Original Article

The Impact of Telehealth Physical Therapy on Recovery Outcomes for Patients with Shoulder Impingement Syndrome

Allied Medical Research Journal
Vol:3 No.1: 54-59

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ABSTRACT

Background: Shoulder impingement syndrome (SIS) is a prevalent shoulder-related musculoskeletal disorder that hinders shoulder mobility and function. Although traditionally, in-person physical therapy is the gold standard for treatment, telehealth is being introduced as an alternative. This study determines the effects of telehealth physical therapy on recovery outcomes of individuals suffering from SIS and compares it with conventional therapy.

Methods: This randomized controlled trial (RCT) involved forty people diagnosed with SIS, divided into two groups, one group receiving telehealth physical therapy (n=20) and the other group receiving in-person therapy (n=20). Recovery possibility was assessed by measures such as Shoulder Pain and Disability Index (SPADI) and Range of Motion (ROM) assessment during a follow-up period of 12-weeks.

Results: Telehealth patients showed a significant positive change in SPADI score, with a mean score reduction of 35% and a ROM increase by 25 degrees, similar to the comparison of the in-person therapy group. Patient satisfaction was elevated by 85% of telehealth program participants indicated they felt good about their experience.

Conclusion: Telehealth physical therapy could provide an equally effective alternative to traditional face-to-face therapy modes for managing SIS with a similar recovery outcome and high patient satisfaction.

Keywords: Digital health, Musculoskeletal disorders, Physical therapy, Rehabilitation, Telehealth.

Received: August 12, 2024**; Revised:** December 30, 2024**; Accepted:** January 13, 2025

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DOI: https://doi.org/10.59564/amrj/03.01/011

INTRODUCTION

Shoulder impingement syndrome (SIS) is a common cause of phantom pain and elbow-related dysfunction around the world[1]. It significantly limits individuals in fulfilling their daily work obligations and sometimes even engaging in sporting activities[2]. SIS occurs due to the rotator cuff tendons and subacromial bursal inflammation, which creates pain, weakness, and limited range of motion in the shoulder joint[3]. This type of injury commonly affects those performing repetitive overhead activities, including athletes, manual labourers, and even office workers[4]. The standard treatment process for SIS uses physical therapy focused on pain control, strengthening exercises, and functional rehabilitation[5-6].

Some evidence has been published on the effect of physical therapy on SIS[5-7]. In particular, conventional physical therapy is considered an approach of the gold standard, given that therapy is directly supervised by a physiotherapist who can perform hands-on techniques and adjust the therapy programs in real time based on individual patient performance and needs[6-7].

Digital healthcare is transforming how services are delivered[8]. The increasing demand for remote healthcare solutions, partly driven by COVID-19 and other factors, has made telehealth a viable alternative[9]. Telehealth physical therapy usually involves remote patient monitoring, virtual

consultation, and guided exercise programs using various computer-based digital platforms[10]. Factors underpinning the move towards telehealth services include greater access to healthcare professionals, the convenience of patients travelling or otherwise being confined from accessing healthcare services, and cost-saving[10-11].Telehealth is already incorporated in many sectors, such as chronic disease management, mental health counselling, and rehabilitation services[11-12]. The debate, however, on its effectiveness in musculoskeletal rehabilitation, particularly SIS, is ongoing. Some literature has documented that telehealth could produce clinical results comparable to face-to-face therapy[13]. In contrast, some others have indicated its possible shortcomings, such as a lack of manual therapy and real-time physical adjustments[13].

Moreover, patient engagement and motivation are the determinants of successful rehabilitation. In traditional therapy settings, exercise is performed under the therapist's direct supervision[14]. In telehealth rehabilitation, the exercise is performed independently by the patient, thus requiring self-discipline and commitment to ensure correct exercises are performed at scheduled times[10].

However, some aspects cannot be fully addressed without including the cost of telehealth services. Healthcare costs worldwide are getting higher, and cost-effective options for treatment are highly needed nowadays[15]. Telehealth therapy reduces the frequency of clinic visits, thereby cutting down on travel budgets. However, though it promotes easy access in rural or under-served communities, some issues, such as technological literacy, access to the internet, and patient-therapist communication barriers, will have to be improved to maximize the potential benefits of telehealth fully[14-15].

The present study hypothesizes that telehealth physical therapy will equally achieve the benefits of in-person therapy for SIS-practicing pain reduction, functional improvement, and patient satisfaction. This research will add to the increasing body of literature on digital health interventions and their applicability in musculoskeletal rehabilitation by analyzing the trial results. Telehealth's effectiveness as an alternative delivery modality to in-person therapy will open doors to other possible remote rehabilitation programs for better access to care for SIS patients worldwide.

