DONJOY

ACL Functional Knee Bracing

CLINICAL RESEARCH

V PROTECTION

V PREVENTION (CONTACT)

4 POINTS-OF-LEVERAGE

+

FOURCEPOINT TECHNOLOGY

=

CLINICALLY- PROVEN ACL PROTECTION & INJURY PREVENTION

V PREVENTION (NON-CONTACT)

KEEPS KNEE OUT OF "AT RISK" POSITION

0°-30°

DJO GLOBAL

ACL INJURY: FACTS & FIGURES

Contributing Factors

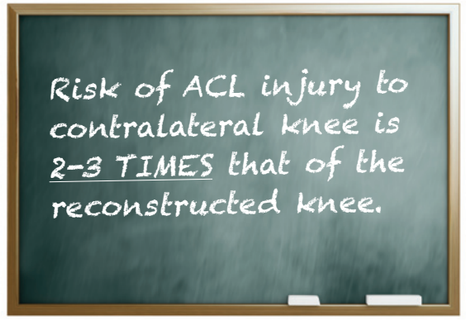
- Decreased knee flexion angle[1]
- Anterior tibial shear forces[2]
- Combined valgus and knee internal rotation moments[2]
- Combined valgus and knee external rotation[2]

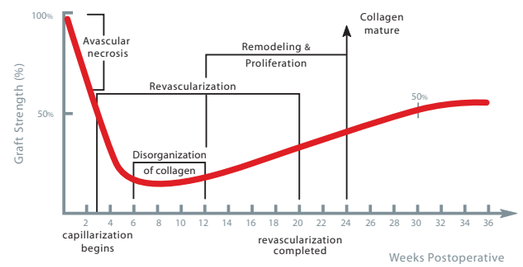
Incidence

- Approximately **200,000** ACL injuries per year occur in the U.S.[3]
- **50%** of ACL injuries occur in **15-25** year olds[3]
- **60-80%** of ACL injuries are **non-contact** related[4]
- **Women** are **2-10x** more likely to injure ACL[5]

Re-injury

- The **re- injury** rate for the ACL reconstructed knee is **5%-10%**[6]
- Risk of **ACL injury** to the **contralateral knee** is **double** that of the reconstructed knee[6]
- Only **1/3** of reconstructed athletes **attempt** to play competitive sports at their **pre-injury level** within **one year** following reconstruction[7]
- **1 in 5** active reconstructive athletes develop **new** injuries[7]
- **Fear** of **re-injury** prevented competitive college and high school football players from returning to play[8]





Immediately following ACL surgery, graft strength quickly declines. Graft healing research indicates that the graft is most vulnerable to injury around post-op weeks 6-12. [9, 10, 11, 12, 13, 14]

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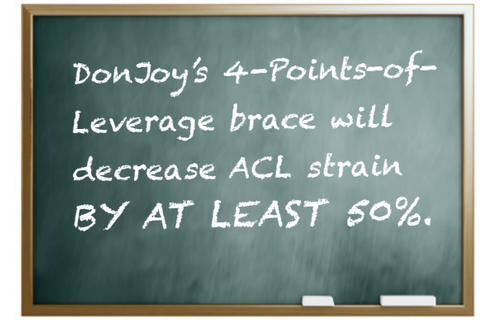
PROTECTION

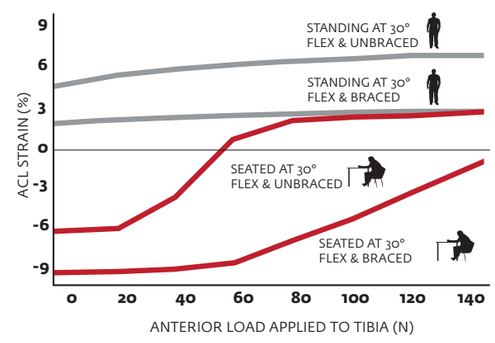
Reducing the risk of ACL reinjury to the reconstructed knee

