3.2.3 Assembly of the THOR-LX / HIIIr Unit to the Knee

The following procedure is a step-by-step description used to install the completed THOR-LX / HIIIr to the knee assembly. This unit was designed to be installed on the Hybrid III 50% male knee assembly which has been upgraded to the ball bearing slider, as specified in the drawing package and bill of materials. The numbers provided in ( ) refer to a specific drawing / part number of each particular part. The numbers noted in { } after the bolt size indicate the size of the hex wrench required to perform that step of the assembly. All bolts should be tightened to the torque specifications provided in Chapter 2.

1. Insert the modified THOR-LX / HIIIr knee skin (T1KNS010) onto the knee assembly prior to attaching the knee clevis.

2. Rotate the inboard and outboard Knee Slider Assemblies to position the slider base toward the femur load cell mounting hole, as shown in **Figure 3.40**.

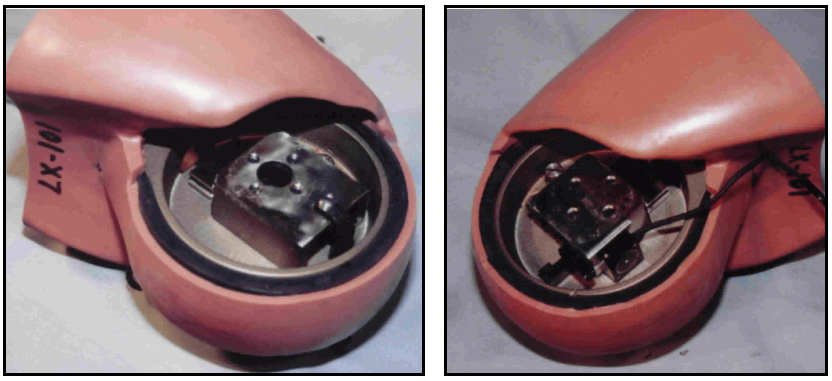

Figure #3.40 - Ball bearing slider positioning for the right knee assembly (outside view / inside view)

3. With the foot oriented in the correct position, and the tibia at right angles to the axis of the femur, slide the Knee Clevis over the rotary knee blocks of the ball bearing slider assembly, as shown in **Figure 3.41**. The knee shear string pot wire is routed out through the hole in the side of the clevis and secured with a strain relief as shown.

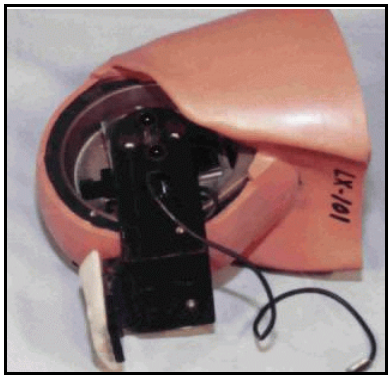

Figure #3.41 - Knee Clevis

4. Attach the knee clevis to the slider mechanism using two 1/4-28 X 3/8" FHSCS on each side of the clevis. These bolts are placed in the vertical countersunk holes as shown in **Figure 3.41.** Position the corresponding knee cover over each side of the knee assembly and secure the covers with four 1/4-28 x 3/4" S.H.C.S. {3/16}. The screws pass through the covers, through the holes in the knee clevis and into the ball bearing slider block, as shown in **Figure 3.42** for the outside and inside of the right knee assemblies.

