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- Apple Mac OS 10.10+ (*Latest Firefox, Safari, or Chrome)
- Android 6.x (Chrome Browser Only)
- Apple iOS (*Latest version, Safari Browser Only)

* Official support for the "latest" version of a newly released browser, among those noted above, will be added within 8 weeks of public release. Until then, the previous version will continue to be supported instead.

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Prosthetic and Orthotic Devices
April 29, 2020
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Presenters

Dr. Robert Hall
Medical Director

Tim Riedlinger, CPO
Certified Prosthetist-Orthotist
Objectives

1. Discuss the medical treatment course for claimants with an amputation.

2. Review the safety, functional, and financial considerations related to the claimant with an amputation.

3. Describe the different types of upper and lower limb prosthetic devices, their advantages, and their potential disadvantages.

4. Discuss the benefits and potential risks of orthotic devices.

5. Review the differences between off-the-shelf and custom-made orthotic devices.

6. Describe the different types of orthotic devices, their indications, and important considerations when they are used.
Prosthetic devices
## Effects of comorbid conditions on amputations

<table>
<thead>
<tr>
<th>COMORBID CONDITIONS</th>
<th>COMPLICATIONS</th>
<th>IMPACT ON USE OF PROSTHESIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>Infection</td>
<td>Weakness</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>Impaired wound healing</td>
<td>Impaired cognition</td>
</tr>
<tr>
<td>Vascular disease</td>
<td>Contractures</td>
<td>Decreased endurance</td>
</tr>
<tr>
<td>Heart disease</td>
<td>Deconditioning</td>
<td>Lack of motivation</td>
</tr>
<tr>
<td>Depression</td>
<td>Pain</td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>Worsening depression</td>
<td></td>
</tr>
<tr>
<td>Arthritis</td>
<td>Sedation</td>
<td></td>
</tr>
<tr>
<td>Substance abuse</td>
<td>Falls</td>
<td></td>
</tr>
<tr>
<td>Aging claimant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Infection
- Impaired wound healing
- Contractures
- Deconditioning
- Pain
- Worsening depression
- Sedation
- Falls
- Weakness
- Impaired cognition
- Decreased endurance
- Lack of motivation
**Hospital course**

<table>
<thead>
<tr>
<th>POSTOPERATIVE CARE</th>
<th>DISCHARGE PLANNING</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pain control</td>
<td>• Home</td>
</tr>
<tr>
<td>• Minimize blood loss</td>
<td>• Subacute nursing facility</td>
</tr>
<tr>
<td>• Adequate nutrition</td>
<td>• Acute inpatient rehabilitation</td>
</tr>
<tr>
<td>• Control swelling</td>
<td>• DME</td>
</tr>
<tr>
<td>• Falls prevention</td>
<td>• Follow-up</td>
</tr>
<tr>
<td>• Early range of motion and mobilization</td>
<td>– Providers</td>
</tr>
<tr>
<td>• Prosthetic vendor referral</td>
<td>– Physical medicine</td>
</tr>
<tr>
<td></td>
<td>– Prosthetic vendor</td>
</tr>
</tbody>
</table>
Post-discharge recovery and rehabilitation

<table>
<thead>
<tr>
<th>PAIN CONTROL</th>
<th>WOUND CARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Postsurgical pain</td>
<td>• Surgical wound management</td>
</tr>
<tr>
<td>• Phantom limb pain</td>
<td>• Compression (wrap / shrinker)</td>
</tr>
<tr>
<td>– Sensations</td>
<td>• Precautions with elevation</td>
</tr>
<tr>
<td>– Pain</td>
<td>• Weight-bearing limitations</td>
</tr>
<tr>
<td>• Anticonvulsants and antidepressants</td>
<td>• Nutrition and hydration</td>
</tr>
<tr>
<td>• Desensitization techniques</td>
<td>• Scar mobilization</td>
</tr>
<tr>
<td>• Mirror therapy</td>
<td></td>
</tr>
<tr>
<td>• “Movement” of the missing limb</td>
<td></td>
</tr>
</tbody>
</table>
### Post-discharge recovery and rehabilitation

