

Case Study

A Case Study on the Integrated Rehabilitation of Chemotherapy-Induced Peripheral Neuropathy in a Patient with Stage IV Breast Cancer

Baneeha Zainab^{1*}, Um I Lela², Kiran Shahzadi³, Laiba Manzoor⁴

¹Visiting Lecturer, M.Phil. Psychology, GIFT University Gujranwala, Pakistan.

²Associate Professor and Associate Dean, PhD Psychology, GIFT University Gujranwala, Pakistan.

³Consultant Oncologist, MBBS, FCPS, Gujranwala Institute of Nuclear Medicine and Radiotherapy, Gujranwala, Pakistan.

⁴Orthopaedic Manual Physical Therapist, MS OMPT, Ripah International University Lahore, Pakistan.

*Corresponding Author: Baneeha Zainab, Visiting Lecturer; Email: Baneeha.zainab@gift.edu.pk

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ABSTRACT

Background: Chemotherapy-induced peripheral neuropathy (CIPN) is a significant complication of cancer treatments, affecting a substantial proportion of patients and severely impacting their quality of life. Current management strategies often fall short in addressing the multifaceted nature of this condition, highlighting the need for integrated approaches that encompass physical, psychological, and social elements.

Objective: This study aimed to evaluate the efficacy of a multimodal rehabilitation program in improving physical function and psychological well-being in a patient with Stage IV breast cancer experiencing moderate CIPN.

Methods: A 40-year-old female with Stage IV breast cancer underwent a 5-week multimodal rehabilitation program, including physical therapy, psychosocial support, and mobility therapy. Assessments of grip strength, knee and shoulder flexion, neuropathic pain (DN4), anxiety and depression (HADS), and overall quality of life were conducted pre- and post-intervention using a hand dynamometer, goniometer, and standardized psychological scales.

Results: Post-treatment results demonstrated significant improvements: grip strength increased from 10 kg to 13 kg (right hand) and 9 kg to 14 kg (left hand); knee flexion improved from 120° to 129° (right) and 125° to 132° (left); shoulder flexion increased from 149° to 160° (right) and 152° to 159° (left). Psychological assessments showed a reduction in anxiety (HADS) scores from 12 to 8 and depression from 10 to 5. The DN4 score decreased from 7 to 4, indicating a reduction in neuropathic pain. Quality of life assessments also noted significant enhancements.

Conclusion: The integrated rehabilitation program was effective in significantly improving both the physical and psychological parameters in a patient with severe CIPN. This case supports the potential benefits of multidisciplinary approaches in managing CIPN, suggesting wider applicability for similar comprehensive care models in oncological rehabilitation.

Keywords: Chemotherapy-Induced Peripheral Neuropathy, CIPN, Multimodal Rehabilitation, Physical Therapy, Psychosocial Support, Quality of Life, Cancer Rehabilitation.

INTRODUCTION

Chemotherapy-induced peripheral neuropathy (CIPN) is a prevalent adverse effect associated with cancer treatments, affecting between 30 to 70% of patients who are administered neurotoxic chemotherapeutic drugs (1). CIPN manifests as pain, numbness, and tingling, or even paralysis in extremities, severely disrupting daily functions and overall quality of life. These symptoms are due to the damage inflicted on peripheral nerves, and although they may diminish following the cessation of chemotherapy, they can persist long-term in 10 to 30% of survivors, leading to chronic neuropathic pain that significantly impairs sleep, emotional well-being, self-care, and occupational capabilities (3-6).

Pathophysiologically, agents such as paclitaxel promote oxidative stress and mitochondrial dysfunction, which disrupt normal neuronal function and compromise the support from Schwann cells, contributing to the aberrant neuron firing seen in CIPN (3).

Despite a general improvement in symptoms after treatment ends, the long-term persistence of neuropathy in a substantial subset of patients underscores the urgent need for effective management strategies (7, 8).