METHODOLOGY

Study Design and Sampling Procedure

This study was established as a randomized controlled trial (RCT) with parallel groups. Participants were enrolled from three outpatient departments of a tertiary care rehabilitation center of Islamabad from February to August 2025.A total of 40 patients diagnosed with SIS were randomized into one of the two intervention groups using a computer-generated randomization schedule to ensure equal distribution and the elimination of selection bias.

Participants and Intervention Groups

Participants were divided into two intervention groups:

1. ***Telehealth physical therapy group (n=20)***
   Patients received guided exercise programs, educational materials, and interactive consultations regarding their physiotherapies via secure online consumption during a particular time and day. The program's exercise routine course for each patient was followed weekly.

2. ***In-person therapy group (n=20)***
   The patients received scheduled visits to the rehabilitation clinic to see physiotherapy for hands-on therapy and supervised exercises.

Both groups completed a patient-specific 12-week rehabilitation program addressing pain management, mobility restoration, and functional recovery.

Sampling Criteria

Patients aged 25-60 years, clinically diagnosed with SIS by an orthopedic physician with no record of previous shoulder surgery and able to perform exercises without limitation, were included. Also, they must be able to use the internet-enabled devices for virtual consults as applicable to the group. Participants were excluded if they demonstrated full-thickness rotator cuff tear and other severe shoulder pathologies, neurological impairments affecting the function of the upper

limb, and enrolled in another shoulder rehabilitation program concurrently.

Outcome Measures

Three primary outcome measures were used to evaluate the effectiveness of both interventions:

- ***The Shoulder Pain and Disability Index (SPADI)***
  This self-reported questionnaire assesses pain intensity and functional limitations due to SIS; it was measured at baseline, six and 12 weeks. The SPADI is reliable (Cronbach's alpha=0.91) and valid for musculoskeletal research[16].

- ***Range of Motion***
  The blinded assessor measured shoulder flexion, abduction, and external rotation in degrees using universal goniometry.

- ***Patient Satisfaction Survey***
  A five-point Likert scale assessed patient experiences, such as ease of use, engagement, and perceived effectiveness. This tool has been validity-tested in telehealth-related studies to determine its effectiveness in rehabilitation[17].

Each outcome measure was measured at three different time points- baseline, mid-intervention, week 6, and post-intervention, week 12- to record change and compare improvements between the groups.

Statistical Analysis

Data were analyzed using SPSS version 29. Independent t-tests were used to compare baseline characteristics, while chi-square tested categorical variables. Repeated measures ANOVA considered within-group changes and mixed-design ANOVA evaluated any between-group differences. Post hoc comparisons were performed using the Bonferroni correction. P-value <0.05 was considered significant.

RESULTS

Baseline Characteristics

Table-1 displays all the baseline demographic and clinical characteristics of the participants. Their mean ages were 45.3±8.7 years, while 60% were female. The groups have no significant differences regarding baseline SPADI scores, ROM measurements, or comorbidities.

Attrition Rates and Intention-to-Treat Analysis

Of the 40 participants recruited, five were dropped (12.5%) when follow-up was done. Meaning their absence may have been due to scheduling issues. Hence, this study uses an intention-to-treat (ITT) analysis instead of the missing data. The method applied was the last observation carried forward (LOCF) for the missing cases to create a more conservative estimate of treatment effects.

Table-1 Baseline Characteristics of Participants

Variable	Telehealth Group (n=20)	In-Person Group (n=20)	p-value
Age (years)	44.8±8.5	45.7±9.0	0.73
Gender (Male/Female)	8/12	8/12	1.00
SPADI Score (Baseline)	62.4±10.3	63.1±11.2	0.81
ROM (Degrees)	85.6±14.2	84.3±13.8	0.76

Comparison of Outcome Measures between Groups

The results showed that both groups had significant improvements in SPADI scores and joint mobility (ROM) after treatment for 12 weeks ($p<0.05$). The telehealth group had a 35 per cent decrease from baseline SPADI scores compared to the in-person group, which measured a mean reduction of 37%. Mobility increased by 32.9 degrees in the telehealth group and 35 degrees in the in-person group; no statistically significant differences existed between groups. Furthermore, patient satisfaction was high in both groups; however, telehealth participants valued their convenience and flexibility, while face-to-face indicated direct supervision with the therapists.

