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# Role of OHM 6000 Plantar Pressure System for Measurement in Neurological disorders affected pateints for Diagnostic Cum Planning Management

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## ABSTRACT

The **sensor plate** is a critical component designed to accurately measure foot pressure distribution in neurological patients. It contains a high-resolution grid of pressure sensors that capture real-time data on gait and weight distribution. This information aids in foot diagnostics and rehabilitation planning by identifying abnormalities in foot mechanics, helping clinicians develop targeted treatment strategies. The sensor plate's reliability ensures consistent, repeatable measurements essential for monitoring patient progress and therapy outcomes. A comparative experimental design was employed, involving 50 participants divided into two groups: a **trial group** (n=25) where sensor plates were utilized for assessment and rehabilitation, and a **control group** (n=25) where traditional rehabilitation methods were used without sensor plates. Participants were assessed pre- and post-intervention over 12 weeks, and the data were analyzed using paired and independent t-tests. Results revealed a statistically significant improvement in FFI scores in the trial group compared to the control group ($p < 0.05$), demonstrating the efficacy of sensor plates in enhancing mobility and functional outcomes. This study highlights the importance of integrating advanced technologies like sensor plates into rehabilitation programs to improve patient outcomes. The findings support the adoption of sensor plates in clinical practice, offering a more precise and effective approach to **neurological rehabilitation**. Further research with larger sample sizes and diverse populations is recommended to validate these findings and expand the applicability of sensor-based technologies.

***Keywords:*** *Sensor plate, Foot Function Index, neurological rehabilitation, trial group, control group, clinical practice, mobility, advanced technology.*

## 1. INTRODUCTION

The foot serves as the primary point of contact with the ground and plays a critical role in guiding movement and maintaining postural control. In individuals with neurological disorders, foot dysfunction is commonly observed due to impairments in sensorimotor integration, which compromise the ability to perform movements against gravity. Comprehensive analysis of plantar pressure function is therefore essential, offering valuable insights that inform goal-setting and facilitate the development of individualized rehabilitation strategies tailored to each patient's specific needs.

Neurological rehabilitation plays a pivotal role in improving the quality of life for individuals affected by neurological disorders, including conditions such as Parkinson's disease, stroke, cerebral palsy, and other movement disorders. These conditions often result in impairments that affect motor function, balance, and mobility, making rehabilitation an essential

component of recovery and functional improvement (Molteni et al., 2022). Among the many facets of neurological rehabilitation, gait and balance stand out as two critical elements that are vital for restoring independence in daily activities and enhancing patient safety.

Gait, which refers to the pattern of walking or locomotion, is often disrupted in patients with neurological impairments due to muscle weakness, coordination issues, or postural instability. These deficits not only limit physical mobility but also contribute to secondary complications such as falls, reduced cardiovascular health, and social isolation (Scott et al., 2023). Effective rehabilitation strategies, therefore, aim to address these gait disturbances through targeted interventions that enhance neuromuscular coordination and strength. Balance, on the other hand, is integral to maintaining stability during static and dynamic activities. Impaired balance increases the risk of falls, which is a leading cause of injury among individuals with neurological disorders (Rucco et al., 2018). Consequently, the rehabilitation process focuses on improving postural control, equilibrium, and the patient's ability to react to changes in their environment.

The integration of advanced technologies, such as sensor plates and wearable devices, has revolutionized the field of neurological rehabilitation. These tools provide precise, real-time feedback on gait and balance, allowing clinicians to tailor interventions to the specific needs of the patient (Deng et al., 2018). Sensor plates, in particular, enable detailed analysis of weight distribution, stride length, and pressure points during walking, offering insights that were previously unattainable through conventional methods (Ancillao, 2018). This level of precision allows for a more objective evaluation of patient progress and the effectiveness of rehabilitation protocols.

Furthermore, rehabilitation programs that focus on gait and balance not only restore physical function but also address the psychological and social aspects of recovery. Regaining the ability to walk independently fosters a sense of confidence and autonomy, significantly improving the patient's overall quality of life (Sharma et al., 2023). For instance, studies have shown that gait-specific interventions, when combined with balance training, can lead to measurable improvements in mobility and a reduction in fall risks among patients with Parkinson's disease and stroke (Fan et al., 2023). These findings underscore the importance of integrating comprehensive gait and balance training into rehabilitation programs.

