Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Scoping Review of Telehealth for Musculoskeletal Disorders: Applications for the COVID-19 Pandemic

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Abstract

Objective: The purpose of this scoping review was to identify information about telehealth and rehabilitation for the evaluation and management of musculoskeletal disorders, patient satisfaction, cost, and access as may be applicable during the COVID-19 pandemic.

Methods: We searched MEDLINE for studies published between January 1, 2000, and June 1, 2019. Search terms consisted of MEDLINE medical subject headings and other words relevant to this review, including "telerehabilitation," "musculoskeletal," "telemedicine," "therapy," "chiropractic," "ergonomics," and "exercise." This review targeted studies of people aged 18 years and older with musculoskeletal concerns. Articles on diagnostic tests, effectiveness of treatment, patient satisfaction, access to care, and cost were included.

Results: Eleven studies were included in this review. Interrater reliability and agreement were moderate to high for several assessment procedures for the lower limb, elbow, and low back. Two clinical trials demonstrated that provider and patient simultaneous telehealth were equally as effective as in-office care. Patient and provider satisfaction with telehealth were reported to be equal to or higher than for conventional rehabilitation. We found no studies reporting cost or access.

Conclusion: In the COVID-19 pandemic environment, telehealth is feasible for health care providers to provide rehabilitation services for their patients with various musculoskeletal conditions. Current evidence suggests that for some musculoskeletal disorders, telehealth evaluation may be reliable, treatment may be effective, and patient satisfaction may be good or better than for in-office care. Results from this study may help physiatry, physical therapy, and chiropractic health care providers in their decisions to implement telehealth during and after the COVID-19 pandemic. (J Manipulative Physiol Ther 2021;44;558-565)

Key Indexing Terms: *Telerehabilitation; Chiropractic; Patient Satisfaction; Musculoskeletal Diseases; COVID-19*

Introduction

The COVID-19 pandemic has created barriers to in-person care.[1] The barrier to access is particularly concerning for people who are older and those with multiple comorbidities and preexisting conditions.[2,3] For people with risk factors for contracting COVID-19, visiting a health care provider may increase their exposure to disease transmission. During the COVID-19 health crisis, health care providers have been confronted with the challenge of preserving access to care while preventing the spread of the SARS-CoV-2 virus. This unusual situation has created greater interest in telehealth. Telehealth, a virtual health care delivery system through either electronic or telecommunication technology,[4] may improve the ability to deliver care when access barriers occur.

Musculoskeletal conditions are highly prevalent, most often managed at the primary level of care, and result in a high level of health care utilization. Globally, musculoskeletal disorders (MSDs) account for 21% of morbidity and affect greater than 25% of the population.[5] Annually in the US, around 70 million physician visits and an estimated 130 million health care encounters are attributed to MSDs.[6] People with MSDs represent more than 25% of all emergency department visits.[7] Among older people, musculoskeletal conditions are particularly important because of the devastating effects that can result from an impairment in mobility or independence.[8] Although health care access has been adversely affected by COVID-19, the high prevalence of MSDs and the need for care of people who have them remain. This quandary has renewed interest in finding

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alternatives to in-clinic care, such as telehealth for musculoskeletal concerns.

The application of telehealth to rehabilitation is a growing area of clinical and research interest. Sometimes referred to as telerehabilitation, rehabilitation for MSDs delivered by telehealth is done remotely using a variety of methods and protocols.[8] There are many forms of telehealth, including those that are performed in real time with patients (synchronous) and those that are not (asynchronous). This article focuses on video telehealth, which is synchronous.[9]

One impetus for telehealth has been the demand for alternatives to traditional in-person encounters to deliver services directly to patients' homes.[2] Telehealth during the COVID-19 pandemic may provide access to health care for people with barriers that may be imposed by geographic, economic, or physical circumstances.[2] The use of telehealth for musculoskeletal care shows promise[2,3,10,11] and may allow providers to overcome limitations they often face during in-clinic visits, such as timing, frequency, and the duration of face-to-face visits.[2,12] However, there is currently insufficient evidence to support routine telehealth assessment and treatment procedures.[2]

The breadth of the literature about telehealth for rehabilitation and MSDs is unknown, and there is a need for greater consideration of literature on the use of telehealth.[2] Therefore, the purpose of this review was to identify available publications on synchronous telehealth and rehabilitation for the evaluation and management of MSDs, including patient satisfaction, cost, and access to telehealth.

