

ORIGINAL ARTICLE

Shoulder kinetics and ultrasonography changes after performing a high-intensity task in spinal cord injury subjects and healthy controls

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Study design: This is a prospective and comparative study between two groups.

Objectives: The objective of this study was to compare the changes in shoulder joint forces and their moments, as well as any possible ultrasound changes, when subjects with spinal cord injury (SCI) and healthy controls (CG) undertake a high-intensity manual wheelchair propulsion test.

Setting: This study was conducted in an inpatient SCI rehabilitation center.

Methods: A group of 22 subjects with SCI at level T2 or below who use a manual wheelchair (MWU), categorized as AIS grade A or B, were compared with a CG of 12 healthy subjects. Subjects in each group performed a high-intensity wheelchair propulsion test. The variables analyzed were shoulder joint forces and the moments at the beginning and at the end of the test. Ultrasound variables before and after the propulsion test were also analyzed. Correlations were also drawn between the ultrasonography and demographic variables.

Results: In both groups, peak shoulder forces and moments increased after the test in almost all directions. No differences in the ultrasound parameters were found. A greater long-axis biceps tendon thickness (LBTT) was associated with more shoulder pain according to WUSPI or VAS ($r=0.428$, $P<0.05$ and $r=0.452$, $P<0.05$, respectively).

Conclusions: Shoulder joint forces and moments increase after an intense propulsion task. In subjects with SCI, these increases center on forces with less chance of producing subacromial damage. No changes are produced in ultrasonography variables, whereas a poorer clinical and functional evaluation of the shoulder of the MWUs appears to be related to a thicker long-axis biceps tendon.

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INTRODUCTION

Manual wheelchair users (MWUs) with spinal cord injury (SCI) have a high prevalence of shoulder pain,^{1–8} with estimates ranging from 30%¹ to 73%.⁹ The shoulder pain in patients with SCI is mostly experienced during activities of daily life and especially during weight-bearing tasks, such as transfers, wheelchair propulsion and weight relief raising.¹⁰

The continuous use of upper limbs by MWUs for weight-bearing and propulsion creates biomechanical challenges to limbs that are not specialized for such actions.⁶ This mechanical stress can lead to overuse syndrome. Indeed, the mechanical forces created by the increased intra-articular pressure and repetitive movements required for manual wheelchair propulsion are believed to contribute to the development of shoulder pain and rotator cuff injuries.^{11,12}

These forces could result in an upward translation of the humeral head and the subsequent compression of the subacromial structures against the overlying acromion.¹³ Repetitive strain of rotator cuff tendons can potentially induce microinjuries, which may facilitate tendon degeneration.¹⁴

Ultrasound has been refined as a versatile and inexpensive diagnostic technique, and it is now widely accepted as a useful, precise

and accurate tool to assess the shoulder rotator cuff.^{15–17} In fact, musculoskeletal ultrasound techniques have several advantages when diagnosing shoulder pathologies, such as portability, ease of clinical implementation, lower cost and the capability to assess joint dynamics in movement.

The acute changes in shoulder tendons¹⁸ that might follow the strong demands of propulsion could contribute to chronic shoulder pathologies and pain. Indeed, acute exercise induces changes in tendon metabolism and augments inflammation.¹⁸ Such acute changes can be rapidly screened for with ultrasound immediately after completing the propulsion task in a controlled environment. Acute tendon injuries after different tasks have been investigated previously.^{19–21} However, to our knowledge, no studies have focused on changes that might occur after a controlled and intense manual wheelchair propulsion task. In addition, it might be interesting to analyze whether such changes could be related to the shoulder joint forces applied or to the basal condition of the shoulder.

The main aim of this study was to investigate the changes in shoulder joint forces and the moments after a high-intensity manual wheelchair propulsion test, both in subjects with SCI and in non-MWUs. In addition, the possible changes in the shoulder on

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performing this task that could be detected by ultrasonography were also assessed. We hypothesized that shoulder joint forces and the moments would increase in both cases and that they would produce changes evident by ultrasound that would allow parameters of the risk of presenting tendon-related pathologies in the shoulder to be identified. Linking ultrasound images and kinetic information may also help interpret the shoulder pathologies associated with manual wheelchair propulsion. The secondary objective of this study was to examine the relationship between the subject's demographic characteristics, shoulder pain and ultrasound parameters.

