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ORIGINAL ARTICLE

Tele-rehabilitation in Person with Multiple Sclerosis in Indian Population

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ABSTRACT
Tele-rehabilitation (TR) seems to be a viable and efficient method for tackling the rehabilitative challenges linked to neurological impairments and improving patients' quality of life (QoL). Tele-rehabilitation aids multiple sclerosis patients by providing convenient, accessible therapy to manage symptoms and improve quality of life. A cross-sectional study of 80 multiple sclerosis patients from Delhi NCR divided participants into Supervised (40) and Tele-rehab (40) groups. Supervised rehabilitation was conducted face-to-face as well as Tele-rehabilitation was conducted via Zoom (V5.17) and assessed using the Multiple Sclerosis Work Disability Questionnaire (MSWDQ)-23 before and after a 12-week exercise protocol. Data was collected online and analyzed qualitatively and quantitatively with MS Excel 2016. Descriptive statistics and an independent t-test compared the inter-group physical, psychological, and external components statistically. No significant intra-group differences have been seen based on physical, psychological and external components. Significant inter-group physical improvement can be seen while there is no significance in the case of psychological and external inter-group improvement. Tele-rehabilitation is equally effective for RRMS individuals, addressing physical, psychological, cognitive, and external aspects, with the MSWDQ-23 questionnaire applicable for assessing, evaluating, and predicting quality of life improvements in Indian PwMS.
Keywords: *Tele-rehabilitation, RRMS, MSWDQ-23, PwMS, Multiple Sclerosis, Indian population.*

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INTRODUCTION

Multiple sclerosis (MS) is a long-term, progressive condition that damages the central nervous system, typically affecting individuals between 20 and 40 years old. This age range coincides with the peak of many people's careers, and as a result, MS can significantly impair their ability to work and maintain their professional lives. (1) Before the characteristic symptoms of a disease appear, a prodrome can occur, which is a set of early indicators, symptoms, or findings. While prodromal phases are well-established in various neurological and inflammatory conditions, the existence of a prodrome in multiple sclerosis (MS) has only recently gained significant attention, despite being overlooked for many years. (2) Multiple sclerosis (MS) imposes a significant economic burden on individuals, families, and society. Notably, the cost of lost productivity, primarily due to early retirement caused by MS, accounts for approximately 45.8% of the total annual MS-related expenses in the Netherlands. Furthermore, research among the Dutch population reveals that unemployment among individuals with MS is linked to a reduced quality of life and poorer mental well-being. (1) The most prevalent form of multiple sclerosis (MS) is relapsing-remitting MS (RRMS), characterized by alternating periods of relative wellness (remissions) and debilitating relapses. This form of MS is marked by a range of symptoms, including physical impairments, mood changes, cognitive difficulties, fatigue, pain, and medication side effects, all of which significantly impact daily life and overall quality of life (QoL). As the disease progresses, it often leads to irreversible functional decline, further compromising the patient's overall health and ability to perform daily activities (ADL). (3) Tele-rehabilitation (TR) emerges as a convenient and effective solution to tackle the rehabilitation challenges linked to neurological impairments, ultimately improving patients' overall

quality of life (QoL). By leveraging remote healthcare technologies, TR offers a promising approach to enhance patient outcomes and overcome traditional barriers to rehabilitation services. (4) The term 'telehealth' has gained significant traction in recent years, despite its origins dating back to the 1940s. Telehealth utilizes electronic communication to remotely exchange medical information and support patient care. The COVID-19 pandemic, first identified in 2019, was declared a global health emergency by the World Health Organization (WHO) on March 11, 2020, due to its rapid spread and severity. As of April 10, 2023, COVID-19 has claimed over six million lives worldwide, posing a significant global threat. (5) The rapid spread of viral diseases continues to pose significant threats to public health. COVID-19, a highly contagious and potentially life-threatening illness with a 2% mortality rate, has spread globally, prompting governments worldwide to implement urgent measures to mitigate its impact. These measures include travel restrictions, quarantine, and social distancing to monitor and manage symptoms, enable early diagnosis, and encourage individuals to avoid contact with others showing flu-like symptoms, such as fever, cough, runny nose, sore throat, and shortness of breath. (6) The pandemic has had far-reaching consequences, not only on public health but also on economic and social development, causing widespread adversity worldwide. The healthcare system has been severely impacted, with in-person care significantly reduced due to safety measures aimed at protecting healthcare workers and patients. This reduction has had profound effects on rehabilitation services, resulting in limited access to essential healthcare and compromising the quality of care for individuals in need of occupational therapy, physiotherapy, and speech therapy. (5)

