

## Impact of Vibration in Older Adults with Parkinson's Disease.

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### INTRO

The RMBand™ (Resonate Forward, LLC) is designed to administer a vibration to the wearer's upper arm to decrease or stop tremors in persons with Parkinson's disease (PD).

We hypothesized that the RMBand™ would decrease tremors, and the effects of the vibration on tremors would be related to the vibration dose (vibration frequency Hz). We further hypothesized that the vibration delivered would be safe and tolerable for the wearer.

### METHODS

#### Study Design

This was a double blinded two-group randomized trial and was conducted in a single, one-hour session. Thirty PD participants were allocated equally amongst the two groups. Group A received a low-frequency level of vibration, and Group B received a high-frequency level. All participants were exposed to 20 minutes of continuous vibration stimulus. The low and high frequencies were selected based on previous research (Jobges, 2002; Winfree, Pretzer-Aboff, Hilgart, et al., 2013).

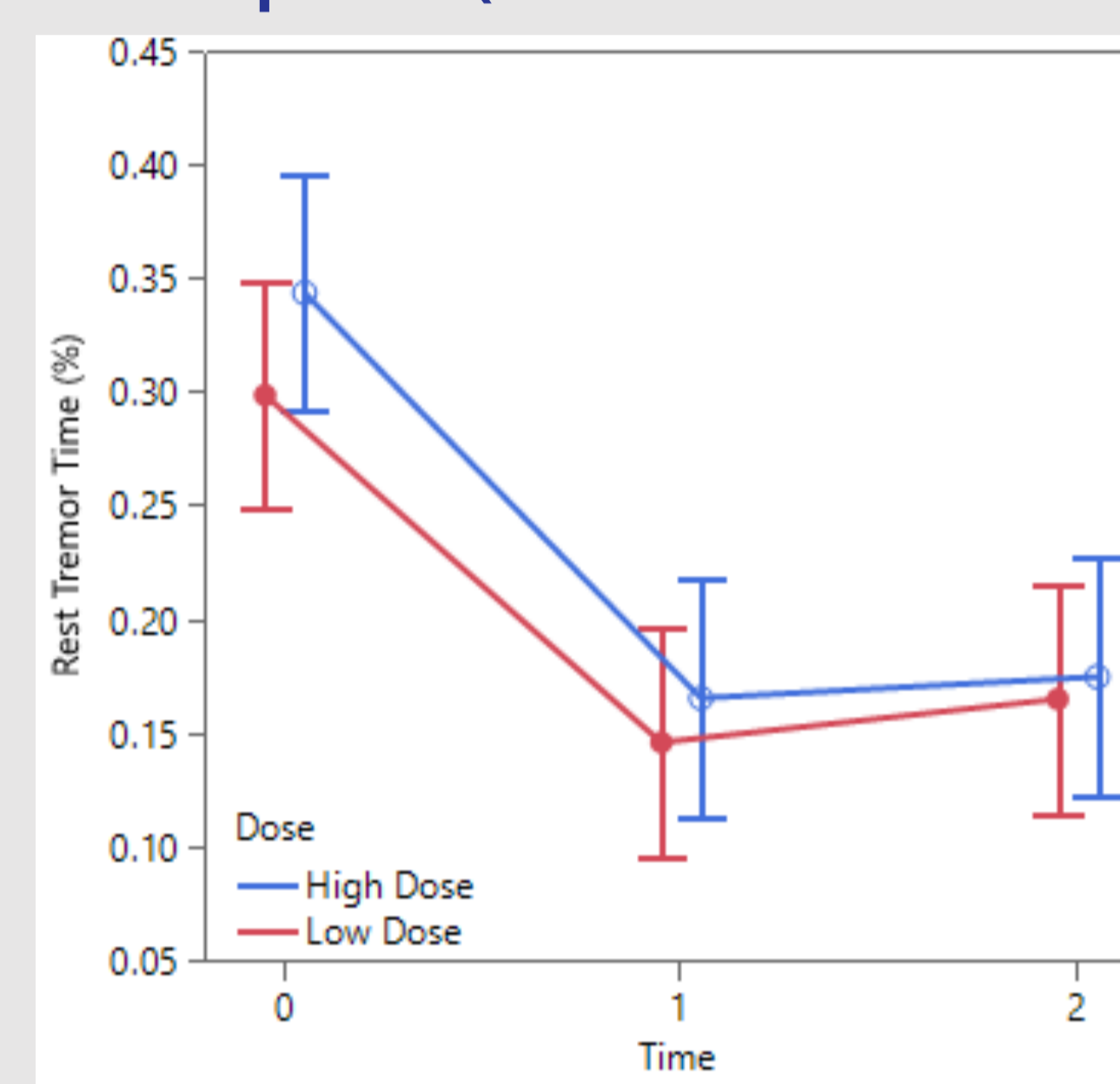
Data was collected pre-, during (5 minutes after vibration turned on), and after vibration was turned off to assess lasting effect. Descriptive statistics were used to depict participants. Linear mixed effects model was used to test group effect (low vs. high dose) and effect of each frequency across time (pre-, during, post). Safety and tolerability of the RMBand™ was learnt by asking qualitative questions.

