Al-Mustaqbal University
Collage of Engineering
Prosthetics and Orthotics Engineering

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Prosthetics III

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Lecture 3

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Lecture 2

Prosthetic Examination and Evaluation

1. Upper-Extremity Amputations

- Examination of such patients necessitates comprehensive documentation of the limb's Range of Motion (ROM).
- Both active and passive ranges are to be distinguished and documented.
- Assessing volitional muscle control is crucial.
- The shape, contour, and tissue consistency of the limb provide essential data.
- Observing grafts, scars, and painful residuum areas is crucial.
- Past medical history, especially affecting prosthetic development and rehabilitation, is indispensable.

2. Incorporating Medical History

- It's essential to account for injuries or pathologies on both body sides.
- For high-level amputations, understanding the integration of prosthetics across axilla and the thoracic wall is paramount.

3.Objective of Prosthetic Interventions

- The aim should always be to restore as much functional potential as possible.
- This is realized by selecting the right components, materials, and interface designs to mirror the lost body segments and functions.
- The design must resonate with the patient's vocational, recreational, and aesthetic needs.

Diverse Prosthetic Options

1. No Prosthesis

- Surprisingly, a significant portion of upper-extremity amputees choose not to regularly use a prosthesis.
- Often, this choice stems from early exposure to suboptimal prosthetic devices.
- Despite innovations, some amputees might not align a prosthesis with their body image. Hence, consistent follow-ups are paramount.

2. Passive Prostheses and Restorations

- Contrary to the name, these devices, while not actively positing or providing grip functions, can be crucial, especially for young children.
- They typically use a realistic hand as a terminal device (TD) and can be self-suspending.
- Latex cosmetic gloves provide a cost-effective solution. Yet, many prefer realistic restorations, often made with silicone due to its resilience and aesthetic appeal.

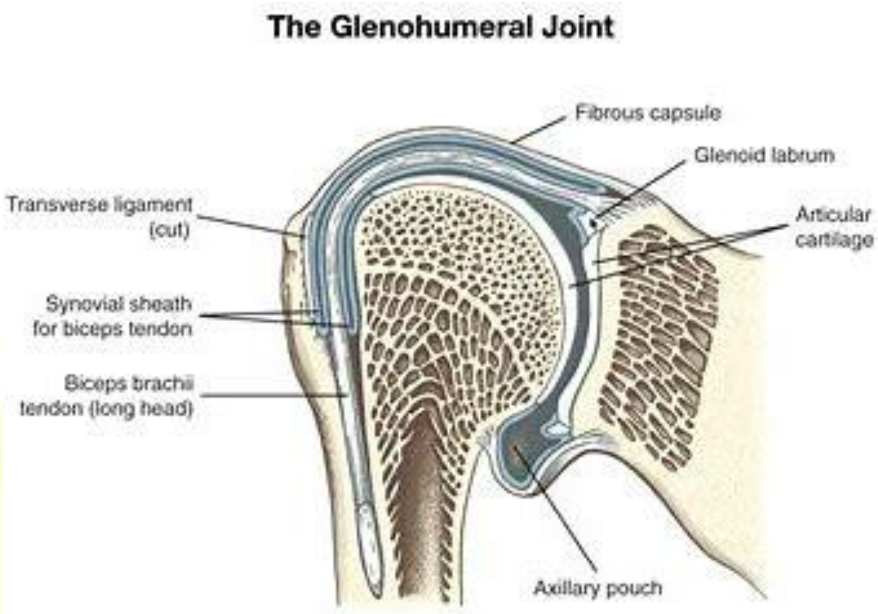
3. Advancements and Innovations

- Laser scanning and computer modeling can reproduce near-perfect mirror images for high-level amputations, such as shoulder disarticulations.
- Silicone has become the preferred choice due to its resistance to staining, durability, and better grip.

4. Conventional Body-Powered Prosthetic Systems

Conventional body-powered systems encompass prostheses that employ a control cable mechanism, enabling the translation of muscle force from voluntary movements of the shoulder or arm to operate a terminal device (TD) or prosthetic elbow. The effective operation of such systems demands specialized strategies from the wearer to generate the necessary cable movement.

