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Title: Fabrication of Compressed Hosiery and Measurement of its Pressure Characteristic Exerted on the Lower Limbs

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Author Questionnaire:

1. Microscopy: Does your protocol involve video microscopy? N

2. Does your protocol demonstrate software usage? Y

3. Which steps from the protocol section below are the most visually important?

n/a

4. What is the single most difficult aspect of this procedure and what do you do to ensure success?

n/a

5. Will the filming need to take place in multiple locations (greater than walking distance? N

Section - Introduction

Videographer: Interviewee Headshots are required. Take a headshot for each interviewee.

1. REQUIRED Interview Statements (Said by you on camera): All interview statements may be edited for length and clarity.

1.1. **Xiaona Chen**: Two different methods are used to measure the pressure characteristics of compressed hosiery. As differences exist between the two methods, it is important to quantitatively analyze these differences **[1]**.

1.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

1.2. **Xiaona Chen**: The compressed hosiery used for most studies is purchased from the market. As the material and structure of these hosiery are uncontrollable, we have fabricated the compressed hosiery samples ourselves **[1]**.

1.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

OPTIONAL Interview Statements: (Said by you on camera) - All interview statements may be edited for length and clarity.

1.3. **Yu Chen**: These methods could also be used to measure other compression garments, such as compressed pants and wrist guards **[1]**.

1.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

1.4. **Yu Chen**: Visual demonstration of these methods will help viewers to better understand the methods and our work **[1]**.

1.4.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

Introduction of Demonstrator (Said by you on camera):

1.5. **Guangwu Sun**: Demonstrating the procedure will be Jiecong Li and Qi Fang, grad students from my laboratory **[1][2]**.

1.5.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

1.5.2. The named technician, post doc, student looks up from workbench or desk or microscope and acknowledges the camera

Section - Protocol

2. Compressed Hosiery (CH) Fabrication

2.1. To create a new sock construction, open the Atlas-MP615 stocking software **[1]** and select **Plain fabric [2]**.

2.1.1. WIDE: Talent opening software, with monitor visible in frame

2.1.2. SCREEN: screenshot_1: 00:20-00:23

2.2. Select **Double welt 1 feed**, **Transfer without pattern**, **Plain medical leg from double welt 1 feed**, **Begin heel from plain medical leg**, **End of heel and plain medical foot**, **Begin toe from plain foot 1f**, **Plain toe with rosso and clip**, **Sock release without turning device**, and **End of sock [1]**.

2.2.1. SCREEN: screenshot_1: 00:23-00:38

2.3. Then click **OK** to complete the sock design **[1]**.

2.3.1. SCREEN: screenshot_1: 00:39-00:40

2.4. Select **200** for the **Needle** and export the program file onto a USB flash disk **[1]**.

2.4.1. SCREEN: screenshot_1: 00:41-00:47

2.5. Switch to **Quasar** to change the fabrication parameters and click any blue button in the **GRADUATION** row to open a new window **[1]**.

2.5.1. SCREEN: screenshot_1: 01:03-01:07

2.6. For fabricating the compressed hosiery with a different structure, enter **500** in the **Cylinder S** and **E** columns **[1]** and click **OK [2]**.

2.6.1. SCREEN: screenshot_1: 01:08-02:24 *Video Editor: speed up or just show a few data cells being changed*

2.6.2. SCREEN: screenshot_1: 02:24-02:26

2.7. Click any one of blue buttons in the **ELASTIC MOTORS** row and enter **800** in the **WELT** rows and the **Cylinder S** and **E** columns **[1]**.

2.7.1. SCREEN: screenshot_1: 02:27-02:48 *Video Editor: please speed up*

2.8. In the **Medical** leg row, enter **800** in the **S** column and **650** in column **E [1]**.

2.8.1. SCREEN: screenshot_1: 02:49-02:55

2.9. Then enter **650** in the **ANKLE** row and the **S** and **E** column and click **OK** to complete the setup **[1-TXT]**.

2.9.1. SCREEN: screenshot_1: 02:56-03:02 **TEXT: See text for adding elastic motor alteration details**

3. Knitting

3.1. To prepare the ground and elastane yarns on the compressed hosiery fabrication machine **[1]**, turn on the machine, insert the USB drive **[2]** and select the compressed hosiery fabrication program file **[3]**.