MATERIAL AND METHODS

A cross-sectional study was conducted on 80 participants with multiple sclerosis from Delhi NCR based on the inclusion and exclusion criteria. Inclusion criteria were RRMS type of Multiple Sclerosis, stable clinical condition at the time of application, expanded disability status scale (EDDS) score of 2 to 6.5, appropriate cognitive ability to comprehend the test, no exacerbation in last 6 months, all age group and all gender inclusive; exclusion criteria was attack in last 6 months. The sampling was convenient sampling and randomization of participants in the two groups were done by G-power application with alpha value of 80% and confidence level of 95%. They were divided into two groups, namely Supervised group with 40 sample size and Tele-rehab group with 40 participants. All participants were informed and instructed about the methodology of the study and signed consent forms were collected from all participants (Appendix 1). Ethical approval was documented from the ethical committee of GD Goenka University. Supervised rehabilitation was conducted face-to-face as well as Tele-rehabilitation was done on Zoom video calling app V5.17 and all participants were assessed with a questionnaire named as Multiple Sclerosis Work Disability Questionnaire (MSWDQ)-23 (Appendix 2). The MSWDQ-23 is a comprehensive self-report instrument consisting of 23 items, aimed at evaluating the work-related challenges faced by individuals with multiple sclerosis. The tool assesses these challenges across three distinct subscales: psychological and cognitive barriers, physical barriers, and external barriers, providing a nuanced understanding of the difficulties experienced by individuals with MS in a work setting. The questionnaires comprehensively assessed various aspects of individuals' lives, including their employment status and work performance, levels of fatigue, cognitive and neuropsychiatric functioning (self-reported), symptoms of depression and anxiety, overall health-related quality of life, and demographic characteristics, providing a broad understanding of their experiences and challenges. A native English speaker, who is also fluent in Dutch and has no prior knowledge of the MSWDQ-23, independently translated the questionnaire from Dutch back into English, ensuring a neutral and unbiased translation process. This process emphasized conceptual and cultural equivalence over direct linguistic equivalence. Participants rate their perceived difficulties over the past four weeks using a five-point Likert scale ranging from 0 (Never) to 4 (Always). Subscale scores are computed by summing the observed item scores, dividing by the total possible item scores for each subscale, and multiplying by 100, with higher scores indicating greater perceived difficulties. The overall MSWDQ-23 score is the average of the three subscale scores. This questionnaire is internally consistent and validated in multiple languages, effectively predicting work outcomes and expectations for individuals with MS.(1) The first assessment was taken through the questionnaire as Pre-intervention assessment, after 12 week of protocol of exercise (Appendix 3) Post-intervention assessment was done by the same questionnaire. Supervised group were assessed, evaluated and treated face-to-face sessions for 12 weeks and for Tele-rehab group were assessed, evaluated and treated via zoom video calling app for 12 weeks.(3) Data were collected qualitatively conducting a survey by sending the questionnaire online to the participants and analysed qualitatively and quantitatively both on MS Excel 2016. Descriptive statistics were used to present data

on performance of two groups on the basis of physical, psychological and external component of the questionnaire; independent t-test was used to make a comparative infer the inter-group difference.