**RESIDUAL LIMB SHAPING**
- Elastic bandages (ACE wrap)
- Shrinker socks

**MOBILIZATION**
- Range of motion
- Strengthening of other limbs
- Ambulation
- Stair climbing

**ENDURANCE**
- Cardiovascular fitness
- Energy conservation techniques
- Joint protection
Prosthetic vendor referral

**PHYSICIAN PREFERENCE**
- Surgeon or physiatrist
- Order set

**CLAIMANT CONTACT**
Usually established prior to discharge from the hospital or rehabilitation center
- Introductory information
- Residual limb care
- Safety and precautions
- Estimated timeline for first prosthetic device

**PEER VISIT**
- Former patient
- Amputee Coalition
Outpatient prosthetic evaluation

• Medical history

• Physical examination

• Functional assessment
  — Prior
  — Current
  — Potential level of function and goals
    • Realistic
    • Meaningful
    • Unlikely to be more functional than prior to amputation
<table>
<thead>
<tr>
<th>Prosthesis timeline</th>
</tr>
</thead>
</table>
| **IMMEDIATE POSTOPERATIVE PROSTHESIS** | • Applied immediately after surgery  
• Initial weight-bearing  
• Only used until temporary prosthesis is created |
| **TEMPORARY PROSTHESIS** | • Provided within several months after amputation  
• Essential components only  
• Gait training  
• Safety |
| **DEFINITIVE (FINAL) PROSTHESIS** | • Created three to six months after amputation  
• Occasional use of some components from temporary prosthesis  
• Additional costs  
• Lifetime dependent upon wear and repairs  
• Repairs vs. replacement |
Characteristics of the population: **Gender and Age**

<table>
<thead>
<tr>
<th></th>
<th>DYSVASCULAR</th>
<th>TRAUMA</th>
<th>CANCER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male:</td>
<td>60%</td>
<td>78%</td>
<td>36%</td>
</tr>
<tr>
<td>Age:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 45</td>
<td>16%</td>
<td>46%</td>
<td>43%</td>
</tr>
<tr>
<td>45-64</td>
<td>58%</td>
<td>44%</td>
<td>42%</td>
</tr>
<tr>
<td>&gt;=65</td>
<td>26%</td>
<td>20%</td>
<td>15%</td>
</tr>
</tbody>
</table>

South Med. J 95(8):875-883,2802
Limb Amputation and Limb Deficiency
Timothy R. Dillingham, D.D. et. al.
### Percent using a prosthesis

<table>
<thead>
<tr>
<th></th>
<th>Dysvascular</th>
<th>Trauma</th>
<th>Cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Never</em></td>
<td>18%</td>
<td>19%</td>
<td>24%</td>
</tr>
<tr>
<td><em>&lt;8 hrs/day</em></td>
<td>22%</td>
<td>18%</td>
<td>11%</td>
</tr>
<tr>
<td><em>&gt;=8 hrs/day</em></td>
<td>60%</td>
<td>63%</td>
<td>66%</td>
</tr>
</tbody>
</table>

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Limb Amputation and Limb Deficiency
Timothy R. Dillingham, D.D. et. al.
### Percent using a prosthesis: Level of Amputation

<table>
<thead>
<tr>
<th></th>
<th>UPPER LIMB</th>
<th>LOWER LIMB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>49%</td>
<td>16%</td>
</tr>
<tr>
<td>&lt;8 hrs/day</td>
<td>27%</td>
<td>17%</td>
</tr>
<tr>
<td>&gt;=8 hrs/day</td>
<td>29%</td>
<td>67%</td>
</tr>
</tbody>
</table>

South Med. J 95(8):875-883,2802
Limb Amputation and Limb Deficiency
Timothy R. Dillingham, D.D. et. al.
## Current activity by age

<table>
<thead>
<tr>
<th></th>
<th>18-44</th>
<th>45-54</th>
<th>55-64</th>
<th>&gt;=65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working or School</td>
<td>66%</td>
<td>49%</td>
<td>35%</td>
<td>9%</td>
</tr>
<tr>
<td>Looking for Work</td>
<td>12%</td>
<td>11%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>Homemaker</td>
<td>8%</td>
<td>5%</td>
<td>5%</td>
<td>6%</td>
</tr>
<tr>
<td>Retired-Disability</td>
<td>14%</td>
<td>33%</td>
<td>42%</td>
<td>28%</td>
</tr>
<tr>
<td>Retired-Other</td>
<td>0%</td>
<td>2%</td>
<td>13%</td>
<td>55%</td>
</tr>
</tbody>
</table>