3.1.1. WIDE: Talent turning on machine
3.1.2. Talent inserting USB drive
3.1.3. Talent selecting program file, with monitor visible in frame

3.2. The machine will automatically fabricate the compressed hosiery sample **[1]**.

3.2.1. Sample being fabricated

4. Direct Measurement

4.1. When all of the samples have been acquired, condition the samples for 24 hours in a standard atmospheric environment **[1]**.

4.1.1. WIDE: Talent placing sample(s) in standard atmospheric environment

4.2. The next day, place a sample onto an artificial lower limb **[1]** and mark six, evenly spaced, circle lines on the compressed hosiery sample dressings from the knee to the ankle **[2]**.

4.2.1. Talent placing sample onto limb *Videographer: Shot will be used again*
4.2.2. Talent marking line(s) *Videographer: Shot will be used again*

4.3. These lines divide the compressed hosiery samples into five parts **[1]**.

4.3.1. LAB MEDIA: Figure 1A

5. Pressure Measurement

5.1. To perform a pressure measurement, place the interface pressure sensors under part 1 of the compressed hosiery sample in the anterior, posterior, medial, and lateral directions **[1]**.

5.1.1. WIDE: Talent placing sensors

5.2. **Jiecong Li**: Be sure to take care when placing the hosiery onto the artificial leg, as the sensor is very soft and may become folded and damaged during the dressing process **[1]**.

5.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

5.3. In the measurement software, select the appropriate serial port **COM** (com) and set the minimum threshold value as **0** **[1]**.

5.3.1. SCREEN: screenshot_3: 00:13-00:20

5.4. Click **Start Measurement**. A 1-4 real-time channel will display the pressure data **[1]**.

5.4.1. SCREEN: screenshot_3: 00:32-00:39 *Video Editor: please emphasize top four graphs with green data lines in right of frame*

5.5. When the pressure is stable, click **Stop Measurement**. The software will automatically export the pressure data **[1]**.

5.5.1. SCREEN: screenshot_3: 00:40-00:45 **TEXT: Repeat for each section of hosiery/hosiery sample**

6. Indirect measurement

6.1. For structure parameter measurement of the compressed hosiery samples, place a directly measured sample onto the artificial lower limb **[1]** and use a tape measure to measure the total length of the sample **[2]**.

6.1.1. WIDE: Use 4.2.1. Talent placing sample onto limb
6.1.2. Sample being measured

6.2. Use a pick glass to measure the course density **[1]** and the Wales density of each divided part **[2]** and use the measuring tape to measure the circumference of each circle line **[3]**.

6.2.1. Course density being measured
6.2.2. Wales density being measured
6.2.3. Circumference being measured

6.3. When all of the structure parameter measurements have been acquired, remove the sample from the limb **[1]** and measure the circumference of each circle line **[2]** and the course and Wales densities of the undressed sample **[3]**.

6.3.1. Talent removing sample
6.3.2. Circumference line being measured
6.3.3. Course or Wales density being measured

6.4. To acquire a thickness measurement, smooth a compressed hosiery sample onto the steel round table of the thickness gauge **[1]** and turn on the gauge **[2]**.

6.4.1. Sample being placed onto table
6.4.2. Talent turning on gauge

6.5. Let another steel round slowly fall down to press onto the sample piece **[1]**. The screen will display the thickness data **[2-TXT]**.

6.5.1. Steel round falling/pressing onto sample piece
6.5.2. Shot of thickness data **TEXT: Repeat on other CH sample regions**

6.6. To perform a tensile experiment, first cut the compressed hosiery sample along the marked circle lines **[1]** and clamp one piece of sample into the tensile testing instrument **[2]**.

6.6.1. Talent cutting sample
6.6.2. Talent clamping piece

6.7. Next, open the software of the tensile instrument **[1]** and enter 5 Newtons as the initial tension, 60 millimeters/minute as the tensile speed, and 200 millimeters as the initial tensile length **[2-TXT]**.