MATERIALS AND METHODS

Subjects

A total of 22 male subjects with SCI were recruited from the discharge records of a monographic inpatient SCI hospital. Their average age was 35.7 ± 7.06 years, their mean height was 1.77 ± 0.06 m and their mean weight was 68.66 ± 10.76 kg. The time since SCI was 104.77 ± 85.05 months (Table 1). Inclusion criteria were as follows: traumatic SCI at level T2 or below, AIS grade A or B,²² age between 18 and 45 years and time since injury >18 months. The subjects must use manual wheelchairs as their primary means of mobility. Subjects were excluded if they had had fractures or dislocations in the nondominant shoulder at any time, upper limb pain that prevented them from propelling a manual wheelchair and progressive or degenerative disability or a history of cardiopulmonary disease. The data from these SCI subjects were compared with age, sex and anthropomorphically matched healthy controls (CG), a group that included 12 male subjects with an average age of 31.3 ± 7.46 years, a mean height of 1.72 ± 0.08 cm and a mean weight of 73.87 ± 11.54 kg (Table 1). This study was approved by the ethics review board, and all the participants signed an informed consent form before their enrollment. Human experimentation has been approved by the local institutional committee and it conforms to the Helsinki declaration.

Instrumentation

A standard adjustable wheelchair (Action3 Invacare, Invacare, Elyria OH, USA) was fitted properly to each subject and placed on a treadmill (Bonte BV, model GTR 2.50, En-Bo systems, Zwolle, The Netherlands). The force transducer location, the custom dead weight and pulley system were previously described (Figure 1).²³

Nondominant upper-limb kinematic data were collected at 50 Hz (maximum recording frequency) using passive markers and four camcorders (Kinescan-IBV, Instituto of Biomecánica of Valencia, Valencia, Spain). All

Table 1 Subject characteristics, mean (s.d.)

Characteristics	Manual wheelchair users			Control group
<i>n</i>	22			12
Sex (male/female)	Male			Male
Age (years)	35.5 (7.06)			31.3 (7.46)
Weight (kg)	68.66 (10.76)			73.87 (11.54)
Height (m)	1.77 (0.06)			1.72 (0.08)
Time since injury (months)	104.77 (85.05)			
Shoulder pain (no pain/pain)	14/8			12/0
WUSPI (0–150)	20.32 (23.66)			
	Subjects with no pain: 7.31 (10.48)			
	Subjects with pain: 43.10 (23.31)			
VAS-F (0–100)	25.62 (1.95)			
Level of injury	D2–D6	D7–D11	D12–L3	
	9	8	5	

Abbreviations: VAS, visual analog scale; WUSPI, Wheelchair User's Shoulder Pain Index.

subjects were right-hand dominant so that the left upper limb was analyzed and spatial marker coordinates were smoothed out using a procedure of mobile means. Reflective markers were positioned according to ISB recommendations to define local reference systems on the hand, forearm and arm.²⁴ The axes of this reference system have been described previously.²⁵

The wheels of the chair were SMART^{Wheels} (Three Rivers Holdings, LLC, Mesa, AZ, USA) to balance the inertial characteristics of both axes and to ensure symmetrical propulsion. Kinetic data were recorded at a frequency of 240 Hz and filtered using a Butterworth, fourth-order, low-pass filter with a cutoff frequency of 20 Hz and a zero phase lag. Spatial marker coordinates were interpolated by cubic spline to synchronize with the kinetic data.

Data collection

A visual analog scale (VAS) was used to measure current pain, with 0 indicating a painless shoulder and 100 indicating an intensely painful shoulder. Pain during functional activities was assessed using the Wheelchair User's Shoulder Pain Index (WUSPI).²⁶ Subjects then underwent a baseline ultrasound screening of the nondominant shoulder before completing the wheelchair propulsion test, and another ultrasound screening immediately after finishing it. Time lapse between exercise cessation and the second ultrasound was no longer than 15 min.

