



NSCA
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Mechanical Perspectives on Injury Prevention

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CONFLICT OF INTEREST STATEMENT

I have no actual or potential conflict of interest in relation to this presentation.

Objectives

- Identify components of a comprehensive IP Plan
- Understand the structures, function, and adaptation of involved tissues
- Develop a system for exercise selection and long term planning

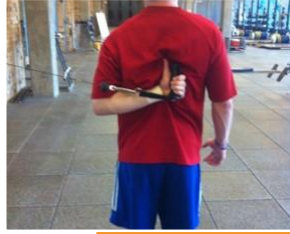
An Understanding

- We cannot prevent all injuries
- Variables that influence injury causation
 - Bahr, R. Krosshaug, T. Understanding Injury Mechanisms: A Key Component of Preventing Injuries in Sport
 - Previous Injury, Age, Gender, Position, Movement, Body Composition, Bone and Joint Structure, Bone Mineral Density, Menstruation, Total Work Load, Nutrition, Sleep, etc.
 - Playing Situation, Athlete and Opponent Behavior, Whole Body Mechanics, Joint/Tissue Mechanics
 - Siff, MC. Supertraining. Supertraining Institute. Denver, 2003.
 - 9 general biomechanical causes; 18 specific causes; 10 causes of “inefficient causes of movement”
- Too many to control for, some of which are non-modifiable

Components of Injury Prevention



- Sport Technique
- Work-Load Management
- Session Warmup / Prep
- Active Recovery (Sleep, Nutrition, etc.)