South Med. J 95(8):875-883, 2802
Limb Amputation and Limb Deficiency
Timothy R. Dillingham, D.D. et. al.
Team approach

- Physician
- Case worker
- Family members
- Prosthetist
- Physical Therapist
- Occupational therapist

Patient
Keep in mind…

• Everyone is different, as will be their prostheses
• Age is **never** a deciding factor for prosthetic intervention
  “Functional” age is important
• There are very few contraindications for a prosthesis
• Patients discuss with other patients - pros and cons
• Generally, new amputees have limited understanding of
  What to expect
  What is possible
Amputation site selection (lower limb)

- Hemicorporectomy
- Hemipelvectomy
- Hip disarticulation
- Transfemoral (above-the-knee)
- Knee disarticulation
- Transtibial (below-the-knee)
- Ankle disarticulation (Syme’s)
- Midtarsal (Chopart)
- Tarsometatarsal junction (Lisfranc)
- Transmetatarsal
- Partial foot/partial toe
Amputation site selection (lower limb)

- Hemicorporectomy
- Hemipelveectomy
- Hip disarticulation
- Transfemoral (above-the-knee)
- Knee disarticulation
- Transtibial (below-the-knee)
- Ankle disarticulation (Syme’s)
- Midtarsal (Chopart)
- Tarsometatarsal junction (Lisfranc)
- Transmetatarsal
- Partial foot/partial toe
### Amputation site and additional energy required for walking

<table>
<thead>
<tr>
<th>Amputation Site</th>
<th>Energy Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Below-the-Knee</td>
<td>25%</td>
</tr>
<tr>
<td>Bilateral Below-the-Knee</td>
<td>41%</td>
</tr>
<tr>
<td>Single Above-the-Knee</td>
<td>60-70%</td>
</tr>
<tr>
<td>Bilateral Above-the-Knee</td>
<td>&gt;200%</td>
</tr>
</tbody>
</table>

Lower limb prosthesis components are determined by claimant’s K-level

Medicare defines K-levels based on the ability or potential to ambulate and navigate the environment.

<table>
<thead>
<tr>
<th>K-LEVEL</th>
<th>FUNCTIONAL POTENTIAL OF AMPUTEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>K0</td>
<td><strong>No ability or potential</strong> to ambulate or transfer safely with or without assistance and a prosthesis does not enhance quality of life or mobility.</td>
</tr>
<tr>
<td>K1</td>
<td>Ability or potential to use a prosthesis for transfers or ambulation on level surfaces at <strong>fixed cadence</strong>.</td>
</tr>
<tr>
<td>K2</td>
<td>Ability or potential for ambulation with the ability to traverse <strong>low-level environmental barriers</strong> such as curbs, stairs, or uneven surfaces.</td>
</tr>
<tr>
<td>K3</td>
<td>Ability or potential for ambulation with <strong>variable cadence</strong> - a typical community ambulatory with the ability to traverse most environmental barriers may have activity that demands prosthetic use beyond simple locomotion.</td>
</tr>
<tr>
<td>K4</td>
<td>Ability or potential for ambulation that <strong>exceeds basic ambulation</strong> skills, exhibiting high impact, stress, or energy levels.</td>
</tr>
</tbody>
</table>

[http://www.oandp.org/olc/course_extended_content.asp?frmCourseId=ACA066EC-443A-4822-822C-89BC1CBD684E&frmTermId=k-levels](http://www.oandp.org/olc/course_extended_content.asp?frmCourseId=ACA066EC-443A-4822-822C-89BC1CBD684E&frmTermId=k-levels)
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<table>
<thead>
<tr>
<th>K-LEVEL</th>
<th>FUNCTIONAL POTENTIAL OF AMPUTEE</th>
<th>TYPE OF PROSTHESIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>K0</td>
<td>No ability or potential to ambulate or transfer safely with or without assistance and a prosthesis does not enhance quality of life or mobility.</td>
<td>Not eligible for a functional prosthesis</td>
</tr>
<tr>
<td>K1</td>
<td>Ability or potential to use a prosthesis for transfers or ambulation on level surfaces at <strong>fixed cadence</strong>.</td>
<td>External keel, SACH feet or single axis ankle/feet, single-axis, constant friction knee</td>
</tr>
<tr>
<td>K2</td>
<td>Ability or potential for ambulation with the ability to traverse <strong>low-level environmental barriers</strong> such as curbs, stairs, or uneven surfaces.</td>
<td>Flexible-keel feet and multi-axial ankle/feet, single-axis, constant friction knee</td>
</tr>
<tr>
<td>K3</td>
<td>Ability or potential for ambulation with <strong>variable cadence</strong> - a typical community ambulatory with the ability to traverse most environmental barriers may have activity that demands prosthetic use beyond simple locomotion.</td>
<td>Flex foot and flex-walk systems, energy storing feet, multi-axial ankle/feet, or dynamic response feet, fluid and pneumatic control knee, microprocessor knee</td>
</tr>
<tr>
<td>K4</td>
<td>Ability or potential for ambulation that <strong>exceeds basic ambulation</strong> skills, exhibiting high impact, stress, or energy levels.</td>
<td>Any ankle foot system appropriate, any ankle knee system appropriate, including microprocessor</td>
</tr>
</tbody>
</table>

