

Reciprocating Gait Orthosis

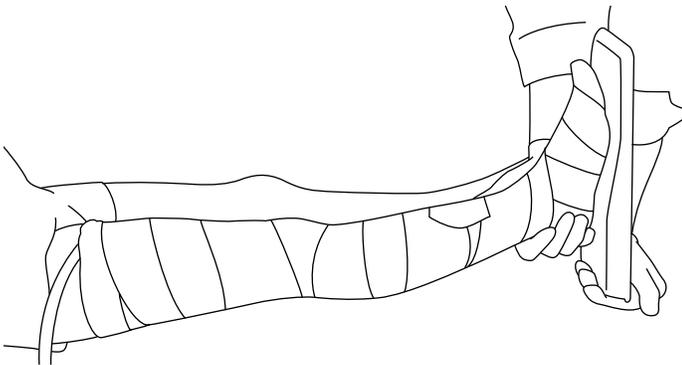
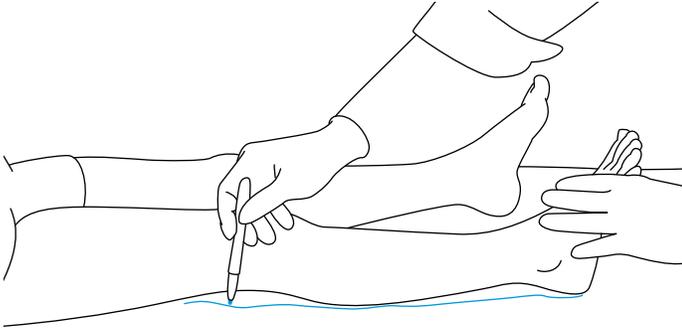
Casting & Fabrication Manual

Fillauer®

Fabrication of the RGO

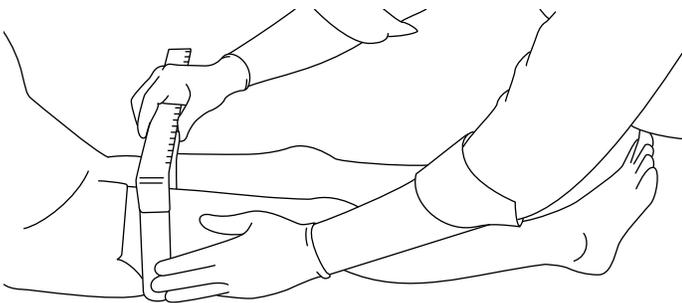
Casting and Measurement of the Patient

A profile tracing is made on paper in the conventional manner with the patient supine from the axillary to the soles of the feet. It is important that the pencil be maintained in the vertical position during the entire process.



Anatomical Measurements of the Patient

Measurements of the circumferences, diameters, and lengths of indicated anatomical parts are recorded on an orthometric chart. Calipers should be used to measure diameters, which should be compared with the appropriate dimensions on the tracing.



Impressions of the extremity from toe to perineum are made of each lower limb with the patient in a supine position. A right angle casting board is used to maintain the ankles in the neutral position with allowance for heel height. Ankle inversion or eversion, toe-out, and knee valgus or varus are corrected to the extent possible.

Surgical tubing is applied along the anterior surface of the leg to permit safe use of the cast cutter when the cast is removed. Cotton stockinette is used to protect the skin and facilitate removal.

The medial and lateral areas about the thighs are flattened so that a minimum of modification of the positive model will be needed for the finished orthoses to provide the M-L stability desired.

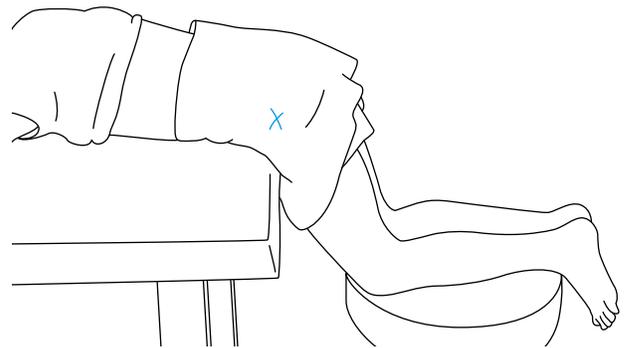
When set, the casts are removed in the usual fashion.

