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RESEARCH ARTICLE

EFFECTIVENESS OF TELEREHABILITATION ON PAIN, FUNCTIONAL MOBILITY AND DISABILITY IN PATIENTS WITH SHOULDER DYSFUNCTIONS DURING COVID-19 PANDEMIC

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ABSTRACT

Background: Telerehabilitation services have become essential for many patients during the Covid-19 lockdown. These services enable accessibility to rehabilitation to restore normal joint function. The modifications in lifestyle owing to the lockdown period seem to be a major cause of shoulder dysfunction. Convenience and safety provided during guided therapy sessions are gaining popularity. It is mentioned that telerehabilitation when applied appropriately is a safe and effective way to deliver services. **Objective(s):** The study was designed to assess the effectiveness of telerehabilitation in patients with dysfunctions of the shoulder joint. **Materials and Methods:** Fourteen subjects with shoulder dysfunctions were recruited in the study based on their inclusion and exclusion criteria during the lockdown period. The pre- and post-assessment for shoulder dysfunction was done using VAS for pain, Functional Assessment of shoulder for functional mobility and Quick DASH for disability via telerehabilitation. **Results:** There was a mean difference seen in the pre- and post-VAS and Functional Assessment scores which were statistically significant ($p < 0.05$). The results of this study also showed that there was a mean difference in the pre and post Quick DASH score with a statistically significant difference ($p < 0.05$) showing an overall reduction in pain and improvement in functional mobility. **Conclusion:** The study concluded that three weeks of telerehabilitation was effective on managing pain and improvement in functional mobility in patients with shoulder joint dysfunction during COVID-19 pandemic.

INTRODUCTION

Pain and dysfunction in shoulder was a common complaint during the lockdown of Covid-19 pandemic. Work from home, excessive use of laptop, tablet and smart phone was identified as the main causative factor. Renowned orthopaedic surgeons have reported the lack of ergonomic seating arrangements plus long duration of abnormal postural stresses to be the culprits of this pain condition. Along with youngsters, people in all the age groups are glued to the screen. Repetitive overhead activities, unavailability of domestic help was another identified factor for a major risk of shoulder pain, among many female subjects. Shoulder pain is the third most common musculoskeletal condition reported (Bjelle, 1989). 70% of the population report prevalence of this kind of pain and discomfort once in lifetime.

This painful condition is associated with reduced functional mobility leading to disability in activities of daily living (ADL's). The main causative factors of pain are identified from the local joint structures, as glenohumeral joint, acromioclavicular joint, sternoclavicular joint, rotator cuff, muscular and ligamentous supporting structures of the shoulder complex. Referred pain results from cervical complex or visceral organs. The overuse of muscles leads to fatigue, weakness, microtrauma and impairment leading to dysfunction. Visual Analogue Scale (VAS) gives a fair idea of pain intensity and can be administered easily virtually (David, 2014). Functional assessment of the shoulder forms an important aspect due to the role of the shoulder complex in activities of daily living both in open and closed kinetic chains (David, 2014). Placing hand behind head is an important action needed for combing hair or getting wallet out of back pocket. Mannerkorpi *et al* and Dutton have studied the importance of functional outcomes of the arm and outlined three movements (Mannerkorpi, 1999; Dutton, 2012). Test one measures the ability of overhead activities. Test position two

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gives a clear idea of lateral rotation of arm. The third test position is useful in evaluating reach of arm to opposition scapula. These activities of daily living are of great concern to the patient. They could be administered on a virtual platform. The other outcome is the Quick DASH which measures the functional strength and endurance. It is an assessment tool which is based on a self-reported questionnaire to study the perspectives from the patient's point of view. It is a reliable and valid score to assess the degree of disability of the complex joint structure. Thus, this study aimed to assess and manage shoulder pain, functional mobility and disability on a virtual platform which is a relatively newer method of rehabilitation service during the Covid-19 lockdown period.

MATERIALS AND METHODS

Institutional review board approval was taken from KJ Somaiya College of Physiotherapy. Individuals meeting inclusion and exclusion criteria were recruited in the study. Online consent was obtained from the participants and orientation to telerehabilitation was given prior to the commencement of session.