DISCUSSION

Findings from our research indicated that telehealth physical therapy may not differ as appreciably from face-to-face treatment regarding rehabilitation for SIS. Both arms showed considerable differences in SPADI scores and ROM after the 12-weeks of intervention. The telehealth group showed a 35% reduced SPADI

Table-2 Comparison of Outcome Measures between Groups

Outcome Measure	Time Point	Telehealth Group *(Mean ± SD)*	In-Person Group *(Mean ± SD)*	p-value
SPADI Score	Baseline	62.4 ± 10.3	63.1 ± 11.2	0.81
	6 Weeks	45.2 ± 8.7	44.8 ± 9.1	0.89
	12 Weeks	27.1 ± 7.5	26.4 ± 7.9	0.77
ROM (Degrees)	Baseline	85.6 ± 14.2	84.3 ± 13.8	0.76
	6 Weeks	105.4 ± 12.6	106.2 ± 12.1	0.83
	12 Weeks	118.5 ± 10.9	119.3 ± 11.4	0.78
Patient Satisfaction	12 Weeks	4.3 ± 0.6	4.4 ± 0.5	0.72

scores and 32.9 degrees of ROM increase, while the in-person group showed a 37% reduction in SPADI scores and an improvement of 35 degrees in ROM. Telehealth could be considered a possible alternative to conventional therapy. This study is distinct as it studies SIS, a common source of shoulder pain evaluated based on telehealth versus traditional therapy modalities. Research has previously looked into the roles telemedicine has played in musculoskeletal rehabilitation[18-19], and specific studies on SIS are lacking. Zhang et al. conducted a meta-analysis examining the application of telemedicine in patients with conditions affecting rotator cuffs and reported significant improvements in shoulder function with pain relief[20]. Even if rotator cuff disorders include different conditions, this study will relatively concentrate on SIS, thus providing new dimensions to the existing literature.

The systematic review conducted by Lorusso et al.[21] explored the diagnostic accuracy of physical tests and the efficacy of manual therapy in shoulder impingement and related disorders, compared with other studies. Their findings highlight the significance of individualized therapy in achieving the best possible outcomes. Our study corroborates this point, showing how individualized telehealth exercise programs are as effective as classical therapy conducted in person. A study further supports this finding, effectively summarizing the impact of physiotherapy on individuals with clinical signs of SIS. Physiotherapy interventions were said to be effective for patients with SIS, which included, among others, exercise therapy. Our study, however, extends these findings by showing that the mode of delivery, telehealth versus in-person, does not impact effectiveness.

Similarly, research into telehealth for rehabilitation after a musculoskeletal injury has been feasibly replicated in Cottrell et al.[23] with emphasis on improved access to therapy and cost-saving towards the delivery of such services. Anil et al.[24] have itemized the aforementioned studies in finding high satisfaction levels among patients undergoing telehealth interventions concerning physiotherapy, further strengthening the derivation of 85% positive feedback by telehealth participants.

Among the strengths of the study, the most notable one is its randomized controlled design, which reduces selection bias and ensures the validity of findings. An analysis based on intention-to-treat accounts for all participants, including those not completing the study, thus giving a complete view of the effectiveness of the intervention. Certain limitations should be noted. The sample included a relatively small number of individuals, which may limit the overallizable aspects of the findings. Additionally, the research was restricted to 12 weeks, as more extended follow-up periods are required to determine whether the above improvements remain over time. Technical constraints, such as internet connection interruptions in the telehealth group, can also be categorized as possible limitations in hampering the establishment of telehealth in practice.

CONCLUSION

Telehealth-based physical therapy is an effective alternative to traditional in-person therapy for patients with SIS. The comparable improvements in pain relief and functional mobility between the two groups suggest that telehealth can be a viable option, particularly for individuals who may face barriers to accessing conventional therapy services. Future research with larger sample sizes and extended follow-up periods is recommended to validate these findings further and explore the long-term efficacy of telehealth interventions in musculoskeletal rehabilitation.

Acknowledgments
None.

Author Contributions
Munaish Kumar contributed to the conceptualization, methodology, and manuscript writing. **Ravi Kumar Katta** was responsible for data collection and statistical analysis. **Aliya Shair Muhammad** conducted the literature review and assisted in data interpretation. **Jeetendar Valecha** contributed to manuscript editing and technical revisions. **Ummar Gill** provided critical insights and supervised the research process. **Zahoor Ahmed** reviewed the final manuscript and approved it for submission.

Ethical Approval
This study received approval from the Institutional Ethical Review Committee (IERC/RIU/2024/042) of Riphah International University, Islamabad.

Grant Support and Funding Disclosure
None.

Conflict of Interests
None.

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