- Neuromuscular Education
- Corrective Exercise
- Tissue Adaptation

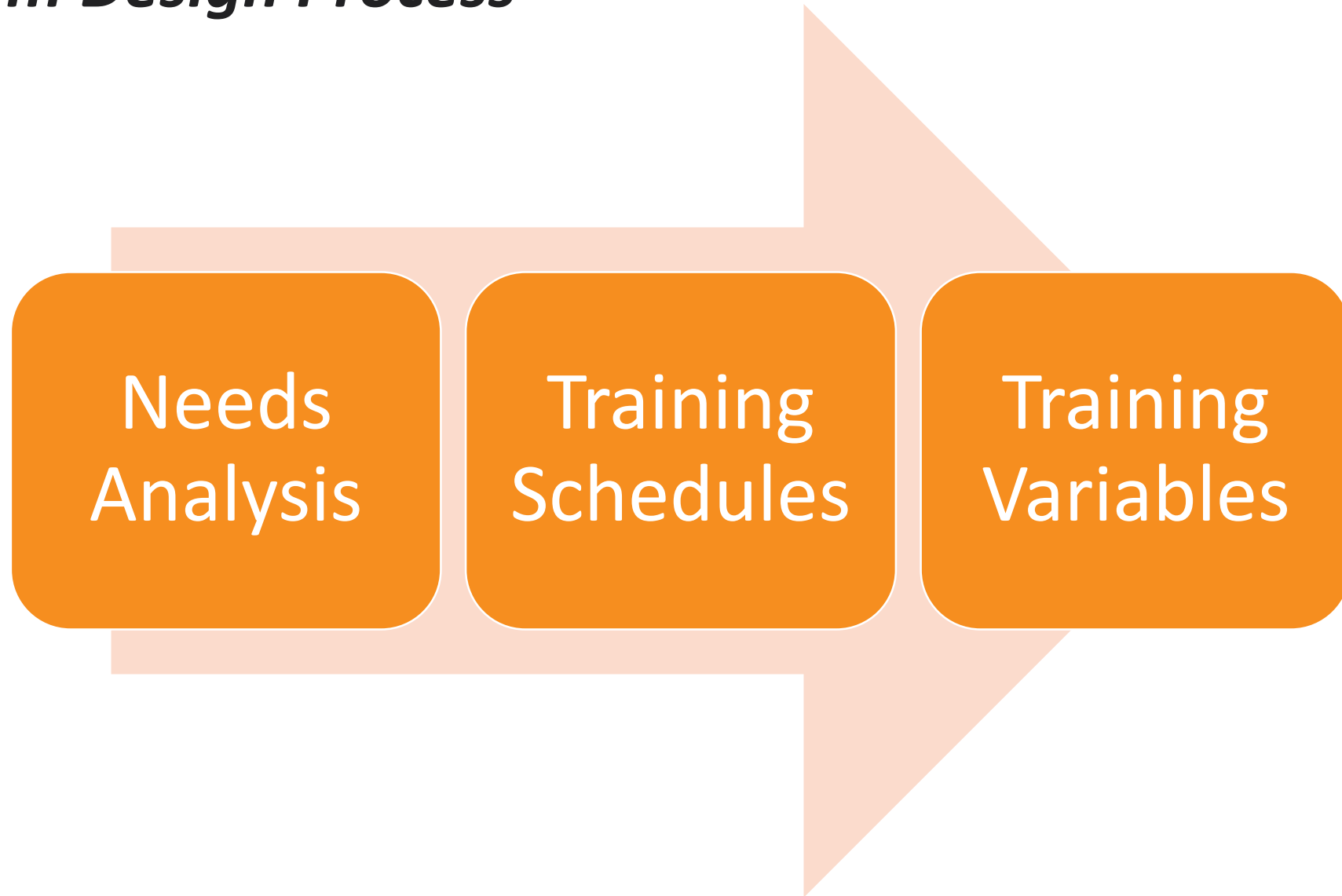


- Metabolic Conditioning / Local Muscular Endurance
- Active Recovery (Soft Tissue, Mobility and General Movement, Aerobic Activity, etc.)
- Overall Performance Enhancement

Efficiency

- Optimize muscular potential
 - Optimize mechanical potential
 - Optimize physiological potential
-
- Ability to accept, transfer, and produce FORCE in order to strategically create and/or prevent motion with little waste.

Program Design Process



Starting Point – Critical Thinking

What are common Injuries?

Acute
Chronic

What are the mechanisms of Injury?

Positions
Joint Forces
Actions

What are involved Tissues?

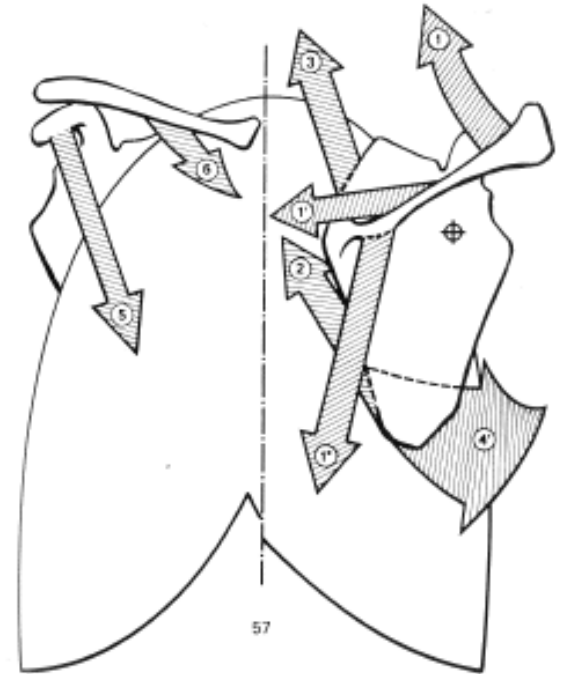
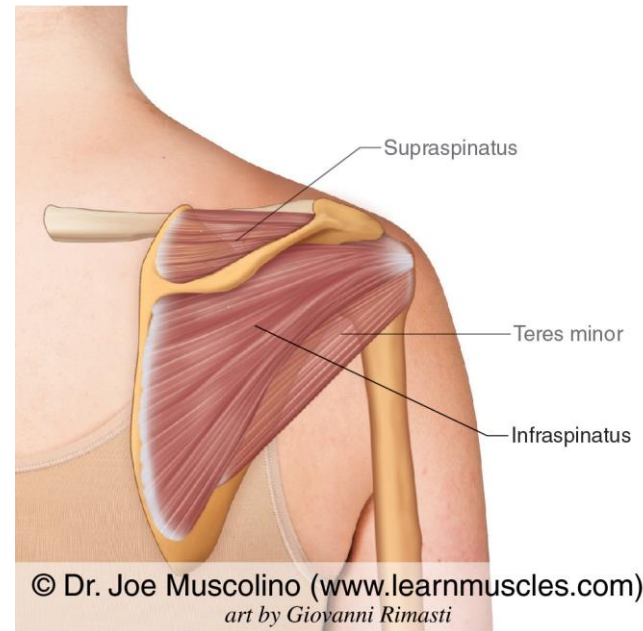
Direct – Injured Tissue
Indirect – Uninjured Tissue

- Agonists which could prevent damage
- Synergistic Tissue
- Support and Suspension

Starting Point – Critical Thinking

Example: Shoulder

- Problem: Bicep Tendonitis or Impingement of Supraspinatus
- Joint Positions: Moving into flexion or abduction
- Agonists: Infraspinatus, Subscapularis, Teres Minor
- Synergist: Deltoid, Bicep, Supraspinatus, Pec Major
- Support: Scapular Upward Rotation (Upper Trap, Lower Trap, Serratus Anterior)



Kapandji, I.A. *The Physiology of the Joints* 1982.