6.7.1. Talent opening software
6.7.2. SCREEN: screenshot_4: 00:05-00:15 **TEXT: Leave other fields at default settings**

6.8. When all of the measurement parameters have been set, click **START** **[1]**.

6.8.1. SCREEN: screenshot_4: 00:16-00:21

6.9. The computer will export the real-time stress and strain on the screen **[1]** and the tensile experiment will automatically stop when the compressed hosiery piece is broken **[2]**.

6.9.1. SCREEN: screenshot_4: 00:22-01:21 *Video Editor: please speed up*
6.9.2. SCREEN: screenshot_4: 01:22-01:25

6.10. Then replace the broken piece of sample with a new sample piece for the next round of testing **[1]**.

6.10.1. Talent removing/replacing sample

Section – Results

7. Results: Representative Pressure Characteristic Measurements

7.1. The course density of the fabricated compressed hosiery sample gradually increases from the knee to the ankle **[1]**.

7.1.1. LAB MEDIA: Figure 2A *Video Editor: please sequentially emphasize data lines from bottom to top of graph*

7.2. In the fabrication process, the graduation affects the sinking depth of the needle **[1]**. Thus, the compressed hosiery samples fabricated with the highest graduation value **[2]** demonstrate the lowest Wales densities and vice versa **[3]**.

7.2.1. LAB MEDIA: Figure 2B
7.2.2. LAB MEDIA: Figure 2B *Video Editor: please emphasize bottom three data lines from bottom*
7.2.3. LAB MEDIA: Figure 2B *Video Editor: please emphasize top three data lines from bottom*

7.3. The use of an elastic motor has a significant effect on the circumference and cross density of the divided parts **[1]**, while graduation exerts a significant effect on the Wales density **[2]**.

7.3.1. LAB MEDIA: Table 2 *Video Editor: please emphasize 0.0302 and 0.0466 data cells*
7.3.2. LAB MEDIA: Table 2 *Video Editor: please emphasize 0.0025 data cell*

7.4. Here representative pressure data obtained from direct **[1]** and indirect measurements can be observed **[2]**.

7.4.1. LAB MEDIA: Figure 3 *Video Editor: please emphasize open circle data lines*
7.4.2. LAB MEDIA: Figure 3 *Video Editor: please emphasize open triangle and asterisk data lines*

7.5. From the ankle to the knee, the exerted pressure magnitude of all of the compressed hosiery samples gradually declined **[1]** and it is clear that the cylinder model measurements **[2]** slightly deviated from the direct measurements **[3]**, indicating that the predicted pressure data from the cylinder model was inconsistent with the measured pressure **[4]**.

7.5.1. LAB MEDIA: Figure 3 *Video Editor: please sequentially emphasize Part 1 data points to Part 5 data points*
7.5.2. LAB MEDIA: Figure 3 *Video Editor: please emphasize triangle data lines*
7.5.3. LAB MEDIA: Figure 3 *Video Editor: please emphasize circle data lines*
7.5.4. LAB MEDIA: Figure 3

7.6. To further quantitatively study the differences between the cone and cylinder models, the Spearman correlation method can be used **[1]**.

7.6.1. LAB MEDIA: Figure 4

7.7. For example, in this analysis, the correlation coefficient between the cone model and the measured pressure was higher **[1]** than correlation between the cylinder model and the measured pressure **[2]**, indicating that the cone model is a better model for predicting the pressure characteristic than the cylinder model **[3]**.

7.7.1. LAB MEDIA: Figure 4 *Video Editor: please add/emphasize Coefficient=0.9914 text*

7.7.2. LAB MEDIA: Figure 4 *Video Editor: please add/emphasize Coefficient=0.9221 text*

7.7.3. LAB MEDIA: Figure 4

Section - Conclusion

8. Conclusion Interview Statements: (Said by you on camera) - All interview statements may be edited for length and clarity.

8.1. **Guangwu Sun**: The samples should be knitted or woven and not acquired commercially **[1]**.

8.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera (Step: 3.2.)

8.2. **Yu Chen**: The pressure can be measured on human skin. The results will differ from those measured for the artificial leg, as the former provides a softer surface than the latter **[1]**.

8.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

8.3. **Yu Chen**: The cone model more accurate than the cylinder model. Therefore, future compression garment pressure measurements should be performed directly on the cone model **[1]**.

8.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera