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TO ANALYZE THE IMPACT OF PECTORALIS MINOR LENGTH ON PAIN AND FUNCTIONAL DISABILITY AMONG THE ELITE SWIMMERS

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ABSTRACT

BACKGROUND: Competitive swimmers are more prone to shoulder revolutionary movements. As a result of overuse by these movements the anterior musculature of Glenohumeral joint will go for hypertrophy. Pectoralis minor is one among the common muscle that goes for tightness which causes abnormal scapular kinematics and shoulder pain which is a leading cause for functional disability. This may lead to affected performance of elite swimmers.

AIM: The aim of the study is to correlate the relationship of Pectoralis minor tightness on shoulder pain and functional disability among the elite swimmers in Chennai.

METHODS: The study included 32 elite swimmers from Chennai who fulfilled the inclusion criteria. The tape measure was done for the Pectoralis minor muscle length for each swimmer and the pain was measured using numerical pain rating scale and functional disability was measured using Shoulder pain and disability index.

RESULTS: The results were analysed using non – parametric tests, the Mann Whitney U test and Spearman's correlation. The mean and standard deviation for the shortened Pectoralis minor muscle right side for 17 subjects will be 40.51 and 10.001. The mean and standard deviation for the shortened Pectoralis minor muscle left side for 11 subjects will be 40.22 and 8.02. The correlation 'ρ' for the right-side tight Pectoralis minor value is -0.612 and left side will -0.641. The pain and functional disability have correlation showing the value 'ρ' 0.397 which is significant at the level < 0.01

CONCLUSION: The study concludes that there is significant correlation between Pectoralis minor tightness, pain and functional disability among the elite swimmers

KEY WORDS: Pectoralis minor, impingement syndrome, swimmers' shoulder

INTRODUCTION

Swimming is a recreational sport that involves forward propulsion of the body through water by combined arm and leg motion. The shoulder is the most vulnerable joint among the competitive swimmers. Swimming mechanics involves early pull through, mid pull through and late pull through of stroke phases. The recovery phase is also subdivided into early and late phases. The forward propulsion in swimming involves mostly the activity of upper extremities and thus most complaint of elite swimmers is about pain on the glenohumeral joint. The prevalence of shoulder impingement syndrome among the Elite swimmers in India has reported to be more than 50%. Around 68% of impingement syndrome associated with swimmers had a positive sulcus sign previously reported. The biomechanical considerations for swimmer's impingement syndrome may include lack of strength and flexibility and also other demanding training sessions.

Elite swimmers are at greater risk of shoulder injury due to overuse of shoulder muscles in which the anterior shoulder musculature will go for hypertrophy. In all the types of swim strokes like freestyle, butterfly and backstroke the swimmers repetitively uses the abduction and internal rotation motions of the Glenohumeral joint. The excessive revolutionary movements may result in repetitive overuse injuries which may lead to imbalance of agonistantagonist muscles.

The repetitive use of upper extremity among the elite swimmers results in protracted scapula which may be a predisposing factor for the tightness of the pectoralis minor muscle [19]. John D. Bostard et al in his study stated that an adaptive short pectoralis minor muscle may reduce the subacromial space and impinge the soft tissue which results in shoulder injury [15]. The diminished activity of pectoralis minor muscle may have an impact on reduced shoulder mobility.

The measurement of pectoralis minor muscle length can be measured using a tape measure. The origin of pectoralis minor is on the ribs 3, 4 and 5 and gets attached to medial border of Coracoid process. It is the sole muscle that connects scapula and thorax which also has a function of depressing the scapula. The pectoralis minor muscle tightness can be measured using various methods. One of the methods is using tape measure. The pectoralis minor length index allows each measurement to be normalized to each participant's height to provide the relative resting length of the individual pectoralis minor. The previous study reported that the individuals with a pectoralis minor index of less than 7.44 could be considered to have a relatively short muscle.

The previous research had done by John D Borstad et al May lee beach et al have stated the reliable measurement technique to identify the pectoralis minor tightness. There was less evidence on the swimmer's prevalence, identifying the risk factors and the role of pectoralis minor shortening among the elite swimmers in Indian population.

The shoulder pain has been measured using Numerical pain rating scale which is a 11-item scale. The shoulder pain and disability index were developed to measure the shoulder pain and the functional ability of the patients with shoulder conditions. The SPADI contains 13 items that assess to domains; a 5-item subscale that measures pain of the affected part and an 8-item subscale

that measures disability. The SPADI has a very high internal consistency and it is a valid and reliable outcome measure which is used to assess the pain and disability among the patients with shoulder dysfunction.

Thus, the present aim of the study is to identify the relationship of short pectoralis minor muscle on shoulder pain and functional disability among the elite swimmers with shoulder dysfunction.

