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INTEGRATION BETWEEN MRI AND PHYSICAL THERAPY TO IMPROVE TREATMENT OF PATIENTS WITH SHOULDER PAIN

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ABSTRACT

Background: Shoulder pain is the second most common musculoskeletal disorder treated by physical therapists. The cause for the shoulder pain is multifactorial. However, a specific diagnosis is crucial in the right management of shoulder dysfunction. Therefore, the aim of this study was to find out the efficacy of integrating the MRI for the accurate diagnosis and impact of this on rendering the effective physical therapy interventions in shoulder dysfunction patients.

Methods: A retrospective study conducted on 14 patients who undergone an MRI with a 1.5 T unit MAGNETOM Symphony (Siemens), for their shoulder pain, where the diagnosis might be Muscle tears like, subscapularis, infraspinatus, supraspinatus and teres minor muscles; subacromial or subdeltoid bursitis and labral tears were included. All the subjects were then continued with usual physical therapy treatments for four weeks depending on their diagnosis which includes; advice, stretching, mobilization and strengthening exercises, manual therapy, massage, strapping, and electrotherapy. The outcome measures documented from the case sheet were; Visual Analogue Scale grade and passive range of motion of shoulder external / internal rotation and abduction.

Results: Paired t test was used to compare the PROM between pre rehabilitation and post rehabilitation testing and the non parametric test, Mann Whitney U test was used for the comparison of VAS. All patients showed a significant improvement in VAS and PROM of abduction, internal and external rotation following physical therapy ($P \leq 0.05$).

Conclusion: MRI is found to be a reliable method of diagnostic procedure for the shoulder pain and the integration of MRI and physical therapy to treat shoulder dysfunction leads to a better outcome.

Keywords: Shoulder Pain, MRI, Physical Therapy, Visual Analogue Scale, Shoulder Range of Motion.

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INTRODUCTION

In United Kingdom, the prevalence rate of shoulder related pathological conditions are estimated to be around 14% and annually 1–2% of adults consult their medical doctor with the new onset of shoulder complaints [1]. Meanwhile, in United States of America the prevalence is around 16% to 21% among the general population. The shoulder pain ranked the third most common musculoskeletal disorder behind spine and knee, according to the American Orthopaedicians [2]. Prevalence of shoulder pain (SP) with the age 65 years and older is 34%. It was reported that SP related conditions are the second most common musculoskeletal disorder treated by the physical therapists and the economical burden for the management of the shoulder related conditions in the United States crosses more than \$7 billion annually [3]. The SP has a negative effect on both the society and individual as well [4]. Usually, about 16% of shoulder pain cases lead to a referral, out of which 27% are sent to secondary care and the majority of about 64% are referred to physical therapy after checked by a general practitioner [5]. Approximately an average of €300- €350 might be the cost of SP treatment per patient, during a 6-month period is spent in Sweden [6].

The management methods which are routinely followed for the SP include several types of procedures. Physical therapy (PT) is usually, the first preference of treatment in the conservative management of SP. The PT includes different electro physical modalities, functional training, therapeutic exercises and manual therapy. Previous studies proved that, the efficacy of PT in various shoulder related pain conditions [2,3,7]. According to the recent studies, it was proposed that the discrepancies in the rehabilitation outcome of patients with shoulder pain are because of poor reliability of shoulder dysfunction diagnoses [7]. Diagnostic tagging related to shoulder diseases has limited diagnostic accuracy and consistency. In order to guide a treatment plan for various shoulder pathologies, a specific shoulder diagnosis is essential [2]. PT assessment, alone is not valid to distinguish between different diseases, due to low reproducibility, sensitivity and specificity. An exact diagnosis is considered substantial to assure that shoulder pain patients are given an appropriate physical therapy intervention (Ottenheijmet al., 2010) [5].

Musculoskeletal (MSK) medical imaging is an important diagnostic procedure for MSK abnormalities. Magnetic resonance imaging (MRI) in particular has a great value in diagnoses of MSK disorders. The potential uses of MRI are sensational for improved patient outcomes [8]. MRI is more applied medical imaging modality in the assessment of SP. It has shown to have high diagnostic soundness for the diagnosis of Rotator Cuff (RC) tears and better than ultrasound in detection of other conditions of the RC, like muscle atrophy [9].

