Telerehabilitation for carpal tunnel syndrome: a new treatment style with new possibilities: a randomized controlled trial

Telerehabilitación para el síndrome del túnel carpiano: un nuevo estilo de tratamiento con nuevas posibilidades: un ensayo controlado aleatorio

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Abstract

Objective: This study aimed to evaluate the effectiveness of a structured telerehabilitation program compared to conventional in-clinic therapy in improving pain, function, and wrist range of motion (ROM) in individuals with carpal tunnel syndrome (CTS).
Methodology: This randomized controlled study included a total of 40 patients (16 males, 24 females) with CTS. The patients were equally randomized into two groups: Group 1 underwent conventional physical therapy (n=20). Group 2 underwent telerehabilitation program (n=20). The effectiveness of treatment was evaluated by recording data on 10-point VAS, the Disability of the Arm, Shoulder, and Hand (DASH), and wrist joint active range of motion (AROM) before treatment at four weeks (12 sessions).
Results: The telerehabilitation group demonstrated a significantly greater improvement in DASH score compared to the control group ($p > 0.001$) and in extension AROM ($p > 0.001$) after four weeks of treatment. However, no significant improvement was observed between groups in VAS score and flexion, radial, and ulnar deviation AROM ($p = 0.414$, $p = 0.96$, $p = 0.799$, respectively)
Conclusions: These findings suggest that tele-rehabilitation can be a feasible and effective alternative to conventional care. Its use may be especially beneficial for patients with limited Access to in-person therapy.

Keywords

Carpal tunnel syndrome; function; pain; rehabilitation; telemedicine.

Resumen

Objetivo: Este estudio tuvo como objetivo evaluar la efectividad de un programa estructurado de telerehabilitación en comparación con la terapia convencional en la clínica para mejorar el dolor, la función y el rango de movimiento (ROM) de la muñeca en individuos con síndrome del túnel carpiano (STC).
Metodología: Este estudio controlado aleatorizado incluyó un total de 40 pacientes (16 hombres, 24 mujeres) con STC. Los pacientes fueron aleatorizados por igual en dos grupos: El grupo 1 se sometió a fisioterapia convencional (n = 20). El grupo 2 se sometió a un programa de telerehabilitación (n=20). La efectividad del tratamiento se evaluó registrando datos sobre EVA de 10 puntos, la Discapacidad del Brazo, Hombro y Mano (DASH) y el rango de movimiento activo de la articulación de la muñeca (AROM) antes del tratamiento a las cuatro semanas (12 sesiones).
Resultados: El grupo de telerehabilitación demostró una mejoría significativamente mayor en la puntuación DASH en comparación con el grupo control ($p > 0,001$) y en la extensión AROM ($p > 0,001$) después de cuatro semanas de tratamiento. Sin embargo, no se observó una mejora significativa entre los grupos en la puntuación EVA y la flexión, desviación radial y cubital AROM ($p = 0,414$, $p = 0,96$, $p = 0,799$, respectivamente)
Conclusiones: Estos hallazgos sugieren que la tele-rehabilitación puede ser una alternativa factible y efectiva a la atención convencional. Su uso puede ser especialmente beneficioso para pacientes con acceso limitado a terapia presencial.

Palabras clave

Síndrome del túnel carpiano; función; dolor; rehabilitación; telemedicina.

Introduction

Carpal Tunnel Syndrome (CTS) is the most common form of peripheral nerve entrapment, affecting approximately 3–4% of the global population, with a higher prevalence among middle-aged females (Padua et al., 2016). The condition is primarily caused by median nerve compression within the carpal tunnel, leading to symptoms such as pain, numbness, paresthesia, and weakness in the hand and fingers (Aboonq, 2015; Chammas et al., 2014). Although Contemporary electrodiagnostic studies are the gold standard, they do not always reflect the degree of symptom severity or the functional limitations experienced by the patients. Instead, pain and functional status are considered the primary factors that may influence participation (Namaz et al., 2025).