In summary, neurological rehabilitation targeting gait and balance is fundamental for achieving functional recovery and enhancing patient independence. The incorporation of sensor-based technologies provides clinicians with powerful tools to assess and optimize these critical aspects of mobility. By focusing on restoring gait patterns and improving balance, rehabilitation programs not only mitigate the physical limitations imposed by neurological disorders but also empower patients to lead more active and fulfilling lives. This dual benefit underscores the critical role of gait and balance in the broader framework of neurological rehabilitation.

The advancement of technology in the field of rehabilitation medicine has introduced transformative tools that are redefining traditional therapeutic approaches. Among these innovations, sensor plates have emerged as a pivotal device in advanced rehabilitation, offering unprecedented precision in assessing and improving mobility-related functions, particularly in patients with neurological disorders. Sensor plates are sophisticated platforms equipped with high-resolution sensors that measure and analyze parameters such as pressure distribution, weight shift, stride dynamics, and postural balance in real time (Ancillao, 2018). Their integration into rehabilitation protocols marks a significant leap forward in delivering patient-specific interventions that are both objective and data-driven.

Traditional rehabilitation methods, while effective to a degree, often rely on observational assessments by therapists, which can be subjective and prone to inconsistencies. Sensor plates eliminate this limitation by providing quantifiable and reproducible data that enable clinicians to make accurate evaluations of a patient's functional deficits (Sharma et al., 2023). For instance, in patients recovering from stroke or living with Parkinson's disease, gait disturbances and balance impairments are common challenges. Sensor plates allow for detailed analysis of these issues by mapping how the patient's weight is distributed across their feet during static and dynamic activities, as well as identifying asymmetries in gait patterns (Rucco et al., 2018). Such precise measurements help therapists pinpoint the root causes of mobility issues, whether they stem from muscular weaknesses, coordination deficits, or postural instabilities.

One of the most compelling advantages of sensor plates is their role in providing real-time feedback. This feature is critical in rehabilitation, as it allows patients to visualize their own progress and actively participate in correcting their movements. Studies have shown that when patients receive immediate feedback about their posture, balance, or gait, they can make adjustments that lead to faster and more effective rehabilitation outcomes (Molteni et al., 2022). Moreover, the continuous monitoring capability of sensor plates facilitates longitudinal assessments, enabling clinicians to track improvements over time and refine treatment plans accordingly. This dynamic approach ensures that therapy remains adaptive to the patient's evolving needs, maximizing the potential for recovery.

In addition to their diagnostic and therapeutic benefits, sensor plates contribute to the field of rehabilitation research by generating large datasets that can be analyzed to uncover trends and develop evidence-based practices. For example, in clinical trials, sensor plates have been used to objectively compare the efficacy of different rehabilitation interventions, shedding light on the most effective strategies for specific conditions (Scott et al., 2023). Their utility extends beyond

neurology, finding applications in sports medicine, orthopedics, and geriatrics, where precise analysis of movement is equally critical.

Furthermore, sensor plates are instrumental in reducing the risk of falls, which is a major concern in patients with neurological impairments. By identifying subtle balance deficits that might go unnoticed during traditional assessments, sensor plates enable early intervention strategies to mitigate fall risks (Deng et al., 2018). This proactive approach not only enhances patient safety but also reduces healthcare costs associated with fall-related injuries.

In summary, sensor plates represent a cornerstone of advanced rehabilitation by bridging the gap between subjective observation and objective analysis. Their ability to provide real-time, quantifiable data empowers clinicians to deliver personalized and effective treatment plans while engaging patients in their recovery journey. As the demand for precision medicine continues to grow, the role of sensor plates in rehabilitation will undoubtedly expand, offering new possibilities for optimizing mobility, enhancing functional independence, and improving the overall quality of life for patients.

