



PHYSICAL THERAPY

Stance Control Gait Training

Mr. Marcelo Lofiego, P.T.

635 Executive Drive
Troy, Michigan 48083
U.S.A.

p 800-521-2192 | 248-588-7480

f 800-923-2537 | 248-588-2960



BeckerOrthopedic.com

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Introduction:

Individuals with lower extremity weakness present with a varied set of problems that often require the provision of a Knee-Ankle-Foot-Orthosis (KAFO). Traditional KAFO's lock in full extension to provide lower limb stability, but eliminating knee flexion forces individuals to make compensations and to ambulate with gait deviations that may lead to other problems over time.

Stance Control Knee Ankle Foot Orthoses (SCKAFO's) provide stability, however, by allowing the knee to flex they also allow movements that relate to forward progression. The decision to prescribe a free motion, locked or stance control KAFO is based upon the individual patient's range-of-motion, muscle strength and the resultant biomechanical and functional deficit. Successful utilization of SCKAFO's is a cumulative process that involves all members of the multidisciplinary team. A key component is gait training; this brochure presents a single case study and introduces some of the key steps that should be considered to achieve successful SCKAFO utilization.



Pre Fitting Phase

The objective is to strengthen the pelvic and abdominal muscles and to increase awareness of pelvic rotation.

Strengthening Abdominals: It is important to strengthen the abdominals (figures 1 & 2) as this muscle group is the foundation for attaining pelvic retroversion.

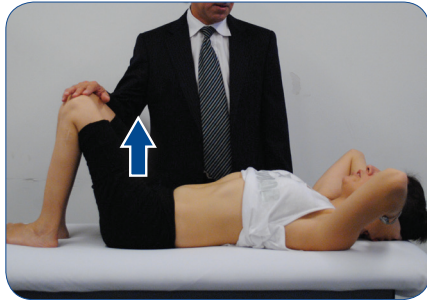


Figure 1

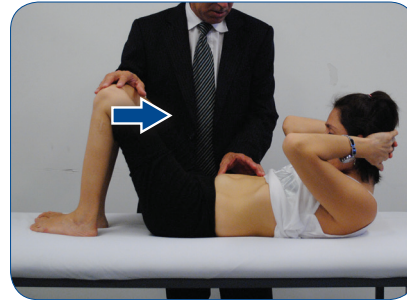


Figure 2

Increasing awareness of Pelvic Retroversion: This movement helps create momentum and facilitates locking of the Stance Control Knee Joint at the end of swing phase; this exercise is performed by contracting the abdominal muscles and is first performed with the knees bent.

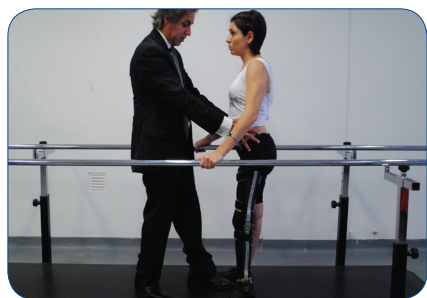


Figure 3

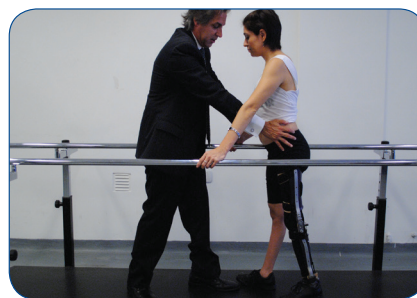


Figure 4

Strengthening and Awareness of Pelvic Rotation: This exercise is performed against resistance with the patient in the lateral position. The awareness and utilization of these exercises increases momentum and can compensate for a hip flexor weakness. Attempts should also be made to strengthen innervated hip flexor musculature.



Figure 5



Figure 6

Initial Standing and Weight Bearing in SCKAFO: The objective is to allow the patient to gain confidence by weight bearing with the SCKAFO knee joint in the locked position. This phase of therapy should be conducted with the patient within the parallel bars.

