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PREVALENCE OF GLENOHUMERAL INTERNAL ROTATION DEFICIT ON RECREATIONAL BADMINTON PLAYERS, VOLLEYBALL PLAYERS AND TABLE TENNIS PLAYERS OF GANGTOK

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ABSTRACT

Background: Glenohumeral Internal Rotation Deficit (GIRD) is a condition in which there is loss of Internal Rotation in the throwing shoulder. GIRD can be defined by a loss of >20° of internal rotation as compared to the contralateral shoulder. Overhead throwing games usually affects joints and tissues of shoulder as it places high loads and stresses on it. **Aim:** To compare the prevalence and severity of GIRD among Volleyball, Table Tennis and Badminton players of Gangtok. **Method:** Measurements of passive ROM of Glenohumeral GER and GIR were taken with a bubble inclinometer. IR was measured first followed by GER and the sum of GIR and GER was done to find TAM. All the assessments i.e. GIR, GER and TAM were done in supine lying. In this position, examiner was first position the shoulder and elbow at 90º of abduction and flexion, respectively. The inclinometer was placed on the dorsal surface of the forearm. The Individuals were asked to relax. Then, the shoulder was passively rotated into GER or GIR depending on the randomization. Once the maximum range achieved, the measurements were read and recorded by examiner. TAM was calculated by summing ER and IR ROM tested position. **Results:** In this study the mean GIRD value for Badminton is more than TT and Volleyball as Badminton is predominantly an overhead sport compared to Volleyball & TT. In the graphical representation it is seen that comparison of Internal Rotation, External Rotation and Total Arc of Motion of right and left side in Badminton is more than Volleyball and Table Tennis. **Conclusion:** This study allows us to conclude that Gleno humeral ROM adaptation is sport specific and is seen more in Badminton as compared to the Volleyball & TT players.

KEYWORDS: GIRD, GIR, GER, TAM, ROM.

INTRODUCTION

Glenohumeral Internal Rotation Deficit (GIRD) is a condition in which there is loss of Internal Rotation in the throwing shoulder. GIRD can be defined by a loss of >20° of internal rotation as compared to the contralateral shoulder.[1] Overhead throwing games usually affects joints and tissues of shoulder as it places high loads and stresses on it.[2] players usually exhibit adaptive changes in the internal rotation (IR)of the glenohumeral-joint in the dominant upper limb.[3]

Internal rotation of the glenohumeral joint becomes limited in the dominant shoulder and this condition, is mostly asymptomatic in terms of pathology, and could become upsetting for the athlete as the condition advances.

In overhead throwing athletes posterior shoulder tightness is a common contributor to shoulder impingement. GIRD is a leading cause of the posterior tightness of the shoulder joint.[4]

During table tennis practice the players need to perform abrupt and fast movements which make the shoulder joint to be one of the most injured joints in this game. Previous study demonstrates that factors like bone adaptation, muscle and tendon alteration and stiffness on the posterior capsule of the shoulder leads to Glenohumeral Internal Rotation Deficit.[5]

Badminton is one of the most popular overhead racquet sports in Asian countries like India. Wind up, early cocking, late cocking, acceleration, and deceleration and follow through are he phases that are involved in throwing. In the late cocking phase, to resist the anterior translation of significant strain.

These sports are not only popular but have also been studied due to increase in the injury rate, hence

prevention of injuries in the elite athletes playing these sports is an integral part. Table Tennis and Badminton have distinctiveness peculiar to the individual game.[6]

Volleyball players are required to perform a high speed repetitive motion which ultimately causes asymmetrical changes between dominant and non-dominant shoulder.[7]

During repetitive high demand throwing activities 8% to 20% of shoulder problems are estimated to occur in Volleyball related injuries.[8]

In Badminton during the overhead motion with shoulder in abduction, with ER+IR is a distinctive action and ultimately high loads is applied to shoulder complex which could lead to increased risk of shoulder pain.[9] There is decreased Internal rotation and Increased External rotation in throwing athletes of dominant shoulder with repetitive throwing motion.