Conservative options wrist splinting, nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroid injection, and physical therapy are typically reserved for mild-to-moderate CTS, while surgical decompression approaches are held in reserve for severe or refractory CTS (Shi & MacDermid, 2011). Physical therapy treatment is particularly effective in improving hand function and symptom alleviation. However, the projected lifetime costs for patients with CTS are approximately 95,735.65 USD for conservative treatment (Gabrielli et al., 2020). Beyond direct healthcare expenditures, CTS additionally impacts workforce productivity, contributing significantly to workdays and, subsequently, financial loss (Gebrye et al., 2024). Also, consistent access to in-person therapy is often problematic due to geographic, socioeconomic, or time constraints, particularly among rural and underserved groups (Costa et al., 2022). Therefore, reducing healthcare costs and socioeconomic burden is increasingly becoming important.

Telerehabilitation involves using information and communication technologies by healthcare providers to remotely provide rehabilitation services (Baroni et al., 2023). It offers an alternative approach by delivering rehabilitation services via digital tools such as video conferencing, sensor-based systems, and mobile apps, allowing real-time therapist-patient interaction, monitoring of therapeutic exercise, and adjusting the treatment plan from the comfort of the home. Unlike traditional rehabilitation, it has been found to lower costs than in-person rehabilitation (Grigorovich et al., 2022), facilitate accessibility, reduce delay in treatment, and improve compliance in chronic rehabilitation settings (Suero-Pineda et al., 2023).

Up-to-date evidence indicates that telerehabilitation is on par with or better than conventional therapy for a wide array of orthopedic and neurological conditions (Núñez-Cortés et al., 2023; Salud et al., 2022). Despite the growing solid evidence supporting tele-rehabilitation in various musculoskeletal conditions, telerehabilitation studies predominantly included patients with lower limb conditions, while its application in the treatment of CTS is scarce and inadequately researched. Low-quality evidence highlighted no significant differences between telerehabilitation compared to in-person therapy for reducing pain and improving function in patients with musculoskeletal conditions. However, findings were based on a small number of trials (n=5) and were limited to knee conditions (Krzyzaniak et al., 2023). Recently, another systematic review indicated that telerehabilitation was comparably effective to clinic-based rehabilitation for treating musculoskeletal disorders, such as low back pain, fibromyalgia, total knee arthroplasty, shoulder subacromial decompression, knee osteoarthritis, and rotator cuff syndrome (Alahmri et al., 2024). Interestingly, only one recent randomized controlled trial comparing the effectiveness of a telerehabilitation program based on pain neuroscience education and exercise versus exercise alone on patient-reported outcomes in patients with CTS reported no significant differences between the groups (Núñez-Cortés et al., 2023).

To our knowledge, no study to date has directly compared telerehabilitation to in-person rehabilitation in patients with CTS. Therefore, this randomized controlled trial aims to bridge this gap by comparing the effectiveness of a protocolized telerehabilitation program for CTS patients, investigating whether distance rehabilitation can lead to clinically significant improvement in pain, range of motion, and hand function compared to standard in-clinic rehab. We hypothesize that participants receiving the telerehabilitation intervention will have improved functional and symptomatic outcomes than those receiving standard treatment. These findings may inform potential strategies to optimize patient-reported outcomes and reduce associated socioeconomic burden on patients and healthcare providers.

Method

Design

This study is a randomized parallel-group clinical trial to investigate the effect of a structured telerehabilitation program compared to conventional in-clinic therapy for four weeks in relieving pain, enhancing functionality, and improving wrist ROM in patients with CTS. This RCT was reported following the Consolidated Standards of Reporting Trials (CONSORT) Statement (Moher et al., 2010).

Ethical considerations

This study was conducted in accordance with the Declaration of Helsinki, and the trial protocol was approved by the International Review Board (IRB) committee of the Faculty of Physical Therapy, Modern University for Technology and Information (MTI), with an approval number (REC/2111/MTI.PT/2412313). All participants signed an informed written consent before participating in the study.

