

Session: Can We Prevent Non-Contact ACL Injury in Female Athletes? A Systematic Review of Existing Large Scaled Clinical Trials

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*Neuromuscular Training is an overused concept but does it really work?

Current trend: we think the rate of ACL injuries are decreasing but actually they are increasing

- Overall NM training does seem to help but there is variability between studies
 - o Some are more effective than others but why?
 - o We don't know what training actually helps to reduce ACL injury...

Researchers looked at 11 studies between the years of 1995 and 2010 to see how to create an optimum program

They assessed 6 aspects of training for each study:

- Mode
- Session length
- Session frequency
- Compliance
- Subject Age

Modes:

- Strengthening:
 - o 5 out of 11 had no strength training
 - o 6 out of 11 had strength training
 - o If no strengthening – no effect in decreasing risk of ACL injury
 - o If had strengthening – helps decrease risk of ACL injury
 - o Russian/Nordic Hamstring Exercise – seem to be the most effective and across the board was seen in the most studies.
- Plyometrics:
 - o 4 out of 11 no plyos = not effective
 - o 7 out of 11 had plyos = effective
 - o Exercises:
 - SL Hop
 - Directional Hop
 - Front/Back
 - Side/Side
 - o Technical education session – biomechanically sound techniques taught and emphasized
 - o Key=Feedback

Overall:

- 3 out of 11: only used 1 mode
- 8 out of 11: multiple Neuromuscular Training modes were used
 - o Need to incorporate many modes in order to be effective in reducing risk of injury
- Number of modes important: isolated plyos are not effective, if combine with other NMT modes you will be more effective in decreasing risk of ACL Injury

Session Length:

- 5 out of 11: sessions were <20 mins & not effective
- 6 out of 11: sessions were >20 mins & more effective

Session Frequency: 2 studies did not address frequency

- 5 out of 9: trained 1 x a week, during season
- 4 out of 9: trained 2 x a week, during season
- Both were effective but increased frequency is better
- One study which had 1 x a week training, did consecutive sessions during pre-season training

Compliance: 6 out of 11 studies addressed this

- To quantify compliance =

Attendance x completion = compliance
(80/100) (70/100) (.56=56%)

- Studies = ranged between 10% - 100%
 - o < 33% = low compliance
 - o 33% - 66% = medium compliance
 - o 66% - 100% = high compliance
 - Most effective to decrease risk of ACL injury
 - These studies made the neuromuscular training similar to a traditional warm-up
 - Incorporated performance enhancement aspects

Age:

- 2 out of 11: 20+ years old – did not show much decrease
- 2 out of 11: 18 – 20 years old
- 7 out of 11: 14 – 18 years old – fewest ACL injury
 - o Younger subjects appear to be most receptive to neuromuscular training

Barriers to implement NMT: time/space/equipment/support from coaching staff

Take Home Message:

- Mode is important
 - o Strengthening + Plyos = multi NMT modes
- Session Length: at least 20 mins or more, not less
- Compliance: high compliance = decrease incidence
- Session Frequency: 1/wk works but 2/wk is best
- Age: younger the age, greater NMT benefits

2nd Part of Session: Deconstructing Barriers to Guide Instruction of a Training Program

Effects of ACL Tear:

Intermediate: risk of subsequent ACL Tear within 1 year after return to play

Long Term: in 20 years 100% chance of osteoarthritis (whether surgical repair or not)

Prevention is Key!!!

- Interventions don't seem to be helping!

Important considerations for successful ACL Rate decrease:

- Compliance/Dosage
- Exercise Selection/Implementation
- When do we initiate the program?

Compliance/Dosage:

- Compliance vs. Complexity
 - o Increase complexity in programs = decrease compliance
- How many do we need to treat to prevent 1 ACL injury?
- Dose Recommended:
 - o Multiple sessions per week \geq 20 mins
 - o In-season vs pre-season?
 - Studies show that when implemented in-season they show decrease only in the 2nd half of season
 - During pre-season: intensive programs decrease deficits during tuck jump assessments
 - Ideally: modified in-season programs for youth
- Targeting Neuromuscular Deficits for Knee Injury:
 - o Measure that is most predictive:
 - Knee Abd = Knee Valgus
 - o Quantification of knee load – most places do not have access to 3D motion analysis
 - o They (Cincinnati Children's Hospital/Authors) devised a quantitative approach with multiple variables as an alternative to 3D analysis

Exercise Selection/Implementation:

Females – show decreased posterior chain strength

- Activate hamstrings 30% less than men

Males – increase hamstring recruitment as the demands of the activity increase

Hamstring recruitment: critical modulator for dynamic stability and control of knee valgus

- Ie: SL RDL/ Pelvic Bridges/ Assisted Russian Hamstring Progression

- Is knee valgus modulated by the hip musculature?
 - o Gluts – glut med significant predictor of knee alignment at initial contact
 - o Increase hip muscle activation related to decrease knee injury
- Core strength and Control – a risk factor!
 - o Exercises: deep holds/trunk mediated balance
- Plyos – deep hold progressions/squat jumps
 - o It is critical to analyze their plyos and give feedback – this is key to success!!!
 - o Assessment of plyos has to progress along with exercise progression

So... dynamic stabilization and balance vs plyos = Both are helpful!!! Need to have cross over!

Program Initiation:

- Prepubescent athlete – low risk?
- Pubertal comparison between men and women show women don't change like men do as they mature
- As we age, the risk increases and their ability to adapt with NM training decreases
- Due to 100% chance of developing OA we need to intervene earlier
- So when? 10 y/o or younger? We don't have any data available...
- Take into account neural plasticity – our patterns become more set