

Table 1  
Paired samples test and ICC

		Paired differences				ICC	
		Mean	S.D.	S.E.M.	Sign. (two-tailed)		Sign.
Pair 1	Cli 1–cli 2	0.17568	1.08991	0.12670	0.170	0.501	0.000
Pair 2	Cli 1 dominant–cli 2 dominant	0.10811	1.02154	0.16794	0.524	0.550	0.000
Pair 3	Cli 1 non-dominant–cli 2 non-dominant	0.24324	1.16441	0.19143	0.212	0.451	0.002
Pair 4	Dominant–non-dominant	−0.35135	0.88870	0.14610	0.021		

higher (more lax) than cli 2, though not significantly. Finally, the dominant and non-dominant hand (pair 4, scores of cli 1 and 2 added) were compared and a significant difference was found. The non-dominant hand scored more lax than the dominant hand. Significant correlations are found between the scores of cli 1 and 2 (pairs 1–3).

The dominant hands from both clinicians were added, this score was compared with the other tests and no significant (Cli versus Mayo) or very low correlations (Cli versus Beighton (0.37), Cli versus GE (0.43)) were found. Between the other tests only low correlations were found: Beighton versus Mayo (0.49), GE versus Mayo (0.57), GE versus Beighton (0.63).

## 6. Discussion

Both clinicians scored the same level of wrist laxity while using their own techniques. Because cli 1 scored (not significantly) higher than cli 2 in all the tests, it may be assumed cli 1 has a higher reference point at this specific population. The difference found between the dominant and non-dominant hand was in contrast with earlier results [6]. A possible reason can be because the muscles strength and tension is likely higher in the dominant hand, the wrist becomes stiffer. The clinical judgment had no or very low correlation with any of the other methods. Correlations, though low, were found between the other methods. Assuming the clinicians estimation of wrist joint laxity is correct, the other methods are not capable of quantifying what they define as wrist joint laxity. Creating a standardized and more detailed scale for clinicians to score the level of wrist joint laxity seems to be the best option for reaching an objective measurement tool. Also, the clinicians test the wrist by translating the hand dorsal and palmar, a measurement device that simulates this movement may be more successful in determining the level of laxity.

## References

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## PP-090

### Comparison by motion analysis of non-operative versus operative treatment of Achilles tendon ruptures

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### 1. Summary/conclusions

The biomechanical findings of this study revealed that the functional outcomes of operative versus non-operative treatment of Achilles tendon rupture were comparable during weight-bearing activities of walking, running and jumping.

### 2. Introduction

Since the mid-twentieth century, operative repair of Achilles tendon ruptures has become increasingly popular. However, early studies suggest that the results of conservative treatment, such as bracing or long-leg casting were just as good as those of surgical treatment [1]. Although, previous investigators have examined the effect of operative versus non-operative treatment on strength, wound problems, re-rupture and return to work/sports, these qualitative assessments have been inconclusive in clearly defining which treatment is superior in restoring weight-bearing function [2]. Furthermore, there have been no published studies that have included comprehensive gait analysis for alteration in gait mechanics or comparison of mechanics between the two treatment approaches. Therefore, the purpose of this study was to compare the effects of operative and non-operative Achilles tendon rupture treatment on weight-bearing function during walking, running and jumping using computerized motion analysis.

### 3. Statement of clinical significance

Rupture of the Achilles tendon has been reported to occur in as many as 37 per 100,000 individuals per year [3]. Untreated Achilles tendon rupture can cause weakness of ankle plantar flexion and significant impairment. Yet, due to

a lack of quantitative data, there remains a debate over the best treatment for this patient population.

