ottobock.

EBS^{pro} Knee Joint

Polycentric knee joint with hydraulic control

Quality for life

Information for Practitioners

Aurelia,
amputation level hemipelvectomy

EBS^{pro} Knee Joint

Lower limb amputees all have different hopes and dreams. However, nearly all of them have one wish in common: to be able to walk naturally and safely again. Custom-made prostheses can make this dream come true.

Mobility
With the C-Leg and Genium electronically controlled prosthesis systems, your customers learn just what modern prosthetics can do. For us, the consistent further development of product functions and features is a matter of course, even when it comes to mechanical components. For this reason, we borrow solutions and model mechanisms from Mother Nature for our orthopaedics technology – what we call Orthobionic at Ottobock.

The EBS^{pro} Knee Joint is our latest example of an innovative mechanical product that emulates the biomechanics of the human knee and offers new prospects. Look and see!

Recommended according to MOBIS, the Ottobock Mobility System, for amputees with mobility grade 2 and 3 (restricted outdoor walkers, unrestricted outdoor walkers). Max. weight: 75 kg/165 lbs

The Design

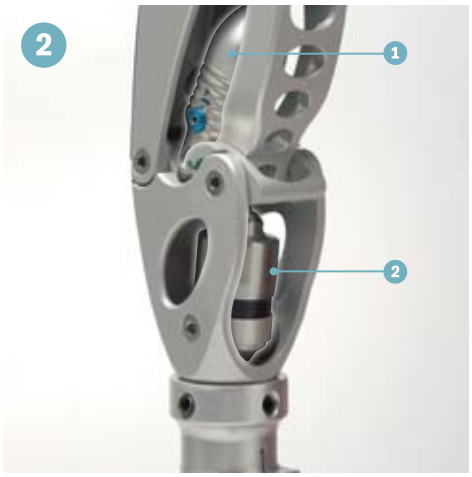
1 The mechanical principle of the EBS^{pro} is based on the proven 3R60 Knee Joint. The polycentric joint has five axes arranged in a ring. The anterior axis chain is designed like a conventional four-axis joint, but the posterior linkage bar is disrupted by an additional pivot point (marked in red).

This sophisticated design allows for two different modes of operation: swing phase mode and stance phase flexion mode.

2 Two specially configured miniature hydraulic units control the two modes.

3 The proximal pyramid adapter can be shifted in the anterior or posterior direction to correct or optimise prosthetic alignment.

One axis makes the difference: five-axis principle of the 3R60 and EBS^{pro}



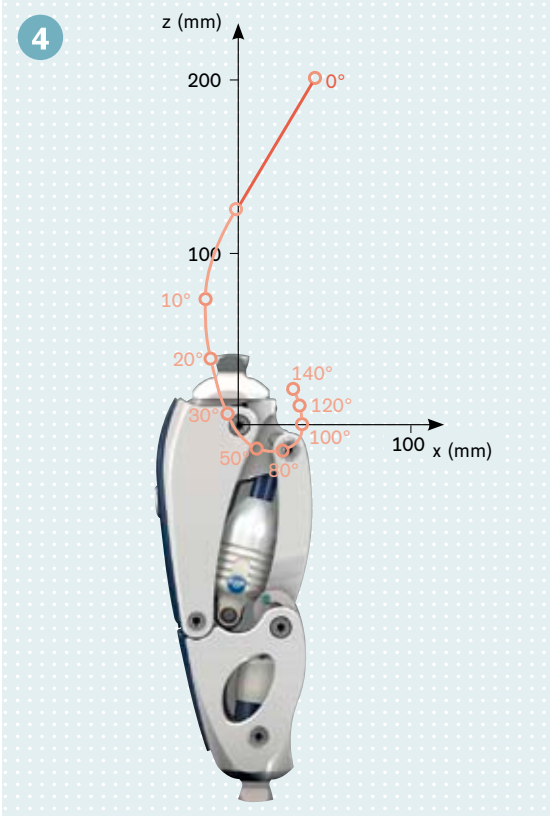
The Technology

Swing phase control and stance phase stabilisation are the two most important functions of prosthetic knee joints. Thanks to its design and the use of hydraulic dampers, the EBS^{pro} Knee Joint fulfills both functions like no other polycentric knee joint.

The Swing Phase

4 For the swing phase, the knee joint assumes the characteristics of a four-axis joint and the posterior lower pivot point remains fixed and without function. The amputee can easily initiate and control the swing phase because of the high position of the instantaneous centre of rotation. A powerful next-generation spring-assisted hydraulic unit controls flexion and extension movements. The characteristics of the separately adjustable resistances are based on the latest gait analysis.