Participants

The study included a total of 40 patients with CTS who were recruited from MTI, the Faculty of Physical Therapy's outpatient clinic between January and April 2025. Patients who showed interest were invited to an introductory meeting where they were provided with an overview of the study's inclusion and exclusion criteria and a detailed explanation of the research methods and collaboration procedures.

Eligible participants met the following inclusion criteria: (1) age between 20 and 40 years; (2) medical diagnosis of moderate or severe CTS following the clinical practice guidelines of the Academy of Orthopedic Physical Therapy and the Academy of Hand and Upper Extremities Physical Therapy (i.e. history, physical examination, and tests/measurements) (Erickson et al., 2019; Fess, 1981) symptoms of at least three months duration, (4) unilateral or bilateral symptoms; (5) access to a smartphone with Internet connectivity, and willingness to participate. Exclusion criteria were inability to understand instructions, neurological conditions of the central nervous system (e.g., stroke, spinal cord injury), patients undergoing alternative therapies, had previous trauma or surgery involving the upper extremities, pregnancy, and a history of radiating neck or back pain in the previous three months.

Procedure

Eligible participants were randomly assigned to either a telerehabilitation intervention (N = 20) or a control group (N = 20) (Figure 1). A baseline evaluation was conducted before randomization to ensure comparability between groups. Data were collected by trained assessors and included demographic and clinical characteristics such as age, sex, and primary outcome measures, including pain intensity (Visual Analog Scale; VAS), upper limb function (Disability of the Arm, Shoulder, and Hand; DASH), and wrist range of motion (goniometry).

Forty eligible participants were randomized into two equal groups (1:1 ratio) using a computer-based randomization sequence available online (www.randomizer.org). Sealed, opaque, and sequentially numbered envelopes were used to communicate the results generated from the software and were known to an outside physical therapist who had no access to participant characteristics and was not involved in the assessment or study intervention. Allocation remained concealed until the end of the intervention and the collection of all study data.

The study group consisted of 20 participants who underwent a telerehabilitation program, while the control group (n = 20) received in-clinic rehabilitation. The participants' baseline characteristics are presented in Table 1.

Participants in the telerehabilitation group received a corrective exercise program with online supervision, delivered via Home-Based Real-Time Video Conference (HBRTVC). The treatment program lasted for four weeks (three sessions per week, 60 minutes per session). In the first session, exercises were demonstrated and practiced face-to-face with a physiotherapist to ensure correct technique. Subsequent sessions were conducted individually under real-time online supervision by the first author, using Zoom, Messenger, or FaceTime on their mobile phones, tablets, or laptops, via the HBRTVC method.

The sessions included a combination of elbow and wrist active range of motion (AROM) exercises, self-stretching exercises (Shem et al., 2020), median nerve gliding (neurodynamic exercises)(Hamzeh et al., 2021), neural mobilization (Ijaz et al., 2022), and isometric strengthening exercises using a stress ball (Salehi et al., 2019). Exercise intensity and repetitions were progressively increased according to participant tolerance. Cold therapy was applied using commercial ice gel packs. The pack was applied to the affected wrist for 12-15 minutes, immediately following the session.

For the control group, subjects received the same rehabilitation program described above, but they were supervised by a physiotherapist in an outpatient setting at the outpatient physical therapy clinic, Faculty of Physical Therapy, Modern University for Technology and Information, Egypt.

Instrument

Measurements were performed two times: before the intervention (baseline) and after the intervention at four weeks (12 sessions). Demographic and clinical characteristics were collected using a standardized data sheet. All clinical outcome measures were evaluated by an unblinded assessor following a standardized protocol to ensure consistency. The outcome measures chosen to assess changes following CTS rehabilitation were:

Pain intensity

A Visual Analog Scale (VAS) was used to assess the pain intensity. Each participant rated their pain on a 0–10 scale (0 = no pain, 10 = worst possible pain). VAS demonstrates good test–retest reliability (Hawker et al., 2011).

