
Comparing the Efficacy of Manual Therapy and Exercise to Synchronized Telerehabilitation with Self-Manual Therapy and Exercise in Treating Subacromial Pain Syndrome: A Randomized Controlled Trial

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Keywords: subacromial pain syndrome; tele rehabilitation; manual therapy



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Article

Comparing the Efficacy of Manual Therapy and Exercise to Synchronized Telerehabilitation with Self-Manual Therapy and Exercise in Treating Subacromial Pain Syndrome: A Randomized Controlled Trial

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Abstract: This study aimed to investigate the efficacy of manual therapy and exercise versus synchronized telerehabilitation with self-manual therapy and exercise in treating Subacromial Pain Syndrome (SPS). Sixty individuals diagnosed with SPS, aged 18-50 years, were randomly assigned to home exercise (HE), manual therapy (MT), and telerehabilitation (TR) groups. Treatment protocols were administered over 8 weeks and included specific exercises and therapy interventions. Outcome measures included Visual Pain Scale (VAS), shoulder range of motion (ROM) via goniometric measurements, Quick Disability Arm-Shoulder-Hand Problems Survey (Q-DASH), and patient satisfaction. Results revealed that both MT and TR groups exhibited reduced pain, increased ROM, lower Q-DASH scores, and higher patient satisfaction compared to the HE group. However, no significant differences were found between MT and TR groups in pain levels, ROM, Q-DASH scores, or patient satisfaction. The study concludes that both telerehabilitation and manual therapy effectively alleviate pain and are well-received by patients with SPS. Additionally, manual therapy demonstrates superiority in enhancing functional levels compared to exercise-based interventions. (Registration: NCT05200130)

Keywords: subacromial pain syndrome; manual therapy; telerehabilitation

1. Introduction

Shoulder pain is a common musculoskeletal disease[1,2]. Compared to other musculoskeletal diseases, it is the third most common musculoskeletal problem [2]. 48% of these patients are diagnosed with Subacromial Pain Syndrome (SPS). This is a chronic complaint, and patients' 54% ' reported persistent symptoms even after 3 years [3].

Exercise has an important place in SPS treatment. Although a standard protocol of exercise therapy has not been established, it has decreased pain and shoulder function with exercise [4–6].

The effectiveness of manual treatment for patients with SPS is one of the topics frequently investigated [7]. Manual treatment techniques are thought to reduce pain thanks to their biomechanical and neurophysiological effects [8]. The general purpose of mobilization techniques is to ensure restructuring, speed up the opening of the adhesions formed, increase the healing capacity of the tissue, and accelerate the return of the person to daily life activities [9]. Passive methods performed by the manual therapy therapist may include active methods and equipment uses that the patient self-applied [10].

Telerehabilitation is one of the popular approaches that stand out with the effects of the pandemic process we live in [11]. With these remote rehabilitation services, healthcare professionals

can evaluate patients, monitor them, and respond to the treatment program [12]. Telerehabilitation help patients manage their symptoms, increase their levels of physical activity, and support their mental health. Allows for the monitoring of whether patients are performing exercises correctly and the control of their exercise adherence [13].

In the literature, there was no study comparing the method of passive manual therapy with exercise and synchronized telerehabilitation with active manual therapy applied to the exercise in cases with SPS and passive manual treatments that can be applied to exercise with additional self-administration. The purpose of our study is to evaluate the pain and functional activity levels of patients, investigate the effectiveness of active and passive manual treatments applied compared to the exercise program, and evaluate the level of satisfaction with the treatment patients receive.

The hypothesis anticipates that both manual therapy and telerehabilitation interventions will showcase comparable efficacy in alleviating pain and enhancing shoulder function. Furthermore, the study seeks to explore the level of patient satisfaction associated with these interventions.

2. Materials and Methods

2.1. Ethical Approval of the Study Protocol

The study protocol received approval from the Hasan Kalyoncu University, Faculty of Medicine Ethics Committee on June 21, 2021, with the reference number 2021/074. The study adhered to the principles of the Declaration of Helsinki.

2.2. Participants

A power analysis using OpeneEpi version 3 determined that a minimum of 26 subjects per group was necessary, considering $\alpha = 0.05$ and $1 - \beta \leq (\text{power}) > 0.80$. Before the research, volunteers were informed about the treatment and evaluation protocol. Those willing to continue signed a volunteer form. Inclusion criteria were individuals aged 18-50 experiencing shoulder pain for over one month, with positive results for specific tests. Exclusion criteria included individuals with certain conditions. A total of 78 individuals were included initially, with the study completed with 60 participants after exclusions.

