# CHRONIC EXERTIONAL COMPARTMENT SYNDROME RELEASE CLINICAL PRACTICE GUIDELINE

## Background
Chronic exertional compartment syndrome (CECS) is a condition caused by repetitive physical activity, commonly seen in athletic and military populations. It causes an increase in intramuscular pressure within fascial compartments of the body, leading to reduced local blood flow and resulting in pain, tightness, paresthesia and possible muscle weakness. Symptoms are increased with exertion and relieved with rest. CECS can occur in any fascial compartment of the body, most commonly in the anterior and lateral compartments of the lower leg. Intracompartmental pressure tests are the gold standard for diagnosing CECS, however diagnosis is not dependent on a positive test result, as false negatives are possible. A positive test is often defined as pressure ≥30 mm Hg 1 minute after exercise, or pressure ≥20 mm Hg 5 minutes after exercise.

CECS can be treated non-operatively, however it is often treated with a surgical fasciotomy if conservative treatment is not successful. This procedure releases the pressure on the compartment and is considered the most successful and definitive treatment for CECS. This protocol will focus on the open fasciotomy for the lower leg, which involves 1-2 incisions approximately 6-10mm in length on the skin. Despite the small skin incisions, the fascia can be completely released from just below the knee to just above the ankle.

## Weight bearing Guidelines
- WBAT immediately following surgery
- Crutches during the first few postoperative days if needed (usually 3-5 days)

## ROM Guidelines
- Progress ROM as tolerated starting within the first few postoperative days

## Criteria to Discharge Assistive Device
- Pain-free ambulation with normalized gait pattern

## Criteria to Initiate Running/Jumping
- Ability to tolerate 15-30 minutes of continuous aerobic activity without onset of symptoms/pain
- 5/5 pain-free ankle strength of involved compartment
- Ability to complete single leg functional movements (i.e. squats and lunges) with proper mechanics and no pain
- No increase in swelling (circumference of lower leg) 12-24 hours following physical activity
- No pain 1-2 hours following physical activity

## Criteria to Return to Sport
- Meet criteria to initiate running/jumping
- Proper neuromuscular control of eccentric and concentric multi-planar activities with absence of pain, instability and swelling
- At least 90% plantarflexion strength of uninvolved side assessed with unilateral heel raises on leg press or maximum heel raise repetitions with equal heel height
  - If bilateral surgery: 25 single leg heel raises full height

## Outcome Tools
- FAAM (ADL and Sports subscales)
- LEFS
## Weeks 0-3: Protection and Mobility

### Weight bearing
- WBAT with progression to full, pain-free weight bearing with ambulation
- Axillary crutches (or other AD) if needed in the first few postoperative days
  - Discontinue crutches when gait is normalized

### Precautions
- Avoid activities that increase swelling (i.e. extended sitting, tight clothing proximal to site of surgery, and excessive heat such as a hot pack or bath)
- Avoid friction over new scar formation at incision site
- Avoid high impact activity such as running, jumping, and hopping

### Edema Control
- Gentle distal to proximal massage of lower leg to assist with venous return and reduce swelling
- Ankle pumps (can perform with lower extremity elevated to assist with swelling reduction)

### ROM
- NWB ankle PROM and AROM
  - PF, DF, inversion, eversion
  - Alphabet exercise
  - Seated BAPS
- Knee PROM and AROM as needed

### Strengthening
- Sub-maximal isometric strengthening
  - Ankle PF, DF, inversion, eversion
- Quad sets
  - Progress to SAQ, LAQ and SLR
- 4-way hip
  - Progress from non-weight bearing to standing

### Goals to Progress to Next Phase
- Lower leg circumference within 2 cm of uninvolved side; If bilateral surgery, decreased circumferential measurements of swelling from weeks 1 to 3
- Knee and ankle AROM equal to uninvolved side
  - If bilateral surgery, knee and ankle AROM WNL
- Normalized gait mechanics including full pain-free weight bearing on level surface, and equal step length bilaterally
# Weeks 4-6: Light Strengthening

