

Two Way Stretch Knee Orthoses

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INTRODUCTION

As is the case with all orthotic devices, a correct fitting is mandatory in order to achieve the maximum benefit and therapeutic value. To provide a service to the patient, the orthotist must know the biomechanics of the knee joint as well as the causes and effects of various impairments to that joint. Once this is known, the correct orthosis may be selected based on its function.

THE KNEE JOINT

The knee joint is the largest, and in its construction, the most complicated joint of the human body. The joint consists of the femur articulating with tibia and patella (Figure 1). Due to the extensive flexion allowed by these joints, the articulating facets do not fit as well on each other as with other less complex joints. Therefore, there exist two menisci, medial and lateral, which act to allow the femur to track on the tibia more efficiently and, because of their elasticity, also act as shock absorbers. The menisci and other non-bony joint structures offer their most elasticity during flexion and extension in the ranges between 40° and 180° (Figure 2). It is the purpose of the knee joint to support our movements during walking, jumping, or sitting in a chair. In order for the joint to remain sturdy and stable during these motions, it relies heavily on the ligaments connecting the bony structures about the knee. These ligaments prevent the shifting



Figure 1. Cross section of knee joints showing femur, tibia, patella, and their articulating arrangement.

of the tibia on the femur. However, they do allow mild internal and external rotation of the joint during flexion (Figure 5).

KNEE ORTHOSES

It is the responsibility of the physician to recommend the correct therapeutic aid. The responsibility of the orthotist is to apply the prescribed knee orthosis such

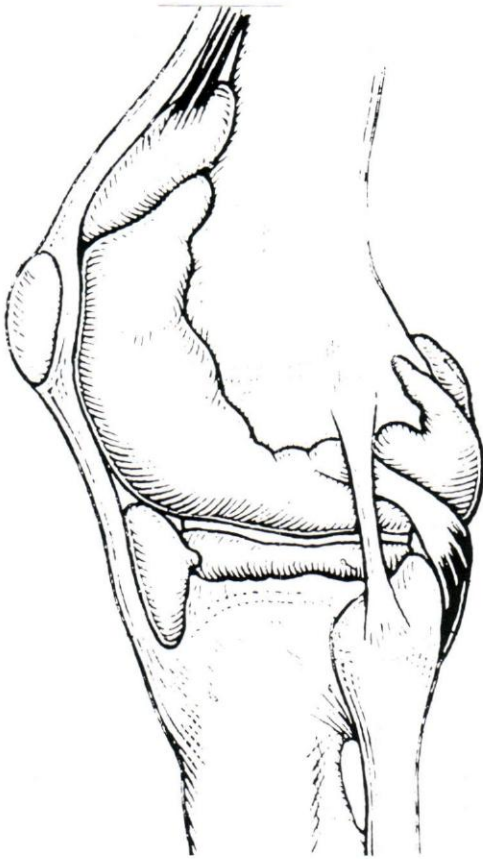


Figure 2. Lateral view of knee joint showing articular cartilage, bursas, patello-femoral ligament and lateral collateral ligament.

