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ORIGINAL ARTICLE

EFFECTS OF PLYOMETRIC TRAINING AND CONVENTIONAL TRAINING ON AGILITY PERFORMANCE IN TENNIS PLAYERS

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ABSTRACT

Introduction: Recreational collegiate and professional level tennis players are at risk of musculo skeletal injuries. Plyometric training enhances balance and body control during movement, which promotes improvement in agility. Aim of this study is to find out the effectiveness of plyometric training on improving agility in tennis player. **Methodology:** This study conducted at Madha medical college and hospital, Chennai. Total 30 subjects were selected from population of tennis players by convenience sampling procedure. The samples were divided into two groups with plyometric training cum conventional training and conventional training program alone. The subjects include both genders with age group of 18 to 22 years based on the selection criteria. The training program consists 6 weeks of plyometric training and conventional training. Illinois agility test score and Tennis specific agility test score were used to evaluate the outcome measures. **Result:** Dependent t test was used to analyze the difference in effect within the group. Pre and post test scores for plyometric training with conventional training and conventional training alone found significance difference in improvement in agility with $p < 0.0001$. The mean difference value of plyometric training with conventional training program is 2.5, which is more than the mean difference value of conventional training program 1.58. **Conclusion:** The study concluded that plyometric training and conventional training are effective to improve agility, yet plyometric training is more effective to improve agility among tennis players.

Keywords: Tennis players, plyometric training, agility, Illinois agility test and Tennis specific agility test.

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INTRODUCTION

Physical demands of tennis cause musculoskeletal adaptation that are sometimes positive (increased strength) and sometime negative (decreased joint ROM and reduced muscular flexibility). These repeated demands to produce force by muscle shortening can cause a cycle of microtrauma to tight muscle, followed scar formation, followed by more micro trauma with continued use. Adaptations can become maladaptations, reducing joint ROM, changing bio mechanical patterns, and decreasing the efficiency of force production, thus increasing the chance of injury to the muscles^{1,2}.

Injury incidence and prevalence rates for tennis elbow were quite high with reported rates for tennis elbow were quite high, with reported incidence varying from 9%to 35% and prevalence varying from 14%to41%.Injury sustained while playing indoors intend to be more severe than outdoor injuries with a higher percentage requiring medical treatment. Injury risk in tennis has been shown to gradually increase with age from 0.01 injuries per player per year in the 6-12 years age group to 0.05 injuries per player per year in those over 75 years of age³.

Tennis is a sport based on unpredictability. The unpredictability of point length short selection, strategy, match duration, weather, and the opponent all influence the complex physiological aspects of tennis play. Physical demands of tennis cause maladaptation that decrease the efficiency of sports performance leads to increasing chance of injury.

Aim of the study: The main objective of the study was to compare the effectiveness of plyometric training over conventional training

on improving agility in tennis player. Secondary objectives of the study were to find out the effectiveness of plyometric training and conventional training program on improving agility performance on tennis players^{4,5,6}.

Null hypothesis: There is no significant difference on improving agility performance on tennis player following the administration of plyometric training and conventional training program.

METHODOLOGY

This was a study with experimental study design did setting at Madha medical college and hospital, Chennai. The data collected from Madha engineering college, Sport medicine center (ffamy) fitness foundation academy and from Madha medical college and hospital, Chennai. Samples included from the Subjects have participated in regular tennis training, both gender with age group of 18 to 22 years, subjects with free of injuries on hand and lower extremity and who have not involved plyometric training or previously.

Subjects with acute impairment of spine or lower extremity, history of surgery in either upper, lower extremity, history of neurological disorder affect upper and lower extremity, vestibular or balance disorder and with BMI above 25 and below 20 were excluded from this study. Total 30 subjects were selected from population convenience sampling procedures. The samples divided in to two equal group (15 subjects in each group) by convenient sampling method. Group 1 allocated with plyometric training and Group 2 with conventional training program. Measurement tools used were Illinois agility test score and Tennis specific agility test score to measure the outcome. Material used

were stop watch, markers, tennis courts, measure tape and cones to conduct this study.

