Celebrating 40 Years of Excellence

PROSTHETIC & ORTHOTIC UPDATE

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— The Stance Control Revolution —

It's been a long time coming, but patients with complete or partial lower-extremity paralysis can now be enabled to walk with a reasonably normal gait, assisted by an exciting new class of knee componentry broadly classified as *stance control orthoses*.

Achieving secure ambulation with knee flexion during swing phase is by no means a new goal in the management of patients lacking voluntary knee control secondary to polio, spinal cord injury, multiple sclerosis, stroke, trauma, etc. But it was not until 2002 that a functionally and commercially viable design became available for use by patients who heretofore have had to walk awkwardly—and wearily—with a fully locked knee.

What's New

For this significant population of individuals who require an orthosis to provide knee stability, the ability to swing a flexed knee is no small accomplishment. With a fully locked knee to prevent unbidden buckling, patients (who typically are already constrained by weak musculature) must adopt gait deviations to compensate for a leg that is functionally too long—a normal leg swing fails to achieve ground clearance.

These deviations—notably an arcing leg swing, hip-hiking on the contralateral side, and distinct lateral shift to the contralateral side—not only extract a major energy penalty but also can lead to degenerative changes to the back and opposite limb. By locking the knee during stance phase then allowing it to flex during swing phase, stance control components enable patients to swing their impaired limb with sufficient ground clearance to make these taxing compensations unnecessary.

SCOKJ joints built into KAFO.
Photo courtesy of Horton Technology Inc.

At least four mechanical and one electronic stance control systems are now commercially available in the U.S. Two, including the pioneering Stance Control Orthotic Knee Joint (SCOKJ), consist entirely of the knee joint itself, which the orthotist fabricates into a custom KAFO (knee-ankle foot orthosis); the others come as an integral KAFO, custom fabricated to a patient model or measurements.

Following are highlights of several stance control systems currently available:

SCOKJ—Orthoses incorporating these joints, originally developed by NASA engineers, have a double bar design incorporating stance control joints on both uprights. Upon actuation by heel contact, the joints' one-way cam lock engages to block further flexion but does not interfere with extension.

Because the joints do not lock the knee in full extension but rather prevent additional flexion, patients with hip flexor and extensor weakness are able to walk safely with KAFOs equipped with these joints.

Swing Phase Lock orthosis is one of the new components that enable patients with lower limb paralysis to walk with a flexed knee.
Photo courtesy of Fillauer Inc.

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Nobbe Orthopedics Inc. is pleased to announce that it has received a three-year re-accreditation award from the American Board for Certification in Orthotics and Prosthetics (ABC). This award represents the highest level of accreditation in the O&P disciplines. Our practice was recognized in all areas of evaluation including organizational management, professional staff, patient care, quality assurance, facilities and safety management.

Nobbe Orthopedics has been providing orthotic/prosthetic services in Santa Barbara since 1963 and in Santa Maria since 1994. Our comprehensive fabrication capabilities and thoroughly trained staff allow provision of all facets of O&P services.

The ABC, a not-for-profit organization headquartered in Alexandria, Va., has provided credentials for practitioners and organizations since 1948.

For additional information about Nobbe Orthopedics Inc. or the ABC, call our offices in Santa Barbara at (805) 687-7508 or Santa Maria at (805) 925-8290.

Orthoses for Stroke Managem

Patients undergoing rehabilitation for complications of a stroke comprise a significant portion of orthotic practice. An estimated four million Americans are living with the effects of a stroke, two-thirds of whom are moderately or severely impaired. An estimated 730,000 Americans suffer a stroke each year; 570,000 will survive the stroke episode, and 73,000 will require care in a nursing home or other long-term care facility.

Orthotic prescription is appropriate in the acute recovery phase for prevention of contractures caused by spasticity or paralysis. Casts, splints and other devices can be applied to both upper- and lower-extremity joints for this purpose. Subsequently, during the period of neurologic recovery, custom-fabricated orthoses are employed to facilitate gait training, protect against further deformity, and support the upper extremity. Off-the-shelf (i.e. prefabricated) orthoses may be used for evaluation of patient potential and temporary use until the definitive, custom orthosis is ready, but their "in the ballpark" fit is generally insufficient to provide the necessary degrees of control, correction and comfort to encourage patient acceptance.

Photo courtesy of Ultraflex Inc.

Orthotics Today

During the primary recovery period, generally defined as the six-month period following the stroke, many patients will recover a substantial degree of lost function, thanks in large measure to aggressive and competent therapy. Nevertheless, the majority of stroke victims will continue to require the support of a leg orthosis for the rest of their life. A similar number will require extended upper-limb support, as provided by a resting wrist splint, to counter contractures or a harness device to support a shoulder subluxation.

The gait pattern of a hemiplegic patient frequently is characterized by poor coordination, dropfoot, asymmetry, loss of forward progression, limited load transfer through the affected limb and balance difficulties. Most patients present with some degree of dropfoot and many with spasticity, which may improve or disappear with time. Patient needs are highly individualized, and a detailed orthotic evaluation and orthotic recommendation are thus critical to achieving an optimal outcome.

