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Correlation of numerical pain rating scale with athletic shoulder outcome rating scale and range of motion restriction in chronic shoulder pain due to rotator cuff injury in badminton players

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ABSTRACT

The aim of this study was to evaluate chronic shoulder pain due to rotator cuff injury and the correlation between athletic shoulder outcome rating scale (ASORS), numerical pain rating scale (NPRS) and shoulder ROM. It was a correlational study using convenient sampling method with a sample size of 80 players chosen according to the inclusion criteria. Data was obtained through NPRS, ASORS and player's shoulder range of motion videos. The results included analysis on age, gender, dominance of hand, pain intensity on NPRS and ASORS. The mean±SD of age, gender, dominance of hand, pain intensity on NPRS, ASORS was 21.51±2.36, 1.66±0.476, 1.95± 0.219, 4.63±1.38, 77.2±0.739 respectively. Mean of all shoulder ROM was flexion – 172.43, extension – 57.43, abduction – 171.31, adduction – 171.43, medial rotation – 63.51 and lateral rotation – 88.12. The study showed the positive correlation in shoulder range of motion and not with the ASORS and NPRS.

Keywords: Badminton players, Rotator cuff injury, Chronic shoulder pain, NPRS, ASORS

1. INTRODUCTION

Badminton is the most popular sport, discovered in England originated from China. It is a national sport played in various Asian countries (Phomsoupha and Laffaye, 2015). Since 1992, badminton has been an Olympic sport. Worldwide 200 million people of every age plays badminton and most of them are recreational players (Ooi et al., 2009). It was estimated by The Badminton World Federation that more than 2000 players indulge in international competitions (Arora et al., 2015). Badminton is alleged to be the world's fastest racket sport (Phomsoupha and Laffaye 2015). This sport

demands the blend of fine technical skills, agility, strength, power, endurance, and intelligent game tactics (Ooi et al., 2009; Hensley and Paup, 1980). It requires high intensity and intermittent action. Events of this sport are: men's & women's singles; men's & women's doubles; and mixed doubles. It mainly involves overhead shoulder activities, rapid arm movements, jumps, lunges at net, and needs change in directions (Hensley and Paup 1980; Phomsoupha and Laffaye, 2015). While playing, player mainly requires shoulder abduction; external rotation and considerable shoulder internal rotation with the shuttle velocity following smash stroke being over 100 m/s and average shuttle velocity during match play ranges from 50 to 75 m/s (Phomsoupha and Laffaye, 2015; Arora et al., 2015).

Badminton is considered a very safe and non-contact sport. Among badminton players in spite of its global following, studies into medical problems are infrequent. Although it is widely approved as safe sport, it does carry burden of injuries (Arora et al. 2015). According to past studies, mostly in Europe, risk of injuries was demonstrated in badminton players to be 1.6-2.9 per 1000 h of play (Risaldar et al. 2020). Some studies showed that, women are less prone to risk of injuries than men; and recreational players are more prone to injuries than elite players (Arora et al. 2015). Despite being injured, a major proportion of players continue to play. 17-28% of players play with an ongoing injury, but it still does not prevent 92% of cases of player from playing, but their quality of performance may get adversely affected. Of all these injuries, upper extremity accounts for 19-32% of injuries, lower extremity accounts for 58-76% of injuries and back accounts for 11-16% of injuries (M. Fahlström and Söderman 2007; Sathya and Doshi, 2018; Phansopkar et al., 2020).