#### 4. Methods

Four patients treated non-surgically with long-leg casting and five patients with unilateral surgically repaired Achilles Tendons were recruited and consented for this study. Mean patient age was  $45 \pm 7$  with an average post-treatment time of  $5 \pm 2$  years. All subjects were treated by the same orthopedic group and underwent similar rehabilitation regimens. Each subject walked, ran and jumped off a force plate (AMTI, Watertown, MA) on the involved side in a 12-m runway while kinematic and kinetic data were collected using an eight camera motion capture system sampled at 120 Hz (Motion Analysis Corp., Santa Rosa, CA). A Helen Hayes marker set was used to define lower body joint centers and segments. All motion analysis data and temporal-spatial data were reduced, analyzed and compared for descriptive statistical analysis purposes. It was determined that peak dorsiflexion, peak plantar-flexion, dynamic ankle ROM and ankle flexor moments were relevant enough to warrant further statistical analysis. Thus, these parameters were subjected to a multi-variate analysis of variance (MANOVA) for each trial condition (walking, running and jumping) at a Bonferonni adjusted level of 0.02 for each of the four dependent variables.

#### 5. Results

Subjects did not differ significantly in all temporal-spatial parameters during walking and running. Likewise, no significant differences were found in peak dorsiflexion, peak plantar-flexion and dynamic ROM during walking (Fig. 1), running (Fig. 2) and jumping (Fig. 3). Ankle moments (Fig. 4) during walking, running and jumping were also statistically similar.

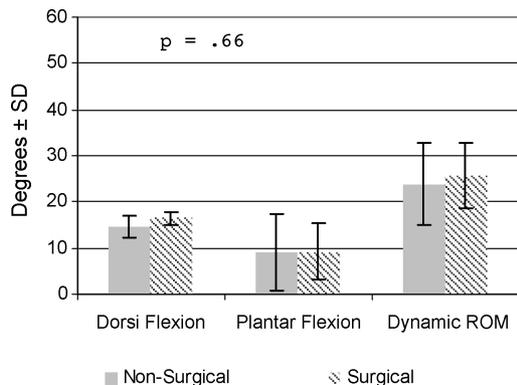


Fig. 1. Peak kinematics during walking.

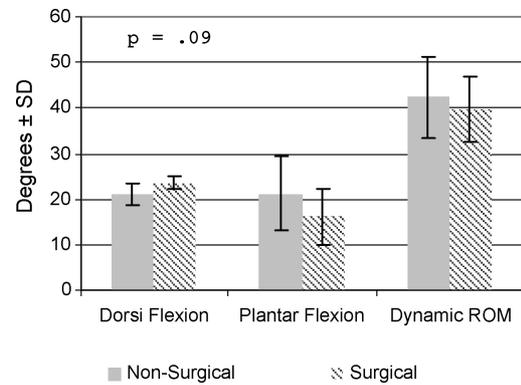


Fig. 2. Peak kinematics during running.

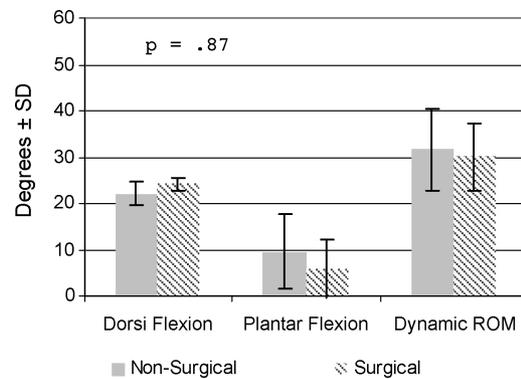


Fig. 3. Peak kinematics during jumping.

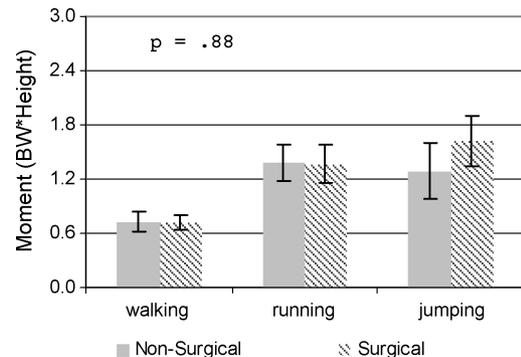


Fig. 4. Ankle plantar-flexor moments.