Impression taking of the Lower Torso

Although prefabricated aluminum pelvic bands have been used successfully on the least complicated patients, most patients are better served by use of a molded plastic pelvic girdle. For this application, a mold of the posterior pelvic section is required.

The impression is best taken with the patient positioned over the end of a table. Placement of the hip joints is crucial to the success of the orthoses.

When the patient is positioned on the casting table, normally a 45 degree angle from the edge of the table top should bisect the hip axis, but this may not prove to be realistic on some paralytic patients.

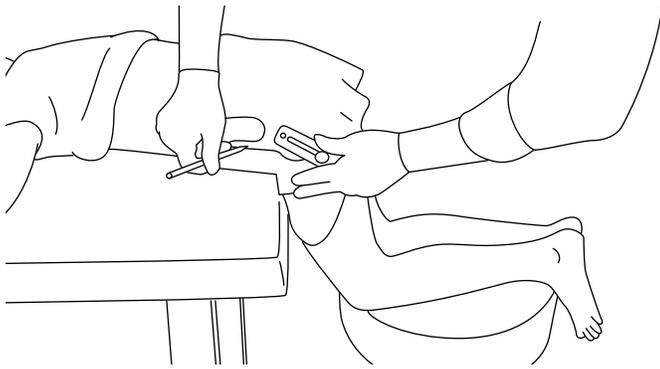


The patient is placed on the table with both upper thighs contacting the table. The knee position of 90 degrees (Shin portion should be parallel to the floor) adjusted so that the buttocks are raised to a point where a normal lordotic curve is present.

The medial-lateral diameter of the pelvis from trochanter to trochanter is measured (a 16 in. M-L gauge is now available for this purpose) and recorded.

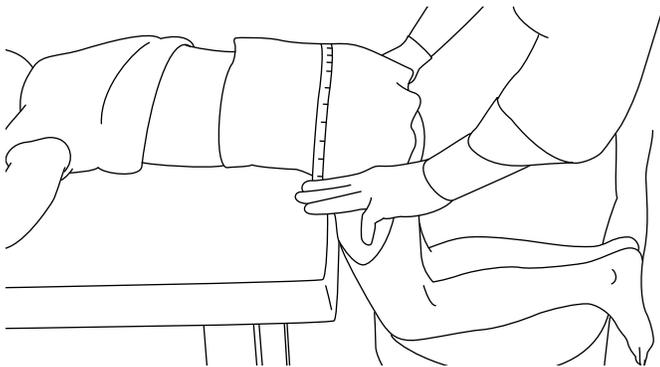
A piece of cotton stockinette is cut off the roll and split along the crease. The resulting single layer of stockinette is draped

over the torso and tucked under the patient anteriorly. The superior and anterior edges of the greater trochanters are marked. The intersections of the two lines identify the hip joint axis.



The template is moved to the other side and location of the hip joint center on the patient is compared with the hip joint center registered on the template. The template and patient are adjusted and shifted until symmetry is obtained. The template is set aside for later reference.

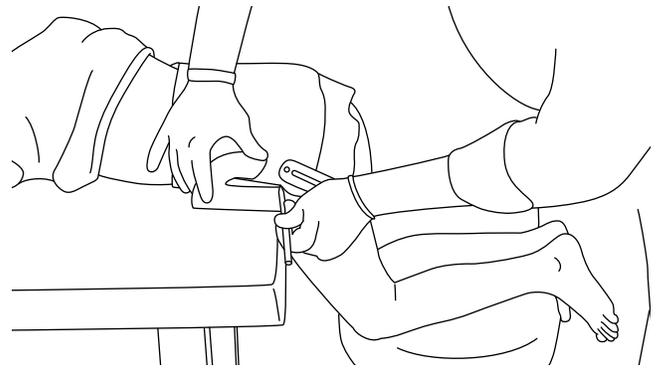
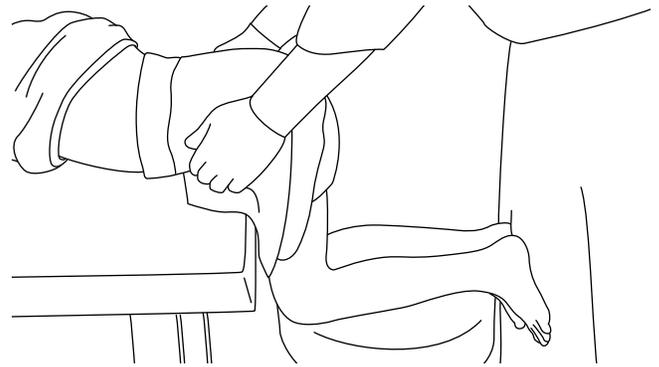
A tape measure is used to measure the distance from ASIS to ASIS, plus an allowance of 2 in. on each side.