Chronic shoulder pain is often considered as rotator cuff injury in athletes. Shoulder pain and rotator cuff impingement caused by shoulder joint anterior instability are common issues for athletes engaged in overhead motion (Martin Fahlström et al., 2011). The majority (74%) of injuries, in badminton are described as overuse injuries and shoulder pain was of insidious onset with no differences noted between male and female players (Martin Fahlström et al., 2006; Arora et al., 2015). Shoulder pain is the main cause of degenerative rotator cuff disease (Beaudreuil et al., 2009). The etiology of the RCI is likely to be multi-factorial in nature, including some of the traditional factors such as overuse, inflexibility and equipment problems (Maganaris et al., 2004). Although there were many studies done on the shoulder pain with rotator cuff injuries in badminton players, but as such, no specific study was done on the correlation of pain and shoulder function with restricted range of motion (Darda et al., 2020). So we need to find out the correlation of athletic shoulder outcome rating scale (ASORS), numerical pain rating scale (NPRS) and range of motion restriction in chronic shoulder pain due to rotator cuff injury in badminton players (Shah and Naqvi, 2020).

2. METHODOLOGY

We had explained the patient about the purpose of our study and the consent had been taken from patient on the telephonic conversation. The study was being conducted from February 2020 to January 2021. The methodology was approved by Institutional Ethical Committee of MGM, Aurangabad with registration number MGM/IEC2020M233.

Figure 1 Shoulder Flexion.

Inclusion and exclusion criteria were considered for selection of criteria. For the purpose of Data collection, NPRS was assessed for measurement of intensity of shoulder pain which was included in the Google document form. Further the Athletic Shoulder Outcome Rating Scale (ASORS) was processed in the Google document form version, so it became convenient for badminton players to fill the form/scale online without any difficulty. We had taken visual ROM movements of players in the form of video with their consent to assess/observe the range of motion of shoulder joint, particularly – flexion (Figure 1), extension, abduction (Figure 2), adduction, medial rotation, lateral rotation (Figure 3).

Figure 2 Shoulder Abduction

Figure 3 Shoulder External Rotation in 90°-90° position

The ASORS is a rating system that allows subjective & objective evaluations of athlete's shoulder. A total of 100 points, 10 points for objective testing and 90 points for subjective items, including: pain, strength/endurance, stability, intensity, and performance, are allocated. The data were aggregated and analysed by outcome measures in order to find out the association between the variables, by considering the above-mentioned instruments.

3. RESULTS

The present study evaluated 80 badminton players with chronic shoulder pain due to rotator cuff injury using SPSS 22 version. Amongst which male accounts 66.3% and female accounts 33.8%. Table 1 show, that there were 53 male and 27 female participating in the study with the percentage of male as 66.3% and female as 33.8%. Table 2 showed mean and standard deviation of demographic characteristics, age, gender, dominance of hand, pain intensity and Athletic shoulder outcome rating scale. Table 3 has shown the mean of all shoulder range of motion. Table 4 represented correlation of athletic shoulder outcome rating scale (ASORS), pain intensity on numerical pain rating scale (NPRS) with all shoulder range of motion. Figure 4 represented the mean on x–axis and variables (age, gender and dominance) on y-axis. Figure 5 shows mean on x-axis and variables of shoulder range of motion (Flexion, extension, abduction, adduction, medial rotation & lateral rotation) on y-axis. Figure 6 represented the mean on x-axis and correlation of athletic shoulder outcome rating scale (ASORS) and NPRS with all shoulder range of motion on y-axis.

Table 1 number of participants

Gender	No. of participants	%
Male	53	66.3 %
Female	27	33.8 %

Table 2 mean and std. deviation of demographic characteristics

Sr. no.	Variables	Mean	Standard deviation (SD)
1.	Age	21.52	2.36
2.	Gender	1.66	0.476
3.	Dominance of hand	1.95	0.219
4.	Pain intensity on NPRS	4.63	1.38
5.	ASORS	77.2	0.739

