Research Article

The Comparative Study between Active Physical Training versus Active Resistance Training in Groin Pain among Young Gymnasts

Sanjiv Jha[1], Sanket Bajpai[1], Ruchi Mishra[1], Ananya Bhargava[2], Ravisha wagle[3]

Background: Groin pain are more common in gymnastic sports. Repetitive microtrauma with thwarted repair might cause persistent injury in the tendon-bone junction. The gymnast with generalized ligamentous laxity is more prone to overuse injuries because lax ligaments fail to provide ligament stability and further stress on the tissues neighborhood of the joint cause overuse injuries. The study aimed to investigate the comparative study between active physical training & active resistance training in groin pain among young gymnasts.

Material and Method: 30 athletes were recruited for study and randomized into 2 Groups. Active physical training (Group A), Active resistance training (Group B). A comparative (Cross-sectional) research design was used. Structured exercise protocol with pain reliving modality was given as an intervention (for 1 Hour working day) to assist improvement in strength and pain in the cases of groin pain.

Results: The statistical analysis showed significantly improved strength of adductor muscles and reduces groin pain with the structured exercise protocol(Group A)

Conclusion: Research concluded that athlete's intervention with structured exercise protocol has a significantly earlier recovery of strength in hip adductor muscle and reduced pain in the groin in the active physical training group (Group A) than the active resistance group (Group B), which had significantly late recovery of the adductor muscle.

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Introduction

Gymnastics is a sport practiced by men and women that requires balance, strength, flexibility, agility, coordination, endurance and control. Competitive artistic gymnastics is the best known of the gymnastic events. It typically involves the women's events of vault, uneven bars, balance beam and floor exercise. Men's events are floor exercise, pommel horse, still rings, vault, parallel bars and horizontal bar.

Gymnastics have high range of motion (ROM) requirements. Involves combinations of extreme hip flexion, extension, abduction, and external rotation. These sports all emphasize jumping or leaping, with landing strategies involving hip control and hip flexion. Finally, tendinopathy and muscular imbalances can also be problematic, independent of bone structure or secondary to compensatory patterns related to underlying bony anatomy. Both male and female gymnasts and athletes have well-studied strength imbalances with stronger hip abductors and weaker adductors. Groin injuries are common in all sports injuries. A well-planned training program in each discipline might prevent overuse injuries, including strengthening and balance.[1] Early diagnosis and proper treatment are important to prevent these injuries from becoming chronic and potentially career-limiting.[2]

Repetitive microtrauma with thwarted repair might cause persistent injury in the tendon-bone junction. The anatomic factors (i.e. malalignment) and overtraining predispose the athletes to overuse injuries most frequently. Also, gymnasts with generalized ligamentous laxity are more prone to overuse injuries. Because lax ligaments fail to provide ligament stability and under further stress on the tissues neighborhood of joint might cause overuse injuries. From the age, ligament laxity and hip rotation angles points of view. Muscular imbalance of the combined action of the muscles stabilizing the

[1]Ujjain college of Physiotherapy, Ujjain, Madhya Pradesh, India

[2]Department of Dentistry, R D Gardi Medical College, Ujjain Madhya Pradesh, India

[3]Private clinician, Ujjain, Madhya Pradesh, India

Correspondence to: Ananya Bhargava, Department of Dentistry, R D Medical College, Ujjain, Madhya Pradesh, India. E-mail: drananyaortho@gmail.com

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hip joint could, from an anatomical point of view, be a causative factor of adductor-related groin pain. Muscular fatigue and overload might lead to impaired function of the muscle and increase the risk of injury. The adductor muscles act as important stabilizers of the hip joint. exercises aimed at muscular strengthening with special emphasis on the adductor muscles, as well as training muscular coordination to improve the postural stability of the pelvis.[3]

For mechanical pain most clinicians feel that moist heat penetrates deep tissues better than dry heat for warming. For pain, moist heat immediately after exercise was more effective than dry heat just after exercise. Hot packs are used most often to reduce pain and muscle spasms and improve tissue extensibility and range of motion.[4]