METHODOLOGY

The study is a correlation study with 50 samples taken for analysis from Anna swimming pool Chennai. In this study the state level competitive swimmers and the swimmers who get trained for 6 days a week with minimum of 10 sessions per week have been included. Here 50 samples were participated. The samples were taken in random sampling in which 34 were satisfying the inclusion criteria and with 2 drop outs from the study, 32 samples were finally taken, informed consent obtained from the swimmers and the procedures were explained.

Each and every swimmer were instructed to stand normal with relaxed posture near the wall supported. The measurement can be taken with the inch tape from medial –inferior angle of the coracoid process of the scapula and lateral to the sternocostal junction of inferior aspect of the fourth rib. Three times the measurements can be repeated and the average value can be recorded. This will help to calculate the Pectoralis minor index for analysis.
A pectoralis minor length index (PMI) has been previously reported and is calculated by dividing the resting length of the muscle in centimetres by subject height in centimetres which will be multiplied by 100. The previous studies reported that individuals with the pectoralis minor index value less than 7.44 could be considered to have a short muscle length.

The pain is measured using Numerical pain rating scale and the subject's functional status is measured using SPADI scale. The correlation of these parameters will be identified.

Figure: 01

Figure: 02

DATA ANALYSIS

			PMI (RIGHT)	PMI (LEFT)	NPRS	SPADI
Spearman's rho	PMI (RIGHT)	Correlation Coefficient	1.000	.981**	-.123	-.612**
		N	32	32	32	32
	PMI (LEFT)	Correlation Coefficient	.981**	1.000	-.126	-.641**
		N	32	32	32	32
	NPRS	Correlation Coefficient	-.123	-.126	1.000	.397*
		N	32	32	32	32
	SPADI	Correlation Coefficient	-.612**	-.641**	.397*	1.000
		N	32	32	32	32

The collected data were analysed using SPSS software in which the ordinal data were analysed using non-parametric tests. The data were analysed using Mann Whitney U test and Spearman's correlation.

TABLE: 01

**. Correlation is significant at the 0.01 level (2-tailed). *.Correlation is significant at the 0.05 level (2-tailed).

TABLE: 02

PMI (RIGHT)	N	Mean	Std. Deviation	Std. Error Mean
SPADI PM TIGHTNESS	17	40.5147	10.00124	2.42566
NORMAL	15	22.4267	10.58641	2.73340

TABLE: 03

PMI (LEFT)	N	Mean	Std. Deviation	Std. Error Mean
SPADI PM TIGHTNESS	11	40.2282	8.02935	2.42094
NORMAL	21	27.7448	14.15443	3.08875