Inclusion criteria:

- Individuals with either unilateral or bilateral shoulder joint pain
- Age group of 40- 60 years of either gender
- Rated as ≥ 3 and ≤ 6 on Visual Analogue Scale

Exclusion criteria

- Any other musculoskeletal condition involving back or lower extremity
- Total shoulder arthroplasty
- Traumatic shoulder conditions
- Neurological disorder
- Cognitive impairments (Mini-mental State Examination MMSE $< 24/30$)

Assessment of shoulder dysfunction was done pre and post Telerehabilitation on the basis of:

- Pain using Visual Analogue Scale
- Functional Assessment of shoulder using
- Test 1: Hand to back of neck
- Test 2: Hand to scapula (from behind)
- Test 3: hand to opposite scapula (from in front)
- Participants were asked to fill self-reported outcome measures, Quick DASH. Quick
- DASH alpha 0.83, ICC 0.87 (95% confidence interval, .77-.93)
- A three weeks protocol was designed to address pain, restore functional activities, improve
- Flexibility and strength of the shoulder joint.
- Data collected was analysed using descriptive statistics.

RESULTS

Fourteen subjects with shoulder dysfunction participated in this study and their data was recorded in the Excel 2007 spreadsheet. It was analysed using Statistical Package for the Social Science (SPSS) software (version 16). Qualitative

variables were expressed as an absolute number and percentage. The quantitative variables were expressed as mean and standard deviation. Shapiro-wilk test was used to analyse normality of quantitative data. According to it, the data for quick DASH score passed normality, so paired t test was used and the data for VAS and functional assessment did not pass normality so Wilcoxon signed rank test was used. There were 43% of males and 57% of females in the present study. The participants were in the age group of 35-50 years. The pre and post mean comparison of VAS score showed a statistically significant difference ($p < 0.05$) as shown in Table 1. The pre and post mean comparison of Functional Assessment score showed a statistically significant difference ($p < 0.05$) as shown in Table 1. The pre and post mean comparison of DASH scores showed a statistically significant difference ($p > 0.05$) as shown in Table 2.

Table 1. Mean values for VAS and Functional Assessment scores

	VAS		Functional Assessment	
	Pre	Post	Pre	Post
Mean	6.42 \pm 1.91	2.21 \pm 1.05	6.50 \pm 1.82	2.14 \pm 0.86
p value	0.00		0.00	

Table 2. Mean values for DASH score

	DASH	
	Pre	Post
Mean	44.12 \pm 14.58	19.97 \pm 9.66
p value	0.00	

DISCUSSION

Shoulder complex is an important functional component of the upper extremity kinetic chain. Complex anatomy and interrelationships between acromio-clavicular joint, sterno-clavicular joint and glenohumeral joint makes the diagnosis of shoulder dysfunction very challenging. The current study assessed the effectiveness of telerehabilitation on pain, functional mobility and disability in patients with shoulder dysfunctions during COVID-19 pandemic. Fourteen subjects with shoulder joint affection were reported to the physiotherapy department during lockdown from the period of August 2020 to December 2020. Online evaluation of pain intensity was done using Visual Analog Scale (VAS). For functional movement assessment 'Hand to back of neck, Hand to scapula (from behind) and Hand to opposite scapula (from front)' and Quick DASH were used. The Visual Analog Scale (VAS) is a validated, subjective measure for acute and chronic pain. On this 10-cm line, the scores are recorded by making a mark that represents a continuum between "no pain" and "worst pain. It can help in categorizing the perceived amount of a patient's pain as none, mild, moderate and severe.⁵ The functional assessment analysis was used as an important indicator for activities of daily living. Hand to back of neck/ Hand behind neck analyses combined gleno-humeral elevation, external rotation and scapular rotation and it is essential for grooming. Hand to scapula (from behind)/ Hand behind back evaluates combined gleno-humeral extension, adduction, internal rotation and scapular distraction. It is important for perineal hygiene, tucking the shirt behind the back, reaching back pockets and fastening bra. Hand to opposite scapula (from front)/ Hand to opposite shoulder assesses gleno-humeral flexion, horizontal adduction and is useful for

washing the opposite shoulder and manipulating objects across the body.^{2,6} As shown in table 1, there was a mean difference seen in the pre and post VAS and Functional Assessment scores which was statistically significant ($p < 0.05$) Functional assessment helped to test joint mobility, endurance, muscle strength and willingness to move. It assists in determining the source of pain. Jing-Ian Yang, et al.⁷ conducted a nonexperimental trial to study the intertester and intratester reliability of three function related tests. The 'Hand to neck, Hand to scapula and Hand to opposite scapula' were the tests used in 46 patients with shoulder pathologies along with decreased range of motion and 46 age and gender-matched control subjects. Two independent therapists performed the tests for intertester reliability. For intratester reliability, the same therapist assessed the subjects again, 3-5 days later. Comparison of scores of these tests between patients and controls was evaluated. The correlation matrix was used to calculate the level of association between the tests. The intratester and intertester reliability on the 3 tests varied from 0.83 to 0.90. The patient's performance levels of the tests were lower than that of the control group. The results thus prove that function related tests are reliable and their use in clinical practice for documentation of reduced function of the shoulder is approved. The level of association between the 3 tests (varying from $r = 0.64$) indicated that each test evaluates a different aspect of shoulder function.⁷ In this study, Quick DASH was used to measure physical function and symptoms. The results of this study showed that there was a mean difference in the pre and post DASH score with a statistically significant difference ($p < 0.05$) showing an overall improvement as per shown in table 1.

