

# **Activity Limitation and Participation Restriction in Sport Rock Climbers with Upper Limb Injury**

Shreevidya Karthik<sup>1</sup>, Uditi Shah<sup>2</sup>

Assistant Professor, School of Physiotherapy, D Y Patil University, Navi Mumbai, Maharashtra, India<sup>1</sup>

Student, School of physiotherapy, D Y Patil University, Navi Mumbai, Maharashtra India<sup>2</sup>

**ABSTRACT:** As any other sport, indoor wall climbing also accounts for certain injuries. According to a study conducted by Murray Maitland, the architecture of the climbing wall affects the pattern of injury [3]. The study conducted by Todd E Paige, David C Foire and Jeffery D Houston showed that the upper extremity is more predominately involved as compared to the lower extremity in the ratio 4:1[2] Present study intends to identify the functional impairment, activity limitation and participation restriction in sport rock climbers with a upper extremity injuries. Method: A Community based cross sectional study was conducted amongst 50 Sport Rock Climbers with upper extremity musculoskeletal problems to identify their functional impairment, activity limitation and participation restriction using the DASH scale. Conclusion: Sport related participation restriction is found to be more affected than day to day activity limitations. In 68% climbers the wrist was identified to be the most commonly affected joint.

**KEYWORDS:** Sport Rock Climbers, ssports injury, upper limb injuries, DASH scale, function limitations.

## **I. INTRODUCTION**

Rock climbing is a sport in which the participant climbs up, down and across natural rock and artificial walls [1]. There are various types of rock climbing ; some of which are aid climbing, free climbing, bouldering, sport climbing and traditional climbing. Traditional climbing takes place outdoor on natural rock. In this type of climbing, the climber uses the weakness in cliffs or mountains such as cracks to ascend upwards. It is in these cracks that the safety equipment are placed which is temporary and later removed [2].

In the early 1970's, a group of French climbers began using bolts to make the dangerous and difficult climb safer. This is how sport climbing was born. Sport climbing is of two types; indoor sport climbing which takes place on the walls of artificial rock and outdoor sport climbing which takes place on natural rock. Indoor climbing takes place on walls which are built in various sizes and shapes which stimulates the different terrains. It also has artificial hand and foot holds for support. These hand and foot holds are made of wood, plastic or ceramic. The protective aid is permanently placed on the walls because of which it is a safe sport. Outdoor sport climbing takes place outside on natural rock on which the safety equipment are permanently attached [2].

Though sport climbing and traditional climbing are both forms of rock climbing, they have certain differences. Sport climbing demands a greater upper extremity support that is most of the body weight is placed on the upper extremity; while in traditional climbing more weight is placed on the lower extremity. Sport climbing also relieves the mental tension in climbers of injury as in traditional climbing due to the provision of permanently placed safety gear [2].

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

Indoor wall climbing is gaining popularity in India due to the increased availability of indoor climbing gyms. The climbers can train in any season and need not require to travel long distances to the mountains [2]. It is developing as an off-road adventure. It is undertaken by people to develop their skill and technique as well as for exercise and fun.

As any other sport, indoor wall climbing also accounts for certain injuries. According to a study conducted by Murray Maitland, the architecture of the climbing wall affects the pattern of injury [3]. The study conducted by Todd E Paige, David C Foire and Jeffery D Houston shows that the upper extremity is more predominately involved as compared to the lower extremity in the ratio 4:1. It is also known through this study that it accounts for greater number of finger injuries than any other injuries because movements in sport climbing put tremendous stress on the joints of the fingers. The elbow and shoulder are also commonly affected [2]. These joints are required for various activities in our day to day lives like for writing, doing overhead activities or picking up objects from the floor and for various sport activities. Injuries in these joints can manifest in the form of some functional limitation in daily lives of the climbers. Hence this study intends to identify the functional impairment, activity limitation and participation restriction in sport rock climbers with a upper extremity injury.

There are various outcome measures available for the evaluation of upper extremity functioning but disability of arm, shoulder and hand (DASH) questionnaire which is a self report questionnaire to measure the physical function and symptoms in a climber with any musculoskeletal disorder of the upper extremity has been used in this study. According to the international classification of functioning, disability and health, DASH measures the impairments, activity limitation and participation restriction in injuries of arm, shoulder and hand [4]. It is a reliable scale that can be used to access all joints of the upper extremity and hence it is most suitable for this study since sport climbing accounts for more upper extremity problems.