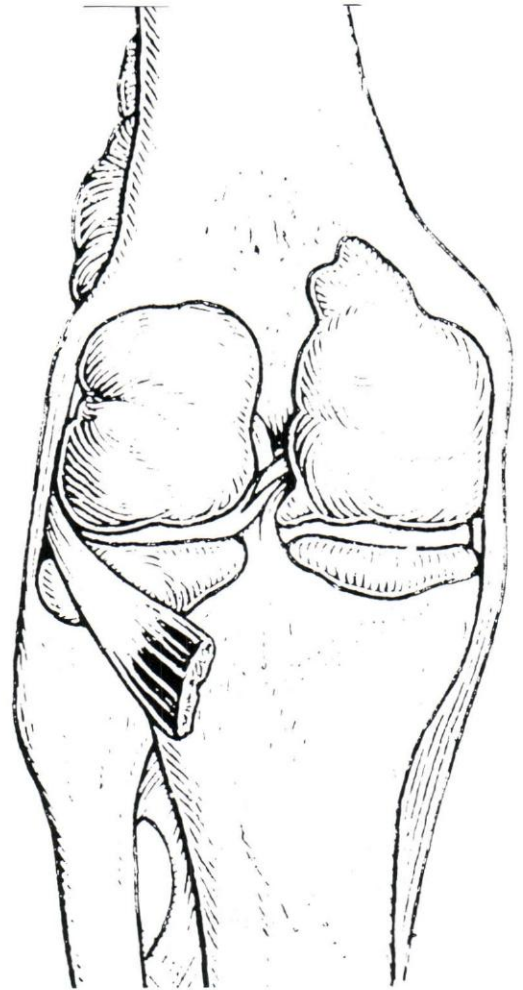


Figure 3. Posterior view of knee joint showing articular cartilage, posterior cruciate ligament, medial and lateral collateral ligaments.

that function and wearing comfort are met optimally.

The purpose of the knee orthosis is not to relieve the muscles of their function, but rather to support them during their function. If the compression rating of the elastic knee orthosis is too low; it is worthless. If the compression rating is too high, you may inadvertently cause thrombophlebitis or muscle atrophy.

Two way stretch knee orthoses, those whose elastic is bidirectional in both length and circumference, offer optimal support to the patient's impaired knee. Ideally, you would expect less stretch to occur circumferentially than in length for an optimal fit and smooth function. This is espe-

cially true for the two-way-stretch knee orthoses equipped with additional longitudinal elastic around the knee joint. Improper fit will cause the orthosis to be displaced during flexion of the joint (Figure 4). These reinforced knee orthoses are indicated for strains and sprains at the joint, following minor surgery, and as prophylactic treatment for weak ligaments.

The "Greifswald Knee Brace" was designed by the orthopaedic clinics of Greifswald and consist of two-way stretch



Figure 4. Elastic knee orthoses with reinforced elastic at the knee joint.

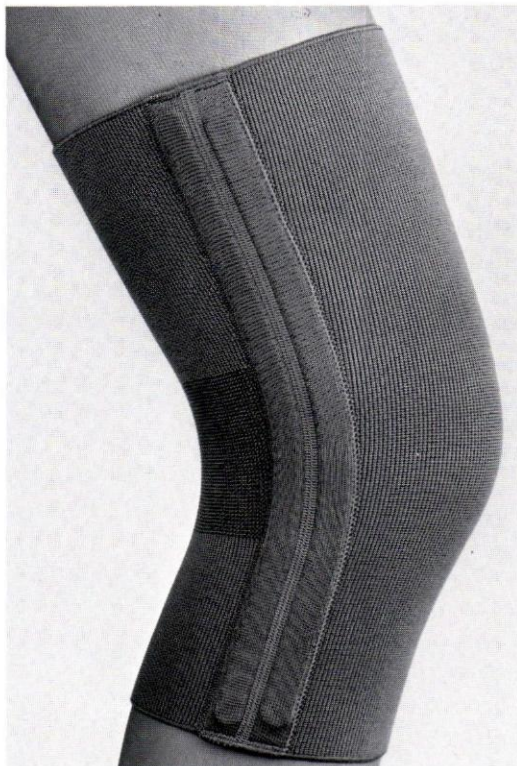


Figure 5. The Greifswald knee brace.

material with coil springs sewn into elastic knitted pockets (Figure 5). This orthosis is indicated in cases where there is damage to the meniscus or lateral collateral ligament injury. The coils may be varied in width and/or length in order to affect the mobility of the knee joint (Figure 6).

The Patellaligner knee orthosis is equipped with two pads and an elastic strap. It is recommended in cases of chronic subluxation of the patella, infra and suprapatellar tendonitis, as well as chondromalacia caused by chronic subluxation of the patella.

The L-shaped lateral pad locks the patella during its entire range. The elastic strap sets the lateral pad tightly against the patella. The medial epicondylar pad maintains the orthosis on the leg (Figure 7).

The Marshall PAC orthosis was developed in New York. It features a horseshoe-shaped pad around the patella, and is indicated for dysplasia, subluxation, and

dislocation of the patella as a prophylaxis for high performance sports or after traumatic injury to the knee.