- Burkhart and Morgan et al. assessed posterior capsular tightness based on total GIRD but tightness should be assessed from genuine GIRD only.[10]

In Racquet sports the dominant shoulder has to deliver highly repetitive actions which include fast internal and external rotation at high speed and force, it may also include working of the arm, shoulder girdle and the trunk at extreme ranges where the player has to reach for the shuttle which thereby increases the possibility of shoulder injuries in racquet players.[11] Shoulder injuries like GIRD is seen common in cricket bowlers as well as fielders. The development of a posterior capsular contracture in throwing athletes swings the contact point of humerus on glenoid postero- superiorly which ultimately results in efficient increase in length of anterior capsule and great external rotation.[12] There are two types of GIRD Anatomical GIRD and Pathological GIRD.[13] An increase in Gleno-humeral external rotation and analogous loss of Internal rotation at 90 degree of abduction when throwing and non-throwing limbs are related in athletes, this changes in motion causes pressure frequently on shoulder joint.[14] Maximum upper extremity strength, flexibility is required to achieve a high velocity outcome. Due to high loads and forces set on shoulder complex risk of shoulder pain increases in players with age.[15]

There are available literatures which suggest GIRD is common in Badminton, Volleyball and Table Tennis players, but the comparison has not been studied. Given the importance of GIRD this study aims to compare the prevalence and severity of it among Volleyball, Table Tennis and Badminton players of Gangtok.

METHODOLOGY

Study Design and Participants: This is a cross-sectional study of asymptomatic recreational players from which 72 participants were included by convenient sampling on the basis of inclusion criteria divided into three groups: Volleyball, Table Tennis and Badminton players. The study period was from April 2019 to March 2020. Participants were included from Palzor Stadium, TNA School, Tadong College, Sikkim University, SRM University, SMIMS, KV School of Gangtok.

Inclusion Criteria

- Age Group: 15 to 30 years
- Gender: Both genders
- Athletes: Badminton, Volleyball and Table Tennis players.
- Duration: Playing for at least 2 years
- Frequency: At least 3 times a week
- Per practice session not less than 60 minutes

Exclusion Criteria

- Shoulder pain since 3 months
- Previous fracture/injury, surgeries in the shoulder
- Continuous use of NSAIDS, pain killer
- Profession should not involve any repeated upper extremity movements

Data Collection

After the Ethical Committee of the Institute accepted the research proposal with the SMIMS IEC Registration No: IEC/522/19-14, an informed consent was taken from the participants. The time taken for the assessment of each participant was approximately 30-40 minutes. All volunteers were examined once at rest without having participated or practice any sports in the previous day. Three readings of each movement were taken (Internal Rotation, External Rotation and Total Arc of Motion) and the mean of it was considered. All the measurement was taken by a single examiner. Measurements of passive ROM of Glenohumeral External Rotation (GER) and Glenohumeral Internal Rotation (GIR) were taken with a bubble inclinometer. Internal Rotation (IR) was measured first followed by GER and the sum of GIR and GER was done to find Total Arc of Motion (TAM). All the assessments i.e. GIR, GER and TAM was done in supine lying. In this position, examiner first positioned the shoulder and elbow at 90º of abduction and flexion, respectively. The inclinometer was placed on the dorsal surface of the forearm. The Individuals were asked to relax. Then, the shoulder was passively rotated into GER or GIR depending on the randomization. Once the maximum range achieved, the measurements were read and recorded by examiner. For measurements in the supine position, examiner provides scapula thoracic stabilization by grasping the coracoid process and scapula spine to avoid compensatory motion of the shoulder. TAM was calculated by summing ER and IR ROM tested position. This technique is described by and is used and advocated by many researchers.

No radiographic procedure was done through the study. The subjects were asked by the assistant examiner the following questions which are sports specific once the measurements are taken.

- For how long they have been practicing
- What all over head activities they do other than playing sport (badminton, volleyball, table tennis).
- Whether they do any shoulder stretches or not.
- Which is their dominant hand?