Procedure: Before giving training of the independent variables for each group on assessment was taken and Illinois agility test, tennis specific agility test were performed and scores of the same was considered as pre test scores^{7,8,9}.

Group 1: Plyometric training – The training program consists 6 week of plyometric training involves that included side to side ankle hops, standing jump and reach, front cone hops, standing long jump, lateral jump over barrier, double leg hops, lateral cone hops, diagonal cone hops, standing long jump with lateral sprint, lateral jump single leg cone hops with 180 degree than, single leg bounding, hexagon drill, cone hops with change of direction sprints.

Plyometric training involves 1 session per week. Training intensity, training volumes, sets, repetitions were increased progressively and subjects were informed to work to maximal efforts during the all training session. After each of plyometric session subjects were informed to not to expose any plyometric or strength training other than conventional training program.

Conventional training program – In this program the subject were informed to perform the basic skills in tennis that includes footwork, sidestep, cross step, forward, backward, service, forehand long service, back hand short service, forehand lob, forehand drop, clear/lift, drive, net, cross lob, cross drop, forehand smash. Subjects were also provide with 30 min match play during every session. At the end of training session of plyometric training and

conventional training program the Illinois agility test, tennis specific agility test were performed and the score was considered.

Group 2: Conventional training program – In this program the subject were informed to perform the basic skills in tennis that includes footwork, sidestep, cross step, forward, backward, service, forehand long service, back hand short service, forehand lob, forehand drop, clear/lift, drive, net, cross lob, cross drop, forehand smash. Subjects were also providing with 30 min match play during every session. At the end of training session of plyometric training and conventional training program the Illinois agility test, tennis specific agility test were performed and the score was considered.

RESULT

Data Analysis for experiment group: The statistical outcomes of descriptive measures on Illinois agility test score and tennis specific agility test score pre and post the plyometric training and conventional training program are glanced at table 1.

The observed mean 23.670 with standard deviation of 1.032 of Illinois agility test of pretest is decreased the performance time to the mean 20.522 with standard deviation of 1.646 of Illinois agility test in posttest. The observed mean of 34.741 with standard deviation of 1.084 of tennis specific agility test pretest is decreased performance time to the mean 32.242 with standard deviation of .934 of tennis specific agility test posttest.

Data Analysis for control group: The statistical outcomes of descriptive measures on Illinois agility test score and tennis specific agility test score of pre and post of conventional training program are glanced at table 2.

VARIABLES	PRE TEST				POST TEST			
	MEAN	S.D	RANGE	SEM	MEAN	S.D	RANGE	SEM
AGILITY PERFORMANCE TIME(SEC) (ILLINOIS AGILITY TEST SCORE)(SECS)	23.670	1.032	19.09-25.22	0.266	20.523	1.646	17.90-23.00	0.425
AGILITY PERFORMANCE TIME(SEC) (TENNIS SPECIFIC AGILITY TEST SCORE)(SECS)	34.741	1.084	33.19-36.50	0.279	32.242	.934	30.85-33.55	0.211

Table: 1 Mean, Standard Deviation, Range For Group1

VARIABLES	PRE TEST				POST TEST			
	MEAN	S.D	RANGE	SEM	MEAN	S.D	RANGE	SEM
Agility Performance Time(Sec) (Illinois Agility Test Score)	24.775	1.878	22.11-26.92	0.485	23.195	1.405	21.41-26.09	0.363
Agility performance time(sec) (tennis specific agility Test Score)	34.328	0.895	33.25-36.10	0.231	32.977	0.738	31.95-34.15	0.191

Table: 2 Mean, Standard Deviation, Range For Group2

VARIABLES	PAIRED DIFFERENCE					DIFF	T	Sig.
	95% CONFIDENCE INTERVAL OF DIFFERENCE							
	MEAN	S.D	SEM	LOWER	UPPER			
Agility performance time (illinois agility test score)	3.147	1.175	0.303	2.496	3.798	14	10.372	.000
Agility performance time (tennis specific agility test score)	2.499	0.183	0.047	2.397	2.600	14	52.863	.000

Table: 3 Paired "T" Test Analysis For Group 1(Experimnetal Group)

Table 2 shows the observed mean 24.775 with standard deviation of 1.838 of Illinois agility test of pretest is decreased the performance time to the mean 23.195 with standard deviation of 1.405 of Illinois agility test in posttest after conventional training program^{10,11}.