## II. RELATED WORK

Todd E Paige, David C Foire and Jeffery D Houston from University of Connecticut compared the pattern of injuries in traditional and sport rock climbing. When injuries were considered by body region, upper extremity injuries predominate in sport and traditional climbing. It was found that the ratio of upper limb to lower limb injuries in traditional sport climbing is 2:1 and that in sport climbing is 4:1 [2]. Volker Rainer Scho'ffl and Thomas Kuepper from the department of trauma and orthopedic surgery, German evaluated the Injuries at the 2005 World Championships in Rock Climbing and found that indoor rock climbing has a low risk of injury and a very good safety profile [5]. D M Wright, T J Royle and T Marshall's study on the frequency of overuse injuries in indoor climbers, showed that 44% of the subjects sustained an overuse injury and the most common site of injury were fingers [6]. Murray Maitland found that the pattern of injury during indoor climbing was closely related to the architecture of the climbing wall, techniques and weakness of anatomical structures [3].

## III. METHODOLOGY

**Research Approach:** Community based cross sectional study using convenient sampling.

**Study Design:** The data for this study was collected by direct method with the help of a validated questionnaire- Disability of arm, shoulder and hand.

**Sources of Data Collection:** a) Arun samant climbing wall b) Rock alien sports climbing gym c) Podar college climbing gym

**Sample Size:** 50 indoor rock climbers with upper limb difficulties.

**Duration of Study:** 3 months

**Inclusion Criteria:**

Sport Rock Climbers

Climbers climbing since at least 1 year

Climbers having upper extremity musculoskeletal problems

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

Climbers in the age group 20-40

**Exclusion Criteria:**

Climbers practicing other forms of climbing

**Procedure:** Ethical Approval: The study was approved by the Institutional Ethics & Research Committee at D. Y.Patil University. Written informed consent was obtained from all the subjects. Information regarding their identification obtained during the study has been strictly kept confidential.

A validated questionnaire was used to evaluate the common practices associated with the sport climbing and details of upper limb injuries.

Disability of Arm Shoulder and Hand questionnaire(DASH) was used to identify the upper extremity impairments, participation restriction and activity limitation in sport rock climbers.

The Questionnaires were administered to 50 sports rock climbers having upper extremity musculoskeletal problems using following methods: 1)Face to face administration of the questionnaire in the indoor climbing center 2) e-mail distribution to indoor climbing centers in the Rock alien sports climbing gym,with questionnaires returned to the authors by e-mail.

DASH scores were calculated for all the subjects. The information obtained from both the questionnaires were analysed using simple percentages and graphs.

## IV. RESULTS

Qualitative analysis of the data obtained revealed the following information.

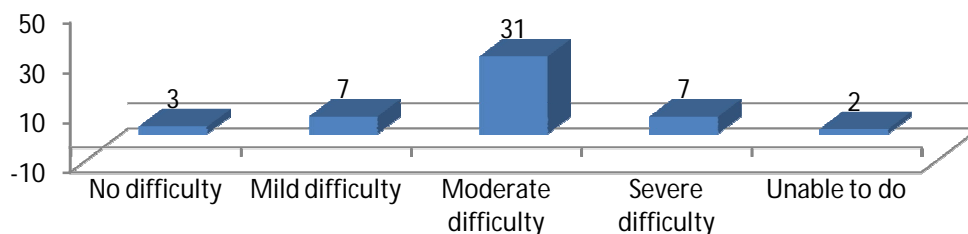
Amongst the 50 study subjects included this study there were 44 males and 6 females.

52% climbers were in the age group of 20-25 years, 22% climbers in 26-30 years, 22% climbers in 31-35 years and 4% climbers in 36-40 years of age.

It was also found that 36% climbers climb for 1-3 days/week, 32 % climb for 3-5 days/week, 26% climbers climb for 5-7 days/week and 6% for 1-3days/month.

Majority of the climbers i.e. 46% climbers have been climbing since 1-5 years, 30% climbers have been climbing since 6-10 years, 12% since 11-15 years and 12% climbers have been climbing since 16-20 years. In 68% climbers the wrist was identified to be the most commonly affected joint.

It was found that the most commonly affected functional activity was caring a heavy object (over10lbs). Graph 1 shows that 6% climbers had no difficulty in carrying a heavy object, 14% climbers had mild difficulty in carrying a heavy object,62% climbers had moderate difficulty in carrying a heavy object,14% climbers had severe difficulty in carrying a heavy object,4% climbers were unable to carry a heavy object.