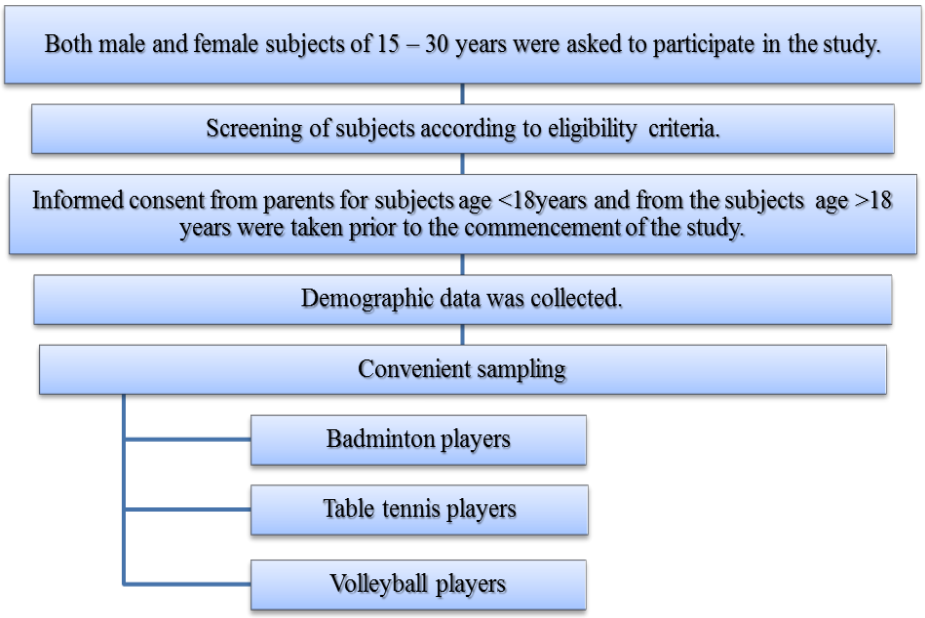

Figure 1: Flow Chart for showing study procedure.

Figure 2: Shoulder & elbow was positioned at 90º of abduction and flexion, respectively.

Figure 3: Showing the range of motion with a bubble inclinometer.

Statistical Analysis: Data were analyzed using SPSS version 20. One way ANOVA and paired *t*-test was used compare the means. For all the statistical procedures, *p* value < 0.05 was considered statistically significant.

RESULTS

Table 1: Descriptive information of the participants (Mean ± S.D.).			
AGE	**Badminton**	**Table Tennis**	**Volleyball**
	23.46±2.934	23.21±3.890	23.96±3.507
ROM Int. rot rt sd	56.25±12.875	57.08±12.061	62.29±9.998
ROM Int. rot lt sd	70.63±10.458	68.96±11.976	74.79±9.381
ROM Ext rot rt sd	60.63±10.034	63.13±11.498	66.04±10.213
ROM Ext. rot lt sd	75.83±10.180	73.96±10.732	78.33±9.168
T.A.M. rt sd	116.88±22.303	120.21±23.101	128.33±19.430
T.A.M. lt side	146.46±20.134	142.92±22.357	153.13±18.226

*Int - internal, rot - rotation, rtsd - right side, ltsd - left side, Ext – external. Above table shows the descriptive statistics of the participants in Badminton, Table Tennis and Volleyball. The number of participants were 24 in each group.

Table 2: GIRD of all the 3 groups of sports.		
Group	**Mean ± S.D.**	***p*-value**
Badminton	14.375±10.142	.000
Table Tennis	11.875±5.863	.000
Volleyball	12.500±6.757	.000

The above table shows significant difference (p=0.00) between all the 3 groups with more GIRD (Mean±S.D) in Badminton as compared to Table Tennis & Volleyball.