Wearing a 4-Points-of-Leverage brace:

- Decreases ACL strain by 50% for anteriorly directed loads during weight bearing and non-weight bearing activities[1, 2, 3]
- Significantly reduces tibial rotation vs. unbraced and sleeved groups[5]
- May improve both proprioception and postural control[6]
- Increases patient confidence after ACL reconstruction[7]



4-POINTS-OF-LEVERAGE STUDY



ACL strain values produced by anterior tibial loading.[2]

Braces utilizing 4-Points-of-Leverage technology effectively reduce ACL strain which could be particularly important during rehabilitation while the graft is remodeling.[1,2,3,4]

Supporting Studies

1. Beynnon BD, Pope MH, Wertheimer CM, Johnson RJ, Fleming BC, Nichols CE, Howe JG. Journal of Bone & Joint Surgery, Am. 1992; 74:1298-1312.
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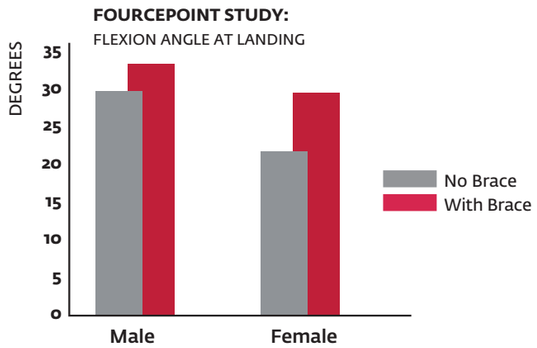
PROTECTION

Reducing the risk of ACL reinjury to the reconstructed knee

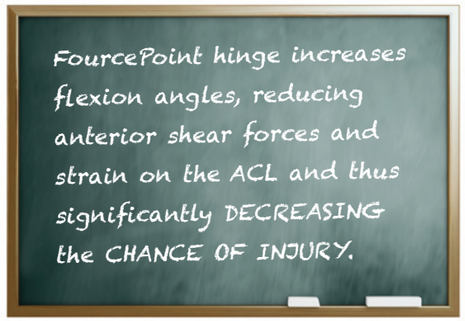


The anterior shear force applied on the tibia was reduced by 9% for females & 13% for males.[5]

The decrease in anterior shear force on the tibia should substantially reduce the load on the ACL.[2, 4]

Using a brace with FourcePoint hinge technology in conjunction with a 4-Points-of-Leverage frame design:

- Significantly increases knee flexion angle at peak posterior ground reaction force (PPGRF) by 9° vs. a standard braced knee and a non-braced knee[1, 3]
- Significantly decreases PPGRF during stop jump task landing and side-cutting activities[1]
- No significant performance limitations were associated with the knee brace with FourcePoint hinge technology[1]



Supporting Studies

1. Lin CH, Liu H, Garrett WE, Yu B. Effects of Knee Extension Constraint Brace on Selected Lower Extremity Motion Patterns During a Stop-Jump Task. Journal of Applied Biomechanics.2008;4:158-165.
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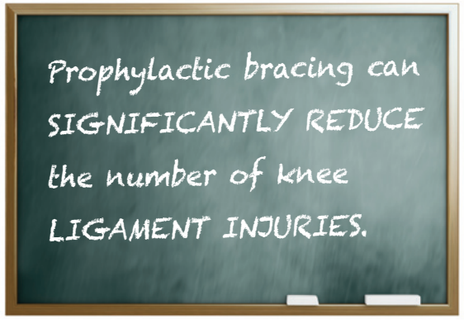
PREVENTION (CONTACT)

Reducing the risk of contact / high impact knee ligament injuries

Football

Prophylactic brace use:

