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Effectiveness of telerehabilitation in musculoskeletal conditions: A review

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Increasing demand for healthcare services related to musculoskeletal conditions, few physical therapists, and healthcare disparity in rural and remote areas necessitates a paradigm shift in healthcare delivery. A few studies encourage the adoption of telerehabilitation which proved a preferred alternative during COVID-19 pandemic. Despite that, there are questions about telerehabilitation efficacy as a physical therapy intervention in musculoskeletal conditions, and thus, this narrative article sought to review the current available literature on telerehabilitation's efficacy in managing musculoskeletal conditions. Telerehabilitation improved quality of life, pain management, decreased painkillers' intake and surgery intent, and enhanced functions in patients with musculoskeletal conditions. Telerehabilitation also was comparable to standard care in the assessment of knee issues; however, it took longer, and patients had problems self-palpating. Evidence also reveals telerehabilitation show significant differences between usual care in the management of patients who had undergone total hip replacement. Telerehabilitation resulted in improved physical function after total hip arthroplasty. Cost-wise, the intervention resulted in fewer resources in a population with lower-limb joint replacement; however, the effect was significant if the patients traveled more than 30 km to access a healthcare facility. Telerehabilitation decreased surgery intent, presenteeism, fear and avoidance, anxiety, and depression. Irrespective, the evidence on the efficacy of telerehabilitation is inconclusive because of low-quality evidence, lack of blinding and randomization, increasing bias, small sample sizes, and lack of homogenous samples making comparability difficult. Hence, it is essential to conduct further studies considering the shortcomings mentioned in this review.

Keywords: Back pain, standard care, telehealth, telemedicine, physical therapy, review

INTRODUCTION

Musculoskeletal (MSK) injuries are highly prevalent and are common among working-age adults and sports (Costa et al. 2022). From 2014 to 2016, MSK attributed to about 4.2 million visits to emergency rooms (Costa et al. 2022). MSK pain is classified as acute or chronic pain that affects nerves, tendons, muscles, ligaments, and bones (El-Tallawy et al. 2021). The condition's pain can be due to a negative cascade of psychological, social, and physical consequences leading to chronic pain (Vos et al. 2020). The latest global burden of diseases study (GBD) published in 2019 that included 204 countries and territories worldwide highlighted the enormous global burden of low back pain (LBP) (Vos et al. 2020). The GBD 2019 study concluded that LBP is the leading cause of years lived with disability ranking number one for contributions to years lived with disability ahead of 369 other diseases and injuries. LBP was estimated to be responsible for 2.5% of global disability-adjusted life years (DALYs) and other MSK disorders were accountable for 1.6% of global DALYs (Vos et al. 2020). Data shows that about 31% of patients suffering from LBP do not recover within six months, and almost half of the patients with acute knee health issues have long-term problems (Costa et al. 2022).

Inadequately managed MSK pain can progress to chronic stage that can be challenging to manage (El-Tallawy et al. 2021). Thus, it is essential to offer appropriate intervention to manage acute and subacute stages to minimize the probability of chronification of the pain. Timely intervention results in the prevention of long-term disability and lowering associated costs (Malik, Beckerly, & Imani, 2018). However, it is challenging to access timely interventions due to transport, physical mobility issues, and limitations of physical therapists. Hence, some propose the adoption of telehealth-based interventions "telerehabilitation", which has shown positive or comparable results to face-to-face rehabilitation (Bucki, Clay, Tobiczyk, & Green, 2021). Irrespective, a lack of consensus on the effectiveness of the approach necessitates reviewing evidence about the intervention and its clinical feasibility.