The horseshoe pad prevents a shift of the patella off of its correct path, while the strap about the thigh decreases the tension from the quadriceps muscle onto the patella (Figure 8).

The Hamburg Patella Brace, with lateral coils and infrapatellar strap, is indicated in cases of non-surgical treatment of chondromalacia and patellofemoral osteoarthritis. Along with the aforementioned orthoses, it is available with an open patella to reduce discomfort caused by pressure on the patella. The strap alters the mechanical action of the patellofemoral knee articulation during walking. The patella is slightly lifted by the pressure to the patellar tendon. This relieves stress to the patella by causing a change in the tension of the extensor muscles of the knee joint (Figure 9).

The Articular orthosis is equipped with

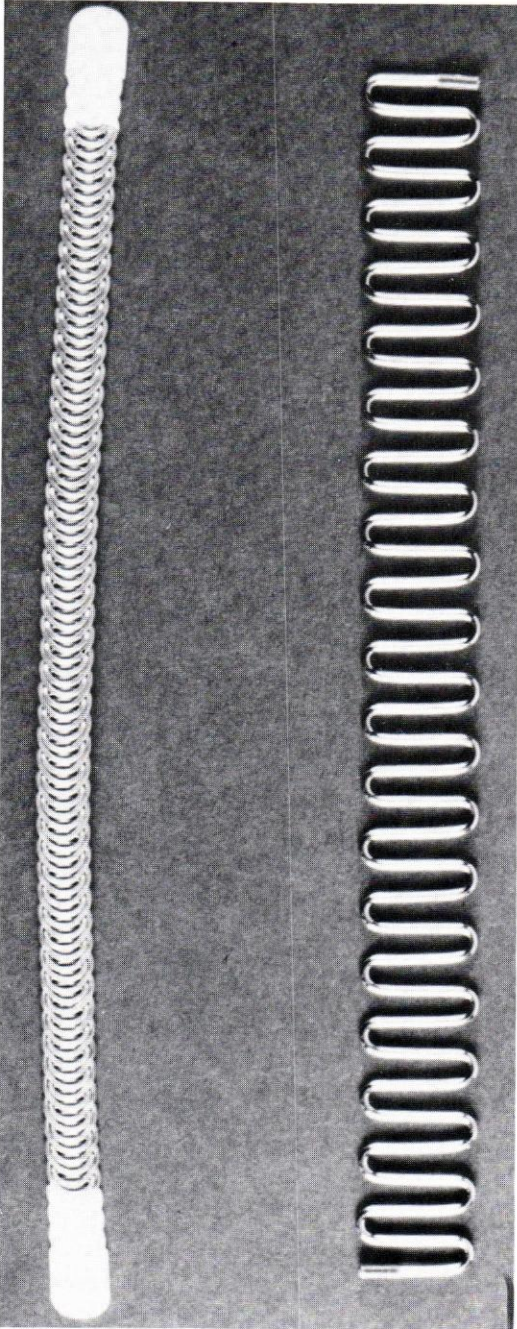


Figure 6. The coils may be varied in length and width to affect mobility of the knee joint.

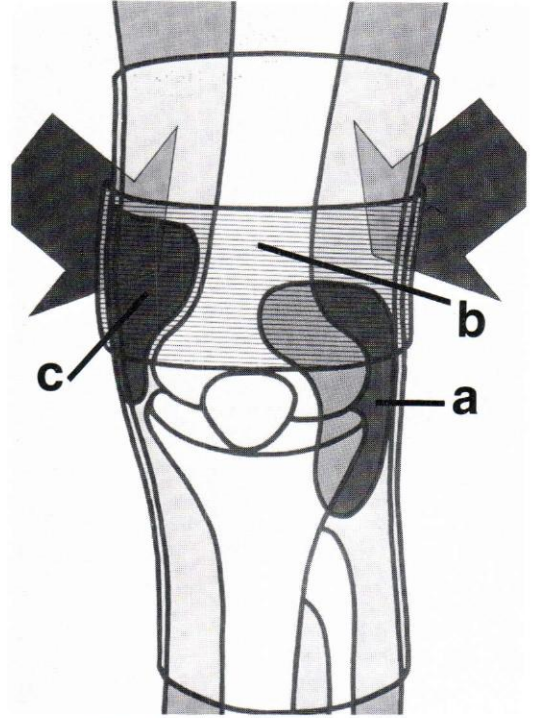


Figure 7. The Patellalinger orthosis with (a) lateral patella pad, (b) suprapatellar strap, and (c) epicondylar pad.



