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Case Series

Positional Variability in Upper Limb Tremor in Both Essential and Dystonic Tremor: A Case Series

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Abstract

The MDS tasks force on tremor defines tremor as an involuntary, rhythmic, oscillatory movement of a body part classified along two axes based on clinical characteristics and etiology. This system allows for classification into various tremor subtypes and good description of specific tremor disorders. However, there are no studies looking at the variability of the tremor in positions other than resting, postural kinetic features and the potential utility in tremor rehabilitation. A study concluded that variability in tremor magnitude with limb position was not consistent with essential tremor. A high intra-assessment variability in tremor amplitude has previously been demonstrated in high amplitude essential tremor.Variability in amplitude and intensity are often considered to support a functional tremor. We demonstrate this positionality in five clinical cases previously diagnosed as essential tremor and hypothesize that this is not an uncommon feature of dystonic or essential tremor.

Keywords: *Dystonic tremor, Essential tremor (ET), positional variability*

Introduction

The MDS tasks force on tremor defines tremor as an involuntary, rhythmic, oscillatory movement of a body part classified along two axes based on clinical characteristics and etiology[1]. This system allows for classification into various tremor subtypes and good description of specific tremor disorders. However, there are no studies looking at the variability of the tremor in positions other than resting, postural kinetic features and the potential utility in tremor rehabilitation. A study concluded that variability in tremor magnitude with limb position was not consistent with essential tremor[3]. A high intra-assessment variability in tremor amplitude has previously been demonstrated in high amplitude essential tremor[4]. Variability in amplitude and intensity are often considered to support a functional tremor. We demonstrate this positionality in five clinical cases previously diagnosed as essential tremor and hypothesize that this is not an uncommon feature of dystonic or essential tremor.

Method

Five patients aged 22 to 85 years with essential tremor were assessed using iPhone accelerometry and gyroscopic data. Three dimensional accelerometry has been previously demonstrated to significantly correlate with all tremors clinical measures except for disability[2]. A previous study by Senova et al showed that appropriately processed accelerometer data from a smartphone offered a higher discriminatory power for postural tremor in essential tremor, but also improved reproducibility[5]. The MATLAB mobile app was utilized. Informed consent was obtained from all participants in the case series. The data was obtained in two cardinal forearm and wrist positions: Combined forearm supination and wrist extension versus combined forearm mid-pronation and wrist flexion. The accelerometer data expressed in milli-Gs (mGs) and gyroscopic data in rad/s as displayed in table 1.

