DIGITAL VOICE ANALYSIS IN PARKINSON'S DISEASE

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Background. Voice abnormalities occur in up to 70% of patients with PD during the course of their disease leading to significant functional disability, loss of communication skills and social isolation. Articulation, rate, prosody and phonation are the typical speech components affected in PD and represents targets for treatment strategies. Currently available measures of voice alterations are often descriptive and qualitative.

Objectives. To quantitatively characterize voice abnormalities in patients with PD using computerized digital voice analysis.

Methods. We performed prospective digital voice recording using non specific 30-60 seconds speech tasks in 24 unselected Hebrew speaking PD patients, 12 healthy controls, and 10 patients with other neurological diseases. Percent-average (F/AVG) and percent-maximal (F/MAX) voice intensities at each voice frequency were analyzed using INSTINCTONE software. These measurements represent fundamental normalized voice parameters. Statistical analysis was done using Fisher exact test, Spearman correlation test and ROC curve.

Results. Characteristic digitalized voice abnormalities in PD include low F/AVG at 220 and 440 Hz observed in 92% of the patients and in 25% of healthy controls, and high F/MAX variability between 390-450 Hz in 96% of the patients and in 25% of healthy controls. Similar changes were detected in only 30% and 50%of patients with other neurological diseases. Sensitivity of these findings is 91% (p<0.05) and specificity is 75% (p<0.05). Correlation to the PD severity expressed as UPDRS is 0.4882 (p<0.05).

Conclusions. Digital voice analysis can be easily performed in evaluation of patients with PD. Low F/AVG at 220-440Hz and high F/MAX variability between 390-450Hz represent characteristic alterations in PD. Possible future applications include aid in early diagnosis and monitoring of the treatment.

- *Voice = sound waves of various **frequencies** and **intensities***
- *The normal voice **frequency** is: 60 Hz - 18,000 Hz*
- *The normal voice **intensity** is: 65-96 dB*
- *The choice of sound wave frequency and intensity is mostly a reflex - instinctive and involuntary*

VOICE ABNORMALITIES IN PD
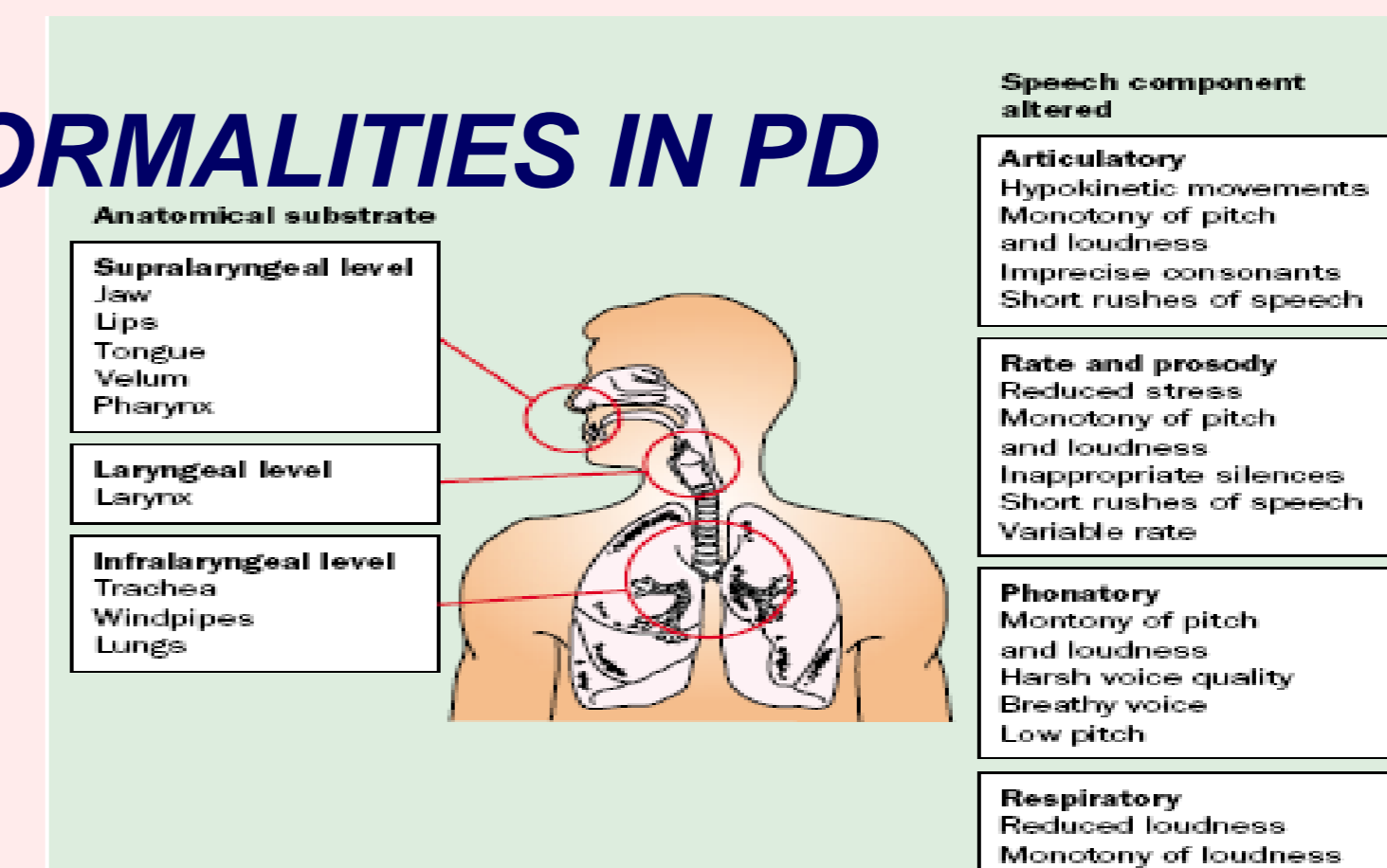
PATIENTS' CHARACTERISTICS:

