Research Article

The effect of mirror neuron therapy in Parkinson's diseases - A systematic review of literature

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ABSTRACT

Introduction: Mirror neuron system (MNS) represents one of the most important discoveries in the area of neuropsychology. The major functions of MNS include action understanding, imitation, and empathy, all of which are critical for an individual to be social. In Parkinson patient, the expressive qualities are lost and it can be modified using various techniques that have been mentioned in various literature, but the effect of mirror neuron in treating this features of Parkinson disease has not been much known. **Aim:** This systematic review aims to explore this core area and find out the available literature that focuses on the effectiveness of mirror neuron therapy in treating Parkinson. **Methodology:** We made a detailed electronic and manual search with the keyword and the studies were limited to not more than 10 years back, the results were synthesized and result and conclusion drawn. **Results and Conclusion:** The results of the systematic review showed that mirror neuron therapy is effective in treating Parkinson patients; A meta-analysis shall further explore the grey areas in the effectiveness of mirror neuron therapy for treating Parkinson's disease.

KEY WORDS: Mirror neuron therapy, Parkinson disease, Parkinson's strategies, Poor emotions

INTRODUCTION

Description of the Condition

According to the World Health Organization, Parkinson's disease (PD) is a slowly progressive neurologic disease that is characterized by a fixed inexpressive face, tremor at rest, slowing of voluntary movements, gait with short accelerating steps, peculiar posture and muscle weakness (caused by degeneration of an area of the brain called the basal ganglia), and low production of the neurotransmitter dopamine.[1]

A British doctor James Parkinson was the one who found PD also called as "shaking palsy" in the year 1817; hence, the disease was named after him.[2] The most common movement and neurodegenerative disorder is PD which is characterized by progressive loss of muscle control, which leads to shaking of the limbs and head at rest, stiffness, slowness in movement, and loss of balance. As symptoms worsen, it may become difficult to walk, talk, and complete simple tasks.[1,3-5]

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The rate of progression and severity of impairment in PD might vary from individual to individual. Life expectancy of PD also varies from person to person based on the level of disability.[4] Parkinson's patients have high risk of fall leading to injuries that possibly cause death at times. However, studies of patent populations with and without PD suggest that the life expectancy for people with the disease is about the same as the general population.[2,5,6]

Associated non-motor problems with Parkinson's are cognitive and language impairment and memory disturbances.[7] Cognitive disturbances can arise at any time in the course of PD and vary widely in severity.[8]

Description of the Intervention

The theory of mirror neuron says that, "In your brain, as you watch me do this, you are activating exactly the same neurons as if you do the actions." (D'Angelo *et al.*)

At first, mirror neurons were found in the ventral premotor cortex (PMv) discharge (PMv; area F5) during the execution of ecological goal-directed manual and oral actions.[9-11] These neurons were later identified in the inferior parietal lobule (areas PF and PFG), which constitutes a "mirror neuron" system (MNS). Several pieces of experimental data suggest

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that a MNS devoted to hand, mouth, and foot actions might also be present in humans.[15]

Various guidelines recommend the inclusion of a variety of physiotherapy interventions as part of the multimodal treatment in treating patients with PD, but their effectiveness is not known.[12-16]

Mirror neurons are a specific group of visuomotor neurons, originally discovered in the premotor cortex. The group of neurons discharges either when it does a particular action or when it observes another individual doing a similar action.[16]

How the Intervention Might Work

Rehabilitation strategies, such as mirror neuron therapy, increase mobility, by ameliorating maladaptive somatosensory and motor cortex reorganization. Mirror neurons target the cognitive function which is the main inflict in patients with PD.[17]

These groups of neurons govern more of the cognitive components and help in improving their learning efficiencies as a therapeutic intervention.[18,19]

Why it is Important to do this Review

A number of systematic reviews suggest that physiotherapy interventions employed in combination with medical management may be beneficial in reducing cognitive disability associated with PD.