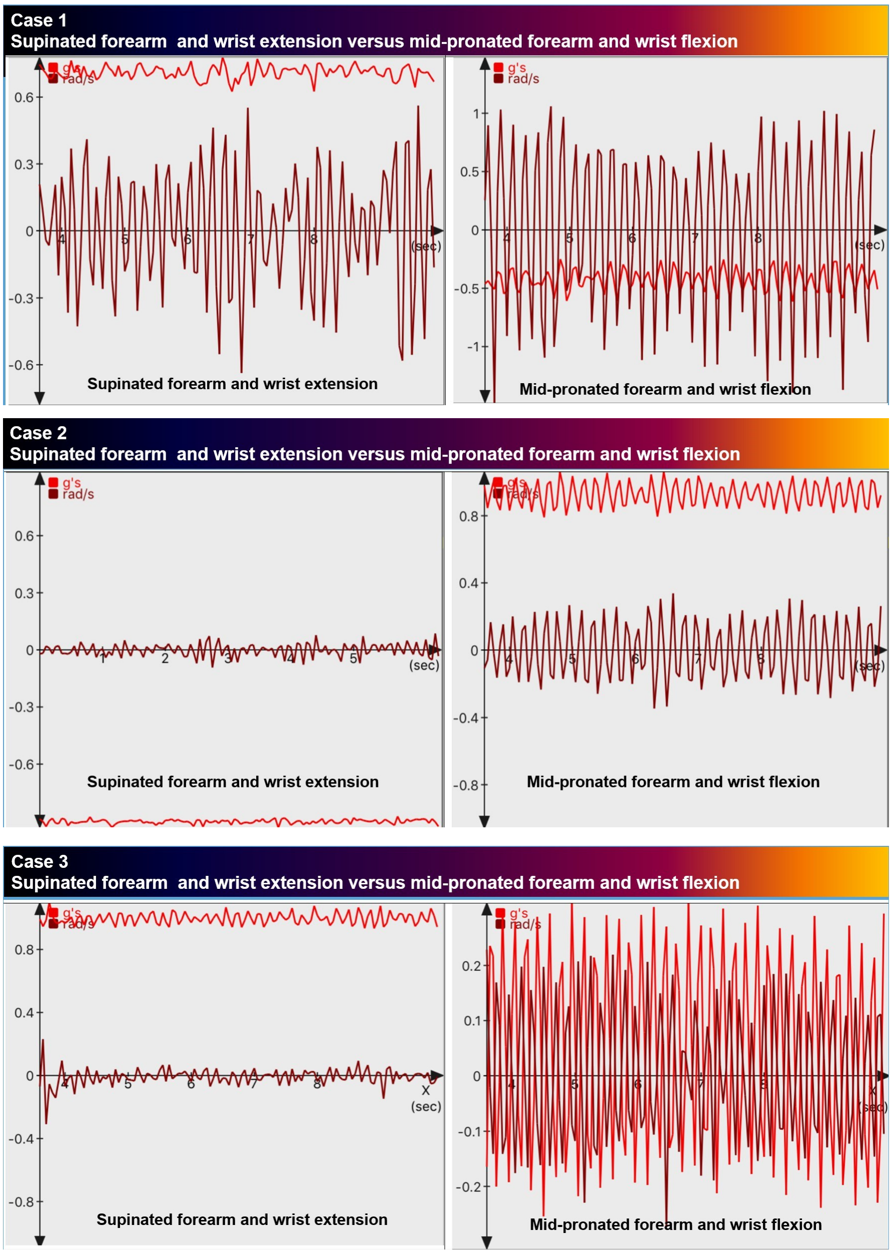
Results

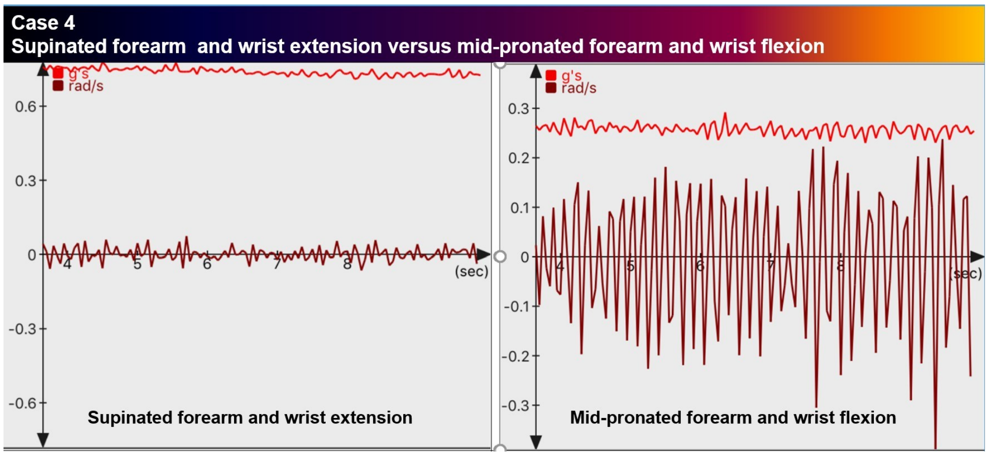
The difference between combined forearm supination and wrist extension versus combined forearm pronation and wrist flexion ranged between 10 and 290 mGs with combined forearm supination and wrist extension being significantly less tremulous in all five cases (Table 1). Figures 1 to 5 are graphic representations of the tremor amplitudes in G's and rad/s against time in seconds for each case comparing combined supinated forearm and wrist extension with combined mid-pronated forearm and wrist flexion. In all 5 cases, the extended wrist and forearm supinated position consistently shows a lower tremor amplitude compared to the flexed wrist and pronated forearm position.

