Effectiveness of Open Kinematic Chain Exercises and Closed Kinematic Chain Exercises in Adductor Groin Pain in Recreational Football Players

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Abstract

Background: Football has been growing considerably for the past decade in India. Many young adults have taken up football as their passion. However, the grounds are underdeveloped with limited number of facilities required for a safe game. Coaching facilities are inadequate and thus fail to provide basic information about the precautions to be taken during play or the necessary steps to be taken post injury. This leads to increased risk of injuries. Groin injuries comprise of 10-18% of all football injuries.

Objective: The objective of the study was to compare the effects of open and CKC exercises on groin injuries in young adults who play football for recreation. Pain Assessment, Tenderness assessment and MMT were used for assessing the individuals.

Method: There were total 40 subjects who were willing participants of this study of which 3 dropped out. This was a study conducted to find the effects of open and CKC exercises on groin injuries in young adults who play football for recreation. Here we evaluated the pain using VAS and tenderness grading. Muscle strength was assessed using MMT.

Result: There was a significant effect of open and CKC exercises on groin injuries. There was a reduction of pain; both on activity as well as on resistance($p=0.0065$ and 0.0235) respectively. Tenderness was also less ($p= 0.0130$). Muscle strength did not show any significant change ($p= 0.1775$)

Conclusion: There is a significant effect of OKC and CKC exercises being administered together rather than giving only CKC exercises on reducing pain and reducing the risk of injuries in recreational football players.

Key Words: *Recreational, Football, Groin Injury, Pain, Tenderness, MMT.*

Introduction

Football is a sport that has been widely accepted in our country. Many young adults have taken up this sport. However most of the players only play for recreation. Such recreational players are those who play only for enjoyment and not to compete in any leagues.[1]

The term 'adductor related groin pain' first originated in the literature in 1997.

Groin injuries are defined as any physical symptom in the groin related to participation in soccer training or match play, incapacitating the player while playing soccer or demanding special medical attention.[2]

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Groin injuries occur most commonly in non-contact situations (71%). Here, a rapid muscle contraction during rapid muscle lengthening is the fundamental mechanism. A quick reaction to a change in play, such as sudden change in direction, running, kicking etc. were the common modes of injury.[6]

Groin injuries make up 2-5% of all sports-induced injuries and 10-18% of all football injuries.

Prevalence of groin injuries in male cub football is 4-19% of all injuries. It was reported in 2002, that about 9.5% of all male football players had groin injuries.[4,7]

Despite groin injury being one of the most prevalent injuries in soccer, it poses a great amount of trouble to a sports physiotherapist. They are extremely difficult to treat, often presenting with long term symptoms[8,9], unclear prognosis[8], long period of absence[10] from play and a high rate of recurrence[11]. This is further added to, by a lack of knowledge among the population about how to approach this subject as it can be a sensitive topic for some. Thus many players just ignore the symptoms which leads to worsening of the symptoms overtime making it more difficult to treat groin injuries.

The treatment of choice for groin injury is physiotherapy.[10] Many forms of therapeutic exercise are chosen as treatment for groin injury, of which OKC and CKC exercises are frequently used.

OKC exercises are non-weight bearing exercises as they involve movement around a single joint. The distal segment is the focus of these exercises. This segment is free to move and also resistance is applied here. An example for the same is when resistance is applied over the ankle in seated knee extension. There is sequential activation of muscles, from proximal to distal, allowing rapid acceleration and speed of movement.[12,13]

CKC exercises are generally weight bearing. Here movement occurs at several joints and no joint is really free to move. Both the distal and the proximal joints are fixed and resistance is applied. Resistance can be applied to both the proximal and/or the distal segment. An example of this is a squat. These exercises imbibe early stability in the proximal joint.[12,13]

A review of various studies shows that the optimal treatment for long standing adductor groin injury is therapeutic exercise.[8,9,10,11,14]A study by Hölmich et al. (1999), concluded that hip and abdominal strengthening exercises along with physiotherapy such as laser therapy, TENS, stretching and transverse friction massage lead to better pain reduction and quicker return to sports.[8,9,15] However in Hölmich's study, the average time taken from the beginning of the treatment to the subject's return to sport was approximately 18.5 weeks. Unfortunately, such a long duration of recovery is not feasible for an athlete, especially elite as there is a lot of pressure on them to return back to their sports in the shortest period of time possible.[13,16,18]

Hence, it is necessary to create an exercise protocol that will benefit these recreational players and will in turn improve their performance and reduce their risk of injury.

