Contemporary Upper Extremity Prosthetic Rehabilitation

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Lecture Overview
- Introduction
- Demographics
- Prosthetic Options
- Socket Design
- Advanced Materials
- Therapy
- Q&A

Comprehensive UE Prosthetic Rehabilitation
- Upper Limb Specialists
- Occupational Therapy
- Counseling
- Case Management
- Insurance Assistance
- Expedited Fitting
- Research & Development

The Profession of Prosthetics
- Allied Health Profession
  - Physical Therapist
  - Occupational Therapist
  - Physician Assistant
  - Clinical Nutritionist
- Master's Level Education
- National Certification (CP)
- State Licensure (CP/L)
- American Academy of Orthotists & Prosthetists
- Upper Limb Society

Limb Amputation and Deficiency
- Data from the Healthcare Cost and Utilization Project, Nationwide Inpatient Sample
- From 1988 to 1996 approximately 166,464 upper extremity amputations occurred.
  - 18,496 per year.

Limb Amputation and Deficiency
- 9%
  - 1,606 Annually
- 91%
  - 16,890 Annually

Limb Amputation and Deficiency

If you disregard amputation levels distal to the wrist and distal to the ankle:

- **Upper Limb**: \(1,606\) /year
- **Lower Limb**: \(63,956\) /year

\[40:1\] Ratio


Causes of Amputation

<table>
<thead>
<tr>
<th>Cause of Amputation</th>
<th>Lower Extremity</th>
<th>Upper Extremity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congenital</td>
<td>41.5%</td>
<td>58.5%</td>
</tr>
<tr>
<td>Tumor</td>
<td>76.1%</td>
<td>23.9%</td>
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<tr>
<td>Trauma</td>
<td>32.4%</td>
<td>68.6%</td>
</tr>
<tr>
<td>Disease (PVD)</td>
<td>95%</td>
<td>5%</td>
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</tbody>
</table>

*Per 100,000 Limb-loss hospital discharges from 1988-1996

**In the United States, there are approximately 1.8 million people living with limb loss. It is estimated that one out of every 200 people in the U.S. has had an amputation.


Glossary

Socket: the interface that contacts and contains the residual limb; the newest sockets are rolled or injected silicone for sensitive or scarred residual limbs

Frame: rigid outer structure supporting the socket
**Glossary**

Harness — transmits energy from specific body motions to move a prosthetic component; also a type of suspension.

**Glossary**

Component — the fingers, hand, wrist, or elbow of a prosthesis.

**Glossary**

Terminal device — component at the distal portion of prosthesis, i.e. hook, hand, etc.

**Glossary**

Suspension — the means of holding the prosthesis on the user.

3 Types:
- Harness
- Self-suspending
- Suction suspension

**Glossary**

Preparatory — first prosthesis a patient is fit with, intended to be temporary.

**Glossary**

Definitive/final — prosthesis that is intended to be used until replacement is needed.
The Challenge

- Traumatic nature of most cases
- Need for comprehensive care
- Limited patient population

Primary Prosthetic Goals

- Function
- Comfort
- Protection
- Suspension
- Cosmesis
- Ease of use

No Prosthesis

Passive Prosthesis

Body-Powered Prosthesis

Body-Powered & Mechanical Fingers
Left Trans-humeral Body-Powered Prosthesis

Electrically Powered Prosthesis

Electrically Powered Prosthesis

Compliant Hands

Partial Hand Myoelectric Prosthesis

Hybrid Prosthesis

• A combination of options
• Electric AND body powered
• Usually seen in above elbow applications
• Body powered ➔ Electric
Transi humeral Hybrid Prosthesis

Activity Specific Prosthesis

Usually limited to specific activities and provides function for a specific use.

Partial Hand Activity Specific Prosthesis

T.R.A.C. Socket Design

1. Antecubital region
2. Olecranon region
3. Epicondylar region
4. Distal radial region
5. Wrist extensor and flexor musculature

TransRadial Anatomically Contoured Socket

Custom Silicone Socket

HTV silicone socket improves fit and comfort of prosthesis through entire ROM

Therapy Critical Component!!

Comprehensive prosthetic training
Community re-integration
Expedited Fitting Procedure
Day 1: Casting / Therapy
    Pre-Prosthetic Training
Day 2: Test Socket / Therapy
    Electrode Placement
Day 3: Preparatory Prosthesis
    Functional Training / Programming
Day 4: Preparatory Prosthesis

Contemporary Upper Extremity Prosthetic Rehabilitation
--Therapy--

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Learning Objectives
To understand the:
A. Collaborative team approach
B. Role of a therapist
C. Phases of prosthetic rehabilitation
D. Potential obstacles

The Collaborative Team

Phases of Prosthetic Rehabilitation

Thankyou!!
Phase I: Initial Management and Protective Healing
Wound care, limb shaping, desensitization, pain management

Phase I: Initial Management and Protective Healing
Basic ADLs, adaptive techniques and equipment

Phase I: Initial Management and Protective Healing
Psychological Support
- Post traumatic stress disorder
- Depression
- The grief cycle: shock and denial, anger, bargaining, acceptance
- Fear of community reintegration
- Substance abuse

Phase II: Pre-prosthetic Training
- Proper posture, body mechanics and prevention of overuse syndromes

Phase II: Pre-prosthetic Training
- Strength, ROM and endurance
- Desensitization and pain management
- Education and Expectations
Phase II: Pre-prosthetic Training

Musculoskeletal Changes
- shift of the trunk
- scoliosis with bowing
- elevation of the shoulder
- torsion of the trunk

Greitemann, et al., 1996

Phase II: Pre-prosthetic Training

Special adaptations and home modifications

Phase II: Pre-prosthetic training

Myoelectric site testing

Phase III: Basic Prosthetic Training

Donning/Doffing
Components
Operation
Prosthetic Care

Phase III: Basic Prosthetic Training

Controls Training
ADL Training
Phase III: Basic Prosthetic Training
Controls Training

Phase IV: Advanced Prosthetic Training

Job site assessment
Home assessment
Community re-integration
IADLs
Driver evaluation and training
Recreational activities

Phase IV: Advanced Prosthetic Training
Job Site Assessment

Phase IV: Advanced Prosthetic Training
Community Reintegration

Phase IV: Advanced Prosthetic Training
Instrumental Activities of Daily Living
Phase IV: Advanced Prosthetic Training

Driver evaluation and training

Recreational Activities

Phase IV: Advanced Prosthetic Training

Conclusion

Success for upper limb amputation patients is possible.

You must be willing to invest in:

- Time
- Team
- Technology

Optimal patient care is achievable.

Thank You!

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