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Restoring Movement Through Clinical Pilates: A Case Report in a Patient with Persistent Symptoms Following Lumbar Spine Surgery

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Abstract

Persistent pain, movement dysfunction, and functional limitations may remain after lumbar spine surgery despite correction of structural pathology, highlighting the need for rehabilitation approaches that support functional recovery. Clinical Pilates (CP) integrates breathing, postural alignment, neuromuscular retraining, and individualized exercise progression, yet evidence regarding its role in long-term postoperative spinal rehabilitation remains limited. This retrospective case report describes the ongoing rehabilitation of a 69-year-old female patient with degenerative lumbar spine disease, scoliosis, spinal stenosis, and previous lumbar spine surgery. Despite surgical intervention, the patient continued to experience persistent pain, postural dysfunction, muscular tension, movement limitations, and reduced functional capacity. An individualized Clinical Pilates program was implemented with a focus on movement restoration through postural organization, spinal decompression, motor control training, and progressive functional retraining. Over the course of rehabilitation, improvements were observed in movement quality, postural control, trunk stabilization, mobility tolerance, functional performance, and confidence in movement. The patient progressed from guarded movement patterns requiring frequent guidance to greater autonomy, coordination, and movement efficiency. A notable milestone was the recovery of previously unattainable lower-extremity movement sequences, suggesting restoration of complex motor control. These findings suggest that Clinical Pilates may serve as a comprehensive movement-based rehabilitation strategy capable of facilitating motor relearning and long-term functional recovery when postoperative limitations persist despite surgical intervention.

Keywords: Clinical Pilates; Lumbar Spine Surgery; Postoperative Rehabilitation; Motor Control; Movement Restoration; Functional Recovery; Spinal Rehabilitation

Introduction

Chronic low back pain (LBP) is one of the most prevalent musculoskeletal disorders, affecting up to 65% of adults, with approximately 90% of cases presenting without a clearly identifiable structural cause [1-3]. This high prevalence, combined with its multifactorial nature, highlights the limitations of approaches focused solely on structural pathology and underscores the need for rehabilitation strategies that address neuromuscular control, motor coordination, and cognitive-emotional factors.

The Pilates method, originally developed by Joseph Pilates under the concept of contrology, was conceived as an integrative approach to enhance the interaction between mind and body. Although initially described from a holistic perspective, current evidence supports its underlying premise, demonstrating that exercise can positively influence cognitive processes, particularly executive function. Within rehabilitation contexts, Clinical Pilates (CP) has evolved as a structured, evidence-informed approach emphasizing controlled movement, core stabilization, breathing, and postural alignment [4-7].

From a biomechanical standpoint, spinal stability depends on the coordinated activation of multiple muscle groups rather than a single dominant structure [8]. Accordingly, stabilization strategies are most effective when they involve the entire spinal musculature under varying conditions. CP aligns with this principle by promoting integrated neuromuscular activation and movement efficiency, often incorporating techniques such as drawing the navel toward the

spine to facilitate alignment and control [9]. Additionally, its use of directional preference, favoring pain-free or easily performed movements, supports individualized rehabilitation and improved motor coordination [10].

To better understand the potential mechanisms through which CP may influence low back pain and functional recovery, it is important to consider the biomechanical concept of spinal stability. Although no universal definition exists, spinal stability generally refers to the ability of the spine to maintain a controlled and functional position during both static and dynamic activities while minimizing excessive stress on spinal structures [11-13]. This stability is not dependent on a single anatomical component but rather emerges from the interaction of three interdependent systems: the Osseo ligamentous structures, the muscular system, and the neural control system, each of which can compensate for deficits in the others when necessary [14].

Within this framework, the concept of the "core" extends beyond isolated muscle strengthening and instead reflects the coordinated neuromuscular control required to maintain functional spinal stability [15]. Deficits in muscular strength, endurance, motor control, or movement coordination may permit excessive or poorly controlled spinal motion, potentially resulting in repetitive tissue loading, nociceptive stimulation, and pain generation.

