Integrated Parkinson's Disease Service Part I: Alternation of postural sensory conflict in dynamic balance control among patients with idiopathic Parkinson's Disease

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Introduction
Idiopathic Parkinson's Disease (iPD) is known to affect postural control, especially in situation needing a change in balance strategy or when a concurrent task is simultaneously performed. In clinical practice, evaluation of postural control is based on the neurological examination, including Romberg's test, examination of gait and performance of pull test as part of the Unified Parkinson's Disease Rating Scale (UPDRS). Few studies were assessing quantities of postural control parameter in clinical routine use in faller and non-fallers of iPD patients.

Objectives
1) To determine the posturographic parameters among the fallers and non-fallers of iPD by means of computerized dynamic posturography using Sensory Organization Test (SOT); 2) To identify the determine factors that contribute to postural instability that help in prediction of fall risks. These will contribute to balance & mobility training and fall prevention of PD rehabilitation in clinical practice.

Methodology
Prospective study of 33 iPD patients in Integrated Parkinson's Disease Service (IPDS) was conducted. The dynamic postural control of 17 fallers and 16 non-fallers was studied by SOT during their 'on' medication period, using Neurocom Smart Balance Master (Clackamas, Oregan USA). This computerized dynamic posturography system allows independent evaluation of the contributions of vestibular, visual and
proprioceptive inputs to the maintenance of dynamic balance 1.

**Result**

Faller group performed significantly worse than Non-faller group under SOT conditions 5 & 6. The average balance score was poorer in the Fallers group (p< 0.01). The somatosensory input and the vestibular input were predominantly impaired and contributed to fall in iPD patients. The PD progression stage, motor control, number of non-motor symptoms and health condition were deteriorated more in faller group (p<0.05). The impaired postural instability measured by average balance score in SOT was significantly correlated to reduced motor control (UPDRS motor), number of non-motor symptoms, disease progression stage (H&Y stages), number of chronic disease that patients need medication intervention, vestibular and visual input (p< 0.01, motor score UPDRS r=-0.526, non-motor symptoms r=-0.434, disease progression stage r= -0.554 & number of chronic disease r=-0.418, vestibular input r= 0.776, visual input r=0.619). Conclusion: Balance impairment is seriously affected in iPD patients at various disease progression stages. Somatosensory and vestibular input dysfunction properly plays a role in their instability and contributing to falls. As iPD is a central nervous system disorder, such deficiency suggests a dysfunction in central processing rather than a peripheral lesion. The postural stability control is related to numerous factors in fallers, like somatosensory, vestibular input, disease progression stage, motor score in UPDRS and non-motor symptoms. Therefore a battery of tests including SOT is highly recommended to assess the fall risk objectively quantified in routine clinical situation. They are reliable parameters for monitoring balance progression in clinical fall management.