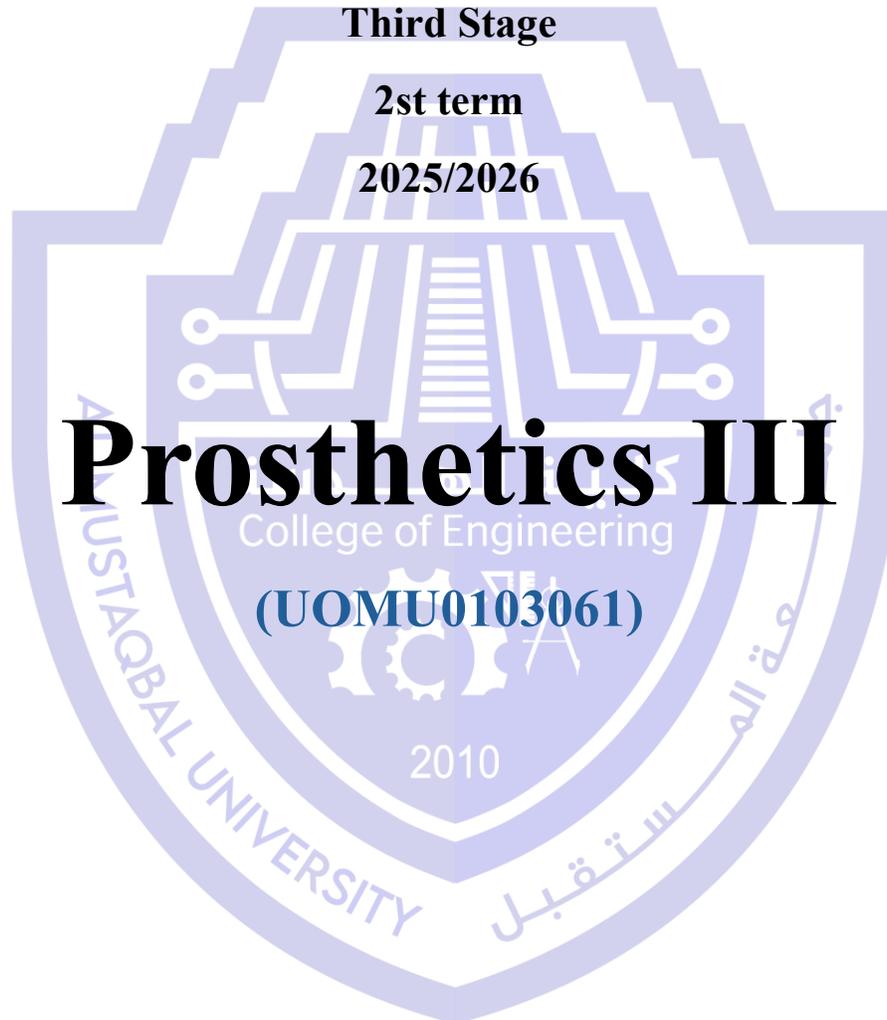




**Al-Mustaqbal University  
College of Engineering  
Prosthetics and Orthotics Engineering**



## **Lecture 3**

**Asst. Lect. Muntadher Saleh Mahdi**

[Muntadher.saleh.mahdi@uomus.edu.iq](mailto:Muntadher.saleh.mahdi@uomus.edu.iq)

## Control and Suspension Strategies for Bilateral Prostheses

For those unfortunate to suffer amputation of both upper extremities, prosthetic systems are not just instruments of rehabilitation but are crucial for restoring their dignity, independence, and quality of life. The challenge is to design a prosthetic system that is not only easily donable but also maximizes functionality.

### 1 Traditional Systems vs. Advanced Techniques

Traditionally, a figure-of-eight harness with a contralateral axillary loop for each prosthesis was employed. However, advancements in understanding and technology have paved the way for linking the two anterior suspension components.

