



CAN FLEXIBILITY OF ANTAGONIST MUSCLE AFFECT THE STRENGTH ASSESSMENT OF AGONIST MUSCLE ?

¹*Darshan Parmar, ²Dr. Mansi Shingala, ³Dr. Dinesh Sorani, ⁴Drashti Jodhani

¹*Final Year Student, ²Tutor cum Physiotherapist, ³Principal, ⁴Final Year Student

Government Physiotherapy College, Jamnagar, India

Abstract: Muscle strength assessment is important aspect for physical fitness. Manual muscle testing with Digital Dynamometer is commonly used method for assessment of muscle strength. There is lack of Evidence which describes relation of antagonist flexibility and strength of agonist muscle during Evaluation procedure. So, this study was conducted with an objective of measuring Quadriceps strength with respect to length of Hamstrings muscle. Strength of Quadriceps and Hamstrings muscle was measured with Digital Dynamometer on 80 subjects, before and after giving stretching of Hamstrings. Flexibility was measured with Sit-n-Reach box. Paired t-test was applied to analyse the data. Significant difference ($P < 0.05$) was found in strength of Quadriceps muscle after stretching of Hamstrings. Stretching of Hamstrings muscle should be incorporated prior to the evaluation of strength of Quadriceps muscle.

Index Terms - Muscle Flexibility, muscle strength, Dynamometer and Sit-n-Reach box.

INTRODUCTION

Flexibility is one of the important components of the health related physical fitness^[1]. Hamstrings flexibility and Quadriceps strength is important for performing daily activities and to prevent development of muscular pain that may occur due to poor flexibility.^{[1], [2]} Flexibility may be hindered for a number of reasons, one of which is fascial restriction as well as muscle tightness. Hamstring muscle tightness is more observed in people.^[1] These restrictions of flexibility can decrease strength, endurance, motor coordination and lead to high amounts of physical pain. Tight Hamstrings will not allow the last degree knee extension which may lead to decrease force production in the strength of Quadriceps.^[3] Different positions of spine may alter the strength of Quadriceps. Close attention to substitution patterns and testing in a variety of positions minimizes the chance of erroneous results. When used reliability, digital dynamometers can provide muscle performance information that is more reliable than that of tests using the traditional criteria for grading 0-5. Standardized protocols exist for isometric measurement of Quadriceps strength, namely the seated knee extension technique.^[4]

NEED OF STUDY

Manual muscle testing with Digital Dynamometer is commonly used method for assessment of muscle strength. [3] There is lack of Evidence which describes relation of antagonist flexibility and strength of agonist muscle during Evaluation procedure. So, this study was conducted with an objective of measuring Quadriceps strength with respect to length of Hamstrings muscle.

AIM

To see the effect of Hamstring Stretching on Strength of Quadriceps Muscle.

MATERIALS AND METHODOLOGY

This comparative study was conducted on 80 (40 Males and 40 Females) young individuals according to the inclusion criteria. Individuals were recruited from Physiotherapy College and OPD. Inclusion criteria were kept as age of 18-25 years and who were willing to participate. The criteria for exclusion were any pathological conditions affecting the whole body (Orthopaedic, Cardio respiratory, Neurological and/or surgical conditions). After taking the informed consent participants were explained the procedure. The materials required were Digital Dynamometer, Sit-n-reach box, Bed sheet, Pen and data sheet.