RESULTS

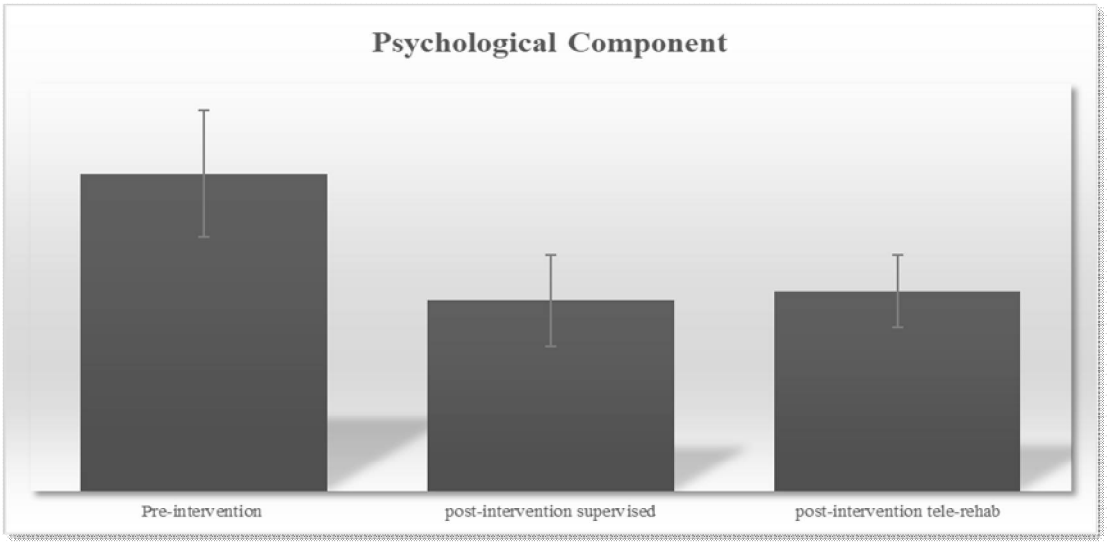

Figure 1: Descriptive Data of the comparison between Pre-intervention Assessment, Post-intervention Assessment for Supervised group and Tele-rehab Group

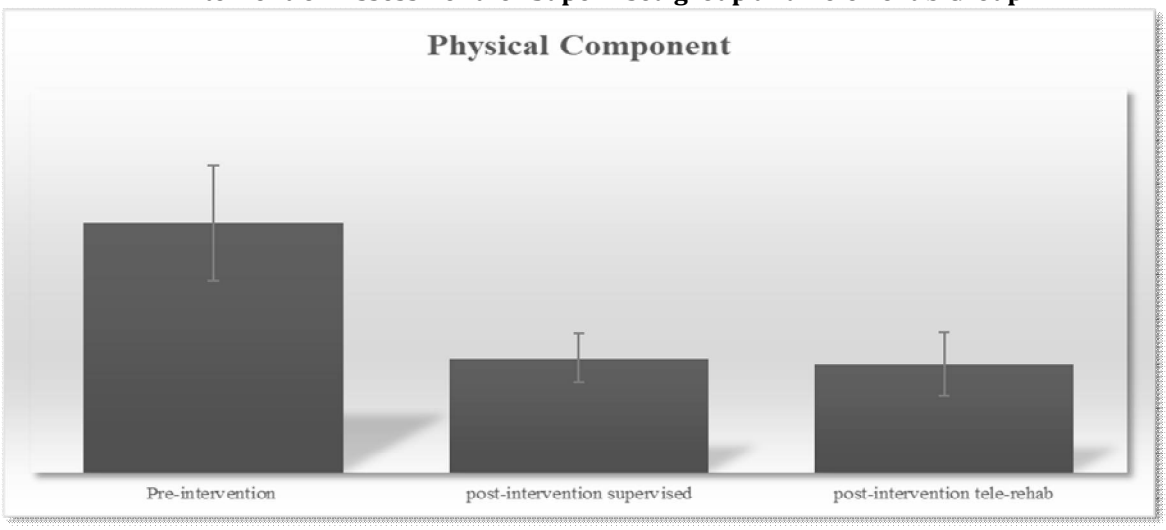

Figure 2: Descriptive Data of the comparison between Pre-intervention Assessment, Post-intervention Assessment for Supervised group and Tele-rehab Group

Figure 1 shows a huge difference between pre and post-intervention scoring in the physical component. But when it is about supervised and tele-rehab group both don't have significant difference.
Figure 2 shows a huge difference between pre and post-intervention scoring in the psychological component. But when it is about supervised and tele-rehab group both don't have significant difference.

