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Correlation of hand held dynamometer and weight cuff for assessing the strength of quadriceps muscle in healthy individuals

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Abstract

Background: The lower limb muscle strength is an important determinant of physical function in healthy individuals. However the quadriceps muscle strength can be assessed traditionally by using weight cuff. By using the traditional method the exceptional level is high. So to reduce this load this study was aimed to correlate the weight cuff and hand held dynamometer for assessing the strength of quadriceps muscles.

Methods: 100 subjects was assessed for the quadriceps muscle strength that is knee extension using hand held dynamometer and weight cuff. For one day the assessment of hand held dynamometer was done and the next day weight cuff assessment was done.

Result: Infra correlation and regression exhibited no statically significant correlation of hand held dynamometer and weight for assessing strength of quadriceps muscle. But was clinically Signiant and correlating with the mean for weight cuff (93.4) hand held dynamometer mean was (3.48) Best fit value for weight cuff was (3.7) and for hand held dynamometer was (-16.7) $R= 0.47$. Which means the study is not statistically significant since the regression.

Conclusion: There is no statically significant correlation between hand held dynamometer and weight cuff for assessing the strength of quadriceps muscle. But the hand held dynamometer and weight are clinically significant and correlating.

Keywords: Healthy individuals, strength, quadriceps, HHD, weight cuff

Introduction

Muscle strength is a broad term that refers to the ability of contractile tissue to produce tension and a resultant force based on the demands placed on the muscle [1]. Insufficient muscle strength may can contribute to major functional loss of even the most basic activities of daily living. Functional strength relate to the ability of neuromuscular systems to produce, reduce or control forces during functional activities in a smooth coordinated manner. Insufficient muscular strength can contribute to major functional losses of even most basic activities of daily living.

The developmental of muscle strength and integral component of most rehabilitation or condition programs for individuals of all ages. Weight cuff- Cuff weights are weighted bands made of artificial fiber fastened with Velcro. The bands have pockets in which lead shot is placed and are made in two sizes and weights, 794g and 1134g. They are supplied in pairs in a carrying case. They add resistance and build strength through the muscle performance of repetitions. The adjustable cuff variable weights, worn on the ankle or wrist can be used during low impact or high impact exercises to add challenge [2].

Context of the study

It is known that strength of a patient can be traditionally assessed by using weight cuffs. However due to this traditional method, the patient is asked to perform repetitions due to which the exertion level is high. So to assess the correlation between handheld dynamometer and weight cuff in measuring the strength of quadriceps muscle. To reduce the load on the patient using weight cuffs to assess the 1RM that is the maximum amount of force that can be generated in one maximal contraction.

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In this study we are finding a different 1RM strengthening program with the help of hand held dynamometer. In this study we will be assessing the validity and reliability of hand held dynamometer for strengthening of quadriceps muscle.

Methods

Study was conducted in LSFPEF’s college of physiotherapy, Nigdi Pune from August 2018 to February 2019 The ethical consent was obtained from the ethics committee. Total 100 subjects were recruited for the study. The study design was a cross sectional study. Each subjects was explained about the purpose and risk of the study.

Procedure

The subjects were instructed about the procedure. The subjects were asked to sit on the examination table leaving the leg hanging freely about 90 degree. HHD was placed over the proximal to the lateral malleoli and medial malleoli. Subjects were asked to hold the table while doing knee extension that is while performing 1RM to prevent themselves being pushed away, stronger subjects was able to push tester backwards so it was important to be prepaid and avoid losing balance. The next day weight cuff assessment was done by using weight cuff. It was placed over proximal to the lateral malleoli and medial malleoli of subject and they were asked to perform knee extension with 1RM (Repetition maximum).The subject were asked to reach the maximum level and hold it for 2-3sec. It was important to maintain communication with your subject.