- 1 **Equal Counteracting Forces** This arrangement fosters an equilibrium. The bilateral prosthetic system is robustly stabilized by the equal counteracting forces from each prosthesis.
- 2 **Single vs. Dual-Ring Systems** The choice between these systems depends on the individual patient's functional requirements. A secondary ring, positioned below the main ring, is designated for the control attachment straps. The upper ring, meanwhile, caters to the anterior suspensor straps and, when dealing with bilateral transhumeral residual limbs, connects the elbow locking straps.



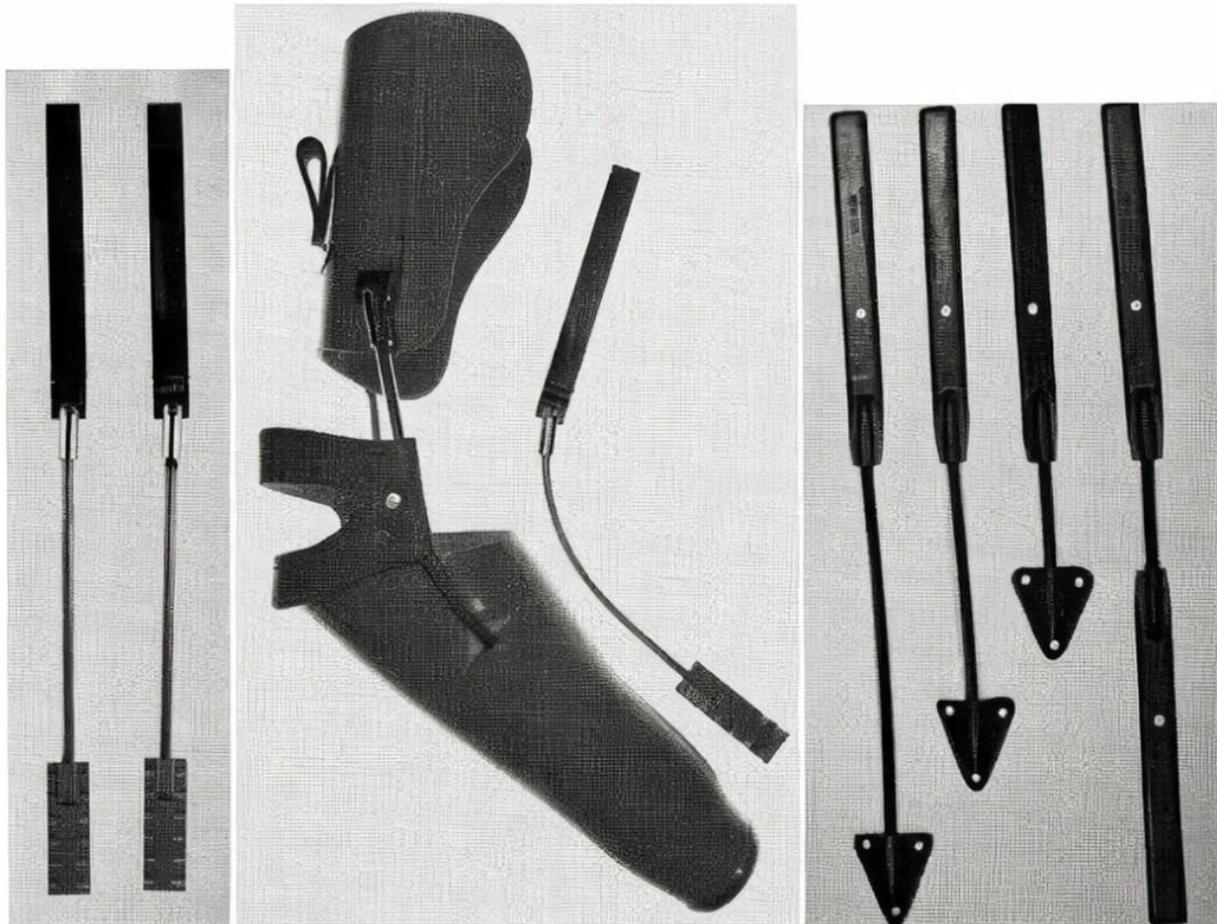
## 2 Individual Preferences and Functional Needs