However, the inclusion of non-randomized clinical trials and case series designs, together with the exclusion of studies involving people with PD as well as those published in other languages apart from English, might have conclusions that are biased.

Furthermore, the methodologies used for conducting systematic reviews have been substantially revised in recent years, such as those recommended within the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach for describing the strength of the evidence, which has not been utilized in previous reviews.

Given the limitations of existing systematic reviews, together with the availability of potentially numerous physiotherapy treatment strategies for PD, an up-to-date systematic review of the evidence from randomized clinical trials for the effectiveness of mirror neuron therapy will help a lot of physiotherapist in exploring new strategies' to handle the cognitive problem in patients with PD.

Hence, due to the above said, this systemic review is mandated to be executed for the wellness of all cognitively affected Parkinson patients.

METHODOLOGY

Criteria for Considering Studies for this Review

Types of studies

We included randomized controlled trials (RCTs) (including those of parallel, cluster-randomized. and crossover design) published for the past 15 years. We excluded studies in which participants were not randomized to intervention groups. Apart from this, we searched every possible resource of database for the almost matching keywords that included library and book searches Figure 1 explains clearly this process as a flow chart.

Types of participants

We included trials of adults, aged 45 years or older, diagnosed with predominant type of PD, the details were considered and the RCT mainly for initial meta-analysis and data synthesis.

Types of interventions

We included all randomized controlled comparisons of physiotherapy interventions, employed in either a standalone fashion or in combination, compared with placebo, no treatment, another intervention or usual care, or of varying physiotherapy interventions compared with each other, which were aimed at treating pain or disability, or both, associated with treating PDv and also with a key main factor of mirror neuron therapy in treatment arm.

Types of outcome measures

Primary outcomes

The primary outcome we considered was the inpatients with PD and also the improvement in activities of daily living.

Secondary outcomes

The other components apart from the above said primary outcomes spatial and temporal parameters of gait were considered as secondary outcomes due to lack of preliminary evidence and time constrain; these were not utilized for meta-analysis.

Search Methods for Identification of Studies

Electronic searches

We identified relevant studies by electronically searching the following databases: Cochrane Central Register of Controlled Trials in the Cochrane Library, Database of Abstracts of Reviews of Effects in the Cochrane Library, Health Technology Assessments in the Cochrane Library, MEDLINE (OVID), EMBASE (OVID), CINAHL (EBSCO), PsycINFO (OVID), LILACS, PEDr, and Web of Science.