#### 6. Discussion

The present study represents the first known attempt at using comprehensive motion analysis to quantitatively assess the functional outcome of operative versus non-operative treatment of Achilles tendon ruptures, particularly during sport-related activities, such as running and jumping. Previous clinical trials left questions on whether the qualitative measurements employed provided definitive evidence to support the claim that both treatments yielded similar results [2]. The findings of this study did indicate that both treatments were biomechanically similar, thereby validating this claim. However, motion analysis was conducted at an average of

5 years after treatment on patients who may have reached normal levels of function at different times prior to testing. Future biomechanical studies should longitudinally evaluate the effects of these two approaches on weight-bearing function in shorter post-treatment times in order to provide additional information that would assist clinicians and patients in determining which treatment would be best in a specific case.

## References

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## PP-091

### The effect of deep brain stimulation on target directed movement of the hand in multiple sclerosis patients

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## 1. Summary/conclusions

Quantitative effect of thalamic deep brain stimulation (DBS) on the accuracy and precision of target directed movement of the hand in patients with multiple sclerosis (MS) was studied. It was found that DBS may be an effective treatment to improve target directed movement of patients with severe ataxia.

## 2. Introduction

Deep brain stimulation is a viable treatment alternative for tremor in patients with Parkinson's disease, essential tremor and MS [1–3]. Besides tremor, some MS patients have ataxic hand movements [4]. Dysmetria, an ataxic disorder, deteriorates target directed movements of the hands [5,6].

## 3. Statement of clinical significance

Yet, it is not clear that DBS improves accuracy and precision of target directed movement of the hands in MS patients.

Table 1  
DBS side, age and gender for the patients tested

Patient	DBS side	Age	Gender
ga	Bilateral	34	M
ir	Bilateral	52	M
gc	Left	32	M
sw	Left	38	F
ck	Left	67	F
dl	Left	42	F
lk	Right	62	F

## 4. Methods

Infrared markers were placed on the tip of index finger of both right and left hands of six healthy and seven MS patients using DBS (Table 1).

Ten cycles of chin-to-target movement, a common clinical maneuver, was performed three times by each arm of each subject. Target was a fixed marker in the level of chin and 30 cm away from subject. Patients completed the test with their DBS in “on” and “off” states. A video tracking system (Optotrak<sup>TM</sup>, NDI, Waterloo, Canada) recorded the spatial position of the markers during the test for 15 s with frequency of 100 Hz.

For each arm of each subject, “average radial distance” and “average radial deviation” from target were, respectively, computed as measures of accuracy and precision of the target directed movement. These measures were, respectively, defined as mean value and standard deviation of the relative radial positions of finger marker with respect to the target marker in the vicinity of the target (i.e. when their relative distance in movement direction is less than 5 mm) in all cycles and trials. Mean value of “average radial distance” and “average radial deviation” were separately computed for healthy group and contralateral and ipsilateral sides to DBS for patients with DBS on and off states.

Analysis of variance (ANOVA) was implemented to check the repeatability of tests for three trials. Significance of difference between patients with DBS on and DBS off was checked by paired *t*-test for contralateral and ipsilateral arms.

## 5. Results

ANOVA confirmed repeatability of tests for both measures ( $P=0.021$ ). Both “average radial distance” and “average radial deviation” were mostly greater for the patients compared to healthy subjects, and reduced for most of the patients when the DBS was in on state, in both contralateral and ipsilateral arms (Fig. 1). Mean value of both measures were greatest in patients with DBS off in both contralateral and ipsilateral arms, and least in healthy subjects. *P*-values resulting from paired *t*-tests between DBS on and off states showed that the mean value of both measures were significantly different for contralateral arm ( $P=0.028$  and  $0.050$ , respectively) but were not significantly different for ipsilateral arm ( $P=0.083$  and  $0.124$ , respectively).