

## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

with Rick Kaselj, MS

Rick Kaselj – ExercisesForInjuries.com

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### More Free Info on Exercise & Injuries

- **\$299 Fitness Education**

- Returning the Shoulder Back to Optimal Function Seminar
- Exercise Modification for the Sensitive Shoulder Seminar
- Visit [www.ExercisesForInjuries.com](http://www.ExercisesForInjuries.com)

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### My Story

- BSc – 1997
- MS – 2008 / RC
- Work – physio, studio, gym, rehab
- Courses
- Writing
- Blog – [ExercisesForInjuries.com](http://ExercisesForInjuries.com)



Rick Hiking 4300 km / 5 months  
from Mexico to Canada

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# Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

## Objectives

- Part 1 - Knee Injuries
- Part 2 - Exercises to Prevent ACL Injuries
- Part 3 - Exercises to Rehabilitate ACL Injuries
- Part 4 - Leg Extension Exercises
- Part 5 - Exercises to Overcome Knee Injuries
- Part 6 - Knees and Toes

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## Part 1 - Knee Injuries

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## What Are Some Common Knee Injuries and Problems?

(General Public)

- Arthritis
- Chondromalacia
- Meniscal Injuries
- Cruciate Ligament Injuries
- Medial and Lateral Collateral Ligament Injuries
- Tendon Injuries
- Osgood-Schlatter Disease
- Iliotibial Band Syndrome
- Osteochondritis Dissecans
- Plica Syndrome
  - irritated synovial tissue

(NIAMS 2006)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Knee Injury Statistics

- 5 million people visit orthopaedic surgeons each year because of knee problems
  - 3 million of the visits are injury-related
  - 2 million due to arthritis & other disorders
  - 26% of all their cases involve the knee
  - 17.6% = spine
  - 14.8% = hip

(AAOS 1997)

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### Knee Injury Statistics

- 1.4 million people emergency room for knee problems
  - 80 percent of the visits are due to injuries

(AAOS 1997)

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### Knee Injury Statistics

- Knee Replacements
  - More than 209,000 people
  - mostly age 65 and older
  - Done due to end pain and restore mobility
  - People age 18 to 64 make up more than 27%

(AAOS 1997)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Knee Injury Statistics

- In 1994, there were 50,000 hospital admissions for repair of the anterior cruciate ligament or posterior cruciate ligament in the knee (AAOS 1997)
- 80,000 annual ACL tears in the USA
  - 56,000 occur during sports (Patrick, 2003)

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The Most Comprehensive Source for Exercises for Injuries

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### Frequency of ACL Injuries

- 1 case in 3,500 people, resulting in 95,000 new ACL ruptures per year in general population
- 50% of patients with ACL injuries also have meniscal tears
- 60,000-75,000 ACL reconstructions are performed annually in the United States.
- 200,000 ACL-related injuries occur annually in the USA
  - with 95,000 ACL ruptures
- 100,000 ACL reconstructions are performed each year (USA)
- 2.4 - 9.7 times greater for females

(Hubbell, 2006)

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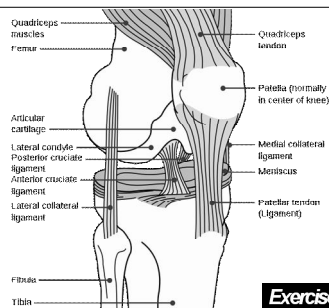
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### What is the ACL



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### Function of the ACL

- limit anterior translation of the tibia
- greatest restraint is in full extension
- secondary restraint to tibial rotation and varus/valgus angulation at full extension
- tensile strength is 2160 N - slightly less than the strength of the posterior cruciate ligament and half as strong as the medial collateral ligament (MCL).

