

## Orthotic Management for Genu Recurvatum and Genu Varus

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“Necessity is the mother of invention.” In this particular case study, the patient refused to have surgery and anti-inflammatory drugs were ineffective. We turned to orthotic management as a solution to the problem.

The patient is a 60-year-old white female, registered nurse who had genu varus on the right side and bilateral genu recurvatum, more severe on the left (Fig. 1). She had had these problems all her life but they had been getting worse gradually. This condition posed no problem until 1968 after a ten-mile hike. Because she thought that her knee pain was the result of not being in condition, she repeated the same prolonged walk the following day. When the pain did not abate, she sought medical care, and being a military dependent, was seen at a government installation.

Blood studies ruled out rheumatoid arthritis or other collagenvascular diseases. Her sedimentation rate was elevated slightly with a Westergren of 25mm/hour (normal 0-20). Her x-rays shows minimal degenerative arthritic changes and generalized osteoporosis. She was placed on aspirin, 10 mg 6 times per day. This made her more comfortable but did not resolve the basic problem. She had to limit her standing and walking time, but she could sit, climb



Fig. 1. White female patient, 60 years of age, with genu varus on the right and genu recurvatum on both sides.

stairs, and ride a bicycle in relative comfort. Other anti-inflammatory drugs were tried, but none were found to be superior to aspirin.

The patient's past contributory history included a total hysterectomy with bi-lateral salpingo-oophorectomy in 1958 for a positive Panicolaou smear, after

which osteoporosis developed. Her general physical status was relatively good except for hypertension. She was on diuretics which apparently maintained relatively good control. However, she did have an elevated chloesterol count infrequently, and was extremely allergic to many materials which was manifested by skin