Muscle strength is essential to maintain balance and reduce pain by stabilizing our lower limb and back. Exercises start with easier exercises moving to more difficult ones. A weight cuff is a useful aid. An active strengthening program consisting of progressive resistive adduction and abduction exercises, balance training, and abdominal strengthening in treating chronic groin strains, whereas a passive physical therapy program of massage, stretching, and modalities effectively treated chronic groin strains.[5]

Our study aimed to assess and compare the significant changes in Active Physical training and active resisitance training among young gymnasts. And also to find out the effectiveness of structured exercise protocol in adductor strength in groin pain

Material and Methods

Study design:- Cross-sectional study design.
Study duration:- 4 months (January 2014-April 2014)
Study done-Ujjain College of Physiotherapy, Ujjain (M.P)
Source of data:- Maharaj Wada gymnasium Ujjain,Railway gymnasium Ujjain
Sample criteria:- 30 young male athletes (gymnasts). They are divided into 2 groups.
Group A – This group has 15 young male athletes (gymnasts) who have groin pain.
Group B – This group has 15 young male athletes (gymnasts) who have groin pain.

Inclusion criteria

1. Young male gymnasts aged 8-18 years.
2. Clinically diagnosed groin pain and weak adductor muscle of hip.
3. Athletes should have a positive adductor stress test.
4. Athlete who had groin pain for at least 2 months due to sport. Pain at adductor tendon and groin pain during active adduction and extension against resistance.
5. Pain present in adductor squeeze test.

Exclusion Criteria

1. Clinical findings indicating inguinal or femoral hernia; prostitis; chronic urinary tract disease.
2. Pain of the vertebrae from the 10^{th} thoracic segment to the 5^{th} lumbar segment, including the facet joints; the presence of malignant disease;
3. Coexisting fracture of the pelvis or lower extremities; other lesions of the lower extremities preventing the patients from fulfilling the treatment program; clinical finding showing nerve entrapment – ilioinguinal, genitofemoral or lateral femoral cutaneous nerves.
4. Radiographic evidence; hip joint arthritis, hip joint disease; bursitis
5. Absence from more than 25% of treatment sessions.

Variables

Dependent Variables: Exercise-induced Groin pain in gymnasts.
Independent Variables: structured exercise protocol
Instruments: sphygmomanometer

Outcome Measures

VAS (visual analog scale), Adductor squeeze test by sphygmomanometer**.**

Procedure

Thirty gymnasts is selected as per inclusion criteria and divided into two groups. An examination of the adductor muscle was done. GROUP A and GROUP B. Both groups had groin pain and positive findings of P. Homlich *et al*.[3] examination techniques. Informed consent was obtained from subjects after explaining the procedure. The assessment form is filled for each patient.(Annexure1)
The examination techniques were

1. Adductor squeeze test-Adduction of the legs against resistance; pain were evaluated by using a sphygmomanometer
2. Palpation of insertion of adductor longus muscle at the pubic bone; pain was evaluated
3. Passive stretching of the adductor muscle; pain was evaluated**.**

VAS scale and sphygmomanometer reading were taken as outcome measures.

Treatment

Group A- The structured protocol is of 45 min. Moist pack applies over the medial aspect of thigh for 10-15 min and 30 min exercise. The present study included two isometric and four dynamic exercises. Start with 10 reps x 10 sec hold/2sets in week 1 ,increase in number of repetitions and holding time 5 reps x 5sec hold/2sets per week according to Holmich *et al.* protocol till 4 weeks.[6]