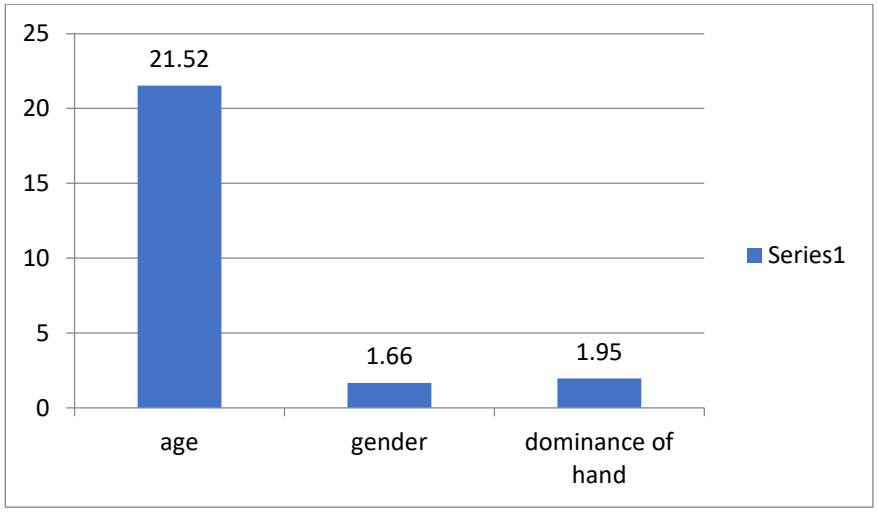

Figure 4 represents mean on x–axis and variables (Age, gender and dominance) on y-axis.

Table 3 mean of all shoulder range of motion

Sr. no.	ROM	Mean
1.	Flexion	172.43
2.	Extension	57.43
3.	Abduction	171.31
4.	Adduction	171.43
5.	Medial rotation	63.51
6.	Lateral rotation	88.12

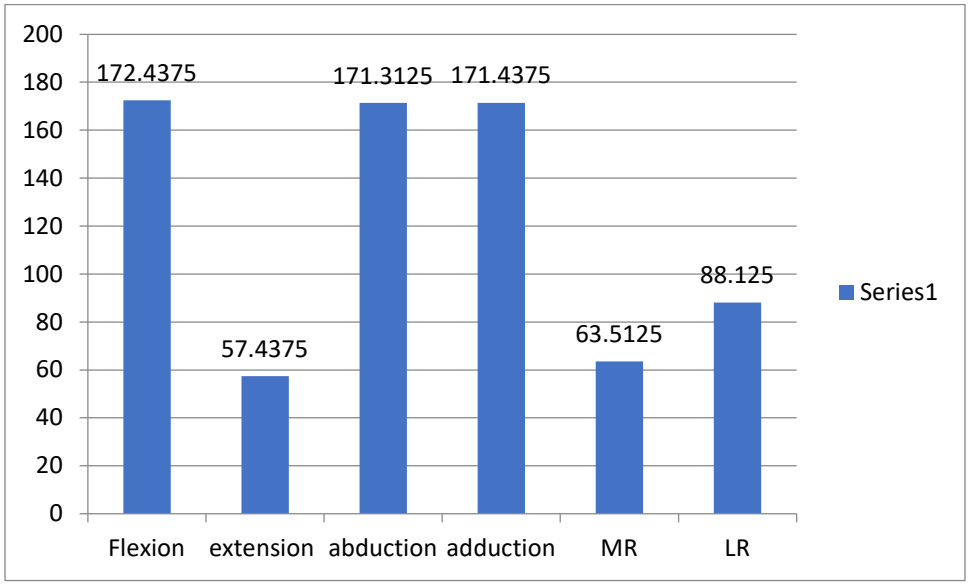

Figure 5 shows mean on x-axis and variables of shoulder range of motion (Flexion, extension, abduction, adduction, medial rotation & lateral rotation) on y-axis.

Table 4 correlation of athletic shoulder outcome rating scale (ASORS), pain intensity on numerical pain rating scale (NPRS) with all shoulder range of motion.