Rehabilitation, which aims to enhance functional ability and psychosocial well-being, is pivotal in managing CIPN. Current trends in rehabilitation practice advocate for an integrated approach that incorporates physical and occupational therapy. This approach is increasingly recognized for its potential in mitigating the debilitating effects of CIPN, yet data, particularly from developing countries, on the effectiveness of such comprehensive rehabilitation programs remains scarce (2). The biopsychosocial model, which addresses physical, occupational, and psychological deficits through multimodal treatments, is supported by emerging evidence. This model includes interventions like graded exercise, joint mobilizations, coping skills training, and peer support, which collectively aim to restore function and improve quality of life (9-11).

This case report illustrates the application of an integrated outpatient rehabilitation regimen in a patient with advanced breast cancer and moderate CIPN following chemotherapy. Over a period of five weeks, the patient underwent graded motion therapy, joint mobilizations, and received substantial psychosocial support. By detailing this comprehensive approach, the report contributes valuable insights into the practical application of a full biopsychosocial model for the management of CIPN. Through meticulous documentation and analysis of the treatment effects, this study aims to inform and guide future therapeutic interventions, highlighting the necessity for post-cancer care that effectively addresses the neurological aftermath of chemotherapy. Patient confidentiality has been rigorously maintained by suppressing all identifiers (12-13).

MATERIAL AND METHODS

In this case study, we evaluated the effectiveness of an integrative rehabilitation program tailored for a 40-year-old female patient, referred to as S.K, suffering from moderate chemotherapy-induced peripheral neuropathy (CIPN) and associated psychological distress following treatment for stage IV breast cancer. As a non-smoker without significant lifestyle-related risk factors, her primary health challenge stemmed from her cancer treatment's side effects (13).

The patient's initial clinical assessment included a thorough examination of hand and foot functionality using a hand dynamometer to measure grip strength and a goniometer to assess the range of motion in knee and shoulder flexion. These assessments were performed by a qualified physiotherapist. Additionally, S.K's psychological state was evaluated using the Hospital Anxiety and Depression Scale (HADS), which provided insights into her levels of anxiety and depression (5). The DN4 questionnaire was employed to characterize and measure the severity of neuropathic pain (6), while her overall quality of life was assessed using a standardized scale that evaluated the impact of her condition on daily activities and well-being (7). Routine oncological follow-up, likely including imaging and blood tests, was conducted to monitor the progression of her cancer and the effects of her ongoing therapy (14-17).

Diagnosis was determined based on symmetrical and distal sensory abnormalities, a reduction in hand grip strength as evidenced by dynamometer readings, and altered joint mobility as measured by goniometer use. S.K's previous chemotherapy regimen was acknowledged as a significant risk factor for neuropathy. Psychological distress was diagnosed through elevated HADS scores, indicating considerable anxiety and sadness.

The treatment program for S.K was designed as a 5-day intensive regimen spread over 5 weeks, with each session lasting approximately 65 minutes. The intervention included guided relaxation, mindfulness exercises, movement therapy tailored to different psychological themes—such as trust-building, self-efficacy, self-esteem, emotional resilience, and positivity—and group discussions. Notably, no pharmacological treatments were administered for neuropathy; instead, the focus was on psychological and physical therapy interventions (17-19).

Data collection was conducted throughout the program, with assessments performed at the beginning and end of the treatment period to measure changes in physical and psychological parameters. Ethical considerations were strictly adhered to throughout the study, with all procedures performed in compliance with the Declaration of Helsinki. All data were anonymized to maintain confidentiality, and informed consent was obtained from the patient prior to her participation in the program (20).

Data analysis involved comparing pre- and post-treatment results using appropriate statistical tools to evaluate the effectiveness of the rehabilitation program. The analysis aimed to identify significant improvements in physical and psychological measures, thereby assessing the integrated approach's impact on the patient's quality of life and symptom management. This comprehensive assessment and tailored treatment approach highlight the potential benefits of integrative rehabilitation programs in managing CIPN and accompanying psychological distress, offering valuable insights for future clinical applications and research in this area.

RESULTS

The analysis of the integrated rehabilitation program for the patient with chemotherapy-induced peripheral neuropathy (CIPN) provides a comprehensive insight into the improvements across various physical and psychological parameters. Initially, the grip

strength of the patient showed significant improvement from the pre-treatment values, with the right hand increasing from 10 kg to 13 kg and the left hand from 9 kg to 14 kg. Similarly, the knee flexion angle enhanced from 120° to 129° on the right and from 125° to 132° on the left. The shoulder flexion also improved notably, with the right shoulder increasing from 149° to 160° and the left from 152° to 159° (Figure 1).

