

1. The ACL is a deceleration ligament . . .decelerating the effects of the ground, gravity and momentum.
2. As soon as the foot enters into the ground the loading mechanisms occur creating a **Chain Reaction** throughout the lower extremity.
3. You can not accelerate unless the motion is initially decelerated. You can not unload unless you first load.
4. If the entire **Chain Reaction** has not been properly trained to decelerate all normal motions in the three planes, injury can occur.
5. The hamstrings decelerate the knee in all three planes of motion.
6. Functional analysis begins by looking for successes in order to determine where to start your program.
7. Training and conditioning, rehabilitation and evaluation are all the same thing; building upon each individual's own functional success is the key.
8. Training should be done at the points of transformation.
9. Pump and Praise provides appropriate training for the body throughout the entire **Chain Reaction**.
10. The whole idea is to make everything fun and functional.
11. Functional research reinforces our understanding of **Chain Reaction** and biomechanics of function.
12. Understanding that the whole body needs to be trained in order to prevent ACL injuries.
13. Tri-plane exercises are the key to training and conditioning for your patient/client.
14. One must first test the loading components of the **Chain Reaction** to determine functional successfulness.



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v2.1 ACL PREVENTION

Threshold Training

By: Gary Gray, PT



TAPE CONTENTS	PAGE
Contents / Objectives	1
Functional Strategies	2
Functional Understanding	4
Functional Analysis	6
Functional Rehabilitation	8
Functional Training	10
Functional Transformation	12
Functional Fun	14
Key Messages / Information	16

OBJECTIVES FOR ACL PREVENTION ***FUNCTIONAL GUIDE***

To assimilate up-to-date information and knowledge of ACL Prevention.

To learn how to apply effective functional techniques when testing, training and rehabilitating the ACL.

To understand and appreciate the tri-plane ***Chain Reaction*** principles as they apply to ACL Prevention.

HOW TO USE THIS ***FUNCTIONAL GUIDE***

This *functional guide* can be used as a convenient summary of the program's contents to take with you after viewing. You can also use this guide as a notebook; space has been provided so that you can make notes on relevant tracts as you watch them.



FUNCTIONAL

Video Digest Series

STRATEGY 1

Strategically understanding function of the anterior cruciate ligament as a sensory ligament, guiding ligament, an end range ligament.

STRATEGY 2

Strategically appreciating the function of the knee, and most specifically the anterior cruciate ligament in reference to the foot, hip, trunk, and the entire Chain Reaction.

STRATEGY 3

Strategically realizing the synergistic friends of the anterior cruciate ligament in order to properly design a preventative training and conditioning program for the anterior cruciate ligament.

STRATEGY 4

Strategically analyzing each athlete individually, developing a successful functional profile from which to build.

STRATEGY 5

Strategically testing the loading components of the **Chain Reaction** to determine the functional successfulness of deceleration and therefore acceleration.



STRATEGY 6

Strategically exploding the myths of the anterior cruciate ligament as well as the musculature around the knee.

STRATEGY 7

Strategically transforming our understanding of the function of the ACL and the knee into logical training and conditioning programs.

STRATEGY 8

Strategically admitting our ignorance relative to conscious knee dominant prevention programs by now designing functionally consistent three dimensional **Chain Reaction** training and conditioning programs.

STRATEGY 9

Strategically blending all components of tri-plane **Chain Reaction** function into our functional training and rehabilitation programs.

STRATEGY 10

Strategically taking advantage of valid functional research articles for the benefit of our clinical practices.



WHAT IN THE WORLD DOES THE ACL DO?

Functionally understanding how it reacts within the **Chain Reaction** of the entire body.

Intransformational . . . becoming the part

Waking up as either the ACL or the PCL . . . realizing that you are the ACL and at much greater risk than the PCL. . . Why?

The old thought process . . . the tibia being anteriorly displaced on the fixed femur.

What are the forces in our life that need to be controlled if we are the ACL?

Internal rotation and abduction (valgus force) create the most stress on the ACL functionally.

The ACL is a deceleration ligament . . . decelerating the effects of the ground, gravity and momentum.

We realize we need to properly train and condition the foot, the hip and the trunk in order to properly train and condition the knee to prevent ACL injuries.

