

## Effect of Exercise in Resting Tremor Using Sensor Analysis

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### ABSTRACT

*A tremor refers to involuntary, rhythmic muscle movements which involve twitching or oscillatory movements of one or more parts of the body. Resting tremor occurs during rest which is a predominant feature of Parkinsonism. The subjective assessment is by the Unified Parkinson's disease Rating Scale, a clinical standard scale for parkinsonism tremor assessment. Hence the sensor based tremor measuring device was used in the study for the prediction of tremors. **OBJECTIVE:** To detect the effectiveness of sensor analysis of resting tremor in Parkinsonism. **METHODOLOGY: STUDY TYPE:** Experimental; **STUDY DURATION:** four weeks; **STUDY SETTING:** SRM medical college and hospital. **PROCEDURE:** 12 samples are taken. The resting tremors will analyse by using sensor-based device then, exercises for upper limb tremor is given for a period of four weeks then again after exercise, tremor will be analysed using a sensor based device to interpret the differences in the tremor after the therapy. **RESULT AND CONCLUSION:** The study shows a significant correlation between pre test and post test values by using vibration sensor as outcome measure.*

**Keywords:** Assessment Tool, Exercise, Physiotherapy, Resting Tremor, Sensor Based Device.

### I INTRODUCTION

Tremor means swift back movements of the body<sup>1</sup>. In clinical practice, it occurs as common disorder which occurs in relation to motor. A tremor activity involves contraction and relaxation of the muscle. Tremor is an involuntary activity and affects the head, upper limb, trunk and lower limb but commonly present in the hands.

In a neurological syndrome, one of the common signs is tremor and it can also be a sign which may associate with disorders in the brain components which controls the muscles throughout the body. Neurological disorders can cause tremor which includes stroke, traumatic brain injury and other neurodegenerative diseases<sup>4</sup>.

Other causes of Parkinsonism may also include the use of drugs, mercury poisoning, and consumption of alcohol. Resting tremor, which occur as a solitary symptom and may also be present in various disorders which may occur in more than twenty-five percentage of patients with Parkinsonism, present along with action tremor, in association with resting tremor.

To and fro movement in Parkinsonism, the main symptom which is present about in 70% of patients. It is present in the patient's head, hand, feet with some specific frequency of about 3.5–7.5 Hz and amplitude varies in range and speed. The tremor is characterized as a "pill-rolling" action<sup>4</sup>.

Parkinson tremor occurs after 60 years. Parkinsonism tremor characterizes as different types: action, rest and postural tremor. Among these types Resting tremor is the common type. The postural tremor, occurs when a person maintains a position against gravity. Carrying out a particular task, during voluntary contraction of a muscle that refers to action tremor.

In Parkinsonism, pure rest tremor is rare<sup>13</sup>. A rest tremor is a combination of a postural tremor, and will disappear on tasks which induces action tremor.

Hence, previously the only way of treating Parkinson was using drugs. But mostly the affected persons hesitate to use drugs due to its side effects. So, there by preferring exercise is harmless and using sensor is a non invasive which works by means of reflex inhibition technique.

Sensors are used in this study which measures frequency and amplitude. It is a thin, low power, small and it has complete accelerometer with voltage outputs<sup>17</sup>. So this study was discussed with bio engineering team and been made for the analysis for the patients. Along with the outcome by giving a set of exercises to reduce tremor.

### II NEED FOR THE STUDY

Developing countries, including India are passing through a phase of epidemiological transition with increasing burden of non-communicable diseases (NCD) consequent to transformation of scenario with improvement of health care services in preventive and primitive domains. Among the NCDs, neurological disorders form a significant proportion of global burden of disease.

In this scenario, it is crucial to determine through Neuro-epidemiological approach the magnitude and pattern of tremors in India to facilitate planning and prioritising health needs at the local, regional and national levels of health care delivery system with necessary human resources, development of infrastructure, to provide accessible, affordable medical care and exercises with allocation of requisite funds to fulfil these objectives. The total number of people suffering from ET worldwide was 24.91 million in 2020.

It abundantly clear that there are lacunae in physiotherapy to assess the frequency and treatment in India. Neuro epidemiological studies have been conducted from Northern, Southern, Eastern and Western regions of the country but there are no reports for assessing the tremors with sensory device and physiotherapy treatment. From Central India and North Eastern regions. Our Focus is to use sensory device for tremors and giving therapy to these patients. Thereby helping the community by the application of exercise protocol for the patients.

There is no portable device to measure tremors so far in the studies. Hence for detection as well as for treatment analysis it is essential as an assessment tool.