## 2. METHOD

### Study Design

This study employs a comparative experimental design conducted over a period of 12 weeks to evaluate the efficacy of sensor plate-assisted rehabilitation in improving Foot Function Index (FFI) scores among neurological patients. The participants are divided into two groups: a trial group undergoing rehabilitation with the assistance of sensor plate technology, and a control group receiving traditional rehabilitation methods without the use of sensor plates. The study design allows for a detailed comparison of pre- and post-intervention outcomes between the groups, providing insights into the specific contributions of sensor plates to mobility and balance improvements. Weekly assessments are conducted for both groups to track progress, ensure consistency in interventions, and collect data for statistical analysis. This approach is aimed at establishing clear evidence of the benefits of sensor plate-assisted therapy, offering a robust framework for understanding its potential advantages over conventional rehabilitation practices. By structuring the study in a controlled yet dynamic environment, this design ensures the reliability and validity of the findings, paving the way for further advancements in neurological rehabilitation.

### Sample Size

The study includes a sample size of 50 participants, with an equal distribution of 25 individuals in the trial group and 25 in the control group. This balanced division ensures a robust comparative analysis between the two groups, minimizing bias and allowing for reliable statistical evaluation of the outcomes. Participants in the trial group undergo rehabilitation assisted by sensor plate technology, while those in the control group receive standard rehabilitation methods without sensor plates. The sample size was determined to provide sufficient power to detect significant differences in Foot Function Index (FFI) improvements between the two groups over the 12-week intervention period. This distribution also ensures that the findings are generalizable within the constraints of the study population, offering meaningful insights into the effectiveness of sensor plates in neurological rehabilitation. By maintaining equal group sizes, the study design achieves a fair and systematic evaluation of the two rehabilitation approaches.

### Instruments

The study utilizes a combination of advanced and standard rehabilitation tools tailored to the needs of each group to ensure accurate data collection and effective intervention.

**Sensor Plates:**

The trial group leverages sensor plates as the primary tool for data collection and analysis. These sophisticated devices are equipped with high-resolution sensors capable of measuring critical gait and balance parameters such as weight distribution, stride length, postural stability, and ground reaction forces. Sensor plates provide precise, real-time feedback to clinicians and participants, enabling dynamic adjustments to therapy sessions. Their data-driven insights facilitate the identification of subtle impairments and progress monitoring, making them a cornerstone of the trial group's rehabilitation approach.

**Standard Rehabilitation Tools:**

The control group employs traditional rehabilitation tools such as balance boards, resistance bands, and guided physiotherapy exercises. These tools are used to address general mobility and balance issues without the technological precision offered by sensor plates. The standard tools are implemented following conventional rehabilitation protocols, focusing on improving strength, coordination, and functional independence. While effective to a degree, these methods lack the objective metrics and real-time feedback provided by sensor plates, serving as a baseline for comparison with the trial group.

By incorporating these instruments, the study ensures a systematic approach to evaluating the comparative effectiveness of sensor plate technology versus traditional rehabilitation practices in enhancing functional outcomes for neurological patients.

**Procedure**

- **Trial Group Methodology**

The trial group in this study undergoes sensor plate-assisted rehabilitation. The methodology includes both pre- and post-assessments using sensor plates and a structured exercise intervention process designed to improve Foot Function Index (FFI) scores. Here's a detailed breakdown:

- **Pre- and Post-Assessments Using Sensor Plates**

**Objective:**

- To evaluate parameters such as weight distribution, balance, gait pattern, and postural stability.

**Process:**

- Patients stand barefoot on the sensor plate during the assessment.
- Real-time data on weight distribution and gait dynamics are recorded.
- Metrics include pressure points, force application, and stride length.

**Outcome:**

Data collected during pre-assessments establish baseline functionality, while post-assessments measure improvements after the intervention.

## 3. EXERCISE INTERVENTION PROCESS

**Structure:**

Exercises are tailored based on sensor plate data, addressing specific gait or balance issues.

Each session lasts approximately 45 minutes, conducted three times a week for 12 weeks.

**Components:**

Balance Training: Using balance boards and stability exercises to improve postural control.

Weight-Bearing Exercises: Guided movements focusing on even weight distribution.

Gait Training: Functional walking drills with real-time feedback from the sensor plate.

Strengthening Exercises: Resistance-based activities targeting lower limb muscles.

**Feedback Mechanism:**

Real-time visual feedback from sensor plates helps patients make immediate corrections during exercises.

Progress is tracked weekly, and adjustments are made to maximize improvement.

