

Knee Designs

As usual, there is always an advantage and disadvantage to every prosthetic knee:

Manual Locking Knee

A manual locking knee is locked in a straight position while the amputee is walking and can be manually unlocked during sitting. The amputee manually unlocks the knee by pulling a lever or cable.

Pros

- Most stable knee for less active amputees who have problems with balance

Cons

- Do not allow for variable, or multiple, speed walking
- Result in abnormal gait, or walking, pattern, due to locked knee
- Require manual control for operation



Weight Activated Stance Control Knee



These knees are often referred to as 'stance control' knees and contain a weight-activated friction brake that stops the knee from bending. These knees swing freely, like a door hinge, when there is minimal or no weight put on the prosthesis. The knee locks once weight is applied. If the amputee attempts to put weight on the prosthesis when the prosthesis is partially bent, the weight-activated friction brake prevents the prosthesis from buckling.

Pros

- Provide increase stability for low activity amputees
- Provide safety lock up to 35 degrees of flexion
- Do not require manual locking by the amputee

Cons

- Do not allow the amputee to walk at a multiple speeds, or variable cadences

- Result in abnormal gait as the knee only flexes when there is no weight applied, which is during swing phase

Polycentric Knee

- Targets Activity Level:



Polycentric knees are commonly referred to as '4-bar' knees and are appropriate for a wide range of amputees. This type of knee is mechanically complex, with multiple joints of motion and flexibility in stability settings. There are many versions of this knee which provide several options for stability and offer the possibility of variable cadence, or walking at multiple speeds.



Pros

- Excellent for longer residual limbs
- Are appropriate for a wide range of functional levels
- Designed with inherent stability
- Allow for adjustability in stability and swing speed
- Can include a hydraulic or pneumatic unit, which permits walking at variable speeds

Cons

- Difficult to cosmetically cover, due to the joints, or linkages
- Historically, polycentric knees have been heavier and bulkier, due to the multiple linkages; however, newer models have improved greatly



Pneumatic Knee

A pneumatic knee contains a cylinder with pistons that include air. The pistons manage the speed of knee flexion (when the knee bends),



which allows the amputee to walk at various speeds. When the amputee increases in walking speed, with cylinder limits the amount of air and allows the knee to bend more quickly. When the amputee decreases walking speed, with cylinder increases the air content, making the knee bend more slowly. The prosthetic knee is locked at heel strike and is automatically unlocked during toe-off.

Pros

- Allow the amputee to walk at various speeds
- Excellent for higher functional level amputees
- Offer considerable stability
- Allow for a smooth gait, or walking pattern

Cons

- Can be heavy
- Require maintenance

Hydraulic Knee



A pneumatic knee contains a cylinder with pistons that include fluid. The pistons manage the speed of knee flexion (when the knee bends), which allows the amputee to walk at various speeds. When the amputee increases in walking speed, with cylinder limits the amount of fluid and allows the knee to bend more quickly. When the amputee decreases walking speed, with cylinder increases the fluid



content, making the knee bend more slowly. The prosthetic knee is locked at heel strike and is automatically unlocked during toe-off.

Pros

- Allow the amputee to walk at various speeds
- Excellent for higher functional level amputees
- Offer considerable stability
- Allow for a smooth gait, or walking pattern

Cons

- Can be heavy

- Require maintenance

Microprocessor



Microprocessor knee units utilize computerized mechanisms to evaluate the various stages of gait during a step and self-adjust to accommodate for speed and/or stability changes. Microprocessors are able to anticipate movement during a step and provide stable and seamless transitions between heel strike and toe-off.



Pros

- High level of stability during various walking speeds
- Excellent for higher functional level amputees who require increased stability
- Allow for a more natural gait, or walking pattern
- Can reduce falls for active amputees
- Allow for safer ambulation over uneven terrain and stairs

Cons

- Can be heavy
- Require regular preventative maintenance
- Include batteries that must be charged
- Can complicate cosmetic finishing
- Involve more financial cost

