Effects of Strength Training and Jatamansi on reducing Hand Tremor amongst archers

Abstract

Objectives: To investigate and compare the effects of strength training (Shoulder girdle and respiratory muscles) and drug (Jatamansi) on reducing hand tremor in archers.

Design: Randomized experimental, different subject design.

Setting: Institutional study done at Manipur Archery Association.

Interventions: Thera-band (Hygienic Corporation) and Nardostachys jatamansi (GMP Certified) were used as interventions. Pre & Post Hand Steadiness Score (Arm-Hand-Steadiness Tester on 4 mm hole) and Performance Test Scores (AAPHER Archery Test) was evaluated. 45 National Level Archers within age 16-28yrs were assigned into three groups: Group I (Medicine), Group II (Strength Training) and Group III (Control). Medicine was consumed for 4 weeks continuously 3 gm TDS and Thera-band strength training was given for 3 times weekly for 4 weeks.

Main Outcome Measures: It was hypothesized that strength training is more effective in reducing hand tremors than medicinal or control groups.

Results:

Arm-Hand-Steadiness:
Numbers of Contact (NOC): On inter Group Comparison of the three Groups using One Way ANOVA, left and right arm showed significant differences (F = 5.64, p<0.05; F = 8.97, p<0.001) respectively and on Post Hoc Scheffe’s analysis, Group II showed maximum improvement.

Total Contact Time (TCT): On inter Group comparison of the three Groups using One Way ANOVA, left and right arm showed significant differences (F = 12.50, p<0.001; F = 9.23, p<0.001) respectively and On Post Hoc Scheffe’s analysis, Group II showed maximum improvement.

Archery Performance: On inter Group comparison of the three Groups using One Way ANOVA showed significant difference (F = 6.53, p<0.005) and on Post Hoc Scheffe’s analysis, Group II showed maximum improvement.

Conclusion: Intervention of strength training and jatamansi may be effective for an archer however, Strength training with Thera-band and Respiratory Muscles Conditioning intervention in combination increases steadiness and archery performance.

Key Words: Arm-Hand-Steadiness, Strength Training, Jatamansi.

Introduction

Archery is a recreational individual sport. It can be described as a comparatively static sport requiring strength and endurance of the upper body in particular the forearm and shoulder girdle. An archer pushes the bow with an extended arm, which is statically held for aiming phase while the other arm exerts a dynamic pulling of the bowstring from the beginning of the drawing phase until the release is dynamically executed. In these phases because of extreme muscular exhaustion, most of the archers experienced static tremor due to deficiency of muscle strength. Accuracy of an archer in shooting is greatly dependent upon being able to hold steady at full draw from a stable base.

Steadiness is the ability to maintain the body or a limb in a fixed position or to execute a smooth movement without any fluctuation from the desired course. Generally as muscle contraction increases, steadiness decreases. Steadiness is an important component of skills that require aiming and general immobility such as shooting, pistol marksmanship, archery or dart throwing.

A slight amount of tremor is always present in a normal healthy individual that is known as static tremor and can be seen when the limbs or trunk are kept in certain positions or when they are moved actively, usually due to near synchronous rhythmic burst in opposing muscle groups that are working to steady the body part in the desired position. Arm-Hand-Steadiness is the ability to hold one’s arm and hand in a specific position for a relatively short period of time. This determines the success in sports events like archery and shooting. Being a psychomotor process it depends upon not only the muscular caliber of an individual but also on the mental ability to concentrate on the target. It is also influenced by various psychological factors like anxiety, depression and lack of concentration or disturbances of sleep-wake cycle besides psychomotor task.

There are many factors that determine arm-hand-steadiness of an individual. Gender being the first and foremost. Physical strength affects perceptual motor abilities and it is well documented that females generally exhibit significantly lower up-
per body strength than males\textsuperscript{3,4} hence implying that females have a lower arm-hand-steadiness than males.