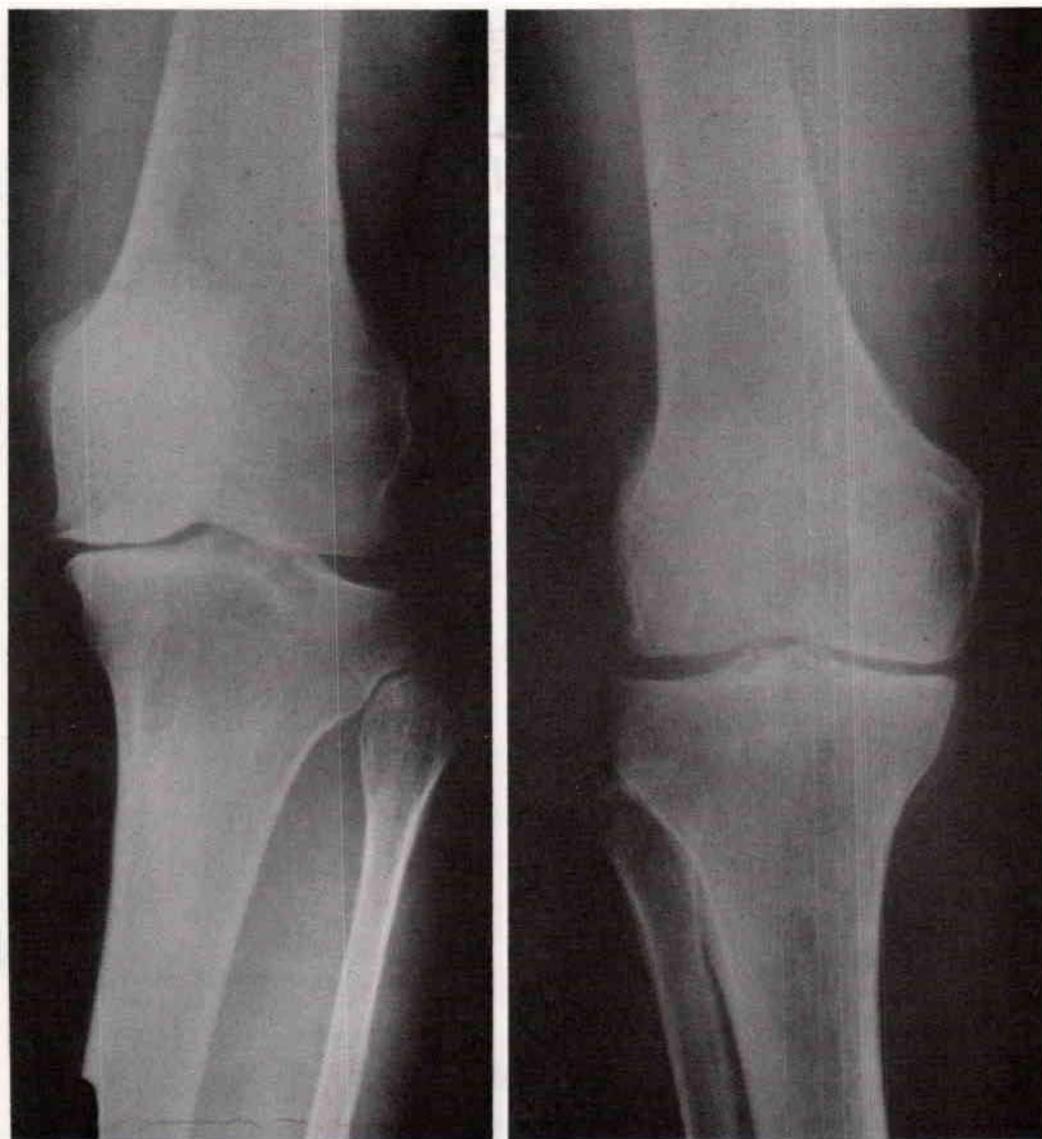


Fig. 2. Two X-Ray views of patient in 1976.

lesions.

Because her tolerance for standing and walking decreased continually, her physicians felt that she should consider total knee replacements as the best resolution of the problem. This she refused to do, and consulted one of the authors for an alternative solution. At this time a prescription was given for orthotic management, which was taken back to the military installation, but they refused to honor it because they felt that this would not resolve her problem. Surgery was still recommended. The patient continued on aspirin and gradually decreased her walking time until she was re-evaluated at Georgetown University Hospital in 1976. New x-rays were taken at that time which showed further deterioration of both knees with more spur formation and further narrowing of the joint space (Fig. 2). By this time she could not stand or walk without outside support. Her total standing and walking for the day was probably limited to one hour. She was on 60 mg of aspirin in divided doses throughout the day, and could not tolerate being out of bed without this medication. It was at this juncture that she decided to go ahead with the orthoses on her own as she still refused to consider surgery.

The patient was referred to the Orthotics-Prosthetics Service at The Fairfax Hospital. Bilateral moulded plastic knee-ankle-foot orthoses with recurvatum and genu varus control were recommended. Free offset knee joints  $\frac{1}{4}$ -inch (0.62 cm) thick polypropylene was used for both the above-knee and below-knee sections. Polypropylene was selected because of its low cost, light weight, good cosmetic appearance, interchangeability of shoes, and the fact that she was not allergic to this material. To obtain free ankle motion the plastic ankle-foot complex was moulded and trimmed appropriately.

### Fabrication

Two layers of tube gauze to reach from the distal tip of the toes to the groin were pulled over the entire right leg. Bony landmarks were outlined with an indelible pencil. A vinyl tube or a 1-inch (2.5 cm) elastic webbing was placed down the entire anterior section of the leg. The patient was in sitting position with legs over the edge of the treatment table. One roll of elastic plaster bandage followed by one roll of standard plaster bandage was applied to the foot and lower one-third of the leg. The foot was placed on a standard footboard with approximately 5 degrees of plantar flexion (Fig. 3). After this section was set the patient was placed in the supine position with the right side

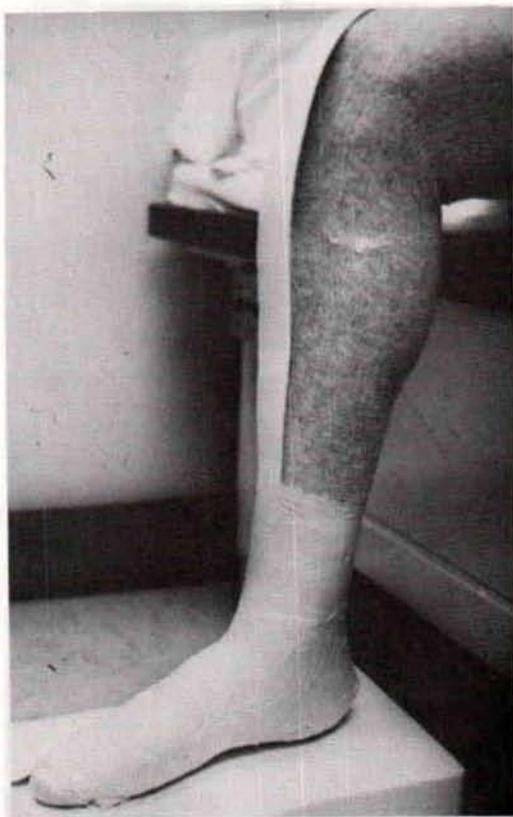


Fig. 3. A standard footboard is used to achieve the desired attitude of the ankle during casting.