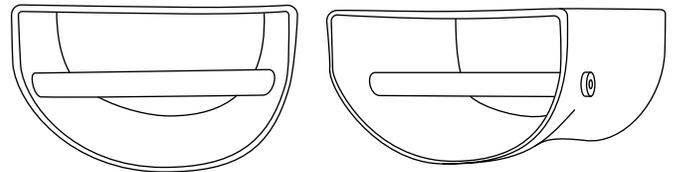
A plaster splint 8 in. wide, 9 layers thick, and the length described above is cut.

The splint is moistened, draped over the patient, and smoothed into place. This splint should extend from just distal of the hip joint marks proximal to the waist. On large individuals, an additional splint may be necessary to gain sufficient height.

The template is used to mark on the exterior surface of the impression, the previously established hip joint center, first on one side and then the other. The superior edge of the template is used to establish a vertical reference line on each side to be used later for location of the thoracic extension bars.



When set, the impression is removed from the patient and checked. Location of the hip joint axis can be checked by inserting a wire rod through the marks on the outside of the cast. At this time, if desired, excess material can be trimmed from the cast in accordance with the following criteria:

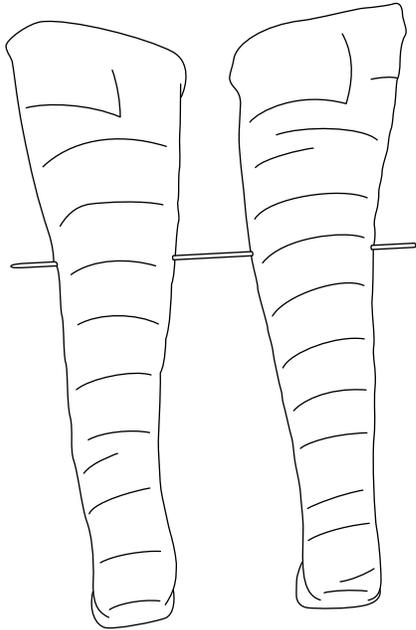


1. Distally, the finished pelvic girdle will be trimmed horizontally just below the level of the hip joint center. Therefore, the cast should extend 1 - 1 ½ in. distal of the hip joint axis.
2. The height of the lateral sides superior to the hip joint center will be about 60% the M-L diameter at the greater trochanters and posteriorly dip about 1 - 1 ½ in. The superior border of the positive model should be flared out for patient comfort before the cast is filled.
3. At this time, the anterior edges are left untrimmed. Eventually the anterior proximal edge will extend about 2 in. anterior of the lateral line through the hip joint center. Below the level of the abdominal strap, the anterior edge is trimmed back in a smooth curve to around the hip joints.

Note: If the impression is to be shipped for central fabrication or if it will be some time before it will be poured, it should be reinforced. In addition, the proper M-L should be established and maintained with tape or a splint across the front.

Preparation of the Negative Impression

A wire rod is inserted through the knee centers of both casts to check the relationship between the two, especially with respect to height, rotation, and angulation. Any obvious deficiencies in ankle or knee attitude should be corrected in the negative casts, rather than attempt to modify the positive model.



When joints are to be used on each side of the knee, an alignment fixture is installed at the knee axis to serve as a spacer, and also to ensure that proper alignment of the joints is maintained throughout the fabrication process. For offset knee joints, the spacers are located accordingly. Usually $\frac{1}{8}$ – $\frac{3}{16}$ in. clearance is allowed on the lateral side and $\frac{3}{16}$ – $\frac{1}{4}$ in. on the medial side. The joint spacer for the pelvic girdle is increased in diameter ($\frac{1}{2}$ in. for children and $\frac{3}{4}$ in. for adults) over the recorded M-L diameter of the pelvis to allow for the thickness of the plastic and for clearance over the trochanters.