Before testing, the subjects were allowed to familiarize themselves with the wheelchair and the experimental setup. Afterward, the individual rolling resistance was determined in a separate drag test.²⁷ The mean and s.d. of the friction coefficient was 0.010 ± 0.002 between the optimal limits established in previous studies,^{27,28} irrespective of the constraints in lateral movement imposed by our safety system. Once the rolling resistance was determined, the propulsion PO (power output) could be regulated by an additional external force that acted via a pulley system on the wheelchair user (Figure 1). The propulsion PO (external) was calculated in accordance with our previous experience.²³

A treadmill speed was calculated to set a PO external of 20 W for all subjects. Discrete increases of 5 W were introduced every 2 min without rest between the stages and varying the dead weights in the pulley system. The trial was completed when the subject was exhausted and could not propel the wheelchair any longer. The maximum criteria were then obtained according to the ACSM guidelines.²⁹ A subjective perception of fatigue (Borg scale) was also recorded immediately after completing each protocol.³⁰

Measures of shoulder pathology

An expert physician with >15 years of training and experience in musculoskeletal ultrasonography performed the ultrasound examination, which was performed with a General Electric Healthcare (Little Chalfont, Buckinghamshire, UK; Logiq S8) apparatus and using a 8- to 12-Mhz linear array transducer (General Electric Healthcare). External reference landmarks were taped to the skin of the shoulder, which were not removed until the second ultrasound examination after the wheelchair propulsion task. This reduced the variation in transducer location for the ultrasound measurements, making the procedure more reliable.³¹ The protocol used to examine the structures in the shoulder was the same in both ultrasound examinations, and it was based on previously described techniques.^{32–34} To examine the transverse image of the biceps tendon, the subject's hand was placed on their thigh with the palm facing upward. This supination of the hand with external rotation of the shoulder improved the visualization of the bicipital groove, and the transducer was then turned 90° to obtain the long-axis image of the biceps tendon. The supraspinatus tendon was observed with the hand placed behind the back with the shoulder in internal rotation, and the acromiohumeral distance was also recorded with the arm in internal rotation.

Data analysis

Biomechanical data. We used an inverse dynamic model described previously to calculate the shoulder joint forces and moments.^{25,35} The model was used to calculate the net shoulder joint forces and moments from segment kinematics, the forces acting on the pushrim and the subject's anthropometric measurements. More information about biomechanical data registration can be found elsewhere.²³

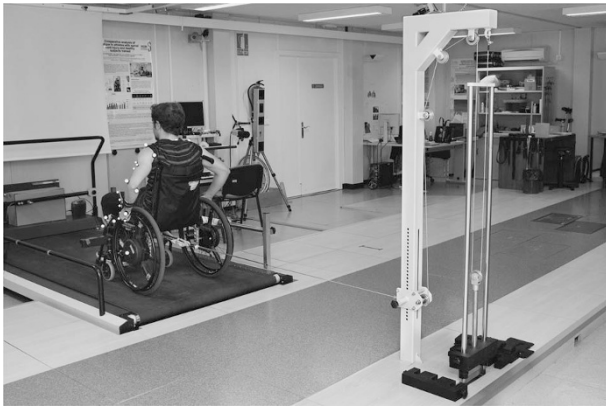


Figure 1 Overview of the test setup in which the subject is working against extra resistance applied through a pulley system and including the positions of the markers. A full color version of this figure is available at the *Spinal Cord* journal online.

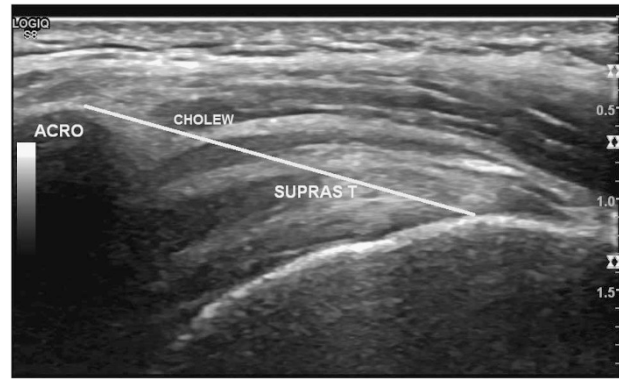


Figure 2 Measurement of the greater acromion tuberosity distance (Cholewinski Index). A full color version of this figure is available at the *Spinal Cord* journal online.