Starting Point – Critical Thinking

Desired Characteristics

- Load Tolerance – Acute (Absolute)
- Load Tolerance - Chronic
- Fatigue Tolerance - Acute

Neuromuscular Input

- Intra-Coordination
- Inter – Coordination
- GTO
- Muscle Spindles

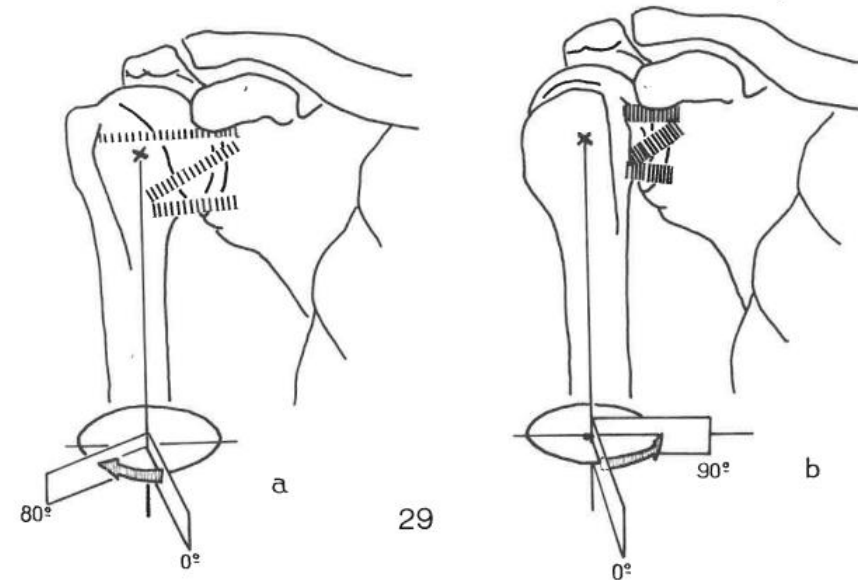
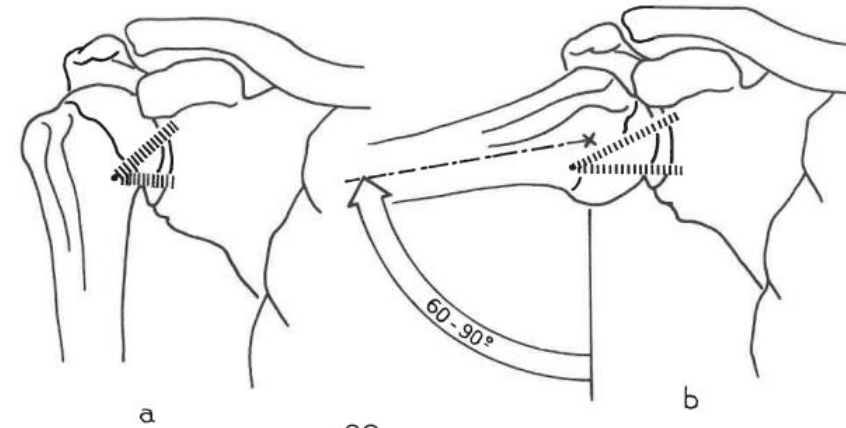
Overall Performance

- Stiffness / Mobility
- Power

Structure and Function

Joint Structure

- Key Joint Positions
 - Close-Packed
 - Loose-packed
- ROM Availability
 - True End Range
 - Joint Receptors



Structure and Function

Connective Tissue	Ligament	More variable orientation of collagen fibers Less resistant to tensile stress; able to resist a wider range of loading patterns
	Tendon	Fibers tend to be in line with contractile tissue (Series Component) High resistance to tensile stress
Stimulus	Ligament	Progressive tensile stress Multiple joint positions and forces
	Tendon	Progressive tensile stress High speed loading
Physiological Adaptation	Increasing collagen content, cross-linkage, tensile strength, and stiffness	
	Some Hypertrophy	

Developing Strategy

What type of exercise?

- Movements or Muscles?
- Isolated or Integrated?

*Evaluate exercises before programming

- What is the target?
- How will it compliment the rest of the system?