Distal of the malleoli, the buildup blends into the dorsum of the foot. These buildups render the medial and lateral walls of the completed orthoses parallel, making it easier for the patient to don the orthoses. In addition, they provide flat surfaces for attachment of the uprights and minimize difficulty with distortion of the plastic and adjusted to the p-L and to assure that the spacers protrude an appropriate amount on each side of the casts.

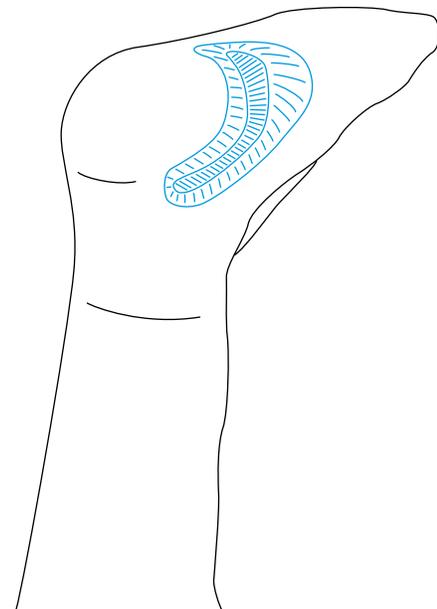
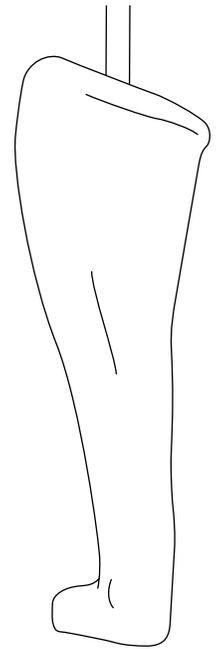
Modification of the Positive Models

The casts are prepared and poured with plaster in the usual fashion. Commonly, we of Fillauer use a mixture of plaster and Zonolite®1 to produce lighter models with superior working characteristics. Once the positive models are stripped, the measurements recorded on the orthometry

chart are used to check the accuracy of the models. Where appropriate, the models are brought into compliance with the dimensions.

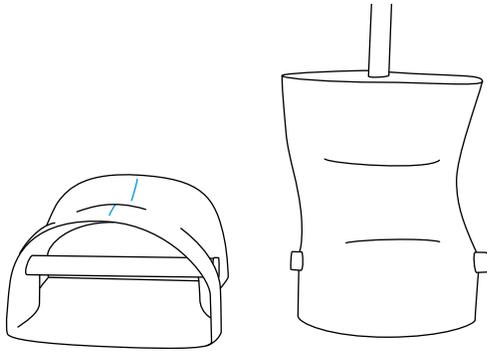
The plantar surface at and just posterior to the metatarsal heads and at the heel is flattened precisely perpendicular to the vertical.

The foot portions of the positive models are modified according to Carlson (1) for control of the subtalar joint. The positive model is smoothed and the M-L dimension at the metatarsal heads is “brought to measurement.” Plaster is removed aggressively in the posterior aspect of the longitudinal arch so as to provide the pressure needed for direct support of the calcaneus in the area of the sustentaculum tali.



Proximally, the positive models are modified and smoothed in the usual fashion. Malleoli, fibular heads and other sensitive areas are built up as appropriate, with relief. The posterior plaster for pressure surface of the thigh is flattened slightly and with the recorded measurements as a guide outwardly flaring radii are created at the proximal medial and proximal posterior trimlines of the thigh $1\frac{1}{2}$ – 2 in. distal to the perineum. Anterior of the medial and lateral midlines and from the malleoli proximal, the surfaces of the positive models are built up flat and tangential to the surfaces at the medial and lateral midlines (Fig. 1). The buildups should extend anteriorly from the midlines a distance equal to

one-half the distance from the midlines to the anterior surfaces of the models. Distal of the malleoli, the buildup blends into the dorsum of the foot.



