

ORTHO
SYSTEMS

2000
2026
Years in motion



Excellence in Neuro-Orthopedics

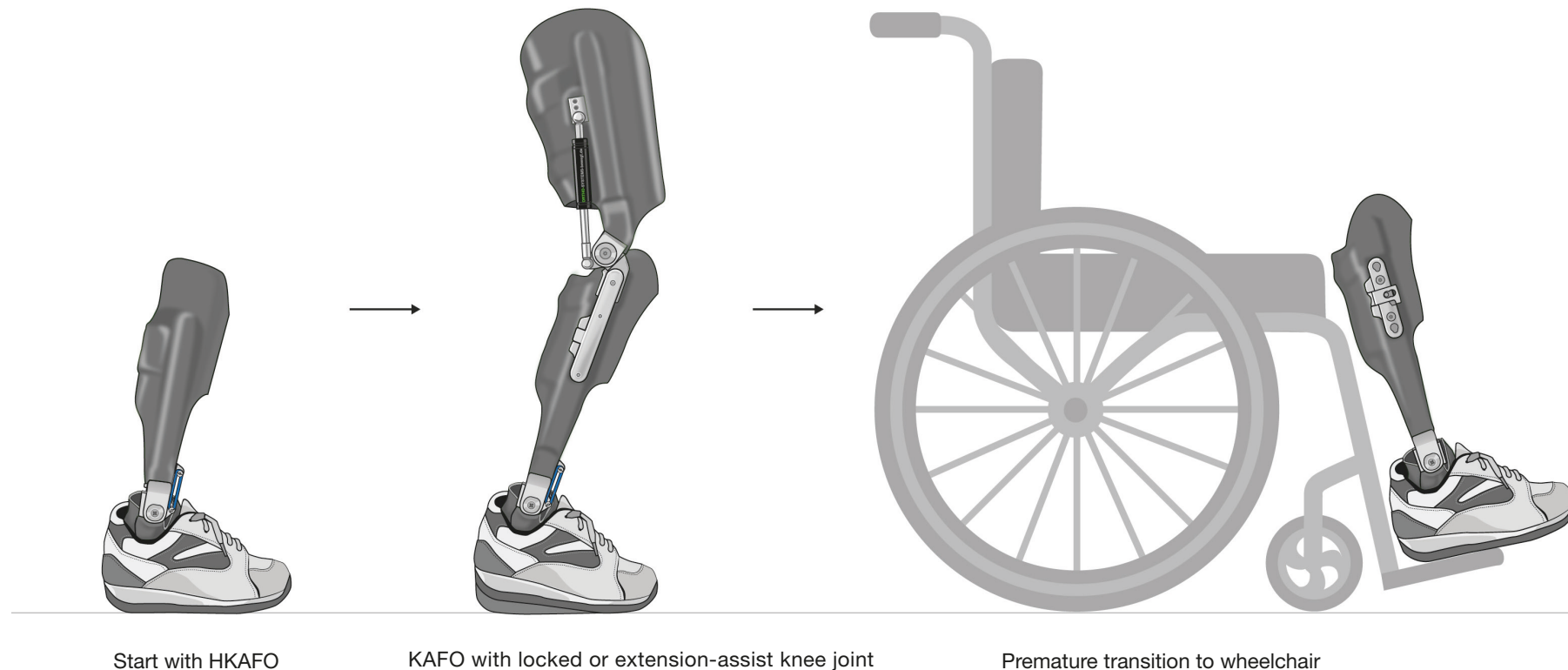
Your Patient – Our Contribution

Catalogue
Excerpt

Orthotics 14.0
Valid from July 2026

AFO ▶ KAFO ▶ Wheelchair

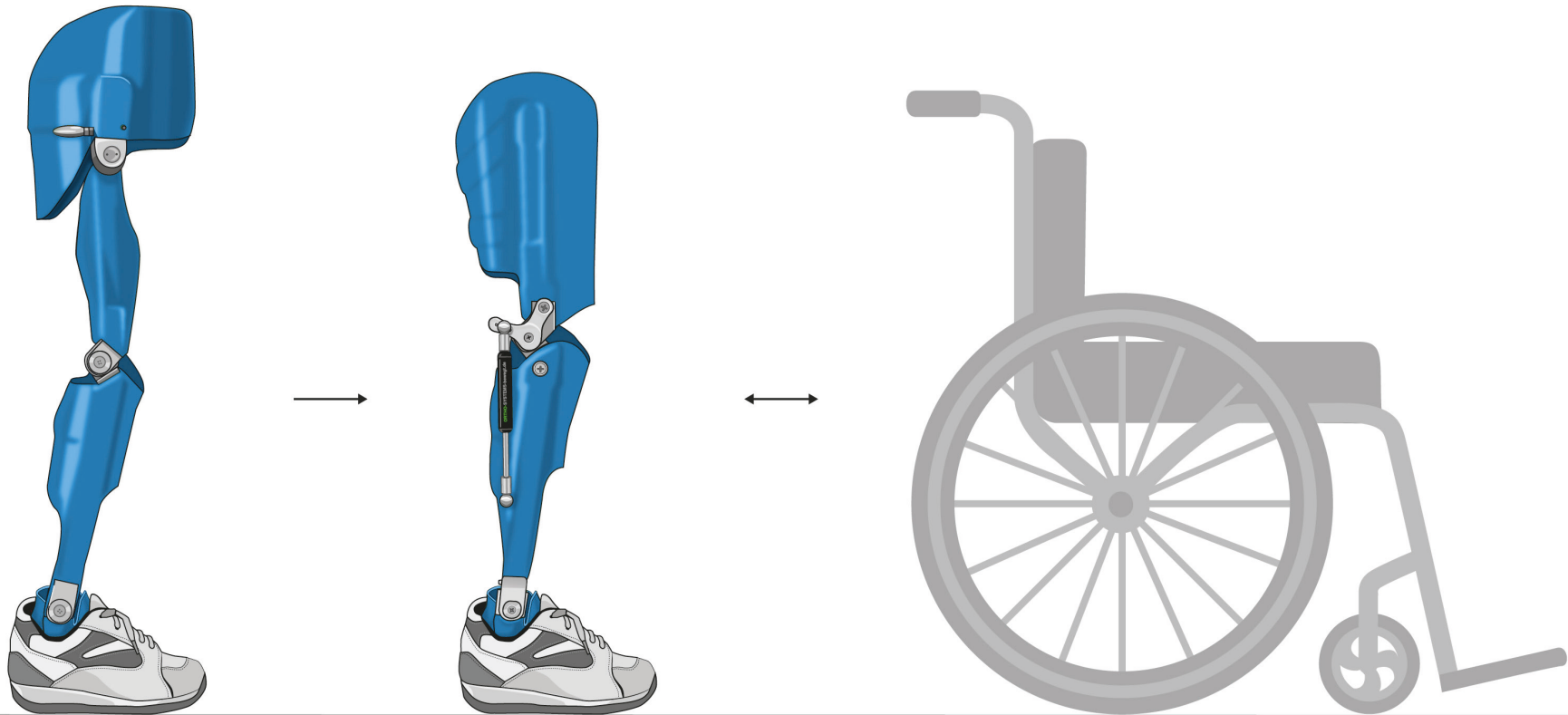
Orthotic management depends not only on current muscle strength, but also on how biomechanical demands **change over time**. This can be illustrated by the following example. In patients with an L4/5/S1 lesion and limited extension at the hip and knee, manual muscle testing using the modified 11-point MRC scale may, for example, result in a grade of 6 (corresponding to 3+ on the 6-point Lovett scale). This indicates that the patient can move the knee against gravity and against a small but sustained resistance. In a small patient weighing around **15 kg**, the external moments acting on the knee joint are still relatively low. In this situation, the quadriceps can often generate enough extension moment to stabilize the knee during the stance phase. As the patient grows and body weight increases to, for example, **40 kg**, the flexion moment at the knee rises significantly. This is due to increased body mass and longer lever arms. Muscle strength does not increase automatically in proportion to body weight. As a result, walking distance decreases as increasing flexion at the knee and hip develops due to insufficient extensor strength.



