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Rapid Eccentric Anaerobic Core Trainer

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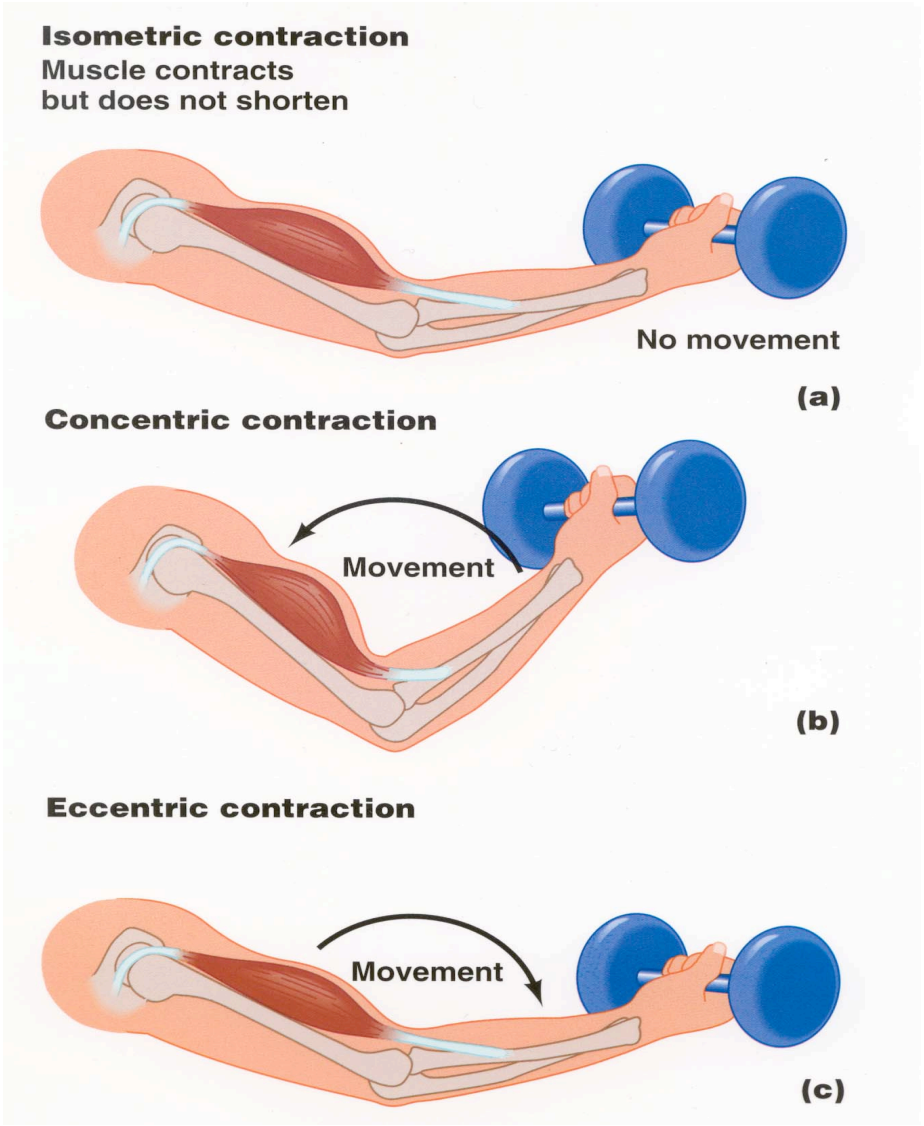
Functional Eccentric Training

Three Types of Muscular Contractions

- Concentric – Muscle Shortening under tension
- Isometric – muscle tension without any change in length
- Eccentric aka “negative” – muscle lengthens under tension

Three Types of Muscular Contractions



Concentric Contraction

Concentric contractions occur whenever you are projecting force externally such as:

- lifting any object against gravity
- Performing an exercise on a machine where the weight stack is moving up
- Throwing anything
- Jumping up, sideways or forward
- The push off phase of running.

