

Controversial Topics

EID 424
Bioengineering Applications in Sports Medicine
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Nov 29, 2021

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Overview

- + Stretching
- + Concussions

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Two Major Stretching Controversies

- + Stretching does/does not prevent injuries
- + Stretching causes/does not cause transient strength loss

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Stretching and Injuries

- + Lots of studies look at "injuries" as a whole
 - + Stretching could prevent muscle strains
 - + Why should stretching prevent fractures?

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Stretching and Injuries

- + Pope, et al., 2000
 - + Static stretching for injury prevention in military recruits
 - + One 20-sec stretch of several major muscle groups in intervention group, no stretching in control group [similar sizes]
 - + No preventive [or causative] effect of stretching on injury

TABLE 2. Summary of injuries recorded.

Lower-Limb Injury Type	Injury Site	Treatment Group		Total
		Control	Stretch	
Bone	Tibia	24	32	56
	Foot	10	11	21
	Femur	4	0	4
	Fibula	1	3	4
	Ilum	2	0	2
	Pubic rami	1	1	2
Acute fracture	Patella	1	0	1
	Tibia	10	15	25
	Foot	2	2	4
Stress changes*				
Soft-tissue				
Joint (articular)	Patellofemoral joint	40	27	67
Ligament sprain	Ankle joint	27	19	46
	Tibiofemoral joint	6	2	8
Muscle strain	Foot	5	12	17
	Shank	9	10	19
	Thigh	10	2	12
	Hip rotators	2	4	6
Tendinitis	Thigh	9	10	19
	Shank	7	10	17
	Hip rotators	1	0	1
Mitraloid lesion	Tibiofemoral joint	1	2	3
Compartment syndrome	Shank	1	1	2
Other (e.g., bursitis)	Thigh	1	0	1
	Tibiofemoral joint	0	1	1
	Shank	1	1	2
Totals		175	158	333

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Stretching and Injuries

- + Behm et al., 2015 review article
 - + Looking at thigh muscle strains, stretching approximately halves risk of injury

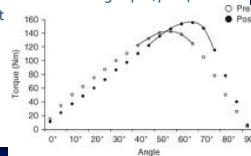
Reference	Stretching Group		Control Group		Relative Risk 95% CI
	n	# injuries	n	# injuries	
Amadio et al. (2003a)	518	3	383	8	0.28 0.07-1.04
Arason et al. (2009)	630	59	966	97	0.94 0.69-1.27
Craig et al. (1999)	195	21	195	43	0.49 0.30-0.79
Ekstrand et al. (1983a)	90	6	90	23	0.26 0.11-0.61
Radala and Barrios (2009a)	28	4	30	22	0.19 0.08-0.49
Pope et al. (2000a)	735	14	803	21	0.73 0.37-1.42
TOTAL	2196	107	2467	264	0.46 0.37-0.57

*Randomized trial; *Longitudinal trial; *multicomponent intervention

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Stretching and Strength Loss

- + MANY studies have shown acute reductions in strength/power/performance following a bout of stretching
 - + [see Behm, et al., 2015 for review]
- + HOWEVER, evidence suggests that there may be an *increase* in strength at longer muscle lengths
 - + Stretching may cause a shift in the muscle length-tension curve
 - + If testing is done isometrically at the same muscle length pre/post, this would appear as a strength decrement



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Concussions

- + Mild traumatic brain injury
- + Lots of misinformation

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Definition

- + "a clinical syndrome characterized by the immediate and transient post-traumatic impairment of neural function such as alteration of consciousness, disturbance of vision or equilibrium etc. due to brainstem involvement."

Congress of Neurologic Surgeons 1966

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Signs and Symptoms

- + Amnesia
- + Loss of Consciousness
- + Headache
- + Dizziness
- + Blurred vision
- + Attention deficit
- + Nausea

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Mechanism of Injury

- + Most often associated with rapid acceleration or deceleration of freely moving head
- + Whiplash
- + Direct impact
 - + Contrecoup

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Neuropsych Findings

- + Disturbances of new learning and memory
- + Difficulties in planning and the ability to switch mental set
- + Reduced attention and speed of information processing

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Pathophysiology

- + Increased glycolysis
- + Decreased cerebral blood flow
- + Mismatch puts the brain at increased risk for subsequent insult

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Complications

- + Second Impact Syndrome
 - + Potentially fatal condition that can occur after a trivial second head injury
 - + Loss of cerebral autoregulation (including intracranial pressure)
 - + CT scan – edematous brain
 - + 100% morbidity, 50% mortality
 - + Controversial!
 - + McCrory P, Does Second Impact Syndrome Exist? *Clin J Sports Med* 11(3):144-149, 2001.

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Post-Concussion Syndrome

- | | |
|---------------------|----------------------------|
| + Headache | + Noise Sensitivity |
| + Vertigo | + Light Sensitivity |
| + Dizziness | + Difficulty concentrating |
| + Nausea | + Fatigue |
| + Memory complaints | + Depression |
| + Blurred vision | + Loss of appetite |
| + Sleep disturbance | + Anxiety |
| + Hallucinations | + Incoordination |

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Post-Concussion Syndrome

- + Treatment
 - + Psychotherapy, behavioral modifications, and PT
 - + Cease activity that causes symptoms until they resolve
 - + Light exercise [does not cause symptoms] is good!
- + Medications
 - + Antidepressants and beta blockers

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Exercise Prescription for Concussions

- + Use graded exercise test
 - + Just like VO₂max test!
 - + Buffalo Concussion Treadmill Test [Leddy, Willer, 2013]
 - + Test is stopped either at maximal exertion OR when patient starts to feel symptoms
 - + Subject is allowed to exercise at 80% of max heart rate during test
 - + Repeat test over time to see progress

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Questions for Determining Concussed Players

- + At which field are we playing?
- + Which team are we playing today?
- + Which period is it?
- + How far into the period is it?
- + Which side scored most recently?
- + Which team did we play last week?
- + Did we win last week?
- + Recall three words

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Controversy: Determining Severity

- + Over 25 scales available
- + None have had prospective validation
 - + Most use loss of consciousness as an indication
 - + Research shows LOC has nothing to do with severity of concussion

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Controversy: Return to Play

- + Often depends on grade of concussion
 - + Grading systems unreliable
- + Neuropsych tests
 - + ImPACT
- + Generally:
 - + Complete resolution of symptoms, both at rest and with exercise
 - + Termination of all contact sports following repeated concussions during an athletic season should be considered

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Research

- + Virginia Tech
 - + Instrumented football helmets with accelerometers
 - + Most-commonly used pro helmet performed worst
- + HITS
 - + Head impact telemetry system
 - + In use at several colleges

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Controversy: NFL Concussion Committee Position Statement

- + "Because a significant percentage of players returned to play in the same game and the overwhelming majority of players with concussions were kept out of football-related activities for < 1 week, it can be concluded that mild TBIs in professional football are *not serious injuries*."

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Controversy: NFL Concussion Committee Position Statement

- + No such thing as post-concussion syndrome
 - + Several committee members resigned
- + Data were falsified
- + See case of Andre Waters
 - + Former safety
 - + Depression, suicide at 44
 - + Post-mortem showed brain tissue changes consistent with 85-year old with Alzheimer's
- + ...and many others...

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