Telerehabilitation is a subfield of telehealth, and it is in its early stages. Utility of telerehabilitation is evolving, and

it refers to medical or rehabilitative services delivered to individuals with rehabilitation needs remotely using different communications modalities (Brennan, Mawson, & Brownsell, 2009). Telerehabilitation is delivered without or with very limited conventional face-to-face interactions with a therapist (Lord Ferguson, 2022). Undoubtedly, the onset of COVID-19 pandemic limited interaction leading to a paradigm shift in managing patients since visiting a healthcare professional may increase the risk of COVID-19 exposure (Sun, Lu, Xu, Sun, & Pan, 2020). The Word Confederation for Physical Therapy persuaded physical therapists to enhance the safety of their patients by postponing non-urgent treatments, resulting in bewilderment among practitioners who find the recommendation to limit their practice and patients living with disability and pain. Hence, the Word Confederation for Physical Therapy issued a statement encouraging telerehabilitation adoption (Turolla, Rossettini, Viceconti, Palese, & Geri, 2020). The COVID-19 pandemic was a major catalyst for telerehabilitation adoption (Bucki, Clay, Tobiczyk, & Green, 2021; Lord Ferguson, 2022). The new approach deviates from manual therapy where the physical therapist adopts hands-on skills that encompass therapeutic exercises and education to restore patients' functional capabilities and self-efficacy. Telerehabilitation involves delivering rehabilitation services consultation, speech therapy, occupational therapy, physical therapy, and patient monitoring using telecommunication technologies such as smart- tele- phones, mobile applications, websites, videoconferencing, and virtual reality, offering assistance to home or bed-bound patients without physical interaction with therapists (Agostini et al. 2015; Bucki, Clay, Tobiczyk, & Green, 2021). Therefore, the purpose of this narrative review was to summarize the available literature on the telerehabilitation's efficacy in managing musculoskeletal conditions. This review outlines current evidence that analyzes the effectiveness of telerehabilitation by physical therapy.

DISCUSSION

Telerehabilitation as a Physical Therapy Intervention

Telerehabilitation among surgery patients targeting motor functions resulted in a significant positive effect in patients with total knee arthroplasty (TKA) (Agostini et al. 2015; Richardson, Truter, Blumke, & Russell, 2017). A Timed Up and Go (TUG) test revealed that patients exposed to telerehabilitation improved 6.5 seconds better than ones treated routinely; however, the difference was not clinically significant (Agostini et al. 2015). Cottrell, Galea, O'Leary, Hill, and Russell (2017) noted that some studies supported that there was no favorable form of intervention in the rehabilitation among telerehabilitation (videoconferencing and telephone) and telerehabilitation matched with usual care in the management of TKA. Irrespective, some studies opposed that position and held that adopting the two forms of interventions resulted in significantly improved outcomes. Cottrell et al. (2017) concluded that telerehabilitation (video conferencing) was not inferior to usual care in TKA and that the intervention was viable in managing musculoskeletal conditions.

Further, Jiang, Xiang, Gao, Guo, and Liu (2018) revealed that telerehabilitation resulted in comparable outcomes to face-to-face therapy in pain management among TKA patients. Jiang et al. (2018) pointed out that the intervention significantly improved Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores than face-to-face encounters. They added that there was statistical significance in the difference between telerehabilitation and face-to-face encounters in quadriceps strength and change in extension range; however, there was no statistical difference in the active flexion range. Grona et al. (2018) and Shukla, Nair, and Thakker (2017) corroborated that patients were satisfied with telerehabilitation (video conferencing), and Grona et al. (2018) reported that the intervention improved patient function with TKA for short-term assessment, not long-term ones. The intervention was considered non-inferior to usual care and encouraged for patients living in remote and rural areas suffering from knee issues.

Shukla et al. (2017) hold that telerehabilitation did not differ significantly from the control group when considering knee flexion and active extension changes and resulted in high patient satisfaction. The study also revealed that telerehabilitation did not result in inferior functional status improvement and physical activity outcomes than the conventional therapy group. Wang, Hunter, Vesentini, Pozzobon, and Ferreira (2019) pointed out that telerehabilitation compared to usual care was more effective in improving function and reducing pain among patients who underwent TKA at three months follow up: However, the effect sizes were small, and the quality of evidence was moderate and very low, and thus, the results were not clinically significant. Wang et al. (2019) argued that a 6-minute walking test reveals that telerehabilitation is not superior for managing patients with TKA at follow-up of 2 to 3 months compared to usual care; however, the evidence's quality was very low.