### III AIM OF THE STUDY

To find the effectiveness of exercise in resting tremor using sensor analysis.

### IV OBJECTIVES OF THE STUDY

- (a) To analyse the frequency and amplitude of the tremors using sensor analysis
- (b) For the application of exercise protocol for the patients.
- (c) To find the effectiveness of exercise in tremors.
- (d) To Reduced direct and indirect cost of care on Rehabilitation.

### V MATERIALS AND METHOD

- (a) **Preparation And Organization of The Data:** Subjects who had suffered from Parkinson and screened for resting tremors who met the inclusion-exclusion criteria were participated in the study during specified schedule. Twelve subjects had recruited using a simple random sampling technique from SRM medical college and hospital, Chennai. The design of research study is an "Experimental Research Design". The duration of study was 6 months overall, for four weeks of intervention, Block

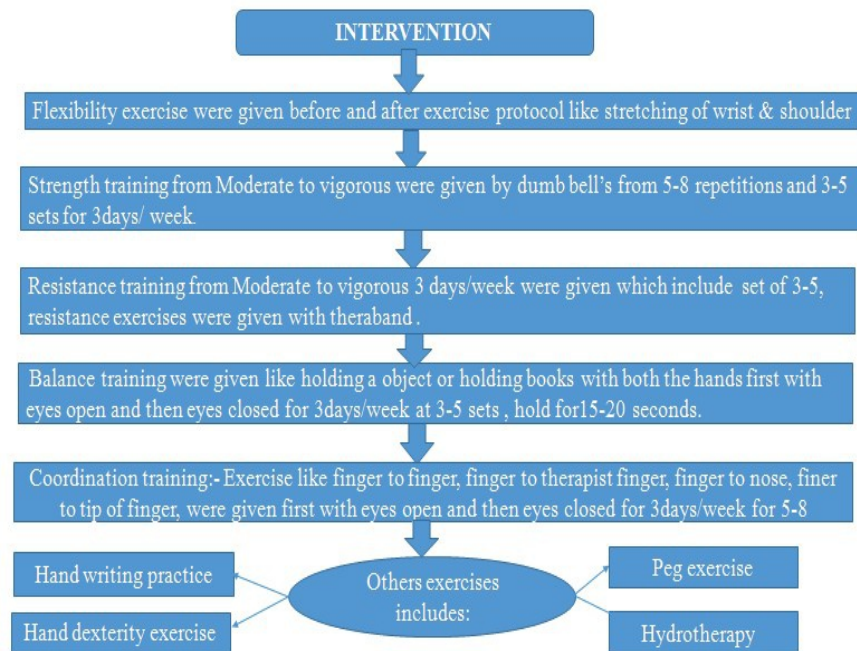
randomization was used for sampling method.

- **Study design:** Experimental
- **Study duration:** four weeks
- **Sampling method:** Block randomization
- **Study setting:** SRM medical college and hospital, Chennai.
- **Materials Used:** Informed Consent and Data collection sheet
- **Equipments / Instruments:** Portable Sensory Device for tremor.
- **Inclusion criteria**
- Parkinson patient with resting tremors
- **Exclusion criteria**
- Parkinson without resting tremors
- Parkinson along with any other debilitating conditions
- **Outcome Measure:** The unified Parkinson's disease rating scale (UPDRS)

#### (b) Procedure

A portable Parkinsonism tremor assessment was used. The subjects were taken according to the inclusion criteria and willing for the study. According to the unified Parkinson's disease rating scale. Initially they were assessed using Tremor rating assessment scale<sup>2</sup>. This study was discussed with the bio engineering team and was approved by scientific committee and the team of people were analyzed and discussed about the analysis and the outcome of the study.

Then the patient was assessed using sensor by placing the sensor over distal extremity with the help of a strap and the values were calibrated which was connected to a monitor. Since it is a non invasive and controlled by own it does not harm the patient. Then a series of hand exercises were prescribed for over four weeks. The exercises which include for hand tremor are hand range of motion exercises, peg board exercises, mirror therapy, hand dexterity exercises, hand resistance exercises and coordination exercises.

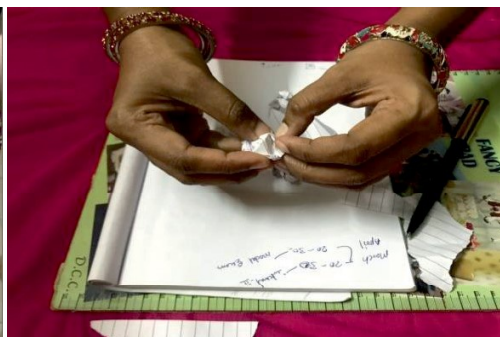


**Fig. 1 Hand exercise protocol for tremor**

After a period of four weeks again the patients resting tremors were analyzed using the sensor as an outcome measure.