Table 2 The performance of both groups in the high-intensity wheelchair propulsion test, mean (s.d.)

	Test duration (minutes)	Speed (km h ⁻¹)	Power output (W)	Increasing steps (kg)	Borg Scale (0–20)
Manual wheelchair users	14 (2.09)	1.43 (0.10)	51 (4.54)	1.26 (0.10)	17.18 (1.00)
Control group	13 (2.30)	1.42 (0.07)	49 (6.55)	1.27 (0.07)	17.41 (1.08)

Ultrasound data. The anatomical shoulder references, and the characteristics of the biceps and supraspinatus tendon, were analyzed with custom software written in Matlab (The Mathworks, Natick, MA, USA). Although the most common ultrasound finding related to the shoulder of SCI MWUs is an increase in the gleno-humeral joint space,³⁶ a comprehensive analysis of shoulder ultrasound parameters was carried out, including anatomical shoulder references such as acromioclavicular distance and acromiohumeral distance using the Cholewinski method (acromion to greater tuberosity of humerus) and the Girometti Index (GI, point of entry of tendon to humeral head)³⁷ (Figure 2). Several tendon characteristics were also analyzed, such as the long-axis biceps tendon thickness (LBTT) and short-axis supraspinatus thickness (SST).³⁸ In the longitudinal images of the biceps tendon, a 2-cm length was selected by the researcher that included the part of the tendon located inside the bicipital groove, and the average diameter of this section was calculated.¹⁹

Statistics. A descriptive analysis, including the means and standard deviation (s.d.) for the continuous variables, was initially performed to describe the subject's characteristics. The shoulder joint forces, moments and ultrasound parameters were analyzed before and after the wheelchair propulsion test. All the statistical analyses were carried out using SPSS V.17 for Windows (SPSS, Chicago, IL, USA).

Peak shoulder forces and moments were averaged to create a representative value for each direction. Shoulder joint kinetics were calculated as the average of the peak force or moment for the wheelchair propulsion test, and the differences between early and late propulsion were analyzed. To calculate the differences in shoulder joint forces and moments, a Shapiro–Wilk test was applied to the normal distribution of the sample. A Student's *t*-test for independent samples was applied to those variables that followed a normal distribution. A Bonferroni correction for multiple comparisons was applied to the kinetic and ultrasound data obtained before and after the test. A Mann–Whitney *U*-test for independent samples was used to compare those variables that showed a nonparametric distribution. Spearman's correlation was used to investigate relationships between continuous measurements, including each ultrasound parameter selected and the demographic data (for example, height, weight, age, years since injury, WUSPI and VAS score). The level of significance was set at $P < 0.05$.

RESULTS

Subjects

This study was carried out on 22 male MWUs with SCI and 12 healthy men in the CG (Table 1). Their performance in the high-intensity propulsion test was recorded (Table 2). The demographic parameters and performance in the test was compared between both these groups to assess the homogeneity of the sample. Both groups were considered homogeneous in terms of both the demographic variables (Table 1) and their performance in the propulsion test (Table 2).

Biomechanics

Late during the high-intensity test, significant increases in shoulder peak forces and moments were found in SCI subjects in all directions except lateral forces (Table 3). In the CG, anterior, posterior, superior and medial peak shoulder forces increased. Comparing both groups, the increase of the superior peak force in the shoulder was higher in the CG than in MWUs, whereas the increase in inferior force and abduction, and in the extension moment, was higher in the MWUs (Table 3).

Ultrasound values

No differences were found in the ultrasound parameters of MWUs before and after the manual wheelchair propulsion test (Table 4). By contrast, when the changes in both groups were compared, the Girometti Index of the CG increased after the test, indicating an increase in acromioclavicular distance and probable inflammatory local changes. Surprisingly, the long-axis biceps tendon thickness decreased in the CG (Table 4).

Considering the baseline data in the MWU group, more shoulder pain according to the WUSPI or VAS was associated with a greater LBTT ($r = 0.428$, $P < 0.05$ and $r = 0.452$, $P < 0.05$, respectively; Figures 3a and 3b). Older MWUs had a narrower acromioclavicular distance ($r = -0.499$, $P < 0.05$; Figure 3c). Bearing in mind the

Table 3 Raw biomechanical variables of the manual wheelchair users and control subjects, mean (s.d.)

