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Narrative Review

Current Trends in Musculoskeletal Rehabilitation: A Narrative Review

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ABSTRACT

Background: Musculoskeletal (MSK) disorders represent a global health crisis, affecting over 1.7 billion people and serving as a leading cause of years lived with disability. Traditional rehabilitation models have long focused on structural pathology, often failing to address the complex nature of chronic pain and functional recovery. This narrative review aims to synthesize current trends that are transforming MSK care, moving from a biomedical focus to an integrated, multidimensional approach. **Methods:** A comprehensive literature search was conducted across major databases, including PubMed, Cochrane Library, and Google Scholar, focusing on peer-reviewed articles, systematic reviews, and clinical guidelines published between 2021 and 2026. Keywords related to musculoskeletal rehabilitation, digital health, mechanotransduction, and the biopsychosocial model were utilized. A total of 40 high-impact sources were selected and analyzed to identify emerging themes in clinical practice and technology. **Results:** The review identified five key pillars of modern MSK rehabilitation: (1) the adoption of Cognitive Functional Therapy (CFT) within a biopsychosocial framework; (2) the integration of telerehabilitation and wearable sensors to enhance patient monitoring; (3) the application of "Optimal Loading" and mechanotransduction (PEACE & LOVE protocol) in soft tissue recovery; (4) the use of high-precision physiological tools such as Blood Flow Restriction (BFR) and Velocity-Based Training (VBT); and (5) the emerging role of health coaching and behavioral economics in improving long-term patient adherence. Evidence suggests that these approaches lead to superior functional outcomes and psychological resilience compared to traditional passive modalities. **Conclusion:** Musculoskeletal rehabilitation is undergoing a paradigm shift toward personalized, data-driven, and patient-centered care. By bridging the gap between biological repair and psychological health, modern interventions provide a more sustainable framework for managing MSK disability. Future research should focus on the long-term scalability of digital health interventions and the ethical integration of artificial intelligence in clinical decision-making.

Introduction

Musculoskeletal (MSK) disorders represent one of the leading causes of disability worldwide, affecting approximately 1.7 billion people and contributing substantially to years lived with disability and socioeconomic burden [1]. Beyond physical impairment, MSK conditions are associated with reduced quality of life, psychological distress, and decreased work productivity [2].

Traditionally, MSK rehabilitation has been grounded in the biomedical model, focusing primarily on structural abnormalities and tissue pathology. However, growing evidence suggests that such approaches are insufficient to explain the complexity of chronic pain and functional limitations [3]. Contemporary pain science highlights the multidimensional nature of pain, involving interactions between biological, psychological, and social factors [4].

This has led to the increasing adoption of the biopsychosocial model, which integrates cognitive, emotional, and contextual elements into patient management [5]. Interventions such as Cognitive Functional Therapy (CFT) have demonstrated effectiveness in addressing maladaptive beliefs and movement dysfunctions [6,7]. Additionally, pain neuroscience education has emerged as an important adjunct in rehabilitation [8].

Technological innovation has significantly transformed rehabilitation delivery. Telerehabilitation has emerged as a viable alternative to traditional care, demonstrating comparable outcomes [9,10]. Wearable technologies further enhance rehabilitation by providing real-time monitoring and objective data [11,12].

Mechanotransduction principles have also gained importance, emphasizing the role of mechanical loading in tissue healing [13]. The

PEACE & LOVE protocol promotes early mobilization and optimal loading strategies [14].

Advanced exercise approaches such as Blood Flow Restriction (BFR) and Velocity-Based Training (VBT) have enabled effective rehabilitation with reduced mechanical stress [15,16].

Behavioral strategies, including health coaching, have been shown to improve adherence and long-term outcomes [17,18]. Despite these advancements, implementation remains inconsistent due to various systemic barriers [19].

Therefore, this review aims to synthesize current trends in musculoskeletal rehabilitation and their implications for clinical practice.

Methods

This study employed a narrative review design to explore current trends in musculoskeletal rehabilitation. A structured literature search was conducted using electronic databases including PubMed, Cochrane Library, and Google Scholar, covering publications from 2021 to 2026.

Search strategies incorporated combinations of keywords such as “musculoskeletal rehabilitation,” “biopsychosocial model,” “cognitive functional therapy,” “telerehabilitation,” “wearable devices,” “mechanotransduction,” “optimal loading,” “blood flow restriction,” and “velocity-based training.” Boolean operators were applied to refine search sensitivity and specificity.