http://www.oandp.org/olc/course_extended_content.asp?frmCourseId=ACA066EC-443A-4822-822C-89BC1CBD684E&frmTermId=k-levels
## Lower limb prostheses

<table>
<thead>
<tr>
<th>TYPE</th>
<th>SPECIAL CONSIDERATIONS</th>
<th>POTENTIAL COMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Functional considerations</td>
<td>• Amputation site</td>
<td>• Contractures</td>
</tr>
<tr>
<td>• Knee and ankle components</td>
<td>• Cognitive abilities</td>
<td>– Knee</td>
</tr>
<tr>
<td></td>
<td>• Residual strength and range of motion</td>
<td>– Hip</td>
</tr>
<tr>
<td></td>
<td>• Endurance</td>
<td>• Gait deviations</td>
</tr>
<tr>
<td></td>
<td>• Claimant weight</td>
<td>• Fall risk</td>
</tr>
<tr>
<td></td>
<td>• Comorbid conditions</td>
<td>• Abandonment of prosthesis</td>
</tr>
</tbody>
</table>

- Contractures
  - Knee
  - Hip
- Gait deviations
- Fall risk
- Abandonment of prosthesis
Components of a lower limb prosthesis

- Suspension
- Socket
- Knee
- Lower leg (shank)
- Foot/ankle
Partial foot

- Partial toe
- Toe disarticulation
- Metatarsal ray resection
- Transmetatarsal (TMA)
- Lisfranc & Chopart
Syme

Ankle disarticulation

• Challenging cosmesis
• Doors/windows for donning
• Weight-bearing end
• Limited foot options
Transtibial

- Resection through tibia and fibula
- Anatomical knee joint preserved
- Requires 25% more energy than normal
Knee disarticulation

• Entire femur and condyles intact

• Advantages
  – Good end-bearing surface
  – Lower trimline
  – Long lever arm for power/control

• Disadvantages
  – Limited space for attachment components
  – Prosthetic knee center lower than anatomical knee which causes gait deviation and sitting anomaly
Transfemoral

• Resection through femur
• Requires 66% more energy than normal

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Lower Extremity Prosthetics

MicroProcessor-controlled Knees

Frequency of falling

- **66%** Transfemoral (TF) Amputees experienced a fall within the previous year
- **4%** of the general population fall annually


Hip Disarticulation / Transpelvic

- Slow fixed cadence
- Component selection and alignment similar for both levels
- Prosthetic fitting typically limited to motivated and physiologically vigorous individuals
- Lack of comfort most common reason for NOT wearing prosthesis at these levels
- Energy requirements up to 200% of normal ambulation
Amputation site selection (upper limb)

- Forequarter
- Shoulder disarticulation
- Transhumeral (above-the-elbow)
- Elbow disarticulation
- Transradial (below-the-elbow)
- Wrist disarticulation
- Transcarpal
- Transmetacarpal
- Transphalangeal
Amputation site selection (upper limb)

• Forequarter
• Shoulder disarticulation
• Transhumeral (above-the-elbow)
• Elbow disarticulation
• Transradial (below-the-elbow)
• Wrist disarticulation
• Transcarpal
• Transmetacarpal
• Transphalangeal
UPPER EXTREMITY AMPUTEES

• The goal of Prosthetic Rehabilitation is to provide appropriate function to meet the goals and abilities in order to return to work.