1. Isometric adduction against a soccer ball placed between the ankles (IBA)
2. Isometric adduction against a soccer ball placed between the knees (IBK)
3. Folding knife (F.K.): a combined abdominal sit-up and hip flexion. Starting from the supine position, with a football between flexed knees, repetitions are performed in a slow pace by flexing the hip and the lower back, bringing knees and chest together
4. Standing one-leg coordination exercise called "cross-country skiing on one leg" (CSS): flexing and extending the knee and swinging the arms in the same rhythm, repetitions are performed on the dominant leg (defined as the preferred kicking leg) as the standing leg.
5. Hip adduction against a partner's hip abduction called "adduction partner" (ADP): in the sitting position, supported by the hands placed on the ground behind the trunk, the tested player places his legs straight and wide apart with the feet and lower shin on the outside of the partners feet and lower shin. He adducts while the partner abducts eccentrically and slowly presses his feet together.
6. Hip abduction against a partner's hip adduction called "abduction partner" (ABP): from the reversed starting position as "adduction partner" with feet and lower shins now placed medially on his partner's feet and lower shin, the player abducts concentrically ("abduction partner") while the partner adducts eccentrically, and is slowly brought into abduction.

Group B

The structured protocol is of 45 min. 10 to 15 minutes of moist pack over medial aspect of thigh and a structured protocol of active resisted exercise of 30 minutes. It contains 5 types of exercises. One Isometric and five Isotonic (Dynamic). And with the resistance of 1 kg weight cuff. Start with 10 reps x 10 sec hold/2sets in week 1, increase in the number of repetitions and holding time 5 reps x 5sec hold/2sets per week till 4 weeks.[6]

1. Isometric adduction- is mainly done for adductor muscle in supine lying with hip 45° flexed with ball placed between the knees and ask the athlete to do press the ball few seconds and then release
2. SLR (Straight leg raising) - It is mainly done for the strengthening of hip flexor muscle group (iliopsoas). Athletes lying in supine position with palms facing upward and legs are little apart and than the athlete ask to do hip flexion up to their pain-free range and hold up for few seconds then release.
3. Hip adduction – Active Resisted hip adduction done for hip adductor muscle group. (Adductor Longus, Brevis, Magnus, Pectineus and Gracilis). Athletes is in side lying position with the upper limb supported by the chair beneath the leg and the athlete asks to do active adduction of lower limb and hold up for a few seconds, then release.
4. Knee extension - Active resistant knee extension it's mainly done for knee extensor group (quadriceps). The athlete is in high sitting position with
5. Hip abduction – Active hip abduction exercise. Mainly done for hip abductor muscle group i.e. gluteus medius and minimus.
6. Bridging – active bridging for core muscles rectus abdominis.

RESULTS

In the present study data analysis was performed using SPSS version 17.0. Since study variable is scale therefore, parametric tests are being used. To compare the before and after scores (in both Strength and Visual Analogue) paired-t tests was used at 5% level of significance i.e. 95% confidence. To compare improvement in strength and visual analogue score independent sample t-test have been used.

Table 1 shows comparison of Visual Analogue Scores Paired –t tests was applied it was found that there were significant differences between pre and post average V.A. Score in Group B. Average VA score in Group A has reduced by 3.80 as compared to 2.27 in case of Group B. Table 2 shows comparison of Improvement in Visual Analogue Score Independent sample t-test were applied which shows a significant difference as p-value is 0.03. It shows that reduction in average V.A. score in Group A is statistically significantly higher than in Group B.

Table 3 Comparison of Average Strength Scores Paired-t tests were applied.p-value obtained was 0.003. It shows that there was significant difference between pre and post average strength Scores in Group A. It also shows significant differences between pre and post average strength Scores in the experimental group.

Table 1: Comparison of Visual Analogue Scores

		N	*Mean*	*Standard error*	*Decrease mean*	*Paired-t*	*p*
Group-I	Visual Analogue Before	15	4.0	0.48	3.80	9.13	0.00
	Visual Analogue After	15	0.20	0.10			
Group-II	Visual Analogue Before	15	2.93	0.23	2.27	9.28	0.00

Table 2: Comparison of improvement in visual analogue score

Group	*Average change in visual analogue score*	*Standard error*	*Independent –t tests*	*P-value*
Group A	3.80	0.41	2.24	0.03
Group B	2.27	0.29		

Table 4 Comparison of Improvement in Strength Score Independent sample t-test was applied, showing a significant difference as p-value is 0.04. It shows that the improvement in strength score in Group A is statistically significant higher as compared to improvement in strength score in Group B.