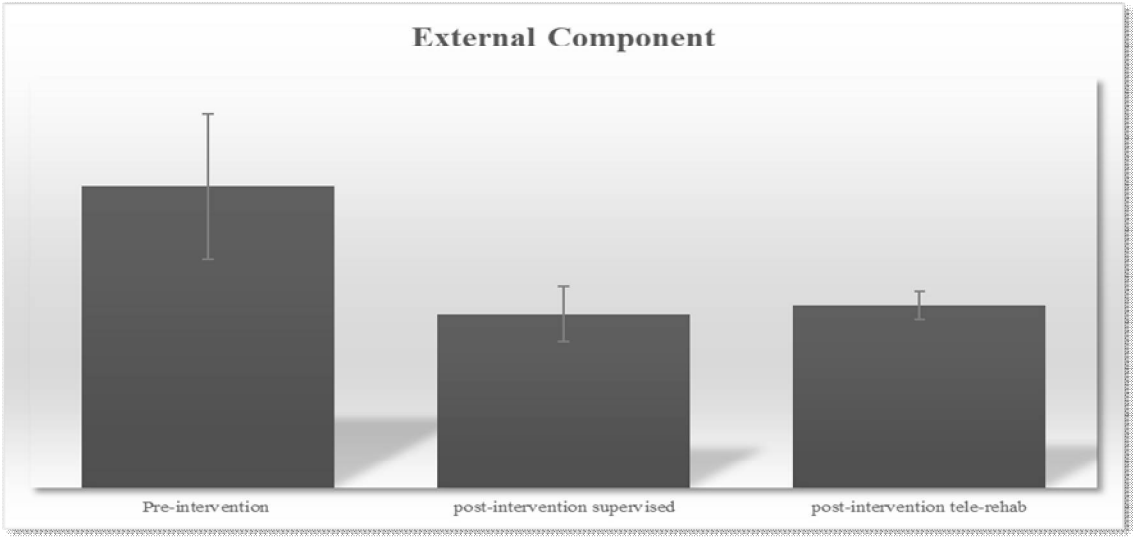

Figure 3: Descriptive Data of the comparison between Pre-intervention Assessment, Post-intervention Assessment for Supervised group and Tele-rehab Group

Figure 3 shows a huge difference between pre and post-intervention scoring in the external component. But when it is about supervised and tele-rehab group both don't have significant difference.

Table 1: p-values in T-test for various factors between two groups

Factors	p-values
Physical factor	0.04637
Psychological factor	0.06185
External factor	0.05048

Table 1 shows mean p-value of T-test between supervised group and tele-rehab group in case of physical, psychological and emotional component are 0.04637, 0.06185 and 0.05048 respectively, considering p-value for t-test as $p > 0.05$.

