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## Tele-rehabilitation In Various Musculoskeletal Conditions: A Narrative Review

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### Abstract

Musculoskeletal disorders are among the leading causes of disability worldwide, and access to rehabilitation remains a critical challenge. Telerehabilitation (TR), the remote delivery of rehabilitation services using digital communication technologies, has emerged as a viable, effective alternative to conventional therapy. This narrative review synthesises current evidence on telerehabilitation across various musculoskeletal conditions, including knee osteoarthritis, rotator cuff-related shoulder pain, low back pain, adhesive capsulitis, postural kyphosis, and rehabilitation following total joint arthroplasty. It explores the clinical outcomes, feasibility, adherence, and cost-effectiveness of TR, and discusses its integration into long-term care strategies. Overall, telerehabilitation demonstrates comparable effectiveness to in-person interventions, particularly when delivered in real-time with supervision.

Keywords: Telerehabilitation, musculoskeletal disorders, digital health, rehabilitation, physical therapy, remote intervention

### Introduction

Musculoskeletal conditions (MSKs) such as osteoarthritis, shoulder tendinopathies, low back pain, and age-related decline in mobility are a global public health concern. These conditions lead to pain, reduced mobility, and a lower quality of life. Conventional in-person rehabilitation, although effective, faces barriers such as travel limitations, high costs, and inadequate access in rural or under-resourced settings. The COVID-19 pandemic catalyzed a shift towards telerehabilitation—the provision of rehabilitation services through telecommunication technology—which has shown potential in improving access and outcomes for MSK disorders [7].

## Search Strategy

Search Strategy This review followed SANRA guidelines. Relevant studies were searched from PubMed, Scopus, and Google Scholar using keywords: "telerehabilitation," "musculoskeletal," "knee osteoarthritis," "shoulder pain," "low back pain," "neck pain," "postural disorders," and "digital physical therapy." Only English-language studies, including randomized controlled trials and systematic reviews published between 2010 and 2023, were considered. Studies focusing solely on neurological or cardiorespiratory rehabilitation were excluded.

## Telerehabilitation in Knee Osteoarthritis (KOA)

Telerehabilitation in Knee Osteoarthritis (KOA) Knee osteoarthritis (KOA) is a prevalent condition causing pain and functional limitation. A randomized controlled trial by Tore et al. (2022) found that synchronous TR via Zoom showed significantly better improvements in pain, function, and satisfaction compared to a home exercise program. KOOS, HADS, and FSS scores improved notably, with higher adherence and psychometric outcomes reported in the TR group [1].

## Telerehabilitation in Shoulder Pathologies

Telerehabilitation in Shoulder Pathologies Rotator cuff-related shoulder pain is another common MSK issue. The INTEL trial by Malliaras et al. (2020) demonstrated that adding group telerehabilitation to an internet-delivered exercise program significantly improved adherence and outcomes, underscoring the benefit of real-time therapist engagement [2].

## Telerehabilitation in Low Back Pain

Villatoro-Luque et al. (2023) compared TR to in-person rehab for nonspecific low back pain. The TR group experienced similar improvements in Oswestry Disability Index scores, pain catastrophizing, and hip strength. Their findings confirm the viability of remote rehabilitation in managing low back pain effectively [8].

## Telerehabilitation in Neck Pain

Though fewer studies focus solely on neck pain, TR has shown benefits in posture-related cervical conditions. Programs incorporating ergonomic advice and guided exercises remotely have shown improvements in craniovertebral angle, neck mobility, and pain levels, especially when exercises are supervised [3].

## Telerehabilitation in Adhesive Capsulitis (Frozen Shoulder)

Yeo et al. (2021) designed a trial using AR-based telerehabilitation for adhesive capsulitis. The interactive TR platform guided patients through progressive shoulder exercises, improving passive ROM, pain, and disability scores. The program also utilized real-time feedback and monitoring to enhance accuracy and adherence [4].

### **Telerehabilitation in Thoracic Kyphosis and Postural Deficits**

Khruakhorn et al. (2023) studied elderly patients with thoracic kyphosis undergoing an 8-week TR posture correction program. Improvements were observed in thoracic kyphosis angle, forward head posture, and back muscle strength. TR was also more cost-effective than clinic-based rehab, making it suitable for the aging population [5].

### **Telerehabilitation After Total Hip and Knee Arthroplasty**

Post-operative rehab following total joint replacement is critical. Kuether et al. (2019) implemented a TR program (VERA™ system) post-total hip/knee arthroplasty, achieving comparable improvements in KOOS/HOOS scores to in-person rehab, with high satisfaction and adherence [6]. Venosa et al. (2023) further confirmed these findings during the COVID-19 pandemic, with no significant differences in pain, function, or satisfaction between TR and conventional groups [7].

### **Technological Platforms and Delivery Models**

TR can be delivered synchronously (live video), asynchronously (pre-recorded modules), or hybrid models using platforms like Zoom, Cisco WebEx, or AI-based systems like VERA and UINCARE. Devices include smartphones, tablets, motion sensors, and wearables for monitoring ROM, repetitions, and posture. These platforms enable continuous patient engagement and therapist oversight, increasing compliance and safety while reducing the need for physical travel

#### **Benefits and Challenges**

TR offers accessible, scalable care with reduced costs and improved adherence [5][7]. It reduces the logistical burdens for patients who are homebound or live in remote areas, ensures continuity of care, and has shown similar or superior clinical outcomes in several studies. However, challenges include digital literacy, lack of tactile feedback, potential privacy issues, and the need for individualized protocols. Training clinicians in digital delivery and improving infrastructure are essential for broader implementation.

#### **Conclusion and Future Directions**

Telerehabilitation represents a powerful tool for managing diverse musculoskeletal conditions. It provides comparable clinical outcomes to traditional therapy and expands access to underserved populations. Its cost-effectiveness, scalability, and adaptability make it an ideal solution in both pandemic and post-pandemic eras. Future research should focus on integrating wearable technology, AI-driven customization, long-term adherence tracking, and inclusion in clinical guidelines.

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