Isometric Contractions

Isometric contractions occur whenever you are stabilizing or preventing movement such as:

- **Rotator cuff muscles of the shoulder contract isometrically to hold the head of the humerus into the glenoid fossa while larger muscles like Pecs move arm.**
- **Torso musculature contracts isometrically to maintain the core in rigid alignment during most movments including lifting, jump, throwing, etc.**

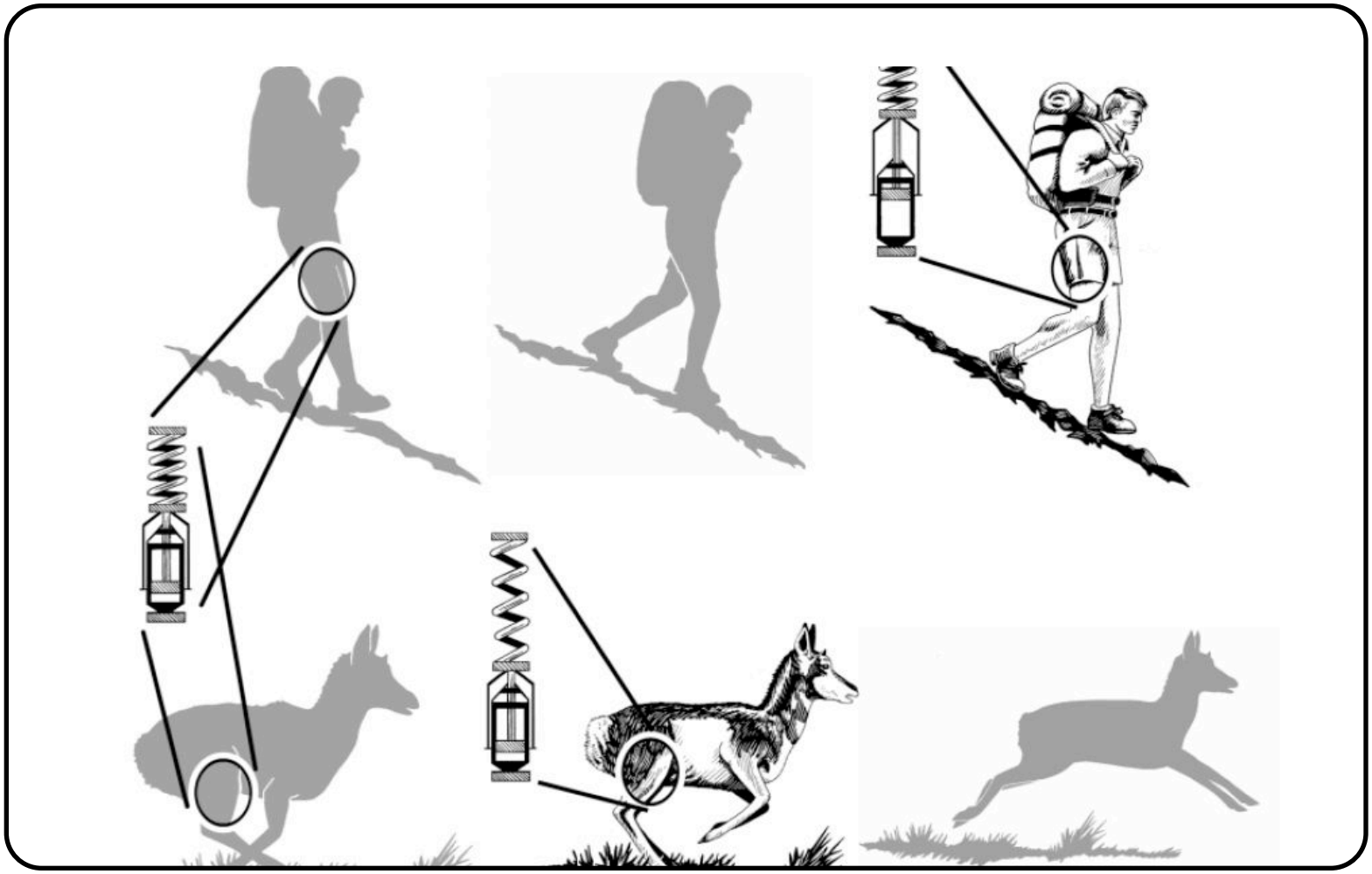
Eccentric Contractions

Eccentric contractions occur whenever you are absorbing force and decelerating such as:

