Long-handled shoehorn length, body mass index (BMI), and hip range of motion in female adults

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Long-Handled Shoehorn Length, Body Mass Index (BMI),
and Hip Range of Motion in Female Adults

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Abstract

The purpose of this study was to examine the affect that long-handled shoehorn (LHSH) length and body mass index (BMI) have on hip range of motion (ROM) in female adults. No standard currently exists for occupational therapists to use when recommending long-handled shoehorns (LHSHs) for their patients. Particularly in patients recovering from hip arthroscopy, strict precautions need to be followed to reduce the chance of hip dislocation. Thirty-eight female participants (mean age = 26 ± 6.9 years, range: 21 to 47 years) volunteered to participate in this IRB approved study. The task involved donning a pre-purchased canvas shoe using a LHSH. This occurred three times using an 18”, 24”, and 30” LHSH. Significant differences in hip flexion were found between the 18” shoehorn and the 24” shoehorn as well as the 18” shoehorn and the 30” shoehorn. No significant differences were found in hip flexion between the 24” shoehorn and the 30” shoehorn or in any of the conditions for hip rotation. There was a significant relationship between BMI and internal rotation for the 18”, 24”, and 30” length shoehorn conditions (p < 0.05). There was no significant relationship between BMI and hip flexion for the 18”, 24”, and 30” LHSH conditions (p > 0.05). The results suggest that among healthy women, individuals with low BMIs using a 24” or 30” LSH have the greatest chance of not violating the hip flexion or hip internal rotation ROM precautions. Implications of this study for the clinic suggest that therapists should consider each individual’s BMI and available ROM before suggesting a LHSH. Future research should continue to investigate the affect different length LHSHs have on joint ROM, especially in populations who likely use LHSHs (e.g., patients who are post-hip arthroscopy and patients with arthritis). The findings in this study provide evidence for appropriate clinical reasoning to use in the clinic with patients who have hip flexion and hip internal precautions.
Introduction

According to the National Center for Injury Prevention and Control (NCIPC), 309,500 people were admitted to the hospital for hip fractures in 2003 (NCIPC, 2006). Almost 90% of hip fractures occurred in individuals above the age of 65 and 75% of admissions were women (Medical News Today, 2006). One-third of these cases resulted in hip replacement surgery (Medical News Today, 2006). Individuals with other degenerative diseases, such as arthritis of the hip joint, sometimes also choose to have hip replacement surgery to decrease pain. Whether hip replacement surgery is used to correct a hip fracture or to mediate pain due to degenerative processes, the hopeful outcome of surgery is to increase functional mobility and independence in completion of occupations of daily living (ODLs).

In order for recovery to go as smoothly as possible, patients must follow standard hip precautions post-surgery. Hip precautions should be followed to reduce the chance of hip dislocation (Rapuri, Cline, & Hozack, 2004). It has been reported that hip dislocations are a complication in approximately 0.5 – 4% of all completed total hip arthroplasty procedures (Smith, Berend, Lombardi, Emerson, & Mallory, 2005). Although hip arthroplasty has become a very cost-effective procedure for the hospital, hip dislocation complications financially burden hospitals considerably (Sanchez-Sotelo, Haidukewych, & Boberg, 2006). Hip dislocations not only burden the hospital but the patient as well. Patients may experience considerable amounts of pain and mental stress (Masaoka et al., 2006; Callaghan & O’Rourke, 2004). Dislocation often destroys part of the hip prosthesis which often requires surgical repair and continued post-dislocation care, including rehabilitation (Masaoka et al., 2006; Sanchez-Sotelo, Haidukewych, & Bobery, 2006).
Adherence to the precautions is especially critical during the first 3 months following surgery to reduce the chance of dislocation (Seeger & Fisher, 1982). The most common type of hip replacement is completed by accessing the hip via a posterior approach (ActiveJoints, 2008). Generally accepted hip precautions for the posterior approach are: no hip flexion beyond 90°, no hip internal rotation, no crossing the legs, and no adduction at the hip (Bear-Lehman, 2002). Some patients may also have restrictions on weight-bearing (Goldstein, 1999).

