

Transfemoral Prosthetic Design



- Amputation b/w femoral epicondyles and greater trochanter are fitted with transfemoral prosthesis.
- Consist of
- (1) foot-ankle assembly
- (2) shank
- (3)knee unit
- (4)socket
- (5)Suspension device

(1) foot-ankle assembly

- SACH Foot is most commonly used
- Single-axis foot is somewhat more frequently prescribed . Nevertheless, any foot, including the energy storing/releasing designs can be incorporated in a transfemoral prosthesis.

Shank

- Either the sturdy exoskeletal or endoskeletal shank may be used.
- Endoskeletal shank creates a more pleasing appearance , particularly in the knee area and adjustable , and lighter than exo...

Knee unit

- Prosthetic knee enables the user to bend the knee when sitting or kneeling.
- Commercial knee units may be described according to four features.
- 1) axis
- 2) friction mechanism
- 3) extension aid
- 4) mechanical stabilizer
- Many combinations of features are available; not every knee unit has all four components.

(a)

Knee Unit: AXIS SYSTEM

Two types of knee units

- i. **Single axis**
- ii. **Polycentric linkage**
 - a) 4 or more pivoting bars
 - b) Provide greater stability
 - c) center of knee rotation in posterior to weight bearing line

Axis system

- The thigh piece can be connected to the shank either by a simple single-axis hinge or by polycentric linkage.
- Polycentric systems have four or more pivoting bars and provide greater stability to the knee. This style is less common b/c of its greater complexity.

(b)Friction Mechanism

- If the knee does not have sufficient friction to retard its natural pendular action
- Friction mechanisms change the knee swing by modifying the speed of the knee motion during various parts of the swing phase and by affecting knee swing according to walking speed.

- **Constant and variable:-**
- The most popular knee unit has constant friction
- **Variable friction:-**
- In which the amount of friction changes during a given swing phase
- At early swing:-high friction.....retard excessive knee flexion
- During mid swing:- friction diminishes to permit the knee swing easily
- Late swing:- friction increases to dampen impact

(c) Extension aid

- Assist knee extension
- Simplest type.... External aid consisting of ***elastic webbing*** in front of knee axis.
- Int ext aid ***Elastic strap or coiled ring*** within the knee unit.... Functions identically to the ext aid during walking

d) Stabilizers

- Most knee units do not have a special device to increase stability. The patient controls knee action by hip motion, aided by the alignment of the knee in relation to other components of the prosthesis.
- Elderly or debilitating pt may benefit from stabilizing mechanism
- a) manual lock Simplest mechanical stabilizer
- b) friction brake..... more elaborate stabilizing system, provides very high friction mechanism during early stance, resisting any tendency of the knee to flex.

socket

- As with all prosthetic sockets, the transfemoral one should be a total contact receptacle to distribute load over the maximum area, thereby reducing pressure.
- Two types
 - 1) quadrilateral socket (traditional type)
 - 2) ischial containment socket (its wall cover the ischial tuberosity & part of the ischiopubic ramus to augment socket stability)

Quadrilateral flexible socket in rigid frame viewed from above



Source: <https://www.researchgate.net/publication/321111111>
Accessed 10/10/2023, 10:00 AM
Copyright © 2023, All rights reserved.

Suction suspension

- Suction refers to the pressure difference inside and outside the socket.
- with suction suspension, internal socket pressure $<$ external socket pressure
- A_p causes the socket to remain on the thigh.

