

Comparison of Internal and External Attentional Focussing Strategy on Power Gain with Plyometric on Upper Limb

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Abstract

Introduction: Attention is a process of selection and selective processing. Attentional focus is either directed internally or externally. The emphasis of verbal instructions can have a significant impact on an individual's attentional focus and the quality of their movements. Instructions that influence an individual's attentional focus can have a significant influence on both the accuracy and efficiency of their movements. A sample consisting total of 30 individuals was selected for the study using randomized sampling. It consisted of all the male participants. Chosen subjects were randomly allocated to the three groups, each having 10 subjects where group A (CG) and group B (PIAFG) performed plyometrics with internal attentional focussing strategy and Group C (PEAFG) external attentional focusing strategy. The data was analysed with SPSS software. **Conclusion:** After providing 6 weeks of plyometrics training to the recreational collegiate athletes, results showed maximum improvement of power in group 2 i.e. the group performing the plyometric training utilizing the internal attentional focus instructions, followed by group 3 i.e. the group performing the plyometric training with external attentional focus instructions and minimum improvement was seen in group 1 i.e. the group performing the plyometric training with no instructions. The internal focusing strategy, may will be beneficial in specific circumstances. It is there by possible that using internally focused instructions to increase muscular activity may aid muscular resistance training and the rehabilitation of injured muscles through increased stimulation.

Keywords: Plyometrics internal attentional focusing (PIAFG); Plyometrics external attentional focusing strategy (PEAFG); Plyometrics.

Introduction

Attention is a process of selection and selective processing, required because the brain has a limited information processing capacity [1] and the attentional focus is defined as the influence of instructions to consciously attend to specific information during the production of action. [2]

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Attentional focus is either directed internally or externally. Recent research has demonstrated that the emphasis of verbal instructions can have a significant impact on an individual's attentional focus and the quality of their movements. Instructions that influence an individual's attentional focus can have a significant influence on both the accuracy and efficiency of their movements. [4]

Instructions emphasizing an external focus have been shown to be more beneficial than internally focused instructions in guiding performance and learning a variety of sporting tasks and skills, such as standing balance [5], golf [2,6], basketball, soccer kicks [7,8] and dart throwing. [9] There are two modes of attentional focusing strategies; intrinsic and extrinsic. Operationalised along the dimension of direction an internal focus is induced when a performer's attention is directed towards the actual bodily movements being produced during a movement and an external focus of

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attention has been defined as when a performer's attention is directed towards an outcome of, or the effects of, the movement being produced (e.g., a goal, target, intended effect).[10] In the past few years, the effectiveness of instructions in the motor skill learning has been found to depend largely on the focus of attention they induce.[10] A lot of work has been conducted spanning over a year on the beneficial effects of extrinsic focusing strategy in if executing a new unlearnt motor skill and EMG has recently been recognized as an effective tool in the assessment of the focusing strategies and their benefits. It has been seen through the EMG analysis that an external focus of attention is adopted then the motor control system responds by recruiting less number of motor units per movement performed and if an internal focus is adopted then more motor units are recruited per movement performed.[11] I focus on postural and suprapostural task performance.

An increase in force could be accomplished with an increase in motor unit recruitment or firing rate of the motor units in the agonists and a decrease in the motor unit recruitment or firing rate of the motor units in the antagonists.

Scientist also found an increase in the EMG activity of biceps muscle while performing biceps curls when an intrinsic attentional focusing strategy is utilized.[4,11]

Although an external focus of attention has been shown to have beneficial implications for specific sporting performance. However, applications such as strength training and physical So in the present study, intrinsic and extrinsic attentional focusing strategies have been incorporated into a progressive plyometric training program and would wish to see whether intrinsic or extrinsic strategy proves to be more fruitful in bringing about more power gains in upper limb. Power is an essential component for successful performance in many sports. Power represents the amount of work a muscle can produce per unit of time. An increase in power gives the athlete the possibility of improved

performance in sports in which the improvement of the speed-strength relationship is sought. Power is an essential component for successful performance in throwing and overhead activities