The goal of the rehabilitation team, when working with patients with hip replacement, is to increase the person’s functioning as quickly as possible (Access Medicine, 2007). The occupational therapist has multiple objectives when working with a patient who had just had a hip replacement. Roles of the occupational therapist often include: assisting the patient so maximum functional independence is reached in completion of ODLs, providing patient and family education, and assessing the need for adaptive equipment for completion of ODLs (Daniel & Strickland, 1992). According to the National Institutes of Health (NIH), occupational therapy is indicated for people with problems with self-care and/or decreased range of motion (ROM) (NIH: Clinical Center, 2007). Occupational therapists will work with patients to help them re-learn how to complete ODLs while adhering to post-surgery hip precautions. Such occupations include, but are not limited to; bathing, dressing, and meal preparation. Approximately only one quarter of hip fracture patients will regain pre-fracture function (Access Medicine, 2007).

Completing ODLs independently is often difficult for patients with hip arthroplasty due to the hip precautions’ restrictions on movement. Prior to surgery, patients may have flexed past 90° at the hip to don their shoes, socks, and pants. Precautions, such as not flexing the hip past 90° may lead patients to rely on external things, such as assistive devices. “Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or
customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities” is the definition of assistive technology device from the Technology Related Assistance for Individuals with Disabilities Act of 1988 (Section 3). According to Nelson, usage of an assistive device is a compensation approach because the person has a deficit in the developmental structure and uses a device to get around the deficit (1996). Ultimately, usage of the device leads to a comparable impact during occupational performance to someone with no deficit in the developmental structure (Nelson, 1996). For example, a patient could use a reacher to adequately don his or her pants while still adhering to the precaution of not flexing past 90° at the hip. The comparable impact is having the pants donned on the body.

Often, occupational therapists will incorporate teaching patients how to correctly use a variety of assistive devices in order to achieve more independence in ODLs. Common assistive devices used by post-hip replacement patients include: reachers, long-handled sponges, long-handled shoehorns (LHSH), and sock-aids. It is very common for home health magazines and medical supply stores to carry “Hip-kits.” It is usual for “Hip-kits” to include those items listed above (Sammons Preston, 2007a). Properly teaching patients how to use these devices may help increase their independence at home and help them to achieve rehabilitation goals (Schemm & Gitlin, 1997; Bear-Lehman, 2002).

Some assistive devices have standards in place for correctly fitting individuals. For example, according to the Merck Manual for crutches:

The end of each crutch should be placed about 5 cm from the side of the shoe and about 15 cm in front of the toe, and the top of the crutch should be about 2 to 3 finger widths (about 5 cm) below the axilla. The hand grip should be adjusted so that the elbow bends 20 to 30°. (2005)
Specific, well-researched instructions give healthcare professionals a definitive explanation of how to properly fit an individual for an assistive device. By correctly fitting an individual, the most can be gained from the assistive device without causing any injury to the individual. Research is needed to establish the determinants for fitting someone for any assistive device, so that standards may be defined, similar to those given for crutches.

Commonly, OTs educate patients with hip replacements about proper usage of long-handled shoehorns (LHSHs) during post-surgery rehabilitation. As suggested by the Occupational Therapy Protocol Management in Adult Physical Dysfunction, the treatment technique for a patient who recently had hip arthroscopy of donning a shoe is having the patient use a LHSH (Daniel & Strickland, 1992). Specifically in this population, shoehorn usage is encouraged so patients do not need to flex their hips past 90° in order to independently don a shoe.

Depending on hospital procedures, patients may be given the assistive device at the facility or buy it on their own from a magazine, medical supply store, or on the internet. Schemm and Gitlin reported that 64 of 86 of patients with CVA, orthopedic deficit, or lower limb amputation received a shoehorn prior to discharge (1997). However, there is a plethora of LHSH lengths available on the market. For example, on the Sammons Preston website, a well-known rehabilitation equipment company, there are 4 different lengths of shoehorns available for purchase (2007b). The shoehorns listed include: 12 inches, 18 inches, 24 inches, and 30 inches in length. This raises the question of the need for standardization for prescribing and using assistive devices. A literature review revealed no methods for proper determination of a shoehorn’s length for an individual. How would one know what shoehorn length is correct for oneself with so many options?
An informal interview was conducted with four Midwestern occupational therapists concerning LHSH. The occupational therapists were queried if they make recommendations about what length shoehorn patients should receive. If they responded that they do make recommendations, they were asked what helps them to make that decision. The majority of the occupational therapists interviewed indicated they do not specify length nor acknowledged the availability of varying lengths on the market.