<table>
<thead>
<tr>
<th>Precautions</th>
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<tbody>
<tr>
<td>• Limit swelling by minimizing prolonged weight bearing activity</td>
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<tr>
<td>• Continue to avoid friction over new scar formation at site of incision</td>
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<tr>
<td>• Avoid excessive weight bearing eccentric loading</td>
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<tr>
<td>• Avoid high impact activity such as running, jumping and hopping</td>
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<thead>
<tr>
<th>ROM</th>
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<tr>
<td>• Initiate scar massage/mobility and desensitization when incision is fully healed</td>
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<tr>
<td>• Gentle ankle stretching</td>
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<tr>
<td>o 30-60 second holds</td>
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<td>• Nerve mobilizations in supine</td>
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<tr>
<td>o Focus on involved compartment (i.e. ankle PF and inversion to focus on common peroneal nerve)</td>
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<td>o Progress repetitions and range of motion as tolerated</td>
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<tr>
<td>• BAPS progression (seated → standing)</td>
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<th>Strengthening</th>
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<tr>
<td>• Start open kinetic chain ankle strengthening</td>
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<tr>
<td>o 4-way ankle with theraband resistance</td>
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<tr>
<td>• Balance and proprioception exercises</td>
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<tr>
<td>o Bilateral → unilateral</td>
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<tr>
<td>o Level, firm surface → soft/unstable surface (foam or BOSU) → balance board</td>
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<tr>
<td>o Eyes open → head turns → eyes closed</td>
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<tr>
<td>• Double leg squats: mini-squats → full squats</td>
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<tr>
<td>• Gait drills</td>
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<tr>
<td>o Sagittal plane → frontal and transverse planes</td>
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<tr>
<td>o Forward and retro marching (sagittal plane), side-stepping (frontal plane), and carioca/grapevine walking (transverse plane)</td>
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<tr>
<th>Cardiovascular</th>
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<td>Only initiate the following when incision is fully healed:</td>
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<tr>
<td>• Stationary bicycle starting with 5-10 minutes at a low resistance and speed</td>
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<td>• Treadmill walking starting with 5-10 minutes at 2-3 mph and progress time and speed as able</td>
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<td>• If desired, may begin aquatic activities/swimming starting with 10-15 minutes and progressing time/amount as able</td>
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<tr>
<th>Goals to Progress to Next Phase</th>
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<tr>
<td>• Lower extremity circumference within 1 cm of uninvolved side</td>
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<td>• If bilateral surgery, no visible swelling in lower extremities</td>
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<td>• Ability to maintain single leg stance with eyes open on unstable surface for 30-60 seconds</td>
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<td>• Ankle DF ROM within 1.5cm of uninvolved side measured with the weight bearing lunge test</td>
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<td>• If bilateral surgery, weight-bearing dorsiflexion 10-12.5cm toe to wall</td>
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<td>• Proper lower extremity mechanics with no pain during functional double leg squats</td>
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**Weeks 6-8: Progression of Strengthening/Return to Jogging**

| **Precautions** | • Continue to limit activities which increase swelling  
| | • Limit friction over scar tissue  
| | • No strenuous or painful activities  |

| **ROM** | • Continue stretching and nerve mobilizations as needed  
| | • Lower extremity soft tissue mobilization to improve flexibility and soft tissue mobility of the lower leg  
| | | o Instrument assisted, foam roller, massage stick roller  |

| **Strengthening** | • Progression of closed chain functional strengthening  
| | o Lunges, step-ups, single leg squats  
| | o Double leg heel raise → single leg heel raise  
| | | • Can combine with gait drills such as marching, or heel/toe walking  
| | • Initiate plyometric exercises at 6 weeks  
| | | o Plyometric shuttle (DL→SL jumping)  
| | | o DL jumping → SL jump to contralateral foot (leaping) → SL jump to same foot (hopping)  
| | | | • Progress repetitions, and height/distance as able  |

| **Cardiovascular** | • Initiate or progress aquatic activities/swimming if wounds are fully healed  
| | • Progressive treadmill walking time and speed  
| | • Once return to running criteria are met, light jogging can be initiated on level surface  
| | | o 6-8 weeks for 1-2 compartment release  
| | | o 8-10 weeks for 4 compartment release  
| | | o Progressive walk-jog interval training  
| | • Biomechanical assessment of running with video analysis as needed  
| | • Running gait changes to decrease anterior and lateral compartment pressures:  
| | | o Change from heel strike to mid or forefoot strike (gradual progression, only attempt if adequate calf strength to avoid secondary injury)  
| | | o Decrease step length and increase step rate  |

| **Goals to Progress to Next Phase** | • Complete 15-30 minutes of continuous aerobic activity without symptoms or pain  
| | • 5/5 pain-free ankle strength of muscles in involved compartment  
| | • Ability to complete SL functional movements (such as SL squats and lunges) without pain, and with proper mechanics  
| | • No residual swelling 12-24 hours following physical activity  
| | • No pain 1-2 hours after physical activity  |
# Weeks 8-12+: Return to Sport / Impact Training

## Precautions
- Continue to avoid pain and increased swelling during and following activity

## ROM
- Continue knee and ankle stretching and ROM exercises as appropriate

## Strengthening
- Progress strengthening exercises to promote stability and neuromuscular control with increased loads and speeds
  - Low velocity, single plane activities → higher velocity, multi-plane activities
  - Forward and backward → side-to-side and transverse plane movements
- Sport-specific training beginning at a low-intensity
  - Instruct patient on gradual return to sport/activity progression

## Goals to Progress to Return to Sport/Work
- Meet criteria to initiate running/jumping
- Proper neuromuscular control of eccentric and concentric multi-planar activities with absence of pain, instability, and swelling
- At least 90% plantarflexion strength of uninvolved side assessed with unilateral heel raises on leg press or maximum heel raise repetitions with equal heel height
  - If bilateral surgery, 25 single leg heel raises, full height

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**Reviewers:** Bryant Walrod, MD; Timothy Miller, MD  
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References