Plyometrics consists of exercises commonly used to enhance explosive power via the stretch-shortening cycle (SSC). This is accomplished by optimizing the SSC refers to eccentric muscle action, whereas the shortening refers to the concentric muscle action.[12] The implementation of SSC programme begins initially with the development of an adequate strength and physical condition base. The development of a greater strength base results in greater force generation as a result of both the increased cross-sectional area of the muscle and the resultant elastic component. Plyometric training for the lower body nearly always the form of various jumping movements, such as hopping, bounding and drop jumps, while upper body plyometrics often uses medicine ball throwing movements. Both of these types of movements have been well documented.

Methodology

A sample consisting total of 30 individuals was selected for the study using randomized sampling. It consisted of all the male participants. Subjects were recruited on the basis of voluntary participation through informed consent. Subjects were recruited from Faculty of Allied Health Sciences, Jamia Hamdard University and Students pursuing D Pharmacy, Jamia Hamdard University. In group A with no instruction (CG) 10 physically active male (age=24.30±0.82 yrs, weight = 66.7±5.65 kg, height = 1.74±4.02 m), in Group B, internal attentional focusing (IAFG) 10 physically active male (age = 24.10±0.87 yrs, weight = 67.20±6.17 kg, height = 1.76±3.65 m) and in Group C that is external attentional focusing group (EAFG) 10 physically active male (age = 24.30±1.05 yrs, weight = 68.70±8.38 kg, height = 1.75±5.97 m) were recruited according to inclusion and

Figure 1: Pre -post PGIAF for group 3

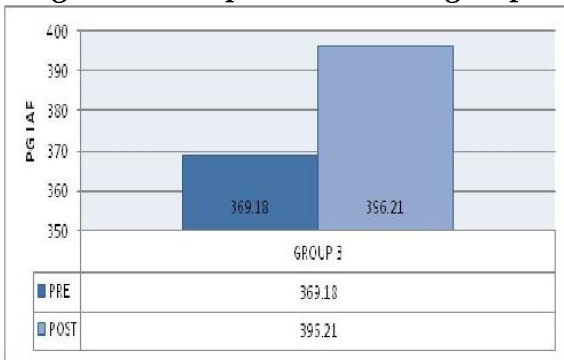
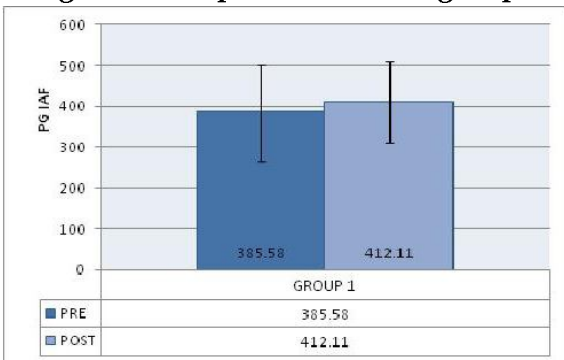


Figure 2: Pre-post PGIAF for group 1



exclusion criteria. A informed consent was obtained from those volunteers.

Inclusion criteria

Healthy young male, age group 18-25, normal BMI value.

Exclusion criteria

Any upper extremity injury in the past 6 months, any cardiac or metabolic condition, Subjects involved in any form of physical