It has been suggested that application of anthropometric principles may help healthcare professionals make recommendations about the assistive devices individuals should receive (Baker 1999; Fairley, 2006). Anthropometry involves the measurement of the human body and is used to design objects and environments used by humans (Baker, 1999). Through anthropometrics, a designer can ascertain the most efficient way to design an environment or object to fit the majority of the population because measuring absolutely everyone is simply impractical (Baker, 1999). It has been suggested that anthropometric techniques can play a significant role in the design of industrial workspace, ergonomic tools, and assistive devices (Baker, 1999; Fairley, 2006).

Body Mass Index (BMI) is calculated by using measurements described in anthropometry literature. BMI is another concept that is important to take into consideration when designing human working environments and investigating human movement. A study by Gilleard and Smith found that hip ROM increased in individuals with higher BMIs in comparison to participants with normal BMIs when engaged in a simulated work task (2007). The authors concluded that because participants were engaged in a work task, they were forced to interact with other objects and their environment. The contributing factors of both body size and environment interaction, forced participants with the higher BMIs to use internal compensation
Few studies have been completed in the area of assistive device fitting and anthropometric techniques, although the idea of merging the two concepts has been suggested in literature (Baker 1999; Fairley, 2006). Studies that have examined assistive devices often examine the device in relation to specific biomechanical aspects of human movement. Kumar, Roe, and Scremin (1995) examined methods of estimating proper cane length by applying anthropometric principles and found improperly fitted canes can lead to poor body mechanics, increased demand on the triceps, and an increased moment arm at the elbow which increases the amount muscles must work. The study also revealed a better way of fitting a cane for a person compared to the conventional method (Kumar, Roe, & Scremin, 1995). Sevey and Rice (2002) found that a bent long-handled sponge in normal populations may help people with ROM limitations in the shoulder and wrist whereas people with wrist limitations may benefit more with the straight long-handled sponge.

Since many assistive devices are mass produced, Sevey and Rice (2002) suggested that an important feature of many devices is their adjustability. A product search of several medical supply companies did not reveal any adjustable shoehorns currently available on the market. The use of static anthropometry techniques may provide a way for healthcare professionals to determine what length LHSH to provide or to recommend to their patients. Static anthropometry is “the science of measuring length, breadth, and width of the human population” (Baker, 1999, p. 51). These measurements and principles may also provide valuable information for design of assistive devices based on individual body size.
The purpose of this study was to examine the influence that 3 different lengths of LHSH, specifically 18, 24, and 30 inches, has on hip ROM (i.e., flexion and internal rotation). Due to the frequent recommendation of this particular assistive device following hip replacement surgery, research is needed to determine if there is a difference in the degrees of hip ROM between different lengths of LHSH. It is hypothesized that there will be less hip flexion and hip internal rotation when using the longer length LHSHs when donning a shoe. The current study will also investigate the determinants of selecting the correct LHSH length for each individual based on static anthropometric principles. Therefore, it is also hypothesized that participants with a higher BMI will have greater degrees of hip flexion and internal rotation than participants with lower BMIs.

Methods

Participants

A convenience sample of 40 female volunteers were recruited by recruitment flyers from colleges in Ohio (mean age = 26 ± 6.9 years, range: 21 to 47 years). Healthy female adults were chosen because no previous study has examined the basic body movements associated with this particular piece of assistive technology. Participants self-reported no orthopedic or neurological health problems that may have adversely affected their ability to participate in the study. Two participants were African American and 36 participants were Caucasian. All participants stated that they were right-handed except for two.

Apparatus

Three identical (except for length) stainless-steel long-handled shoehorns measuring 18, 24, and 30 inches in length where purchased (item #2061, Sammons Preston, Bolingbrook, IL; item #2064, Sammons Preston, Bolingbrook, IL; #2062, Sammons Preston, Bolingbrook, IL).
Pre-purchased, non-tying, black canvas shoes in sizes 6-12 were also purchased (Item #2572575 White Stag, Walmart, Toledo, Ohio). Data were gathered using a 4-camera Qualysis 3-D kinematic system with Qualysis Track Manager (QTM) software (version 1.10.282, Gothenburg, Sweden) which collected data through sensors placed on the body. Movement data were collected at 240 Hertz. The 3-D system was interfaced with Petium IV desktop computer running Windows 2000 operating system software.