PROCEDURE

After explaining the procedure, all the participants were assessed for the Quadriceps and Hamstring muscle strength with digital Dynamometer. Sequence for Quadriceps and Hamstring muscle strength assessment was designed randomly. Measurements were taken three times and the best was considered for analysis. Rest period of 1 minute was given between each measurement. Then Flexibility was measured using Sit and Reach Box for 3 times and the best was considered. Self Hamstring stretching was performed with 30 seconds of hold and 3 times for both the legs. After the rest of 3 minutes, Strength of Quadriceps and hamstring muscles were again measured with the same protocol as was before the stretching. Position for Quadriceps strength measurement was High sitting with knee flexion of 10° - 15° , with roll bed sheet under the thigh and dynamometer was placed at distal leg just above the ankle for isometric strength assessment (Figure 1). Position for Hamstring isometric strength assessment was prone lying with foot outside the plinth and knee flexion in mid range 45° - 60° with Dynamometer at distal leg and resistance was applied in the direction of knee extension (Figure 2). Figure 3 and 4 demonstrate Self Stretching of Hamstring and flexibility assessment using sit and reach box^[5] respectively.



Figure 1: Quadriceps strength assessment



Figure 2: Hamstring Strength assessment



Figure 3: Self Stretching of Hamstring



Figure 4: Assessment of flexibility

RESULT

Data of 80 participants were analysed by using statistical package for social sciences version 16 (SPSS 16) and Microsoft Excel 2007. Paired t test was applied to evaluate data. Results for 80 participants are shown in tables 1, 2 and 3. Gender wise (Male=40, Female =40) comparison was done and p values for all the five parameters is shown in Table 4.

Table 1: Comparison of Flexibility (n=80)

	Pre (mean±SD)	Post (mean±SD)	p value
Flexibility(cm)	26.50±8.46	29.41±8.07	<0.05

Table 2: Comparison of Quadriceps Strength Pre and post stretching of hamstring (n=80)

	Pre (mean ±SD) Kgs.	Post (mean±SD) Kgs.	p value
Rt. Quadriceps	18.98±5.03	20.65±4.18	<0.05
Lt. Quadriceps	18.78±4.64	20.11±4.29	<0.05

Table 3: Comparison of Hamstrings Strength Pre and post stretching of hamstring (n=80)

	Pre (mean±SD) Kgs.	Post (mean±SD) Kgs.	p value
Rt. Hamstrings	13.30±4.68	13.27±4.57	0.897
Lt. Hamstrings	13.21±4.35	13.33±4.92	0.627

Table 4: p values for all parameters (Gender wise)

	p value	
	Male(n=40)	Female(n=40)
Flexibility	0.000	0.000
Rt. Quadriceps	0.003	0.001
Lt. Quadriceps	0.001	0.016
Rt. Hamstrings	0.558	0.226
Lt. Hamstrings	0.126	0.129

Thus, There was Significant Difference noted for Strength of Quadriceps muscle before and after stretching of hamstring muscle (p value<0.05). While no Significant Difference was noted for Strength of Hamstring muscles before and after stretching of hamstring muscle (p value>0.05).

DISCUSSION

Purpose of the present study was to find out whether the flexibility of Antagonist muscle (Hamstring) affects the Strength of Agonist (Quadriceps) muscle or not. For that, total 80 participants were included in the study for evaluation of Quadriceps strength before and after stretching of hamstring muscles. Results showed significant improvement in strength of Quadriceps muscle after Stretching of Hamstring muscle. End ROM is required for quadriceps strength analysis. [3], [4] Standard protocol is given for Digital Dynamometer in which the knee is slightly flexed and the isometric tension of the Quadriceps muscle is checked at the last degree of knee extension. [6] There is a direct relationship between isometric tension development and length of sarcomeres in muscle fibres. At optimal length – maximal isometric tension develops. Lengthening or shortening beyond optimal length causes reduced amount of active tension. [7], [9] So, it is important to get proper length of hamstring muscle for accurate force production and measurement of strength of quadriceps muscle. [6] Limitation of the present study was that there was inclusion of all the subjects irrespective of tightness.

CONCLUSION

Stretching of hamstring muscles should be incorporated prior to the strength assessment of Quadriceps.

FUTURE STUDY

Comparative study can be done on subjects with and without tightness of Hamstring muscle. The study can be done on different age group. Another study can be done with some other group of muscles.

CONFLICT OF INTEREST: None

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