Similarly, Jansson, Rantala, Miettunen, Puhto, and Pikkarainen (2022) maintained that telerehabilitation did not significantly differ from conventional care in influencing change in passive or active knee extension, flexion, range of motion, and isometric or quadriceps strength. Also, there were no differences in clinical gait, limb girth, chair stand test, change in pain, timer stair test, and Knee injury and Osteoarthritis Outcome Score (KOOS) in a population with lower-limb joint replacement. Nonetheless, Jansson et al. (2022) pointed out that telerehabilitation exhibited significant differences from conventional care in patient-specific functional scale, WOMAC score, Harris hip score, and quality of life.

Costa et al. (2022) indicated that a reduction in pain was faster in the first four weeks, but it is essential to know that there were more patients suffering from neck pains than

those with low back and hip problems. In addition, Costa et al. (2022) pinpointed that patients under the remote digital care program had an 81.9% reduction in the consumption of painkillers on average per week. While surgery intent decreased on average by 62.7%, patients with high body mass index (BMI) showed a higher willingness to pursue surgery options. In managing the pain, Cottrell et al. (2017) pinpointed that over time, neither form of intervention nor telerehabilitation was favorable, and there was no difference between the groups exposed to telerehabilitation alone and with usual care in the management of pain among the population with musculoskeletal conditions.

Dario et al. (2017) supported that telerehabilitation (phone calls, email discussions, mobile website, and online chat group, or combination) in managing non-specific LBP for a period of 35 weeks to 1-year relative to usual care cannot be regarded as more effective than minimal interventions in managing chronic LBP or reducing disability. Irrespective, some studies do support that the combination of usual care and telehealth in reducing disability is superior to standard care alone for the period under study (Dario et al. 2017). Dario et al. (2017) added that telehealth, combined with other interventions, is superior in improving functionality among people suffering from acute and subacute LBP. Notably, telehealth did not affect the functionality of people suffering from chronic LBP. Nevertheless, it has a superior impact on improving the quality of life (Turolla et al. 2020).

Nicholl et al. (2017) reported mixed results on the impact of digital intervention in managing patients with chronic LBP; some studies did not show any benefit, while others showed that digital intervention favors self-efficacy. Subsequently, Nicholl et al. (2017) supported that digital intervention improves self-care. Heapy et al. (2015) argued that different technologies (internet, interactive voice response, and telephone) were effective in improving chronic pain self-management in adults and none of the modalities proved superior. Cottrell et al. (2017) revealed that there was no difference in significant improvement in self-efficacy in the management of arthritis whether the group was exposed to stand-alone education sessions or weekly telephone intervention and one-off education sessions. Subsequently, Cottrell et al. (2017) highlighted that physical therapy delivered in usual care and telerehabilitation among individuals with knee osteoarthritis significantly improved psychological and physical domains, but not social domains. Schäfer, Zalpour, von Piekartz, Hall, and Paelke (2018) argued that e-health exercise interventions greatly impacted pain management in the short term; however, for long-term management, the effect was small among patients suffering from knee osteoarthritis.

Additionally, the exercise intervention showed small but favorable physical function results for the group exposed to e-health exercise interventions for a period between 9 and 12 months (Schäfer et al. 2018). The researchers added that the intervention favors the improvement of quality of life (small significant effect) in a follow-up done between 3 to 6 months and 9 to 12 months. Notably, the quality of evidence to determine the impact of the intervention on long-term outcomes concerning pain was moderate, while the one for quality of life and physical functioning was high. However, the quality of evidence for short-term results was moderate for quality of life and low for physical function and pain (Schäfer et al. 2018).