These buildups render the medial and lateral walls of the completed orthoses parallel, making it easier for the patient to don the orthoses. In addition, they provide flat surfaces for attachment of the uprights and minimize difficulty with distortion of the plastic.

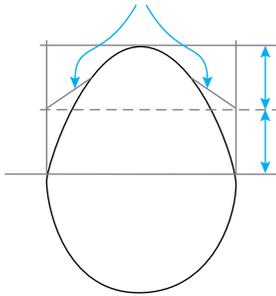


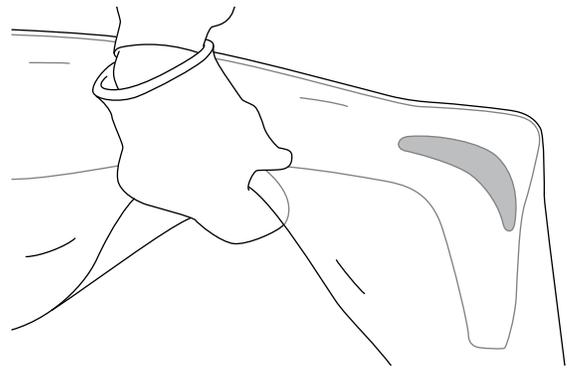
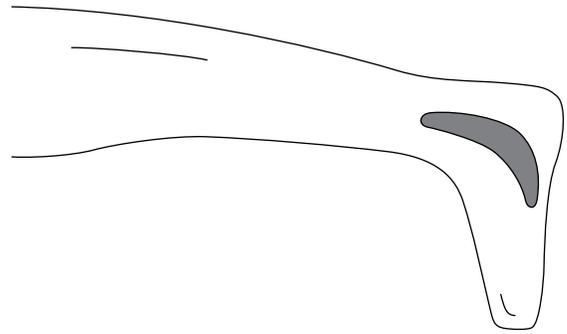
Figure 1: Cross section of a leg showing location of buildups anterior to medial and lateral midlines

The positive model of the pelvic section is modified and smoothed in the usual fashion. Note the outward flare of the posterior superior trimline.

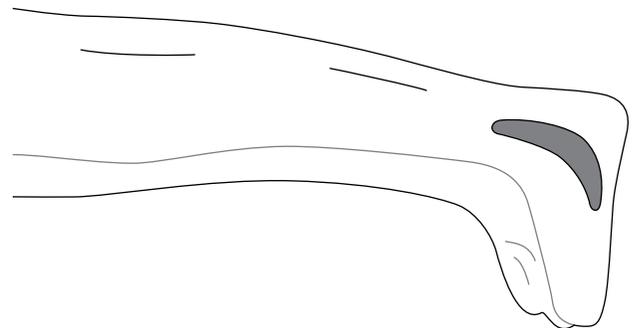
Fabrication of the KAFOs

Use of carbon composite inserts (2) such as Fillauer PolyCar-C™ or Comfil™ is recommended for reinforcement of the ankle areas to achieve total rigidity and so that the thickness of the polypropylene used in the orthosis can be kept to a minimum. A pre-cut insert of appropriate size and thickness is fastened, using “Scotch Mounts” with the beveled edges against the plaster on each side of the model. The polypropylene will flow into the area under the bevels to hold the insert in place permanently (Fig. 2).

The positive models of the legs are set up for hand draping and vacuum forming of sheet thermoplastic in the usual fashion. Polypropylene either 1/8 in. or 3/16 in. thick, depending on the patient’s size, is heated and molded to the models.



Care should be taken that the polypropylene is sufficiently hot and the trapped air is evacuated fast enough to ensure that the carbon composite inserts are properly encapsulated by the plastic. Proper results have been achieved when the plastic surrounding the inserts presents a well sculptured appearance.



When cool, the polypropylene thigh and shank sections are trimmed to initial trim lines. The uprights are formed and trimmed to the proper length, and fastened to the thigh and shank sections by #4-40 machine screws and nuts. Velcro closure straps are added in the usual fashion. A tongue in the thigh section of A-30 extra firm Pe-Lite™ is recommended. The distal border of the tongue, immediately proximal to the patella, should be flared.

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