In evaluating a new stroke patient, the orthotist immediately seeks to determine (1) which muscles are working; (2) which ones aren't; (3) what degree of spasticity, if any, is present; (4) how much balance is present; and (5) what is the patient's overall physical condition and energy level. Also vital are the physician's and therapist's assessments of the patient's current status, progress-to-date and rehabilitation goals.

Thanks to improved designs, materials and fabrication technology, most stroke patients now wear an ankle-foot orthosis (AFO) as opposed to a more bulky and heavier knee-ankle-foot orthosis (KAFO). However, KAFOs continue to be appropriate for patients with extreme muscle weakness and/or knee instability.

Floor reaction AFO helps control knee instability.

Primary indications for application of an AFO include:

- inadequate dorsiflexion for foot clearance during midswing;
- mediolateral subtalar instability in stance phase;
- initial-contact equinovarus position
- insufficient dorsiflexion to permit heel-first contact; and
- inadequate knee stability for midstance and terminal stance.

Mild involvement with no spasticity may call for a relatively simple flexible AFO incorporating dorsiflexion-assist to counter dropfoot. At the opposite extreme, patients with moderate-to-severe involvement may need a KAFO with knee locks or perhaps a rigid AFO incorporating rotational control and a floor reaction moment to enhance knee stability. For patients with residual spasticity, neurophysiological features, such as found in a dynamic ankle-foot orthosis (DAFO) or supramalleolar orthosis, can be incorporated to stimulate reflexes antagonistic to spastic movements.

Why an Orthotist?

In the present difficult reimbursement climate, the concept of the multidisciplinary team is, unfortunately, sometimes sacrificed to the profit demand; some members of the team are expected to assume the role of other specialists to cut costs. Seldom does such practice work to the benefit of the patient, particularly a stroke patient.

When another member of the rehab team is asked to assume the role of the certified orthotist, the patient is deprived of the expertise offered by a dedicated, board-certified specialist in biomechanics, orthotic evaluation, component design, materials, and fabrication technology, not to mention in most cases the availability of a full on-site fabrication laboratory. Typically such "short cuts" produce prefabricated or "semi-custom" orthoses or components made in a remote central fab facility based on a prescription and measurements provided by an individual underqualified to perform that role optimally.

There are exceptions to every rule, of course; but generally speaking, the best outcome results when each member of the rehab team: physician, therapist, orthotist, patient, vocational counselor, etc. is allowed to exercise fully the expertise he/she brings to the table.

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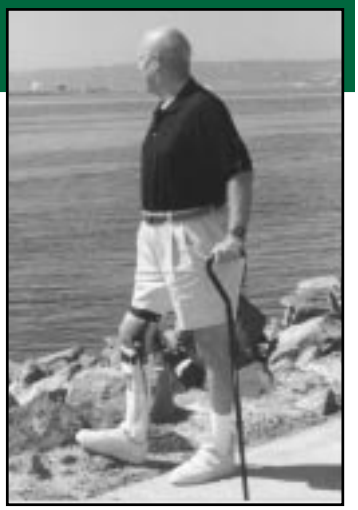


Photo courtesy of Horton Technology Inc.

Orthosis designs incorporate one or more three-point force systems applied proximally and distally to a joint to produce angular change in a specific plane. Generally speaking, the more complex the impairment, the more three-point systems are designed into the orthosis.

Whatever the orthotic design and incorporated features, the key point is that the functional anomalies, needs and rehabilitation goals for each stroke patient are unique, and it is the orthotist's role to understand and provide the optimal limb rehabilitation system to meet those variables in an orthosis the patient can tolerate.

Ultimately, the orthotist's goal, and that of the entire rehabilitation team, is to minimize the external hardware required by the stroke patient and to enable that patient to maintain his/her maximum level of function for as long as possible.

In the long run, this approach produces the most efficacious and cost-effective pathway for providing orthotic management of this large patient population.

Orthotic follow-up therefore is important. Adjustments and modifications are frequently necessary to maintain optimal support, and replacement becomes necessary from time to time, depending on patient activity level. Patients are usually seen for at least one follow-up visit and are encouraged to revisit whenever subsequent changes or problems arise.

For additional information about orthotic management of stroke patients, we invite you to call our office.

Prescription Notes

Key points for making an orthotic prescription for stroke survivors:

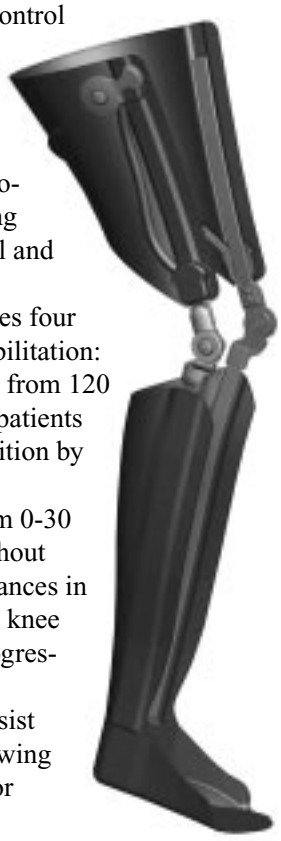
- A thorough orthotic evaluation should precede the prescription of definitive orthoses.
- Prefabricated orthoses are a viable option for making an initial evaluation of patient capabilities and/or temporary use until a definitive orthosis can be fabricated; however...
- To achieve optimal, total-contact fit and results, functional orthoses should be custom-fabricated to a positive mold of the patient's affected limb segment.
- The practitioner best trained and prepared to design and fabricate an orthosis is the board-certified orthotist, ideally as a participant on a multidisciplinary rehab team.
- After design, fabrication and delivery of a functional orthosis, stroke patients should return at least every three months for adjustment and general follow-up.