Psychologically, there was a substantial reduction in the scores of the Hospital Anxiety and Depression Scale (HADS), with anxiety levels dropping from 12 to 8 and depression from 10 to 5. The DN4 neuropathic pain score also decreased from 7 to 4, indicating a reduction in neuropathic pain symptoms. In terms of quality of life, assessed using the EORTC QLQ scale, there was noticeable progress in physical activities, work and leisure capabilities, and symptom management, alongside an overall improvement in health perception and quality of life scores (Figure 2).

Table 1 Assessment Measures

Assessment Measure	Baseline (Pre-Treatment)	Post-Treatment	Improvement
Grip Strength- Right Hand	10 kg	13 kg	Increased by 3 kg
Grip Strength- Left Hand	9kg	14 kg	Increased by 4 kg
Knee Flexion Right	120°	129°	Increased by 9°
Knee Flexion Left	125°	132°	Increased by 7°
Shoulder Flexion Right	149	160	Increased by 11°
Shoulder Flexion Left	152	159	Increased by 7°
HADS- Anxiety	12	8	Reduced by 4 points
HADS- Depression	10	5	Reduced by 5 points
DN4 Neuropathic Pain	7	4	Reduced by 3 points
EORTC QLQ Physical Activities (Q1-Q5)	1-3 (Varied)	Improved	Scores decreased
Work & Leisure (Q6-Q7)	2-3	Improved	Scores decreased
Symptoms (Q8-Q28)	1-4 (Varied)	Improved	Scores decreased
Overall, Health (Q29)	5	7 (Excellent)	Maintained
Quality of Life (Q30)	3	5	Improved by 2 points