Initial Standing: The patient is asked to stand with feet evenly spaced (figure 7) with weight evenly distributed over both legs. Attention should be paid to the alignment of the pelvis in the sagittal plane (figure 8). During this exercise the patient is asked to contract their abdominal muscles. This exercise is repeated with the sound side advanced (figure 9).



Figure 7

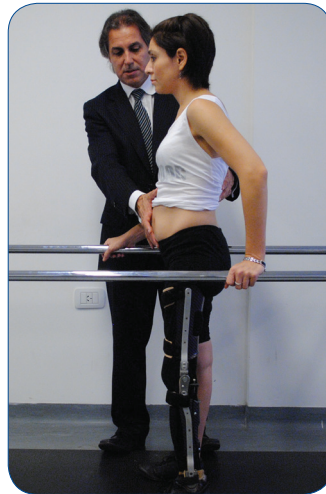


Figure 8

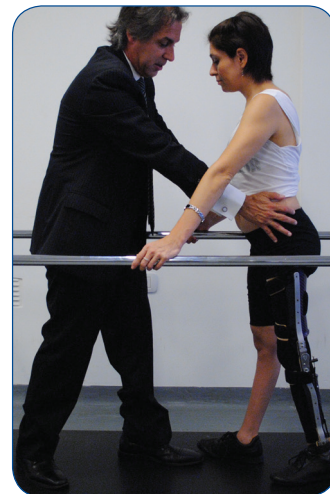


Figure 9

Weight Transfer (figures 10, 11 & 12): Beginning with the feet evenly spaced the patient is encouraged to transfer weight to achieve full weight bearing on the SCKAFO side. This should be done gradually against resistance until the patient gains confidence and full control of weight distribution.



Figure 10



Figure 11



Figure 12

Walking in the SCKAFO: During this stage we will introduce unlocking of the SCKAFO at terminal stance to facilitate knee flexion. This phase of gait training should be conducted methodically; the goal is to achieve consistent locking and unlocking of the SCKAFO and in some cases to disrupt the compensations that the patient may have used in a locked KAFO.

Unlocking of the SCKAFO: Begin by asking the patient to advance their sound leg by taking a single step (figure 13) while checking for pelvic rotation. During this exercise, weight will be transferred gradually to the sound side. As weight is transferred, the leg with the SCKAFO will advance to terminal stance (figure 14), which will cause the SCKAFO to unlock. This single step exercise should be repeated until the patient can safely transfer weight and effortlessly generate unlocking of the SCKAFO.



Figure 13



Figure 14

Additional Considerations: If the patient does not advance the sound side and adequately (figure 15) transfer weight there will be excessive loading of the SCKAFO, which may cause the knee joint to unlock abruptly and create insecurity. Alternatively, if the patient elevates the pelvis before terminal stance (figure 16), the foot will not be in contact with the ground, and the SCKAFO will remain locked.



Figure 15



Figure 16

SCKAFO Swing Phase: The SCKAFO is unlocked at terminal stance. Immediately after unlocking, the patient must be taught to generate enough momentum to fully extend the SCKAFO to achieve locking prior to initial contact. In many cases, the patient must overcome combined weakness of the quadriceps and hip flexors.

Note: If the patient presents with significant hip flexor weakness and is unable to generate sufficient momentum, consideration should be given to adding an extension assist mechanism to the SCKAFO.

The patient is asked to rotate and advance the hemipelvis on the affected side. The goal is to generate momentum to effectively create a pendulum. This exercise (figures 17, 18 & 19) should be repeated until the patient is consistently unlocking and achieving full extension (locking) of the SCKAFO.



Figure 17



Figure 18



Figure 19

Additional Considerations: When innervated, the hip flexors should be strengthened (figure 20) to generate maximum momentum. Figures 21, 22, and 23 illustrate the coordinated unlocking of the SCKAFO in combination with pelvic rotation and hip flexion.