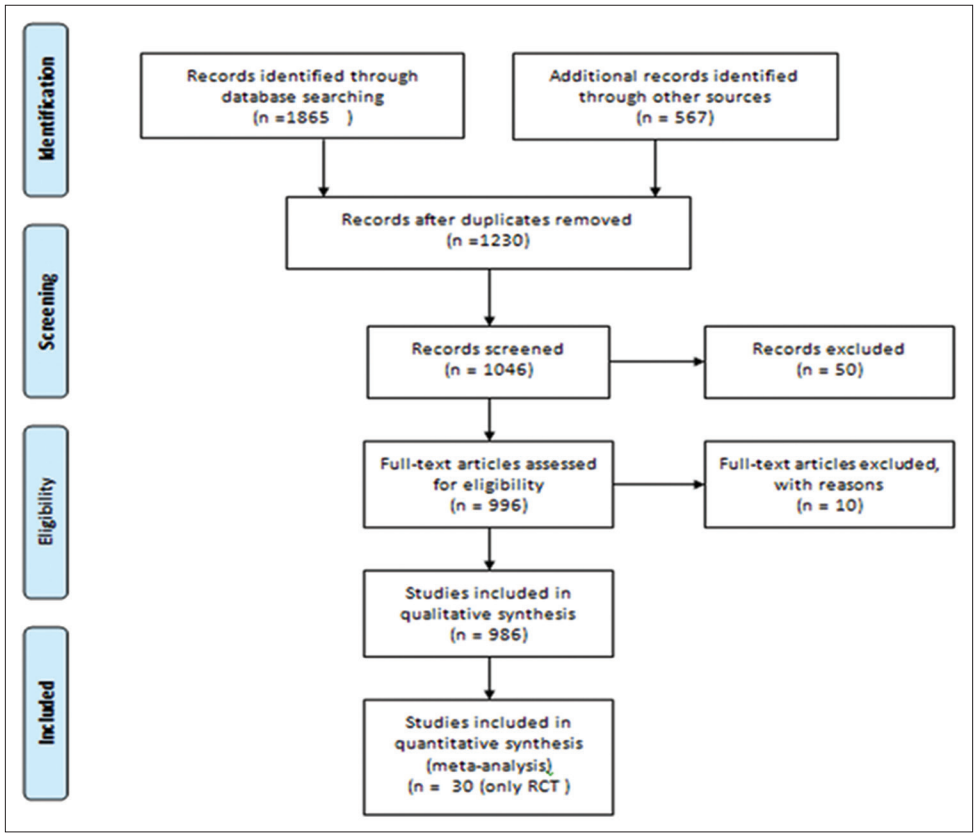

Figure 1: Flowchart showing the process of search strategy

Searching other Resources Reference Lists

On completion of the electronic searches, we searched the reference lists of all eligible studies to identify additional relevant studies.

In addition, we screened the reference lists of key physiotherapy textbooks and previous systematic reviews.

External Experts

We sent the list of included trials and resources to a content expert to help identify any additional relevant studies. In order to minimize the publication bias Unpublished data were also reviewed.

We searched the following registers and databases to identify unpublished research as well as research in progress: OpenGrey (System for Information on Grey Literature in Europe), Dissertation Abstracts (ProQuest), National Research Register Archive, Health Services Research Projects in Progress, Current Controlled Trials Register (incorporating the metaRegister of Controlled Trials and the International Standard Randomized Controlled Trial Number, ClinicalTrials.gov, International Clinical Trials Registry Platform, and Pan African Clinical Trials Registry.

DATA COLLECTION AND ANALYSIS

Selection of Studies

We independently assessed the titles and abstracts of studies, we identified by the search strategy for eligibility. If the eligibility of a study or resource was unclear from the title and abstract or content, we assessed the full-text article or whole materials. We excluded trials that did not match the inclusion criteria. More concentration and care were taken in this initial process.

Data Extraction and Management

We independently extracted data from all included source. We extracted data using a standardized and piloted form. We resolved any discrepancies and disagreements by consensus. We extracted the following data from each included resource: Study design; study population (including diagnosis, diagnostic criteria used, symptom duration, age range, and gender split); type of noxious initiating event: Surgery, fracture, crush injury, projectile, stab injury, other, or no event; type of tissue injured: Nerve, soft tissue, and bone; presence of medicolegal factors (that may influence the experience of pain and the outcomes of therapeutic interventions); concomitant treatments that may affect outcome: Medication,