Jatamansi (Nardostachys jatamansi) is an herbal drug which has a rich history of medicinal use but it has not yet tried in sports as performance enhancer. It has a superb rejuvenating effect on the mind. The rhizomes and roots of Jatamansi have medicinal values and contain a variety of sesquiterpenes, coumarin, crystalline acid and jatamansi acid\textsuperscript{6}. The root powder (60gm) of N.jatamansi showed a sedative action in a clinical study on 24 medical students as evidenced by the prolongation of the visual reaction time\textsuperscript{7}. The decoction of the root is used in mental disorders, insomnia, disease of blood and circulatory system\textsuperscript{7}.

The strength of the arm is required to control the bow during the drawing and holding phases which will reduce the hand tremor and fatigue. Resistance training has become a primary component of athletic conditioning, rehabilitation and general fitness programs\textsuperscript{8,9} and the notion that the sports specific resistance training should be an integral component for sport preparation by virtue of the direct enhancement on muscular strength facilitate an improvement in sporting performance\textsuperscript{10}. Thera-band elastic bands are recognized as a system of progressive resistance for over 25 years. Research has proved that elastic resistance training is effective in improving many attribute from strength to function, both in young and older individuals. The rehabilitation community has readily and widely accepted the use of elastic material for strengthening exercise programs\textsuperscript{11}. In the recent study\textsuperscript{12} it was concluded that there was 18-25% increase in upper and lower extremity strength following theraband strengthening exercises. Thera-band are extremely versatile tools as exercises can be performed in many different positions because elastic resistance is not significantly gravity dependent\textsuperscript{13,14}. The strength gain following theraband elastic resistance training are not influenced by training speed\textsuperscript{15} and it is safe to exercise at moderate to high speed with elastic resistance.

Only little literature is available on strength training and intervention of jatamansi on archers and effects on hand tremor and archery performance, the present study was undertaken to see its efficacy.

### Materials and methods

An experimental study with a different subject design was conducted. 45 National Level Archers (14 females and 31 males) of age group 16-28 years were recruited and randomly divided into 3 groups: Group I (Medicine), Group II (Strength Training) and Group III (Control). Subjects were familiarized with experimental procedure and informed about the possible risk and benefits associated with the study both verbally and in writing before obtaining their informed consent. The study was approved by Institutional Medical Ethics Committee. Dependent variables included steadiness (NOC and TCT) and Archery Performance while Strength Training and Jatamansi administration were the independent variables. Exclusion criteria included any previous or recent injury to the upper limb and allergic disorders. Pre and Post assessment of Arm-Hand-Steadiness (NOC and TCT) and Archery Performance was done for all subjects. Medicaid Hand Steadiness Tester Hole Type-320 was used to evaluate the steadiness of both the arm of all the subjects (4 mm hole). AAPHER (American Association of Physical Health Exercise, Recreation and Dance) Archery test was used to evaluate the performance\textsuperscript{16}.

Testing procedure of Arm-Hand-Steadiness

Arm-Hand-Steadiness of both sides was tested with the subjects seated comfortably on a chair for hole of diameter (4mm) for time duration of 60 seconds. The apparatus was adjusted so that the top of the apparatus was at shoulder height and its outer edge was in line with the edge of the shoulder of the arm.

For evaluating steadiness, subject was told to insert the tip of the probe for a single trial in a 4mm hole, upon signal, into the hole to a depth of about 5mm and try to hold it there without touching the sides of the hole until signaled to stop (after 60 sec). The inter trial interval was 2 minutes. After each trial both the Number of Contact (NOC) and Total Contact Time (TCT) were noted.

Testing procedure of Archery Performance

AAPHER Archery Test was done to evaluate the performance of all the subjects. This test was developed as a part of sports skills project of the Research Council of AAPHER; it consists of two ends (total of 12 arrows) with intervening rest from distances of 10 & 20 yards.

