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Effect of hand rehabilitation in overuse injuries of hand in professional rock climbers

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Abstract
Background: Rock climbing places extreme forces on the upper extremity. The various grip techniques transmit extremely high forces through the tissue of the digits, hand and forearm resulting in a variety of acute and chronic injuries. Climbers present a stronger imbalance, it is probable that they have more difficulties in controlling and protecting their joints and are, therefore more exposed to joints instability, joint surface over-use and/or ligament tear. For this type of injuries hand rehab can be given which can improve their strength and prevent injuries.
Aim: Effect of hand rehabilitation in overuse injuries of hand in professional rock climbers.
Objectives: Effect of hand rehabilitation on overall hand function on overuse injuries of hand in professional rock climbers.
Material and methodology: Total number of 60 professional rock climbers between age 18-35 years of both genders with at least 1 year of experience were selected by simple random sampling. Michigan hand outcome questionnaire was used to assess using aneroid sphygmomanometer was used pre and post intervention. Intervention is based on strengthening exercises of finger flexors and extensors, intrinsic and numerical muscles for thrice a week until 3 week for 30 minutes.
Results: After comparing pre and post intervention data using student paired t test results showed that there was significant improvement in hand function (p<0.000), work (p<0.000), adls (p<0.000), reduction of pain (p<0.000) and hand grip strength (p<0.000).Conclusion: There is significant improvement in overall hand function and hand grip strength in professional rock climbers.

Keywords: Rock climbers, overuse injuries, hand function, strengthening

1. Introduction
Rock climbing is often a physically and mentally demanding sport, often tests the climber's strength, endurance, agility and balance along with mental control. Climbing is the activity of using ones hand, feet or any other part of body to ascend a steep object [1]. Rock climbers rely predominantly on digital and upper extremity strength and tactile ability to ascend shallow ledges and rock faces, using any of four griping techniques i.e. open grip, cling grip, pocket grip, pinch grip depending on the terrain [1]. All four of the grip techniques transmit extremely high forces through the tissue of the digits, hand and forearm resulting in a verity of acute and chronic injuries. Fingertip injuries are most common hand injuries among rock climbers. Fingertip injuries have maceration and splitting of the skin of finger pads due to prolonged pressure and abrasion [3] When a climber pushes and twists his or her fingers until they are wedged into a crack, torque forces on the finger joints can be very high. This type of climbing is associated with joint dislocations and digital avulsion amputations following a sudden slip or fall [3]. Among these most serious injuries are flexor tendon strain, pulley strain and rupture [2, 3]. The most commonly affected site was the proximal inter phalangeal joint, or proximal phalanx of the middle and ring fingers, with pain or injury reported at this site in 69% [4]. The incidence of hand and wrist injuries can be closely correlated with the duration and frequency of climbing and with the climbing techniques used [3]. For this type of injuries hand rehab can be given which can improve their strength and prevent injuries. Consequent to the stronger enhancement of finger flexors, climbers exhibited higher imbalance between flexors and extensors around both the wrist and MCP joints [17]. Climbers present a stronger imbalance, it is probable that they have more difficulties in controlling and protecting their joints and are, therefore more exposed to joints instability, joint surface over-use and/or ligament tear [17].

In professional rock climbers gripping techniques may result in soft tissue injuries, flexor tendon injuries etc, this can affect their rock climbing activities. So there is a need of hand rehab for the affected rock climbers. Therefore there is important to examine the effect of hand rehabilitation in professional rock climbers.

2. Material and Methodology

2.1 Methodology

Study Design: Pre-Post Experimental study. Study Setting: Trekking camps in and around Pune**.** Total number of 60 professional rock climbers between age 18-35 years of both genders with at least 1 year of experience were selected by simple random sampling. Michigan hand outcome questionnaire was used pre and post intervention.

2.2 Exclusive Criteria

- Thesubjectsnot willing to participate
- Any recent surgery or fracture of upper limb

Any known medically diagnosed neurological disorder and cardiovascular disorder

2.3 Outcome Measure

- Michigan Hand Outcome questionnaire [8]

2.4 Procedure

Ethical clearance was taken from institutional ethical committee of Tilak Maharastra Vidyapeeth, department of physiotherapy**.**Various trekking camp was approached and permission was taken to conduct the study**.** Sample were selected according to the inclusion and exclusion criteria. They were explained about the aim and objectives of the study and a consent form was taken**.**Random sample collection was done by chit method. Data collection form were used for demographic identification. Michigan Hand Outcome questionnaire was used for ore and post intervention. Intervention is based on strengthening exercises which is to flexors and extensors intrinsic and numerical muscles. Intervention protocol as follows**.** Rehab was given for thrice a week until 3 week for 30 minutes**,** 5 min flexor tendon gliding and blocking exercise**,** 5 min for extensor tendon gliding exercise**,** 5 min of rest**,** 10 min of interpose and numerical muscle strengthening,5 min of rest**,** Post intervention taken. This outcome measures was taken by a blind assessor. Data was collected and got subjected for statistical analysis.