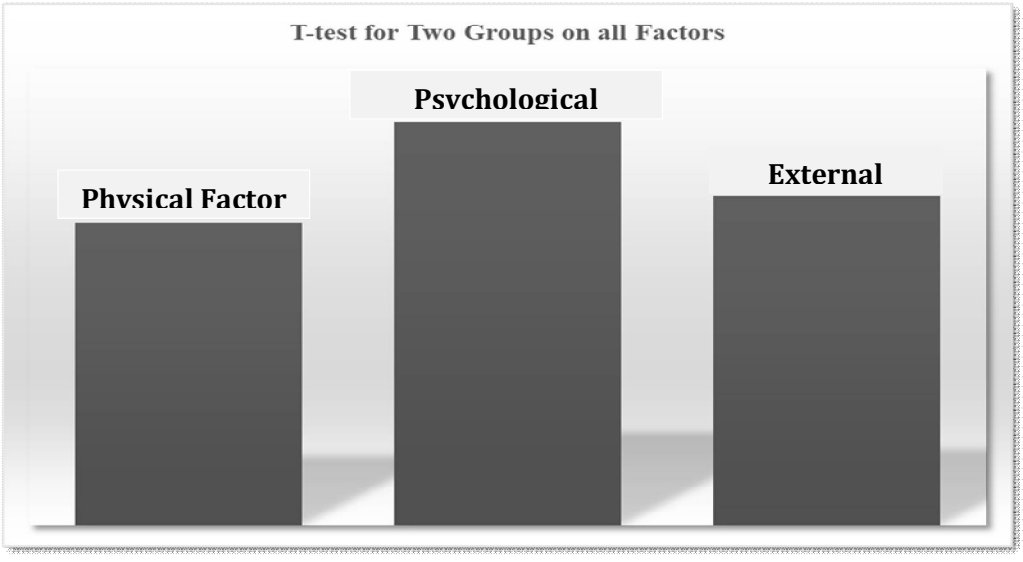

Figure 4: Descriptive Data of p-value in T-test for various factors between two groups based on Physical, Psychological and External Factors

Figure 4 shows a huge difference between pre- and post-intervention scoring in the emotional component. But when it is about supervised and tele-rehab group neither have significant difference.

DISCUSSION

Multiple sclerosis is an inflammatory neuropathy consisting autoimmune demyelination followed by gliosis. As it happens among the age group of young adults or older adults, which is considered as functional future of industrialization, effects the productivity of industrial workforce. Through this study it has been observed that in case of RRMS, supervised rehabilitation and tele-rehabilitation has no significant difference in intra-group physical, psychological/cognitive and external factor improvement as well as inter-group overall improvement, though significant psychological factor improvement has been seen in case of inter-group comparison. In the study of Tarakci E. et. al. (2021), authors has been suggested home-based tele-rehabilitation programs are a valuable intervention for individuals with multiple sclerosis (PwMS), who often face challenges such as weather conditions, transportation issues, and distance to rehabilitation facilities, exacerbating their fatigue. Well-managed home-based exercises offer a convenient and effective way to enhance health-related quality of life (QoL) and prevent adverse outcomes. This is particularly important during exceptional circumstances like pandemics and curfews, when access to rehabilitation facilities is limited. Telerehabilitation interventions provide an efficient alternative for delivering rehabilitation treatments in a convenient setting, especially in remote areas with limited services. Our findings indicate that structured exercises, both supervised and home-based, managed through telerehabilitation, can have similarly positive effects on improving daily living activities, health-related QoL, and reducing fatigue. (3) Author like Pagliari C. (2024) also suggested that multiple sclerosis (MS) has a profound impact on patients' overall health and life satisfaction, leading to significant declines in family and work life during their most productive years, thereby diminishing their quality of life (QoL). However, enhancing the perception of well-being and self-health can have a positive impact on individuals with MS (PwMS), leading to improved mood and reduced depressive symptoms. This emotional improvement is consistent with findings from other randomized controlled trials (RCTs) involving PwMS and digital interventions for other chronic diseases. The improvement in QoL may be attributed to the sense of empowerment and engagement in the care process, fostered by a collaborative communication loop with healthcare professionals. (7) According to Plow M. et al. (2022), the benefits of tele-rehabilitation interventions were consistent across participants with varying baseline characteristics, suggesting that these interventions are inclusive and effective for individuals with diverse sociodemographic backgrounds and functional abilities. However, it is also possible that the study's sample size was not sufficient to detect subtle moderation effects, and a larger sample size may be necessary to capture these effects, which could be small to medium in magnitude. (8) According to Kahraman T. et al. (2020), Tele-MIT (Tele-Motor Imagery Training) has been shown to improve various aspects of physical and mental well-being, including dynamic balance, walking speed, perceived walking ability, balance confidence, cognitive functions, fatigue, anxiety, depression, and overall quality of life. However, cognitive and motor dysfunction in individuals with neurological diseases may impact their ability to engage in motor imagery training, potentially limiting its effectiveness and applicability in these populations. (9) According to Di Tella S. (2020), tele-rehabilitation, which incorporates Kinect-based exergaming, remote monitoring, and cognitive training follow-up, is a promising and acceptable alternative to traditional in-person outpatient therapies for improving ambulation and mobility outcomes in veterans with multiple sclerosis. This approach not only shows potential physical benefits but also offers the advantages of increased accessibility, reduced travel burden, and decreased barriers to care, making it a convenient and effective option for veterans with MS. (10).