(Hubbell, 2006)

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### Mechanism of ACL Injury

- anterior translation and rotation occurs
- low-velocity, noncontact, deceleration injuries
- contact injuries with a rotational component
  - *twisting, valgus stress, hyperextension*

(Hubbell, 2006)

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### Consequence of an ACL Injury

- increased rate of degenerative changes
- increased risk on meniscal injuries

(Hubbell, 2006)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Consequence of an ACL Injury

- **The most “at risk” sports involve**

- Jumping
- Pivoting
- Cutting

Examples: soccer, basketball, football, volleyball, skiing

- **girls soccer and basketball players undergo the greatest number of knee surgeries every year.**

(Hubbell, 2006)

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### Surgery & Activity Level

- **Surgery options are based on level of activity. Knee Documentation Committee categories activity levels:**

- Level I includes jumping, pivoting, and hard cutting.
- Level II is heavy manual work or side-to-side sports.
- Level III encompasses light manual work and noncutting sports (eg, running, cycling).
- Level IV is sedentary activity without sports.

- Nonsurgical treatment may be considered for patients who participate in level III or IV activities; all others may be considered as candidates for surgery.

(Hubbell, 2006)

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### ACL Repair Success Rate

- long-term success rate of ACL reconstruction is 75-95%
- Failure rate is 8% - recurrent instability, graft failure, arthrofibrosis (scar tissue build up)

(Hubbell, 2006)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Part 2 - Exercises to Prevent ACL Injuries

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### Exercises to Prevent ACL Injuries

#### • Running Exercises

- Straight Ahead
- Hip Out
- Hip In
- Circle Shuffle

(FIFA 2009)

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### Exercises to Prevent ACL Injuries

#### • Strength / Plyometrics / Balance Exercises

- Front Plank – 3 x 20 sec
- Side Plank – 3 x 20 sec
- Kneeling Hooked Hamstring – 5
- Single Leg Balance – 3 x 20 sec
- Squat with Toe Raise - 2 x 20 sec
- Vertical Jumps - 2 x 30 sec

(FIFA 2009)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Exercises to Prevent ACL Injuries

- **Running Exercises**

- Straight ahead
- Bounding
- Plant and cut

(FIFA 2009)

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### Part 3 - Exercises to Rehabilitate ACL Injuries

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### Exercises to Rehabilitate ACL Injuries

- 6 phases each being 3 to 5 weeks

- balance exercises
- dynamic joint stability exercises
- polymeric exercises
- agility drills
- sport-specific exercises

(Risberg 2007), (Risberg 2009)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Exercises to Rehabilitate ACL Injuries

- **Phase 0: Early Post Surgery Phase**
  - Week 1 to 2
  - begin 2 weeks after surgery for 3 times a week for 6 months
- **Goal:**
  - Full passive knee extension
  - reduced swelling

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### Exercises to Rehabilitate ACL Injuries

- Reduce Swelling
  - *Leg elevated*
  - *Repeat ankle plantar flexion and dorsiflexion range of motion exercises*
- Isometric quadriceps
- Isometric hamstrings
- Supine terminal knee extension
- Crutches used to improve gait & reduce swelling

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### Exercises to Rehabilitate ACL Injuries

- **Phase 1: Walking Phase**
  - Week 2 to 4
- **Goal:**
  - Normal walking
  - Controlled double leg balance
  - Controlled single leg balance
  - Controlled dynamic stability of the uninjured leg

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Exercises to Rehabilitate ACL Injuries

- Stationary bike to improve range of motion & reduce swelling
- Floor walking
- Walking on treadmill to improve walking gait
- Squatting exercise - if pain is present or swelling perform with pulleys in order to counter bodyweight
- Both leg calf raises
- Single leg balance - start on uninjured leg and progress to injured leg
- Single leg balance on uninjured leg with toe touch
- Single leg balance on uninjured leg with arm touch
- Lunge exercises at 12, 2, 3, 4 and 6 o'clock with uninjured leg
- Step-up exercises in anterior, lateral, posterior with uninjured leg
- Ice applied for 15 minutes right after exercise program for as long as swelling is present after workout

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### Exercises to Rehabilitate ACL Injuries

#### • **Phase 2: Balance & Dynamic Joint Stability Phase**

- Weeks 5 to 8

#### • **Goals:**

- Controlled two leg balance on uneven surface
- Controlled single leg balance on uneven surface
- Controlled two leg dynamic stability
- Injured leg step-ups and step-downs
- Two leg squatting
- Sideways and backwards walking

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### Exercises to Rehabilitate ACL Injuries

