ACL reconstruction
Early Rehabilitation: Are We Doing Enough?

Loading symmetry

Susan Sigward PhD, PT, ATC
Loading

2. Chan et al, ACSM 63th annual meeting, 2016
7. Adams et al. JOSPT, 2012

Normal gait, Full ROM, Quadriceps strength >80%, Begin running progression

Agility exercises
Sports specific exercises

1 month
3 months
5 months
1 to 2 years

Sit-to-stand
32% lower vGRF

Body weight squat
14% to 11% lower vGRF

Body weight squat
17% lower knee extensor moment

Drop land
19-20% lower vGRF

Normal gait,
Full ROM,
Quadriceps strength >80%,
Begin running progression

Agility exercises
Sports specific exercises

1 month
3 months
5 months
1 to 2 years

Sit-to-stand
32% lower vGRF

Body weight squat
14% to 11% lower vGRF

Body weight squat
17% lower knee extensor moment

Drop land
19-20% lower vGRF

USC Division of Biokinesiology
and Physical Therapy

Human Performance Laboratory
Loading asymmetry

- Bilateral tasks/ squat
  - Knee extensor moment deficits during an unweighted maximal depth squat at 1, 3 and 5 months post-op ACLr (n=11).

---

**Knee ext mmt**

- **T1**
- **T3**
- **T5**

**GRF**

- **T1**
- **T3**
- **T5**
SQUAT

- Vertical GR Force
- Knee Flexion Angle
- Knee Extensor Moment
- Knee Power

USC Division of Biokinesiology and Physical Therapy
Human Performance Laboratory
SQUAT

- **Vertical GR Force**
  - Force (N) vs. Time (% stance)

- **Knee Flexion Angle**
  - Degrees (Ext./Flex.) vs. Time (% Stance)

- **Knee Extensor Moment**
  - Nm/kg (Ext./Flex.) vs. Time (% Stance)

- **Knee Power**
  - Watts/kg (Abs./Gen.) vs. Time (% Stance)
Instructed SQUAT

- Vertical GR Force
- Knee Flexion Angle
- Knee Extensor Moment
- Knee Power

USC Division of Biokinesiology and Physical Therapy
Human Performance Laboratory
Do they?

- Sit-to-stand
- Double-leg stand
- Stand-to-sit
- Squat

Can they?

Natural condition

Instructed condition

Feedback condition

* Ming-Sheng (Matt) Chan-Pilot data
Instructed
Feedback
12-16 weeks post ACLr
12-16 weeks post ACLr

Body weight squat

Symmetry index

NATURAL INSTRUCTED FEEDBACK

USC Division of Biokinesiology and Physical Therapy

Human Performance Laboratory
Daily Activities

• 12-16 weeks post ACLr
• submaximal demands

*Practice throughout the day?*
  – *Sit-to-stand*
  – *Double-leg stand*
  – *Stand-to-sit*
  – *Squat*
Daily Activities

Daily loading

plantar pressure inserts
(Orpyx LogR, Calgary, Canada)
0-75 PSI, 100Hz

Daily data

Time (seconds)

V force impulse/BW

USC Division of Biokinesiology and Physical Therapy
Human Performance Laboratory
12-16 weeks post ACLr

Daily limb loading symmetry

- **Symmetry Index**
  - **Ctrl**
  - **ACLR**

Natural condition

- **r = .78**

Limb loading in body weight squat

**USC Division of Biokinesiology and Physical Therapy**