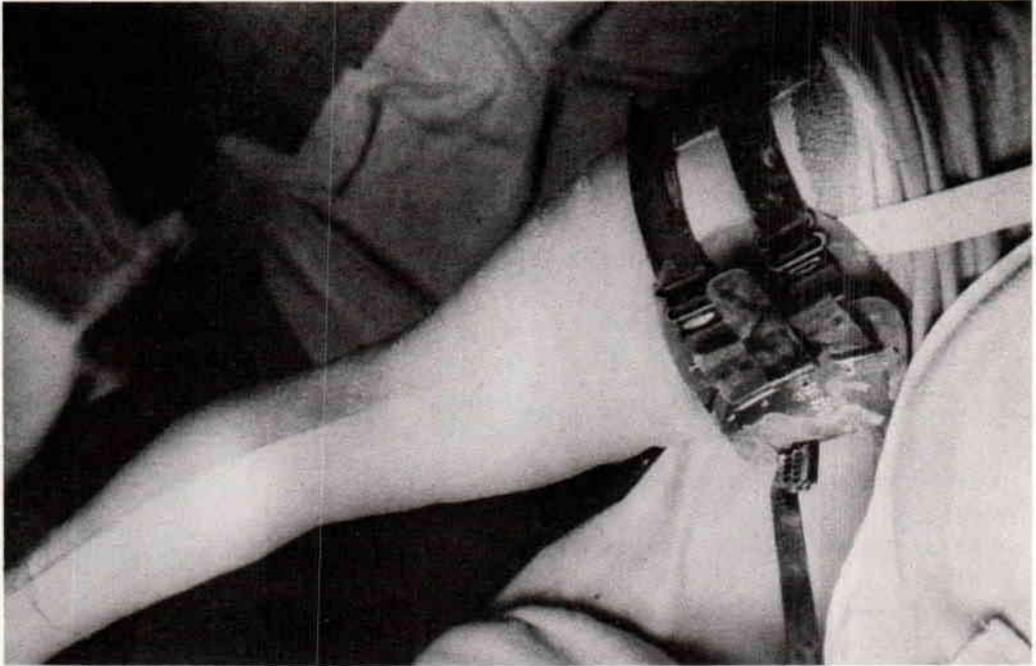


Fig. 4. An NYU above-knee prosthetics casting brim is used for casting of the thigh section.

of the body very close to the edge of the treatment table and on a slight angle to allow wrapping of the entire leg and prevent any abduction of the thigh. A New York University prosthetics casting brim<sup>3</sup> was used to form the proximal section (Fig. 4). This gave a quadrilateral shape that prevents rotation about the thigh section.

After the cast was set, it was removed with a cast cutter in the conventional manner. The same casting procedure was used for the left lower limb.

The following measurements were taken bilaterally: 1) medial-lateral dimension of the knees, 2) circumference at ischial level, 3) length from the perineum to the plantar surface of the foot, and 4) the distance between medial-tibial plateau and the plantar surface of the foot.

The casts were resecured along the cut seam with staples, plaster strips were applied along the seams to avoid breakage. A Pope alignment jig<sup>4</sup> of the appropriate medial-lateral measurement was inserted at the knee center and slightly posterior of each cast. The casts, after being slushed with a soap solution to act as a parting agent, were filled with a plaster-of-Paris slurry. A 1/2-inch (1.25 cm) water pipe coated with Vaseline was inserted anterior to the Pope jig to coincide approximately with the long axis of the leg. While the plaster was setting the water pipe was turned slowly to facilitate removal later. The negative wrap was removed and the indelible pencil marks were reinforced as necessary.

Basically, the modification of the cast in the above-knee section was a quadrilateral shape with attention to flat medial

and posterior walls. Bony landmarks—head of fibula, malleolus, navicular, and achilles tendon—were provided with the necessary reliefs. Particular attention was paid to the fibula head and to the area of the peroneal nerve. Stockinet marks were removed and both casts were smoothed. Measurements were checked during modification of the cast.