Physical examination and diagnostic imaging should be performed to determine the stage of disease and identify any abnormality that may be contributory. A thorough shoulder evaluation should be done in all subjects complaining of SP, with radiographs and advanced imaging, such as ultrasonography and MRI [10,11]. Usually the

imaging procedures are reserved for those patients who have either failed a trial of conservative treatment or have a high probability of a RC tear. Since the shoulder complex is composed more of structural tissues, MRI considered to be the more accurate method of imaging the soft-tissue structures. MRI is noninvasive, readily available and details the entire shoulder region with high accuracy. Several studies report values approaching 100% specificity and sensitivity of MRI for the diagnostic accuracy of full-thickness supraspinatus tears [10]. Therefore this study is aimed to find out the efficacy of integrating the MRI for the accurate diagnosis and to render effective physical therapy intervention in patients with shoulder dysfunction.

SUBJECTS AND METHODS

This was a retrospective study conducted at King Abdul Aziz University Hospital (KAUH), Jeddah, Saudi Arabia. The medical records of 56 patients who treated for various shoulder conditions during June 2015 and December 2015 were screened. Out of 56 subjects, a total of 14 patient's data were collected for the study analysis because only those subjects have fulfilled the criteria of needed outcome measures recorded for the study. The ethical clearance was obtained from the Institutional Ethical Review Committee. Patients with SP were included if they were of older than 18 years of age and have undergone MR imaging. Patients who did not have a complete data in the PT recording system were excluded. MR images were done with a 1.5 T unit MAGNETOM Symphony (Siemens). Following which the subjects were referred to the PT department for the further evaluation and treatment. The outcome measures documented from the case sheet were; the Visual Analogue Scale (VAS) grade to know the degree of pain and shoulder joint passive range of motion (PROM) which includes the abduction, internal and external rotation. There are several self-reported assessment tools used by the physical therapists (PTs) for documentation of intensity of pain and function in order to check the various PT interventions effects. Among which the most common tool used by PTs to understand and document the intensity of pain in SP patients are the VAS, which is a valid and reliable measure to estimate the intensity of pain. The VAS is comprises of a grading of level of pain intensity from 0 to 10, where 0 indicates no pain and 10 indicate maximum unbearable pain [12,13]. If there is a change of 20mm in the score it is found to be clinically meaningful improvement in the VAS [14]. The other outcome measure used in the current study was PROM of shoulder abduction, internal and external rotation. These two outcome measures were documented at the start of the study and at the end of 4 weeks of intervention. The usual PT treatment methods selected for these kinds of shoulder cases include advice, stretching, mobilization and strengthening exercises, manual therapy, massage, strapping and electrotherapy depending on the condition [15]. Exercise therapy remains a mainstay of the treatment of RC abnormality, especially for tendinitis or tendinosis, partial-thickness articular sided tears and massive and irreparable tears [16]. The goals of exercise therapy focus on stretching and strengthening intact RC muscles and periscapular muscles through land based protocols. For those

with massive, irreparable tears, improving strength of the anterior deltoid is paramount for the restoration of function. Initial therapeutic efforts are focused on reducing inflammation and improving the range of motion. During this phase of treatment, modalities such as cryotherapy or massage can be beneficial in reducing painful inflammation. Stretching often involves remedying posterior capsular contracture, a common source of pain. Posterior capsular contracture is manifested as decreased internal rotation with the arm at 90° of abduction, and can often be successfully treated with a series of stretches including horizontal adduction and “sleeper” stretches. Once pain has been managed and motion normalizes, therapeutic efforts shift toward correcting scapulothoracic dyskinesia and weakness with abduction and forward elevation, which have been proved to lead to pain and loss of function in those patients with RC tears. Muscles of the shoulder girdles should be targeted with an array of strengthening exercises to restore normal mechanics. Treatments directed toward improving scapular motor function and shoulder abduction can produce improvements in self-reported disability and pain control in those suffering from subacromial impingement. Strengthening exercises should be relatively pain free, and can be performed with rubber bands and/or free weights [10,17].

The statistical package SPSS for Windows (version 19.0; SPSS Inc, Chicago, IL) was used for the statistical analysis of the data. Descriptive statistics included mean, standard deviation, and 95% confidence interval values were performed. Paired *t* test was used in order to compare the dependent variables of PROM between pre and post rehabilitation testing and the non parametric test, Mann Whitney U test was used to find out the difference in subjective outcome variable VAS.

RESULTS

The population included 6 male and 8 female patients; the average age was 51.1 years, ranging between 33 to 70 years. The results of the MRI findings show that, out of the 14 subjects; 05 of them had Supraspinatus tendinitis, 05 of them had Supraspinatus tear, 01 of them had Subacromial bursitis, 01 of them had calcific tendinitis, 01 of them had labral tear and, 01 case of Hill Sach's lesion.