The observed mean of 34.328 with standard deviation of 0.895 of tennis specific agility test pretest is decreased performance time to the mean 32.976 with standard deviation of 0.738 of tennis specific agility test posttest.

Table 3, shows the statistical outcome of paired "T" test analysis on Illinois tennis test and tennis specific agility test with plyometric

training and with conventional training program¹².

The experimental group of the mean of Illinois agility test is decreased performance time with paired difference of 3.147 with standard deviation of 1.175 and standard error mean is 0.303. The change in 95% of confidential interval is 3.798-2.496.

The experimental group of the mean of tennis agility test was decreased the performance time with paired difference of 2.498 with standard deviation of 0.183 and standard error mean is 0.047. The change with standard deviation interval is 2.60 -2.397.

VARIABLES	PAIRED DIFFERENCE					DIFF	T VALUE	SIG
	95% CONFIDENCE INTERVAL OF DIFFERENCE							
	MEAN	S.D	SEM	LOWER	UPPER			
Agility performance time (illinois agility test score)	1.580	0.742	0.192	1.169	1.99	14	8.248	.000
Agility performance time (tennis specific agility test score)	1.351	0.224	0.058	1.227	1.475	14	23.373	.000

Table: 4 Paired "T" Test Analysis For Group 2 (Control Group)

GROUPS	MEAN	SD	SEM	MEAN DIFF	95% OF CI DIFFERENCE	T VALUE	SIG
GROUP 1	20.523	1.646	0.425	2.672	3.817	4.782	0.581
GROUP 2	23.195	1.405	0.363		1.527		

Table: 5 Comparision of post test scores of illinois agility test scores

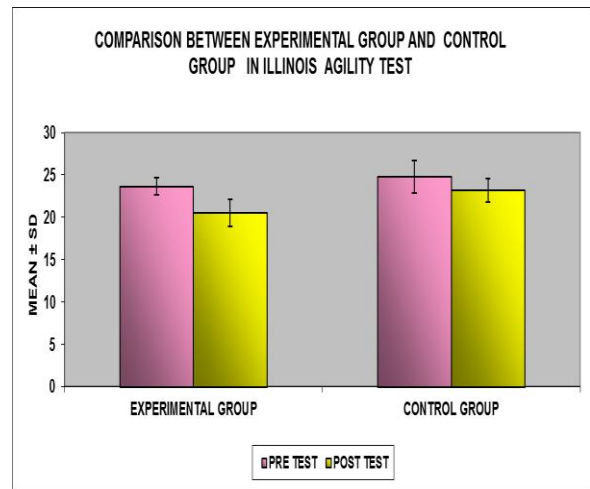
Above Table 4 shows the statistical outcome of paired “T” test analysis on illinois tennis test and tennis specific agility test with pre and post of conventional training program.

The control group of the mean of Illinois agility test is decreased performance time with paired difference of 1.580 with standard deviation of 0.742 and standard error mean is 0.192. The change in 95% of confidential interval is 1.990-1.169.

The control group of the mean of tennis agility test was decreased the performance time with paired difference of 1.35133with standard deviation of .22392and standard error mean is 0.056. The change with standard deviation interval is 1.475-1.227.

The statistical outcome of post test score of comparison of illinois agility test for group 1 and group 2 glanced in Table 5.

The illinois agility test with conventional training program of experiment group has the mean of 20.523 and conventional training program of control group has the mean illinois agility test of is 23.195 with mean difference of 2.672. The 95% diff is -3.817 – 1.527 with t value of -4.782.