Assessments included time in tremor using TremorSense<sup>3</sup> device on wrists, MDS-UPDRS III, Fahn-Tolosa-Marin tremor (F-T-M) rating scale.

## RESULTS

### PARKINSON'S DISEASE TREMORS significantly decrease both during and after vibration

Rest Tremor Time plot (means and standard errors)

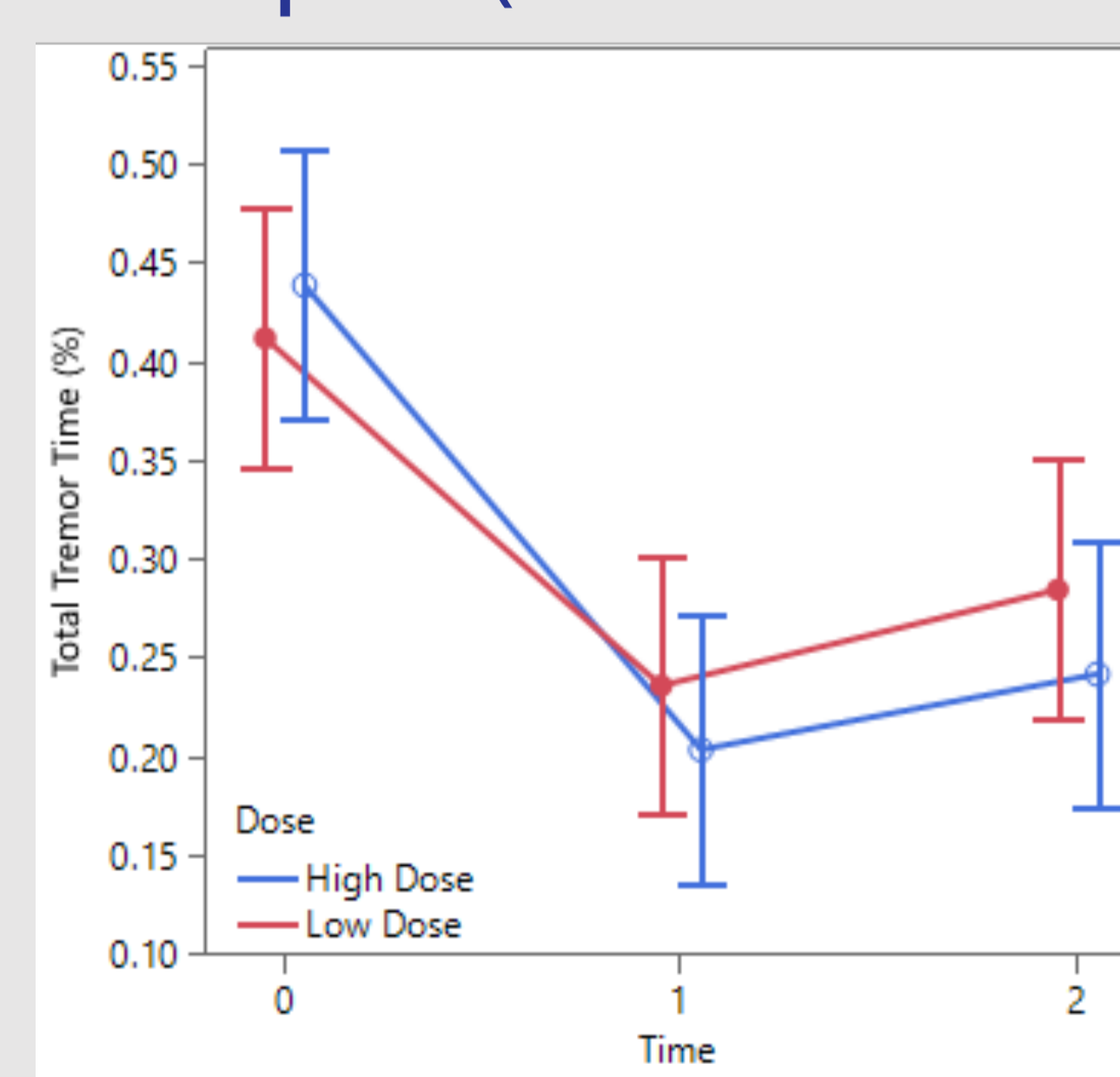


#### Rest Tremor Percent Model

##### Fixed Effect Tests

Source	Nparm	DF	DFDen	F Ratio	p-value
Group	1	1	27	0.1509	0.7007
Time	2	2	54	19.1388	<.0001 ←
Group*Time	2	2	54	0.1883	0.8289

Total Tremor Time plot (means and standard errors)



