PRINCIPLES OF PROSTHETICS AND ORTHOTICS

2nd year 1st semester

Lecture 6

Dr. Muslim Muhsin Ali

Understanding the Syme Amputation

The Syme, colloquially known as the tibiotarsal amputation, is a specialized surgical procedure involving disarticulating the talocrural joint. Key features of this technique include:

- Complete removal of the forefoot.
- Preservation and anchoring of the heel fat pad to the distal tibia. This unique aspect permits distal end bearing, allowing some degree of ambulation without a prosthesis.

By the late 19th century, the Syme amputation had gained immense popularity, primarily due to its superior patient survival rates. The minimized risk of sepsis and shock - resultant of avoiding bone severance - rendered it a favorable choice over other contemporaneous surgical methods.

Challenges and Solutions

Despite its benefits, the Syme amputation is not without challenges:

Migration of the distal heel pad: While primarily a result of surgical technique, this issue can sometimes be exacerbated by early weight-bearing before prosthetic fitting. Proper surgical techniques can mitigate this risk.

Cosmetic Concerns: Poor aesthetic results may arise, through these can sometimes be addressed through malleolus removal.

For successful outcomes, ensuring an adequate vascular supply is paramount, as it guarantees healing. In contemporary times, the Syme amputation has witnessed a resurgence in popularity, attributed to heightened recognition of its energy-efficient gait relative to transtibial levels. Modern vascular evaluation techniques and advanced medical procedures further ensure primary wound healing, even more distally.

A salient advantage of the Syme amputation is the significant weight-bearing potential of a well-executed surgery, with or without a prosthesis. Pressure management becomes paramount, with certain areas like the tibial crest and fibula head being pressure-sensitive, while others like the midpatella tendon are pressure-tolerant.

Postoperative Care

Postoperative care emphasizes the importance of appropriate weight bearing. Gait training and therapy should ideally commence only after the delivery of the prosthesis, ensuring minimal risk of medial migration of the heel pad. The use of walking casts, whether temporary or definitive, plays a crucial role in managing postoperative care, and their application requires expertise in prosthetics.

Prosthetic Management

The prosthesis design for a Syme amputation demands strength, especially at the ankle section, to withstand the dynamic forces throughout the gait cycle. Before World War II, Syme amputees were typically fitted with anterior lacing wooden or leather sockets with steel sidebars. Today, prosthetic designs, including the Canadian Syme prosthesis introduced in the 1950s, have revolutionized the field. While the Canadian design offers cosmetic benefits, it does have its limitations, notably around the ankle area.

Canadian Syme Prostheses

The Syme amputation has been adorned with numerous prosthetic approaches over the years. One of the most significant among these is the Canadian Syme prosthesis. Let's delve deeper into its design, history, advantages, and challenges.

Historical Evolution

The Canadian Syme prosthesis marked a significant departure from traditional prosthetic designs when introduced in the 1950s. Before its advent, most patients with Syme amputations were fitted with anterior lacing wooden sockets or leather sockets, supported by a robust superstructure of medial and lateral steel sidebars. The Canadian design represented the first significant enhancement over these traditional, often cumbersome designs.

Canadian Syme Prostheses

Design Specifics

Aesthetics and Structure A standout feature of the Canadian Syme prosthesis is its seamless appearance when viewing the ankle in the coronal plane. This design lacks obvious buildups, windows, or hardware that might increase the ankle diameter.

Access Panel Unique to the Canadian Syme prosthesis is its removable posterior panel. This "donning window" is ingeniously designed to facilitate the putting on and taking off of the prosthesis. The window extends from the apex of the distal expansion and moves proximally as far as necessary, ensuring clearance for the bulbous end.