Thanks to a special joint geometry, the knee joint can reduce the length of the prosthesis by more than 25 mm, depending on the flexion angle. This allows the user to gain significant additional ground clearance in the swing phase.



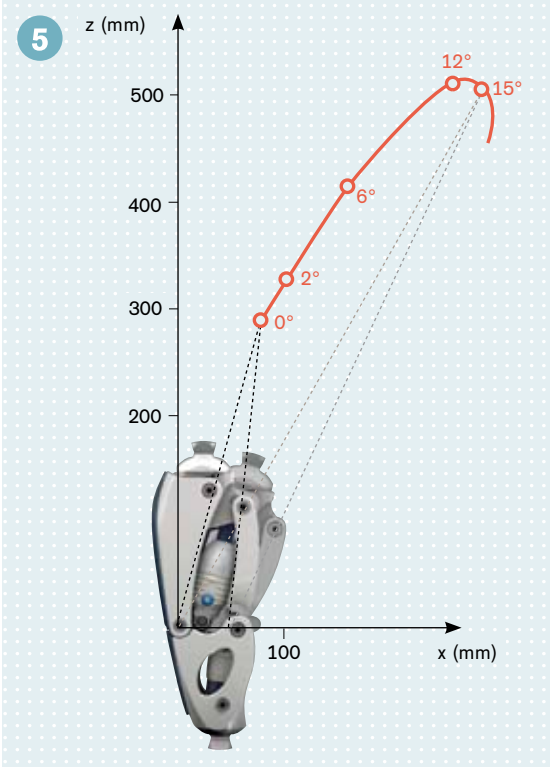
Changes in the instantaneous centre of rotation

The Stance Phase

Outstanding performance during the stance phase is the key feature of the 3R60. The EBS^{pro} Knee Joint is built on this proven technology. With it, controlled and stable flexion of up to 15° under load is possible – a unique feature for a mechanical knee joint. During this flexion, the instantaneous centre of rotation (ICR) clearly moves upwards and backwards in relation to the force vector.

5 The distance between the ICR and the load line grows with increasing flexion. This results in a crucial increase in joint stability and allows the prosthesis wearer to make use of the stance phase movement, which is very important in terms of biomechanics.

The movements during the stance phase (stance phase flexion and stance phase extension) must be controlled. This important task is assumed by the advanced EBS unit. Mechanical control of stance phase flexion by means of a combined spring and hydraulic unit is a first-of-a-kind in the world. For the first time ever, the EBS unit automatically adapts to the requirements of the prosthesis wearer in accordance with the walking speed.

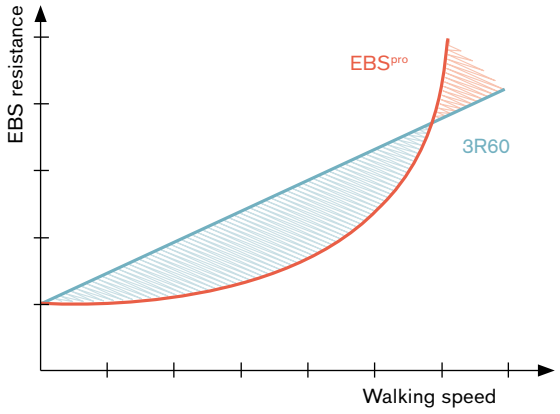


Changes in ICR during stance phase flexion

This has many advantages:
Knee joints with elastomer or spring elements almost always cushion flexion only. They cannot compensate for quick, unharmonious knee extension movements. Moreover, fluctuations in weight, speed and force cannot be fully balanced because springs act independently of speed and strongly change their behaviour within a defined force range. To eliminate this loss in functional efficiency, different spring resistances must be selected to match the patient's individual requirements. This is not necessary with the EBS^{pro}. The combined spring and hydraulic unit is individually adjustable and can be precisely adapted to suit the requirements of the prosthesis wearer. Thanks to the progressive EBS resistance – realised with an auto-adaptive EBS unit – the effectiveness systematically adapts itself over a large range of walking speeds for the first time ever.

6 The higher the walking speed, the greater the extent to which flexion is limited. The lower the walking speed, the lower the damping resistance and the greater the stance phase flexion. This means the function adapts to a wide variety of day-to-day situations. For the prosthesis wearer, this means enhanced safety and comfort as well as a highly natural gait pattern.