Diversity in amputation types and personal needs implies that there's no one-size-fits-all solution

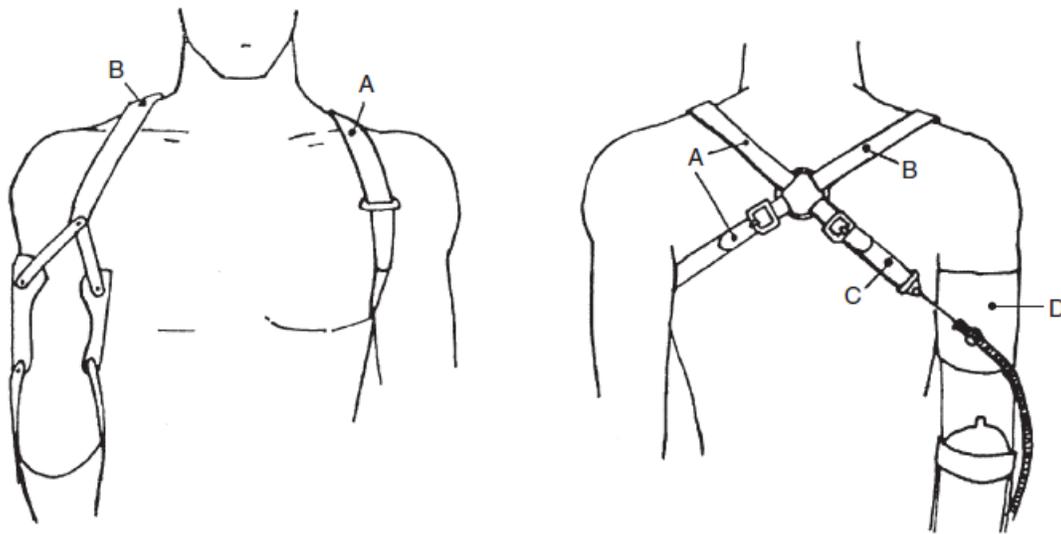
- 1 Some patients, especially those occasionally donning just one prosthesis or those with mismatched prostheses, might prefer separate and entirely independent harness systems.
- 2 An interesting example is that of an individual with bilateral transradial amputations. They might decide on a conventional cable-driven system for the nondominant side, whereas an externally powered prosthesis that's self-suspending becomes preferable for the dominant residual limb.

## 3 The Role of the Triceps Cuff in Conventional Transradial Prosthesis

- 1 Harness Suspension and Control: Individuals harnessing conventional suspension control the terminal device (TD) through a singular cable. The triceps cuff serves a dual purpose here, it optimally positions the cable housing and provides a foundational link to the forearm section.
  - 2 Connection Mechanisms: There are various connection methods between the triceps cuff and the forearm
- Flexible Dacron hinges are typically satisfactory, offering robust suspension and range of motion (ROM) for most midlength transradial amputations.



- In scenarios where the wearer might be subjected to excessive axial loads – perhaps due to occupational demands of lifting or moving heavy objects – steel cable hinges are preferable.
- Lastly, for those with notably short transradial amputations, metal hinges offer superior medial-lateral stability at the elbow. They also provide a functional stop at full extension, shielding the residual limb.



**FIGURE 30-9** Anterior and posterior view of a figure-of-eight harness system for a transradial prosthesis, with the axillary loop (A), the anterior support strap that provides stability during a downward pull (B), the attachment strap for cable control of the terminal device (C), and the triceps pad that anchors the control cable in the most effective position (D). (Modified from the Northwestern

