Forces Used In Manual Therapy Of The Shoulder As Measured With The Novel Pliance Glove Using Ultrasound Imaging In Healthy Individuals

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Introduction

- Manual therapy (MT) can be used by health care professionals for the management of multiple pathologies. Joint manipulation is a form of MT where different forces applied to the joint capsule have been used to decrease pain or increase range of motion (ROM).[4,6,8]
- Research has been limited due to a lack of devices able to accurately quantify the forces applied over a measured distance while replicating what occurs when a manual therapy technique is applied on human tissue.[9]
- Past literature on MT has focused specifically on which grade manipulation is appropriate for which pathologies.[4]
- Researchers have been looking at what constitutes best parameters of MT, such as forces being used and the potential teaching methods of a given MT technique.[6,16,17]
- The aim of this study was to measure the amount of force and distance required to take the humeral head to end-range within the glenohumeral joint using an inferior glide manual therapy technique in healthy young adult shoulders.

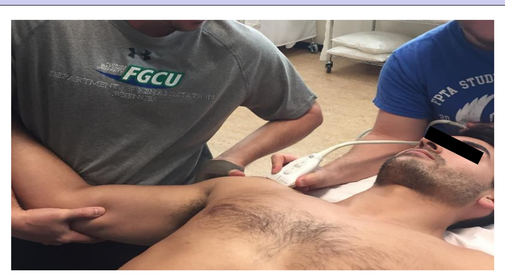
Objectives

- Investigate average distance and forces needed to take the humeral head to end-range of motion
- Investigate what impact, if any, subject characteristics such as gender, height, weight, age, and limb dominance have on the amount of force and distance required to translate the humeral head within the glenohumeral joint using an inferior glide manual therapy technique in healthy young adult shoulders.
- This study serves as a bridge between past literatures in confirming or refuting suggested normative values as newer devices more appropriately allow for proper body mechanics, contour of force sensors to target tissue, and in vivo measures providing real-time biofeedback to the clinician.

Methods

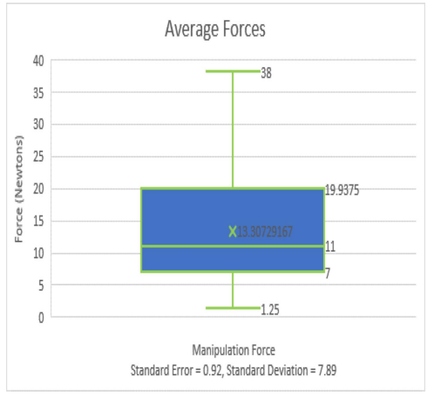
- Descriptive quasi-experimental research study
- Each manipulation force was measured and recorded using the Novel Pliance Glove device and software. The distance of humeral head translation within the glenohumeral joint was measured using the GE LogiQe USI device and software.
- Inferior glide joint manipulation was performed 3 times with resulting forces and distances then averaged for each subject.

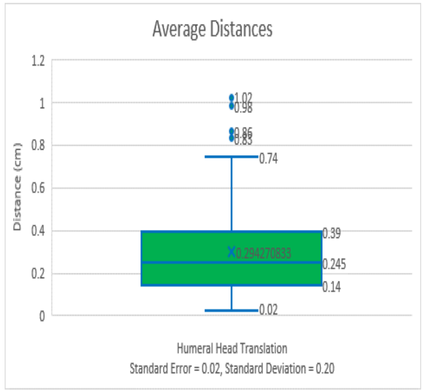
Subjects	Gender	Age	Height (in.)	Weight (lbs.)	BMI
N = 69	M: 29 F: 40	24.41	67.29	157.77	24.37

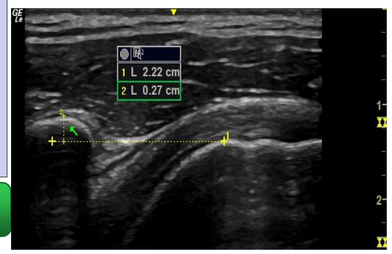


Results

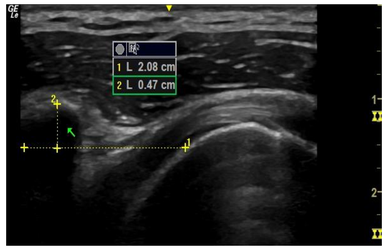
- Average forces were consistent across all 3 trials with no outliers while distance remained similar for trials 1 and 2 but increased on trial 3 comparatively.
- Subject age demonstrated a fair degree of correlation with average humeral head translation distance.
- Average force required to reach joint capsule end range was 13.3+7.89 N, with a range from 1.25 N to 38 N, standard error=0.92
- Average distance of humeral head translation during an inferior glide joint manipulation within the GH joint was 0.3 +0.20 cm with a range from 0.02 cm to 1.03 cm, standard error 0.02.