Challenges and Modern Solutions

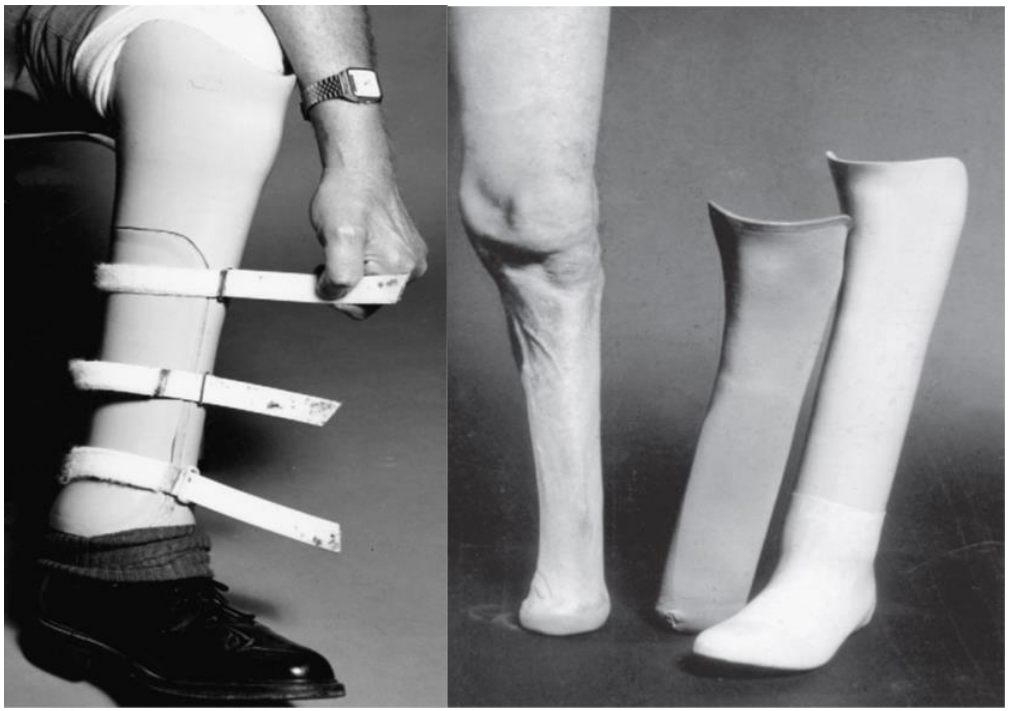
Ankle Durability One inherent challenge with the Canadian Syme design is the posterior region's window cutout around the ankle. This design choice, while enhancing the prosthesis's usability, has the inadvertent effect of weakening the ankle area. This region is particularly crucial as it undergoes immense compression and tension during ambulation.

Modern Materials Breakage, due to the above reason, might be higher with the Canadian design than with other Syme prostheses. However, with the advent of modern materials, like carbon fiber and acrylic lamination techniques, these challenges have been substantially mitigated. These new-age materials enhance the prosthesis's strength, making it more robust and durable.

Cosmetic Advantages While the Canadian prosthesis is aesthetically more appealing, contemporary prosthetic designs have provided alternative solutions, sometimes limiting the Canadian design's use for specific patient needs.

Medial Opening Syme Prostheses

- The *Medial Opening Syme Prosthesis*, also known as the *Veterans Administration Prosthetic Center Syme Prosthesis*, emerged subsequent to the Canadian Syme prosthesis.
- Introduced at the New York City Veterans Administration Medical Center in 1959, its hallmark feature is a removable donning door on the medial side.
- It offers cosmetic advantages around the ankle and boasts greater strength than its Canadian counterpart. This has made it a favorite amongst many patients who have undergone Syme amputation.



Sleeve Suspension Syme Prostheses

- Commonly dubbed the Stovepipe Syme Prosthesis due to the cylindrical design of its removable liner.
- Comprising an inner flexible insert, the wearer first dons this liner before the external prosthetic shell.
- Despite its bulkiness and reduced cosmetic appeal, it offers remarkable strength. This strength is ideal for individuals who are heavier, or those who have experienced prosthetic breakage with other designs.

Expandable Wall Prostheses

- The design philosophy here is rooted in an inner socket wall just proximal to the distal expansion. This wall is both elastic and expandable.
- Multiple materials have been used for this type, from Surlyn to silicone elastomer.

- Its construction, which requires a flexible inner socket and a rigid outer structure, makes it bulkier than the Canadian or medial opening designs. Still, for patients with specific needs, such as those with cognitive impairments, this could be an optimal choice.

Tucker-Winnipeg Syme Prostheses

- A design less commonly seen in the United States, this prosthesis features lateral and medial donning slots.
- Particularly well-suited for children, this design does come with caveats, including potential risks for those with vascular diseases.

Prosthetic Feet for Syme Prostheses

- A challenging aspect of Syme prostheses is the fitting of a prosthetic foot within the limited space beneath the residual limb. Maintaining equivalent leg lengths is essential to ensure a level pelvis.

- The determination of the *Prosthetic Clearance Value* is critical. This involves measuring the available space between the distal end of the limb and the floor while considering factors such as the height of the Syme nut.

Non-Articulating Syme Feet

- Many feet used for transtibial amputations have been adapted for Syme amputations.
- The Solid-Ankle, Cushion-Heel (SACH) Foot stands out as a historical choice for many Syme amputation patients. Known for its durability and cost-effectiveness, the SACH design, although old, remains an essential part of the prosthetic toolbox.

Thank You