Figure 20



Figure 21



Figure 22



Figure 23

Independent Unlocking, Extension and Locking of the SCKAFO:

This involves starting from double support; generating the pelvic retroversion with the contralateral leg, thus unlocking the brace and fully transferring the weight to the contralateral leg. The pelvis on the SCKAFO side rotates and advances to full extension to lock the SCKAFO. This sequence ends at initial contact of the SCKAFO. The physiotherapist must correct the patient in order to achieve the greatest possible coordination and timing of this sequence of movements (figures 24, 25 & 26).



Figure 24



Figure 25



Figure 26

SCKAFO Initial Contact and Stance Phase: The goal is maintain stability; the SCKAFO should remain locked from initial contact to terminal stance. The importance of step length should be emphasized during this phase of training.

The SCKAFO should be locked at terminal swing, i.e. prior to initial contact. Regarding step length the goal should be to attain symmetry. During this exercise (figure 27), the therapist should focus on making the patient aware of step length, as well as the attitude of the foot at initial contact. During loading response, the patient must be instructed to transfer weight onto the affected side; attention should be paid to weight distribution and step length. The advancement and initial contact of the sound side (figure 28) will result in double support. As weight is transferred fully to the sound side, the SCKAFO will approach terminal stance and the knee joint will unlock to facilitate knee flexion (figure 29).

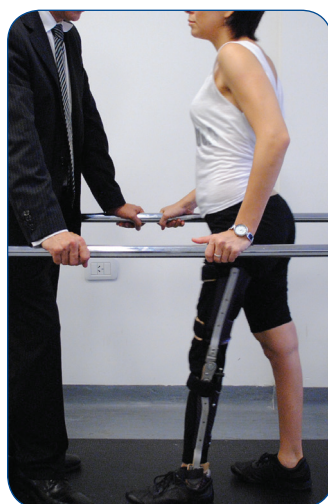


Figure 27



Figure 28



Figure 29

Progression to Walking Outside the Parallel Bars: Patients with significant hip weakness and or weakness of the contralateral limb may require the use of Canadian Crutches.

Consideration can be given to initially asking the patient to use one crutch (figure 30). Once the patient demonstrates competency (consistent locking and unlocking) with (or without) the walking aid, training is then focused on ADL's. To sit (figures 31, 32 & 33), the patient should step back with the SCKAFO. When weight is applied to the forefoot the foot ankle complex will dorsiflex causing the knee to unlock.

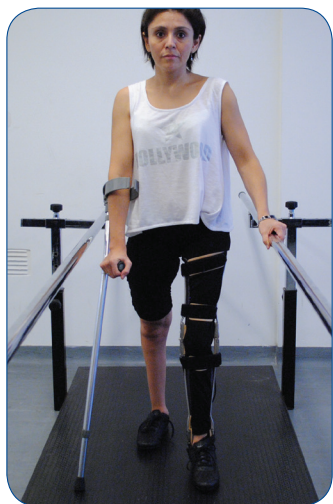


Figure 30

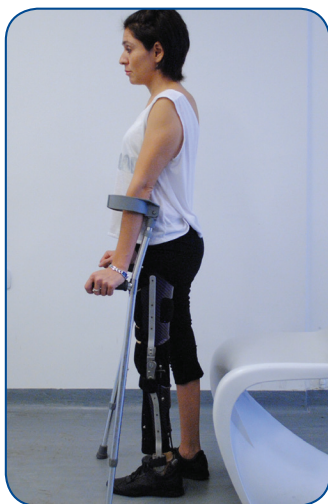


Figure 31



Figure 32



Figure 33

Ramp Ascent and Descent:

To prevent premature unlocking when ascending ramps the patient should be instructed to take a shorter step (figures 34 & 35) with the SCKAFO. When descending ramps the patient should be instructed to lead with the SCKAFO (figures 36 & 37); attention should be paid to step length.