Methods

Study Design

We performed a scoping review of the literature to determine what has been reported and what areas are in need of further investigation.[13-16] Scoping reviews typically do not include quality assessment and detailed critical appraisal of individual articles, and we therefore did not perform those.[14,16] Instead, we chose to investigate whether adequate literature exists to perform a systematic review later.[16]

A review protocol was not registered in PROSPERO, because PROSPERO does not include scoping reviews.[15,17] The article was organized and reported based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews statement (PRISMA-ScR).[18,19]

Definitions of Terms

Rehabilitation by telehealth was defined as the delivery of rehabilitation services over telecommunication networks.[20] Synchronous telehealth was defined as remote, live, face-to-face video encounters using internet or cellular data connections.[21] Rehabilitation was defined as therapy intended to improve physical condition and function.[22] Musculoskeletal disorders were defined as pain or injuries of anatomic structures related to the spine and limbs.[23]

Eligibility Criteria

This review targeted studies of adults, aged 18 years and older, receiving rehabilitation through telehealth for common MSDs. We included studies in English that compared the validity or reliability of diagnostic tests or the effectiveness of synchronous telehealth methods with traditional in-clinic face-to-face rehabilitation sessions for common MSDs. We also searched for studies related to cost, access to care, and patient satisfaction. To be included, assessments and interventions had to be provided by qualified trained practitioners and had to be one-on-one.

All asynchronous types of telehealth (eg, stored video recordings, reports later sent to patients) and telephonic health care services were excluded. Studies were excluded when related to non-MSDs. Severe MSDs, such as severe arthritis, autoimmune disorders, cancer-related MSDs, emergent injuries, fractures, ruptures, dislocations, genetic MSDs, and neurologic disorders, were excluded, as these conditions are likely to require face-to-face care.

We excluded reviews of any type, qualitative studies, case reports, cross-sectional studies, pilot studies, cohort studies, and case-control studies; and guideline statements, books, lectures, government reports, unpublished manuscripts, letters, editorials, and commentaries.

Information Sources and Search Strategy

We searched the MEDLINE biomedical database for studies published between January 1, 2000, and June 1, 2019. Search terms consisted of MEDLINE medical subject headings and free-text words relevant to the review. The Supplementary Data include the search terms and strings used. The term "veteran" was included because this is the population cared for by the first 3 authors of this article, and it has relevance to our practices.

Selection of Sources of Evidence

Article titles were screened by 3 reviewers for duplicates and initial exclusion based on the defined criteria. The 3 reviewers then screened the remaining abstracts. The remaining full-text articles were screened by 3 reviewers to eliminate studies not matching our selection criteria. The remaining studies were selected for this scoping review.

Data Charting Process

Data were extracted from the included studies by the team using an extraction form meeting Methodological Expectations of Cochrane Intervention Review standards for collecting and reporting information about studies for a review and analyzing results.[24] Two reviewers (H.T. and F. M.B.) extracted the data.

Data Items

The extraction forms included data tables containing risk-of-bias criteria, information about sample sizes, standard deviations, mean scores, participant characteristics, interventions, treatment duration, and outcome measures from the studies.

Critical Appraisal of Individual Sources of Evidence

We did not conduct in-depth critical appraisal of the studies included, as this was a scoping review. A preliminary assessment of the quality of the literature may be performed to determine whether adequate quality of evidence exists to justify a future systematic review.[17] Using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach, we elected to perform a preliminary quality assessment of included clinical trials to see whether adequate literature exists to justify a future systematic review of effectiveness.[25]

Synthesis of Results

A summary table was created to organize the results. The findings were then summarized as they relate to the purpose of this review of the literature.

Results

Study Selection

The PRISMA flow diagram (see Supplementary Data) displays the search-phase main steps. There were 737 initial hits. We excluded 636 articles by eliminating duplicates and those not meeting the inclusion criteria. We then reviewed 101 abstracts to determine qualification; studies not meeting inclusion based on reading the abstracts were removed, and the remaining 19 studies were read in full, with 8 eliminated due to not meeting the inclusion criteria. There were ultimately 11 studies to review.