#### • **Week 5**

- Single leg standing with eyes closed on injured leg
- Single leg standing on balance mat
- Two leg wobble board
- Single leg on injured leg with toe touch
- Single leg on injured leg with arm touch
- Step-ups with both legs

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Exercises to Rehabilitate ACL Injuries

- **Week 6**

- Backward walking on treadmill
- Sideways walking on a treadmill
- Two leg wobble board with dumbbells
- Two leg wobble board with medicine ball throwing
- Single leg balance on wobble board with injured leg
- Step-downs with injured leg

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### Exercises to Rehabilitate ACL Injuries

- **Week 7**

- Single leg balance on trampoline and throw medicine ball
- Step-up at different angles
- Step-downs at different angles
- Single leg toe touch with injured leg on balance mat
- Single leg hand touch with injured leg on balance mat
- Single leg toe touch with injured leg on wobble board
- Single leg hand touch with injured leg on wobble board

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### Exercises to Rehabilitate ACL Injuries

- **Week 8**

- Forward lunge with dumbbells
- Single leg standing on a trampoline on injured leg throwing medicine ball forward
- Single leg standing on a trampoline on injured leg throwing medicine ball backwards
- Single leg standing on a trampoline on injured leg throwing medicine ball sideways
- Single leg standing on a balance mat on injured leg throwing medicine ball forward
- Step-up on wobble board

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Exercises to Rehabilitate ACL Injuries

- **Phase 3: Muscle Strength Phase**
  - Weeks 9 to 12
- **Goal:**
  - Increase muscular strength

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### Exercises to Rehabilitate ACL Injuries

- Slide board exercises
- Single leg standing on injured leg with eyes closed with dumbbells
- Single leg standing on injured leg with eyes closed
- Squatting exercises on wobble board
- Squatting exercises on wobble board with dumbbells with into a deeper squat
- Forward lunge with weights focusing on a deeper squat bend
- Step-up with weights at a higher height and increasing weights
- Two legged jump on a trampoline

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### Exercises to Rehabilitate ACL Injuries

- **Phase 4: Running Phase**
  - Week 13 to 16
- **Goal:**
  - Running
  - Controlled two leg jump on a trampoline
  - Controlled two jumps on a trampoline with a turn

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Exercises to Rehabilitate ACL Injuries

- Running on a trampoline
- Running on a treadmill
- Running or jogging outdoors
- Jumping on a trampoline with two legs focusing on deeper squat
- 180 degree jump on a trampoline

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### Exercises to Rehabilitate ACL Injuries

- **Phase 5: Jumping Phase**
  - Weeks 17 to 19
- **Goal:**
  - Running sideways
  - Running backwards
  - Slow speed controlled cutting
  - Controlled two leg jumping on flat even surface
  - Controlled bounding
  - Controlled jump on a step

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### Exercises to Rehabilitate ACL Injuries

- Running backwards
- Bounding for distance
- Two leg jump with a 180 degree turn on a flat even surface
- Two leg jump up and down from a step
- Running in a figure-of-eight
- Running and stop-turn-run
- Agility drills at a slow speed

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Exercises to Rehabilitate ACL Injuries

- **Phase 6: Plyometric and Agility Training Phase**
  - Weeks 20 to 24
- **Goals:**
  - Controlled single leg jumps
  - Controlled vertical jumps
  - Controlled cutting at full speed
  - Controlled sport-specific activities

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### Exercises to Rehabilitate ACL Injuries

- Single leg jumps on injured leg on trampoline
- Single leg jumps on injured leg on mat
- Single leg jumps on injured leg forward on a flat even surface
- Single leg jumps on injured leg backwards on a flat even surface
- Single leg jumps on injured leg sideways on a flat even surface
- Vertical jumps
- Scissor jumps
- Two foot jump onto a 6 to 8 inch step, then jumping off step with two feet and then vertical
- Specific sports tasks

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### Recommendations for Rehabilitation of the ACL Injuries

1. Early weight-bearing appears beneficial and may decrease patellofemoral pain.
2. Early motion is safe and may help avoid problems with later arthrofibrosis.
3. Continuous passive motion (CPM) is not warranted to improve rehabilitation outcome in patients and can avoid the increased costs associated with CPM (machine that promotes motion).
4. Minimally supervised physical therapy in selected motivated patients appears safe without significant risk of complications.
5. Until further studies are performed, protocols should use closed kinetic chain exercises in the first 6 weeks.