Parkinson's disease

Age 68.5 (mean); F/M – 9/15; Hoehn & Yahr stage: 13 pts – 1; 7 pts – 2; 4 pts - 3

UPDRS: Mean 52.5 (range 16-132)

Treatment: 6-ReQuip, 18-Dopicar(Levopar), 3- Stalevo, 6-Jumex, 3- PK Merz, 4-Sinemet CR, 2-Dekinet, 9- Comtan, 1-Pergolide,3-Azilect; 3 newly diagnosed
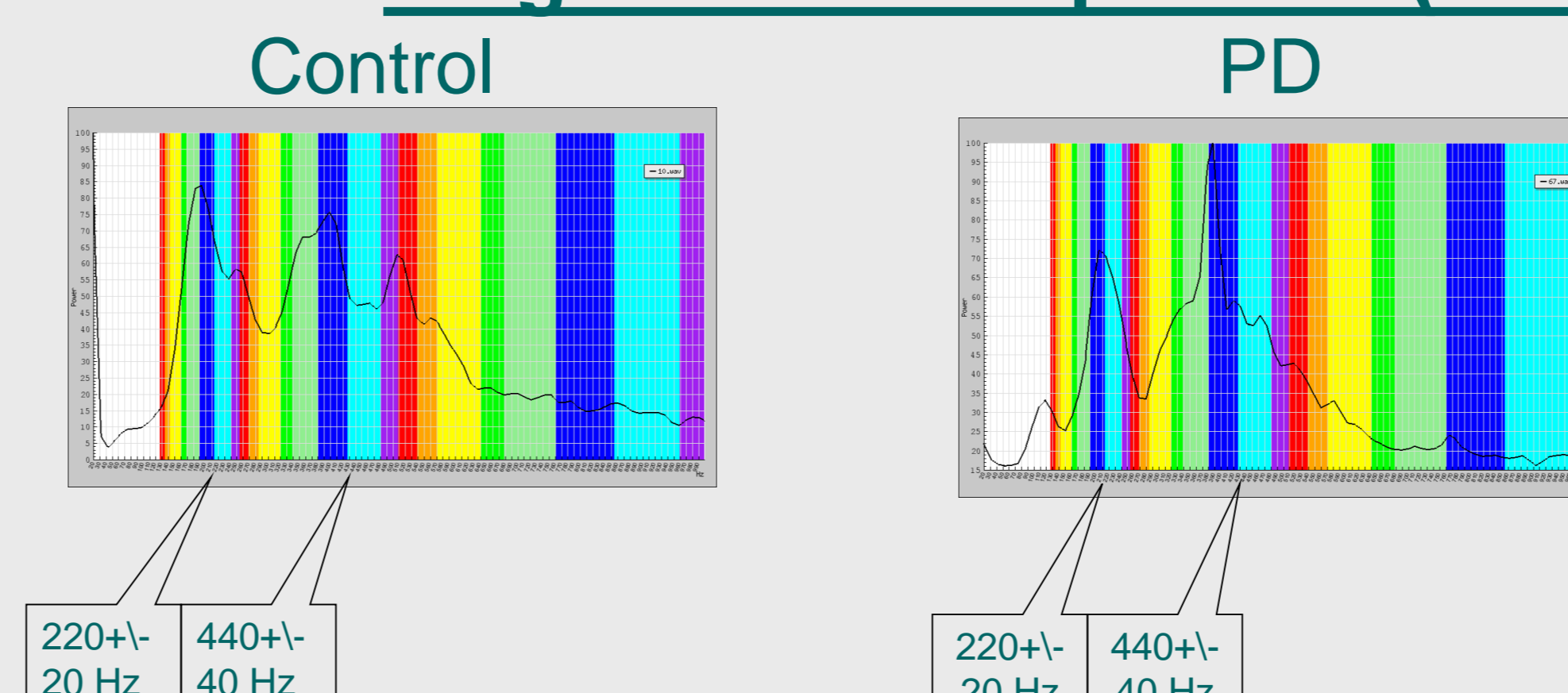
Other neurological diseases