## 4. CONTROL GROUP METHODOLOGY

The control group underwent traditional rehabilitation exercises without the use of sensor plates. This approach served as a baseline to evaluate the efficacy of sensor plate-assisted rehabilitation in the trial group. The methodology for the control group involved pre- and post-intervention assessments using standard tools, and the exercise regimen was tailored to improve general mobility, strength, and balance.

## 5. STANDARD REHABILITATION EXERCISES

**Balance Training:**

Exercises using balance boards and stability balls to improve posture and coordination.

**Strengthening Exercises:**

Resistance band exercises targeting lower limb muscle groups.

**Gait Training:**

Guided walking exercises on level surfaces to improve stride length and weight distribution.

**Functional Activities:**

Activities such as sit-to-stand exercises and step-ups to promote functional independence.

Assessment Without Sensor Plates

FFI (Foot Function Index) was measured using subjective observation and standard scales pre- and post-intervention.

Changes in mobility and balance were recorded manually by the clinician.

**Comparative Results**:

| Group | Average Pre FFI (%) | Average Post FFI (%) | Average Improvement (%) |
|---|---|---|---|
| **Trial** | 52.04 | 29.32 | 22.72 |
| **Control** | 56.19 | 42.00 | 14.19 |

The average improvement scores indicate the percentage change in FFI scores from pre- to post-intervention. The Trial group showed an average improvement of 22.72%, while the Control group showed an average improvement of 14.19%.

## 6. DISCUSSION

Sensor plates have revolutionized neurological rehabilitation by providing precise, real-time data on foot pressure distribution and balance, enabling personalized and effective treatment plans. Unlike traditional methods that rely on subjective assessments, these plates detect subtle gait and balance changes, allowing clinicians to adjust exercises dynamically for targeted neuromuscular retraining. They also enhance patient motivation through immediate visual feedback, leading to better adherence and significant improvements in functional outcomes, such as Foot Function Index scores. By identifying asymmetries early, sensor plates help prevent further complications, and their ability to simulate real-life walking patterns supports safer and more confident mobility, particularly in neurological patients Deng et al. (2018), Ancillao (2018), Sharma et al. (2023).

This study underscores the transformative potential of sensor plates in enhancing neurological rehabilitation, particularly in improving Foot Function Index (FFI) scores. The findings clearly demonstrate that patients in the trial group, who underwent sensor plate-assisted therapy, exhibited significantly greater improvements in FFI scores compared to those in the control group receiving traditional rehabilitation. The ability of sensor plates to provide precise, real-time feedback on gait and balance allowed clinicians to tailor interventions effectively, addressing individual deficits with targeted exercises. These personalized approaches resulted in more efficient neuromuscular retraining, fostering quicker and more sustained improvements in mobility and functional independence.

The integration of sensor plates into rehabilitation practices represents a paradigm shift from subjective, observation-based methods to objective, data-driven strategies. As highlighted by Sharma et al. (2023), technologies that offer real-time analysis not only improve diagnostic accuracy but also enhance patient engagement by visually demonstrating progress. This study aligns with such findings, showcasing how sensor plates motivate patients by providing tangible evidence of their recovery journey. Moreover, the advanced metrics captured by these devices—such as weight distribution, stride length, and postural stability—enable clinicians to detect and address subtle dysfunctions that might otherwise go unnoticed in conventional assessments.

Given these significant outcomes, incorporating sensor plate technology into routine rehabilitation practices is strongly recommended. Sensor plates not only improve clinical outcomes but also streamline the therapy process by reducing guesswork and ensuring that interventions are both precise and effective. Additionally, as Milani (2022) emphasizes, technologies that integrate seamlessly into therapeutic workflows enhance both clinician efficiency and patient satisfaction. By adopting sensor plates, rehabilitation centers can elevate the standard of care, ensuring that patients benefit from cutting-edge methodologies that are grounded in evidence-based practices.

In conclusion, sensor plates offer a game-changing solution in neurological rehabilitation, significantly improving functional outcomes as measured by FFI scores. Their ability to combine precision, engagement, and efficiency makes them an invaluable addition to modern clinical practices. It is imperative for healthcare providers to embrace these advancements, bridging the gap between innovative research and practical application, to ensure that patients receive the highest quality of care.

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