Upper Limb Function

The Disability of the Arm, Shoulder, and Hand (DASH) questionnaire was used to assess upper limb disability related to CTS. This 30-item tool includes 21 functional items, six symptom-related items, and three psychosocial items. Patients rated their ability to perform daily activities using a 5-point Likert scale. The final score ranges from 0 (no disability) to 100 (severe disability). The validity and reliability of the Arabic version of DASH were established in a prior study (Alotaibi et al., 2016), with excellent reliability (Cronbach's $\alpha = 0.94$, ICC = 0.97).

Wrist Range of Motion (ROM)

Active wrist ROM was measured using a goniometer while participants were in a seated position with the shoulder abducted to 90°, elbow flexed to 90°, and wrist over the edge of a table or plinth with the forearm in pronation. For flexion/extension movements, the fixed arm was aligned parallel to the ulna, the movable arm along the 5th metacarpal, with the lateral aspect of the triquetral bone as the axis. And for ulnar/radial Deviation, the fixed arm was aligned with the dorsal midline of the forearm, while the movable arm was along the 3rd metacarpal (Fess, 1981; Horger, 1990; Norkin & White, 2016).

Sample size calculation

A priori sample size calculation indicated that 60 participants were required to detect a clinically meaningful difference between groups with 95% power at 5% significance level. However, due to practical constraints in recruitment and resource availability, the study was completed with 40 participants. While this may have reduced the statistical power of the study, we believe the results provide valuable preliminary insights that can inform future research. Analysis was performed using the Statistical Package for Social Sciences (SPSS) version 27.0 (IBM Corporation, Armonk, NY, USA).

Data analysis

All statistical analysis was performed using SPSS version 27.0 (IBM Corporation, Armonk, NY, USA). The normality of the data was tested using the Shapiro-Wilk test, confirming its non-normal distribution and thus using the appropriate non-parametric tests. Baseline characteristics were first compared between the two groups. For the continuous variables, median and interquartile range (IQR) were used to describe data. Whereas categorical variables were presented in frequencies and percentages. Between-group differences were analyzed using the Mann–Whitney U test while within-group pre–post comparisons were examined with the Wilcoxon signed-rank test. These tests are appropriate for continuous, non-normally distributed data and provide robust comparisons without assuming normality. Categorical variables were analyzed using the Chi-square test, or Fisher's exact test as appropriate. A p-value of <0.05 was considered statistically significant.

Results

The Consolidated Standards of Reporting Trials flow diagram is shown in Figure 1. Forty patients diagnosed with CTS participated in this study, and all were included in the analysis. Baseline characteristics of participants are included in Table 1. There were no significant differences in p variables between the two groups at baseline in terms of age (p = 0.925), gender (p = 1.000), VAS (p = 0.102), confirming comparability between groups at baseline. The demographic characteristics of participants are shown in Table 1. No dropouts were reported in this study. The Consolidated Standards of Reporting Trials flow diagram is shown in Figure 1.