**Fig. 2 and 3 Hand stretching and resistance training exercise**



**Fig. 4 and 5: Hand coordination and dexterity exercise**

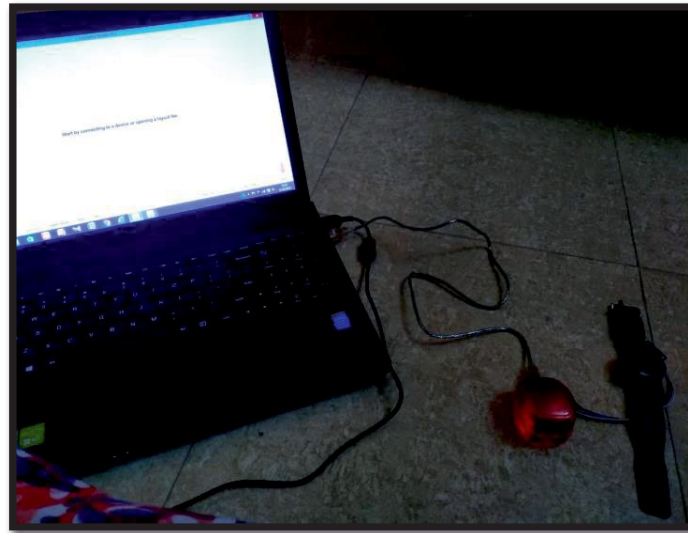


Fig. 6 Sensor Device

## VI REVIEW OF LITERATURE

- **Peige Song et al (2021)** conducted a meta-analysis on the global prevalence of essential tremor, with emphasis on age and sex.
- **Sajjad Farashi, Leila Kiani et al. (2021)** this study concluded that exercises as inexpensive, non-invasive and easy-to-implement strategies could be applied for PD patients alongside medical interventions for reducing tremors.
- **Alexandra Karamesinis et al. (2021)** The study concluded that novel interventions for essential tremor are described, with a detailed review of open and closed-loop peripheral electrical stimulation methods.
- **Alejandro Pascual-Valdunciel et al. (2021)** The study concluded that peripheral electrical stimulation as an intervention for tremor reduction, identify the limitations and benefits of the current state-of-the-art studies, and provide ideas to guide the development of novel approaches based on the neural circuitries and mechanical properties implied in tremor generation.
- **Onanong Jitkriksadakul et al. (2017)** The study concluded that Tremor's glove is light-weight with a good safety profile, making it a future potential therapeutic option for PD patients with medically refractory tremor.
- **Hyoseon Jeon et al (2017)** the study concluded that the machine-learning algorithms utilized in this study present the most accurate and reliable findings out of all of the related studies referenced based on our results and are the most logical candidates for use in a clinical or home context.
- **Xiaochen Zheng et al. (2017)** This study demonstrates the feasibility of prolonged and continuous monitoring of tremor severity during daily activities by a highly portable non-restrictive system, a useful tool to analyze efficacy and effectiveness of treatment
- **Rodger J. Elble et al (2016)** The study concluded that Accelerometers, gyroscopes, and digitizing tablets are used most commonly, but few are sold for the purpose of measuring tremor. Tremor amplitude and occurrence correlate strongly with clinical ratings of tremor severity.
- **Rodger J Elble (2016)** The study concluded that Gyroscopic transducers are superior to accelerometry for assessment of head tremor.
- **Dietrich Haubenberger (2016)** the study concluded that the use of transducer-based measures requires careful attention to their limitations and validity in a particular clinical or research setting.
- **Houde Dai, Haijun Lin et al (2015)** This study concluded that it is helpful to those who want to use consumer-grade inertial sensors for quantitative assessment of motor symptoms during treatment.
- **M Gourie-Devi et al (2014)** The study concluded that the Essential tremors (ET) were the commonest among all movement disorders with overall prevalence rates varying over a wide range of 8-395/100000 in India.
- **Louis E.D. Et al. (2014)** the study concluded that there is accumulating evidence that the entity referred to as 'essential tremor' (ET) is not a single disease. It may be a family of diseases

better referred to as 'the ETs'.