2.3. Randomization

We performed using the sealed envelope method. Envelopes were prepared that had been assigned to each group, and participants randomly selected an envelope to be allocated to the manual therapy, telerehabilitation or control group. A double-blind design was not used. Due to the nature of the intervention (e.g., manual therapy) in this study, it was not possible to prevent researchers and participants from knowing which group they were assigned to.

2.4. Treatments

Home Exercise Group(HE):

This group received recommendations related to daily life activities. These suggestions included avoiding excessively strenuous and repetitive activities and not sleeping on the painful side.

- Taught shoulder stretching, posture correction, and scapular-focused exercises.
- Instructed to perform exercises 5 days a week for 8 weeks, 12 times a day, and document in an exercise follow-up form.
- The physiotherapist monitored exercise continuity through weekly reminders.
- Patients documented their exercise follow-up for 8 weeks.

Manual Therapy Group (2. Group):

- Advised on daily life activities, receiving the same home exercise program.
- Instructed to perform exercises five days a week.
- Additional 8 weeks of exercise included 2 days a week of joint mobilizations.

Telerehabilitation Group (3. Group):

- Advised about daily life activities, and learning active manual therapy techniques with the same home exercise program.
- Instructed to perform exercises five days a week and two days a week for 30-45 minutes via video conferencing with a physiotherapist.
- Exercises and active manual treatment methods were performed against the physiotherapist under the home exercise program.

2.5. Outcomes Measures

Vizual Pain Scale (VAS)

There are numbers from zero to ten on VAS. "0" on the line defines no pain, and "10" defines unbearable pain. It is one of the best methods to subjectively evaluate the patient's pain at that moment [14]. The patient was asked to mark the pain he felt during the activity and at night. Marking was measured with the help of a ruler [15].

Range of Motion (ROM)

Goniometric measurements were made for shoulder flexion, abduction, and internal and external rotation movements to assess the range of shoulder joint movement. Measurements were recorded in degrees using the universal goniometer [16].

Quick Disability Arm-Shoulder-Hand Problems Survey (Q-DASH)

Q-DASH is a questionnaire filled out by patients with upper limb problems to determine pain and functionality levels during daily life activities. In our study, the first part of the questionnaire, consisting of 11 questions, was used. In the Q-DASH survey, scoring for each section is done between 0-100 (0, no disability, 100, most serious disability). Answers are answered between one and five (1: no difficulty, 2: mild difficulty, 3: medium difficulty, 4: extreme difficulty, 5: never being able to) [17].

Patient Satisfaction Assessment

To assess patient satisfaction, patients will be asked to give a score of VAS 0–10 cm, indicating satisfaction with using their shoulder in daily life activities compared to before treatment. A high score shows satisfaction with treatment.

2.6. Statistical Analysis

The descriptive statistics for continuous variables were presented as mean and standard deviation ($X \pm SD$). The normal distribution of the data was assessed using the Kolmogorov-Smirnov test. In comparing the Home Exercise, Manual Therapy, and Telerehabilitation groups, the Kruskal-Wallis test was utilized. To identify differences between different groups, the Mann-Whitney U test was employed. For comparing measurements taken before treatment, at 8 weeks, and at 12 weeks within each of the three groups, the Friedman test was conducted. The Wilcoxon signed-rank test was used to determine which group contributed to any observed differences. A significance level of $p < 0.05$ was considered for critical decision-making in the study. Data analysis was performed using SPSS 25.0 (Statistical Packages for Social Sciences) software.

3. Results

Patients

A total of 60 people, including 20 people, were included in each of the Home Exercise (HE), Manual Therapy (MT), and Telerehabilitation (TR) groups. HE group age average 39.75 ± 10.36 years, TR average 24.27 ± 2.4 kg/m²; MT age average in group 41.2 ± 8.08 years, No significant difference was found between the female and male ratios of MT and Telerehabilitation group patients (Table 1).

Table 1. Comparison of socio-demographic data of patients.