Study Characteristics

Seven studies were found that focused on assessment.[26-32] The assessment studies investigated validity and reliability. They included assessment of the lower limb, ankle, knee, elbow, and low back. Five studies investigated interrater and intrarater reliability, comparing diagnostic agreement from assessments.[26-29,31] One study investigated diagnostic agreement from assessments that included pain with specific lumbar movements, the single-leg raise test, and postural analysis.[30] One study compared diagnostic agreement from assessments that classified diagnostic categories into treatment based categories.[32]

Two trials on outcomes were found with a low risk of bias.[33,34] These studies measured the effectiveness of synchronous telehealth compared to conventional therapy. Three assessments on patient satisfaction were found.[32,35,36] One of the satisfaction studies was embedded in an assessment study.[32] There were no studies about cost or access.

Critical Appraisal

Participants and personnel in the study by Truter et al[30] were not blinded. Peterson et al[32] did not use random-sequence generation. Neither Tousignant et al[33] nor Russell et al[34] blinded outcome assessments, nor—for Tousignant et al—participants and personnel. Moffet et al[36] did not blind outcome assessments and had incomplete outcome data. Patient satisfaction data were embedded in another study. Using the GRADE approach, the 2 outcome trials were found to have evidence of moderate quality.

Results of Individual Sources

The findings from the studies included are presented in Tables 1 and 2.

Synthesis of Results

Assessment. The findings from the assessment studies suggest that telehealth was reliable and feasible for assessing common MSDs. Studies found diagnostic agreement for intrarater and interrater findings. Studies investigating assessment of lumbar conditions found conflicting agreement on the straight-leg raise test: one found poor agreement and the other found moderate agreement.

Effectiveness. The findings from trials suggest that the effectiveness of telehealth is comparable to that of conventional methods. One study found better improvements for the conventional-therapy group 2 months after the end point, whereas the other found the telehealth group to be better 6 weeks after the end point.

Satisfaction. Patient satisfaction with telehealth assessment and therapy was comparable to that for conventional approaches. Providers' satisfaction with delivery of rehabilitation by telehealth was high.