FIGURE: 01

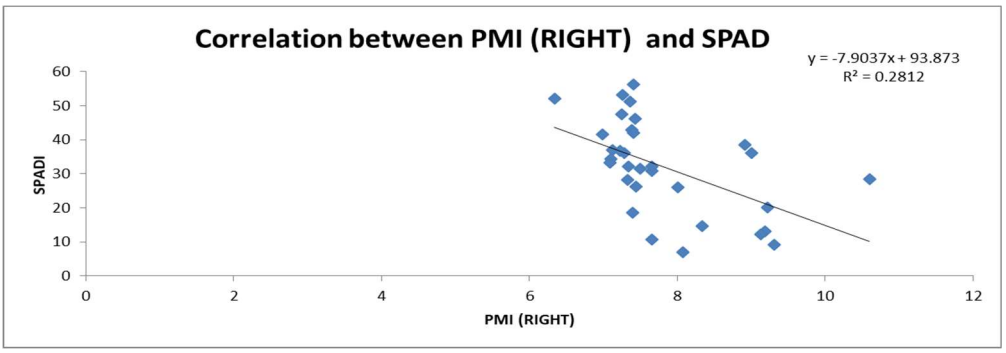


FIGURE: 02

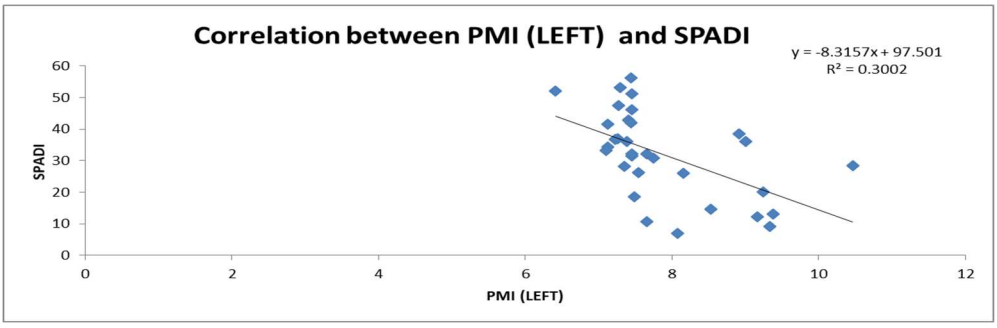
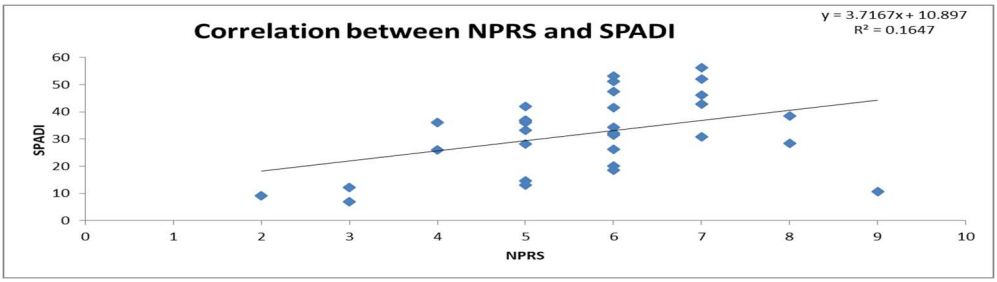


FIGURE: -03



RESULTS

The present study included 32 samples which were taken from Chennai swimming pools. The nominal data used in our study are Numerical pain rating scale, SPADI and Pectoralis minor length. The table 2 and 3 shows mean and standard deviation for the 32 subjects who have pectoralis minor tightness and its relationship to functional disability. The table 1 describes the correlation between the tightness of the Pectoralis minor muscle both the sides with pain and disability.

The mean and standard deviation for the shortened pectoralis minor muscle right side for 17 subjects will be 40.51 and 10.001. The mean and standard deviation for the shortened pectoralis minor muscle left side for 11 subjects will be 40.22 and 8.02. The statistical analysis with spearman's correlation coefficient 'ρ' shows correlation for pectoralis minor tightness with pain and functional disability Table.1

The results of the present study show statistically and clinically significant correlation for the swimmers who have short pectoralis minor muscle which have a relationship between pain and functional disability. The correlation 'ρ' for the right-side tight pectoralis minor value is -0.612 and left side will -0.641. The pain and functional disability have correlation showing the value 'ρ' 0.397 which is significant at the level < 0.01.

DISCUSSION

The present study identified the relationship of pectoralis minor muscle tightness which in turn will have an impact on the pain and shoulder disability, a predominant cause for shoulder dysfunction among swimmers. Here the study was conducted in 2 swimming centres at Chennai which consists of 32 samples which was done as a pilot study.

John D. Borstad et al in his previous research stated the validity of the measurement technique of the tight pectoralis minor muscle. Jonathan roman et al shows the short-term effects of positional release therapy on pectoralis muscle tightness. There was less previous evidence stated the relationship of tightness of pectoralis minor muscle and shoulder dysfunction among the competitive Indian swimmers.

Sneh Bansal et al was the only study noted the prevalence and risk factors of shoulder impingement syndrome among the competitive Indian swimmers. The present study aim to

identify the exact relationship of pectoralis minor muscle with pain and functional disability for the swimmers in and around Chennai.

The reduced pectoralis minor muscle flexibility creates anterior tilting of scapula and protraction which will have a pull over coracoid process. This may limit the scapular upward rotation, external rotation and posterior tilting which will have a direct impact on the Glenohumeral joint mobility. This scapular dyskinesia will be directly associated with the risk of shoulder injuries and causing pain in Glenohumeral joint among swimmers. One of the main causes of this is pectoralis minor tightness which may be a contributing factor for the shoulder impingement. All the previously explained study have been reported outside India. Considering the different training methods, lifestyle and race the present study focus on the Indian swimmers.

The percentage swimmers affected with shoulder impingement was higher which can be above 55% in Indian swimmers. Thus, the repetitive nature of swimming can result in the postural adaptations which gives way for subsequent injuries. Insufficient scapular positioning may predispose to altered Glenohumeral rotation strength, altered neuromuscular activation patterns and an increased prevalence of impingement. The tightness of the pectoralis minor in this way causes shoulder pain and shoulder dysfunction which will affect the functional status of the patient. This may have an impact on the swimmer's performance during competitions.

The results of our pilot study shows significant relationship between the shortened pectoralis minor muscle and altered functional status of the swimmers. The study also shows correlation between pectoralis minor tightness and shoulder pain. The elite swimmers who have tightness of pectoralis minor muscle also shows functional disability with the help of shoulder pain and disability index. The limitation of the present study is that small sample size and as it is a pilot study the results cannot be generalized. Further research can focus on large samples and can plan a better intervention for the tightness of the pectoralis minor shortening.

CONCLUSION

The present study concludes that there is a significant correlation between the pectoralis minor muscle tightness with shoulder pain and functional disability among the competitive swimmers.

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