The next step was to contour the uprights to the shape of the model using the Pope jig to be sure that the uprights were square, at the appropriate height, and in the correct anterior-posterior placement

rather than  $\frac{3}{4}$ -inch (1.87 cm) uprights because of the added strength achieved with this method.

The cast was dried thoroughly in the oven before vacuum forming. The pipes and uprights were removed from the casts which were cut in half, horizontally just proximal to the end of the Pope jig.

Two nylon stockings were pulled over each plaster model, and the uprights were again secured to the model. Each section was vacuum formed with  $\frac{1}{4}$ -inch (0.62 cm) thick polypropylene (Fig. 6).

The vacuum-formed polypropylene and uprights were removed from each

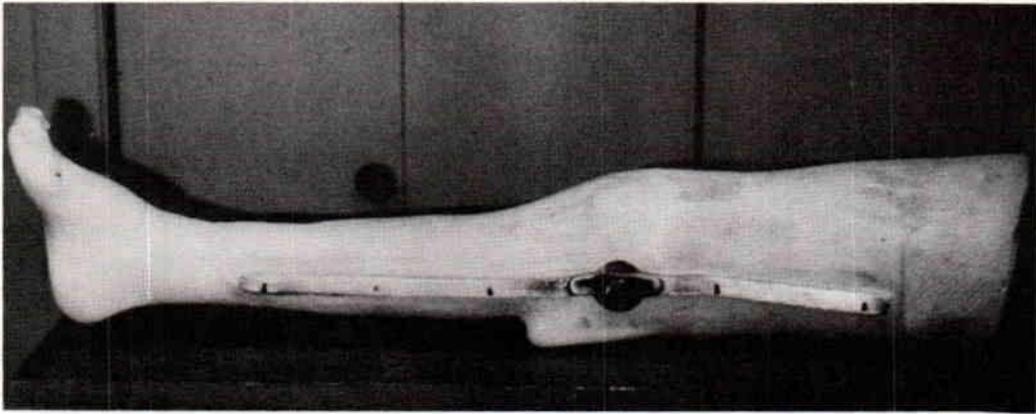


Fig. 5. Alignment of the side-bars.

(Fig. 5). Distally the length of the uprights was between two and three inches (5 to 7.5 cm) proximal to the malleolus. Any space between the cast and uprights was filled with plaster. Holes (#29) were drilled in the uprights in the thigh and calf section, and the uprights were nailed to the cast.

The uprights were placed against the cast, and, thus, inside the polypropylene. We felt this would provide control of genu varus and good cosmesis. Also we were able to use  $\frac{5}{8}$ -inch (1.56 cm)

section with a cast cutter, and then trimmed and smoothed.

The below-knee trim lines were approximately 1-inch (2.5 cm) anterior to the uprights with a single anterior-proximal 2-inch (5 cm) Velcro closure. The above-knee section encompassed the thigh medially, laterally, and posteriorly with two 2-inch (5 cm) Velcro closures anteriorly. The uprights were tapped and attached to the polypropylene shells with #8-32 screws (Fig. 7).

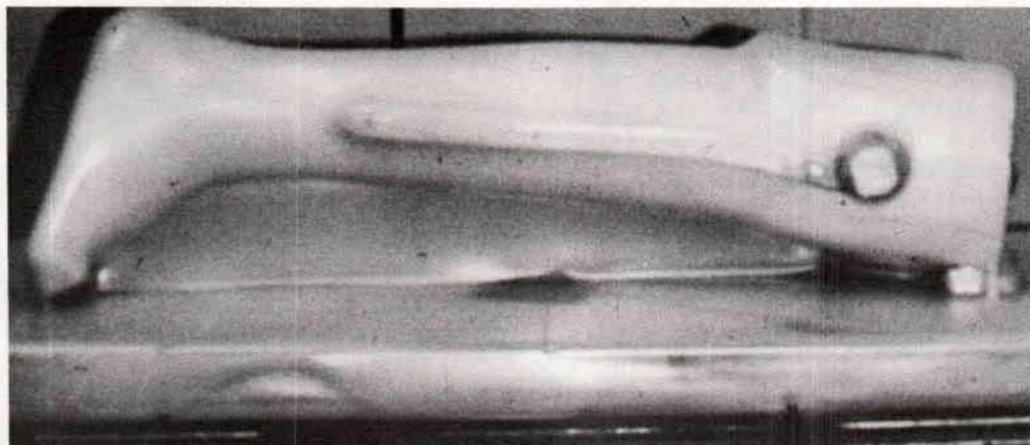


Fig. 6. The shank-and-knee portion immediately after the vacuum forming procedure.