### Experimental Protocol

a) Strength Training Group: The subjects in this group performed theraband elastic resistance exercises viz., shoulder flexion, abduction, scaption, internal and external rotation, shrugging, seated row and elbow flexion, extension along with routine exercise schedule. The color that allows to complete 2-3 sets of 10 repetitions with mild fatigue on the last set was choose as the initial color mainly, green color (heavy) for boys and red color (medium) for girls. Progression to next color of band when easily able to complete 3 sets of 10-15 repetitions. In initial 2 weeks of training the resistance level was kept 50% of its resting length and progress to 75% in the last 2 weeks of training. These exercises were performed for 3 sets of 10 repetitions with 1 minute rest interval in between the sets for 3 sessions per week for the duration of 4 weeks. Thera-band exercises were followed by respiratory muscles exercises with Mediciser for 15 minutes and the diaphragmatic exercises 15 repetitions each for 3 sessions per week for 4 weeks.

b) Medicine Group: The subjects of the medicine group were given jatamansi, a herbal drug in a dose of 3 gm TDS for a period of 4 weeks along with routine exercise schedule. The root extract of the drug was from Alva’s Pharma (GMP Certified) and the laboratory testing was done at Bangalore Test House certified by ISO 9001-2000.

c) Control Group: The control group followed their routine exercise schedule.

Adequate care was taken that the physical, mental and emotional well being of all the subjects were maintained throughout the study by strictly following the ethical research guidelines.
Data was analyzed for its statistical significance using SPSS-14.0. Intra and Inter Group Comparison were done by related and unrelated t-test, One-Way ANOVA and Post Hoc Multiple Scheffe's Tests. All the baseline readings between groups were found to be non-significant.

Arm-Hand-Steadiness:
Inter Group post intervention comparison for NOC of left arm ($t = 2.83$, $p < 0.05$); right arm ($t = 3.19$, $p < 0.005$) and TCT of left arm ($t = 4.19$, $p < 0.001$); right arm ($t = 5.19$, $p < 0.001$) in Group II revealed statistically significant improvement as compared to Group I and only NOC of left arm ($t = 2.74$, $p < 0.05$); right arm ($t = 3.91$, $p < 0.001$) in Group II revealed statistically significant improvement as compared to Group III.

The TCT of left arm ($t = 3.97$, $p < 0.001$); right arm ($t = 2.69$, $p < 0.05$) in Group I revealed statistically significant improvement as compared to Group III and NOC were found to be non-significant. One-Way ANOVA of NOC & TCT in all the 3 Groups showed statistically significant differences ($F = 5.64$, $p < 0.05$; $F = 8.97$, $p < 0.001$) & ($F = 12.50$, $p < 0.001$; $F = 9.23$, $p < 0.001$) on left and right arm respectively & on Post Hoc Scheffe's test revealed that Group II showed most significant changes in both NOC and TCT.

Archery Performance:
Inter Group post intervention comparison in Group II ($t = 3.41$, $p < 0.005$) and ($t = 3.26$, $p < 0.005$) showed statistically significant as compared to Group I and Group III. Comparison of Group I and III were found to be non-significant. One-Way ANOVA yielded statistically significant differences ($F = 6.53$, $p < 0.005$) between the Groups. The results of Post Hoc Scheffe's test indicated that Group II showed the most significant changes.

### Table 1

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<th>Significant level</th>
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Distribution of Number of Contact (NOC) of 4 mm hole in all the three Groups of left side.

### Table 2

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Distribution of Number of Contact (NOC) of 4 mm hole in all the three Groups of right side.

### Table 3

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Distribution of Total Contact Time (TCT) of 4 mm hole in all the three Groups of left side.

### Table 4

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Distribution of Total Contact Time (TCT) of 4 mm hole in all the three Groups of right side.

### Table 5

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Distribution of performance scores in all the three Groups.
The results of the present study indicate that the strength training of the upper back, shoulder girdle and arm muscles with theraband followed by respiratory muscles training influence the various parameters of steadiness (NOC and TCT) and archery performance. It is observed that all the variables show significant changes. The training group were the steadiest followed by medicine group and then the control group. The better performance and accuracy of shooting in training group can be attributed to many factors like proper conditioning of girdle musculature along with respiratory muscles which plays a key role in stabilizing the shoulder girdle for accurate shooting in archery.