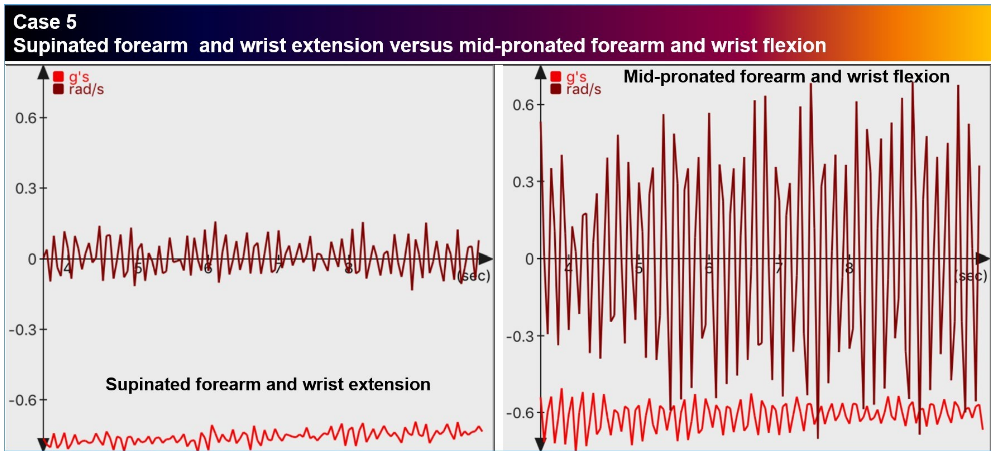
Table 1: Accelerometer measurements and change in tremor magnitude (in mGs) from extended wrist and supinated forearm to flexed wrist and pronated forearm positions in five cases.

Case	Extended-supinated [min – max]		Flexed-pronated [min – max]		Change in mG
	mGs	(Rad/s)	mGs	(Rad/s)	
Case 1	600 – 810	(-0.80 – 0.75)	-740 - -240	(-1.70 – 1.40)	290
Case 2	-930 - -870	(-0.09 – 0.11)	790 – 1060	(-0.35 – 0.34)	210
Case 3	880-960	(-0.11-0.08)	273-408	(-1.88-1.60)	60
Case 4	708 – 780	(-0.06 – 0.07)	230 – 292	(-0.39 – 0.24)	10
Case 5	-860 - -690	(-0.18 – 0.22)	-750 - -510	(-0.70 – 0.69)	70

Figures1 to 5: Graphic representations of the tremor amplitudes in G's and rad/s against time in seconds for each case.







Discussion

Although the mechanics of the wrist and forearm vary depending on the angle of rotation and therefore would impact the amplitude of the tremor, this alone does not explain the observations in this series and clinical practice, and we deduce based on the observations that specific muscle groups considered hyperactive are more responsible for the tremulousness.

This is exemplified by the reduction in tremor when motion involves activation (contraction) of these muscle groups such as wrist extension in the case of wrist extensor being hyperactive and increase in tremor with wrist flexion with movement involving the antagonistic muscles (wrist flexors). There is more evidence from the use of targeted botulinum toxin injection therapy in head tremor and to a lesser extent upper limb tremor that suggests a variable involvement of muscles groups.

This case series suggests the need for a more standardized tremor assessment that takes into consideration the positional variability of various types of tremors as this is not fully captured by current methods of assessment. Measurements in several postural arm positions with the option of 2-3 repetitions in each position. A tremor onset latency was also observed suggesting that brief periods of observation less than 30 seconds might provide an inaccurate measurement or conclusion. Tremor should therefore be observed or measured for a duration of 30 seconds or greater.

Conclusions

This case series demonstrates the variability in tremor amplitudes in specific hand and arm positions. These findings have both adaptive and rehabilitative implications for the patients including altering grip or arm positions/posture to minimize the interfering impact of the tremor. We also suggest that this be taken into consideration especially when making the diagnosis of a functional or psychogenic tremor to reduce the risk of a wrong diagnosis.

Conflict of Interest

The author declares no conflict of interest.

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