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POLYPROPYLENE KNEE ORTHOSIS WITH SUPRAPATELLAR LATEX STRAP

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With the advent of plastics and their utilization in orthotics, continued advances have been made in the development of new orthopedic devices. Plastic orthoses are lighter in weight and usually are more acceptable cosmetically than conventional orthoses. In recent years all-plastic orthoses have been fabricated for the ankle and foot as, for example, the Texas Institute of Research and Rehabilitation polypropylene ankle-foot-orthosis (*1*), and, for the entire lower limb, the VAPC polypropylene knee-ankle-foot orthosis.

A major problem with the fabrication of satisfactory knee orthoses has been the provision of adequate suspension. This has been approached in the past in several ways:

1) Use of a waist belt and strap.

2) Use of a circumferential elastic suspension device such as an elastic knee support or the Lenox Hill derotation orthosis[3] with elastic suspension cuffs.

3) Use of a bar, or bars, extending to the shoe (i.e., Jones knee cage; double-bar knee-ankle-foot orthosis).

The polypropylene knee orthosis described here is a plastic knee support which uses the principle of the strap suspension used for the original patellar-tendon-bearing below-knee prosthesis (*2*). The VAPC plastic knee orthosis with suprapatellar latex strap provides support for the knee without involving another joint, and avoids the use of a constricting circular elastic band.

POLYPROPYLENE KNEE ORTHOSIS

The VAPC polypropylene knee orthosis is fabricated over a positive mold of the patient's knee, which provides for a very accurate and intimate fit. The basic components are:

1) Polypropylene full cuffs: 4 1/2 in.–5 in. in length at the calf and 5 in.–6 in. in length at the thigh. Closure is obtained by use of Velcro straps (Fig. 1).

2) A box joint using ring or slip locks with bars that are 3/4 in. x 1/4 in. The box joint is made of polyethylene and the pivots are made of Delrin. The orthosis provides both mediolateral and anteroposterior stability (Table 1). The placement of a latex strap across the superior pole of the patella in the manner of a PTB suspension strap prevents the orthosis from slipping distally. This was shown in clinical tests on patients.

To prevent buckling of the knee, an additional strap of one-inch wide webbing is placed across the anterior aspect of the proximal tibia as illus-

Fig. 1. Lateral and anterior views of an early model of the VAPC polypropylene knee orthosis with a suprapatellar latex strap.

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TABLE 1. FUNCTIONAL DESCRIPTION OF POLYPROPYLENE KNEE ORTHOSIS WITH LATEX SUPRAPATELLAR STRAP SUSPENSION

Lower Limb	Horizontal Displacement	Flex.	Ext.	Abd.	Add.
Hip					
Thigh	H				
Knee	Locked	H	H	H	H
	Unlocked	F	F	H	H

trated in Figure 1. Also, to provide additional security from slippage, the closing flaps on the thigh and calf cuffs are lined with a layer of 1/16-in.-thick latex. Six polypropylene knee orthoses have been prescribed and fitted by the VAPC Special Clinic Team in the past year.

Fig. 2. X-ray of knee of the subject described in the text. Note that the patella has been removed.

CASE HISTORY

The patient sustained wounds to his right knee as a result of shell fragments in 1969. He underwent several operations which included removal of the medial and lateral menisci, and eventually a patellectomy (Fig. 2).

The patient walks with a marked limp on his right side. Knee-flexion range is from 10 to 80 deg. There is marked atrophy. Beyond the 70 deg. range of motion the patient has pain. Stress testing of the medial and lateral collateral ligaments and cruciates elicits pain. Instability is not elicited.

At the time of examination the patient was using a hinged elastic knee support that was inadequate. Patient feels less pain and more security when knee is held stiff in extension. It has been suggested to him that knee fusion may be necessary. The "Lenox Hill derotation brace" was prescribed with a slip lock at the knee. It was learned later that the Lenox Hill device cannot be fabricated with a slip lock. The next step considered was a Jones knee cage. The authors, members of the VAPC Clinic Team, suggested an experimental polypropylene knee orthosis with solid polypropylene joints, slip lock and suprapatellar latex strap.

The new orthosis proved to be very satisfactory. It is all plastic except for the latex suprapatellar strap for suspension and a proximal pre-tibial strap to prevent knee flexion and to replace the knee-cap pad. Although the patella had been removed, the fibrous tissue prominence of the reconstructed quadriceps tendon produced a sufficient shelf to provide an area of suspension support for the "suprapatellar" strap. The orthosis is very cosmetic and holds its position well. The patient is extremely pleased with the results.

With the assistance of M. Danisi, C.O., and E. Lamberty, C.O., a significant improvement was made in the suspension system, and it is the one now used routinely. The new suspension device resembles the strap of the PTB prosthesis more closely as can be seen in Figures 3 and 4.