As soon as the foot enters into the ground the loading mechanism occurs with calcaneal eversion, ankle dorsiflexion, unlocking midtarsal joint, tibial internal rotation, knee flexion, knee internal rotation, knee abduction, with the hip and trunk being loaded and "turned on" in all three planes of motion.

If you are the ACL you want this loading mechanism to occur in order to reactively and proprioceptively turn on all of the locomotor and trunk musculature to decelerate the effects of loading and to transform this into productive motion.

You can not accelerate unless the motion is initially decelerated. You can not unload unless you first load.



Does the foot have the ability to load and then unload?

Turning on of the hip in all three planes includes hip internal rotation, hip adduction and hip flexion. The powerful hip muscles can help decelerate what is happening at the knee as well as at the foot and up into the trunk.

The ACL simply asks "Who are my friends?"

The motion of the pelvis as a result of an effective loading mechanism in all three planes turns on the trunk muscles in all three planes.

If the entire **Chain Reaction** hasn't been properly trained to decelerate all normal motions in all three planes, injury can occur.

The old strategy of trying to train the hamstrings to flex the knee in order to prevent anterior displacement of the tibia on the femur has gone out the window.

The hamstrings decelerate knee flexion, knee rotation as well as knee abduction.

The ACL again asks "Who are my friends?" Answer. Everybody . . . everybody's goal is to decelerate the effects of gravity. Therefore "Who could be at fault when I get injured?" asks the ACL. Answer. Any of your friends.

The biggest hint the ACL gives us in designing training and conditioning as well as rehabilitation programs is to "get away from me and my knee and functionally understand the rest of the body".



CASE PRESENTATION -

Thanking Meghan Faust for her valuable assistance in the analysis, rehabilitation, training and conditioning in reference to prevention of ACL injuries.

Understanding the ACL in order to train and condition

The evaluation begins by looking for successes in order to determine where to start our prevention/rehabilitation program . . . How will the training and conditioning program be blended to prepare the entire body for all types of functional activities?

Gait Analysis with shoes on and shoes off

Looking at the feet and their relationship to the knee

- Looking for the ability of the feet to load and unload in all three planes
- Single leg balance trunk rotation looking for collapsing of the arch with calcaneal eversion.
- Single leg balance with knee flexion excursion looking for ankle dorsiflexion
- Single leg balance with knee flexion excursion with trunk rotation with knee abduction drive and knee adduction drive
- Looking at the ability to load and unload in all three planes of motion
- Quick biomechanical scan of the feet looking at position, angulations and motions
 - Lower leg to calcaneus relationships
 - Calcaneus to forefoot relationships
 - Callus patterns

Looking at the hip and it's relationship to the knee and foot

- Single leg balance with opposite leg anterior to posterior reach (sagittal plane drive)
- Single leg balance with opposite leg lateral to medial reach (frontal plane drive)
- Single leg balance with opposite leg right rotational to left rotational reach (transverse plane drive)



- Single leg balance with bilateral U. E. anterior reach at waist height to overhead posterior reach (sagittal plane drive)
- Single leg balance with bilateral U.E. overhead lateral to overhead medial reach (frontal plane drive)
- Single leg balance with bilateral U.E. right rotational reach to left rotational reach at shoulder height (transverse plane drive)

Looking at preloaded rotational excursion tests

- Single leg balance, toe touch rotational reach to facilitate internal rotation, opposite arm same side overhead rotational reach
- Single leg balance, toe touch rotational reach to facilitate external rotation, opposite arm same side overhead rotational reach

Step down with return testing

- Anterior, posterior and medial step down and return test
- Medial rotational, lateral rotational step down and return test

Description of tweak progressions

Knee flexion excursion tests with feeding in and feeding out

- Hip flexion (feed in) with bilateral U.E. anterior reach at knee height
- Hip adduction (feed in) with bilateral U.E. overhead medial overhead reach
- Hip internal rotation (feed in) with bilateral U.E. same side rotational reach at shoulder height
- Triplane (feed in) with opposite arm anterior lateral rotational reach at knee height
- Hip extension (feed out) with bilateral overhead posterior reach
- Hip abduction (feed out) with bilateral U.E. overhead lateral reach
- Hip external rotation (feed out) with bilateral U.E. opposite side rotational reach at shoulder height
- Triplane (feed out) with bilateral U.E. overhead posterior lateral rotational reach

Description of bottom up tweaks in the sagittal plane, frontal plane and transverse plane



ANALYSIS AND REHABILITATION DEBRIEF WITH BOB WIERSMA, P.T.