Srikesavan, Bryer, Ali, and Williamson (2019) reported that the web-based interventions showed a non-significant impact in managing pain compared to a waiting list in short and medium terms among rheumatoid arthritis patients. The researchers also indicated that web-based programs had no significant difference in improving function in the long run compared to usual care. Further, the results showed that web-based programs result in small but non-significant differences with waiting list cohorts in short or medium terms. In enhancing self-efficacy, results were inconclusive as some trials favor web-based interventions in managing rheumatoid arthritis compared to the waiting list group in the short and medium term, while others did not (Srikesavan et al. 2019).

In addition, there was no difference between the intervention and usual care for the group undergoing total hip arthroplasty (Shukla et al. 2017). Cottrell et al. (2017) indicated that two randomized clinical trials (RCTs) did favor the adoption of telerehabilitation over routine care in the management of total hip arthroplasty as it was associated with physical function improvement. Pastora-Bernal, Martín-Valero, Barón-López, and Estebanez-Pérez (2017) agreed with Cottrell et al. (2017) that telerehabilitation results in positive outcomes in the management of the hip but caution that the evidence for upper limb intervention was weak or moderate.

Patients suffering from musculoskeletal problems did not significantly exhibit absenteeism; however, presenteeism was significantly decreased by 81.4% among the intervention group (Costa et al. 2022). Additionally, Costa et al. (2022) stated that fear and avoidance scores decreased by 39.5%. Participants who showed symptoms of depression and anxiety at onset improved over time, reducing anxiety by 54.2%, while depression dropped by 58.2% (Costa et al. 2022). Further, Joice, Bhowmick, and Amanatullah (2017) reported that patients receiving care at home spent fewer resources than those in post-acute facilities. Jansson et al. (2022) noted that telerehabilitation significantly reduced health care costs, in-person outpatient therapies, and office calls compared to conventional treatment in a population with lower-limb joint replacement. However, the variance in health care costs was meaningful when patients traveled more than 30 km to a health care facility. Home-based intervention is an efficient and viable alternative to outpatient rehabilitation, considering the cost implication

and unreported differences between the two interventions (Joice et al. 2017).

Telerehabilitation Assessment Effectiveness

Richardson et al. (2017) supported that telerehabilitation can successfully facilitate the musculoskeletal evaluation of the knee. The study showed that telerehabilitation had high validity as the mode of treatment and a high level of agreement with diagnoses conducted in face-to-face encounters. The study revealed that the impacts of telerehabilitation in the immediate management of swelling, pain, and functional movement restoration would be similar to face-to-face intervention. The intra and inter-rater reliability for digital rehabilitation assessment were significant, with 89% and 67% agreement, respectively (Richardson et al. 2017). The high validity and reliability imply that any differences in the mode of treatment (telerehabilitation and physical interaction) may be due to issues such as therapists' skills, clinical reasoning, and patient performance difference as opposed to the technology per se.

Richardson et al. (2017) found that telerehabilitation makes it challenging to conduct palpation, but the therapist encouraged participants to self-palpate; however, the challenges were palpating posterior knee structures. Participants had difficulties testing anterior cruciate ligament patency, irrespective of "biomechanical frame by frame analysis," and functional testing aided in the successful diagnosis of the telerehabilitation system. Despite the success of telerehabilitation, some challenges were noted, such as online examinations taking more time than physical contact interactions. Of course, more time was spent on self-palpitation, explaining positioning, and qualifying the findings. Similarly, there were technical failures resulting in the interruption of the telerehabilitation sessions, which may have impacted the patient's confidence in the mode of treatment (Richardson et al. 2017).