	Home Exercise Group (n=20)	Manual Therapy Group (n=20)	Telerehabilitati on Group (n=20)	H	p ¹
Age (year)	39,75±10,36	41,2±8,08	38,3±7,67	3,423	0,622
				χ^2	p ²
Gender					
Woman	8 (%40,0%)	11 (55,0%)	12 (%60,0%)	1,322	0,448
Man	12(%60,0%)	9 (45,0%)	8 (%40,0%)		

*p<0.05, p¹: Kruskal-Wallis Test, p²: Chi-Square Test.*Pain Assessment*

The bilateral comparison was similar in the MT and TR groups (p>0.05). The pain level in the MT and TR groups was found better than the HE group (p<0.05). (Table 2).

Table 2. Bilateral comparison of pain levels between groups.

Pain		Home	Manual	Tele	Between Groups						
		Exercise	Therapy	rehabilitatio	HE- MT		HE-TR		MT-TR		
		Group	Group	n Group	z	p	z	p	z	p	
	After										
VAS Activity	Treatment 8th week	6,68±0,76	5,12±0,75	5,57±0,66	2,42	<0,001*	2,49	<0,001*	1,65	0,112	
	Follow-up 12th week	5,79±1,05	3,42±0,71	4,34±0,64	2,85	<0,001*	2,93	<0,001*	1,12	0,281	
	After										
VAS Night	Treatment 8th week	6,68±0,76	5,12±0,75	5,57±0,66	2,88	<0,001*	2,58	<0,001*	1,63	0,118	
	Follow-up 12th week	5,07±0,82	3,39±0,66	4,17±0,73	2,74	<0,001*	2,76	<0,001*	1,58	0,128	
SF- McGill- Melzack	Follow-up 12th week	47,75±9,9 7	34,35±8,52	36±8,94	2,77	<0,001*	2,67	<0,001*	1,03	0,324	

*p<0.05.

Functional Assessment

Range of Motion (ROM)

When looking at the bilateral comparison in shoulder ROM, the increase in ROM in the manual treatment and telerehabilitation groups was found to be higher than in the home exercise group (p<0.05). ROM scores in the manual treatment and telerehabilitation groups increased at a similar level (p > 0.05) (Table 3).

Table 3. Binary Comparison of Shoulder Range of Motion.

Shoulder ROM		Home Exercis e Group	Manua l Therap y Group	Tele rehabilitati on Group	Between Groups					
					HE-MT		HE- TR		MT-TR	
					z	p	z	p	z	p
Flexion	After Treatm ent 8th week	173,55 ± 3,12	179,5 ± 1,54	178 ± 2,51	3,0 8	<0,001 *	2,9 6	0,01*	1,5 2	0,14 3
	Follow- up 12th week	174,75 ±1,97	179,00 ± 2,62	180,0 ± 0,0	2,5 9	<0,001 *	3,2 9	<0,001 *	1,9 3	0,05 8
Abductio n	After Treatm ent 8th week	172,0 ±4,70	179,5 ± 1,54	177,5 ± 2,56	3,5 3	<0,001 *	3,4 1	<0,001 *	1,5 1	0,15 9
	Follow- up 12th week	173,25 ±3,73	179,5 ± 1,54	179,0 ± 2,62	3,4 8	<0,001 *	3,4 5	<0,001 *	1,6 0	0,11 2
Internal Rotation	After Treatm ent 8th week	82,45 ± 5,91	89,0 ± 2,05	86,75 ± 2,94	3,1 3	<0,001 *	2,9 3	<0,001 *	1,4 8	0,16 2
	Follow- up 12th week	84,2 ± 5,31	89,25 ± 1,83	89,75 ± 1,12	3,1 8	<0,001 *	3,1 9	<0,001 *	1,6 8	0,10 4
External Rotation	After Treatm ent 8th week	87,9 ± 3,37	90,0 ± 0,0	89,25 ± 2,45	3,0 1	<0,001 *	2,8 8	<0,001 *	1,5 5	0,13 5
	Follow- up 12th week	88,25 ± 2,94	90,0 ± 0,0	89,5 ± 1,54	2,3 5	<0,001 *	2,3 1	0,027*	0,9 9	0,33 4

In the bilateral comparison of the groups, Q-DASH levels were found to be low in the MT group at 8 and 12 weeks compared to the HE and TR groups ($p < 0.05$). Compared to the HE and TR groups, the groups were not superior to each other ($p > 0.05$) (Table 4).

Table 4. Bilateral Comparison of Q-DASH Values.