- The first question following ACL surgery is “What potentially has caused this injury?”
- With function . . . prevention, training and conditioning, rehabilitation and evaluation are all the same thing; building upon each individual’s own functional success
- Affording an individualized approach to ACL preventative programs
- Start with a “feeding in” scheme
- Discussion of teaching an entire team tweakology in order to individually progress
- It’s the “my son or my daughter” approach
- Be able to do ABC before XYZ and also functionally and intelligently filling in the rest of the alphabet
- There are basically two camps . . .
 - Camp #1 - training the athlete to consciously prevent any frontal plane or transverse plane motion of the knee
 - Camp #2 - functionally understanding that the knee needs to go through significant amounts of frontal plane and transverse plane motion in order to facilitate the success of the rest of the body
- Camp #1 is consciously knee oriented where Camp #2 is subconsciously oriented to the rest of the body in all three planes of motion
- In Camp #1 . . . consciously keeping the knee from going through normalized motion shuts down the rest of the system. It was essentially a “knee jerk” reaction to not understanding function



- Training should be at the points of transformation
- Getting to the points of transformation in a multitude of ways to create an endurance effect
- Praying is okay but we must use our functional knowledge to do something about it

Brad Gray, Director of PEAK PE
PEAK PE - Promoting Encouragement and Athleticism in Kids of all ages

A major component of PEAK PE is Pump & Praise

Pump and Praise in a functional circuit training workout driven by music, and structured by three dimensional functional exercise opportunities

Pump and Praise provides a multitude of opportunities to experience function

Pump and Praise provides appropriate training for the body throughout the entire **Chain Reaction** and therefore the knee is properly trained in all three planes of motion as well

One of the major goals, besides providing encouragement and proving to each individual that they are an athlete, is to prevent injury and to enhance function . . . building upon each individual's athletic success.



STRATEGICALLY BUILDING UPON DEMONSTRATED FUNCTIONAL SUCCESSES

- Two footed jumping with overhead 3D Dumbbell Matrix
- One footed hopping with overhead 3D Dumbbell Matrix
- Two footed jumping, anterior-posterior with overhead 3D Dumbbell Matrix
- Two footed jumping, right lateral-left lateral with overhead 3D Dumbbell Matrix
- Two footed jumping, right rotational-left rotational with overhead 3D Dumbbell Matrix
- Two footed jumping with overhead 3D Dumbbell Matrix with 5 lb dumbbells
- Two footed jumping, anterior-posterior with overhead 3D Dumbbell Matrix with 5 lb dumbbells
- Two footed jumping, right lateral-left lateral with overhead 3D Dumbbell Matrix with 5 lb dumbbells
- Two footed jumping, right rotational-left rotational with overhead 3D Dumbbell Matrix with 5 lb dumbbells
- One footed hopping with overhead 3D Dumbbell Matrix with 5 lb dumbbells
- Description of one footed hopping in all three planes and progression to 3D Dumbbell Matrix waist to shoulder progression

- 3D Balance Matrix
- 3D Balance Matrix faster
- 3D Balance Matrix with bilateral U.E anterior reach at mid chin
- 3D Balance Matrix with bilateral rotational reach same side at waist height
- 3D Balance Matrix with bilateral U.E overhead posterior reach
- 3D Balance Matrix with bilateral U.E. rotational reach opposite side at waist height



- Description of additional progressive tweaks
 - Two footed mini hurdle jumps, anterior-posterior
 - Two footed mini hurdle jumps, right lateral-left lateral
 - Two footed mini hurdle jumps, right rotational-left rotational
- Description of progression to one footed hops over mini hurdles in all three planes of motion
 - Two footed mini hurdle jumps, anterior-posterior with sagittal plane medicine ball catch and throw
 - Two footed mini hurdle jumps, right lateral-left lateral with sagittal plane medicine ball catch and throw
 - Two footed mini hurdle jumps, right rotational-left rotational with sagittal plane medicine ball catch and throw
- Description of tweaking the plane of the medicine ball catch and throw
 - 36-360° two footed jumps
 - 36-360° two footed jumps with hands behind head
 - 36-360° two footed jumps with medicine ball rotations at shoulder height
 - 36-360° two footed jumps with medicine ball behind head
- Description of the various tweaking opportunities and progressions

Thanking Meghan Faust for an amazing workout.