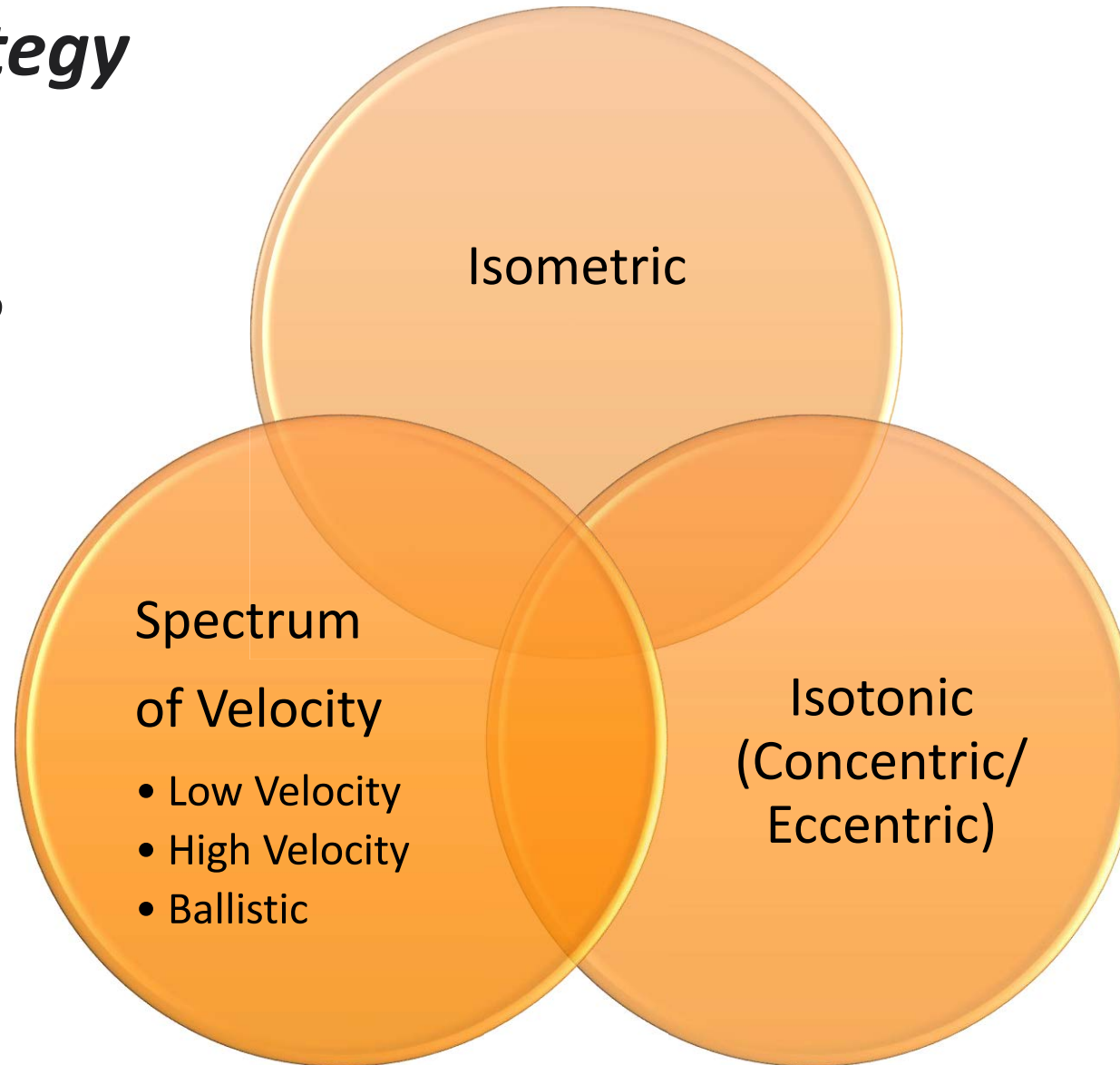
Developing Strategy

- How do I want to load the tissue?
- What type of adaptation do I want to influence?



Developing Strategy

What type of Force?



Developing Strategy

What type of Progression?

Load

Volume

Rest

Skill

Variation

Developing Strategy

- Evaluating Standard Protocol – Does this meet our needs?

Thrower's 10

8 Isolated; 4 Integrated

2 ER; 2 IR

3 Retraction; 3 Protraction

3 Upward Rot; 2 Downward Rot.

Buchberger 12

4 Isolated; 8 Integrated

4 ER; 1 IR

5 Retraction; 1 Protraction

5 Upward Rot; 1 Downward Rot.

Developing Strategy

- How do we fit it all in?
 - Target a few major needs
 - Utilize the warmup segment for neuromuscular coordination and corrective strategies
 - Implement strategic supersets for additional tissue stress and neuromuscular integration
 - Leverage movement skill and conditioning work for additional stress
 - Exploit the entire year or even multiple years

Summary – Use the Force

- Direction of *Force*
- Amount of *Force*
- Duration of *Force*
- Transfer of *Force*
- Timing of *Force*
- *Tolerance of *Force*

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THANK YOU

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QUESTIONS

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