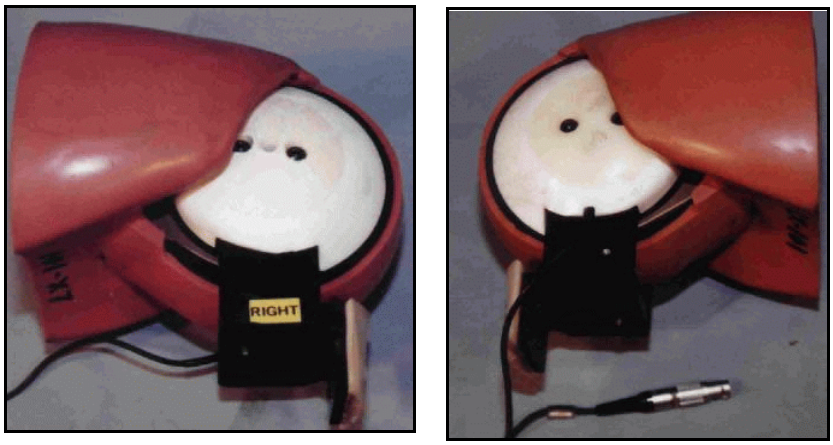

Figure #3.42 - Knee Covers

NOTE: WHEN THE LOWER LEG IS ATTACHED TO THE KNEE, THE KNEE JOINT SHOULD NOT EXCEED THE NORMAL RANGE OF MOTION OF A HUMAN KNEE. IF THIS OCCURS IT INDICATES THAT THE KNEE SLIDER MECHANISM WAS NOT PROPERLY POSITIONED AS DESCRIBED IN STEP #2. DETACH THE LOWER LEG FROM THE KNEE ASSEMBLY AND ROTATE THE KNEE SLIDER ASSEMBLIES TO GIVE PROPER RANGE OF MOTION.

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5. Repeat the procedure for the Left Lower Extremity Assembly.

6. The completed THOR-LX / HIIIr Assembly is shown in **Figure #3.43.**

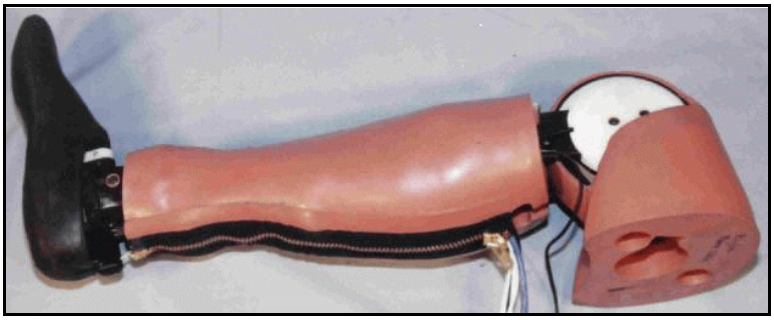

Figure #3.43 - Completed THOR-LX / HIIIr Assembly

3.3 Adjustments for the THOR-LX / HIIIr Assembly

The THOR-LX / HIIIr assembly was designed with an adjustable Achilles Tendon Cable which can change the engagement point of the Achilles relative to the ankle rotation angle. The THOR-LX / HIIIr was designed to have a neutral position (zero resistive torque in the ankle joints) at an angle of 15 degrees in plantar flexion. The motion of the foot from this neutral position to zero degrees dorsiflexion (tibia and foot are perpendicular) was designed with a minimum torque contribution from the Achilles tendon. This initial 15 degrees of rotation is allowed by the soft foam compression element of the Achilles Spring Tube. At the position of zero degrees dorsiflexion, the soft foam element must be fully bottomed and the Compression Spring should begin to load. The following steps will describe the correct preliminary adjustment of the Achilles Spring Cable tension. Further fine tuning of this adjustment may be required for dynamic performance response - this procedure is designed to set the nut in the correct general position.

Equipment Needed:

1. THOR-LX / HIIIr Unit
2. Voltmeter and Power Supply
3. Handheld Digital Scale (0-50 lb capacity, 0.1 lb resolution)
4. Calibration Cable Loop (T1CEM410)

1. Securing the lower leg to a stationary fixture will make the calibration much easier to perform. The leg can be secured by bolting the upper tibia load cell to a rigid structure.

