

USING INHERENT MUSCLE LENGTH TO PREDICT KNEE RANGE LOSS IN LIMB LENGTHENING.

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Introduction

Loss of knee movement is a recognised problem during limb lengthening, but the amount lost is variable between patients and the factors associated with it are not clearly identified. The study aimed to investigate if the inherent passive compliance and

length of patients' tissues effects the amount of knee flexion lost during lengthening.

Method

28 patients undergoing femoral lengthening were studied. A simple mathematical model was developed to calculate the inherent length of the quadriceps and hamstrings based upon anthropometric data derived from plain radiographs. The spare length of the muscle was then calculated and this was compared to the loss of knee flexion during limb lengthening. For each patient the 'spare' length of the quadriceps (SLQ) and hamstrings (SLH) was calculated using the formulae

$$SLQ = 2 * \Pi * \text{radius femoral condyles} * \text{pre-op knee flexion} / 360.$$

$$SLH = 4 * \Pi * 3.8 * \text{radius femoral head} * SLR / 360.$$

The difference between the lengthened and shortened position of the hamstrings was calculated by (1) measuring the ROM of the hip and knee joints respectively (2) Estimating the distance of the muscle / tendon from the centre of rotation of the hip (3) measuring the arc of movement of the hamstrings at the hip (SLR).

Results

The mean spare length of the quadriceps was 4.6 cm (SD12.14) and of the hamstrings 10.8 cm (SD13.9). Stepwise linear regression modelling was performed to identify factors associated with a loss of knee ROM. There was an association between loss of knee flexion and SLQ ($R^2=37.5\%$, $p=0.001$) and between loss of knee extension and SLR ($R^2=20.7\%$, $p=0.001$).

Discussion

The method of calculating spare muscle length or compliance was simple but is well suited to the clinic setting utilising only x-rays taken as part of a routine patient assessment. This method of calculating muscle length produced comparable results to those produced by more sophisticated methods e.g. Gadjosik et al¹. The association between loss of knee motion and the inherent length of the quadriceps and between loss of knee extension and SLR was interesting and may indicate that there are some patients whose tissues are better suited to tolerating an imposed increase in length. It is suggested that SLR measurement be incorporated into the pre-operative assessment of patients undergoing limb lengthening.

Reference

1.Gajdosik RL, Giuliani CA, Bohannon RW. Passive compliance and length of the hamstring muscles of healthy men and women. *Clinical Biomechanics*. 1990; 5: 23-29.

