

# Effects of Strength Training and Aquatherapy on the Rehabilitation of ACL Injury

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**Abstract - The aim of this study was to find out the effect of strength training and aqua therapy in the rehabilitation of ACL injury. To achieve the purpose of this study, the investigator selected 60 sportsmen who were treated for ACL injuries in Andhra Pradesh. Their age between 18 and 28 years. the investigator considered for this study as ACL injuries, which occurs in knee due to other major ligaments and dependent variables, flexibility measured through sit and reach and half squat were selected. The subjects (n=60) were randomly assigned to three equal groups of twenty in each. The groups were assigned as Experimental Groups I, II and control group respectively. Pre tests were conducted for all the subjects on selected criterion variables, flexibility and half squat using standard tests. The experimental groups participated in their respective experimental treatments for four weeks while control group was not. Immediately after the completion of the experimental period the criterion variables were measured and the post test scores obtained. The difference between the pre and post test scores on each variable was considered as the effect of respective treatments. To find out the statistical significance, ANCOVA was employed. The results showed that there was significant improvement due to strength and aqua therapy exercises among the ACL injured. The paired adjusted mean comparisons between the groups proved that strength training and aqua therapy were equally good in improving flexibility than control group while strength training was found to be significantly better than aqua therapy and control group in improving half squat test. Hence it was concluded that strength training stretches and aqua therapy would be significantly contributing to improve ACL injured in the process of their rehabilitation.**

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## INTRODUCTION

Competitive sports makes a tremendous demand on the physical condition vitality, endurance and mental powers of the participant. Only athletes in the finest condition can withstand the wear and tear of a competitive season. Only the fittest can play to the best of their ability. Athletes not in condition are prone to injury or going state, and might never take the team. Thus proper conditioning not only is necessary in preparing for sports participation, but is of great importance in preventing injuries. The athlete who is properly trained and conditioned will sustain a lower incidence and severity of injuries and a higher level of performance. Individuals who are obese, awkward, considerably underweight, or ill trained suffer the greatest number of injuries. The athlete who is well muscle and properly conditioned rarely requires medical treatment for injuries (Hardayal Singh. 2004).

Anterior cruciate ligament (ACL) injury occurs when the anterior cruciate ligament (ACL) is either stretched, partially torn, or completely torn. The most common injury is a complete tear. Symptoms include pain, an audible cracking sound during injury, instability of the knee, and joint swelling. Swelling generally appears within a couple of hours.<sup>[2]</sup> In approximately 50% of cases, other structures of the knee such as surrounding ligaments, cartilage, or meniscus are damaged. (AAOS (2014)

ACL injuries often occurs because of a rapid change in direction, sudden stop, landing after a jump, or direct contact to the knee. It is more common in athletes, particularly those who participate in alpine skiing, football (soccer), netball, American football, or basketball (Prodromos CC et.al.2008) The occurrence of ACL injuries among college athletes were highest in male football players with 15 per 10,000, followed by female gymnasts with 8 per

10,000 and female soccer players with 5.2 per 10,000. (Gans I, Retzky et.al. 2018) High school athletes are at increased risk for ACL tears when compared to non-athletes.

The goals of rehabilitation following an ACL injury are to regain knee strength and motion. If an individual with an ACL injury undergoes surgery, the rehabilitation process will first focus on slowly increasing the range of motion of the joint, then on strengthening the surrounding muscles to protect the new ligament and stabilize the knee. Finally, functional training specific to the activities required for certain sports is begun. It may take six or more months before an athlete can return to sport after surgery, as it is vital to regain a sense of balance and control over the knee in order to prevent a second injury. (AAOS, 2018)

Prins and Cutner (2005) found Increasing interest in aquatic physical therapy can be attributed in part to its evolution from the limited confines of spas and "Hubbard tanks," to the larger venues of swimming pools. These larger exercising areas accommodate a greater variety of exercises, including those that require sustained propulsive movements. Risberg, Lewek and Mackler (2004) reviewed the effectiveness of various rehabilitation programs that have been used for surgically or non-surgically treated anterior cruciate ligament (ACL) injuries in adult patients and found high intensity neuromuscular electrical stimulation in addition to volitional exercises significantly improves isometric quadriceps muscle strength compared to volitional exercises alone. The reviews of the related studies proved that there is further scope for research in finding out the effect of strength training and aquatherapy in the rehabilitation of ACL injury as measured through flexibility and half squat abilities.

## METHODOLOGY

To achieve the purpose of this study, the investigator selected 60 sportsmen who were treated for ACL injuries in Andhra Pradesh. Their age between 18 and 28 years. the investigator considered for this study as ACL injuries, which occurs in knee due to other major ligaments and dependent variables, Flexibility measured through Sit and Reach and Half Squat were selected.