	Manual wheelchair users			Control group			Relative change between groups (MWUs vs CG)
	Early propulsion	Late propulsion	Relative change (late-early)	Early propulsion	Late propulsion	Relative change (late-early)	
<i>F_x (N) (+anterior, -posterior)</i>							
Max	40.07 (10.84)	50.30 (13.67)	10.23 (8.64) ^a	42.53 (12.68)	51.92 (11.14)	9.39 (6.13) ^a	
Min	-42.29 (10.60)	-76.67 (21.01)	-34.38 (19.55) ^a	-66.83 (14.22)	-104.10 (33.62)	-37.26 (25.34) ^a	
<i>F_y (N) (+superior, -inferior)</i>							
Max	-1.25 (15.01)	20.04 (21.49)	21.30 (21.16) ^a	15.54 (19.06)	62.64 (20.51)	47.09 (25.78) ^a	*
Min	-49.61 (13.24)	-70.84 (23.61)	-21.22 (17.24) ^a	-52.40 (11.85)	-56.51 (9.62)	-4.10 (11.07)	*
<i>F_z (N) (+lateral, -medial)</i>							
Max	14.52 (7.37)	18.58 (8.05)	3.97 (9.95)	15.12 (12.93)	15.28 (6.94)	0.15 (12.73)	
Min	-11.13 (10.10)	-16.71 (9.11)	-5.58 (10.77) ^c	-21.05 (8.58)	-34.15 (15.25)	-12.99 (14.53) ^c	
<i>M_x (N.m) (+adduction, -abduction)</i>							
Max	2.76 (2.12)	5.14 (5.37)	2.38 (5.21) ^c	4.46 (4.87)	9.38 (4.56)	4.92 (5.12) ^b	
Min	-5.42 (2.40)	-8.14 (4.13)	-2.71 (2.85) ^a	-6.19 (2.87)	-6.20 (2.26)	-0.01 (1.45)	*
<i>M_y (N.m) (+internal rotation, -external rotation)</i>							
Max	2.81 (2.18)	5.14 (2.52)	2.33 (2.60) ^a	4.11 (2.03)	5.27 (3.48)	1.16 (2.86)	
Min	-2.94 (1.91)	-4.78 (2.46)	-1.83 (2.31) ^b	-2.67 (3.88)	-3.70 (1.92)	-1.03 (3.99)	
<i>M_z (N.m) (+flexion, -extension)</i>							
Max	11.79 (4.41)	22.44 (7.11)	10.65 (6.07) ^a	17.38 (5.02)	28.70 (7.44)	11.31 (5.64) ^a	
Min	-7.82 (3.28)	-13.00 (7.01)	-5.17 (5.23) ^a	-6.06 (1.73)	-7.20 (2.32)	-1.14 (1.96)	+

Abbreviations: CG, control group; Max, maximum; Min, minimum; MWU, manual wheelchair users. Differences within groups ^a<0.001, ^b<0.01, ^c<0.05; Differences between groups * <0.01, + <0.05; Bonferroni correction *P*<0.002.

variations in the ultrasonography values before and after the test in the CG, greater shoulder pain in the VAS was associated with a shorter acromioclavicular distance ($r = -0.546$, $P < 0.05$) and with a larger SST.

DISCUSSION

This study shows that performing a high-intensity manual wheelchair propulsion test provokes an increase in shoulder joint forces and moments, both in MWUs and CG. However, no relevant changes in the ultrasound parameters were found. The clear increase in shoulder joint forces was not apparently translated into morphological alterations of the tendons in the shoulder.

As found previously, the two largest shoulder joint forces in early and late propulsion were the posterior and inferior forces.³⁹ Joint loading in the posterior direction results from forces actively applied to the pushrim, whereas the inferior force arises from a combination of the weight of the arm and inertial forces. When increasing the intensity of manual wheelchair propulsion, all shoulder joint forces and almost all moments also increase, as found when increasing speed or inclination.^{7,13,39,40} In the current study, shoulder joint forces and moments increased in the high-intensity propulsion task except for the lateral forces in MWUs. Variations in muscle strength between participants may also have influenced the response to the fatiguing wheelchair propulsion test.