2. Adjust the power supply to provide an excitation of 10.00 +/- 0.05 V. Connect the Ankle Y Rotary potentiometer to the power supply, and use the volt meter to monitor the Output signal from the potentiometer.

3. Loosen the the #4-40 x 1/8" Nylon Tipped SSS in the Achilles Retaining Nut to allow the nut to be adjusted. This was shown in **Figure 3.19**

4. Remove the foot skin from the dummy s foot to expose the carbon fiber foot plate.

5. Position the foot in the neutral position of 15 degrees plantar flexion as shown in **Figure 3.44**. Adjust the Achilles Retaining Nut to remove the slack from the cable and the spring tube assembly. The soft foam compression element should have a very small amount of compression at this time - just touching.

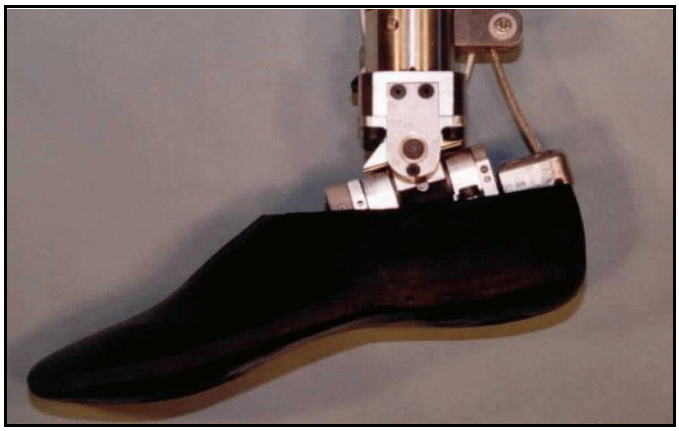

Figure #3.44 - Neutral position of foot

6. Pass the Achilles Cable Calibration Loop (T1CEM410) through the calibration hole in the toe section of the foot plate - the swaged end should rest on the inferior aspect of the sole plate. Attach a hand held force scale (accuracy: +/- 0.2 lbf) to the calibration loop, as shown in **Figure 3.45.**

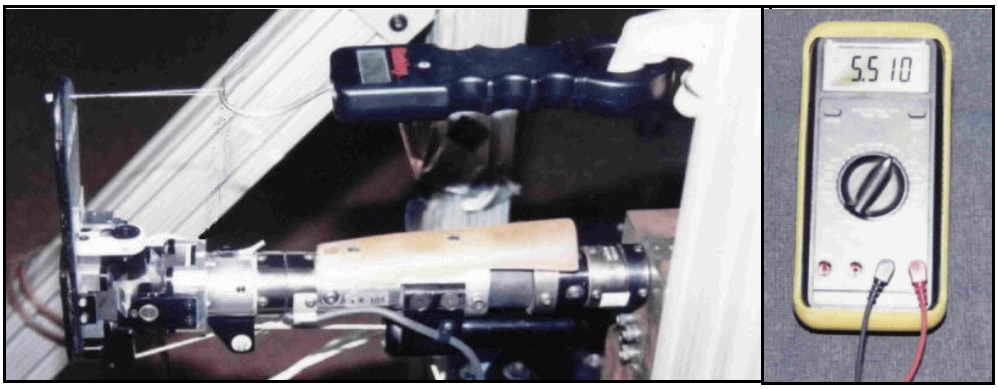

Figure #3.45 - Calibration of Achilles Cable Nut

7. Pull on the hand-held force scale until the foot is in the calibration position - perpendicular to the tibia assembly (0 degrees dorsiflexion or plantar flexion), as shown in **Figure 3.45**. This position is verified by matching the Ankle Y potentiometer reading with the calibration value provided by the zeroing procedure in **Section 3.4.1**. The ankle Y potentiometer reading is measured with the voltmeter (5.51 V in the example photo). The reading on the force scale should be 17.5 +/- 1.0 lbf. Adjust the position of the Achilles nut to achieve the desired force setting.