Procedure

This study was approved by the Institutional Review Board. Informed consent was obtained from each participant prior to participation in the study. This was a counter-balanced, repeated-measures design, where participants served as their own control and were randomly assigned to one of three order groups. The groups all donned a right-foot canvas slip-on shoe three times with the aid of a LHSH in one of the following orders: 18”-24”-30”, 24”-30”-18”, or 30”-18”-24”. To ensure similarity between participants, the pre-purchased canvas slip-on shoes were purchased in a variety of sizes prior to the study. Data were collected from the time participants pick up the LHSH from the start/stop area to the time they replace the LHSH in the start/stop area. The testing for all three conditions was completed in 1 day and took approximately 20 minutes.

Using anthropometric principles, the investigator recorded the overall height, sitting height, weight, and waist circumference measurement of each participant. Body Mass Index (BMI) was also calculated. Participants were asked to sit comfortably in a straight-back chair. Participants were then asked to remove their right shoe. A pre-purchased canvas shoe was placed for them just lateral to their right foot. They were instructed to place their feet flat on the floor, so that their knees were bent at a 90° angle. Platforms, upon which to rest the feet, were be
available to accommodate varying heights of individuals. They were also asked to sit with their back straight, so that a 90° angle was made at the hips. The following instructions were be given:

- One practice session will be provided for each type of device.
- Pick up the long-handled shoehorn and use it to put the right-foot canvas shoe on your right foot. Once your foot is flat in the shoe, please wait until I tell you before you take the shoe off.
- Go ahead and practice it once.
- Okay, great.
- Now do the same thing when I say “Go.”

After the participant successfully placed her right foot in the shoe with the first length of shoehorn she was assigned, she took off the canvas shoe. The investigator then supplied the participant with a second length of shoehorn and the same process was repeated. Following completion of the task with second length of shoehorn, the same process occurred with the third length of shoehorn.

Hip flexion and rotation were calculated using a system the Qualysis 3-D kinematic system. Data was collected from reflective markers placed on the body. Markers were placed on the right lower extremity at the epicondyle of the femur, the greater trochanter, the distal anterior border of the tibia. Markers placed on the upper extremity were placed at the head and lateral epicondyle of the humerus. Successfully donning the canvas shoe was determined when the sensor placed inside the bottom of the shoe was depressed by the heel. Depression of the sensor signaled the data collection computer via an analog to digital board marking the time at which the heel made contact with the sensor.

Statistical Analysis
Two primary pre-planned hypotheses were tested in statistical analyses. The first hypothesis tested was that the longer the shoehorn, the less ROM of rotation and flexion there will be at the hip. The second hypothesis was to investigate the relationship between BMI and hip ROM. The ROM for the hip was analyzed. Movement data were smoothed (2nd degree curve using 25 frames per window) and reduced into maximum and minimum ROM scores. Hip flexion was calculated from the markers placed on the head of the humerus, the greater trochanter of the femur, and the lateral epicondyle of the femur. Data from these markers were analyzed to determine the most acute angle made for each trial. Hip internal rotation was calculated performing trigonometric calculations with the data collected from the marker placed on the distal anterior border of the tibia and the lateral epicondyle of the femur. The angle made from the starting point of distal anterior border marker, the lateral epicondyle of the femur, to the maximum height the distal anterior border marker made in the same plane was determined for each sampling of each trial using custom software written in Microsoft’s Visual Basic development software, version 6.0. Paired t-tests (one-tailed) were performed to determine the statistical difference across the three conditions on both hip flexion and rotation. A Bonferroni correction was used to set the alpha at 0.017 for the paired t-tests due to multiple comparisons of the same independent variable. An analysis of variance (ANOVA) was also performed to test for order effects, with and alpha of 0.05.

Results

Due to investigator error and technical difficulties, data from 2 participants were discarded. Therefore, 38 participants were included in the data analyses. All participants were able to successfully don the right shoe in each of the three conditions. All participants were
required to complete the donning task with their right hand. Mean waist measurement, height, and sitting height are presented in Table 1. Mean weight was 158.0 lbs. ± 37.6 lbs. Mean BMI was 25.7 ± 6.3.