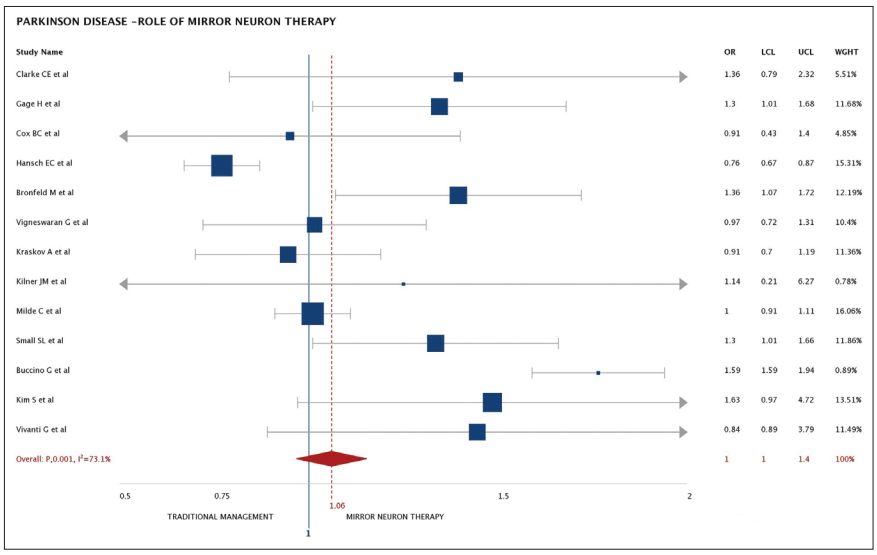

Figure 2: Forest plot of selected randomized controlled trials showing the effect of mirror neuron therapy

procedures, etc.; sample size: Active and control/comparator groups; intervention (including type and parameters (e.g., frequency, dose, and duration), setting, and professional discipline of the clinician delivering the therapy); type of placebo/comparator intervention; outcomes (primary and secondary) and time points assessed; adverse effects; author conflict of interest statements; and assessment of risk of bias.

Assessment of Risk of Bias in Included Studies

We assessed the overall risk of bias for each included trial on the basis of an evaluation of key domains using a modified version of the Cochrane "risk of bias" assessment tool.

We classified risk of bias as either "low" (low risk of bias for all key domains), "unclear" (unclear risk of bias for one or more key domains), or "high" (high risk of bias for one or more key domains), as outlined in the Cochrane handbook for systematic reviews of interventions.

We also considered experimental design-specific (e.g., crossover study designs) "risk of bias" issues where appropriate. We assessed the key domains of risks of bias for each included trial using either "yes," "no," or "unclear" judgments. We also evaluated included trials for the additional sources of bias associated with sample size and duration of follow-up.

Measures of Treatment Effect

We presented treatment effect sizes using appropriate metrics. We calculated the risk ratio with 95% confidence intervals (CIs) for dichotomized outcome measures, and the number needed to treat as an absolute measure of treatment effect where possible.

A point estimates with 95% CI was found for results of every RCT and was plotted with available datausing forest plots Figure 2 explains the effects of mirror neuron therapy on Parkinson disease. If the clinical trials were found to have homogeneity, then a meta-analysis was performed to quantify the pooled treatment effect sizes which were done using a random effects model.

We did not perform a meta-analysis when clinical heterogeneity was present and it was more limited to flowchart represented systemic review.

Unit of Analysis Issues

The main idea of this review was to limit to pre-synthesis, but only qualified RCTs were planned for further synthesis with a simple metric methods.

Dealing with Missing Data

We attempted to contact the authors of included trials when numerical data were unreported or incomplete. If trial authors only presented data in graphical form, we did not attempt to extract the data from the figures.

Assessment of Heterogeneity

We evaluated the included trials for clinical homogeneity regarding study population, treatment procedure, control intervention, timing of follow-up, and outcome measurement.

Assessment of Reporting Biases

We tested for the possible influence of publication bias as part of our GRADE assessments of the quality of evidence.

Data Synthesis

Where possible, we grouped extracted data and the main data used for data synthesis were from the randomized trials that were used in forest plot.

Subgroup Analysis and Investigation of Heterogeneity

We planned to perform subgroup analyses, but we did not undertake them due to the insufficient number of included trials.

Sensitivity Analysis

We planned to perform sensitivity analyses, on risk of bias did not perform them as insufficient data were available.

RESULTS

Results of the Search

1. The systemic study result showed and supported that mirror neuron therapy helps in treating patients with PD mainly the cognitive components.
2. The study also supported that the mirror neuron can be utilized as a cotherapy along with other treatment protocols in treating Parkinson patients.
3. This study did not find much scope in secondary components of gait and a detailed study is recommended in that aspects.

CONCLUSION

This study shows that the mirror neuron therapy is very effective in treating Parkinson's disease it also showed a new dimension in rehabilitation method. A detailed meta analysis is indispensable to know the depth of mirror neuron therapy.

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