Figure 1. CONSORT flow diagram

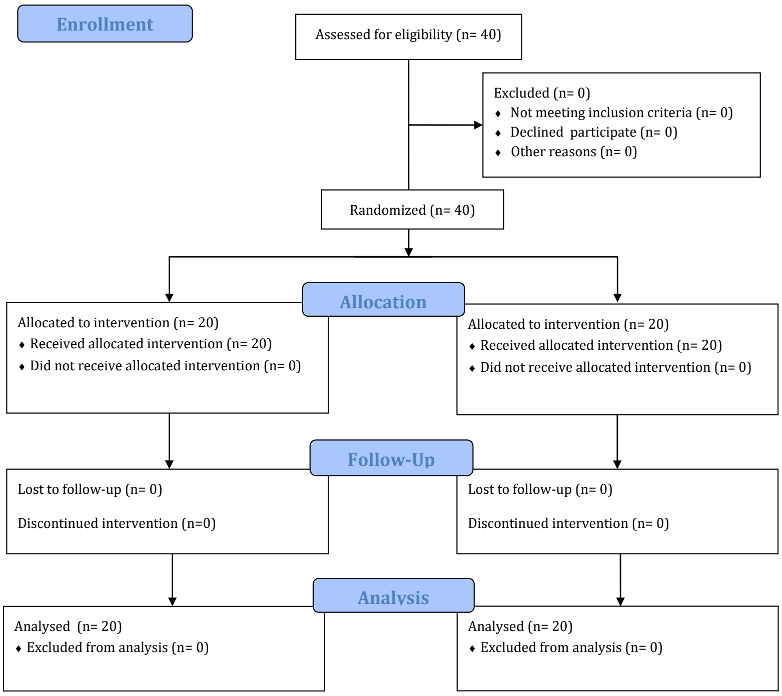

Table 1. Baseline demographic and clinical characteristics of the groups (n=40)

Characteristics	Telerehabilitation group (n = 20)	Control group (n = 20)	P-Value	Sig.
Gender, n (%)				
Males	8 (50%)	8 (50%)	1.000[b]	NS
Females	12 (50%)	12 (50%)		
Age, years	37 (34.2-39)	36.5 (33.2-39)	0.925[a]	NS
Baseline VAS score	8 (7-8.7)	7 (7-8)	0.102a	NS

Abbreviations: Sig: significance, NS: not significant, P-value: Probability value, VAS: Visual Analogue Scale. Note: Values are expressed as median (quartile1-quartile 3), or numbers and percentages, [a]: Mann-Whitney U test, [b]: Chi-Square test.

Pain intensity

Both groups showed a significant reduction in pain scores post-intervention (p > 0.001). However, no statistically significant difference was observed between both groups after the intervention (p = 0.414) (Table 2).

Upper limb function (DASH)

Both groups exhibited a significant reduction in DASH scores post-intervention (p > 0.001). The telerehabilitation group demonstrated a significantly greater improvement in function compared to the control group (p > 0.001) (Table 2).

Range of motion (ROM)

Flexion and radial deviation: both groups improved significantly post-intervention (p > 0.001). However, no statistically significant difference was observed between the two groups after the intervention (p = 0.96, p = 0.799, respectively) (Table 2)

Extension: a significant improvement was observed in the telerehabilitation group compared to the control group (p > 0.001) (Table 2).

Ulnar deviation: no statistically significant difference was observed between both groups after intervention (p = 0.799) (Table 2).

Table 2. Primary and secondary outcomes for the two treatment groups (n=40).

Outcome assessment		Telerehabilitation group (n = 20)	Control group (n = 20)	P-Value (between-group)	Sig.
DASH* (Function Score)	Before	65 (64-66)	60 (54.2-65)	0.006[a]	S
	After	36 (35-37)	25 (24-26)	<0.001[a]	S
	P-Value (Within group)	<0.001[b]	<0.001[b]		
VAS* (Pain Score)	Before	8 (7-8.7)	7 (7-8)	0.102[a]	NS
	After	2 (1-2.7)	2 (1.2-3)	0.414[a]	NS
	P-Value (Within group)	<0.001[b]	<0.001[b]		
ROM					
Flexion** (degrees, ◦)	Before	42.5 (40-45)	40 (31.2 - 45)	0.383[a]	NS
	After	80 (75-80)	65 (52.5-85)	0.96[a]	NS
	P-Value (Within group)	<0.001[b]	<0.001[b]		
Extension** (degrees, ◦)	Before	30 (25-30)	30 (21.2-30)	0.904[a]	NS
	After	60 (50-80)	40 (40-50)	<0.001[a]	S
	P-Value (Within group)	<0.001[b]	<0.001[b]		
Ulnar Deviation** (degrees, ◦)	Before	10 (5-10)	15 (15-15)	<0.001[a]	S
	After	20 (20-20)	20 (20-20)	0.799[a]	NS
	P-Value (Within group)	<0.001[b]	<0.001[b]		
Radial Deviation** (degrees, ◦)	Before	10 (5.7-10)	10 (10-10)	0.183[a]	NS
	After	20 (20-20)	20 (20-20)	0.799[a]	NS
	P-Value (Within group)	<0.001[b]	<0.001[b]		