		ASORS	NPRS	Flexion	Extension	Abduction	Adduction	MR	LR
ASORS	Peason Correlation p-value	1	.103 .361	-.025 .827	.034 .762	.029 .796	.040 .725	-.109 .334	-.057 .617
NPRS	Peason Correlation p-value	.103 .361	1	-.072 .526	-.124 .272	-.135 .233	-.132 .243	.002 .983	-.089 .434
Flexion	Peason Correlation p-value	-.025 .827	-.072 .526	1	.263* .018	.490** .000	.483** .000	.357** .001	.167 .138
Extension	Peason Correlation p-value	.034 .762	-.124 .272	.263* .018	1	.235* .036	.221* .049	.213 .058	.386** .000
Abduction	Peason Correlation	.029	-.135	.490**	.235*	1	.996**	.491**	.112

	p-value	.796	.233	.000	.036		.000	.000	.321
Adduction	Peason Correlation	.040	-.132	.483**	.221*	.996**	1	.517**	.110
	p-value	.725	.243	.000	.049	.000		.000	.333
MR	Peason Correlation	-.109	.002	.357**	.213	.491**	.517**	1	.108
	p-value	.334	.983	.001	.058	.000	.000		.340
LR	Peason Correlation	-.057	-.089	.167	.386**	.112	.110	.108	1
	p-value	.617	.434	.138	.000	.321	.333	.340	

*.Correlation is significant at the 0.05 level.

**.Correlation is significant at the 0.01 level.

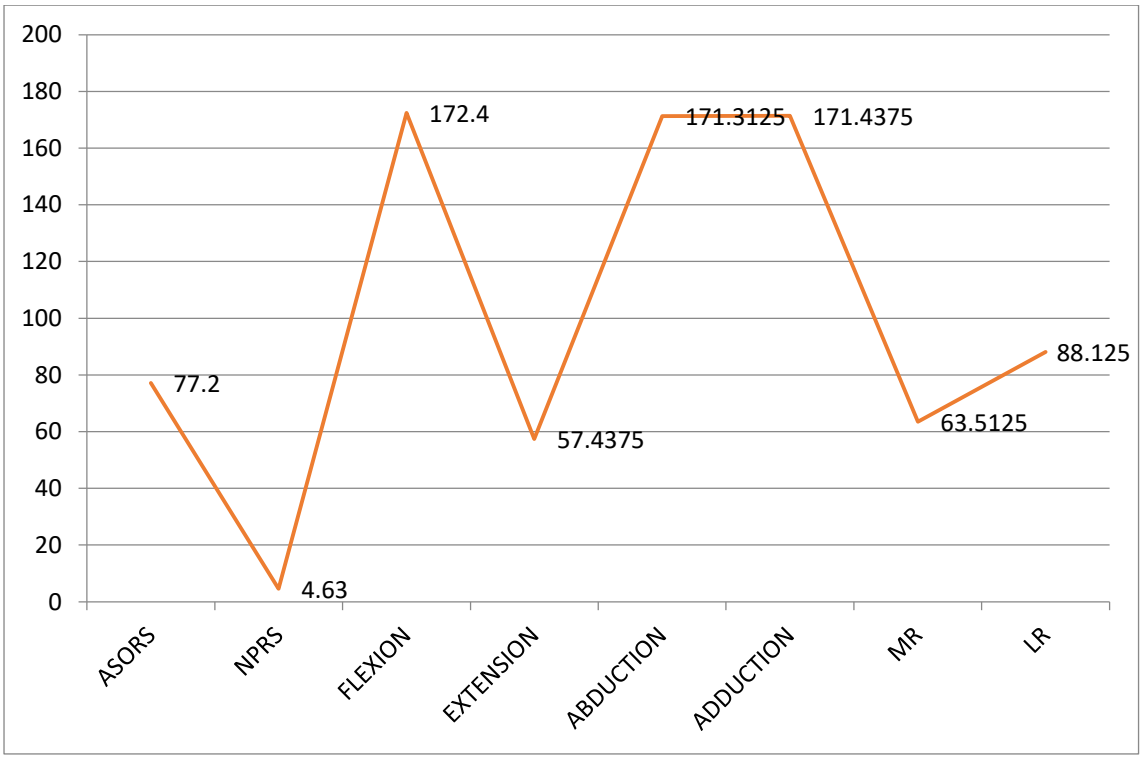

Figure 6 mean on x-axis and correlation of athletic shoulder outcome rating scale (ASORS) and NPRS with all shoulder range of motion on y-axis.