Since the results of the study showed there is a significant difference between pre to post comparison of VAS for the shoulder pain ($p = 0.000$ [$p > 0.05$]), which demonstrates that there was a significant reduction in the intensity of pain at the end of 4 weeks of treatment (Table 1). The mean range motion of abduction, internal and external rotation of the shoulder was examined for all the patients. The results for the PROM show that there was a significant difference in all the PROM of pre to post values in terms of the passive joint mobility ($p \leq 0.05$) and that shows a better improvement in the PROM and function in those patients (Table 2).

Table 1: Pre to Post Comparison of VAS

	Mean Mean diff	Paired Differences				T	Sig. (2-tailed) <i>p</i>
		SD	95% Confidence Interval of the Difference				
			Lower	Upper			
VASPRE - VAS-POST	6.71	5.03	0.877	4.494	5.506	21.331	.000
	1.68						

Table 2: Pre to Post Comparison of Passive Abduction, External Rotation and Internal Rotation of Shoulder Range of Motion

	Mean	Paired Differences				t	Sig. (2-tailed) <i>p</i>
		Mean Difference	SD	95% Confidence Interval of the Difference			
				Lower	Upper		
SH.ROM-ABDPRE - SH.ROM-ABDPOST	87.5	30.50	7.65	-34.92	-26.08	-14.91	.000
	118						
SH.ROMER-PRE - SH.ROMER-POST	29.67	18.20	9.28	-23.36	-12.64	-7.27	.000
	47.87						
SH.ROMIR-PRE - SH.ROMIR-POST	32.48	19.34	9.84	-25.64	-16.47	-9.58	.000
	51.82						

DISCUSSION

This research was conducted to investigate the effectiveness of integrating the MRI in order to make a specific diagnosis in patients with SP and whether this makes any impact in the management of shoulder dysfunction with PT. The study results showed that, all the patients who had undergone PT treatment had shown a significant improvement in the reduction of pain and improvement in the PROM. The differential diagnosis of the SP is an important factor in order to provide better care for the patients. Even though, patient's subjective history and physical examinations can be considered as the most useful clinical methods to make decision process among the patients with SP, sometimes the diagnosis may go wrong and the patient may receive a wrong treatment for their dysfunction [18]. However, if with the aid of an MRI screening it can be detected, the exact cause for the SP; both the PTs and the patient may get benefitted mutually. According to *Gail Dean Deyle*, the capability of PTs to combine overall knowing of clinical anatomy and evidence-based imaging and differential diagnosis skills with uses of MRI achieved improved healthcare results among the patients. Thereby it helps the PTs to facilitate exact diagnoses and decreases the occurrence of surgical procedures as a result; it reduces the risk for their patients [8].

MRI is found to be a reliable method of diagnostic imaging for the injured tendons. One of the previous studies was concluded that, for the confirmed diagnosis of supraspinatus tendon lesions, irrespective of whether traumatic or non-traumatic lesions, the MRI is an ideal tool [19]. According to *Melissa MB et al*, MRI detected tears of tendon in 70% of scanned shoulders, and 90% of the RC tears happened at the tendon intromission site. They also stated that, it's an ideal tool to detect the labrum, ten-

dinopathy, injury of long head of the biceps and bursitis [20]. High-resolution MRI sensitivity for demonstrated labral tears ranged from 74 to 100%, with specificity of 95 to 100% [8]. Tiffany K. Gill et al stated that the RC muscles and subacromial bursa were the most common disorders which were diagnosed with MRI [9]. As reported by *Melissa MB et al*, our study results also shows that the supraspinatus tears and tendinitis were most common than tears in the long head of the biceps tendon, subscapularis, or infraspinatus [20]. The major limitation of MRI is its relatively high cost and a higher false-positive rate, particularly in imaging RC abnormality in older patients. Therefore, it is always recommended to correlate the MRI findings with the physical examinations [10]. The common treatment methods followed for the SP include; mobilization, electrotherapeutic modalities, shoulder orthoses, and stretching and strengthening exercises, appears to be beneficial for pain relief and functional improvement [21, 22].

CONCLUSION

This study result insists the importance of diagnostic imaging, especially the MRI in the diagnostic process of shoulder dysfunction patients along with the physical examinations. It also sheds some light on how to provide a better care for the patients whose diagnosis is accurate. It also stresses on the benefits of appropriate PT interventions for the early recovery of patients with SP.

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ABBREVIATIONS USED

MRI- Magnetic Resonance Imaging
 SP- Shoulder Pain
 PT- Physical Therapy
 MSK- Musculoskeletal
 RC- Rotator Cuff
 VAS- Visual Analogue Scale
 PROM- Passive Range of Motion
 PTs- Physical Therapists

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