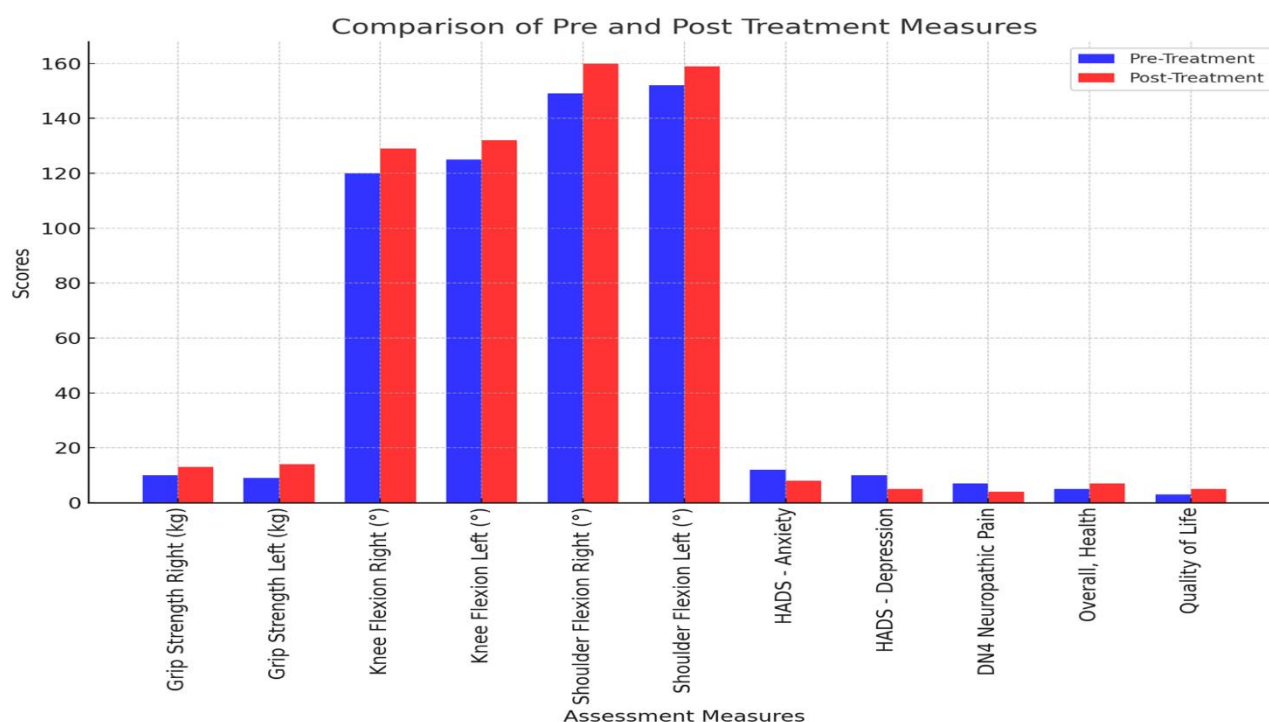


Figure 1 PRE AND POST ASSESMENT MEASURES

Table 2: FEEDBACK AFTER EVERY SESSION

Week/Question	Week 1	Week 2	Week 3	Week 4	Week 5
How do you feel right now compared to before the session?	Slightly improved	More comfortable	Notably better	Significant improvement	Very positive progress
Did you experience any discomfort or pain during our session today?	Mild discomfort	Less discomfort	Minimal discomfort	No discomfort	No discomfort
What activities or parts of the session did you find most beneficial?	Relaxation exercises	Strength exercises	Flexibility exercises	Mindfulness activities	Combined exercises
Have you noticed any improvements in your daily activities or overall functioning since our last session?	Slight improvements	Improved hand function	Better mobility	Easier daily activities	Much easier activities
Are there any new challenges or symptoms you have experienced since our last meeting?	Minor fatigue	Less fatigue	No new challenges	No new challenges	No new challenges
How are you feeling emotionally? Are there any changes in your mood or stress levels?	Less anxious	Mood improvements	More positive outlook	Reduced stress levels	Very positive mood
Do you have any questions or concerns about your treatment or recovery process?	Some concerns	Fewer questions	Clear understanding	No concerns	Completely confident
Are you comfortable with the pace and progression of your therapy?	Adjusting	More comfortable	Comfortable with pace	Very comfortable	Completely comfortable
What are your goals or hopes for the next session or in the coming weeks?	Building strength	Increasing mobility	Enhancing flexibility	Maintaining progress	Continuing improvements
Are you comfortable with the pace and progression of your therapy?	Adjusting	More comfortable	Comfortable with pace	Very comfortable	Completely comfortable