Discussion

The results of the current study demonstrate that there was significantly improved strength and pain after giving structured exercise protocol as an intervention in both groups. The result showed effectiveness of both exercise protocol by denoting significant difference in both VAS scale and sphygmomanometer readings(Table1,2). Patient reported that the patient intervention with structured protocol (Group A) had significantly earlier recovery of strength in adductors muscles in case of groin pain as compared to Group B (Table 3). It inference statistically that groin pain intervention with the active resistance exercise protocol had significantly improved in strength in adductor muscle but with Holmich *et al.* structured protocol (Group A) found to be more effective. (Table 4)

Group A intervenes with the structured protocol by per Holmich *et al.* The result of current study indicate that three of dynamic exercises in the groin injury prevention programme can be categorized as exercises with sufficient intensity for strength improvements in athletes targeting important muscle relevant in the prevention of groin injuries, adduction partner for adductor longus, abduction partner for gluteus medius and folding knife for the rectus abdominis and external oblique.

Authors of several studies have identified a decrease in strength in adductor preceding and following on set of groin injuries, which makes adductor strength training a top priority in the prevention and rehabilitation of groin injury. However, isometric exercise induced angled specific strength gains and are predominantly recommended in the range of motion, limits and ability to perform dynamic muscle contraction and recommended for strength training. The exercise "cross-country skiing on one leg" did not reach the strength training but it might promote dynamic stability in single leg stance and pelvic alignment through improved endurance capacity of gluteus medius, especially during minor to moderate and repetitive loading situations, such as maximal sub running which is helpful in gymnast for their performance in taking speed from the start. Physiological response to resistance training occurs predominantly in the nervous system which place an important role in the initial adaptation of muscle[7]. The effect and adaptation of nerve root may be responsible for the successful motorization of motor units. Thereby providing more muscle power . The 90% increase in muscle strength during active physical training in the initial two weeks and 40 to 50% increase in the following two weeks are attributable to neural adaptation. In group B we used a structured protocol of active resisted exercises of groin muscles. Yet there is also improvement in strength but as compared to group A results are not specific. And time taken is more to return to sport.

Our results are in accordance with Kasper krommes *et al.*[6] who suggested that the exercise intensity of all six exercise-investigated exercises in the Holmich groin

Table 3: Comparison of Average Strength Scores

		N	Mean	Standard error	Increase in mean	Paired-t	p
Group A	Pre-Strength	15	103.80	6.47	15.60	3.63	0.003
	Post-Strength	15	119.40	6.43			
Group B	Pre-Strength	15	113.73	4.63	5.60	3.57	0.003
	Post Strength	15	119.33	4.57			

Table 4: Comparison of improvement in strength score

Mean change in Strength	Standard error	Independent -t	P value
15.60	4.30	2.18	0.04

injury prevention program is sufficient to be considered as strength training for specific muscle group.

Our results were in accordance with Timothy F. *et al*.[5] in Lenox hill hospital New York who assessed the association of hip strength and flexibility with the incidence of adductor muscle strains in professional ice hockey players. Found that a player was 17 times more likely to sustain an adductor muscle strain if his adductor strength was less than 80%. And pre-season strength training is effective at reducing the incidence of adductor strains in players identified at risk.Our results were in accordance with Tyler *et al*.[8] in 2010 who performed a randomized controlled study on U.S. male soccer player and suggested an emphasis on strengthening exercises may reduce the recurrence rate of groin strain.

Conclusion

1. We found that treatment of groin pain among young gymnasts with a structured exercise protocol in an active physical training group aimed to improve muscle strength of Groin muscle was significantly better than active resistance group exercise group.
2. Moreover maximum of patients in group A had no residual pain at clinical examination and had returned to the sport at the same level or an even higher level of activity without Groin pain as compared to group B.
3. The main element of the study is to the restoration of strength with reducing pain in the Groin area. The treatment principles will also be helpful in other injuries related to tendons should be investigated because it should be the potential benefit of a shorter programme.

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