Table 1. *Summary of Findings for Telehealth Assessment.*

Reference	Summary	Conclusions
Russell et al[26]	Primary pathoanatomic primary diagnosis for telehealth and face-to-face assessments of lower limb was in exact agreement in >63% of cases and similar in >79%. Systems diagnosis agreed > 79% of the time. For primary pathoanatomic diagnosis, intrarater agreement was 84% exact and 100% similar, and interrater was 63% exact and 89% similar. Systems diagnosis had 100% intrarater and 89% interrater agreement. Substantial agreement was found on clinical observations with very high intrarater and interrater reliability for both exact and similar agreement, ranging from 93% to 99.2%.	Telehealth, when compared to therapist face-to-face assessments, was found to be reliable for non-articular lower limb musculoskeletal conditions.
Steele et al[27]	Telehealth and face-to-face assessments of shoulder disorders had moderate agreement (59.2%) for combined same and similar pathoanatomic diagnosis with high interrater (73.08%) and intrarater (100%) agreement. Systems diagnostic agreement was 78.6%, with 82.1% intrarater and interrater agreement. Strong agreement for most physical exam measures was found with the exception of joint assessment, which was poor.	Telehealth diagnosis and examination findings of shoulder musculoskeletal disorders were both reliable and viable compared to traditional in-person examinations.
Russell et al[28]	There was 80% agreement on primary systems diagnosis, 93.3% agreement on similar pathoanatomic diagnosis, and high levels of interrater and intrarater reliability for telehealth and face-to-face assessments of ankle disorders. Clinical observations for binary data had significant agreement, whereas categorical data had very strong agreement.	Musculoskeletal assessments of the ankle joint complex via telehealth were found to be valid and reliable compared with conventional face-to-face exams.
Richardson et al[29]	The primary diagnosis was exact in 67% and similar in 89% of knee cases assessed, comparing telehealth to face-to-face evaluation. The system of pathology agreed in 94% of cases. Intrarater reliability was found to be high at 89%, and interrater reliability was moderate at 67%. Physical-exam objective data were found to have substantial agreement.	Findings indicate that telehealth is both feasible and reliable for assessment of the knee complex, compared with traditional face-to-face assessments.
Truter et al[30]	There were high levels of agreement between face-to-face and telehealth assessments on low back examination when eliciting pain and symptoms with specific lumbar movements as well as single-leg-raise sensitization. For determining active lumbar range of motion, worst lumbar movement direction, and straight-leg-raise range of motion, there was moderate agreement. Determining reasons for limited lumbar range of motion and postural analysis had poor agreement.	Findings validate certain elements of a standard evaluation for low back pain done with telehealth and identify issues to be addressed with further study.
Lade et al[31]	Agreement on diagnosis of the elbow joint complex was found to be 73% between telehealth and in-person examinations. Intrarater agreement was 90% and interrater agreement was non-significant at 64%, $P = .11$. The physical-exam data were found to have >68% agreement between the compared methods except for poor agreement on nerve test (46%) and joint assessment (43%).	Examinations using a telehealth system for musculoskeletal assessments of the elbow joint complex were found to be both valid and reliable in determining diagnosis compared to findings from face-to-face physiotherapy examinations.
Peterson et al[32]	Overall, the rate of agreement for determining classification categories was 68.1% for telehealth and face-to-face assessments, and there was no significant difference in the distribution of patients into these classifications. Percentage agreement varied between 48.9% and 59.6% for the measured variables, except straight-leg raise over 91°, which was 35.1% for telehealth compared to face-to-face assessments.	Telehealth assessments of low back pain were found to be reliable in determining which treatment-based classification patients were categorized into when compared to traditional face-to-face assessment.

Cost and Access. No studies included information about cost or access.

Discussion

This scoping review identified supporting evidence for rehabilitation provided by telehealth for the evaluation and management of common MSDs that could be applied during pandemic situations, such as with COVID-19. Moderate-quality evidence was found for effectiveness. Several studies found high interrater and intrarater reliability when comparing synchronous telehealth assessments with traditional face-to-face assessments. Home outcomes achieved with telehealth were comparable to and at least as effective as those of conventional rehabilitation.[33,34] Good to high levels of patient satisfaction were found with telehealth.[32,35,36] Therapist satisfaction was also found to be high.[35]

Table 2. *Summary of Findings for Telehealth Effectiveness and Satisfaction*

Reference	Topic	Summary	Conclusions
Tousignant et al[33]	Effectiveness	Outcomes improved significantly for all participants in both groups. Some variables showed larger improvements in the usual-care group 2 mo after discharge.	Telehealth outcomes significantly improved between end points, and telehealth was found to be as effective as conventional rehabilitation for therapy after knee replacement surgery.
Russell et al[34]	Effectiveness	Both the telehealth and conventional groups had significant improvement in outcomes ($P < .01$) and were comparable after 6 wk of intervention for both secondary measures and the primary measure of Western Ontario and McMaster Universities Osteoarthritis Index scores. The telehealth group achieved better outcomes on the Patient Specific Functional Scale and Western Ontario and McMaster Universities Osteoarthritis Index Stiffness subscale ($P < .05$).	Telehealth was comparable to conventional physiotherapy 6 wk after total knee arthroplasty, and both groups had significant improvements.
Tousignant et al[35]	Satisfaction	No difference was found in satisfaction between the telehealth group and the conventional group for the therapy. The therapist's satisfaction was determined to be high.	Patient and therapist satisfaction were both high when using telehealth, and no differences were found when compared with conventional therapy for total knee arthroplasty.
Peterson et al[32]	Satisfaction	56% of participants agreed that telehealth assessment was as good as face-to-face assessment, 97% agreed that telehealth was recommendable, and 66% felt no difference in connection with the therapist. During the telehealth assessment, 83% agreed that the therapist was visible and 98% agreed they could hear the therapist for the entire time.	Satisfaction with telehealth compared to face-to-face assessment was good.
Moffet et al[36]	Satisfaction	Perceived satisfaction for standard and telehealth groups at 4 mo after hospital discharge did not differ, and was higher than 85% on the Health Care Satisfaction Questionnaire.	Questionnaires for participants receiving telehealth and conventional care indicated high levels of satisfaction at the end point, and no differences were found between the comparison groups after therapy for total knee arthroplasty.