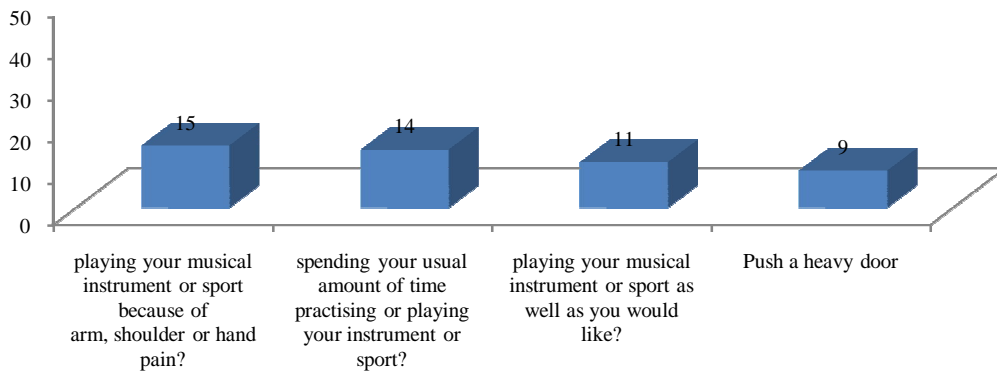
Graph 1: Most commonly affected functional activity-Carry a heavy object (over 10lbs)

## International Journal of Innovative Research in Science, Engineering and Technology

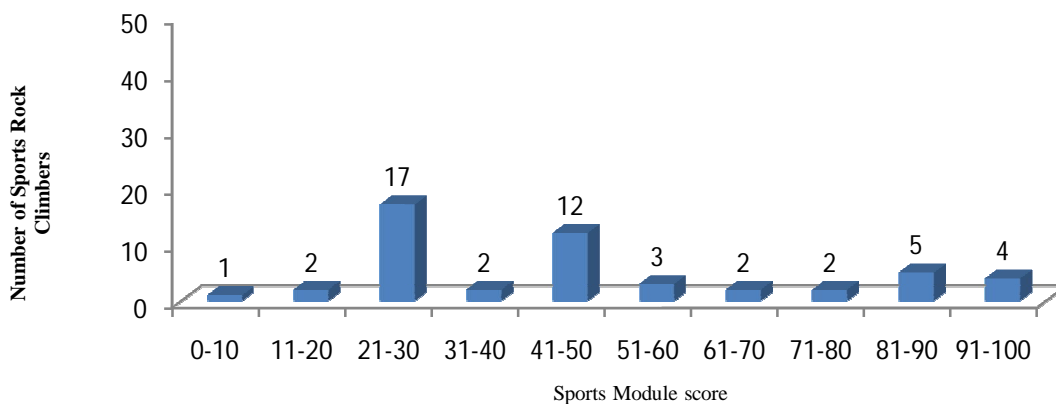
(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

amongst activities of daily living pushing a heavy door was found to have most number of severe responses (response 4 and 5). Graph.2 shows 30% of climbers marked severe responses (response 4 or 5) for question- difficulty in playing the sport because of pain, 28% marked severe responses (response 4 or 5) for question on inability to spend usual time playing the sport, 22% climbers had severe difficulty (response 4 or 5) in playing the sport as well as they would like to. Of the activities of daily living Pushing a heavy door had most severe responses (18%).



In the sports Module Highest number of climbers (34%) had a total sports module score between 21-30 followed by 24% in score range 41-50.



**Graph3: Total Scores: Sports Module**

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

## V. DISCUSSION

This study intended to identify the amount of dysfunction in sport rock climbers due to injury of the upper extremity due to their sport. We found that the most common cause of injury in this sport was due to stress on a joint while climbing i.e. 60% climbers. From the study it was found that 20 climbers who complained of injury due to stress on a joint while attempting a move did not follow a proper warm up- cool down protocol which might be the cause of injury. Warm up increases the elasticity of the muscles and smoothens muscular contractions thereby preventing injuries. Cool down helps to prevent tightening of muscles and soreness [7]. The study shows that 38% of the climbers did not perform any warm up exercise prior to climbing and 58% did not cool down .

It was found that 34% climbers were injured due to falling. Safety gears play vital role in preventing the incidences of fall. Various protective aids are used in climbing such as slings, harness, bolts etc. Absence of these protective aids can lead to fall. This study revealed that 88% of the climbers used protective aids regularly, 12% did not use any protective aid . It was also found that 6 climbers who did not use any protective aid have mentioned fall as the reason of their injury. Specific climbing shoes also aid to the injury prevention in this sport. Climbing shoes fit very closely to support the foot and allow the climber to use smaller footholds effectively. It was found that 20% of the climbers did not use these shoes while the remaining 80% climbers used specific climbing shoes while climbing. The use of smaller climbing shoes has been predisposed as a risk factor to injury [8].

Study shows that the wrist joint is the most commonly injured joint during climbing. 68% climbers complained of wrist problems due to their climbing activity. The probable cause for this could be the use of smaller hand-holds which increases the stress on the wrist while climbing and can cause an injury. Another cause responsible for wrist injury could be fall on the wrist . Out of the 10 climbers who did not use specific climbing shoes, it was found that 4 climbers were injured due to falling. This could be due to use of improper shoes which did not give the climber a proper grip leading to a fall while climbing. A study was done by Todd E Paige, David C Foire and Jeffery D Houston which concluded that there greater upper extremity insjuries compared to lower extremity injuries in the ratio 4:1[2]. Hence a fall during sport climbing can lead to pulling or grasping to prevent the fall will put more weight on the upper extremity than the lower extremity resulting in an injury.

