Applications of Low-Cost Wearable Medical Device in Measuring Gait Parameters of Stroke Patient in a LMIC – A Case Study

Padma Naveena Ganapam[1], Mythreyi Kondapi[1], Suresh Susurla VS[1], Jesswinth Raja J[1,*]
[1]Startoon Labs Pvt. Ltd, Hyderabad, India - 500003.

Background: A person's impaired gait/walking pattern is a critical indicator of musculoskeletal/neurological disorders. Quantitative gait analysis is essential for understanding gait characteristics and helps in taking informed clinical decisions [1]. Unfortunately, Gait assessment tools largely remain confined to research settings due to exorbitant costs, complexity, and the necessity for specialized training. Wearable devices now serve as effective alternatives to traditional gait analysis tools, addressing previous limitations. Pheezee® – a novel USFDA and CDSCO registered wearable device comes handy and stands out as a cost-effective solution for Gait assessment as it accurately measures joint kinematics and muscle function using surface electromyography (sEMG) simultaneously.

Method: Pheezee® features a single-channel sEMG to measure muscle activity, alongside integrated motion sensors to measure joint kinematics with an accuracy of 97% [2,3]. It's small formfactor and ease of use enables measuring range of motion (ROM) and sEMG during activities of daily living. Pheezee® also has the potential to assess Joint Health [ROM and sEMG] during functional activities like walking, thereby finding use in a real-life setting. To measure walking parameters, Pheezee® device is placed on the subject as shown in Figure 1A. The subject then walks for ten meters with the device on each knee, one at a time. This process yields six key walking parameters, namely Cadence, Step length, Stride length, Percentage of Stance phase, Total number of steps, and Total time. Additionally, the device measures knee flexion and extension during walking while also recording the sEMG of the quadriceps and hamstring muscles to evaluate phase-specific muscle activation patterns during Gait. The measured parameters are easily accessible to the patient and the clinician in the form of a clinical report as shown in Figure 1B.

Applications: Quantitative data obtained with Pheezee® powered Gait Software, helps the clinician in objective goal-setting and making personalized adjustments in treatment protocols during physical rehabilitation. Other common applications are: Early intervention in musculoskeletal ailments like Osteoarthritis etc., tracking patient's recovery in neurological cases like Stroke/SCI, developing tailored postoperative treatment protocols and assessing fall risk in the elderly, but not limited to the same.

Case study: A 53-year-old male subject, with a history of Stroke presented with bilateral Knee pain underwent Gait assessment with Pheezee®. The findings revealed that the Step length and Stride length were reduced by 42 % compared to the normative values [Figure 1B] coupled with an 18% increase in the Stance phase. While Knee extension was normal during the ROM testing, a notable reduction in extension [2° on left and 3° on right] became apparent while walking.

Conclusion: Based on the testing insights, customized recommendation incorporating Knee extension exercises at the end range and targeted quadriceps strengthening were suggested. This case highlights the importance of assessing functional activities to accurately evaluate joint and muscle health which help a clinician in tailor making treatment protocols during rehabilitation.

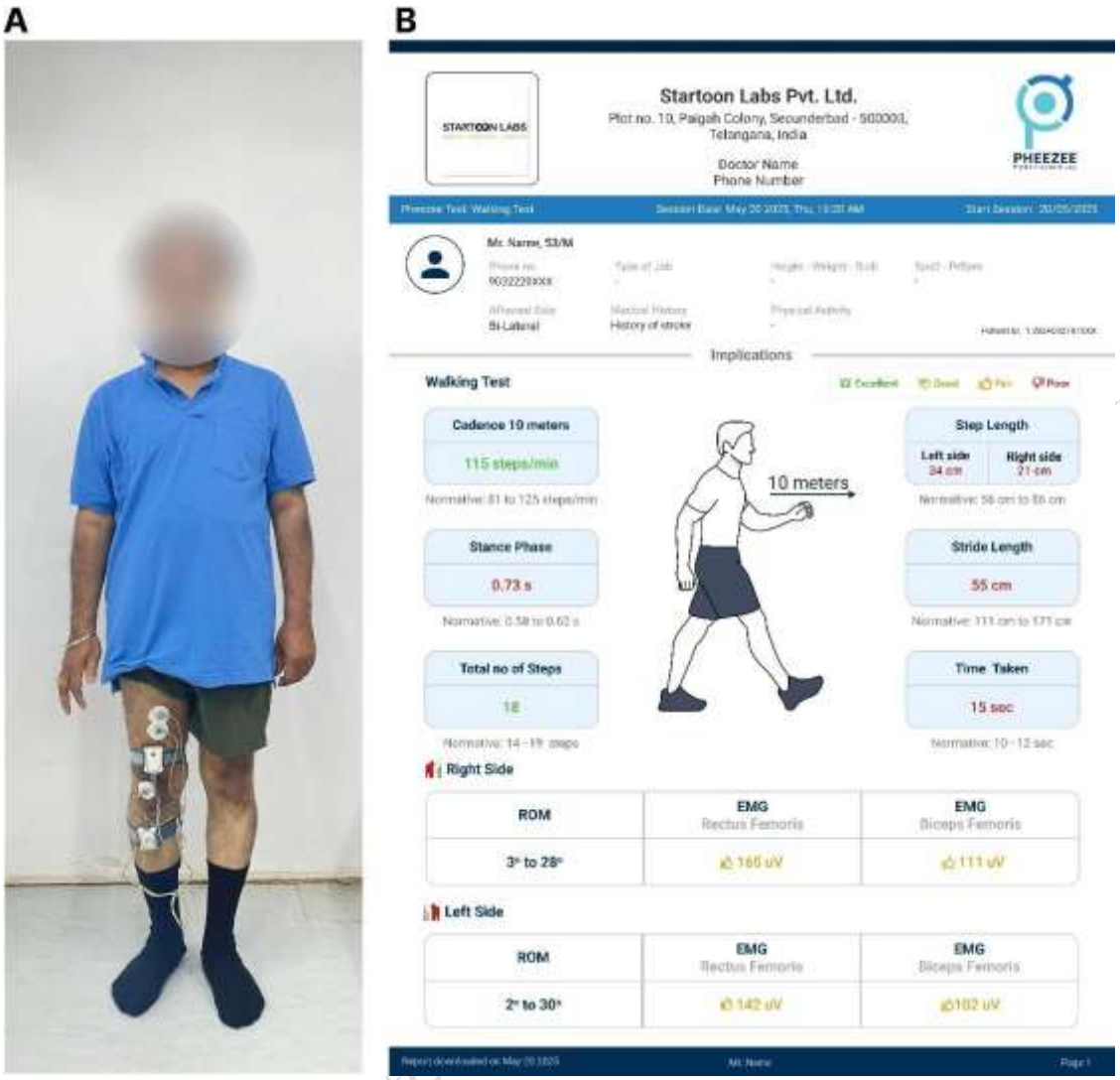

Figure 1: A – Pheezee device used to measure walking parameters on a subject. B – Walking report format including six walking parameters, bilateral ROM of the knee, sEMG of Biceps femoris and Rectus femoris muscles.

Keywords: Step length, Cadence, Stride length, Quantitative gait analysis, Stroke

References *(max. three)*

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* Presenting author: research@startoonlabs.com