#### All Tremor Percent Model

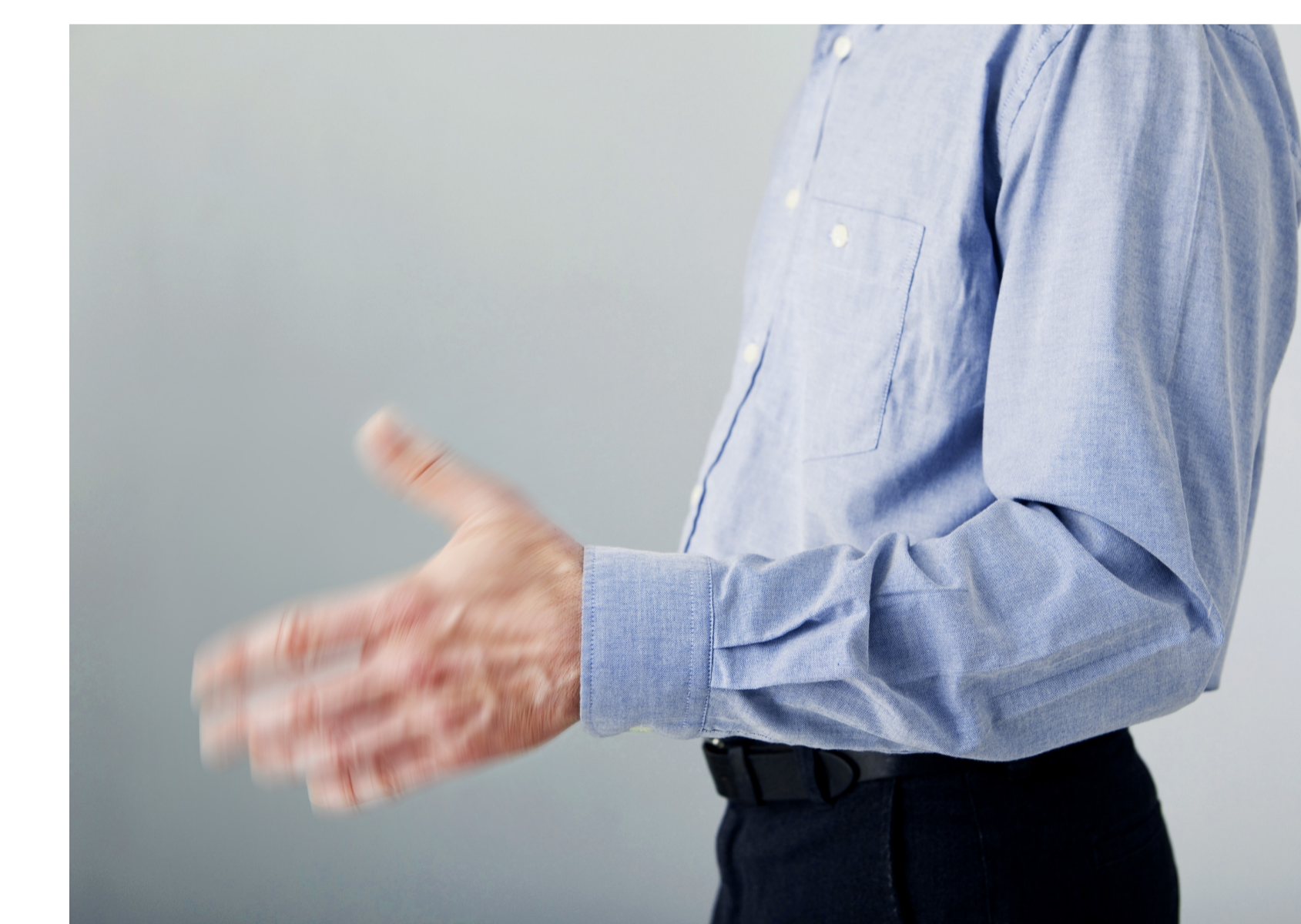
##### Fixed Effect Tests

Source	Nparm	DF	DFDen	F Ratio	p-value
Group	1	1	27	0.0346	0.8539
Time	2	2	54	22.4077	<.0001 ←
Group*Time	2	2	54	0.6717	0.5151

### PD Participants:

	Group			p-value
	Low Dose Mean (SD)	High Dose Mean (SD)	Pooled Mean (SD)	
Number years with PD	7.1 (6.2)	6.3 (5.1)	6.7 (5.6)	0.7253*
Age PD Symptoms	59.2 (9.5)	58.1 (12.7)	58.6 (11.0)	0.7840*
Age PD Diagnosed	60.2 (9.6)	61.3 (11.4)	60.7 (10.4)	0.7842*
	N (%)	N (%)	N (%)	
<b>Race</b>				0.3091†
Caucasian	15 (100)	14 (93)	29 (97)	
Black	0 (0)	1 (7)	1 (3)	
<b>Hoehn &amp; Yahr Stage</b>				0.0022‡
I	5 (33)	0 (0)	5 (17)	
II	7 (47)	15 (100)	22 (73)	
III	3 (20)	0 (0)	3 (10)	
<b>Deep Brain Stimulator</b>				0.3091 †
Yes	1 (7)	0 (0)	1 (3)	
No	14 (93)	15 (100)	29 (97)	
	Mean (SD)	Mean (SD)	Mean (SD)	
<b>Baseline Tremor Total Score</b>	21.6 (11.3)	18.4 (5.4)	20.0 (8.8)	0.3459*
<b>Baseline MDS-UPDRS Part II</b>	9.3 (6.8)	6.9 (4.1)	8.1 (5.7)	0.2537*
<b>Baseline MDS-UPDRS Part III</b>	8.1 (4.6)	7.8 (2.9)	7.9 (4.1)	0.8132*
<b>Total Daily Dose of Levodopa</b>	595.3 (426.3)	619.0 (594.6)	607.2 (508.5)	0.9012*

\* Using a two-sample t-test; † using a likelihood ratio test; ‡ using a Fisher's Exact test



### DISCUSSION

Percent time with tremor during the pre-vibration period was significantly greater than during- and post-vibration ( $p < 0.0001$ ), for both dose groups. *This suggests that vibration therapy applied to the proximal arm may suppress PD tremor.*

No significant difference was observed between the high and low dose groups in the MDS-UPDRS part 3 or the FTM tremor scale ( $p = 0.83$  and  $0.48$ , respectively). This may be due to the crude nature of these scales.

No significant adverse events related to vibration therapy occurred. In conclusion the RMBand™ appears safe and possibly effective for suppression of PD tremor.

#### Conflict of Interest

Drs. Ingrid Pretzer-Aboff has financial interest in Resonate Forward, LLC, a company with commercial interest in technology. This conflict has been reviewed and managed by VCU.

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