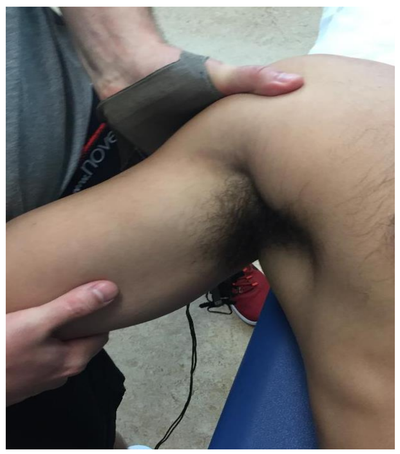


USI Distance: Neutral

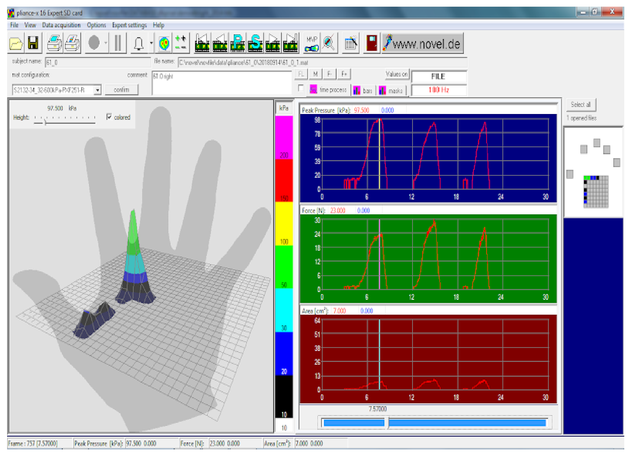


USI Distance: Mid-Range

USI Distance: End-Range



Novel Pliance Glove



Novel Pliance Glove Biofeedback

Data Analysis

- Descriptive statistics were calculated from overall raw data using Microsoft Excel
- A 1-tailed Pearson bivariate correlation was used to assess significance between variables

Discussion

- Average force data remained constant throughout all 3 trials while average distance of humeral head translation increased on the 3rd trial performed. This demonstrates that there was tissue relaxation or elongation.
- Force applied was proportional to the translational distance and therefore lends credibility to the theory that progressive manipulations taking the joint to end range repeatedly has an effect on increasing pliability of the joint capsule.[32]
- Suggests that tissue creep took place with each successive joint manipulation applied to the glenohumeral joint capsule as affected collagen and elastic fibers warmed and progressed along the stress versus strain curve.[33]
- Results demonstrated a much lower average force of 13.3 N compared the previously suggested 80 N to glide the humeral head to end range using inferior joint manipulation and maybe due to the use of better technology devices with flexible force sensors and real-time biofeedback measures.[2]
- Data shows a fair degree of relationship between average distance of translation and the subject's age. One can imply that as the body ages, the joint capsule increases in stiffness but muscle tone decreases resulting in overall increased force in order to reach end range within the joint capsule.[35]
- Subjects' weight and BMI also demonstrated a near significant negative correlation suggesting the average distance of translation was affected by an increase in physical resistance imposed by the increase in tissue.[34]
- No definitive parameters can be stated from the results of our study, the data suggests subject characteristics warrant further investigation and must be included as well as controlled for as variables in future research.

Conclusions

- Average force required to reach joint capsule end range was 13.3 N with a range from 1.25 N to 38 N in young healthy adult shoulders.
- Average distance of humeral head translation during an inferior glide joint manipulation within the GH joint was 0.3 cm with a range from 0.02 cm to 1.03 cm.
- Average force remained constant while the average distance increased with after trial 3.
- Characteristics such as a subject's weight, BMI, and age had an effect on the average forces required to perform an end-range joint manipulation.
- The Novel Pliance glove and ultrasound imaging enable accurate measures while performing joint manipulations on human tissues with real-time biofeedback.

Clinical Relevance

- An inferior glide joint manipulation to end range can be performed with an average force of 13 N, or 1.3 kg, in healthy young adult human shoulders.
- Tissue pliability did not increase after the second inferior glide of the humeral head but did increase after the third glide of the humeral head.
- Clinicians looking to increase tissue pliability need to perform at least three glides for inferior GH head translation.

References: See Handout with Reference List