## EXPERIMENTAL DESIGN

The study was formulated as a true random group design, consisting of a pre test and post test. The subjects (n=60) were randomly assigned to three equal groups of twenty in each. The groups were assigned as Experimental Groups I, II and control group respectively. Pre tests were conducted for all the subjects on selected criterion variables, flexibility and half squat using standard tests. The experimental

group I participated in strength training consisted of weight distribution on injured leg, walking on the line, sideward walking, quadriceps strengthening, hamstring curl, adductor strengthening, and half muscle strengthening for 4 weeks. Experimental group II participated in aqua therapy consists of normal walking in water, backward walk, side ward walk and one leg standing in water for 4 weeks. The control group was not participated in any training programme. The training programme was scheduled on week days excluding Sundays. Immediately after the completion of the experimental period the criterion variables were measured and the post test scores obtained. The difference between the pre and post test scores on each variable was considered as the effect of respective treatments. To find out the statistical significance, ANCOVA was employed. In all cases 0.05 level was fixed to test the significance.

## RESULTS

**Table 1: Results on Calculation of Analysis of Covariance on Selected Flexibility and Half Squat Among Experimental and Control Groups**

Calculation of Analysis of Covariance on Flexibility								
	Strength Training Group	Aqua therapy Trg Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained F
Pre Test Mean	9.33	9.05	8.80	Between	2.76	2	1.38	1.09
				Within	72.29	57	1.27	
Post Test Mean	12.30	11.83	8.88	Between	137.73	2	68.86	76.55
				Within	51.27	57	0.90	
Adjusted Post Test Mean	12.21	11.83	8.96	Between	122.67	2	61.34	78.69
				Within	43.65	56	0.78	
Mean Diff	2.98	2.78	0.07					

Calculation of Analysis of Covariance on Half Squat								
	Strength Training Group	Aqua therapy Trg Group	Control Group	Source of Variance	Sum of Squares	df	Mean Squares	Obtained F
Pre Test Mean	19.05	18.00	18.20	Between	12.43	2	6.22	1.10
				Within	322.15	57	5.65	
Post Test Mean	23.50	20.30	18.50	Between	256.53	2	128.27	23.57
				Within	310.20	57	5.44	
Adjusted Post Test Mean	23.21	20.49	18.60	Between	208.94	2	104.47	24.29
				Within	240.82	56	4.30	
Mean Diff	4.45	2.30	0.30					

Required  $F_{(0.05, 2, 42)} = 3.22$  \*Significant

**Table 2: Scheffe's Post Hoc Analysis Results**

Post Hoc Analysis for Flexibility				
Strength Training Group	Aqua Therapy Training Group	Control Group	Mean Difference	Reqd. C.I
12.21	11.83		0.39	0.70
12.21		8.96	3.25*	0.70
	11.83	8.96	2.87*	0.70
Post Hoc Analysis for Half Squat				
23.21	20.49		2.71*	1.65
23.21		18.60	4.61*	1.65
	20.49	18.60	1.89*	1.65

\*Significant

## DISCUSSIONS

The knee is the body's largest and most complex joint, with lots of moving parts held together by four main ligaments. These ligaments, which include the anterior cruciate ligament (ACL), are non-stretchable connective tissues that attach muscles to bones. (Elizabeth, Q (2020)

Studies show that progressive exercise programs, including some of the ACL stretches are a key component to ACL injury recovery. (Eitzen I ET.AL. 2010) Additionally, people who use ACL stretching regimes in recovery see a significant improvement compared with those who do not. Athletes of all ages can follow this recommendation to help protect their ACLs. Research is clear that keeping the muscles surrounding the ACL both strong and flexible will result in a stronger knee. (AOSSM, 2011) The purpose of the study was how best the strengthening exercises in the form of strength training and aqua therapy contribute for flexibility in knee through measuring half squat test and hip flexibility through sit and reach tests. The results presented in Table I shows that there was significant improvement due to strength and aqua therapy exercises among the ACL injured as the obtained F value was greater than the required F value to be significant. Since significant values were obtained, the paired adjusted mean comparisons between the groups were made and the results presented in Table II proved that strength training and aqua therapy were equally good in improving flexibility than control group while strength training was found to be significantly better than aqua therapy and control group in improving half squat test. Hence it was found that strength training stretches and aqua therapy would be significantly contributing to improve ACL injured in the process of their rehabilitation.

## CONCLUSIONS

Hence it was concluded that strength training stretches and aqua therapy would be significantly contributing to improve ACL injured in the process of their rehabilitation.

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