suspension

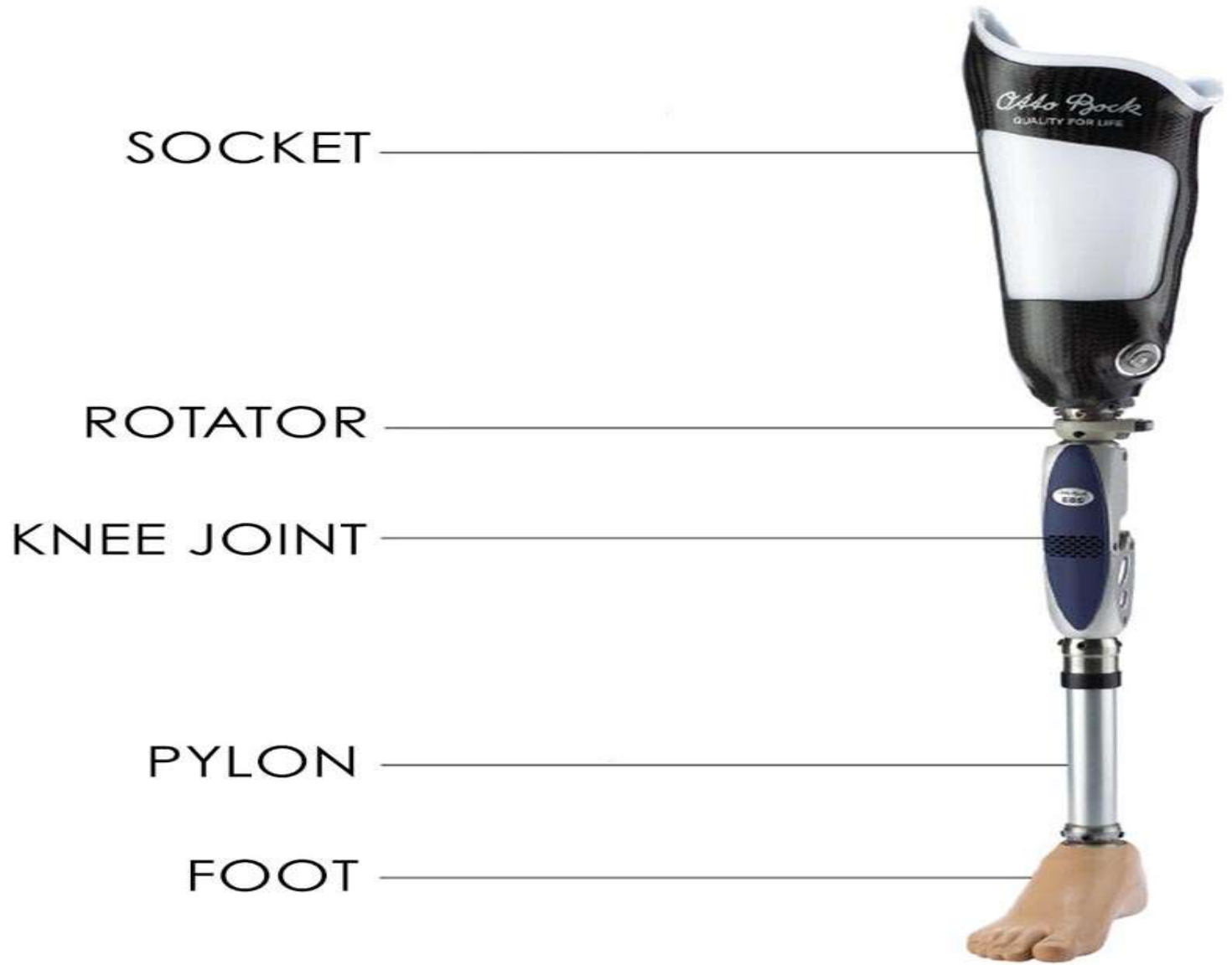
- Three means are used to suspend the transfemoral prosthesis
- Total suction
- Partial suction
- No suction
- **Total suction**:-
- Max control of the prosthesis, without any encumbering auxiliary suspension, can be achieved only if the socks fits very snugly to give total suction.

Partial suction

- Socket that is slightly loose may enable partial suction susp.
- Pt wears one or more socks or a liner made of silicone or other synthetic material.
- Auxiliary suspension aid is needed either a fabric silesian bandage or a rigid plastic or metal hip joint and pelvic band.

No suction

- If socket has distal hole but no valve, then there is no pressure difference between inside and outside the socket.
- The client wears one or more socks and require a pelvic band.
- Loose socket makes prosthesis donning easy, but hinders control of prosthesis and sitting comfort.
- Another alternative is the addition of a transfemoral suspension sleeve.



SOCKET

ROTATOR

KNEE JOINT

PYLON

FOOT