Methodology

Included participants were divided in 2 groups (group A and group B) by convenience sampling method. Group A consisted of 19 players and group B consisted of 18 players. Demographic data was acquired. They were explained the purpose of the study. Pre and post assessment was taken with the help of the outcome measures.

Procedure

Group A received ckc and okc exercises 4 times a week for 5 weeks.

For the 1st and 2nd week leg press, squats with medicine ball between the legs, lunges, side-lunges, Resisted seated hip adduction, Resisted standing hip abduction, Resisted standing hip adduction, Supine leg abduction adduction and Resisted side lying hip adduction for 10 repetitions for a 5 sets. For the 3rd and 4th week they were for 20 repetitions for 5 sets. For the 5th week for 30 repetitions for 5 sets.

Group B received ckc exercises 4 times a week for 5 weeks.

For the 1st and 2nd week leg press, squats with medicine ball between the legs, lunges, side-lunges, for 10 repetitions for 5 sets. For the 3rd and 4th week they were for 20 repetitions for 5 sets. For the 5th week they were for 30 repetitions for 5 sets.

Result

1) **Age wise distribution:**

Table 1: Age wise distribution

Interpretation: Table no.1 shows that, the mean age of individuals in Group A and B

2) **VAS score**

Table 2: VAS score

Mean VAS Score (VAS)							
Group A				**Group B**			
On Activity		**On Resistance**		**On Activity**		**On resistance**	
Pre	Post	Pre	Post	Pre	Post	Pre	Post
5.43±0.91	0.83±0.82	7.07±0.69	0.92±0.93	5.82±0.90	1±0.74	6.82±0.62	1.23±0.86

Interpretation: Table no. 2 shows that, the mean VAS scores on activity and on resistance for group A and B

3) **Tenderness and MMT:**

Table 3: Tenderness and MMT

	Group A		**Group B**	
	Pre	**Post**	**Pre**	**Post**
TENDERNESS	1.28±0.46	0.5±0.51	1.37±0.49	0.95±0.52
MMT	4.72±0.46	4.94±0.23	4.68±0.47	4.79±0.41

Interpretation: Table no. 3 shows that, the mean tenderness and MMT grades for Group A and B pre and post treatment

4) **Wilcoxon signed ranks test and paired t-test results**

Table 4: Wilcoxon signed ranks test and paired t-test results

VAS w- value		**Wilcoxon signed ranks test**	
		p- value	
Group A	On Activity	171.0	<0.0001(ES)
	On Resistance	171.0	<0.0001(ES)
Group B	On Activity	190.0	<0.0001(ES)
	On Resistance	45.0	0.0039(VS)
		Paired t-test	
TENDERNESS		t- value	p- value
Group A		4.507	0.0003(ES)
Group B		3.618	0.0020(VS)
MMT		t- value	p- value
Group A		2.557	0.0204(S)
Group B		1.821	0.0774(NQS)

Interpretation: Table no. 4 shows that, the association between the outcome measures pre and post treatment

5) **Mann-Whitney test and Unpaired t-test**

Table 5: Mann-Whitney test and Unpaired t-test

Outcomes	**Group A vs Group B**	**Mann-Whitney Test**	
		U'-value	**p-value**
VAS	On activity (Pre)	225.0	0.1037(NS)
	On activity (post)	261	0.0065(VS)
	On resistance (pre)	201	0.3696(NS)
	On resistance (post)	246	0.0235(S)
Outcomes	Group A vs Group B	Unpaired t-test	
		t-value	p-value
TENDERNESS	Tenderness (pre)	0.5753	0.5688(NS)
	Tenderness (post)	2.618	0.0130(S)
MMT	MMT (pre)	0.2461	0.8070(NS)
	MMT (post)	1.376	0.1775(NS)

Interpretation: Table no. 5 shows the association between outcome measures pre and post treatment

Discussion

Pain assessment was used to note the severity of groin pain in all the participants. The discomfort or pain experienced by the players was divided into 2 categories; pain on activity and pain on resistance. Pain was assessed both before and after completion of the treatment protocol.

