

A Qualitative Comparison between Closed and Open Kinetic Chain Exercises on Development of Soccer Kicking Ability

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Abstract: The purpose of the study was to investigate the effect of closed chain and open chain kinetic exercise on development of Soccer kicking ability and to determine which mode resulted in the greatest performance enhancement. The case study incorporated randomly a total of thirty college level soccer players, each aged between 19 to 24 years. The total thirty students were randomly divided into equal three groups. Among these groups two different groups were gone through closed chain kinetic and open chain kinetic exercises respectively and one group kept as control group. Progressive weight training thrice a week for 14 weeks scheduled. Necessary data was collected by administering kicking distance performance prior to training and at the completion of the training period. Statistical technique Analysis of covariance test was applied to compare the efficacy between close chain and open chain kinetic exercise at 0.05 level of significance, while significant changes were seen in the open kinetic chain group and close chain kinetic group. The closed kinetic chain group improved 56.40 meters (27.6%) which was significantly more than the 52.28 meters(25%) seen in the open kinetic chain group. The result reveals close chain kinetic exercise mode of training resulted in the greatest performance enhancement in terms of soccer kicking.

Keywords: Close chain kinetic exercise, open chain kinetic exercise, soccer kicking, Squats, Lunges, leg extension, leg curl.

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I. Introduction

Soccer (Football) is the most popular participant sport in the world and has been since soon after the codification of its rules in Great Britain in 1863. In the United States, the first intercollegiate Soccer game, played between Princeton and Rutgers in 1869, was actually played by association or “soccer” rules. The World Cup of Soccer, directed by Federation International de Soccer Association (FIFA), the international governing body of soccer, was held in the United States in 1994.

In sports such as soccer, in which numerous bursts of explosive activity are required, explosive strength determines high-level performance. Moreover, players need an important specific strength on soccer tasks. Subsequently, one of the most important aims of training programs should be to improve soccer-specific strength, which can be defined as the ability of a player to use muscle strength and power effectively and consistently in soccer-specific tasks during the soccer game. The ability to kick with both feet is regarded as a desirable skill in high level soccer players; however, most players display a dominance of kicking ability on one side. Several authors have emphasized that kicking is one of the most important skills in soccer. Its effectiveness depends on various factors, such as maximal strength of the muscles involved, rate of force development, neuromuscular coordination, linear and angular velocities of ankle in the kicking leg, and the level of coordination between agonist and antagonists. Although some authors identified a relationship between the strength of the lower limbs and ball speed in both male and female players, there is a lack of information concerning the effects of a strength training program on the characteristics of a task such as kicking. Although some studies reported an increase in performance after the application of training programs involving explosive strength, maximal strength, isokinetic strength, or mixed technical and strength training, others found the opposite.

The term “chain” refers to the kinetic chain of the body, which simply means that all our bones and muscles are connected in a “chain” and therefore the movements we make are also part of a that kinetic chain. Our hand or foot is free to move during an open chain exercise. These types of movements tend to isolate a single muscle group and a single joint. During closed chain exercises our hands or feet are in a constant, fixed position. In closed chain exercises multiple joints and multiple muscle groups are involved at the same time. The ultimate goal of exercise and sports biomechanics is performance enhancement and minimizes the chances of

unwanted injuries. Few studies stated that in terms of injury prevention during open chain exercises for the hamstrings produce a posterior shearing force and stress at PCL and quadriceps produces an anterior shearing force and stress at ACL, which increased ACL stress near full extension and PCL stress near 90 degrees knee flexion. The purpose of the study was to investigate the effect of close chain and open chain kinetic exercise on development of Soccer kicking ability and to determine which mode resulted in the greatest performance enhancement.

II. Methodology

Research Approach: Experimental research design was adopted for the fulfillment of research approach for the study.

Sampling Technique: Random Sampling technique was used for the study

Selection of the Subjects: 30 male Soccer players from National Institute of Technology Patnawere selected as subjects for this present study, each aged between 19-24 years.