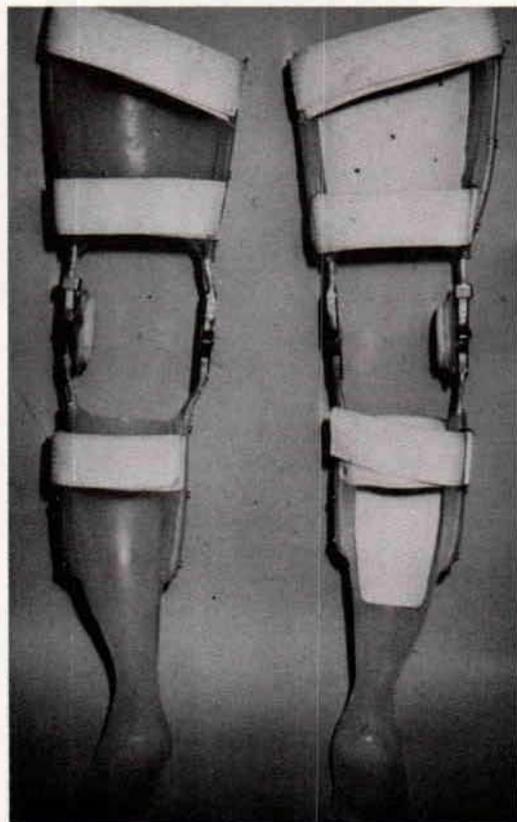


Fig. 7. Anterior view of the two orthoses.

### Fitting

The orthoses were fitted and were tolerated well by the patient. Small adjustments were made for pressure areas. After several weeks an outer knee dial was added to each orthosis for more control of genu varus (Fig. 8). In other patients with genu varus and valgus the orthotist used a vacuum-formed polyethylene control pad lined with Pelite. And, recently in some patients, because of the intimate fit achieved with the moulded plastic shells, the orthotist has been able to eliminate the need for any varus or valgus control pad or dial (Fig. 10).

At the present time the patient is wearing her orthoses from the time of rising in the morning until going to bed at night. She takes them off only when she is dressing for a formal occasion or when bicycling. She is perfectly comfortable wearing them and does not require aspirin or any other anti-inflammatory drugs. She is walking as much as she desires for her usual activities as a housewife requiring no other outside support. The

latest report that we received from her January 1, 1978 indicates that she had been out dancing on several occasions wearing her orthoses and enjoyed the entire evening.

#### Footnotes

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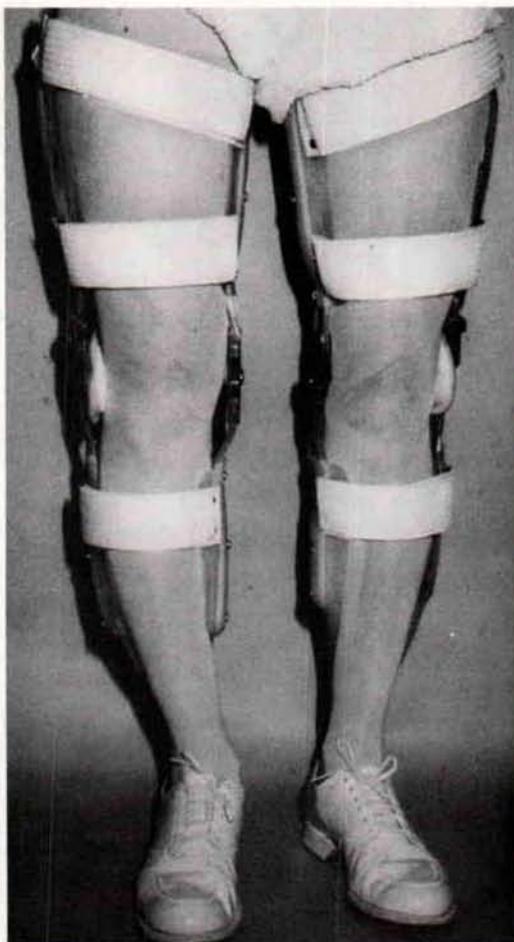


Fig. 8. Anterior view of patient with both orthoses in place.