Table 3: Comparison of IR ROM of Dominant shoulder between the sports group.		
Group	**Mean Difference**	***p*-value**
Badminton vs TT	.833	.806
Badminton vs Volleyball	6.042	.078
TT vs Volleyball	5.208	.128

I.R-internal rotation, ROM-Range of motion, TT-Table tennis

Above table shows that there was no significant difference in IR ROM between 3 different groups, *p* value= (≥0.05)

Table 4: Comparison of E.R. ROM of Dominant Shoulder between sports group.		
Group	**Mean Difference**	***p*-value**
Badminton vs TT	2.500	.417
Badminton vs Volleyball	5.417	.081
TT vs Volleyball	2.917	.344

Above table shows that there was no significant difference in ER ROM between 3 different groups, p value= (≥0.05)

Table 5: Comparison of I.R. ROM of Non- Dominant shoulder between sports group.		
Group	**Mean Difference**	***p*-value**
Badminton vs TT	1.667	.590
Badminton vs Volleyball	4.167	.180
TT vs Volleyball	5.833	.062

Above table shows that there was no significant difference in IR ROM between 3 different groups, p value= (≥0.05).

Table 6: Comparison of E.R ROM of Non-Dominant shoulder between sports group.		
Group	**Mean Difference**	***p*-value**
Badminton vs TT	1.875	.520
Badminton vs Volleyball	2.500	.392
TT vs Volleyball	4.375	.136

Above table shows that there was no significant difference in ER ROM between 3 different groups, p value= (≥0.05).

Table 7: Comparison of T.A.M. of Dominant shoulder of between sports group.		
Group	**Mean Difference**	***p*-value**
Badminton vs TT	3.333	.596
Badminton vs Volleyball	11.458	.071
TT vs Volleyball	8.126	.198

Above table shows that there was no significant difference in T.A.M. of dominant side between 3 different groups, p value= (≥0.05).

Table 8: Comparison of T.A.M. of Non-dominant shoulder of between sports group.

Group	Mean Difference	*p*-value
Badminton vs TT	3.542	.548
Badminton vs Volleyball	6.667	.259
TT vs Volleyball	10.208	.086

Above table shows that there was no significant difference in T.A.M. of non-dominant side between 3 different groups, p value= (≥0.05).

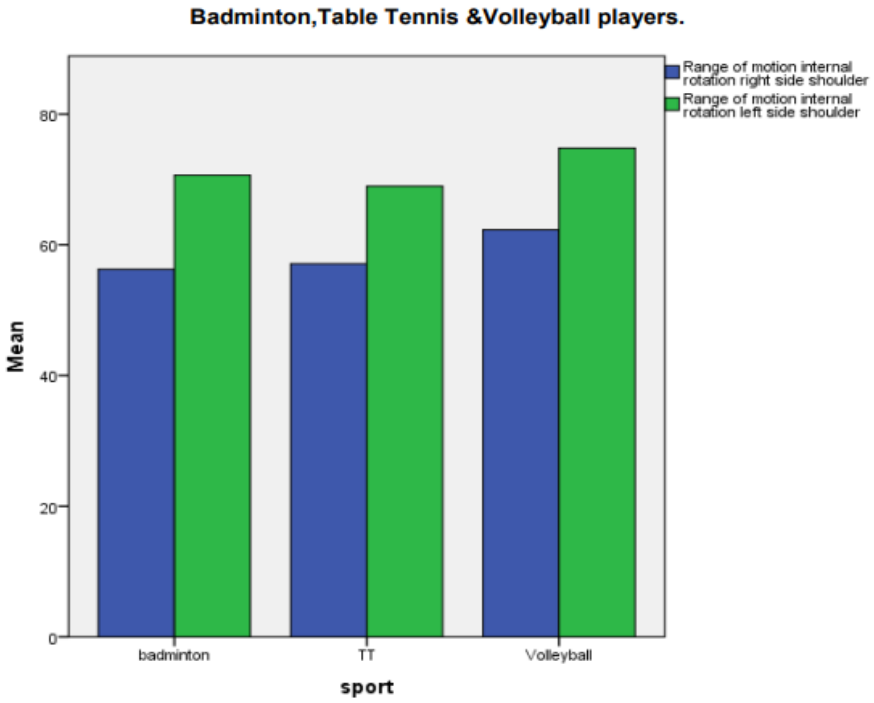

Figure 4: Mean Internal Rotation Shoulder of Left and Right side of Badminton, Table Tennis & Volleyball players.