Higher posterior forces and internal rotation moments during propulsion have been related to shoulder pathology.⁷ When comparing both groups, the increase in the peak inferior force and in the peak

moments of force in abduction and extension were greater in the MWUs. However, in the CG, a greater increase in the peak of vertical forces was detected in the upward sense. These vertically oriented shoulder joint forces could result in an upward translation of the humeral head and the subsequent compression of subacromial structures against the overlying acromion.¹³ As such, this is a force that is more likely to provoke a subacromial conflict. It is possible that experienced wheelchair users have adapted their propulsive stroke in order to try to obtain a longer and smoother stroke, maximizing contact with the pushrim and minimizing upward shoulder peak force. The differences in shoulder forces seen with increasing resistance between experienced and novice MWUs is consistent with the literature on differences with the experiences and motor learning that occurs, demonstrating increased tangential forces with experience.⁴¹

No differences were evident in the ultrasound parameters of MWUs before and after the propulsion test. Several studies have assessed the shoulder by ultrasonography before and after performing a specific task, yet the task performed did not coincide in any of these, including our present study.¹⁹⁻²¹ In the first study, a decrease in the biceps tendon echogenicity was detected.¹⁹ In our study, LBTT decreased in CG and did not change significantly in MWUs. An increase of this parameter was expected considering local inflammatory phenomena. No significant difference was found in the acromiohumeral distance in the study considering repetitive weight-relief lifts.²¹ There may be several explanations as to why so few ultrasound differences were found in our subjects. Longer activities provoke a larger increase in the

Table 4 Raw ultrasound values for manual wheelchair users and control subjects, mean (s.d.)

	Manual wheelchair users			Control group			Relative change between groups (MWUs vs CG)
	Before test	After test	Relative change (after-before)	Before test	After test	Relative change (after-before)	
LBTT	0.37 (0.06)	0.38 (0.06)	-0.008 (0.02)	0.43 (0.13)	0.40 (0.07)	-0.026 (0.06)	+
ACD	0.70 (0.16)	0.75 (0.23)	0.051 (0.21)	0.73 (0.09)	0.74 (0.17)	0.001 (0.09)	
GI	1.43 (0.21)	1.48 (0.19)	0.047 (0.16)	1.19 (0.10)	1.26 (0.11)	0.075 (0.09) ^b	
CHI	2.48 (0.50)	2.50 (0.50)	0.017 (0.38)	1.94 (0.45)	2.01 (0.45)	0.069 (0.26)	
SST	0.61 (0.07)	0.59 (0.06)	-0.014 (0.07)	0.56 (0.09)	0.55 (0.08)	-0.011 (0.06)	

Abbreviations: ACD, acromioclavicular distance; CG, control group; CHI, Cholewinski Index; GI, Girometti Index; LBTT, long-axis biceps tendon thickness; MWU, manual wheelchair users; SST, short-axis supraspinatus thickness.
Differences within groups ^a $P < 0.001$, ^b $P < 0.01$, ^c $P < 0.05$.
Differences between groups ⁺ $P < 0.05$.
Bonferroni correction $P < 0.005$.