Figure 8. The Marschall Pac orthosis.



Figure 9. The Hamburg Patella Brace.



Figure 11. The Lastic Steel Hinged Brace.



Figure 10. The Articular Orthosis.

malleable side bars and centered joints, and provides support to the knee joint without restricting motion (Figure 10).

The Lastic Steel Hinged Brace is supplied with steel hinges. These may come with or without flexion stops, and provide for controlled motion of the knee joint, especially with damaged lateral collateral ligaments. The steel hinges are inside knitted elastic pockets while maintaining the two-way stretch properties of the over-all orthosis (Figure 11). Both of the above articulating orthoses are indicated for arthritis of the knee, damaged cruciate or collateral ligaments, as well as for postoperative management of the knee.

A wide variety of adaptations are available to alter these orthoses to the customized needs of the patient. Various closure systems, i.e. Velcro® or laces, are available, as are assorted sizes, dimen-



Figure 12. Knee instability in the presence of varicose veins should not be treated by knee orthoses alone.

sions, and durometers of corrective padding.

In cases where to treat the knee alone would cause damage elsewhere, as with varicosities of the calf and ankle with concomitant risk of phlebitis, elastic knee orthoses can be incorporated into a compression stocking (Figures 12 and 13).

CONCLUSION

To properly treat the patient with knee instability or insecurity, it is important to know the function of the various supports that are available to treat the associated disorders.

This article has described several elastic knee orthoses which may be used to treat mild to moderate disorders at or about the knee joint, and was developed to serve as a reference source for orthotic practitioners who must fit these orthoses.

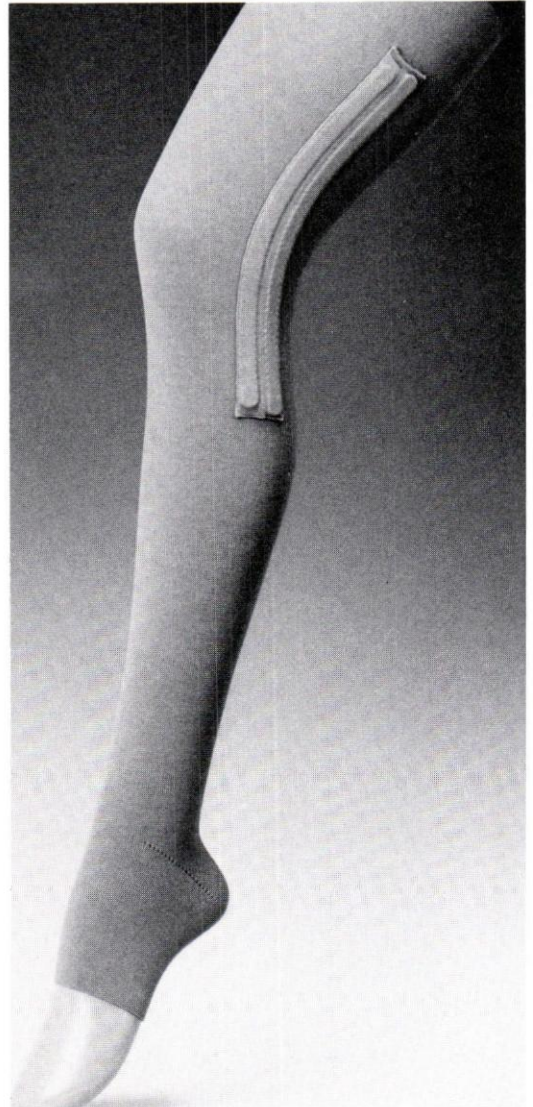


Figure 13. A knee orthosis may be integrated into a compression stocking.

AUTHOR

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