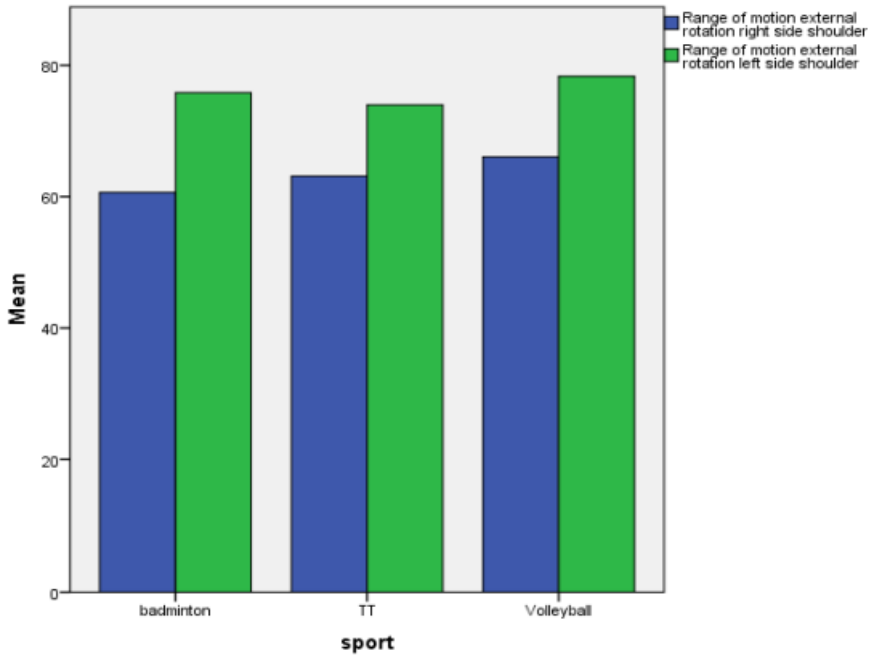

Figure 5: Mean External Rotation Shoulder of Left and Right side Badminton, Table Tennis and Volleyball.

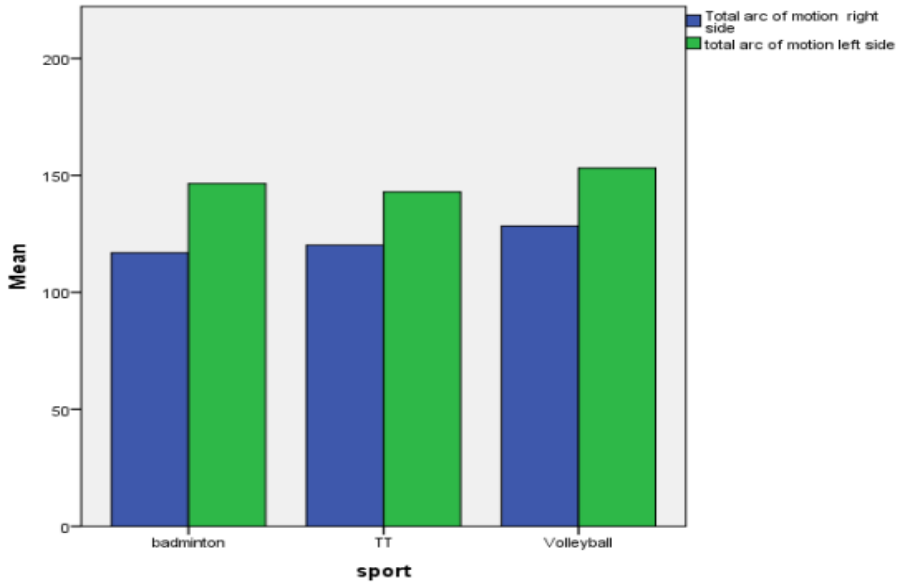

Figure 6: Mean Total Arc of Motion of Left and Right side of Badmint on, Table Tennis & Volleyball.