Q-DASH	Home	Manual	Tele	Between Groups					
	Exercise	Therapy	rehabilitati	HE-MT		HE-TR		MT-TR	
	Group	Group	on Group	z	p	z	p	z	p
After	26,48	18,3	30,11						
Treatment	±	±	±	4,65	<0,001*	1,401	0,128	5,21	<0,001*
8th	9,07	12,01	7,83						
week									
Follow-	20,45	6,71	18,98						
up 12th	±	±	±	5,23	<0,001*	0,550	0,663	5,03	<0,001*
week	6,43	9,31	4,68						

Patient Satisfaction Assessment

When looking at Patient Satisfaction-VAS values, patients in the manual treatment and telerehabilitation groups had higher levels of treatment satisfaction than in the home exercise group ($p < 0.05$). (Table 5)

Table 5. Bilateral Assessment of Patient Satisfaction-VAS Levels.

Patient	Home	Manual	Tele	Between Groups					
	Exercise	Therapy	rehabilitati	HE-MT		HE-TR		MT-TR	
	Group	Group	on Group	z	p	z	p	z	p
Satisfaction	6,10±0,	7,70±0,4	7,90±0,45	4,2	<0,001*	4,03	<0,001*	1,0	0,335
Follow-up	72	7		4			*	2	
12th week									

4. Discussion

Based on the findings of our study, we aimed to evaluate the comparative effectiveness of different treatment modalities, including a home exercise program, active manual treatment and passive manual treatment telerehabilitation supported by video call. Our results revealed discernible differences among the groups concerning pain, functionality, and patient satisfaction levels.

Initially, we recorded consistent demographic information for all patient groups, indicating similar age, height, and body mass index distributions. Notably, our study determined an average age of 40 across the groups, with no significant correlation found between age and pain severity.

Several studies underscore the critical role of exercise in treating subacromial pain syndrome. While the effectiveness of manual therapy remains a topic of interest, systematic review indicated that exercise programs alone could yield comparable results to those combined with manual therapy [18]. These findings align with existing guidelines that endorse exercise prescriptions for SPS and recommend the incorporation of various adjunct therapies, including manual techniques and psychosocial interventions [19].

Manual therapy, known for its effects on muscles, joints, soft tissues, and the neurovascular system, has demonstrated promise in reducing pain, as supported by both our study and existing literature [7]. However, challenges in evaluating the precise efficacy of manual therapy interventions

in SPS persist due to insufficient clarity on the intervention differences and application methods within various studies [20].

Our study further supports the importance of active mobilization approaches, which have been observed to be beneficial in various musculoskeletal conditions. Notably, we found that both passive manual therapy and telerehabilitation supported active mobilization methods were effective in managing pain, with home exercise intervals demonstrating higher pain levels compared to the intervention groups.

Active mobilization is a type of mobilization that patients apply to themselves and can involve the use of equipment [10]. Studies conducted on the active mobilization approach in the literature were found to be present in subacromial pain syndrome, increasing thoracic mobilization, treating ankle injuries, equipment-assisted hamstring flexibility enhancement, sacroiliac dysfunction, and neck pain [21].

Additionally, we observed significant improvements in joint range of motion across all three groups, consistent with existing literature. Both manual therapy interventions and active and passive joint mobilizations were found to relax tightened tissues around the shoulder joint and contribute to muscle strengthening, ultimately facilitating recovery.

In contrast, Park et al., in their randomized controlled study, did not observe a significant difference in joint range of motion measurements between the group receiving additional mobilization for subacromial pain syndrome and the group included in the specific exercise program [22].

Telerehabilitation, a key focus of our study, has shown promise in assessing and implementing treatment programs across a range of medical conditions. Notably, its ability to evaluate patient progress, ensure exercise adherence, and monitor pain and physical function has been highlighted. While existing research has not directly compared clinical passive manual therapy with telerehabilitation-supported active manual therapy, our study presents valuable insights into the comparable effectiveness of these modalities.

Furthermore, the use of telerehabilitation methods has garnered attention due to its potential to reduce treatment costs, save time, and improve treatment accessibility, keeping pace with advancing technological developments. Our findings indicate that the telerehabilitation group exhibited pain levels and joint range of motion measurements similar to the manual therapy group. However, the manual therapy group demonstrated the highest increase in functionality, Q-DASH scores, indicating superior functionality improvement compared to the other groups.