Significant differences in hip flexion were found between the 18” shoehorn and the 24” shoehorn as well as the 18” shoehorn and the 30” shoehorn (See Table 2). No significant differences were found in hip flexion between the 24” shoehorn and the 30” shoehorn or in any of the conditions for internal rotation (See Table 2).

There was a significant relationship between BMI and internal rotation for the 18”, 24”, and 30” length shoehorn conditions, \( F(1,36) = 9.3, p = 0.005, F(1,36) = 4.99, p = 0.033, \) and \( F(1,36) = 9.39, p = 0.004, \) respectively (see Figure 1, Figure 2, Figure 3). There was no significant relationship between BMI and hip flexion for the 18”, 24”, and 30” length shoehorn conditions, \( F(1,36) = 2.77, p = 0.105, F(1,36) = 0.998, p = 0.324, \) and \( F(1,36) = 0.192, p = 0.664, \) respectively (see Figure 4, Figure 5, and Figure 6). There were no order effects for hip flexion or for hip internal rotation (\( p = > 0.05 \)).

Discussion

The purpose of this study was to investigate the influence 18”, 24”, and 30” long-handled shoehorns have on hip ROM. From the results of this study, a few points can be made. First, there was a significant difference in hip flexion when using both the 24” and 30” shoehorns when compared to the 18” shoehorn. However, there was not a significant difference in hip flexion when comparing the 24” and the 30” shoehorns. Therefore, no significant difference in hip flexion can be expected from using a 24” versus a 30” LHSH in healthy adult females. When occupational therapists are making recommendations for LHSHs, it may be important to remember that 24” and 30” shoehorns are more similar to each other than either are to an 18”
LHSH for this population. There seems to be little significant difference between the use of an 18”, 24”, or 30” LHSH on hip internal rotation in healthy adults.

In general, participants with a higher BMI moved more both in hip flexion and hip internal flexion. Regardless of LHSH length, BMI was statistically significantly related to hip internal rotation. Participants with higher BMIs internally rotated at the hip more than individuals with lower BMIs (see Table 1, Table 2, and Table 3). Although not found to be statistically significant, it appears there is a trend by which the same phenomenon is true for hip flexion and BMI. That is, participants with higher BMIs exhibited more hip flexion than participants with lower BMIs, regardless of shoehorn length (see Table 4, Table 5, and Table 6).

The relationship between BMI, hip flexion, and internal rotation from this study contrasts findings in other studies on BMI and ROM. Other studies have indicated that a higher BMI is significantly related to less ROM at elbow, trunk, hip, and knee joints of the body in comparison to healthy controls when simply measuring joint ROM (Brown, P., 2008; Kotani, A., Yonekura, A., & Bourne, R., 2005). However, in the current study participants with higher BMIs exhibited more movement at the hip in order to complete the donning task. The findings of this study are similar to the findings in the Gilleard and Smith study (2007), which supports the concept of individuals moving differently when engaged with the environment during task. These findings may indicate that in order for participants with higher BMIs to see what they were doing, they needed to increase their internal rotation and hip flexion. If they were unable to see their shoe by simply gazing down with their eyes or flexing at the neck, they may have flexed more at the trunk and hips in order to see where the shoe and their body were in space. Because hip internal rotation was statistically significantly related to BMI in all conditions whereas hip flexion was not, it may have been easier for participants to move their foot further away from midline while
keeping their knee in relatively the same place and laterally flexing their trunks than hip flexion so they could see. Data for forward and lateral trunk flexion were not collected and therefore, not analyzed.

The higher BMI forced people to increase internal rotation as a compensation strategy so they could access the shoe with the shoehorn. BMI alone did not seem to influence hip flexion. However, BMI did affect internal rotation. Both hip flexion and internal rotation were necessary to don the shoe with the shoehorn, but it seems that the 24” and the 30” shoehorns were equally effective in reducing hip flexion. However, BMI appears to have a proportional relationship with internal rotation. In conclusion, individuals with lower BMIs using a 24” or 30” shoehorn have the greatest chance of not violating the hip flexion or hip internal rotation ROM precautions.