Figure 3: Pre-post PGIAF for group 2

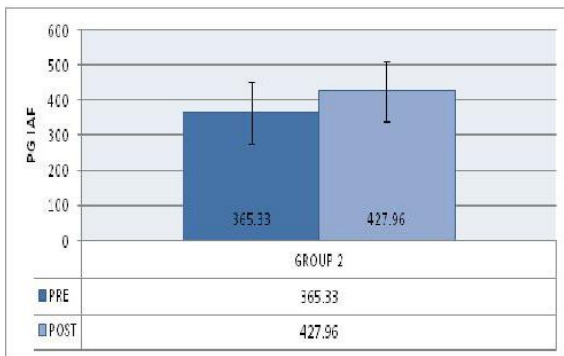


Figure 4: Difference in power between group 1 and 3

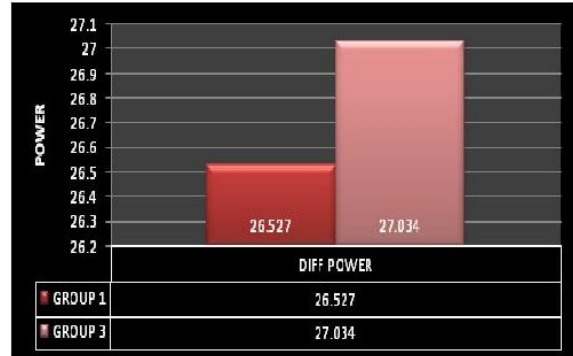
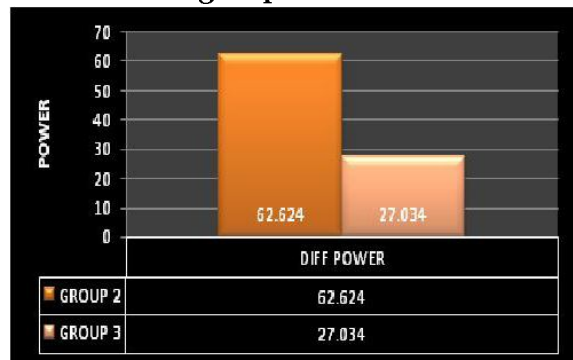


Figure 5: Difference in power between group 2 and 3



exercises for upper extremity for atleast 3 months and any neurological or cognitive disorder.

Samples were assigned to control group internal attentional focusing and external attentional focusing strategy randomly based on lottery method.

Chosen subjects were randomly allocated to the three groups, each having 10 subjects where group A (CG) and group B (PIAFG)

Figure 6: Difference in power between group 1 and 2



performed plyometrics with internal attentional focussing strategy Group C (PEAFG).

Each subject in group A and group B underwent plyometric training according to their group for 6 weeks for 3 days per week with 2 days rest between the sessions.

Pre test measurement included measuring weight, height, computing BMI values from respective weight height data and all the dependent variables.

$$\text{BMI} = \text{Body Mass (kg)} \div \text{Stature (m}^2\text{)}$$

Measurement of upper limb power

Medicine ball put test

Result

A total of 30 subjects participated in the A total of 30 subjects participated in the study out of which 10 participated in (group 1) i.e no focus group with only plyometrics training (conventional training group), another 10 subjects participated in (group 2) i.e. plyometrics with internal attentional focusing strategy i.e experimental group (IAFG). Then (group 3) involved another 10 subjects with external attentional focusing strategy their demographic data was analysed by comparing means of descriptives. They have their mean age to be 24±0.66 years, 24.30±0.67

Table 1: Comparison between group 1 and 3 i.e. difference in power gains

	Group 1 Mean ± SD	Group 3 Mean ± SD	'p' value
Pre-Post difference power-	26.527±7.737	27.0340±31.171	0.999

Significance level ≤ 0.05

Table 2: Comparison between group 1 and 2 i.e. difference in power gains

	Group 1 Mean ± SD	Group 2 Mean ± SD	'p' value
Pre-Post difference power	26.5270±7.7372	62.624± 43.094	0.038

Significance level ≤ 0.05

Table 3: Comparison between group 2 and 3 i.e. difference in power gains

	Group 2 Mean ± SD	Group 3 Mean ± SD	'p' value
Pre-Post difference power gain	62.624 ± 43.094	27.034 ± 31.171	0.042

Significance level ≤ 0.05

years and 24.30±.67 years. They have their mean height 1.75±6.00 m, 1.75±3.88 m and 1.76±2.41 m. Their mean weight was 68.10±8.79 kg, 66.40±5.71 kg and 68.10±5.98 kg, 68.70 ± 8.38 kg respectively. The p value for each age, height and weight was found out to be Age (p value=0.523, Height (p value=0.728) Weight p value=0.822. Each of this indicates there is insignificant difference between these Groups. The p value for each age, height and weight was found out to be Age (p value=0.523) within group results.