• There are many prosthetic options and adaptations

• One prosthetic system typically does NOT meet all of the needs of an individual

There is NO standard prosthesis or protocol
Factors influencing success

50% Of upper limb amputees do not use a prosthesis

LONG-TERM IMPLICATIONS
• Overuse injuries
• Psychosocial
• Posture

We take for granted the simple bimanual tasks we do every day.
Upper extremity prosthetics: “Golden Period” of within 30 days

93% Success rate for patients fitted within 30 days

42% Success rate for patients fitted after 30 days

Malone et al. 1984
## Upper limb prostheses

<table>
<thead>
<tr>
<th>OPTIONS</th>
<th>SPECIAL CONSIDERATIONS</th>
<th>POTENTIAL COMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• No prosthesis</td>
<td>• Amputation site</td>
<td>• Overuse injuries</td>
</tr>
<tr>
<td>• Passive (semi-prehinsile, cosmetic)</td>
<td>• Cognitive abilities</td>
<td>• Skin wounds</td>
</tr>
<tr>
<td>• Manual/body powered (cable operated)</td>
<td>• Residual strength and range of motion</td>
<td>• Abandonment of prosthesis</td>
</tr>
<tr>
<td>• Myoelectric</td>
<td>• Durability requirements</td>
<td></td>
</tr>
<tr>
<td>• Hybrid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Adaptive / activity specific</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Components of an upper limb prosthesis

- Suspension
- Socket
- Upper arm
- Elbow
- Forearm
- Wrist

- Terminal device (hand)
  - Functional vs. cosmetic
  - Hand vs. hook

- Control system
  - Body powered
  - Myoelectric
Bad first experience with a prosthesis

- Unaware of options
- Limited functional ability
- Not worth the “hassle”
- Lack of sufficient prosthetic training
- Development of one-handedness
- Unnatural look
Passive prosthesis

- A cosmetic restoration with limited functional capabilities.
- Used for functional activities that do not require active prehension.
- Typically digits can be manipulated to enhance function.
Upper extremity prosthetics: Custom cosmetic restoration

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Prosthesis options

CABLE-OPERATED PROSTHESIS

Powered and controlled by gross body movements captured by a harness system.

**Excursion**: Body motions used for control

**Force**: Force associated with those body motions

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Prosthesis options

<table>
<thead>
<tr>
<th>CABLE-OPERATED PROSTHESIS</th>
<th>HOOKS - HOSMER DESIGNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powered and controlled by gross body movements captured by a harness system.</td>
<td>In general, hooks are used for function versus a hand. They offer a better visual of the object being manipulated.</td>
</tr>
<tr>
<td><strong>Excursion</strong>: Body motions used for control</td>
<td></td>
</tr>
<tr>
<td><strong>Force</strong>: Force associated with those body motions</td>
<td></td>
</tr>
</tbody>
</table>

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Prosthesis options

ELECTRICALLY POWERED PROSTHESIS

- Battery system

- Various Control Options: Myoelectric (single or dual site), Switch – rocker, pull, push, Touch Pads, Servo control.
Prosthesis options

<table>
<thead>
<tr>
<th>ELECTRICALLY POWERED PROSTHESIS</th>
<th>HYBRID PROSTHESIS: BODY POWERED + EXTERNAL POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Battery system</td>
<td>• A prosthesis utilizing various control strategies</td>
</tr>
<tr>
<td>• Various Control Options: Myoelectric (single or dual site), Switch – rocker, pull, push, Touch Pads, Servo control.</td>
<td>• Most universal configurations:</td>
</tr>
<tr>
<td></td>
<td>– Cable-driven elbow / electric hand</td>
</tr>
<tr>
<td></td>
<td>– Passive elbow / electric hand</td>
</tr>
</tbody>
</table>

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Prosthesis options

ADAPTIVE PROSTHESIS

A prosthesis that is designed for a specific activity
OR
An adaptation to an existing prosthesis
### Prosthesis options

<table>
<thead>
<tr>
<th>ADAPTIVE PROSTHESIS</th>
<th>MULTIPLE PROSTHESES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A prosthesis that is designed for a specific activity OR An adaptation to an existing prosthesis</td>
<td>• Many prosthetic users rely on more than one prosthesis to perform diverse types of activities and tasks. • The secondary prosthesis may also serve as a back-up prosthetic system.</td>
</tr>
</tbody>
</table>