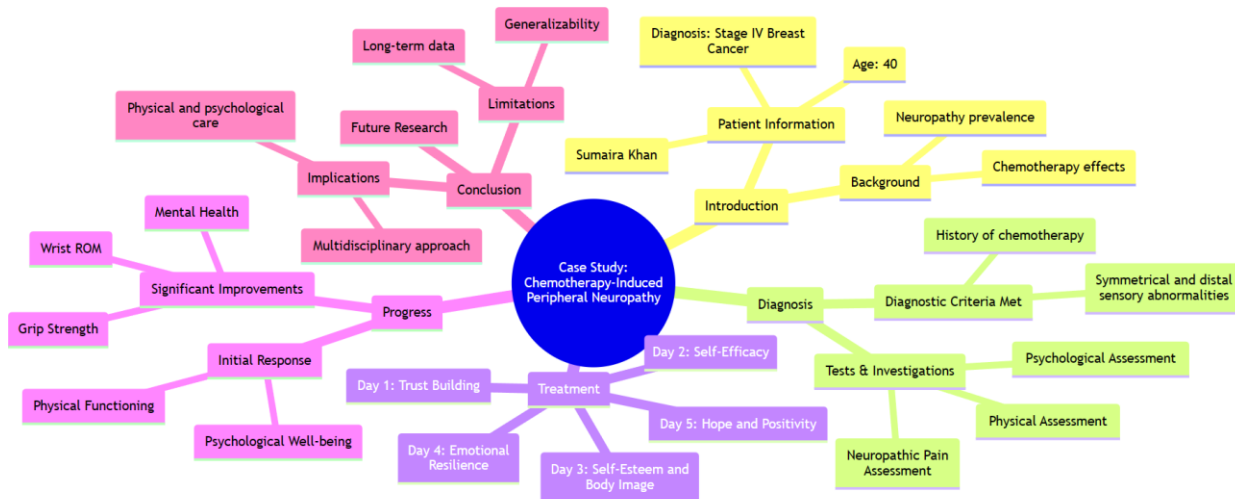


Figure 2 Theoretical Framework

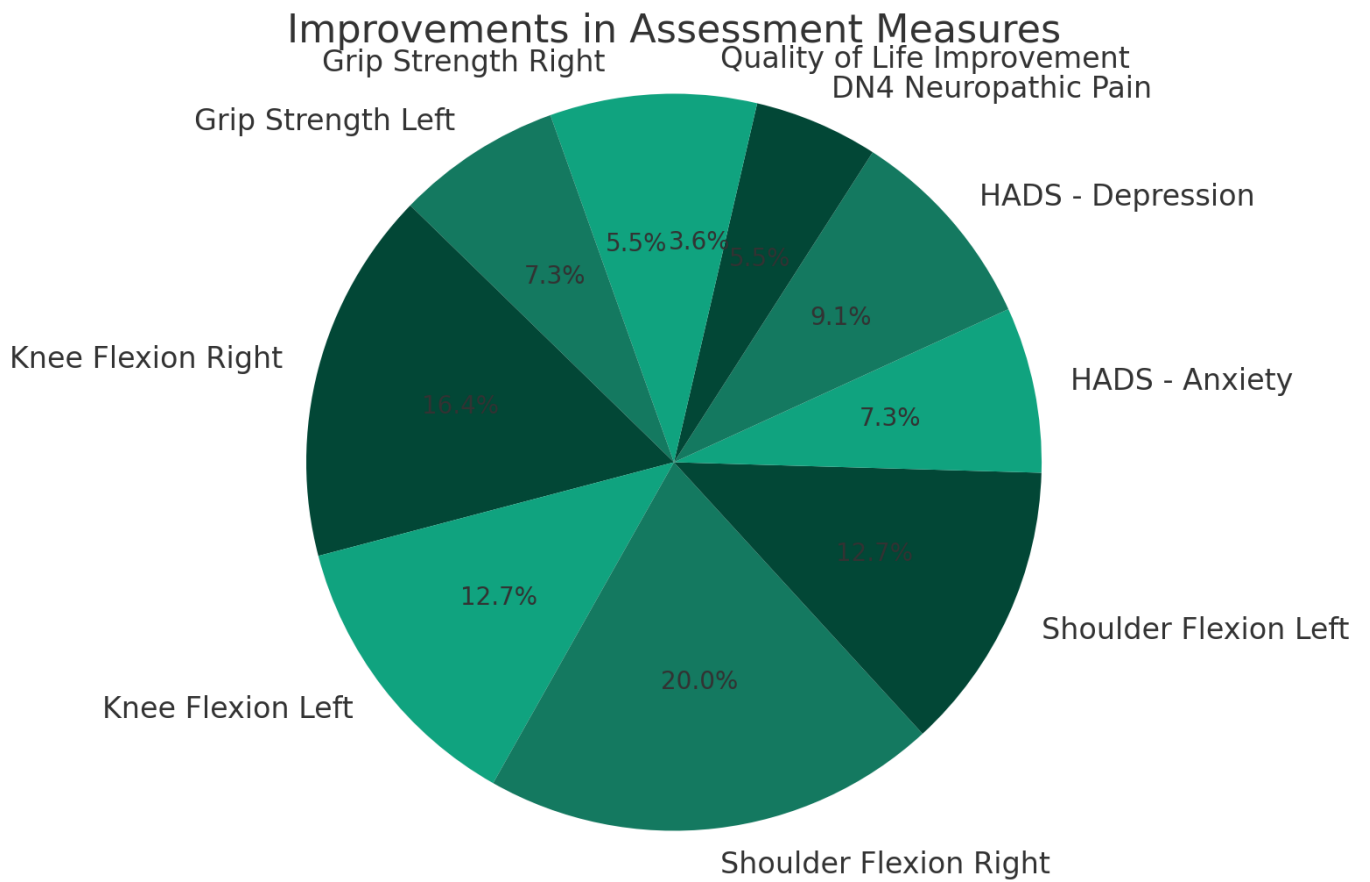


Figure 3 improvement in assessment measures

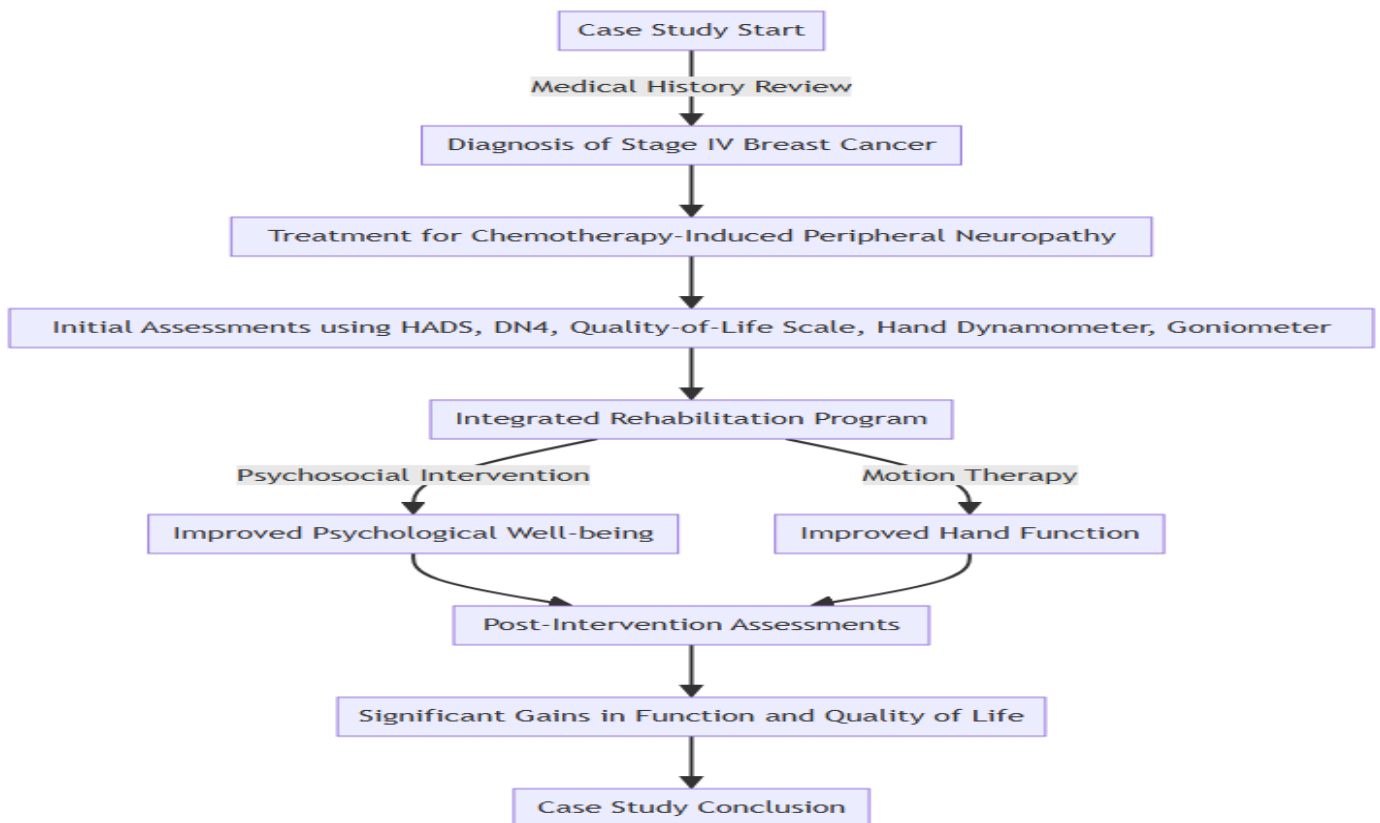


Figure 4 Schematic Methodology Flowchart

Feedback collected after each session further supports the effectiveness of the treatment. The patient reported progressive improvements in comfort, reduction in discomfort, and enhanced functionality in daily activities over the weeks. Emotional well-being also improved, with reduced anxiety and stress levels, leading to a very positive mood by the end of the fifth week. Importantly, the patient expressed increased confidence and comfort with the pace and progression of her therapy throughout the program (Figure 3).