SUMMARY AND CONCLUSION

A well-fitting lightweight polypropylene knee orthosis providing mediolateral and anteroposterior stability can be fabricated without involving the hip or ankle joint. The success of this orthosis depends on its intimate fit, with thigh and calf

cuff lined anteriorly with a thin layer of latex and with a suprapatellar latex strap in the correct position.

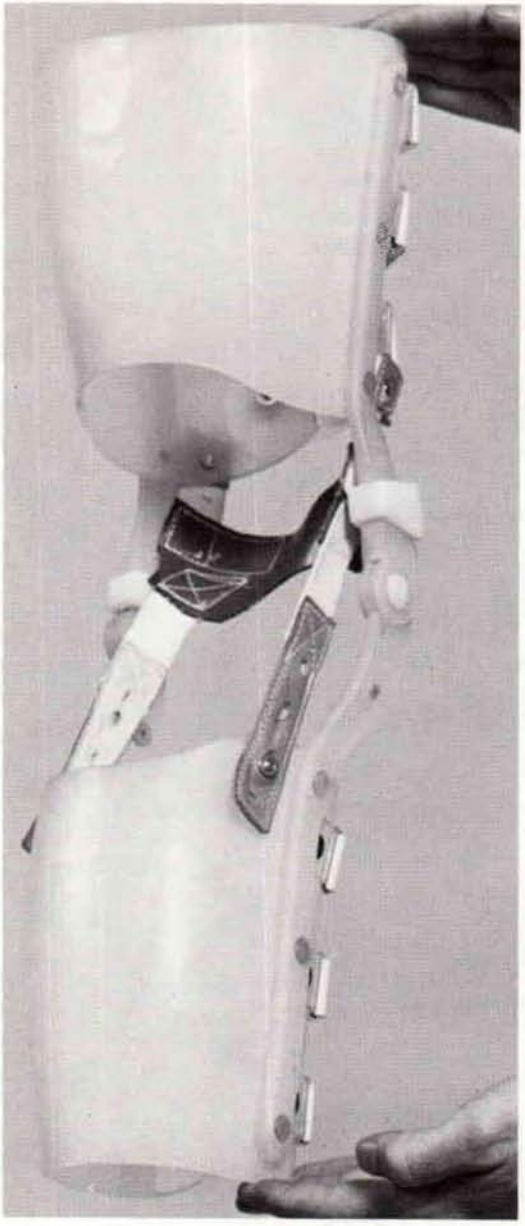

Fig. 3. Posterolateral view of current model of the VAPC polypropylene knee orthosis. Note the suprapatellar suspension strap modeled closely after the suspension strap originally designed for the first PTB prostheses.

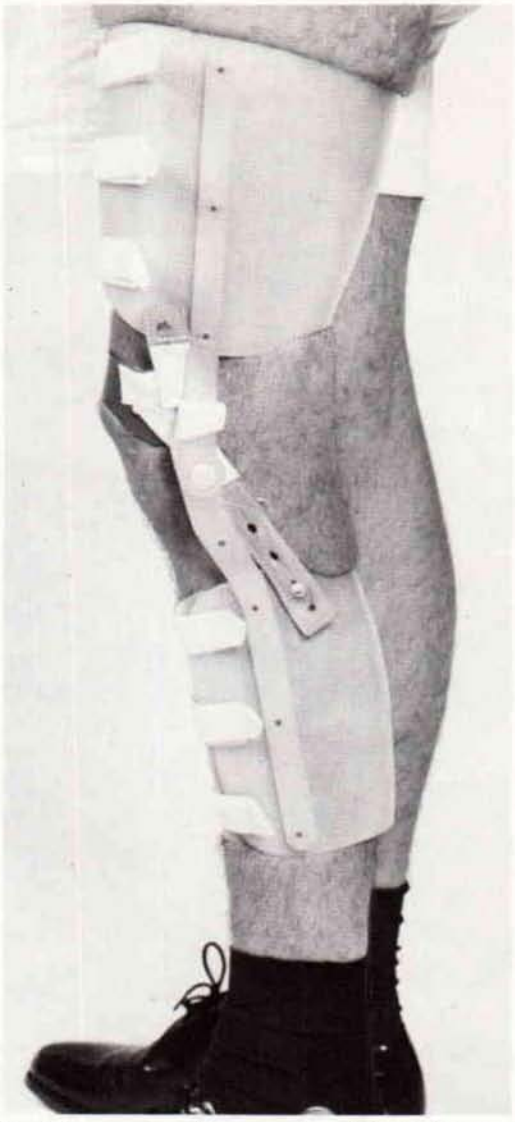

Fig. 4. Lateral view of latest version of the VAPC polypropylene knee orthosis.

LITERATURE CITED

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