---

Copyright Texas Assistive Devices

Copyright TRS Prosthetics

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Partial hand

- **Transphalangeal**
- **Transmetacarpal**
- **Transcarpal**

<table>
<thead>
<tr>
<th>PASSIVE/COSMETIC RESTORATION</th>
<th>PASSIVE/MECHANICAL</th>
<th>EXTERNALLY POWERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cosmetic appearance</td>
<td>• Augmentation of active grasp</td>
<td>• Myoelectric</td>
</tr>
<tr>
<td>• Protection of tender areas</td>
<td>• Less expensive than cosmetic glove</td>
<td></td>
</tr>
<tr>
<td>• Augmentation of active grasp</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Prosthesis options

WRIST DISARTICULATION / TRANSRADIAL

• The longer the limb, the more supination/pronation is preserved

• Control
  – Body powered
  – Externally powered
## Prosthesis options

<table>
<thead>
<tr>
<th>WRIST DISARTICULATION / TRANSRADIAL</th>
<th>ELBOW DISARTICULATION / TRANSHUMERAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The longer the limb, the more supination/pronation is preserved</td>
<td>• Crucial Factors</td>
</tr>
<tr>
<td>• Control</td>
<td>– Length of the bony lever arm</td>
</tr>
<tr>
<td>– Body powered</td>
<td>– Quality &amp; nature of soft-tissue coverage</td>
</tr>
<tr>
<td>– Externally powered</td>
<td>– Shape and muscle tone of the residual limb</td>
</tr>
<tr>
<td></td>
<td>– Flexibility, ROM, &amp; stability of proximal joints</td>
</tr>
<tr>
<td></td>
<td>• Successful long-term use</td>
</tr>
<tr>
<td></td>
<td>– Comfort</td>
</tr>
<tr>
<td></td>
<td>– Perceived value to patient</td>
</tr>
</tbody>
</table>

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Shoulder Disarticulation/Interscapulothoracic (Forequarter)

Major challenges

- Prosthesis stability
- Cosmetic appearance (especially natural shoulder profile)
Orthotic devices
Purpose of an orthotic device

An externally applied device to a body segment that facilitates or improve function by supporting, correcting, or compressing for skeletal deformity or weakness.

<table>
<thead>
<tr>
<th>POTENTIAL FUNCTIONS</th>
<th>SAFETY CONSIDERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Support and align</td>
<td>• Compliance</td>
</tr>
<tr>
<td>• Prevent or correct deformity</td>
<td>• Skin breakdown or blisters: too tight or too loose</td>
</tr>
<tr>
<td>• Substitute for function</td>
<td>• Muscle weakness</td>
</tr>
<tr>
<td>• Pain relief</td>
<td>• Overdependence or overreliance</td>
</tr>
<tr>
<td>• Transfer load from one area to another</td>
<td></td>
</tr>
<tr>
<td>• Inhibit tone</td>
<td></td>
</tr>
<tr>
<td>• Restrict motion</td>
<td></td>
</tr>
</tbody>
</table>
Differences between off-the-shelf and custom-made orthotic devices

• Availability

• Patient-fit

• Cost
  – Devices are often requested by brand-name instead of function
  – If physician fits the product, how often is the least expensive device provided or contract with certain company.
    • If insurance pays.....price is not an issue !?!?
  – A prosthetic-orthotic clinic cannot stock all brands in each office(s)
  – Brand-specific requests could result in higher cost without improved function or outcome and possibly delay care if certain brand not in stock..
  – Cost of orthosis or prosthesis includes all practitioner clinical evaluation, casting, fitting, and follow up time.
  – If deformity present, special circumstances, or measurements are outside of sizing guidelines, custom-made is indicated for.
Lower limb orthotic devices

Knee-ankle-foot orthosis (KAFO)

• Single axis
• Posterior offset
• Locking knee (drop lock, bail lock)
• Stance control
Lower limb orthotic devices

Ankle-foot orthosis (AFO)

- Posterior leaf
- Semi-rigid
- Solid plastic
- Articulated
- Tone-reduction properties
- Carbon
Lower limb orthotic devices

Knee orthosis (KO)

• Mediolateral stability
• Flexion extension limits (ROM joints)
• Swedish cage: used in the management of knee hyperextension
Lower limb orthotic devices

Ankle support orthosis (ASO)