Given this understanding of spinal biomechanics, it is not surprising that numerous studies have reported associations between impaired core muscle function, altered neuromuscular control, movement dysfunction, and the presence of low back pain. CP directly targets these domains through exercises designed to improve motor control, trunk stabilization, movement awareness, postural organization, and coordinated activation of the musculature responsible for maintaining functional spinal stability [15].

While surgical intervention is often necessary to address structural pathology in degenerative lumbar spine conditions, restoration of function is not guaranteed by surgery alone. Persistent pain, altered movement patterns, reduced physical capacity, and loss of confidence in movement may continue long after the surgical procedure. This case report describes the rehabilitation trajectory of a patient with persistent postoperative dysfunction and explores the potential role of CP as a movement-based strategy for restoring function, movement quality, and participation in daily life.

Methods

This retrospective case study was based on previously collected clinical, surgical, and rehabilitation records. The participant was a 69-year-old female with severe degenerative lumbar spine disease, scoliosis, and spinal stenosis who underwent multilevel lumbar surgery. Despite surgery, she continued to experience persistent low back pain, cervical discomfort, muscular tension, restricted mobility, and difficulty performing daily activities.

Intervention

Rehabilitation consisted of an individualized supervised CP program emphasizing controlled movement, spinal decompression, diaphragmatic breathing, core activation, postural alignment, and neuromuscular coordination. Exercises targeted trunk stabilization, lumbopelvic control, mobility, fascial release, and movement retraining. The program was continuously adapted according to symptom presentation, movement quality, and functional progression.

Data Collection and Analysis

Data were obtained retrospectively from medical records, rehabilitation notes, and documented clinical observations. Analysis focused on changes in movement quality, postural control, exercise tolerance, mobility, functional performance, and overall clinical progression.

Ethical Considerations

This study followed the ethical principles of the Tri-Council Policy Statement (TCPS 2, 2022) and PHIPA (2004). All data were de-identified prior to analysis, and ethical approval was obtained from the Swivero Research Ethics Committee.

Results and Discussion

This case describes the ongoing rehabilitation of a 69-year-old female with degenerative lumbar spine disease, scoliosis, spinal stenosis, and persistent symptoms following lumbar spine surgery performed approximately six years before rehabilitation. At presentation, movement was characterized by guarded motor behavior, excessive muscular tension, reduced mobility, and limited tolerance to functional activities.

The patient participated in an individualized CP-based rehabilitation program that remains ongoing at the time of manuscript preparation. No treatment-related adverse events were reported, supporting the feasibility of CP as a long-term rehabilitation approach in complex postoperative presentations.

Progressive improvements were observed in postural organization, trunk control, movement quality, and functional performance. Clinical observations documented reduced compensatory tension, improved sit-to-stand control, increased tolerance to spinal flexion and extension, enhanced pelvic and shoulder mobility, and greater movement autonomy. Over time, the patient progressed from requiring frequent manual guidance and verbal cueing to performing increasingly complex movement tasks with greater independence and control.

A particularly meaningful milestone was the patient's ability to independently perform lower-extremity circular movement sequences that had previously been unattainable. Approximately seven months of rehabilitation were required before this movement could be completed without compensatory muscular recruitment, suggesting restoration of coordinated motor control rather than isolated improvements in strength or flexibility.

The most notable finding was the progressive recovery of movement capacity despite longstanding postoperative dysfunction. Improvements extended beyond mobility and included enhanced motor control, postural organization, and confidence in movement. These observations support the concept that recovery after spinal surgery requires more than structural correction alone. Persistent impairments in movement control and function may benefit from rehabilitation approaches that integrate neuromuscular retraining, breathing, postural control, and progressive movement exposure.

The patient's sustained engagement and continued progression throughout rehabilitation further highlight the potential value of CP in chronic spinal conditions, where recovery often extends beyond traditional rehabilitation timelines. Taken together, these findings suggest that CP may serve as a comprehensive movement-based rehabilitation strategy aimed at restoring functional movement capacity and supporting long-term recovery after spinal surgery.

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