- **Daryl J Wile, Ranjit Ranawaya et al (2014)** this study concluded that A smart watch device can provide accurate and diagnostically relevant information about postural tremor. Its portability and ease of use could help translate such techniques into routine clinic use or to the community
- **Walter Maetzler MD, Josefa Domingos et al. (2013)** this study review discusses promising wearable technology, addresses which parameters should be prioritized in such assessment strategies, and reports about studies that have already investigated daily life issues in PD using this new technology
- **Rory J O'Connoret. Et al (2011)** the study concluded that neuromuscular physiotherapy, strength training and functional electrical stimulation show promise in their applicability and adaptability. Tremor-suppressing orthoses based on viscous materials, weighted splints and vibration therapies need further evaluation especially in the domiciliary setting and applied to improving personal activities of daily living.
- **Benoit Carignan et al. (2010)** The study concluded that the removal of the oscillations within 1-3.5 Hz band from the PT signal reduced the amplitude of the original PT signal by 56% in displacement.
- **Christian Duval et al (2005)** the study concluded that the velocity of tremor oscillation is more suitable for detection of the impact of

finger loading because it enables detection of amplitude changes in both the low and high-frequency components of PT.

- **K E Norman et al. (1999)** the study concluded that the EMG measurements showed good correspondence in some trials but poorer correspondence in others, attributed to the low level of muscle activity required in the task.

- (a) **Statistical Analysis:** The values of resting tremors were analyzed using vibration sensor. The data obtained was tabulated and statistically analyzed using the SPSS 17. The mean and standard deviations of all variables were analyzed paired "t" test was used. The demographical data were analyzed using descriptive statistics such as percentage, frequency, mean, and standard deviation. The raw data entered into the computer database. The responses of frequencies were calculated and analyzed by using the raw data of 12 subjects. Data management and storage: Data will be stored for 5 years in a password-protected file after completion of the study/after publication on the researcher's personal computer.
- (b) **Ethics approval of research:** The study was approved by scientific committee of SRM Institute of science and technology. Permission was obtained from the member secretary for research on human subjects. Confidentiality was maintained by using obtained data only for study purposes. Informed consent was taken from the subjects before the study.

### VII RESULTS

This chapter deals with the analysis and interpretation of findings from the 12 subjects with Parkinsonism from SRM Institute of science and technology, Chennai. Data collection was done by using the unified Parkinson's

disease rating scale (UPDRS). The values of resting tremors were analyzed using vibration sensor. The data obtained was tabulated and statistically analyzed using the SPSS 17. The mean and standard deviations of all variables were analyzed paired "t" test was used. The results were displayed in tables and figures as follows.

**Table 1 Statistics**

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 pre test	1.9725	12	.08519	.02459
post test	1.4775	12	.32847	.09482

Table 1 show the Comparison of pre test and post test analysis mean values shows that there is statistically

significant decrease in mean value of pre test from 1.97 to post 1.47.

**Table 2**  
**Paired Samples Test**

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pre-test - post test	.49500	.29737	.08584	.30606	.68394	5.766	11	.000

Table 2 shows the there is a significant correlation between pre and post values.

**VIII DISCUSSION**

According to the study, Parkinsonism is a neurological disorder with disabling pathology which has affected globally about more than millions of people. Hence, this disease has much influence in quality of life of patients that leads to increasing the level of care and expenses for health of the society. This study focuses on the use of wearable devices that is for early diagnosis, tremor, motor fluctuations, motion analysis of the body and long-term monitoring to analyse. This study also gives recommendations for future improvements.

Recent advances in approximating motor deficits in Parkinson sing an objective wearable technology, using agyroscope and accelerometer. It is into the clinical trials.

Some technologies or devices wereshown as helpful to differentiate between healthy subjects and Parkinsonism patients and their validity in the differential diagnosis in movement disorders and the predictive values in the premotor stage.

However, wearable accelerometer and gyroscope used sensors that access the quantification for both patient care and clinical trials to measure the movements that help to

gain and allow continuous monitoring of longterm motor alterations or disturbances.

The sensor used in the study is able to analyze the frequency and amplitude on resting tremor. It further required to use this kind of sensor along with postural and action tremor, which coordinate in doing activities. Hence, the exercise regimen for the patient to improvise more on the basis of outcome and the functional activities of patient as well.

Hence in our study we especially concentrated on resting tremors and gave the interventions which show significant on comparing pre and post values by using vibration detection sensor as an outcome measure and our sincere thanks to biomedical department and scientific team for the development of the device.

**IX CONCLUSION**

Hence in this study we especially concentrated on resting tremors and given the interventions which shows significant on comparing pre and post values by using vibration detection sensor as a outcome measure.

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