Physiological tremor occurs in every normal individual and has no clinical significance. It is rarely visible to eye and may be heightened by strong emotion such as anxiety or fear or physical exhaustion. So, strength training and jatamansi have been used to overcome such strong emotions in archers.

Arm-Hand-Steadiness and Archery Performance in relation to Strength Training

Hand-Steadiness could be improved by training and experience. Concentration of an individual while performing any motor act affects performance. Conscious concentration on the limb position and bodily attitudes heightens performance.

Out of many factors affecting the psychomotor performance kinesthetic and audio-visual feedback is also of importance. All voluntary movements are influenced by perceptual processes including duration, intensity, velocity of movement, accuracy of limb positioning and replication of desired limb position and steadiness. Apart from these, there can be many other factors affecting the psychomotor performance of an individual as human mind is a puzzle in itself.

As far as improvement with Thera-band is concerned, it can be justified by the study who concluded that as one becomes more accustomed to training an increase in training load is required so as to sufficiently overload the neuromuscular system.

Intervention of strength training and respiratory muscles exercises proves to be effective in reducing hand tremor as it can overcome the muscular exhaustion and anxiety level of an archer. A possible explanation for the above findings is in accordance with Michael Linsen who stated that accuracy of an archer is greatly dependent upon being able to hold the bow steady at full draw which required greater strength of the muscles.

Another important part of the study was a significant improvement in accuracy and performance with the combination of strength training and respiratory muscles exercises (Diaphragmatic Conditioning) as breath holding is an important component of an archer during shooting. During inspiration the shoulder girdle moves up and thereby it affects the accuracy of aiming and release. So, shoulder girdle needs to be stabilized and this can be achieved by increasing breath holding time and this can be possible by Diaphragmatic Conditioning.

Specific respiratory muscle training incorporating with rigorous experimental designs, utilizing appropriate outcome measures, has a positive influence upon exercise performance.

Effects of Jatamansi on tremor

Improvement is found in both steadiness and performance in medicine group following training group. Jatamansi is useful in mental and nervous disorders. It both cools and nourishes a hot and exhausted nervous system. The exact mechanism is unknown but it is thought to act directly on CNS like that of GABA receptors.

The ethanolic extract (50%) of N.jatamansi rhizomes had no effect on the CNS of mice. The essential oil from the rhizomes had a depressant action on the CNS of guinea pigs and rats.

Aqueous, alcoholic, volatile oil and alkaloidal fraction of N.jatamansi rhizomes and roots were studied for sedative and CVS effects. The fraction also produced a marked relaxation of plain muscles and depression of CNS and a mild degree of relaxation of skeletal muscle. An infusion of its fresh roots in the doses of 25-50 gm three times daily is recommended in spasmodic, hysterical affections, palpitation of heart, nervous headache, chorea and flatulence. The plant is used by tribal (sandals) in madness, epilepsy, unconsciousness after child birth, convulsion, small pox, ulcers, cholera, dry cough and bronchitis. The alcoholic extract of N. jatamansi inhibited the constrictor response induced by histamine, serotonin and acetylcholine in isolated smooth muscles. The root powder (60gm) of N.jatamansi showed a sedative action in a clinical study on 24 medical students as evidenced by the prolongation of the visual reaction time. As jatamansi has relaxing effect on CNS, so it can help an archer to perform better under game situation by suppressing the Pre Competition Anxiety, thus enabling the archer to perform better.

Following training and medicine groups, improvement was also seen in control group who followed their routine exercise schedule.

In conclusion, to our best knowledge this is the only study of its kind which evaluated and compared “The Effects of Strength Training and Jatamansi on reducing hand tremor amongst archers” and our results revealed that there are significant changes noted in the steadiness of arm in 4mm hole and performance in 10 & 20 yards distances with the application of both strength training with theraband and respiratory muscles training.

Acknowledgement

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