Abbreviations: DASH: Disabilities of the Arm, Shoulder, and Hand, VAS: Visual Analogue Scale, Sig: significance, ROM: Range of motion, NS: not significant, P-value: Probability value. Note: Before and after variables are expressed as a median (quartile 1-quartile 3), [a]: Mann-Whitney U test, [b]: Wilcoxon signed-rank test, *: Lower values = Better, **: Higher values = Better: Bold values provide the significant *p* values (P-values are significant at <0.05)

Discussion

Telerehabilitation is an emerging method to deliver healthcare services. To date, however, little evidence supports its efficacy for treating patients with CTS. This randomized controlled trial primarily aimed to evaluate the effectiveness of a structured telerehabilitation program compared to traditional in-clinic rehabilitation for individuals with CTS. Specifically, the study sought to determine whether telerehabilitation could produce clinically significant improvements in pain, upper limb function, and wrist ROM. The telerehabilitation group showed a statistically significant difference compared to traditional face-to-face conventional treatment at four weeks in improving upper limb functional status as measured by DASH score and extension ROM, whereas pain and remaining ROMs did not show any significant change.

For the upper limb function, the telerehabilitation group showed a significantly greater improvement compared to the control group, as stated earlier. The literature presents a scarcity of studies examining CTS through the use of telerehabilitation tools. The literature indicates that the management of musculoskeletal conditions through real-time telerehabilitation effectively achieves a significant improvement in physical function. Only one previous trial indicated no difference between a telerehabilitation program based on pain neuroscience education and exercise compared to exercise alone on patient-reported outcomes in patients with CTS awaiting surgery. Similarly, A previous RCT reported no statistically significant differences between telerehabilitation compared to supervised treatment in functionality in patients with distal radius fractures (Pech-ArguÓelles et al., 2024). Thus, the structured, real-time feedback provided via video conferencing may have enhanced participant engagement and precision in performing functional exercises, contributing to these outcomes. At baseline, however, the functional status was significantly higher in the telerehabilitation group compared to the other groups, despite randomization. Given the baseline heterogeneity, post-treatment comparisons could be potentially biased. Therefore, this difference is not valid since these variables were not homogeneous from the beginning.

Regarding pain, both groups achieved comparable and statistically significant reductions, with no differences between groups (p = 0.414). This suggests that pain relief in patients with CTS may primarily be influenced by the therapeutic exercises themselves (e.g., nerve gliding, stretching) rather than by the methods of delivery. Our finding is consistent with Núñez-Cortés et al. (2023) reporting equivalent pain reduction in telerehabilitation and in-person groups (Núñez-Cortés et al., 2023). Pech-Argüelles et al. (2024) also reported that both treatment groups showed statistically significant differences in the reduction of pain, with no inter-group differences at 24 weeks in patients with distal radius fractures (Pech-ArguÓelles et al., 2024).

While both groups improved in wrist flexion, extension, and radial/ulnar deviation, the telerehabilitation group achieved notably greater gains in extension ROM. A previous systematic review reported that telerehabilitation was slightly better than usual care at improving range of motion (SMD 0.28, 95% CI 0.1-0.46; I2=0%) in older adults with various musculoskeletal disorder (Jirasakulsuk et al., 2022). This advantage may be attributed to the real-time feedback and technique correction provided during dynamic exercises. Nevertheless, the absence of significant between-group differences in other ROM measures suggests that the fundamental mobility enhancements can be attained effectively through either delivery approach. Other ROMs, however, did not show any significant post-treatment difference between the groups. Particularly, flexion did not show any between-group improvements, which is consistent with the lack of improvement between groups in ulnar deviation. However, this result should be interpreted cautiously, since ulnar deviation exhibited a statistically significant difference at the beginning of the study. As a result, the potential for observing significant improvements in ulnar deviation ROM was likely limited, given its initial levels.