Findings from this review are comparable to those of some previous reviews of the literature. Mani et al[37] found that telehealth assessment for MSDs—with the exceptions of lumbar posture, orthopedic tests, neurologic tests, and scar assessment—had excellent reliability and good concurrent validity and were technically feasible. In a systematic review and meta-analysis, Cottrell et al[5] suggest that telehealth is effective for improving physical function and improving pain, comparable to face-to-face care for the management of musculoskeletal conditions. A systematic review of evidence of benefits of telehealth found limited evidence regarding telehealth interventions for the upper limb but strong evidence for use after total knee and hip arthroplasty.[37] Contrary to the present review, Grona et al[38] found validity and reliability studies with high risk of bias; unlike our review, theirs included case-control and preexperimental studies.

Our search demonstrated that the topic of telehealth is not new. We found a citation dating back to 1978 that discussed telehealth.[39] Research on telehealth is still emerging in physical medicine, rehabilitation, and chiropractic. Due to the COVID-19 pandemic, health care providers have quickly adapted to using telehealth to help patients with MSDs,[40,41] and there has been a call to action and application regarding telehealth.[42-44] As time progresses, we hope to see more research in this area across all health care disciplines.

Limitations

The search was limited to the MEDLINE database, and thus we may have missed studies that were indexed elsewhere. This review was limited to the studies locating using our search criteria and dates. We did not consult a reference librarian, who could have provided guidance on how to create a more expansive and sophisticated electronic search strategy.

We did not include cohort and case-control studies. Some studies regarding cost, access, and patient satisfaction may have been inadvertently excluded based on the study design. Studies included in this review pertain to a small sample of MSDs. Outcome trials included only postoperative knee rehabilitation. A greater variety of MSDs would provide a wider evidence spectrum

regarding effectiveness. GRADE is not a quantitative system, and involves judgements which are not exclusive.[25] Thus, its use here should not drive practice recommendations. Seven trials were found from either *Telemedicine Journal of eHealth* or *Journal of Telemedicine and Telecare*, limiting the diversity in data sources.

Future Studies

We found no evidence concerning cost or access in telehealth. Thus, for future reviews, studies should investigate patient assessment and treatment to include cost and access. Our study is relevant to many types of health care providers. However, there is a need for more research that investigates a greater variety of MSDs managed with telehealth, given the limited number of conditions found in this review.

Conclusions

Telehealth may be a feasible means for health care providers to provide rehabilitation services for their patients with various musculoskeletal conditions in the COVID-19 pandemic environment. Our findings suggest that for some MSDs, telehealth evaluation may be reliable, treatment may be effective, and patient satisfaction may be as good as or better than for in-office care. Results from this study may help health care providers in areas including but not limited to physiatry, physical therapy, and chiropractic consider implementing telehealth during and after the COVID-19 pandemic. Our study also shows gaps in the literature, such as information about cost and access; thus, these are areas where we suggest that more research is needed.

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Contributorship Information

Concept development (provided idea for the research): F.M.B., M.B.C.
Design (planned the methods to generate the results): F.M.B., M.B.C.
Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): F.M.B., M.B.C., B.N.G.
Data collection/processing (responsible for experiments, patient management, organization, or reporting data): F.M.B.
Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): F.M.B., B.N.G.
Literature search (performed the literature search): F.M.B., H.T.
Writing (responsible for writing a substantive part of the manuscript): F.M.B., B.N.G.
Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): F.M.B., M.B.C., H.T., B.N.G.

Practical Applications

- Evidence suggests that telerehabilitation may be effective for delivering chiropractic, overcoming obstacles like those during the COVID-19 pandemic.
- Opportunities exist to investigate chiropractic and telerehabilitation.
- Delivery of telerehabilitation for common musculoskeletal diseases may lead to equal patient satisfaction as conventional care.

Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jmpt.2021.12.003.

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