Intra-group association was studied using Wilcoxon signed ranks test for VAS and Paired t-test for tenderness and MMT. The results of current study indicate that the changes in groin pain observed from week 1 to week 5 after administering treatment for groin injury differed significantly in groups trained using OKC and CKC exercises versus only CKC exercises. Pain on activity and on resistance within group A post intervention had a p-value of <0.0001 whereas in group B the reduction in pain on resistance was not as significant; seen by the p-value of 0.0039(VS).

Tenderness was assessed by palpation of the groin pre and post intervention. There was a more significant reduction in tenderness within group A after treatment compared to group B as seen by the p-value of <0.0003(ES) and 0.0020(VS) respectively.

MMT was checked by resisting adduction of the hip pre and post intervention. MMT grades again showed a better result within group A compared to group B having a p-value of 0.0204(S) and 0.1628(NS).

Thus, the intra-group results following treatment showed to be more significant for group A as compared to group B in terms of reducing pain, tenderness and improving strength.

Also, inter-group comparison between the results of group A and group B was done by Mann-Whitney test for VAS and Unpaired .t-test for tenderness and MMT, which proved that the difference in the outcomes of group A and group B was significant, thus confirming that administration of both OKC and CKC exercises together had a better result than administration of CKC exercises only. This is confirmed by the p-value of 0.0065(VS) for pain on activity, 0.0235(S) for pain on resistance, 0.0130(S) for tenderness and 0.0774(NQS) for muscle strength.

Similar studies previously, have showed results supporting our study. A study conducted by Mikkelsen C, Werner S, Eriksson E. investigated the effect of CKC quadriceps rehabilitation versus the same program with addition of OKC exercises following ACL reconstruction on anterior knee laxity and isokinetic muscle torque. They concluded that the addition of OKC quadriceps training after ACL reconstruction results in a significantly better improvement in quadriceps torque without reducing knee joint stability at 6 months and also leads to a significantly higher number of athletes returning to their previous activity earlier and at the same level as before injury.[20]

When performing OKC exercises, the movement causes a rotatory stress on the joint. Also, they focus on a single muscle group. Thus, a combination of OKC and CKC exercises are better because of use of isokinetic training, which allows specific eccentric loading. Since, most of the movement occurring at the hip in football players is rotatory, leading to groin injury, this may be why addition of OKC exercises to the standard CKC exercises improves groin injury significantly.

Another study by Tagesson S, Öberg B, Good L, Kvist J assessed the impact of a CKC protocol versus that of a OKC protocol on knee pain in subjects post-ACL reconstruction. They concluded that people with ACL deficiency may need addition of OKC exercises to improve quadriceps torque.[21]

OKC exercises have certain biomechanical advantages such as an increase in the rotational forces as well as an increase in the concentric acceleration and eccentric deceleration forces. This leads to a faster increase in muscle strength which is supplemental to CKC exercises in rehabilitation post injury. Hence, this may be a reason for greater improvement in those who received both OKC and CKC exercises.

There are numerous possible reasons for our results. It is important to first keep in mind all the sources of groin pain during the rehabilitation period. Various sources of pain will react differently to our treatment. As we know, the main muscle injured in adductor type of groin injury is the adductor longus.[22] The main movement during OKC activation is hip adduction whereas during CKC activation it acts as a pelvis stabilizer, lower extremity stabilizer during the stance phase and also as a secondary hip rotator.[23,24] Administration of both OKC and CKC exercises is therefore necessary as the muscles are trained in both the phases of activation separately. This improves the stability and strength of the adductors and the surrounding ligaments leading to a reduction in pain which is comparatively greater than the effect of administration of CKC exercises only.

During the phases of kicking a ball, according to Charnock BL et al, the adductor longus remains at a risk of injury for around 65% of the swing phase. Also, its maximal co traction is seen during the initial 455 of the swing phase and then lengthening occurs.[25] The OKC and CKC exercises administered in our study cover the entire range of a football kick. This improves the strength of the muscles during the kicking motion thus reducing the risk of injury.

Thus, from the above mentioned effects of OKC and CKC exercises being administered together, we can state that they are more effective when administered together than just CKC exercises.

Conclusion

On the basis of the results of the study, it was concluded that there is a significant effect of OKC and CKC exercises being administered together rather than giving only CKC exercises in recreational football players.

Conflict of Interest: There were no conflicts of interest in this study

Ethical Clearance:: Ethical clearance was taken from institutional committee of Krishna Institute of Medical Sciences, Deemed to be University, Karad.

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