- May be effective in reducing the risk of incurring an MCL sprain in football, and generally provide 20-30% greater MCL resistance to a lateral blow[3]
- Reduces injury rates among college football players, linemen, linebackers and tight ends when worn in both practices and games vs. unbraced players[1, 5]
- During one season at a Division I University, football players who wore braces missed only 43 practices and 3 games vs. 258 and 43 respectively for unbraced players[2]
- Of the 12 knee surgeries of the season, only one occurred in a player who was wearing a brace at the time of injury[2]
- In a 2 year study at a major Division I university football program, the number of days lost due to knee injury (and related associated healthcare costs) was reduced by 99% from year 1 to year 2 through the use of a custom fitted prophylactic knee brace in the 2nd year[7]



Off-road Motorcycling

Prophylactic brace use:

- Reduces ACL injury rates by 50% with a 7-fold decrease in MCL injury rates[4]

Skiing

Prophylactic brace use:

- Reduces ACL reinjury by 3-times[6]

Supporting Studies

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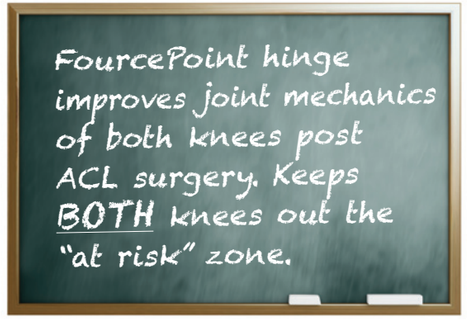
PREVENTION (NON-CONTACT)

Reducing the risk of injury to the contralateral knee

Wearing NO brace or a knee brace WITHOUT FourcePoint hinge technology (results at 6-12 months post-op):

- 30% deficit in joint mechanics
- Asymmetry of mechanics in both knees[1]



Wearing a knee brace WITH FourcePoint hinge technology:

- Improved joint mechanics on **BOTH** the surgical and non-surgical knees for enhanced symmetry[1]
- Improved mechanics caused **BOTH** knees to act more symmetrical[1]
- Increased peak knee flexion velocity of **BOTH** knees[1]
- Helped keep **BOTH** knees out of the *"at risk"* position (0°- 30° flexion)[1, 2]

Supporting Studies

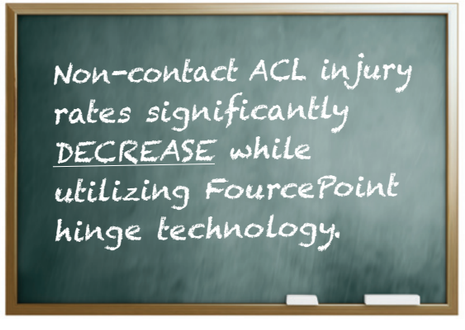
1. Queen R, Butler RJ, Dai B, Garrett WE. Effects of Knee Extension Constraint Bracing on Lower Extremity Motion Patterns in Post-ACL Reconstruction Patients. Interim report of six and twelve month data from the ongoing study, 2012.
2. Yu B, Herman D, Preston J, Lu W, Kirkendall DT, Garrett WE. Immediate Effects of a Knee Brace with a Constraint to Knee Extension on Knee Kinematics and Ground Reaction Forces in a Stop-Jump Task. American Journal of Sports Medicine. 2004;32:1136-1143.

PREVENTION (NON-CONTACT)

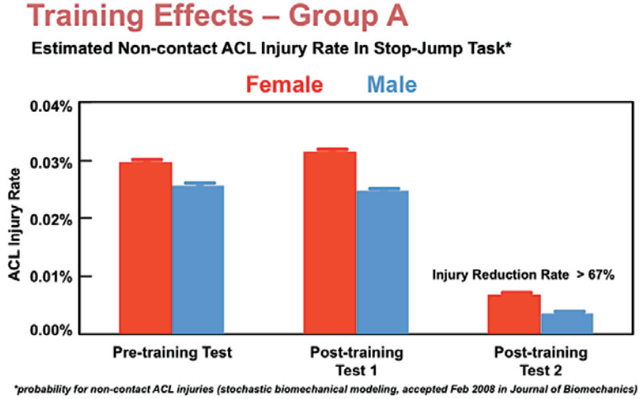
Reducing the risk of non-contact ACL Injury