(Wright 2008)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Recommendations for Rehabilitation of the ACL Injuries

6. Postoperative rehabilitative bracing either in extension or with the hinges opened for range of motion does not offer significant advantages over no bracing.
7. Accelerated rehabilitation appears safe, at least in the 5-month to 6-month time frame as demonstrated by the studies by Beynnon et al and Ekstrand. Further studies are necessary to determine whether shorter time frames are safe.
8. Water-based therapy, stair climber, and slide board exercise programs appear safe and may add variety if available for patients.
9. Gait, proprioception, and psychological training may be of some benefit.

(Wright 2008)

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### Part 4 – Leg Extension Exercises

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### OKC Exercises for ACL Injuries

- Closed kinetic chain exercises appear to have gained popularity over more traditionally used open kinetic chain (OKC) exercises because many clinicians believe that CKC exercises are safer and more functional
- When improvement in quadriceps femoris muscle function is an essential treatment goal, combine OKC exercises with CKC exercises to provide optimal training stimuli

(Fitzgerald, 1997)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### OKC Exercises for ACL Injuries

- Group 1 carried out quadriceps strengthening only with CKC while group 2 trained with CKC plus OKC exercises starting from week 6 after surgery.
- No significant differences in anterior knee laxity were noted between the groups 6 months post surgery
- Patients in group 2 increased their quadriceps torque significantly more than those in group 1, but no differences were found in hamstring torque between the groups. - higher number of patients in group 2 returned to sports at the same level as before the injury
- Patients from group 2 who returned to sports at the same level did so 2 months earlier than those in group 1.

(Mikkelsen, 2008)

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### OKC Exercises for ACL Injuries

- Both OKC and CKC exercises can be modified and implemented for quadriceps strengthening after ACL reconstruction without causing excessive ACL strain or patellofemoral joint stress.

(Ross, 2001)

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### OKC Exercises for ACL Injuries

- Biomechanical studies have shown that the peak strains produced on a graft are similar
- Clinical studies suggest that both play a beneficial role in the early rehabilitation of the reconstructed knee

(Fleming, 2005)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### OKC Exercises for ACL Injuries RECOMMENDATIONS

1. Perform 6 weeks after surgery

(Mikkelsen 2008)

2. At post-ACL reconstruction period or in the joint with ACL injury, the exercise should preferably be avoided at near full extension positions under large resistant forces. (Mesfar 2008)

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### Part 5 – Exercises to Overcome Knee Injuries

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### Overcoming Knee Injuries Preventing

- ACL Reoccurrences
  - I don't know
- Most of the research is focused on addressing ACL laxity and deficiency

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Part 6 – Knees and Toes

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### Knees and Toes

- Why you should be letting the knees pass the toes?
- Why you should getting your knee injury clients doing full squats?

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### Knees and Toes

1. More functional
2. Strengthen through full range of motion
3. Necessity
  - *Bathroom in the woods*

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Knees and Toes

- **Fitness Professionals should be focusing on the weighted squat**
  - patellofemoral joint stress increases as the knee flexion angle increases, and that the addition of external resistance further increases patellofemoral joint stress. (Wallace 2002)
  - Reduce PFJ stress by doing wall and one leg squat from 0 to 50 degrees (Escamilla 2009)

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### Knees and Toes

- **Safe Full Squat**
  - Sumo Squat
  - Hands Together – Finger touch
  - Fingers to the Side Touch

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### Knees and Toes

- **Fitness Professionals should be focusing on the hamstrings**
  - reduced hamstring length and increased PFJ stress during squatting due to increased PFJ reaction force and reduced medial PFJ contact area (Whyte 2009)

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## Exercises for Prevention, Rehabilitation and Overcoming Knee Injuries

### Thank You

- Send me your questions!
- Visit [ExercisesForInjuries.com](http://ExercisesForInjuries.com) to get \$299 in Fitness Education Gifts
- Rick Kaselj
  - [rick@ExercisesForInjuries.com](mailto:rick@ExercisesForInjuries.com)
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### End

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