Mactermid et al.⁸ determined the validity of the shortened version of the Disabilities of the Arm, Shoulder and Hand questionnaire (Quick DASH) in comparison to the full DASH in patients undergoing Total Shoulder Arthroplasty (TSA) and Rotator Cuff Repair (RCR). It concluded that when the Quick DASH was substituted for the full DASH, similar score estimated in patients following TSA and RCR.⁸ Treatment program was given depending on the irritability of the joint.⁹ Pain reported by participants in this study were treated by physical agents. Cold packs and hot packs that could be easily made available at home, were used to treat acute and chronic inflammatory conditions respectively. Treatment targeted to the source of pain assisted in the healing process and helped to provide relief of discomfort.^{6,9} Cold packs are given to decrease intra articular temperature useful to reduce swelling due to inflammation. Hot packs provide local analgesia and increase in circulation around the shoulder joint.^{6,9} Post muscle relaxation, simple non-weight bearing exercises helped to reduce the friction in the joint and pain. The three weeks protocol of shoulder exercises was designed. In the first week, following aspects were addressed such as patient education, active assisted exercise in the pain free range, multiple angle muscle setting exercises, scapulothoracic muscles stabilization exercises, prevention or correction of postural deviations and prevention of loss of mobility of adjacent regions. The free exercises in pain limits helped in lubrication of joints and thus reduced pain. In the second week exercises were progressed within safe limits. Number of repetitions were customised as per the strength and endurance of the patient. In the third week, an injury prevention program was added. The further modifications of exercises were done to achieve desired functional outcomes and the needs of the patient as per his/her occupation. The pain and dysfunction in the shoulder joint

during Covid-19 lockdown ranged from muscle, tendon and ligament pathology surrounding the shoulder joint. In most of the cases, the causative factors could be attributed to malalignment due to poor ergonomic design of work from home arrangements. Overuse of laptops and smartphones in awkward postures result in disturbance of the length-tension ratio of the muscles in the upper quadrant. The other common contributing factors observed were the unaccustomed household activities that many were exposed to during the lockdown. The domestic help was unavailable hence repeated activities that were previously not performed lead to microtrauma. The psychosocial/ psychosomatic aspect was also the contributing factor. Many patients reported the fear of losing their jobs and uncertainty during the pandemic. Few participants in the study also reported change in their schedules. The erratic eating, sleeping habits and disruption in their daily workouts as well as exercise routines affected their overall fitness and mobility. Alteration of sustained posture and repetitive movement patterns required attention and correction with therapeutic exercises.

These exercises focused on improved muscle performance, joint mobility and soft tissue mobility. Improved physiological capabilities provided a better foundation for optimal posture, movement control and controlled tissue loading. These exercises re-established the neuromuscular control and promoted stability.¹⁰ Simple closed chain exercises facilitated joint proprioception and scapular control. Stretching exercises were initiated within the pain free range initially. Self-stretching gave confidence to the patient to work on increasing the capsular length as well as low load cyclic stretching helped to maintain the new achieved length. This in turn improved the proteoglycans circulation to reduce pain and enhance healing.^{6,9} The strength training program targeted shoulder muscles, rotator cuff group and scapulothoracic muscles to improve overall shoulder stability. Loading the joint gradually decreased the prostaglandins and improved healing. The scapular muscles such as serratus anterior, middle and lower fibres of trapezius muscles were targeted to improve the overall stability and function of the shoulder.^{6,9} Telerehabilitation therapy was thus essential for return to a physically active lifestyle of the active and pain free shoulder joint. Limitations: Online physiotherapy rehabilitation protocol had limitations such as advanced techniques like instrument assisted soft tissue release, dry needling, soft tissue mobilization and joint mobilization could not be advocated. Even electrotherapeutic modalities could not be utilized.

Conclusion

Telerehabilitation was effective in achieving pain relief, restoring functional activities, and improvement in quality of life during the COVID-19 pandemic with an online rehabilitation program.^{11,12}

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Abbreviations

ADL's- Activities of Daily Living
VAS – Visual Analogue Scale

DASH – Disabilities of Arm, Shoulder and Hand Questionnaire
 MMSE- Mini Mental State Examination
 TSA-Total Shoulder Arthroplasty
 RCR- Rotator Cuff Injury

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