- Landing from a jump and landing phase of walking and running
- Walking down stairs
- Cutting/changing direction rapidly while running
- Stopping quickly while running
- Absorbing bumps while skiing
- Decelerating arm when throwing

Eccentric Contractions

Muscles act as springs during eccentric contractions



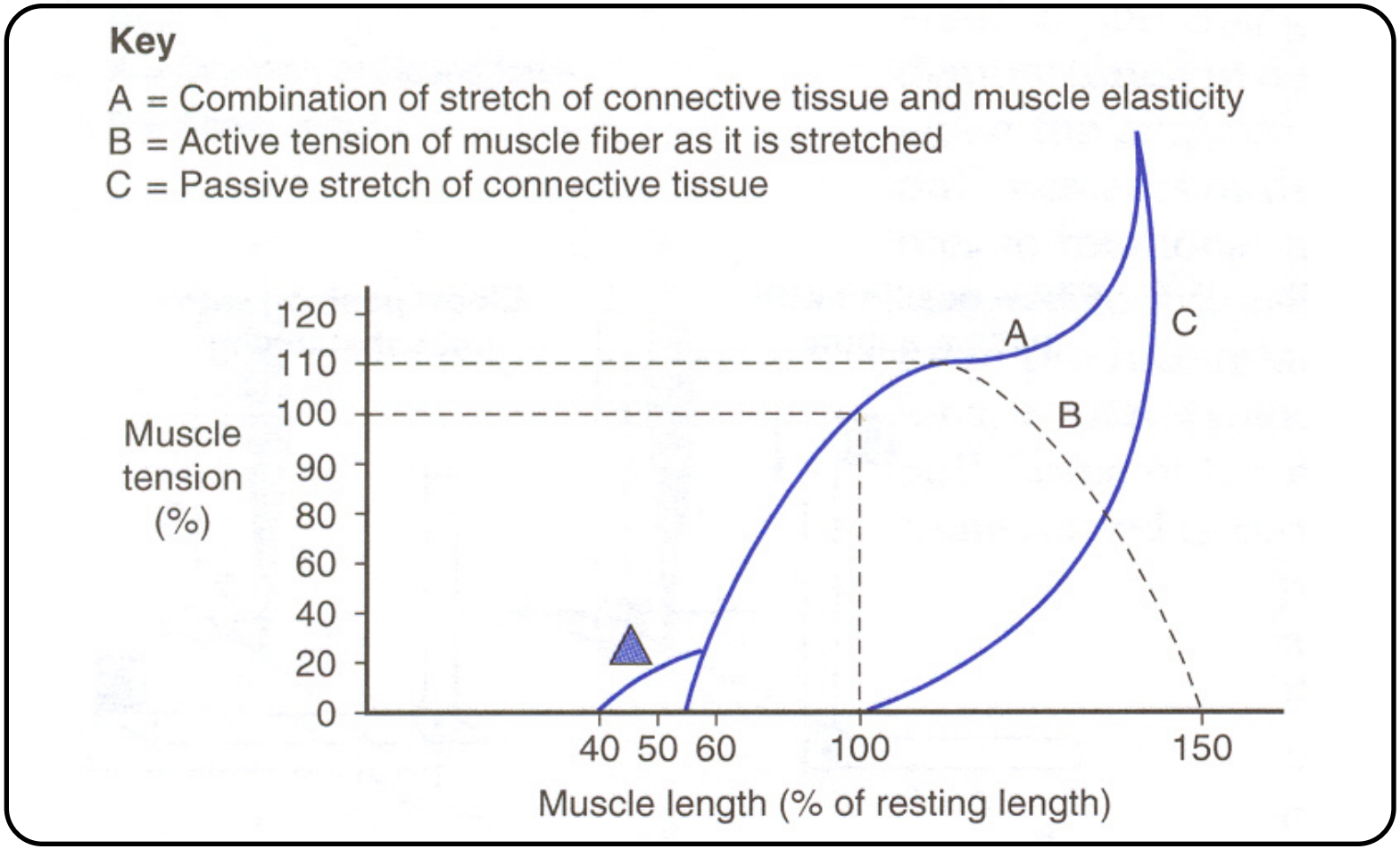
Muscles as Springs

- During most movement eccentric contractions allow us to store kinetic energy which is then used during concentric contractions – this process is ubiquitous and is known as the Stretch Shortening Cycle or SSC.