These results underscore the benefits of a multimodal rehabilitation approach in managing both the physical and psychological aspects of CIPN in cancer survivors. The improvements in muscle strength, joint mobility, and psychological well-being not only contribute to better daily functioning but also enhance the overall quality of life, demonstrating the potential of integrated care programs in oncological rehabilitation.

DISCUSSION

The case of S.K, a 40-year-old female diagnosed with Stage IV breast cancer, highlights the complex challenges involved in managing chemotherapy-induced peripheral neuropathy (CIPN), a prevalent yet debilitating side effect of cancer treatments. This case is significant for illustrating the potential of a multimodal rehabilitation program to significantly improve outcomes for patients suffering from cancer-related neuropathies (8). The neurotoxic effects of chemotherapy, such as pain, numbness, and functional impairment, significantly affect patients' daily activities and quality of life. While it is documented that symptoms of CIPN might improve following the cessation of chemotherapy, persistent impairments can linger, emphasizing the need for specialized rehabilitative interventions (9).

In this context, the treatment administered to S.K involved a comprehensive biopsychosocial approach, integrating both mobility therapy and psychosocial support. The notable improvements in grip strength, knee and shoulder flexion, and reductions in both neuropathic pain and psychological distress validate the effectiveness of an integrated approach that addresses the multifaceted needs of patients with CIPN (10). Such findings align with a growing body of research advocating for multidisciplinary strategies that amalgamate physical and psychological therapies, critical for holistic cancer care (11).

This case also underscores the importance of diverse and regular assessments in cancer rehabilitation. Utilizing diagnostic tools like the hand dynamometer and goniometer for physical evaluations, alongside psychological and neuropathic assessments such as HADS and DN4, provided a comprehensive understanding of S.K's condition and the effectiveness of implemented therapies (5,6). These assessments allowed for precise monitoring of her progress and the ability to tailor interventions to her evolving needs.

However, the study presents limitations, including the lack of long-term follow-up data, which restricts the ability to evaluate the enduring benefits of the treatment and the potential for symptom recurrence. Additionally, the absence of detailed information regarding the specific chemotherapy regimen limits a thorough understanding of the relationship between the type and intensity of chemotherapy and the severity of CIPN. This case serves as a valuable example for healthcare practitioners, demonstrating the benefits of a multidisciplinary approach to cancer care that addresses both medical and psychological needs, potentially serving as a model for similar future interventions aiming to improve management practices for CIPN and enhance the overall care of cancer patients (18-20).

The significant findings from this case suggest that addressing both physical constraints and psychological challenges can optimize patient outcomes. This concurs with the perspective that effects of illness are interconnected rather than discrete. The instance emphasizes the importance of coordinated, specialized care from a diverse team of healthcare providers working collaboratively to meet all aspects of a patient's needs.

Nevertheless, further research is essential to overcome the inherent limitations of a single case study. Larger controlled trials are necessary to determine whether integrated rehabilitation consistently delivers significant, sustainable improvements compared to conventional therapy across a broader patient population with CIPN and related conditions. Longitudinal follow-up would help to delineate long-term outcomes and confirm that the benefits are maintained over time. Additionally, qualitative studies into patients' subjective experiences could further clarify the perceived impact on quality of life beyond quantitative measures (19, 20).

CONCLUSION

In conclusion, this case study provides promising preliminary evidence supporting the potential efficacy of integrated rehabilitation programs in alleviating symptoms of CIPN and enhancing the quality of life for cancer patients. The substantial improvements observed in S.K's case suggest that a multidisciplinary treatment approach, which addresses both physical and psychological aspects, may enhance overall patient outcomes. Continued research is required to validate these findings and to explore the utility of such integrated care models more broadly, potentially transforming the landscape of survivorship care in oncology by offering more personalized, comprehensive solutions that address the full spectrum of complications arising from cancer and its treatment.

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