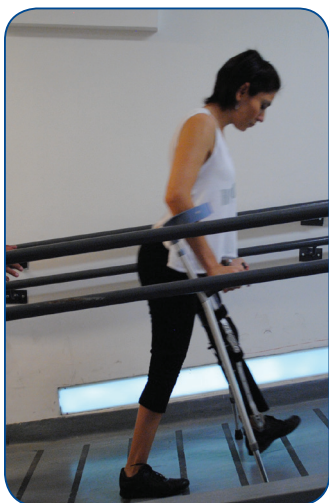


Figure 34

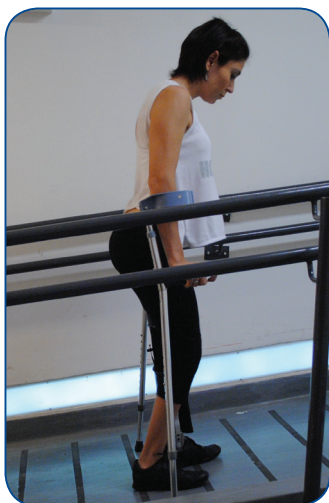


Figure 35

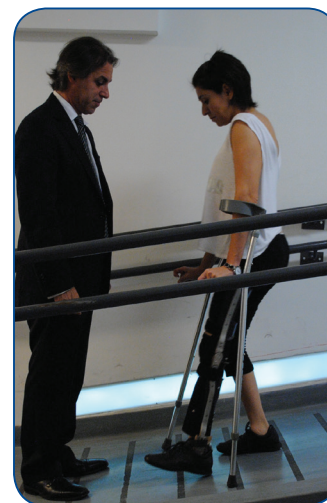


Figure 36

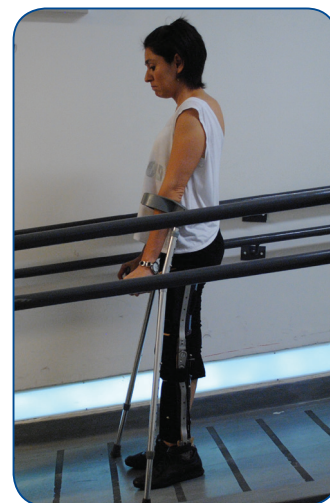


Figure 37

Stair Ascent and Descent: When ascending stairs, the patient should lead with the unaffected (or stronger) side (figure 38); the SCKAFO should remain locked. It is important that weight is not placed on the forefoot of the SCKAFO side as this could result in premature unlocking. When descending stairs the patient should be instructed to lead (figure 39) with the SCKAFO. Before discharge from therapy, the patient should be exposed to the environment outside of the clinical facility (figure 40).



Figure 38



Figure 39



Figure 40

Note: The patient shown in this guide was 42 years old and had poliomyelitis. She had previously utilized a locked KAFO on her left leg. Upon physical exam she had full range-of-motion; key muscle strengths are shown below.

Muscle Group	Left Leg	Right Leg
Hip Flexors	3	5
Quadriceps	0	4
Hamstrings	0	4
Hip Abductors	0	3
Hip Extensions	0	3
Dorsiflexors	0	4
Plantarflexors	0	3

This patient has successfully used a FullStride™ SCKAFO for 36 months. The prescription for SCKAFO's should be based upon a formal assessment conducted by a multidisciplinary team comprised of the Physician, Orthotist and Physical Therapist. Stance Control component selection, KAFO design and a therapy treatment program should be matched to the individual patient and be based upon musculoskeletal, functional and biomechanical deficit.



FullStride™

Stance Control Knee Joint

The FullStride is a mechanical stance control orthotic knee joint that utilizes a low-profile cabling system to automatically unlock at the end of stance phase. At the end of swing phase, when the orthotic knee joint reaches full extension, the locking mechanism re-engages to provide knee stability for stance phase.

When necessary, the stance control capability of the FullStride can be easily converted into a traditional automatic bail lock.

The FullStride is also available in “B” size, or youth size for smaller adults and adolescents. Offering a 25% reduction in weight to enhance the clinical

application, the “B” size FullStride gives you additional possibilities in offering stance control to your patients.

To increase your design options with our FullStride stance control system, we have recently developed two new Slim Line double action stirrups that can connect directly to the cabling system. It is no longer necessary to use the heel cable receptor that comes with this stance control system when using either of these new stirrup options.



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Be sure to view our
FullStride video!



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