The comparison for within group significance was done using Paired sample 't' test for group 1, group 2 and group 3 respectively. Pre- post measurements were compared for each outcome measure of power of subject

In within group analysis, on comparing pre and post power, power was improved significantly in all the three groups with (p value = 0.000, p=0.001 and 0-023 respectively.

When all the three groups were compared using ANOVA, it was found that there was statistically significant difference ('p' value =0.021) in power gain values. The mean improvement was highest in the internal attentional focusing group (427.96±86.48) followed by external focus i.e training group (3). The p value and F value were found to be significant ('p' value =0.021, F value =4.448).

After doing ANOVA, post hoc analysis was done to do comparisons between different groups. When multiple comparisons done for difference in power gains in different groups.

Group 1 is compared to group 2 .group 1 is compared with group 3, and group 2 is compared with group 3.

When (group 1) was compared with (group 3), it was found by post hoc analysis, that there

was statistically insignificant difference ('p' =0.999)

However, mean improvement in group 1 (26.527 ± 7.737) was less than mean improvement of group 3 (027.0340 ± 31.171). Thus plyometric training with external attentional focusing strategy improved upper limb power gain more than the plyometrics training with no focus group. The p value ('p' value = 0.999) was found to be insignificant ('p' value =0 .001).

When (Group 1) was compared with (group 2), there was statistically significant difference ('p' =0.038) in power gain values. The p value was found to be significant.

When (Group 2) was compared with (group 3), it was found by post hoc analysis that there was statistically significant difference.

In the analysis, that there was no statistical significant difference ('p' =0 .489) in agility performance values. However, mean improvement in group 2(0.475 ± 0.362 sec) was more than mean improvement of group 1(0.312 ± 0.357 sec). The p value was not significant ('p' value =0 .489).

Discussion

After providing 6 weeks of plyometrics training to the recreational collegiate athletes ,results showed maximum improvement of power in group 2 i.e. the group performing the plyometric training utilizing the internal attentional focus instructions, followed by group 3 i.e. the group performing the plyometric training with external attentional focus instructions and minimum improvement was seen in group 1 i.e. the group performing the plyometric training with no instructions.

When the group 1 (no attentional focus) was compared to group 3 (external attentional focus) it was seen that though group 3 performed better than group 1, but the results were not statistically significant here are many possible reasons why there were more strength gains with internal attentional focus when compared with external attentional focus or

no attentional focus.

Instructions which increase muscular activity (internal focus) might have practical relevance in rehabilitation and strength training settings. Weight training or rehabilitative exercises often isolate the contribution of a single muscle group, for example to promote muscle growth or strength gains.As such, the increased muscular activity observed in the internal focus conditions, may will be beneficial in such specific circumstances if increased muscular activity is the aim ,it is possible there by using internally focused instructions to increase muscular activity may aid muscular resistance training and the rehabilitation of injured muscles through increased stimulation.

Emanuel *et al* conducted a study in which adults and children were made to perform a dart throwing task they found that though the adults performed better with the internal external focus instructions. They reasoned out that children may use body movement guidance (instructions on internal focus of attention) to improve their motor learning,unlike adults for whom these instructions seem to compromise automatic motor control.[9]

Recently, EMG activity of the target muscles has been utilized as an objective measure to judge the performance under various attentional foci. It has been seen that there is an increased EMG activity when an internal focus of attention is adopted and a decrease in EMG activity when an external focus of attention is adopted.[13,4,11] This increase in EMG activity seen with the internal focus can lead to attentional strength/power gains in that group because physiologically it has been seen that only those motor units that are recruited in the exercise are subject to adaptations with weight training. Adaptations with resistance training enable greater force generation so if more motor units are recruited per contraction in the internal focus conditions then more motor units will adapt with weight training as compared to other groups and would thus produce greater force with internal attentional focus strategy. Attentional

styles have also been classified into association and dissociation. Association is a cognitive strategy in which the individual attends to the bodies internal related cues such as muscle tension and breathing. This strategy allows individuals to alter their movement pattern according to body awareness racing strategies and muscular tension. The athlete with an aim of performance improvement as the primary goal may be best served by an associative strategy. Dissociation, on the other hand is a cognitive strategy in which the performer focuses on external cues, day freaming, admiring the views, and problem/task solving ther by restricting influence of sensory information from the body.[14]