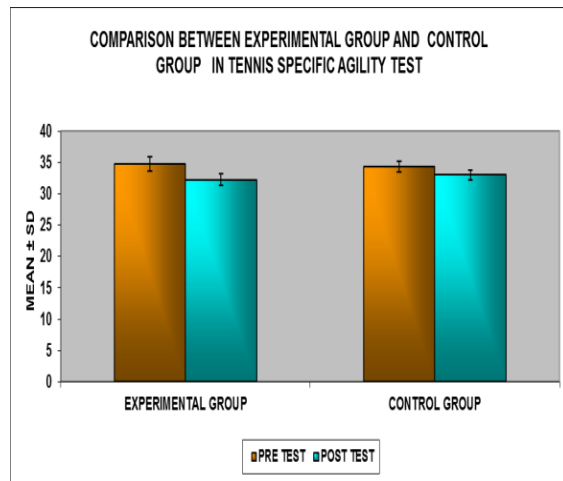
Graph: 1 Comparision of post test scores of tennis illinois agility test scores

The statistical outcome of post test score of comparison of tennis specific agility test for group 1 and group 2 glanced in Table 6.

The tennis specific agility test with conventional training program of experiment group has the mean of 32.2420 and conventional training program of control group has the mean illinois agility test of is 32.9767with mean difference of 0.735. The 95% diff is 0.105 – 1.364 with t value of -2.39.

GROUPS	MEAN	SD	SEM	MEAN DIFF	95% OF CI DIFFERENCE	T VALUE	SIG
Group 1	32.242	0.9343	0.241	0.735	1.364 To 0.105	-2.390	0.229
Group 2	32.977	0.738	0.191				

Table: 6 Comparision of post test scores of tennis specific agility test scores



Graph: 2 Comparison of post test scores of tennis specific agility test scores

The study was done of 30 subjects who consist of 15 subjects in each group with the duration of 6 weeks. The results shows Mean value of independent variable before the pretest and post test score for plyometric training with conventional training program shows significance difference in improvement.

Mean value of independent variable before the pretest and post test score with conventional training program shows less significance difference in improvement. Paired “t” test value of pretest and post test scores significance in experiment group. Paired “t” test at pretest and post test score shows less significant in control group. In paired “t” test of experimental group shows highly significant difference improving agility performance on tennis players. Mean difference of experimental group shows significant difference in improving agility performance on tennis player.

Mean difference of control group shows less significant difference improving agility performance while comparing to experimental group.

DISCUSSIONS

30 subjects were taken to compare the effectiveness of plyometric training with conventional training program alone. In this study statistical analysis shows plyometric training with conventional training program was effectiveness in improving the agility performance in conventional training program alone.

The result of the study in conventional training program was more effective than conventional training program alone, because it is thought to be reinforcement of motor programming through neuro muscular condition and neurological adaptation of muscle spindle and golgi tendon organ and joint proprioception that helps to enhanced the balance and body control during movement, promotes improvement in agility.

Statistical mean value of plyometric training with conventional training program of pretest and post test score of Illinois agility test, Tennis specific agility test scores were 23.670/20.522, 34.740/32.242.

The post test score shows more significant in improving agility performance than the pretest score in tennis player. Statistical mean value of conventional training program of pretest and post test score of Illinois agility test, Tennis specific agility test scores were 24.774/23.195, 34.328/32.977. The post test score shows less significant in improving agility than the pretest score is in tennis players.

The above mentioned statistical analysis also supports the statement of this study. Plyometric training enhances balance, control muscular movement, promote improvement in agility (miller 2001).

Limitation of study: The study was limited to specific population sample size. Sample size was a small to derived accurate conclusion. The duration was only 6 week and have long term in agility performance with this program is not obvious with this study.

CONCLUSION

From this result of study it was concluded the plyometric training with conventional training program is more effective in improving agility performance in tennis player.

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