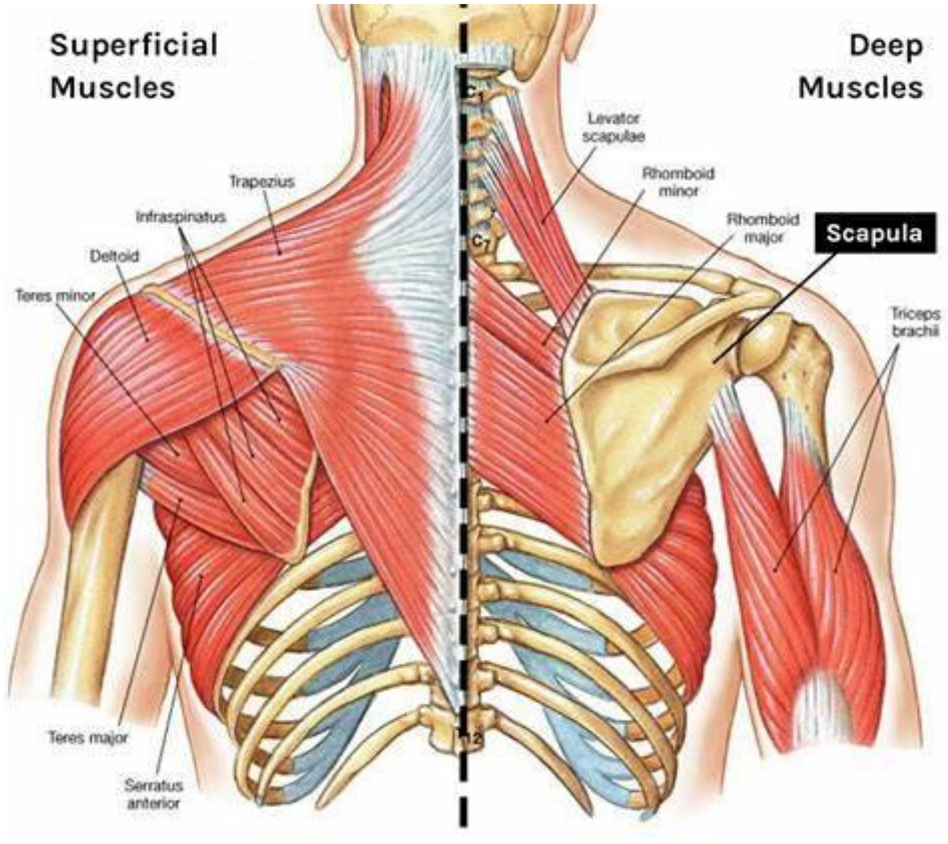
1. Role of the Glenohumeral Joint in Prosthetic Control



1 The glenohumeral joint, being pivotal in controlling conventional prostheses, contributes the most excursion.

2 Glenohumeral flexion, in particular, boasts a remarkable range and power, thus serving as an optimal motor for this control system.

3 Secondary movements, such as scapular and biscapular abduction or scapular protraction, further enhance the functional envelope - the space within which the user can control the TD effectively.



Back View (with Muscles)

2. Limitations of Conventional Systems

1 **The functional envelope's constraints**, Activities must primarily occur below the shoulders, above the waist, and not excessively beyond the shoulder width.
2 **Challenges faced by prosthetic wearers** , Difficulties arise particularly during tasks like grasp-and-release actions at extreme heights or close to the feet.
3 **Task limitations**, Activities behind the back remain unfeasible due to the cable's flexion and protraction-based control strategy.

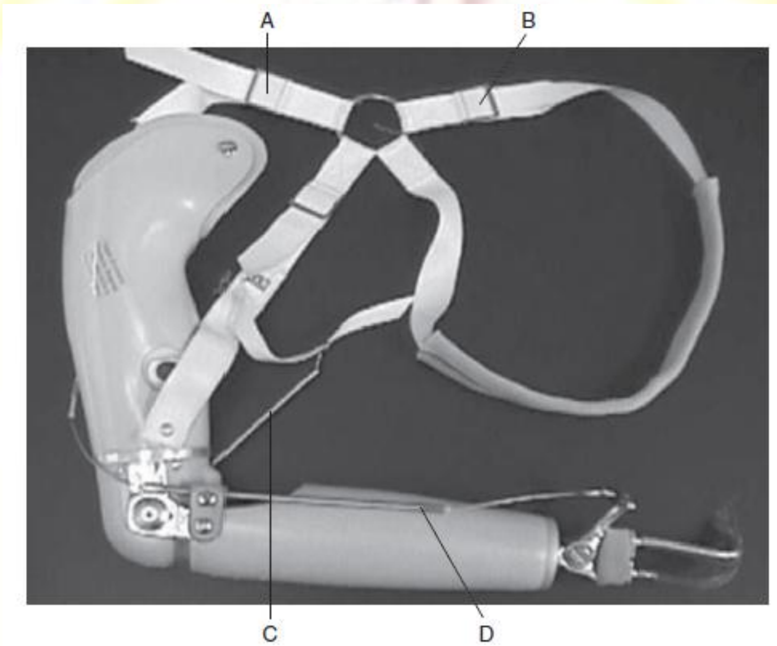
3. The Figure-of-Eight Suspension and Control Cable

1 The backbone of these prostheses is a harnessing system offering a stable control cable anchor and, frequently, a reliable suspension mechanism.
2 A prevalent design is the figure-of-eight harness, characterized by its distinct formation, which includes;

- An axillary loop fitted over the opposing shoulder.
- A control attachment cable.
- An anterior suspension component on the side of amputation.

3. Ideal harness positioning and configuration; Centered slightly below the seventh cervical vertebra and leaning towards the non-amputated side.

4. Construction materials; Predominantly medium weight Dacron webbing, supplemented with leather and plastic components.



4. Cable Control and Self-Suspending Sockets

1 When a self-suspending socket is deemed appropriate by the prosthetist, the anterior suspension component becomes redundant.

2 In such scenarios, a figure-of-nine harness, emphasizing the contralateral axillary loop, is used. This offers minimal harness complexity while ensuring robust cable control.

3 These self-suspending sockets might adopt an anatomical design or comprise a flexible silicone interface, each incorporating either a locking or suction valve mechanism.