Independent Variables:

Closed Kinetic Chain Exercises: Selected Closed Kinetic Chain Exercises were half squats and lunges for the study.

Open Kinetic Chain Exercises: Selected Open Kinetic Chain Exercises were sited leg raise and leg curl (Hamstring curl) for the study

Dependent Variable: Kicking distance was considered as dependent variable for the study

Experimental Design: Thirty male (30) Soccer players playing in National Institute of Technology Patna, Biharwere selected randomly as subject for this study. Their fitness was considered according to Institute medical report and their age was verified by the institute register. The subjects were be divided into three (3) groups viz. (a) Close Kinetic Chain Exercise group, (b) Open Kinetic Chain Exercise group (c) Control Group. Each group consisted of twenty five (25) subjects. All groups were administered initial tests on kicking distance by three trials among the best one was counted. After the initial tests, the training programme was administered to the two experimental groups whereas no training was provided to the control group. After 7 weeks of training program again the same test administered and compares the test result with initial one.

The whole training program based on a 7 weeks macro cycle

Week 1	Flat Pyramid
Week 2	Flat Pyramid
Week 3	Ascending Pyramid
Week 4	Ascending Pyramid
Week 5	Ascending Pyramid
Week 6	Double Pyramid
Week 7	Double Pyramid

Statistical Technique: Analysis of co-variance (ANCOVA) was applied to find out the difference among the selected training programme. For testing the hypothesis the level of significance was set at 0.05.

III. Discussions of Findings

The data was analyzed and compared with the help of statistical procedure ANCOVA and finding reflected in the form of following tables.

Table 1: Mean and SD of different groups measured in post testing

Different treatment groups	Mean	Std. Deviation	N
Close chain kinetic exercise group	53.4420	8.27204	10
Open chain kinetic exercise group	52.5630	6.10271	10
Control group	52.2420	5.96220	10
Total	52.7490	6.64020	30

Descriptive statistics of the data measured in the post testing shown in table 1, the mean and standard deviation of the different treatment group during post testing which going to be used in writing the final results of this study.

Table 2: Adjusted mean and standard error of different groups in post testing

Different treatment groups	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Close chain kinetic exercise group	56.406a	.804	54.754	58.058
Open chain kinetic exercise group	52.281a	.774	50.690	53.872
Control group	49.560a	.798	47.919	51.201

Descriptive statistics of the data measured in the post testing after adjustment with the initial difference. The mean and standard deviation showed in table 2 which going to be used for writing the final result using SPSS outputs.

Table 3: ANCOVA table for the post test data on Soccer kicking distance

Source	Type I Sum of Squares	df	Mean Square	F	Sig.
Pre_test	915.243	1	915.243	152.862	.000
Treatment	207.762	2	103.881	17.350	.000
Error	155.672	26	5.987		
Corrected Total	1278.676	29			

ANCOVA table for the post-test data on Soccer kicking distance shown at table no 3. The main analysis of covariance table the significance value has been named as p-value is used instead of the term significant value. Post hoc comparison for the group means in post-measurement adjusted with the initial differences since the F-ratio in the above mentioned table is significant. Table 3 clearly shows the F-value for comparing the adjusted means of the treatment groups (Closed chain kinetic exercise, open chain kinetic exercise and control) during post-testing. Since p value for the F- statistics is .000 which is less than 0.05, it is significant. Thus, the null hypothesis of no difference among the adjusted post-means for the data on Soccer kicking distance in the treatment groups may be rejected at 5% level.

Since F-statistics is significant, post hoc comparison has been made for the adjusted means of the three groups which shown table 4.