BMI could be used as a component of the decision making process when determining what length LHSH healthy individuals should have when the desired outcome of using the LHSH is decreasing hip ROM, specifically hip internal rotation and hip flexion. However, clinical reasoning should be based upon more than just BMI when deciding the appropriate length LHSH a patient should receive. It has been suggested that BMI is not an appropriate predictor of overall health or fitness because a high BMI may be the result of being very muscular (Gallagher et al., 1996). It is likely someone who is very fit and muscular would have no problem seeing around their body in order to don a shoe or compensating in some other manner. Therapists can consider BMI when deciding on a LHSH length. However, the available ROM at other joints in the body should also be taken into consideration.

There are several limitations to this study. First, participants needed to don a pre-purchased canvas shoe which was not their own. Since it was a non-tying shoe, participants may have had no familiarity with this style of shoe. However, this was done in order ensure
similarities between participants. Another limitation to this study was the unnatural setting in which the experiment took place. There were also multiple sensors placed on the body which may have inhibited participants from moving naturally.

Many people who purchase or obtain LHSHs may be under some sort of health-related precautions or have disabilities which in some way limit available ROM. Therefore, the findings of this study should not be generalized to all populations. The purpose of this study was to examine the effect that shoehorn length has upon hip ROM in healthy female adults. Healthy female adults were chosen because no previous study has examined the basic body movements associated with this particular piece of assistive technology. Therefore, follow-up studies should be conducted with participants who may more frequently use LHSH in ODLs. In order to establish clinical significance in individuals who have diagnoses that typically use LHSHs, a comparison study would be very appropriate. Participants who have recently undergone arthroplastic hip surgery or who have arthritis may be good candidates for future studies. Individuals with these two conditions will likely move very differently than healthy individuals when donning a shoe with a LHSH.

Other future studies should continue to examine the effect different length LHSHs have on joint ROM. Future research should study more natural movement patterns individuals use when donning their shoes while using LHSHs. The findings in this study provide evidence for appropriate clinical reasoning to use in the clinic with patients who have hip flexion and hip internal precautions.
References


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groups? American Journal of Epidemiology, 143, 228–239.


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Table 1.

*Mean Waist Measurement, Height, and Sitting Height.*

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Mean (inches)</th>
<th>Standard Deviation (inches)</th>
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<tr>
<td>Waist measurement</td>
<td>33.1</td>
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</tr>
<tr>
<td>Height</td>
<td>65.8</td>
<td>2.6</td>
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<tr>
<td>Sitting Height</td>
<td>32.4</td>
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</table>
Table 2.

*Shoehorn Length and Hip Flexion and Internal Rotation.*

<table>
<thead>
<tr>
<th>Hip Motion</th>
<th>Shoehorn length</th>
<th>Means (degrees)</th>
<th>Standard Deviation</th>
<th>Effect Size (d)</th>
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</thead>
<tbody>
<tr>
<td>Flexion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30” – 24”</td>
<td>77.55 – 76.55</td>
<td>15.93 – 14.18</td>
<td>0.07</td>
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</tr>
<tr>
<td>30” – 18”</td>
<td>77.55 – 69.06</td>
<td>15.93 – 11.01</td>
<td>0.44</td>
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</tr>
<tr>
<td>24” – 18”</td>
<td>76.55 – 69.06</td>
<td>14.18 – 11.01</td>
<td>0.59</td>
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</tr>
<tr>
<td>Internal Rotation</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30” – 24”</td>
<td>10.64 – 10.26</td>
<td>8.36 – 5.24</td>
<td>0.05</td>
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<tr>
<td>30” – 18”</td>
<td>10.64 – 9.87</td>
<td>8.36 – 7.20</td>
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<td>24” – 18”</td>
<td>10.26 – 9.87</td>
<td>5.24 – 7.20</td>
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</table>
Figure 1. BMI and Hip Flexion with 18” LHSH.
Figure 2. BMI and Hip Flexion with 24” LHSH.
Figure 3. BMI and Hip Flexion with 30” LHSH.
Figure 4. BMI and Hip Internal Rotation with 30” LSH.
Figure 5. BMI and Hip Internal Rotation with 24” LHSH.
Figure 6. BMI and Hip Internal Rotation with 30” LHSH.