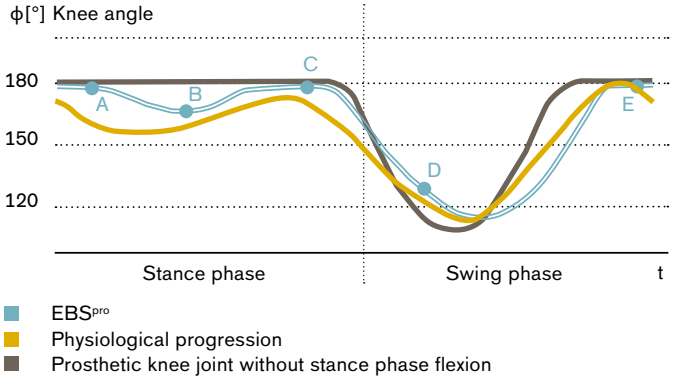
6 Resistance – Speed

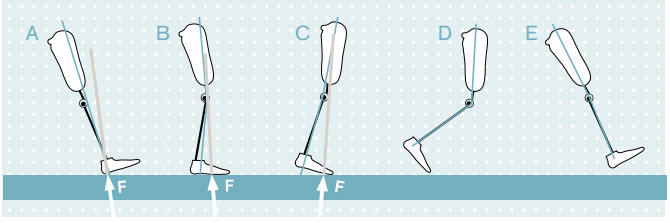


Biomechanical Aspects

The aim of the EBS^{pro} is to imitate the natural gait pattern as closely as possible. The direct comparison of the knee angle curves in graph 7 illustrates this: the load and movement for both legs is more even and the gait more symmetrical. This relieves strain on the amputated side as well as the sound side, and reduces possible long-term damage to the locomotor system.

7 Load while walking





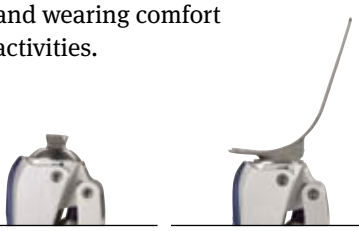
Advantages at a Glance

- The proven design allows controlled stance phase flexion of up to 15°
- Stress reduction for both limbs, reduction of the forces acting upon the residual limb, pelvis, and spine, and close approximation of a sound, physiological gait pattern
- Progressive stance phase damping for harmonious, natural movements under load and adaptation of movements to different everyday situations
- Comfortable and safe walking, even on uneven ground and on inclines of up to 10°
- Easy initiation of the swing phase and progressive damping for focused control of the pendulum motion of the lower leg
- The design offers greater protection in high-risk situations: the wearer can always flex the joint in a controlled manner without delay or prior full extension, so there is less risk of falling than with locking knee joints
- Low weight of 740 g and a very large flexion angle of 175° for greater freedom of movement
- Adaptation of prosthesis alignment using the movable pyramid adapter
- All amputation levels can be fitted thanks to individual connectors
- Knee dimensions and function permit an attractive and natural cosmetic appearance

Connection Systems and Technical Data

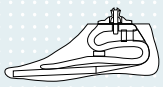
Indication and Area of Application
The EBS[pro] is suitable for amputees with knee disarticulation, transfemoral amputation, hip disarticulation and hemipelvectomy, with low to moderate activity levels. It offers amputees of all age groups maximum safety and wearing comfort for a wide range of everyday activities.

The EBS[pro] Knee Joint is suitable for users with knee disarticulation, transfemoral amputation, hip disarticulation and hemipelvectomy. Four different connection systems allow optimum adjustment to the patient's specific amputation level.

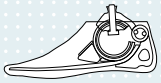


Article numbers	3R60-PRO	3R60-PRO=KD	3R60-PRO=ST	3R60-PRO=HD
Area of Application	Transfemoral amputation	Knee disarticulation	Transfemoral amputation – long residual limb	Hip disarticulation Hemipelvectomy
Proximal connection	Pyramid adapter (movable)	Lamination anchor	Threaded connector	Pyramid adapter (angled 10° anteriorly)
Distal connection	Pyramid adapter			
Knee flexion angle	175°	145°	125°	175°
Weight	770 g	840 g	750 g	770 g
System height	150 mm	169 mm	165 mm	150 mm
Proximal system height up to the alignment reference point	2 mm	21 mm	17 mm	2 mm
Distal system height up to the alignment reference point	148 mm			

Depending on the patient's functional requirements, the following prosthetic feet are recommended in combination with the EBS[pro]:
1D35 Dynamic Motion, 1C30 Trias, 1C40 C-Walk, 1E56 Axtion or 1E58 Axtion DP, 1C60 Triton, 1C61 Triton Vertical Shock, 1C63 Triton Low Profile.

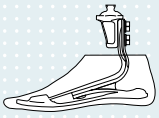

1D35 Dynamic Motion

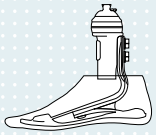

1C30 Trias


1C40 C-Walk


1E56 Axtion


1E58 Axtion DP


1C60 Triton


1C61 Triton Vertical Shock


1C63 Triton Low Profile

Please contact us if you have any further questions
or would like more information.

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