

**Dynamic Neuromuscular Analysis Training:
Techniques to Target the Athlete at High ACL Injury Risk
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What Makes the Female ACL MORE Vulnerable?

- Identify Parallel Neuromuscular Imbalances:
 - Knee Abduction
 - Ligament Dominance
 - Low flexion
 - Quadriceps Dominance
 - Single leg
 - Leg Dominance
 - Foot Away from COM
 - Decreased Trunk Stability

How to Make the Female ACL LESS Vulnerable

- Address the Mechanism:
 - Knee Abduction
 - Biomechanics/Technique
 - Low flexion
 - Power- H/Q recruit
 - Single leg
 - Balance/Symmetry
 - Foot away from COM
 - Core Stability

Algorithm: A precise rule (or set of rules) specifying how to solve a problem

- What is the Problem?
 - Females have high risk of knee injury
- Injury Prevention Algorithm
 - Technique + Plyometrics + Core + Strength training = Decreased ACL Incidence

Making the Female ACL LESS Vulnerable?

- Address the Mechanism:
 - Knee Abduction
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Dynamic Neuromuscular Analysis (DNA) Training: Concepts

- Dynamic
 - Fast-Paced

- Sports-specific
- Henning Basketball Video

DNA Training Components

- Biomechanics
 - Safe and Effective Technique
 - Biofeedback
- Plyometrics
 - Neuromuscular Adaptation
- Stretch
- Speed
- Core Stability
 - Kinetic Chain Control
 - Balance
 - Perturbation Control
- Strength
 - Functional Speed and Multi-Directional Power

Plyometric Principles: Warm-Up

- Warm Up
 - Recent evidence: static stretching prior to intense exercise bouts does not reduce acute injuries.
- light active warm-up
- exercises that mimic the upcoming exercise bout
- continuous stretch after a strenuous exercise bout
- Training Order
 - Plyometrics need to be done with athlete is fresh.
 - Precede all other training:
- Functional Core
- Weight-training
- Skill/sport

Plyometrics Principles

- Neuromuscular Adaptation to Stretch
- Series elastic component: Rubber band theory
- Muscle spindle: Thermostat theory
- Actin-Myosin cross-bridges: Gear theory
- Speed of Movement

Plyometrics Principles

- Goal: Decrease Amortization Phase
 - Rapidly deceleration of body mass followed by almost immediate rapid acceleration of the mass in the opposite direction.
- Should include sport-specific exercises.
- Allows safe adaptation to the rigors of explosive sports.
- Focus on proper technique and body mechanics

- effective at reducing serious ligamentous injuries.
- No more harmful than other forms of sports training.

Training Principles

Biomechanics and Technique

- Training for Technique-
 - critical to perform each exercise with perfect technique
 - Technique critically evaluated by the trainer or coach with constant feedback
- Analysis component is extremely important
- correct poor technique
- potentially harmful body alignment
- Strong athletic positioning
 - Boxer Stance
- Good body control
- Efficiency of Movement

Training Principles

Biomechanics and Technique

- Supervision and Analysis
- Technique
- Safety guidelines
- Feedback

What Plyometric Training

Should Not Be

Important Plyometric Training Techniques

- Strong Athletic Positioning
 - Erect, athletic position
 - Knees over balls of feet
 - chest over knees
- Body Control
 - No side-to-side or forward-backward motion
 - Ready to react in all planes of motion

More Plyometric Training Techniques

- Use feet to dissipate impact force
 - Toe-to-mid-foot rocker
- Soft, Quiet impacts
- Hit like a feather
- Roll your feet
- Flex your body and get deep with gluteus
 - Instant recoil for next jump
- Drop like a shock absorber
- Take off like a spring

Biomechanics and Technique

Variable Parameters

- Exercise selection
 - Progressions
- Modify intensity
- arm position
- closing eyes
- increasing or decreasing speed
- adding unanticipated movements or perturbations
- adding sports specific skills

Plyometric Principles: Equipment Variables

- Footwear
 - Good lateral support, arch support, heel cushioning and a non-slip sole
- Surface
 - The surface should be semi-resilient, non-slip
- Equipment
 - Break away barriers
 - Sturdy, non-slip boxes

Demonstration

Techniques to Target the Female Athlete at High ACL Injury Risk

Plyometric Principles: Progressions

- Exercise selection
 - Progressions
- Double leg low intensity
- Double leg rotatory
- Double leg power
- Double to single leg (transitional)
- Single leg hops
- Single leg power
- Depth jumps/sport specific

Potential Neuromuscular Imbalances

DNA Components

Critical Analysis and Feedback are Essential

Targeted Training - Biofeedback: Hip Abduction/Adduction Balance

Training for Ligament Dominance

- Wall Jumps
- Tuck Jumps
- 180° Jumps

Tuck Jumps

180° Jumps

Active Valgus

Active Dynamic Valgus

Training for Ligament Dominance

Active Valgus

- Broad Jumps
- Single Leg Heel Touches
- Single Leg BOSU

Knee Stability Evaluation

Challenging Evaluations

Training for Quad Dominance

- Assisted Russian Hamstrings Curls
- Squat Jumps
- Deep Holds
- Swiss Supine Heel to Butt Touch

Squat Jumps

Potential Neuromuscular Imbalances

Functional Core Control/Perturbations

Bilateral Abilities

Targeted Training:

Lateral Hop-Stick-Unstable Surface

Targeted Training:

Multi-Segment Single-Limb Tasks

Training for Limb Dominance

- Scissors Jumps
- Single Leg Hops
- X-Hops
- Bounding
- Balance

More Sports-Specific Training

Jump into Bounding

Core Stability

Functional Core Strength

Training Principles

- Goal
 - Core strength and stability are related to bodies ability to actively control its center of gravity in response to the forces generated from distal body parts during athletic competition. Training for core strength and stability can reduce the risk of injury and prepare the athlete to achieve optimal performance levels.

Core Stabilization

Target: Trunk Flexors

- BOSU crunch
- BOSU reverse crunch
- BOSU double crunch
- BOSU toe touches
- BOSU medicine ball toss
- Swiss ball prone crunch

Core Stabilization

Target: Trunk Rotators

- BOSU swivel crunch
- BOSU opposite crunches
- BOSU medicine ball touch
- BOSU medicine ball Roman twist

Core Stabilization

Target: Trunk Extensors

- BOSU Superman Balance
- BOSU swimmers
- BOSU medicine ball dead lift
- Swiss ball back extensions
- Swiss ball reverse extensions

Core Stabilization

Target: Lateral Flexors

- BOSU Medicine Ball Reverse Chops
- Swiss Ball Lateral Crunch
- Straight Leg Lateral Double Crunch
- Swiss ball back tosses

Core Stabilization

Target: Hip Extensors

- BOSU pelvic bridge
- Russian Hamstring curls
- Band Good mornings
- Swiss ball hamstrings curls

Core Stabilization

Target: Lower Extremity

- Overhead Squats
- Swiss ball double knee balance
- BOSU single leg knee Balance
- BOSU single hip balance

- BOSU single leg balance
- BOSU single leg pick
- BOSU balance w/perturbations

Core Stabilization

Target: Upper Extremity

- Double BOSU prone stabilization
- BOSU push up
- Swiss ball push up
- BOSU medicine ball push up

Functional Balance

- BOSU hop stick
- BOSU side to side stick
- BOSU volley

General Core

Weight Training Program

Neuromuscular Imbalances in Female Athletes

Thank You

FOR MORE INFORMATION:

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