Essential Tremor -1, Torticollis-1, Alzheimer's Disease-1, Partial Epilepsy-1, Cerebrovascular Disease -1, Multiple Sclerosis -1, Benign Positional Vertigo-1, Myelopathy (paraparesis) -2, Peripheral Sensory-Motor Neuropathy -1

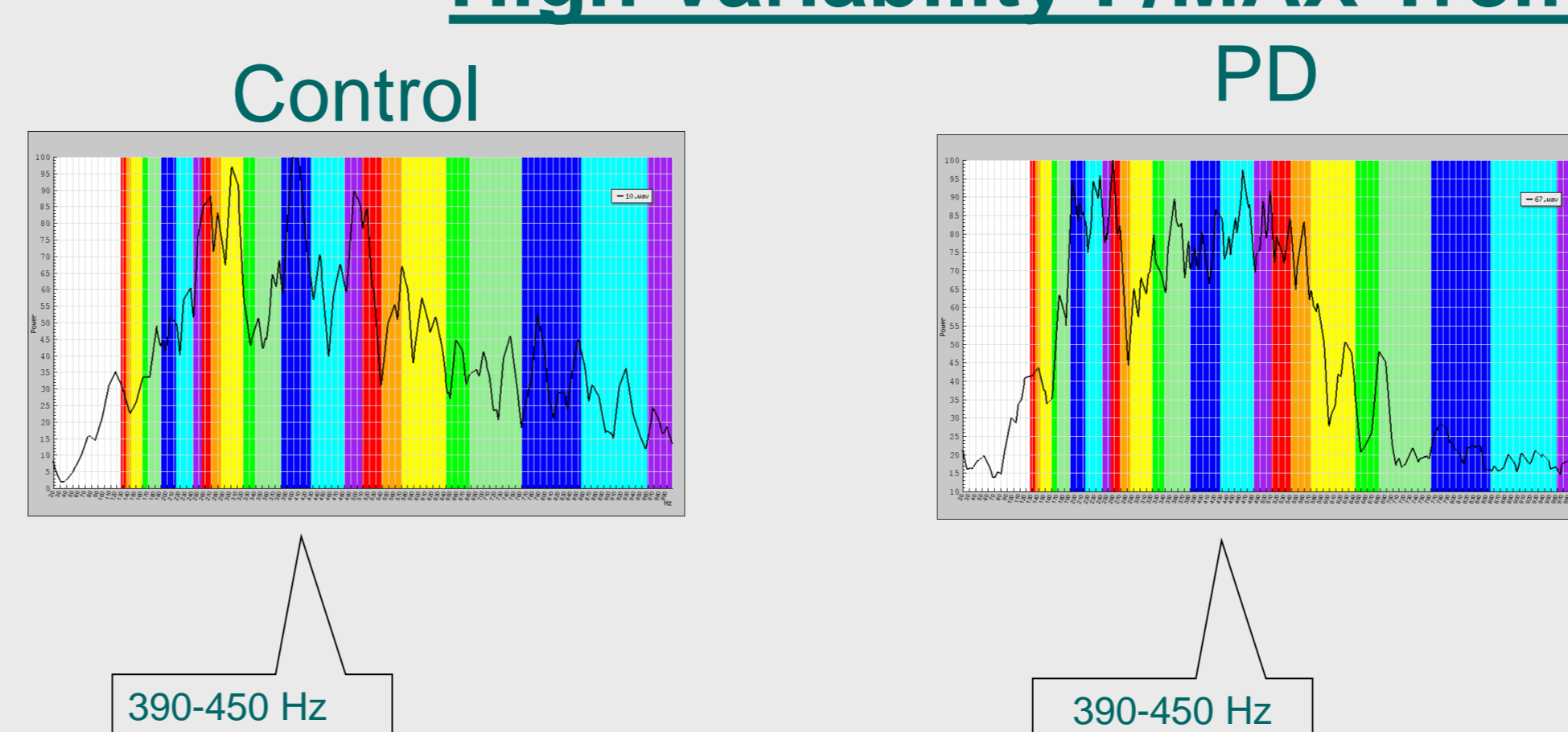### Representative Normal Voice using the INSTINCTONE Software