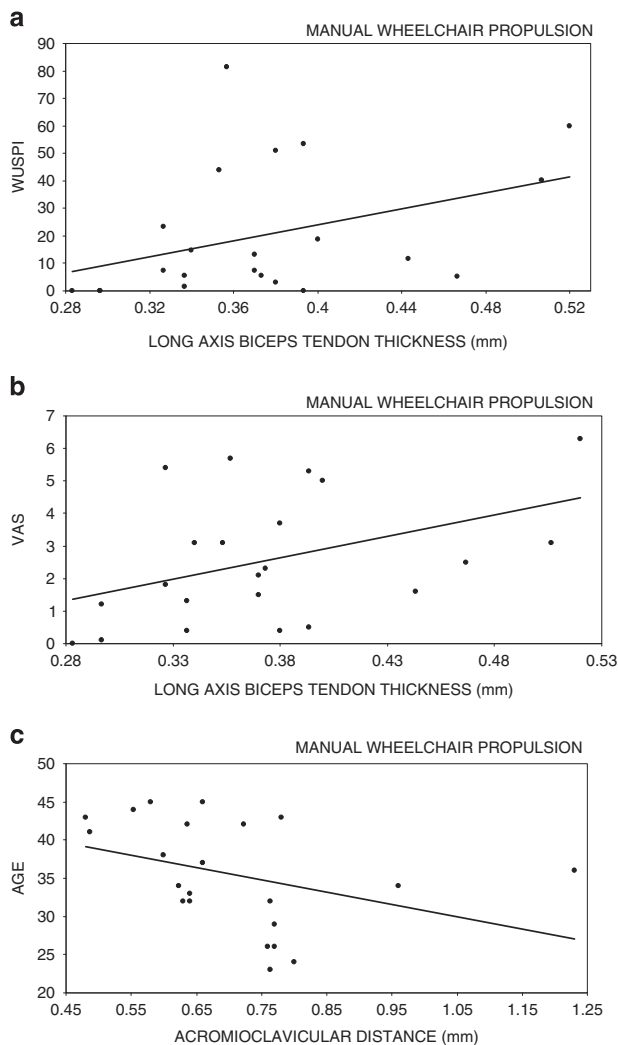


Figure 3 (a) Correlation analysis for long-axis biceps tendon (LBTT) thickness with WUSPI in MWU ($r = 0.428$, $P < 0.05$, $n = 22$). (b) Correlation analysis for long-axis biceps tendon (LBTT) thickness with VAS in MWUs ($r = 0.452$, $P < 0.05$, $n = 22$). (c) Correlation analysis for acromioclavicular distance (ACD) with age in MWUs ($r = -0.546$, $P < 0.05$, $n = 22$).

biceps tendon diameter, highlighting the significance of continuous activity.¹⁹ Moreover, shoulder lesions are generally injuries associated with overuse, and it is more likely that they appear after activities that last longer than after a highly intense but short activity. Thus, our protocol might be too short to provoke such changes, as when weight lifting was analyzed. Accordingly, it is possible that the techniques used here were not sufficiently sensitive to detect the early changes in ultrasound variables. More experience is needed to establish a threshold in forces exerted on the shoulder to cause ultrasound tendon changes.

No differences were detected here in the subacromial space when measured, as seen elsewhere.²¹ As indicated, this might reflect the fact that not all subjects have experienced overuse in the rotator cuff muscles. Alternatively, compensatory scapular motions⁴² and motor strategies or muscle firing patterns⁴³ may have been used to preserve the subacromial space.⁴⁴

Here we found that more shoulder pain, as assessed by WUSPI or VAS, was associated with a greater LBTT. The thickening of the biceps tendon may be because of the presence of edema, which was also one of the most outstanding findings of a study that analyzed the changes in this tendon after exercise.¹⁹ Our results were consistent with other studies that found that acromiohumeral distance parameters were not significantly correlated with the characteristics commonly linked to subacromial impingement syndrome, such as age and weight.²¹ The SST appearance was not significantly influenced by demographic parameters or biomechanics, as seen previously.²⁰ This might be because of the fact that the supraspinatus was visualized transversally as opposed to the longitudinal images obtained of the biceps tendon. Indeed, collagen fiber organization is less evident in the transverse view.

Study limitations

One limitation of this study is that eight of the MWUs were experiencing pain, whereas none of the control subjects made any reference to shoulder pain, such that pain could introduce a bias that is difficult to avoid when analyzing the data. Another issue that can be improved in future studies would be the inclusion of female MWUs and controls, as all the subjects analyzed here were male. Thus, further studies will be necessary to determine the kinetic threshold values of the shoulder above which ultrasonography changes appear that predispose to the development of a subacromial lesion.

CONCLUSIONS

Shoulder joint forces and moments increased during the test as the resistance to propulsion was increased, and the treadmill speed was held constant. However, experience in the use of a wheelchair means that individuals adapt their form of propulsion so that these increments are centered on forces that are associated with a lower risk of provoking subacromial damage. No changes were found in either the acromiohumeral distance or in the tendinous structure of the supraspinatus and the brachial biceps after an intense manual propulsion test. Increased shoulder pain of MWUs appears to be related to a greater LBTT. Better understanding shoulder kinetics and their relationship with radiographic findings may help define the mechanisms that provoke shoulder pain in MWUs.

DATA ARCHIVING

There were no data to deposit.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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