CONCLUSION

Tele-rehabilitation has same effective rehabilitation for RRMS type of PwMS (person with multiple sclerosis) whether it is physical or psychological / cognitive or external improvement. The questionnaire MSWDQ-23 also can be used for Indian population to assess, evaluate and prognose the quality-of-life improvement regarding the structure interventions in case of PwMS.

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Appendix 2: MSWDQ-23

Questions	Never	Rarely	Sometimes	Often	Almost always
1. I experienced lack of coordination during my movements	0	1	2	3	4
2. I felt that employer did not understand me very much my need	0	1	2	3	4
3. I found it difficult to learn something new	0	1	2	3	4
4. I felt that my boss or colleagues were not supportive	0	1	2	3	4
5. I felt that my bowel or bladder function were distracting me from a task	0	1	2	3	4
6. I had to be reminded to do a task at a certain time	0	1	2	3	4
7. I felt that I couldn't perform at the level expected of me	0	1	2	3	4
8. I found it difficult to tolerate the temperature at work	0	1	2	3	4
9. I found it difficult to enter my workplace or office	0	1	2	3	4
10. I had to struggle to remember a recent conversation	0	1	2	3	4
11. I experienced pain while undertaking work	0	1	2	3	4
12. I was afraid that I would not be able to support myself if I could no longer work	0	1	2	3	4
13. I became sleepy while trying to complete a lengthy task	0	1	2	3	4
14. I found it difficult to keep my balance	0	1	2	3	4
15. I had trouble concentrating on task	0	1	2	3	4
16. I had difficulty communicating my thoughts to colleagues	0	1	2	3	4
17. I found it more difficult to balance obligations at work and at home	0	1	2	3	4
18. I found it difficult to write or type	0	1	2	3	4
19. I found it difficult to get along with people	0	1	2	3	4
20. I was afraid that I would be incontinent	0	1	2	3	4
21. I found it difficult to reduce my working hours because my wages would also be reduced	0	1	2	3	4
22. I forgot what task I had to do next	0	1	2	3	4
23. I felt that the work became harder due to responsibilities at home	0	1	2	3	4

Appendix 3: 12 Weeks Exercise Protocol

1. **Warm-up exercise for 10 min.:**

a. Bicycle ergometer, no resistance, 5 min
b. Self-stretching 3 min
c. Arm Circles 10 repetitions
d. Squats 10 repetitions

2. **Training for 40 min.:**

a. Stretching exercises of Iliopsoas, Hamstring,
b. Gastrocnemius muscles with the help of a physical therapist.
c. Breathing exercises combined with core stabilization
d. Strengthening of the upper limb and lower limb with proprioceptive neuromuscular facilitation methods.
e. Balance exercises, standing on one leg, tandem posture, perturbation exercises
f. Coordination training was selected from Frenkel exercises and progressed.
g. Weight transfer and walking exercises

3. **Cool-down exercise for 10 min.:**

a. Self-stretching 3 min
b. Arm Circles 10 repetitions
c. Squats 10 repetitions