Repeated attempted of an under-cling grip can be another cause of wrist injury. The under-cling grip has been observed to cause an indirect fracture of the hook of hamate. The under-cling grip places the wrist in extreme flexion. This could place greater than normal pressure on the carpal tunnel leading to carpal tunnel syndrome [9]. Crimp grip is another grip used by the climbers. It causes hyperextension at the DIP joint and hyper flexion at the PIP joint. It has been proposed to be a risk factor for injury at the wrist [8]. Through the survey, it is found that the most commonly affected functional activity according to DASH scale is carrying a heavy object (over 10lbs) (Fig. 1). This activity requires increased ulnar deviation at the wrist, increased shoulder flexion and decreased elbow flexion. Hence injury to any of the above mentioned joints can lead to difficulty in performing this activity<sup>10</sup>. In this study it was found that 68% of the climbers complained of wrist injury, 30% complained of shoulder injury and 2% climbers complained of elbow injures due to climbing. Through the survey, we found that though sports related activities had the most number of severe responses (4 or 5), amongst activities of daily living pushing a heavy door had most number of severe responses (Fig. 2). This activity requires wrist extension of approximately 43o and slight ulnar or radial deviation. Injury to wrist could affect this activity. In this study it was found that 68% climbers complained of wrist injury.

It was found that the sports related participation restriction is more compared to activity limitation (Fig. 3). Three out of four questions in the sports module had high number of severe responses. 30% climbers marked severe responses (response 4 or 5) in the question on difficulty in “playing musical instrument or sport because of arm, shoulder or hand pain?” This was followed by high number of severe responses in questions on “spending your usual amount of time practicing or playing instrument” (28%) or sport and “playing your musical instrument or sport as well as you would like?”(22%) . The demands of activities like sport climbing are higher compared to activities of daily living. As referred from previous studies on climbing it was found that sport climbing requires a greater upper limb support [2]. Hence the subjects in the study complained of greater sport related participation restriction as compared to activities of daily living, which are comparatively low intensity tasks.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

## VI. CONCLUSION

It is concluded that the sport related participation restriction is found to be more than activity limitation. The commonly affected joint has been identified to be wrist. The most commonly affected functional activity is carrying a heavy object. The most severely affected functional activity is pushing a door.

## REFERENCES

- [1] Eng, Ron. Mountaineering: The freedom of the hills. Mountaineers Books.;p592, 2011.
- [2] Paige, Todd E., David C. Fiore, and Jeffrey D. Houston. "Injury in traditional and sport rock climbing." *Wilderness & environmental medicine* vol. 9,No.1,pp. 2-7.,1998.
- [3] Maitland, Murray. "Injuries associated with rock climbing." *Journal of Orthopaedic & Sports Physical Therapy* vol. 16, No.2, pp. 68-73, 1992.
- [4] Dixon, Diane, Marie Johnston, and Margaret McQueen. "The Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) can measure the impairment, activity limitations and participation restriction constructs from the International Classification of Functioning, Disability and Health (ICF)." *BMC musculoskeletal disorders* vol. 9, No.1,pp.1,2008.
- [5] Schöffl, Volker Rainer, and Thomas Kuepper. "Injuries at the 2005 world championships in rock climbing." *Wilderness & environmental medicine* vol. 17,No. 3,pp.187-190, 2006.
- [6] Wright, D. M., T. J. Royle, and T. Marshall. "Indoor rock climbing: who gets injured?." *British journal of sports medicine* vol. 35, No.3,pp-181-185, 2001..
- [7] Safran, Marc R., Mr Anthony V. Seaber, and William E. Garrett Jr. "Warm-up and muscular injury prevention an update." *Sports Medicine* vol. 8, No.4, pp- 239-249, 1989.
- [8] Dabholkar, Ajit, Sinan Tejani, and Sujata Yardi. "Common Musculoskeletal Injuries in Rock Climbers." *EXECUTIVE EDITOR*, vol. 4, No. 4,pp-194,2013.
- [9] Schweizer, Andreas. "Sport climbing from a medical point of view." *Swiss Med Wkly* vol. 142, w13688, 2012.
- [10] Allen, Jaclyn L., Carole James, and Suzanne J. Snodgrass. "The effect of load on biomechanics during an overhead lift in the WorkHab Functional Capacity Evaluation." *Work* vol 43, No.4,pp-487-496, 2012.