4. DISCUSSION

The current study aims to find out correlation of numerical pain rating scale with athletic shoulder outcome rating scale and range of motion restriction is chronic shoulder pain due to rotator cuff injury in badminton players. The present study was done on 80 badminton players of age group 16 to 25 years. The SPSS package (version 22) was used for all statistical calculation. Mean value, median, standard deviation and range are used to describe the data. P-value of <0.05 and <0.01 was considered statistically significant.

The Pearson correlation test and SPSS exact routine was used. Mean changes, range and SDs were calculated for all outcome measures and relative change was recorded where applicable. Some studies also suggest that there is significance seen in between all range of motion, if one range is affected then other ranges also gets affected. In statistical evaluation, correlation is used to show association with athletic shoulder outcome rating scale, NPRS and shoulder range of motion. As shown in Table 4, *correlation is significant at p<0.05 level and **Correlation is significant at p<0.01 level with shoulder range of motion. As seen in Table 4, the study found negative correlation between numerical pain rating scales, athletic shoulder outcome rating scale with all shoulder range of motion. Hence, it concluded negative significance between them. As we analyse Table 4 further, the positive correlation is

seen between the shoulder ranges of motion. The result came to the conclusion that positive correlation is significantly seen only in the range of motion and not with the ASORS scale and NPRS.

Martin Fahlström et al., (2006) studied overhead motion is the important component in badminton sport, which mainly requires shoulder abduction and external rotation. Sathya and Doshi, (2018) studied the different underlying mechanisms of injuries sustained by badminton players when the shoulder transform from cocking to acceleration phase. Phomsoupha and Laffaye, (2015) studied generation of power needed in the badminton stroke with minimum energy cost, sequential shoulder motions are required. Abduction, external rotation, flexion, internal rotation –these shoulder motions are used in sequential manner during overhead stroke. Hence, we can estimate the correlation of shoulder movements with one another. It suggests that, if one range is affected then other shoulder ranges also gets affected (Deshmukh et al., 2020). Above mentioned studies supports the correlation theory of shoulder range of motion with each other, accordingly, the result concluded in the present study can be considered significant.

5. CONCLUSION

Data analysis shows that among 80 badminton players 53 (66.3%) of male participants and 27 (33.8%) of female participants have chronic shoulder pain due to rotator cuff injury using SPSS 22 version. This study has demonstrated a negative correlation between numerical pain rating scales, athletic shoulder outcome rating scale with all the shoulder range of motion. As we scrutinize further, the positive correlation is significantly seen only in the range of motion and not with the athletic shoulder outcome rating scale and numerical pain rating scale.

Findings

Present study demonstrated a negative correlation between numerical pain rating scales, athletic shoulder outcome rating scale with all the shoulder range of motion. As we scrutinize further, the positive correlation is significantly seen only in the range of motion and not with the athletic shoulder outcome rating scale and numerical pain rating scale.

Implication

The study showed that there is positive correlation in range of motion ofshoulder, and the consequences are most likely of importance for their training and playing capacity. And if either the player or the therapist is not able to connect with each other this method of sending pictures and videos is serviceable for clinical practice.

Future Scope

ASORS scale shows less significant correlation with the other outcome measures, hence a new scale which is specific for rotator cuff injury, that includes the correlation in athletes with movement and ROM should be developed. As the present study was carried out by using Google form, in future participants should be assessed in person through physical assessment.

Author's contribution

All authors contributed equally to the manuscript.

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We thank the patients who participated and contributed samples to the study.

Conflict of interest

The authors declare no conflict of interest.

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Data and materials availability

All data associated with this study are present in the paper.

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