- Ankle sprain
- Ankle instability
Upper limb orthotic devices

<table>
<thead>
<tr>
<th>STATIC</th>
<th>DYNAMIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Immobilize or support</td>
<td>• To substitute for loss of motor function</td>
</tr>
<tr>
<td>• Help prevent deformity</td>
<td>• To correct an existing deformity</td>
</tr>
<tr>
<td>• Prevent soft tissue contracture</td>
<td>• Provide <strong>controlled</strong> directional movement</td>
</tr>
<tr>
<td>• Allow attachment of assistive devices</td>
<td>• Aid in fracture and wound healing</td>
</tr>
<tr>
<td>• Block a segment</td>
<td></td>
</tr>
</tbody>
</table>

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Finger orthoses
Upper limb orthotic devices

COCK-UP SPLINT/
CARPAL TUNNEL SPLINT

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Copyright djoglobal

Copyright djoglobal
### Upper limb orthotic devices

#### COCK-UP SPLINT/ CARPAL TUNNEL SPLINT

<table>
<thead>
<tr>
<th>Image</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="COCK-UP SPLINT" /></td>
<td>COCK-UP SPLINT by Truform</td>
</tr>
<tr>
<td><img src="image2" alt="CARPAL TUNNEL SPLINT" /></td>
<td>CARPAL TUNNEL SPLINT by djo global</td>
</tr>
<tr>
<td><img src="image3" alt="Wrist splint" /></td>
<td>Wrist splint by djo global</td>
</tr>
</tbody>
</table>

#### TONE-REDUCING SPLINTS

<table>
<thead>
<tr>
<th>Image</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="TONE-REDUCING SPLINT" /></td>
<td>TONE-REDUCING SPLINT by Leeder Group</td>
</tr>
<tr>
<td><img src="image5" alt="Hand splint" /></td>
<td>Hand splint by Leeder Group</td>
</tr>
<tr>
<td><img src="image6" alt="Ankle splint" /></td>
<td>Ankle splint by AllMed</td>
</tr>
</tbody>
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Spinal orthotic devices: cervical spine

- Soft
- Rigid
- Sterno-occipital mandibular immobilizer (SOMI)
- Halo
Spinal orthotic devices: thoracic spine

• Thoracic-Lumbar-Sacral Orthosis (TLSO)
• Jewett brace
Spinal orthotic devices: corsets

- Lumbar
- Kinesthetic reminder
## Managing the whole claim

<table>
<thead>
<tr>
<th>PSYCHOLOGICAL</th>
<th>WOUND CARE</th>
<th>DURABLE MEDICAL EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Evaluation</td>
<td>• Monitoring by provider</td>
<td>• Cane</td>
</tr>
<tr>
<td>• Counseling</td>
<td>• Home health</td>
<td>• Walker</td>
</tr>
<tr>
<td>• Medications for depression and/or PTSD</td>
<td></td>
<td>• Wheelchair</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Hospital bed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CASE MANAGEMENT</th>
<th>CONTINUITY OF CARE</th>
<th>PROSTHESIS TIMELINE AND EXPECTATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Coordination of care</td>
<td>• Discharge planning</td>
<td>• Claimant</td>
</tr>
<tr>
<td>• Continuity of care</td>
<td>• Surgeon</td>
<td>• Providers</td>
</tr>
<tr>
<td>• Specialized services</td>
<td>• Primary care</td>
<td>– Prescriber</td>
</tr>
<tr>
<td></td>
<td>• Rehabilitation providers</td>
<td>– Prosthetist</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Payer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>REPAIRS AND REPLACEMENTS</th>
<th>RETURN TO FUNCTION AND WORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Appropriate device and component selection</td>
<td>• Home and vehicle modifications</td>
</tr>
<tr>
<td>• Routine follow-up and maintenance</td>
<td>• Job modifications</td>
</tr>
<tr>
<td></td>
<td>• Activity and safety levels</td>
</tr>
</tbody>
</table>
Summary

• Prosthetic and orthotic devices are important in restoring function and improving safety but they must be prescribed and used appropriately.

• Prosthetic success may be dependent on underlying comorbid conditions.

• Orthotic devices can, in many cases, be off-the-shelf but custom fabrication may be needed in certain circumstances.

• Orthotic devices can provide joint and spine stability but muscle weakness can develop if used for prolonged periods of time.
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