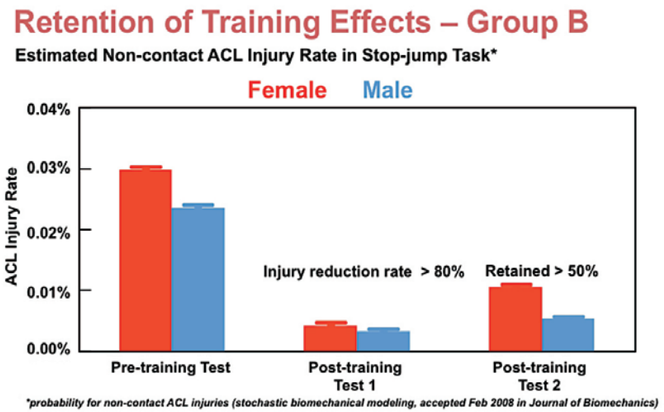
Significant reduction in ACL injury rate

- > 80% while wearing brace with FourcePoint hinge[1]
- > 50% after training in brace with FourcePoint hinge[1]
- Training effects (increased flexion angles) retained by > 50% while not wearing the brace[1]
- Training in a **SINGLE** (one leg brace) with FourcePoint technology results in a 6-fold decrease in non-contact ACL injury rate in both knees[1]
- Inertial sensor-based feedback system used in training during jump landings showed reduced key risk metrics for ACL injury[2]



Subjects wore brace a minimum of one (1) hour 3x per week for 4 weeks





Supporting Studies

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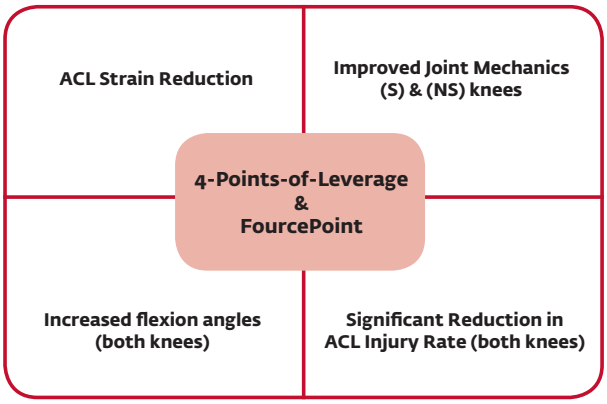
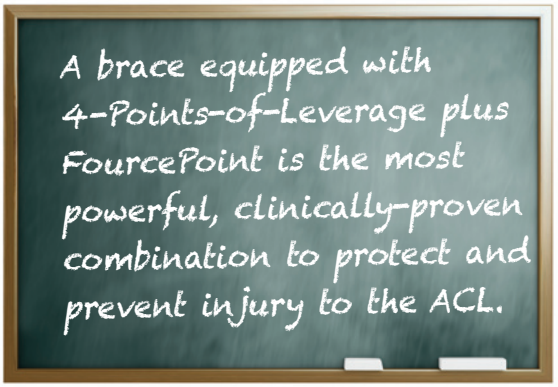
PRESCRIBE CONFIDENCE

Clinical Biomechanics Review

- Training **WITH** FourcePoint hinge will encourage the knee to stay out of the "at risk" position (0°-30° of flexion)
- Training effect **WITH** FourcePoint hinge will be retained despite intermittent brace wear
- Rehab training after ACL reconstruction **WITHOUT** a FourcePoint hinged brace leads to abnormal joint mechanics of **BOTH** knees
- Rehab training after ACL reconstruction **WITH** a FourcePoint hinged brace improves joint mechanics in **BOTH** knees

CLINICAL PERFORMANCE OVERVIEW





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