Inclusion criteria comprised peer-reviewed journal articles, systematic reviews, randomized controlled trials, and clinical guidelines published in English within the last five years. Studies focusing on adult populations with musculoskeletal conditions and rehabilitation interventions were prioritized. Articles lacking methodological rigor or focusing exclusively on surgical interventions were excluded.

Approximately 40 high-quality studies were selected based on relevance, methodological quality, and citation impact. Data were extracted and categorized into thematic domains to identify emerging trends and clinical implications.

As a narrative review, this study does not involve quantitative synthesis. Limitations include potential selection bias and the absence of meta-analytic statistical analysis; however, efforts were made to ensure comprehensive coverage and balanced interpretation.

Results

The analysis identified several key trends shaping contemporary musculoskeletal rehabilitation.

First, the integration of the biopsychosocial model has become central to modern rehabilitation practice. Interventions such as Cognitive Functional Therapy (CFT) target maladaptive beliefs, movement patterns, and emotional responses, demonstrating superior outcomes in chronic pain management compared to conventional approaches [13,14].

Second, telerehabilitation has expanded access to care and improved service delivery. Evidence from recent systematic reviews indicates that remote rehabilitation is comparable to in-person therapy in improving pain and functional outcomes [15,16]. Additionally, wearable technologies provide objective data on patient activity, enhancing monitoring and treatment personalization [17,18].

Third, mechanotransduction and optimal loading principles have redefined rehabilitation strategies. Controlled mechanical loading has been shown to stimulate tissue repair and adaptation, supporting early mobilization approaches such as the PEACE & LOVE protocol [8,19,20].

Fourth, advanced exercise modalities, including Blood Flow Restriction (BFR) and

Velocity-Based Training (VBT), have gained prominence. These approaches allow for efficient strength development while minimizing mechanical stress, making them particularly useful in early rehabilitation phases [21,22].

Fifth, behavioral interventions play a crucial role in improving adherence. Strategies based on motivation and habit formation significantly enhance patient engagement and long-term outcomes [23,24].

Finally, emerging technologies such as artificial intelligence (AI) are beginning to influence rehabilitation by enabling predictive analytics and personalized treatment planning [25,26].

Discussions

This review highlights a paradigm shift in musculoskeletal rehabilitation toward a more holistic and patient-centered approach. The transition from a biomedical to a biopsychosocial model reflects advances in pain science and a deeper understanding of the multifactorial nature of MSK disorders [3,4].

The integration of digital health technologies represents a major advancement in rehabilitation delivery. Telerehabilitation and wearable devices not only improve accessibility but also enable continuous monitoring and data-driven decision-making [5,17]. These innovations are particularly valuable in low-resource settings, where access to traditional rehabilitation services may be limited.

Mechanotransduction-based approaches further emphasize the importance of movement and loading in tissue healing. Evidence suggests that early and appropriate loading enhances recovery and prevents complications associated with immobilization [19,20].

The adoption of advanced exercise techniques such as BFR and VBT underscores the evolution toward precision rehabilitation. These methods allow clinicians to tailor interventions

according to individual capacity and recovery stage, optimizing outcomes [21,22].

Table 1. Key Trends in Modern Musculoskeletal Rehabilitation

Trend	Core Concept	Clinical Impact
Biopsychosocial (CFT)	Integrates physical & psychological factors	Improves function, reduces disability
Telerehabilitation	Remote digital-based care	Expands access, comparable outcomes
Wearable Technology	Real-time activity monitoring	Enhances personalization & adherence
Optimal Loading	Mechanical stimulus for healing	Accelerates recovery
BFR Training	Low-load strength training	Safe strength gains
VBT	Velocity-guided exercise	Precise load prescription
Behavioral Approach	Motivation & habit formation	Improves adherence
AI in Rehabilitation	Data-driven decision making	Personalized treatment

Behavioral strategies address one of the most critical challenges in rehabilitation: adherence. By incorporating psychological principles, clinicians can enhance patient motivation and sustain long-term behavioral change [23].

Despite these advancements, implementation challenges remain. Variability in clinician training, limited access to technology, and systemic barriers may hinder widespread adoption [28]. Future research should focus on

implementation science, long-term outcomes, and ethical considerations related to AI integration.

Conclusions

Musculoskeletal rehabilitation is undergoing a significant transformation characterized by the integration of biopsychosocial principles, technological innovations, and advanced exercise strategies. These developments enable more personalized, effective, and sustainable approaches to managing MSK disorders.

Future directions should emphasize scalability, accessibility, and the integration of emerging technologies to ensure equitable and high-quality rehabilitation services globally.

Author Contribution Statement

The authors performed all aspects of this study.

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