During conditions of low effort, attention can be easily and voluntarily shifted from internal to external, and from wide to narrow widths.

However, when effort level become high or maximal attention cannot be voluntarily shifted or controlled but is forced to remain internal and narrow. Due to those constraints, dissociative strategies no longer become effective during exercise of high intensity and long duration.[14,15]

Findings of Scott *et al*[16] study confirmed that an associative strategy is allied with superior endurance performance. Their results also suggested that novice athletes can benefit from an associate coping strategy and should be encouraged to adopt associative strategy. They also stated that associative can effectively assist the novice athletes's skill acquisition.

The present study incorporated a high resistance training type of task. so according to the ab The above discussion explains why internal focus is performing better than external focus in achieving power gain, but what wud be the reason for external focus group although not statistically significant but still performing slight better than the control group. in some previous study external focus has performed quite well in enhancing performance in context of skill this could be the reason for external performing better than control although insignificant difference is present.

Wulf su's[17] research stated that external focus improved the performance of novice and skilled players in skillfully hitting the target, more efficiently and accurately i.e external focus improving movement efficiency more than more muscular output.

Through mounting evidence it can be assumed that during an intense task such as plyometrics training in the present study association would be utilized to provide better results and association is nothing but focusing all the attention internally (in this study focusing all the attention on the arms movement). Also novices perform better under associative (or internal) conditions because in this they can concentrate on their basic body movement and muscle contractions which may help in greater force and simultaneously power production.

This may be another explanation which supports the results of the present study i.e. the group with internal attentional focus performing better than the othr group.

This could also be the reason for external focus showing more power than control that all participants were utilizing the dissociative strategy (external focus)[14,15] which is less effective in high intensity tasks hence external could not perform better but slightly better than control as control group had no instructions to follow hence attention might have moved from internal to external at times Hence external and controlled showed better results but not better than internal attentional focus.

Results for power gain in within group subjects demonstrated a significant improvement because plyometric training drills are believed to develop explosiveness and ability to use strength as quickly as possible.

The results from enhancing motor unit recruitment and improving muscles ability to store kinetic energy within the elastic components of the muscle this enhances power of the muscle groups involved in plyometrics (physiological considerations of strength and power training drills).

Physiotherapists, sports trainers, coaches,

and others in situations where verbal instructions guide movements for power training should be aware of the impact that differently emphasized instructions can have on power gains clearly based on current evidence, it can be concluded that for healthy subjects and athletes internal focus attentional instructions can help in achieving better power gains for upper limb. As per previously known facts, the improvement in power can perform better in sports like volley ball basketball etc. and reduces the risk of injuries during sports participation. Therefore, the young population can get immense benefit from this attention with plyometrics protocol

Limitations

There were some limitations like the generalization of the result on subjects with any pathology is not possible as it was conducted on normal subjects lack of adequate financial support and non-availability of isokinetic machine to measure power as power was measured using only medicine ball test, sample size was small.

The subjects to this study were all male so gender comparisons was possible to determine if the results were same or different in males and females.

Future scope

Future studies can take the use of proper laboratory set up and instruments like isokinetic machines. Future research can be warranted to determine the effect of plyometrics and attentional focusing on age groups other than the young adults used in the present study, to determine if similar results are obtained for middle aged and elderly adults. Gender specific studies should be designed to evaluate difference in patterns between men and women. Further studies should be done to find the effect of attentional focusing on other activities to make this training beneficial for athletes.

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