DISCUSSION

The purpose of the study was to compare the prevalence and severity of GIRD among recreational Badminton, Table Tennis and Volleyball players of Gangtok. To the best of our knowledge prevalence of GIRD among Badminton, TT & Volleyball were not studied. In a previous study where ROM was taken for non-players and there were no differences noted in IR and ER ROM of non-dominant shoulder whereas 7 degrees difference documented in the dominant shoulder. According to the study normal subjects have greater ER ROM and less IR ROM on dominant side as compared to non-dominant side. This may be due to the increased use of dominant shoulder in daily work (Khushboo Bathia, Lalkishan Sewani et al) Researchers have demonstrated in previous study that repetitive overhead activities might alter shoulder-rotation motion, rotator dysfunction in the dominant shoulder compared with the non dominant shoulder. GIRD occurs in overhead athletes and is the most common adaptation seen in the Gleno humeral joint, with excessive ER ROM and decreased total ROM. Repetitive and cumulative loads during the deceleration phase of overhead activity cause micro trauma and posterior capsule scarring. The stiff posterior capsule decreases Gleno humeral IR and horizontaladduction mobility, which have been shown to be related to shoulder injuries. In this study I.R. range is seen to be less than E.R. among all three groups. Decreased IR ROM, increased ER ROM, and dominant shoulder compared with the non dominant shoulder, which might put them at risk for shoulder injuries. (Gulcan Harput; Hande Guney et al) In the current study mean I.R.ROM and E.R. ROM of non-dominant shoulder was more compared to the mean I.R and E.R. ROM in Badminton players. In the dominant shoulder that is in right side ROM was less compared to left side. This could be due to the overuse of dominant shoulder as it requires repetitive and forceful movements which render the shoulder vulnerable to injuries and reduces the capsular pliability causing restriction of internal rotation ultimately leading to GIRD (Gleno-humeral Internal Rotation Deficit) in the throwing or serving shoulder (Pradanya Patil and Anand Gangwal). GIRD is well documented in previous studies done on Table tennis players. The decelerating phase while hitting the ball was considered for the cause of it(Danilo Harudy Kamoneski, 2017). In the TT players mean I.R. ROM and E.R. ROM of nondominant shoulder was less compared to the mean I.R. and E.R. ROM of dominant shoulder. In the group comprising of Volleyball players mean I.R. ROM and E.R. ROM of non-dominant shoulder was also less than mean I.R. and E.R. ROM of dominant shoulder was. Repetitive stress on the hitting shoulder during volleyball spiking and serving is assumed for the cause of GIRD in case of volleyball players according to previous study which was done on collegiate volleyball players (Kazutomo Miura, Eiichi Tsuda, Yasuyukiet al) In this study the mean GIRD value for Badminton is more than TT and Volleyball as Badminton is predominantly an overhead sport compared to Volleyball &TT. In comparing the prevalence of GIRD between groups of different sports i.e. Badminton vs TT, Badminton vs Volleyball & TT vs Volleyball the p value were ≥ 0.05 which is not significant. In the graphical representation it is seen that comparison of Internal Rotation, External Rotation and Total Arc of Motion of right and left side in Badminton is more than Volleyball and Table Tennis.

CONCLUSION

This study allows us to conclude that Gleno humeral ROM adaptation is sport specific and is seen more in Badminton as compared to the Volleyball & TT players as in Badminton during the overhead motion as it poses high loads to shoulder capsule and ultimately leading to a decrease in Internal Rotation thereby leading to loss of function and maybe affect the performance of the game in the long run.

LIMITATIONS

This study has some limitations such as Athletes from other sports with upper limb dominance can be included and Geographical containment of the sample population so Further study can be done on prevalence of different sports along with age group more than 30 years.

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