F/AVG   F/MAX
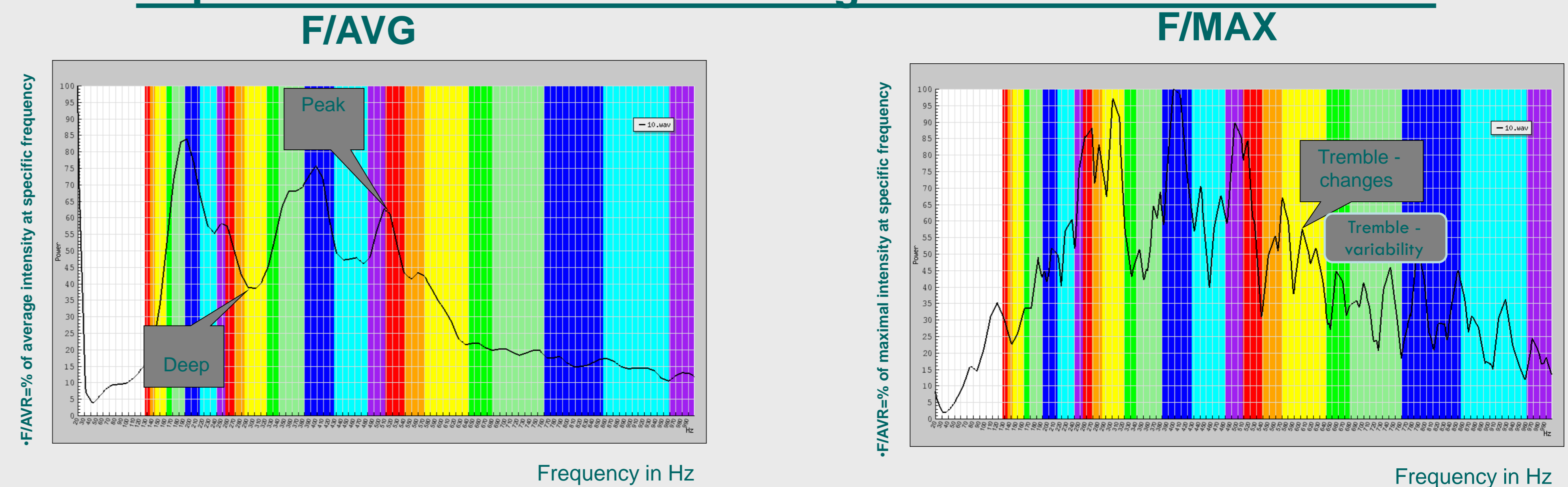
Large F/AVG Deep at 220 (+\- 20) and 440 (+\- 40) Hz

Control   PD

- PD – 92%
- Healthy – 25%
- Other neurological Diseases - 30%
- Specificity - 91.3%
- Sensitivity - 75%
- Correlation to the UPDRS - 0.4882 (p<0.05)

High Variability F/MAX Trembles at 390-450 Hz

Control   PD

- PD – 96%
- Healthy – 25%
- Sensitivity – 91.3%
- Specificity – 100%
- Correlation to UPDRS - 0.4882 (p <0.05)