Table 4: Pair-wise comparisons

Dependent variable: Post-testing score of Soccer kicking distance			
(I) Different treatment groups	(J) Different treatment groups	Mean Difference (I-J)	Sig. ^b
Close chain kinetic exercise group	Open chain kinetic exercise group	4.125*	.001
	Control group	6.846*	.000
Open chain kinetic exercise group	Close chain kinetic exercise group	-4.125*	.001
	Control group	2.722*	.021
Control group	Close chain kinetic exercise group	-6.846*	.000
	Open chain kinetic exercise group	-2.722*	.021

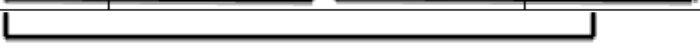
The mean difference is significant at the 0.05 level

It may be noted here that p-value for the mean difference treatment between close chain kinetic exercise, open chain kinetic exercise and control group in all aspects is 0.000 which is less than 0.05 and hence they are significant at 5% level. Thus the following conclusion can be drawn:

- (i) There is a significant difference between the adjusted means of the close chain kinetic exercise and control groups on the data of Soccer kicking distance during post testing.
- (ii) There is a significant difference between the adjusted means of the open chain kinetic exercise and control groups on the data of Soccer kicking distance during post testing.
- (iii) There is a significant difference between the adjusted means of the open chain kinetic exercise and close chain kinetic exercise groups on the data of Soccer kicking distance during post testing.

Table 5: Post hoc comparison of adjusted means of the data on Soccer kicking distance obtained in post measurement shown in graphics

Control Group	Open chain kinetic exercise group	Close chain kinetic exercise
49.56	52.28	56.40

“  ” Representation on significant difference between means

In order to find as to which treatment is the best, one can see the adjusted mean values of different treatment groups during post testing given in table 2. Clubbing these adjusted means with the three conclusions mentioned above, one may get the answer. However, this task became much easier if table 5 is created. In this table, the adjusted post-means of different group have been written in descending order. If the difference between any two group means is significant (which can be seen from table 4), nothing is done if the mean difference is not significant, a line is drawn under the two groups. Thus, it may be concluded that the Soccer kicking distance of the three different groups are not equal. Open chain kinetic exercise group have been performed better than control group and close chain kinetic exercise group have been performed better than open kinetic chain group.

Hence, it may be inferred that close chain kinetic and open chain kinetic exercise are not equally effective, close chain exercise is much more effective in enhancement the Soccer kicking distance among the subjects in comparison to that of the open chain exercise group. Open chain kinetic exercise is also effective in enhancement of the Soccer kicking distance among the subjects in comparison to that of the Control group.

IV. Conclusions

This kind of a study is helpful in terms of practical application for coaches and sport researchers. Inseason testing can provide coaches with useful information about the players workout ability and characteristics so that they could place them member in specific training for better performance as individual or as a team in a competition. The result shows a significant difference among these two training program in terms of close chain kinetic workout and open chain kinetic workout which improve proper training, reduce unnecessary workload, prevent from unwanted injury. In terms of injury prevention open chain exercises for the hamstrings produce a posterior shearing force and stress at PCL and quadriceps produces an anterior shearing force and stress at ACL, which increased ACL stress near full extension and PCL stress near 90 degrees knee flexion.[8] More specifically open kinetic chain means that the tibia is moving upon a fixed femur, such as in a leg extension or leg curl. There is no force being applied under the foot, therefore, the chain is "open". closed kinetic chain means the femur is moving upon a fixed tibia, with the ground or other support (such as a step or leg press platform) under the foot, so the chain is closed.[7] When the chain is closed, the integrity of the joint is more stable. Joint compression forces between the femur and tibia are higher, which keeps the femoral condyles seated properly in relation to the medial and lateral meniscus. The quadriceps and hamstrings are co-contracting, decreasing the shearing forces on the meniscus and articulating cartilage, and with proper technique, shearing forces to the posterior patella are minimized.[10] Researcher can conclude that close chain kinetic exercise mode of training resulted in the greatest performance in Soccer kicking and minimize the chances of unwanted injury.

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