Dave and Gary playing Jog Golf

Rules of Jog Golf

- Two players per jog golf team
- Only one putter per team, each player may carry 1 or 2 other clubs
- Five golf balls per team
- Players must wear jogging shoes
- All divots must be replaced
- No running on the green
- Putter must be used when putting on the green
- From the initial drive on hole 1 until the last shot on hole 9 (or hole 18 if playing 18 holes) an alternate shot format must be followed
- Teammate must start behind the teammate driving off on hole 1
- The teammate who holes out, passes the golf ball to the teammate who will be teeing off, and can begin running down the fairway.
- Score is determined by time
- For each lost ball add 30 seconds
- For each par, subtract 30 seconds
- For each birdie subtract one minute
- An eagle, and especially a hole in one are cause for immediate celebration and therefore that team can immediately pull out lawn chairs and begin celebrating.

Thinking about the anterior cruciate ligament in golf

- During loading in a right handed golfer, the right knee goes through flexion, internal rotation and abduction. A successful tri-plane load at the right knee is indicative of effective loading at the right foot and especially at the right hip.



- The left knee undergoes significant tri-plane loading during the backswing with a right handed golfer. Successful tri-plane left foot motion and tri-plane left hip motion allows significant left knee abduction and internal rotation along with flexion.
- Following a successful load, the explode of the golf swing creates a significant load to the left side during the follow-thru with a right handed golfer
- The left foot remains “cleated” into the ground, while the pelvis drives the femur into significant external rotation. Relatively speaking, this creates significant internal rotation at the left knee joint.
- Proportional amounts of stress must be absorbed throughout the entire chain, so undue stress isn’t created at the left knee, and especially through the left ACL.
- The whole idea is to make everything fun and functional

(Editor’s Note: Dave & Gary recently took third place in a jog golf tournament turning in a time of 21:40 over a regulation 9 hole course. 12 other teams participated, all of them younger and quicker and better golfers, but obviously not tougher)



RESEARCH ROUNDTABLE WITH DR. DAVID TIBERIO

- Looking for research that impacts our clinical practices
- We used to think that the quad extended the knee, that the hamstring flexed the knee, and that the ACL was torn by something displacing the tibia forward . . . now that we know function and realize that in function the quad doesn't extend the knee, and the hamstring doesn't flex the knee, and that the ACL is torn by the forces of gravity, ground reaction and momentum in all three planes, there is no excuse to not have valid studies.
- Validity means studying and testing that which you believe you are studying and testing.

Discussion of research article

J.A. Nyland, D.N.M Caborn, R. Shapiro, D.L. Johnson DL. Fatigue after eccentric quadriceps femoris work produces earlier gastrocnemius and delayed quadriceps femoris activation during crossover cutting among normal athletic women. *Knee Surg, Sports Traumatol, Arthrosc* 5 (1999): 162-167

- With quad fatigue (or possible proprioceptive detraining) the gastroc turns on quicker
- Duplicating the study with fatiguing the quad through integrated isolation by "tweaking out" may provide a more valid study
- Introducing fatigue tweaks as a part of our training and conditioning strategy
- Introducing sequencing tweaks as a part of our training and conditioning strategy



R. Fagenbaum, W.G. Darling, Jump landing strategies in male and female college athletes and the implications of such strategies for anterior cruciate ligament injury. Am J of Sports Med 31 (2003): 233-240

- Knee flexion may be the body's subconscious mechanism to turn on more friends, especially the hip and the calf
- Discussion of the speed of knee flexion
- Abnormal and normal is not only the amount of motion, but the speed of motion and the timing of that motion
- Understanding timing takes function to a whole new dimension

Taking advantage of wonderful research studies and thanking Dave for his ongoing exceptional efforts in bringing pertinent research articles to the table.