Strengths, Limitations, and Future Direction

This study has its strengths and limitations. The main strength of this study is that it is the first study comparing a tele-rehabilitation program to conventional rehabilitation for patients with CTS. Also, the study's strengths include adherence to CONSORT guidelines and the use of validated outcome measures. The telerehabilitation protocol was standardized and delivered via accessible platforms (e.g., Zoom, FaceTime, Facebook Messenger), ensuring reproducibility. Additionally, the absence of dropouts underscores the feasibility and acceptability of the intervention.

However, the study has some drawbacks that may affect the strength of the evidence. Therefore, our results should be approached dubiously. The main limitation of the study is the small sample size (n=4). Firstly, although a formal sample size calculation was performed, the estimated number was relatively higher than what was accessible to recruit within the current resources. As a result, the study may be underpowered to detect smaller between-group differences, and the risk of type II error cannot be excluded. Therefore, our results are preliminary and not generalizable to a larger population of similar patients with CTS. Our findings should be confirmed with larger RCTs. Also, as a single-center study, the generalizability of the findings to a broader population may be limited. Secondly, the short follow-up period (4 weeks) precluded assessment of long-term outcomes. Therefore, future RCTs are needed to determine the long-term effects of the intervention. Thirdly, the unblinded assessor could introduce bias, along with the use of a subjective outcome measure, impacting measurement reliability. It is worth noting, however, that blinding is not always feasible in physiotherapy trials due to the nature of the interventions being tested. Fourthly, the focus of our study was limited to the outcome measures of physical performance (e.g., functionality, pain, and ROM). However, a recent systematic review and meta-analysis reported psychological measures, including depressive symptoms, anxiety, and catastrophizing, as important predictors in patients with CTS (Núñez-Cortés et al., 2022). Furthermore, patients' satisfaction is another critical component, reflecting patients' responsiveness during the treatment plan (Tousignant et al., 2011). Therefore, these variables should be addressed by upcoming RCTs. In addition, some outcomes (e.g., Functional status and ulnar deviation ROM) were significantly different between the two groups at baseline, introducing baseline heterogeneity. This baseline imbalance limits the comparison of effectiveness at the end of the treatment. Lastly, it remains unclear which types of patients with CTS would be more suitable for telerehabilitation, since we did not stratify patients at baseline based on severity.

Despite limitations, the findings obtained could offer valuable insights for future research endeavors. Consequently, further RCTs are indicated to explore long-term effects, cost-benefit ratios, and applicability to various populations. Overall, telerehabilitation emerges as a promising, scalable strategy to broaden access to high-quality care for patients with CTS.

Practical Implications

Based on our results, telerehabilitation may present a viable alternative to conventional rehabilitation in patients with CTS facing geographic, economic, or time barriers to in-clinic care. The improvements observed in upper limb function and wrist ROM support the incorporation of telerehabilitation protocols in managing CTS. Hence, we recommend therapists consider hybrid models (combining remote and in-person sessions) to fully optimize patient outcomes. Still, this trial provides preliminary evidence that telerehabilitation may yield similar outcomes to conventional rehabilitation for individuals with CTS, with distinct advantages in functional recovery. The feasibility and effectiveness of telerehabilitation in our study align with observations by Hartantri et al. (2020). They describe successful integration of telerehabilitation alongside conventional therapy in managing a case of bilateral CTS during the post-COVID era, highlighting its role in increasing accessibility and minimizing the risk of transmission (Hartantri & Arfianti, 2020). Our study provides empirical support for this particular remote care model, demonstrating that telerehabilitation can achieve comparable or superior functional outcomes in CTS management compared to conventional therapy alone.

Conclusions

The telerehabilitation exercise program significantly improved functionality and extension AROM in patients with CTS although there was no significant difference between both group in enhancing pain and flexion, ulnar, and radial deviations AROM. These findings suggest that the use of telerehabilitation may enhance functionality while reducing physical contact. More trials are indicated to confirm current findings.

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