Helping Stroke Patients Learn to Rise, Walk Again

Like the recently introduced stance-control orthoses now enabling individuals with isolated quadriceps weakness to walk safely with a flexed knee in swing phase and thus achieve a more normal gait, another new orthotic design incorporating stance-control properties is helping post-stroke patients regain basic postural and ambulation skills.

The UltraSafeStep system incorporates four distinct features to facilitate stroke rehabilitation:

- Sit-to-stand ratchet support ranging from 120 degrees flexion to full extension assists patients relearning how to rise from a sitting position by preventing knee buckling.
- Adjustable stance control angle from 0-30 degrees provides safe stance control without locking the knee. As the patient advances in ambulation ability, the knee can be set to allow progressively greater flexion.
- Dynamic swing assist enhances terminal leg swing for patients with extensor weakness.
- Dynamic shock absorption at initial contact dampens ground reaction force for a smoother gait.



UltraSafeStep
Photo courtesy of Ultraflex Inc.

This orthosis can be of benefit both as a temporary post-stroke gait training aid and as an ongoing gait assist for patients with permanent extensor weakness. It is applicable for patients weighing up to 220 pounds with fair or better cognition.

The UltraSafeStep orthosis can be billed using existing L-codes.

Note to Our Readers

Mention of specific products in our newsletter neither constitutes endorsement nor implies that we will recommend selection of those particular products for use with any particular patient or application. We offer this information to enhance professional and individual understanding of the orthotic and prosthetic disciplines and the experience and capabilities of our practice.

We gratefully acknowledge the assistance of the following resources used in compiling this issue:

Becker Orthopedic • Fillauer Inc. • Horton Technology Inc.
Ultraflex Systems Inc.

Stance Control Orthosis Options Plentiful

(Continued from page 1)

The flexion lock is released automatically in late stance phase by a mechanical linkage, either by reduction of heel weight-bearing or ankle motion. In addition to its automatic mode, the SCOKJ can be locked in full extension or always unlocked for specific activities requiring those extremes.

Swing Phase Lock (SPL) System (see photo, page 1)—Like the SCOKJ, this design consists of a knee control device integrated into a double-upright KAFO. A locking component is built into the lateral upright, while the swing phase control is placed on the medial bar.

The SPL operates on a unique pendulum mechanism, which rocks fore and aft in response to momentum and gravity. Just before heel strike, the pendulum moves backwards, locking the knee in extension for weight-bearing. At the end of stance phase, the pendulum swings forward again, releasing the lock to allow flexion in swing phase. For additional patient safety, an extension moment is required both to lock and unlock the joint. The SPL incorporates a remote control device that enables the patient to manually lock or unlock the knee mechanism as needed.

UTX orthosis
Photo courtesy of Becker Orthopedic.

UTX Swing KAFO—This lightweight single-upright KAFO constructed of tubular stainless steel is stabilized for stance phase by a ratchet that engages to provide stance stability when the knee reaches full extension and releases with ankle dorsiflexion. The actuating cable for the knee lock runs along the medial side, opposite the upright.

Selectable variations on the basic UTX design address patients' specific deformities and physical condition. A comparable orthosis, the **Free Walk**, stems from the same initial design and offers similar properties.

E-Knee—This, the first electronic stance control orthosis, allows orthotists to program the knee mechanism to lock at any degree of flexion or unlock in response to various conditions. The E-Knee incorporates a microprocessor whose primary inputs come from a foot sensor positioned between the orthosis footplate and the patient's foot or shoe to signal weight-bearing.

The knee locks upon ground contact; unweighting the footplate in the absence of a flexion moment unlocks it. When the knee is locked, it can move to increased extension but not to further flexion.

The E-Knee can be used on patients with a higher level of disability than can be accommodated by the mechanical SCOs, which require some degree of hip, knee or ankle and foot function to actuate. Patients with even a completely flail limb are reported to be able to achieve improved gait with this design.

E-knee features microprocessor control.
Photo courtesy of Becker Orthopedic.

Caveats—Exciting as this new technology is, it is still in its infant stage. Not all patients with lower limb paresis or paralysis will benefit from stance control capability. With still-limited clinical experience and the sudden availability of many varied designs, patient selection criteria are still being determined.

Reimbursement is another concern: Medicare currently reimburses these products only under the same code as simple drop locks...well below the actual cost.

Despite these issues, stance control knee orthoses may well be the most remarkable orthotic development of the past decade.

Watch for further improvements in the months and years ahead.

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