CLINICAL VIGNETTE

Knee Orthosis for Femoral Neuropathy

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History

A 73-year-old male nursing home resident was referred for a new left knee brace. Past medical history includes hypertension, obstructive sleep apnea, hypothyroidism, coronary artery disease, chronic low back pain, and non-insulin dependent diabetes mellitus. At the Brace clinic consultation, he denied knee pain but reported frequent left knee buckling impairing his ability to ambulate. He was previously issued standard bilateral hinged knee braces did not help his left leg buckling. He was recently diagnosed with femoral neuropathy causing left leg weakness due to diabetic amyotrophy.

The patient had been admitted to the hospital 3 months prior to this evaluation with sepsis from a urinary tract infection and was re-hospitalized with COVID Pneumonia shortly after discharge. Prior to these admissions, he lived alone in the community and ambulated without an assist device. After the urinary tract infection and COVID resolved, he was discharged to a nursing home for physical therapy as he was debilitated and wheelchair dependent.

The nursing home physical therapist noted that he had a weak left leg interfering with his ambulation. Further testing included electrodiagnostic testing and MRI of the lumbar spine and pelvis.

On physical exam at the brace clinic, the patient appeared deconditioned and in a manual wheelchair. He had poor memory for details but was otherwise alert, aware and oriented to person, place, time and reason for consultation. He answered questions appropriately to the best of his ability but was a poor historian for details over the past three months. Physical exam noted left quadriceps atrophy. Active knee extension lacked 5 degrees from neutral but was able to get to neutral passively. His strength was normal in the lower extremities except for left knee extension which was 2/5. Sensation was decreased in the left anterior thigh. He was observed cautiously ambulating with a front wheeled walker a few steps without knee buckling.

Imaging studies included left knee x-rays which showed moderate osteoarthritis. MRI of the lumbar spine showed mild central and foraminal stenosis commensurate with his age, without significant L2, L3 or L4 nerve root compression. MRI of the pelvis showed no evidence of mass compressing the lumbar plexus and no mass on the left femoral nerve. The left nerve was also similar in appearance to the right femoral nerve. Electrodiagnostic testing showed active neuropathic changes consistent with an acute femoral neuropathy. This was superimposed on an axonal sensory and motor peripheral polyneuropathy. HgB-A1C ranged from 7.8 to 10.8 in the past 18 months.

Brace clinic team and patient agreed the goal of bracing, would be help stabilize the knee and prevent falls secondary to knee buckling as pain was not his primary complaint. He was anticipating discharge home and would need to ambulate safely. A custom knee orthosis was ordered with an adjustable locking system in the joint. The brace was set with range at 0 (full extension) with a stop at 40 degrees of flexion to minimize risk of full knee buckling and falls. This orthosis allowed for interval expansion of the flexion stop in anticipation of quadriceps strength improvement.

At 6 months, follow up, he was wearing the knee orthosis and ambulating 50 yards with a front wheeled walker. At nine months, he was wearing knee orthosis for community distances. His knee extension strength was remeasured and had improved to 3/5. The brace range of motion was expanded from 0 to 100 to allow him to sit more easily. He had developed increasing knee pain now that he was increasingly active. MRI of the knee showed degeneration of the medial and lateral menisci with a medial meniscus tear. At subsequent follow up, his knee strength recovered to normal 5/5 with no documented falls. He continued to note knee pain. Follow up records do not document how often he is wearing the brace. Edema and cellulitis were noted.

Discussion

High quality studies on orthosis for knee instability in patients with neuromuscular and central nervous system disorders are very limited.[1] Even less is published on bracing for isolated quadriceps weakness due to femoral neuropathy. Treatments for femoral neuropathy include medications for pain, physical therapy, lifestyle modifications, and consideration of surgery if there is a structural block of the nerve itself.

Goals of bracing should be clearly established when designing a brace. One major goal is to prevent falls due to knee buckling. One tenth of falls have resulted in traumatic brain injuries and/or serious fractures contributing to high costs to the patient and the healthcare system.[2] Other outcomes include pain con-

trol, durability, reliability, comfort, and effectiveness to improve a patient's mobility and quality of life. Negative effects of bracing are skin breakdown with sequalae of infection, damage to clothes, and difficulty donning and doffing.[3] Adjacent joint and contralateral limb pathology should also be evaluated as bracing can alter forces on other parts of the body.

In a study of 5 cancer patients with femoral neuropathy, knee immobilizer braces were issued to patients with 0-2 quadriceps strength due to femoral neuropathy. Three of the subjects stopped using the brace due to recovery within two months. The other two, reported reduced falls, up to 10-fold and increase ambulation distance over 4-fold.[4]

Many knee immobilizers are available and range in cost depending on the material, complexity of the locking mechanism and customization. They can be large and cumbersome with a drop lock that a patient activates when ambulating and releases, allowing the joint to bend for sitting position. A custom knee brace can be fitted to the thigh and calf after making a cast impression of a patient's leg. Polycentric knee joints mimic a natural knee. The locking mechanism can vary as well as the type of knee joint. Range of motion in the joint can be set to allow some knee flexion in order to optimize gait with a set stop to provide stability. These settings can ideally be changed if patient' neurologic status improves.

Conclusion

Further studies are needed to help guide the treating physician and orthotist regarding type of knee orthosis for femoral neuropathy. Patients with acute femoral neuropathy should have periodic follow up to assess for improvement in strength, need to adjust knee orthosis settings as well as any positive or negative sequelae to optimize compliance and benefit of prescribed orthotic devices.

REFERENCES

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