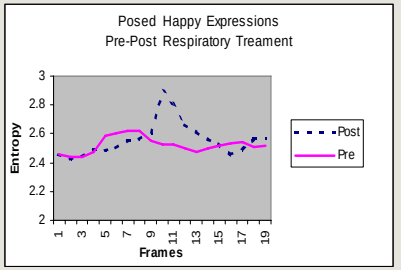
For each expression, pixel intensities of adjacent frames were subtracted to obtain difference images over time (see below). On these difference images, we plotted histograms of the ROI (See below). Custom software, developed by Gokcay (2000), was then used to compute total **entropy**, a quantitative index of movement change over the face during the course of the entire expression.

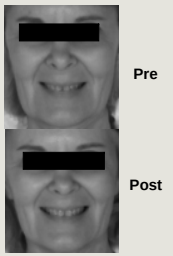


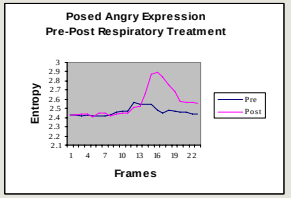
Frame-by-frame change of hemifacial expression and entropy (sample image)

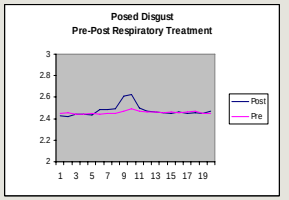
RESULTS

Improvement in Facial Expressivity (Happy)
Before and After Respiratory Treatment









Summary of Results

•The patient was not anxious or depressed (BDI = 10; STAI state anxiety SS = 60; STAI trait SS = 58).

•Objective analysis of change in facial movement revealed a 250% increase in entropy post-therapy "on" medication, which was also reflected by observers and UPDRS facial score (pre = 2; post = 1).

CONCLUSION

- We found that EMST resulted in improvements in facial expressivity in a patient with idiopathic Parkinson disease.
- Similar improvements in expressivity were described in a study using intensive voice therapy (Spielman et al., 2003)
- The basis for this improvement is unknown, but could be due to improved muscle strength related to exercise.
- We are currently investigating this effect in a blinded randomized treatment trial, with sham treatment as a control.
- Increased facial expressivity may have implications for improvements in interpersonal interactions and quality of life.

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