Under these changed biomechanical conditions, muscle strength that was previously sufficient for standing may become insufficient over time. The available extension moment is no longer adequate to maintain stable knee and hip extension. **Compensatory strategies develop**, such as increased forward trunk lean or the use of walking aids for additional support. For orthotic decisionmaking, this means that walking ability cannot be assessed on the basis of muscle grade alone. The key question is whether the available muscle moment—relative to body weight, lever arms, and functional demands—is sufficient both now and in the future.

HKAFO ► KAFO

It is not always easy to convince patients and their families to use an HKAFO when walking may still be possible with an AFO. However, the focus should be on a long-term orthotic strategy that begins at this stage. The goal is to enable safe, upright standing, weight-bearing without any arm support, and energy-efficient walking—both now and in the future. **At the outset, an HKAFO** with partially restricted 3D or 2D hip joints is often appropriate. Weak hip extensors and abductors require flexion and adduction stops to ensure a stable standing position. Depending on the degree of weakness, the knee extensors can be supported by either locked or free-motion, posterior-off-set knee joints. At a later stage, **a transition to a KAFO** may be appropriate. This may occur toward the end of growth or as walking distance decreases and mobility increasingly shifts to a wheelchair.



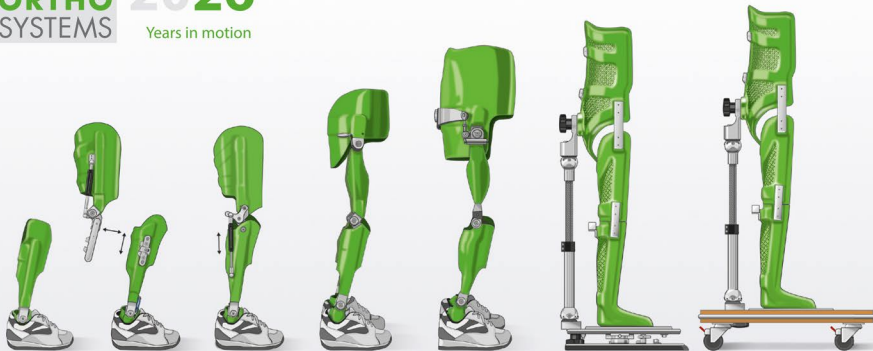
Start with HKAFO

KAFO with locked or extension-assist knee joint

Orthosis and wheelchair used as needed

History: The first scientific publication of a hip-encompassing walking system was the LSU orthosis, dating back to **1983** (Douglas, Larson et al., USA). The system used a cable-coupled, reciprocating 1D hip joint and was applied in cases of low-level lesions with free knee joints, and locked knee joints in cases of higher lumbar lesions. Today, modern RGO systems are typically used for lesion levels ranging from T5 to L3. The next major milestone was introduced by Adriano Ferrari and first presented in **1985** at a conference in Stresa, Italy. This was a 3D HKAFO hip joint designed to make use of residual muscle function, allowing a controlled degree of rotation, abduction, and extension. Newer HKAFO systems are now primarily used for lesion levels between L3 and L5.

Today: Unfortunately, there are still orthotic approaches that—similar to those used in the 1970s—recommend KAFOs even for lesions at the thoracolumbar junction (T12-L1), although the primary functional deficit lies in hip and trunk stability. At the same time, manufacturers increasingly promote microprocessor-controlled knee joints as a high-tech solution for lesions at L1–L4, even though the **underlying problem can not be addressed at the knee joint**.



Contact

You can reach us from
by telephone
per Fax
per E-Mail
Address
Contact persons

9 am to 5 pm (Germany)
+49 89 904 7575 0
+49 89 904 7575 5
kontakt@ortho-systems-mail.de
Merowingerstr. 14, 85551 Kirchheim, Germany
Jeff Matwichuk and Thomas Böckh

www.ortho-systems-inmotion.com