Challenges to Telerehabilitation

When offering physical therapy, it is essential to provide different therapeutic modalities (proxemics and touch) depending on the type of impairment which may not be possible when offering remote care. Moreover, the mode of care is limited by internet coverage and complimentary devices needed to provide such care. Subsequently, the practice faced challenges due to a lack of sufficient evidence to support its efficacy as common research materials were qualitative synthesis which is not a potent form of clinical evidence (Turolla et al. 2020). Other features commonly crucial in the healing rituality miss when rehabilitation is done remotely (Sun et al. 2020). For instance, concepts such as interaction with other patients, the smell of cream, the therapy table, and physical modalities' noises are conspicuously missing at home. Assuming that care is not only physical but psychological, the absence of such may underrate the therapeutic encounter (Sun et al. 2020). Accordingly, remote rehabilitation excludes key processes crucial in diagnosis; for instance, telerehabilitation does not encompass special tests and palpation, which may result in missing significant red flags. Hence, contact is essential when dealing with patients with complex clinical problems mandating high-intensity care (Sun et al. 2020). One cannot underrate the significance of equipment barriers such as weights, medical balls, and elastic bands limiting therapeutic solutions possible in remote care.

Further, Nicholl et al. (2017) argued that most studies assessing the impact of digital interventions in the management of LBP utilize a study population predominately consisting of a well-educated, white, female, and middle-aged cohort; therefore, the results may not be generalizable. Additionally, Pastora-Bernal et al. (2017) reported that telerehabilitation may show a higher effect than other high-quality studies because it lacks adequate blinding procedures. Nonetheless, it is impossible to blind patients in the administration of telerehabilitation interventions. Patients in telerehabilitation are in frequent contact with therapists and are likely to receive additional services. Therefore, assessing whether the positive outcomes are due to the telerehabilitation approach or other associated initiatives is problematic.

Future Direction

Grona et al. (2018) recommend that future studies discussing the effectiveness of telerehabilitation in managing musculoskeletal conditions should address validity and reliability arising from inclusion criteria, participants' selection, and the assessment methodology. Future studies need to include control groups and adopt randomization. Nicholl et al. (2017) recommend adopting a diverse and broad range of participants. They also add that digital interventions' efficacy depends on the modality adopted; as a result, future RCTs should investigate which forms result in more positive outcomes in the self-management of LBP.

Telerehabilitation can be supplemented or enriched by contextual factors such as clear instructions, paraphrasing, expression of support, language reciprocity, and astute nonverbal communication (open body posture, eye contact, and affirmative nodding) costumed to the patient's profile (Sun et al. 2020). It implies that when offering telerehabilitation, therapists must plan the tools necessary for engaging in therapeutic exercise and deliver them to patients' homes (Sun et al. 2020). Moreover, telerehabilitation is prone to medico-legal issues, and patients must be assured of privacy and data protection consistent with deontological codes and principles. Therapists should work with lawyers, information technologists, and communication professionals to enhance the delivery of competent, accountable, and honest services (Sun et al. 2020). While telerehabilitation may not be effective in the long-term management of TKA,

it can be supplemented with face-to-face sessions (Dario et al. 2017).

Moreover, Pastora-Bernal et al. (2017) advised that telerehabilitation should be classified, conceptualized, grouped, and coded in a unified system to enable explorers and assessors to effectively investigate and conclude whether an outcome is due to a particular type of intervention. A comparison should be made to the best mode of treatment for the condition under investigation to enable effective comparison with telerehabilitation. The frequency of telerehabilitation should be similar to the control group to eliminate biases that may result from elaborate programs. It is essential to ensure significant homogeneity in terms of duration of intervention, follow-up, and type of pathologies. Researchers also need to improve the quality of the studies, adopt larger samples, and publish studies that show the adverse effects of telerehabilitation (Pastora-Bernal et al. 2017).

CONCLUSION

While the evidence does attempt to support that telerehabilitation results in positive or comparable outcomes in the management of musculoskeletal conditions, the low quality of evidence, possible biases, and heterogonous nature of interventions make the evidence on the efficacy of the intervention inconclusive. Hence, there is a need for more robust research with a larger sample size comparing different forms of telerehabilitation with the best standard care and prolonged follow-ups to conclude the effectiveness of the intervention. Irrespective, the evidence does support that telerehabilitation may be a viable option for patients in remote or rural areas not suffering from severe musculoskeletal conditions mandating physical clinical visits.

CONFLICT OF INTEREST

The author declares that he has no conflict of interest.

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AUTHOR CONTRIBUTIONS

The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

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