2.5 Statistical Analysis

Data was collected and tabulated and analyze using primer of biostatistics software. MS Excel sheet 2007 was used. Mean and standard of deviation of all variables were analyzed. Data was compared using student paired t test with 95% of confidence. Mean Age was 22.62±2.975.Total number of 35 males and 15 female rock climbers participated in study of which 12 had right side dominance and 38 with left side dominance. After comparing pre and post intervention data using student paired t test results showed that there was significant improvement in hand function (p<0.000), work (p<0.000), adls (p<0.000) and reduction of pain (p<0.000)

3. Results and Discussion

3.1 Tables and Figures

Table 1: Represents Age, year of experience, gender and hand dominance of rock climbers

Results	Mean+SD
Age	22.62+2.975
Year of Experience	6.63±4.516
Gender	Male=35, Female=15
Dominance	Right=12, Left=38

Table 2: Represents pre and post intervention values of Michigan hand outcome questionnaire

Michigan hand outcome questionnaire	Pre	Post	p value
Overall hand function	65.6±12.9	88.5±6.566	0.000
Adls	80.38±9.736	93.96±5.59	0.000
Pain	45.3±16.14	18.94±12.4	0.000
Work	69.69±15.73	91.66±12.94	0.000
Anesthetics	97.7±7.098	99.8±1.414	0.028
Satisfaction	69.27±10.42	90.88±6.96	0.000

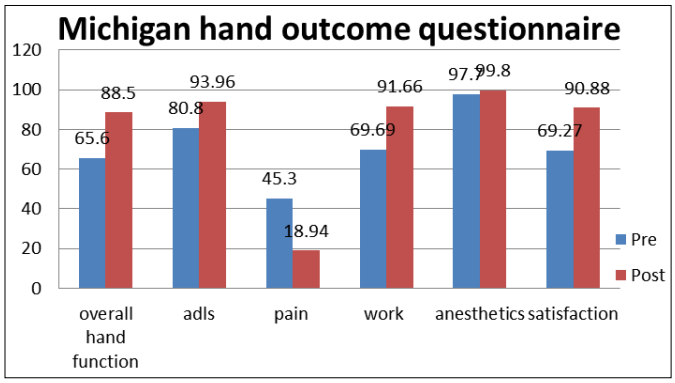

Fig 1: Pre and post intervention values of Michigan hand outcome questionnaire

3.2 Discussion

A total 60 samples were selected by random sample collection using Chit method. The sample collected between the age group of 18-35 with mean age 22. Out of which 15 subjects were female and 35 were male. In that 12 subjects were having right hand dominance and 38 having left hand dominance. Experience of each player into the game was summarized to a mean of 6.53.

Out of 60 samples 10 dropped out from the study, 3 samples opted for tendon repair and remaining 7 subjects discontinued the follow up

After comparing the pre and post intervention using paired t test for overall hand function (p value=0.000), adls ((p value=0.000), pain (p value=0.000), work (p value=0.000), ansthetics (p value=0.0028), and satisfaction (p value=0.000)

The pre and post intervention using paired p test for right hand strength (p value=0.000) and left hand strength (p value=0.000)

Marwan A. Wehbe *et al* concluded a study after tendon gliding exercises the differential tendon gliding occur even though range of motion is limited thus improving cartilage nutrition and joint motion [7]

Anandhi have proved that after functional task training or resistance training of hand improved wrist flexor and extensor

strength leading to the overall hand function, Adls and work to be increased in elderly people [18]. Resisitance exercises concentrating more on flexors and extensors and activity of finger leads to neural adaptation to improve functional movement capability of older individuals [18]

A. HARTH *et al* conducted a study concluded that hand rehabilitation program reduce pain and improve satisfaction towards hand which helps to patient returned to their former job [19].

Training finger flexors and extensors is of great importance from pathological point of view as this leads to coactivation of an antagonist muscle and the associated mechanical action are crucial for articulation in order to protect from excessive shear forces and excessive involuntary torque by increasing joint rigidity [19].

Hence there is improvement in overall hand function, adls, work, pain, anesthetics and satisfaction and grip strength in professional rock climbers.

4. Conclusion

There is significant improvement in overall hand function, adls, work, pain, anesthetics and satisfaction in professional rock climbers.

5. Limitations and Future Scope of Study

Small sample size was collected. The study duration was very short. Functional exercises for hand can be added in protocol can be taken

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