

Introduction

Accelerometry can be used to objectively monitor tremor, though lack of clinical validity and cumbersome devices have limited widespread adoption. With ongoing maturity, smartphones and wearable devices are shaping personalized medicine, especially in movement disorders. The current study reviews the correlation of intraoperative tremor as measured by an iPhone® accelerometer to postoperative tremor, functional outcomes and quality of life.

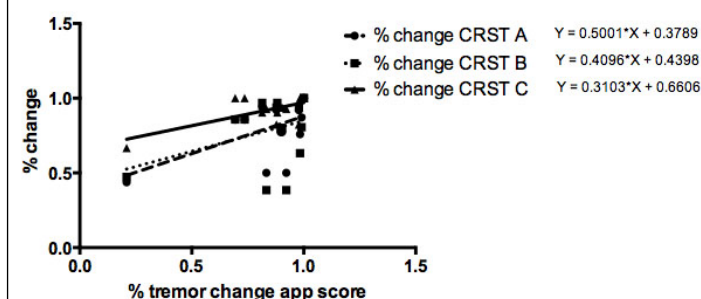
Methods

The authors retrospectively reviewed a prospective series of eight consecutive patients (15 hemispheres) who underwent tremor measurements using a publicly available accelerometer app (ParkinsonMeter) for the iPhone®. Tremor magnitude was measured preoperatively and intraoperatively during Vim DBS surgery. Patients were clinically evaluated during a median follow-up period of 13.6 (range 5.9 – 18.9) months using the Clinical Rating Scale for Tremor and Quality of Life in Essential Tremor Questionnaire.

Results

All but one patient (unilateral) presented with bilateral medically refractory action-induced tremor at an average age of 65.6. Linear regression analysis of CRST and QUEST scores compared to tremor measurements revealed a statistically significant correlation between improvement in total CRST score and intraoperative change in tremor score (slope=0.5, p=0.0361, R²=0.3). Analysis of individual CRST components (A: Tremor Severity; B: Motor Tasks; and C: Functional Disabilities) illustrated a significant correlation between change in tremor score and components A and B, and a positive correlation with component B, though this did not reach statistical significance (A: slope=0.5, p=0.036, R²=0.30; B: slope=0.41, p=0.165, R²=0.14 C: slope=0.31, p=0.007, R =0.44). Similarly, a positive correlation between change in tremor and quality of life was observed (slope=0.28, p=0.65; R²=0.03). This also did not reach statistical significance.

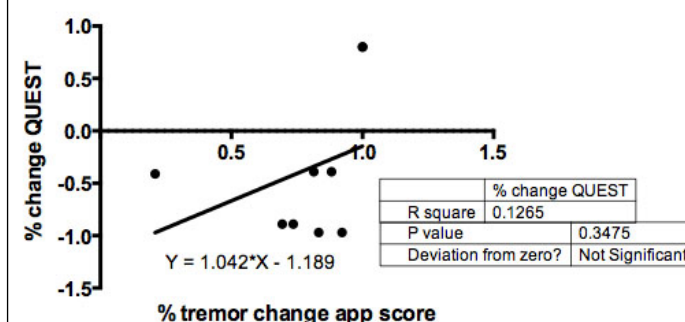
Tremor change vs CRST subscores (A,B,C)



	% change CRST A	% change CRST B	% change CRST C
R square	0.2959	0.1428	0.4414
P value	0.0361	0.1650	0.0069
Deviation from zero?	Significant	Not Significant	Significant

Regression analysis of CRST subscores shows significant relationship between tremor app score and tremor severity (CRST A) and Functional Disability (CRST C)

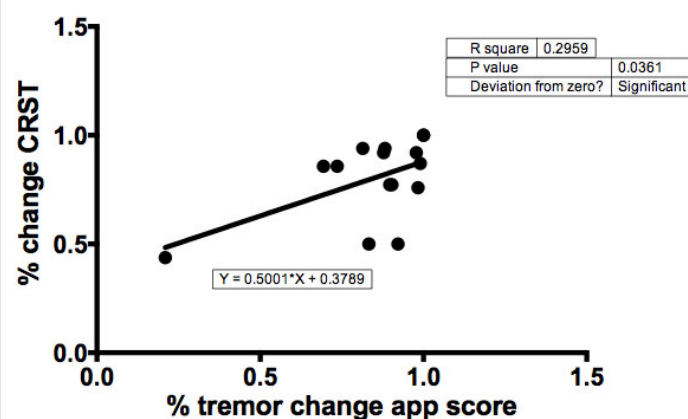
Tremor change vs QUEST



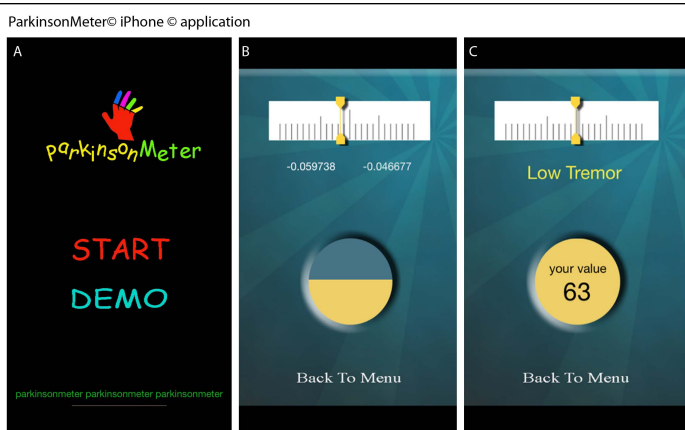
	% change QUEST
R square	0.1265
P value	0.3475
Deviation from zero?	Not Significant

Regression analysis of tremor change vs QUEST scores showing positive trend. No significance reached.

Tremor change vs CRST score



Regression analysis of change in tremor vs change in CRST score shows significant trend



Commercially available iPhone app. (A) Start screen (B) use of accelerometer to test tremor (C) results

Conclusions

In the current study, patients exhibiting the greatest improvement in intraoperative tremor showed a statistically significant improvement in overall disease burden and a positive correlation with quality of life. This data suggests that simple devices can be used intraoperatively to evaluate tremor quantitatively and possibly assist with lead placement to improve outcome.