Results

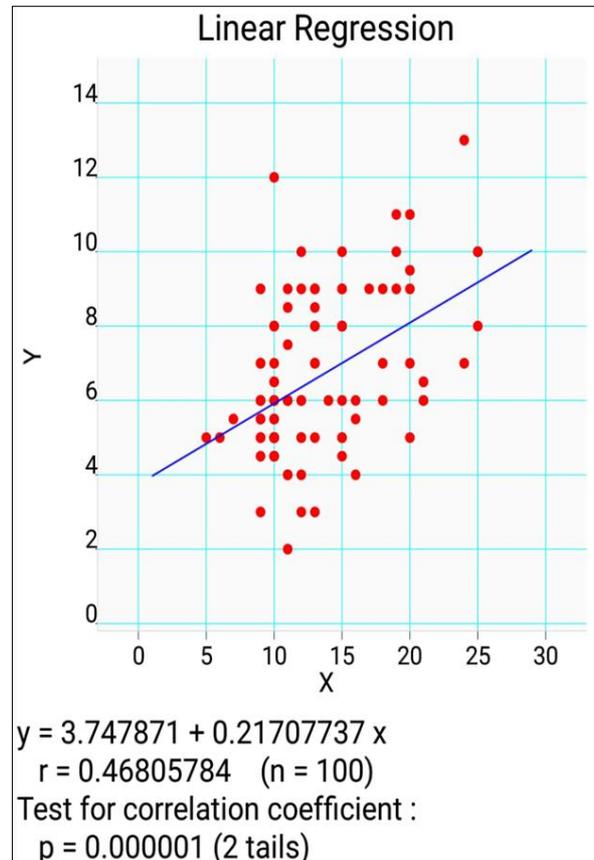
Intraclass correlation coefficients (ICC 2, 1) were used in the study of correlation between handheld dynamometer and weight cuff for assessing the strength of quadriceps muscle. The study was done on 100 healthy individual.



r = 0.47
p = 0.000001

Which means the study is not statically significant. Since the regression line miss many points the regression (r) is not significant.

Parameters	Mean square	Standard error	Best fit value
Weight cuff	93.4	0.59	3.7
HHD	3.48	00	-16.7



Discussion

The purpose of the study was to correlate hand held dynamometer and weight cuff for assessing the strength of quadriceps muscle. Articles have stated that hand held dynamometer is clinically reliable for assessment of quadriceps muscle strength. The weight cuff and hand dynamometer device have previously shown excellent results for use as a clinically feasible alternative to check quadriceps muscle strength.

But this study showed no significant correlation existed in weight cuff and hand held dynamometer for assessing the strength of quadriceps muscle. The HHD demonstrated mean percent of (3.74) and weight cuff demonstrated mean percent of (0.21)The correlation coefficient revealed that there is no significant correlation between the hand held dynamometer an Correlation of HHD and weight cuff showed moderate to excellent validity to assess the strength of quadriceps muscle.

This was the first study to evaluate the correlation of hand held dynamometer and weight cuff.

Several factors may have confounded hand held dynamometer muscle performance assessment in this study. These factors include muscle strength, stabilization, and gravity.

One confounding factor in the clinical use of hand held dynamometer is tester strength. Tester strength has been reported to affect the measurements obtained when testing the large muscle group

Wilhelm and Bohannon stated that testing variability was related to the tester’s strength because the weaker testers could not be able to match quadriceps force production [8]. The inability of the tester to adequately match the

quadriceps force may explain why the hand held dynamometer could not correlate to the weight cuff. So the large differences exist between hand held dynamometer and weight cuff to assess the strength of quadriceps muscle.

A second factor that may have confounded hand held dynamometer was the limited stabilization of the patient during hand held dynamometer testing.

The third confounding factor in this study was the effect of gravity on quadriceps muscle performance values [6].

Gravity correction was not used in this study because means to assess the effects of gravity are not available when using hand held dynamometer.

Conclusion

There is no statically significant correlation between hand held dynamometer and weight cuff for assessing the strength of quadriceps muscle.

But the hand held dynamometer and weight are clinically significant and correlating.

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