Telerehabilitation is used in the assessment and implementation of treatment programs for musculoskeletal diseases, cardio-pulmonary rehabilitation, neurological conditions, geriatric and pediatric patients [23–27]. In the literature, no study comparing clinical passive manual therapy with telerehabilitation supported active manual therapy, as in our study, has been found.

Greiner et al. reported that in their study involving 132 participants who underwent shoulder surgery and received a tele-rehabilitation-supported exercise program, the majority of patients experienced improvement and were satisfied with this treatment [28]. In a study examining the satisfaction levels of both the practitioner and the patient in tele-rehabilitation programs applied to musculoskeletal disorders, both the practitioner and the patient reported satisfaction with this application. Patients recommended the combination of tele-rehabilitation with face-to-face rehabilitation applications [23].

In addition, in the VAS satisfaction assessment that we used to examine the satisfaction levels of our patients, it was determined that the satisfaction levels of the TR group and the MT group were similar, but the satisfaction levels of the EE group were lower than these two groups.

While our study has contributed valuable insights, it is crucial to note certain limitations. Specifically, we acknowledge the need for a more comprehensive assessment of patient satisfaction, including evaluating technological ease of use, patient preferences for telerehabilitation over face-to-face treatment, and the recording of technical and infrastructure issues experienced by patients. We believe that these detailed records could significantly inform future studies in this domain.

Lastly, the comparison between face-to-face and online measurements of the telerehabilitation group was not conducted in our study. This comparison could have provided valuable insights into the feasibility and reliability of online assessments and measurements, thereby enhancing our understanding of the applicability of telerehabilitation in clinical settings.

5. Conclusions

In the study, it was found that both manual therapy and telerehabilitation groups exhibited similar pain levels, while the group performing home exercises showed a lesser reduction in pain intensity. The research highlighted a significant increase in shoulder joint range of motion in individuals with SPS, with manual therapy and telerehabilitation surpassing the home exercise group's improvement. Moreover, both manual therapy and telerehabilitation interventions were seen to enhance functionality in patients with subacromial pain syndrome, with the most noticeable improvement observed in the manual therapy group. The study indicated that satisfaction levels were comparable between the manual therapy and telerehabilitation groups, surpassing those in the home exercise group. Additionally, telerehabilitation-supported exercise and active mobilization were deemed as effective as face-to-face exercises and passive mobilization in reducing patient pain and improving functionality.

Exercise interventions play a crucial role in managing subacromial impingement syndrome. Therefore, we suggest designing patients' rehabilitation programs with a strong emphasis on exercise-based regimens. During extraordinary circumstances like a pandemic, when factors such as transportation may hinder traditional treatment approaches, we advocate the utilization of telerehabilitation-supported treatment methods in situations where face-to-face treatment options are limited. We believe that telerehabilitation practices facilitate enhanced patient access to treatment. For patients in the telerehabilitation group, we propose the integration of self-mobilization techniques, known as active mobilization, into the treatment plan. These techniques are designed for easy application by the patients themselves. Our observations indicate that both active and passive manual therapy interventions significantly impact patient treatment satisfaction. Therefore, we recommend maintaining continuous patient interaction throughout the treatment process, even in an online setting.

6. Patents

This section is not mandatory but may be added if there are patents resulting from the work reported in this manuscript.

Supplementary Materials: The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Figure S1: title; Table S1: title; Video S1: title.

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Written informed consent for publication must be obtained from participating patients who can be identified (including by the patients themselves). Please state “Written informed consent has been obtained from the patient(s) to publish this paper” if applicable.

Data Availability Statement: We encourage all authors of articles published in MDPI journals to share their research data. In this section, please provide details regarding where data supporting reported results can be found, including links to publicly archived datasets analyzed or generated during the study. Where no new data were created, or where data is unavailable due to privacy or ethical restrictions, a statement is still required. Suggested Data Availability Statements are available in section “MDPI Research Data Policies” at <https://www.mdpi.com/ethics>.

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Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

The appendix is an optional section that can contain details and data supplemental to the main text—for example, explanations of experimental details that would disrupt the flow of the main text but nonetheless remain crucial to understanding and reproducing the research shown; figures of replicates for experiments of which representative data is shown in the main text can be added here if brief, or as Supplementary data. Mathematical proofs of results not central to the paper can be added as an appendix.

Appendix B

All appendix sections must be cited in the main text. In the appendices, Figures, Tables, etc. should be labeled starting with “A”—e.g., Figure A1, Figure A2, etc.

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