- Up to 50% of all the energy needed to accelerate/lift the body can be reclaimed from the eccentric/ muscle lengthening phase of the stride!

Eccentric Contractions

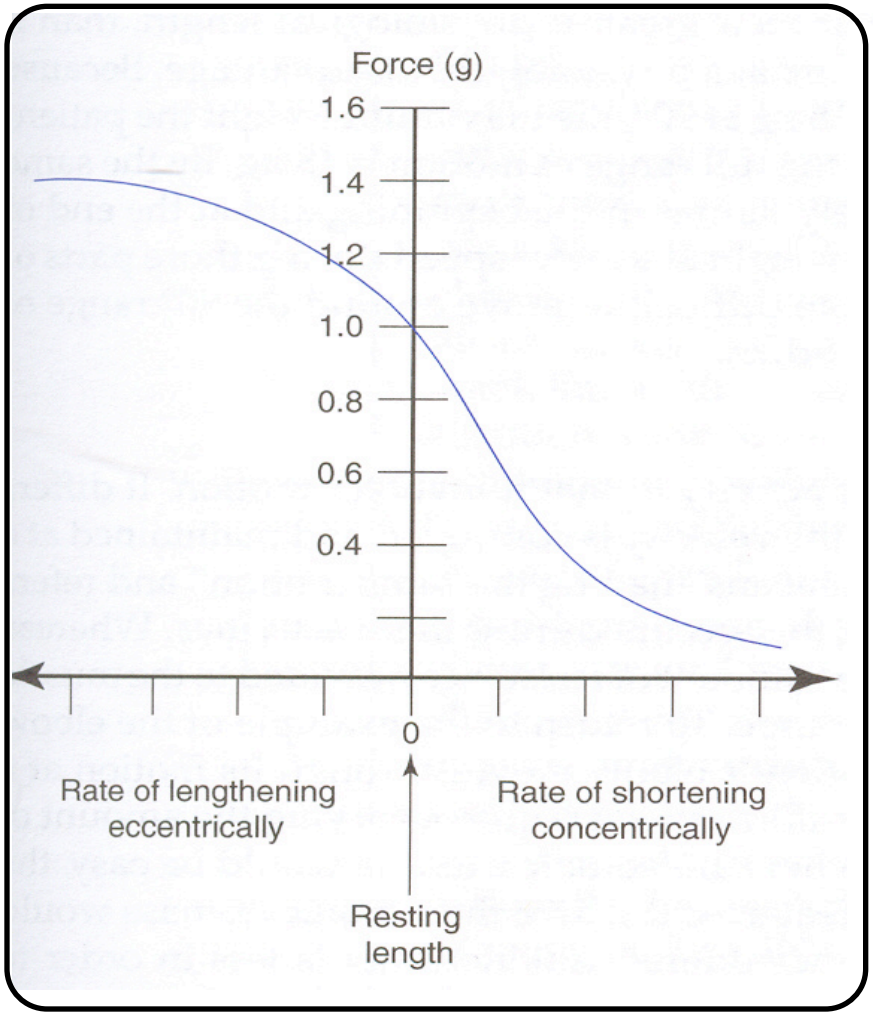
Length/Tension Curve



Elftman Principle

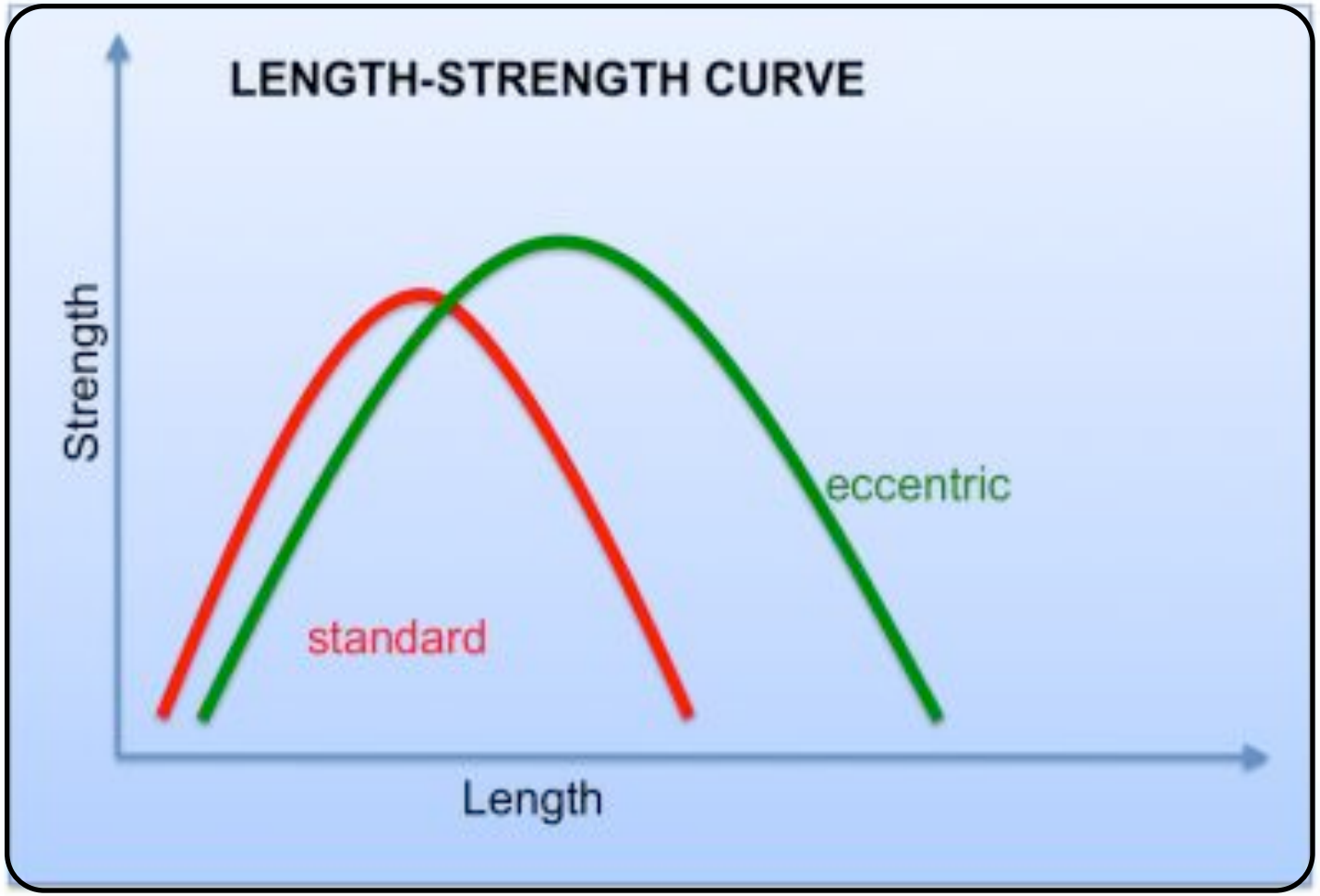
- Ranks muscle contractions based on their inherent level of force production
  - Muscles can produce the lowest amount of force concentrically
  - Muscles can produce more force isometrically
  - Muscles can produce the most force eccentrically!
  - During eccentric contraction force comes from contractile elements AND from the viscoelastic components of the connective tissue (primarily tendons)!

Force- Velocity Curve



Unlike Concentric contractions muscles are capable of producing more force the faster they contract eccentrically (to a point) which allows them to store the kinetic energy during rapid movements such foot strike during running.

Length/Tension Curve



Length/Tension Curve

Eccentric Training moves the Length/Tension Curve

- Eccentric training increases a muscle's ability the muscle to produce force at a longer length!

- This is one of the ways eccentric training prevents injury!

Effects of Eccentric Training

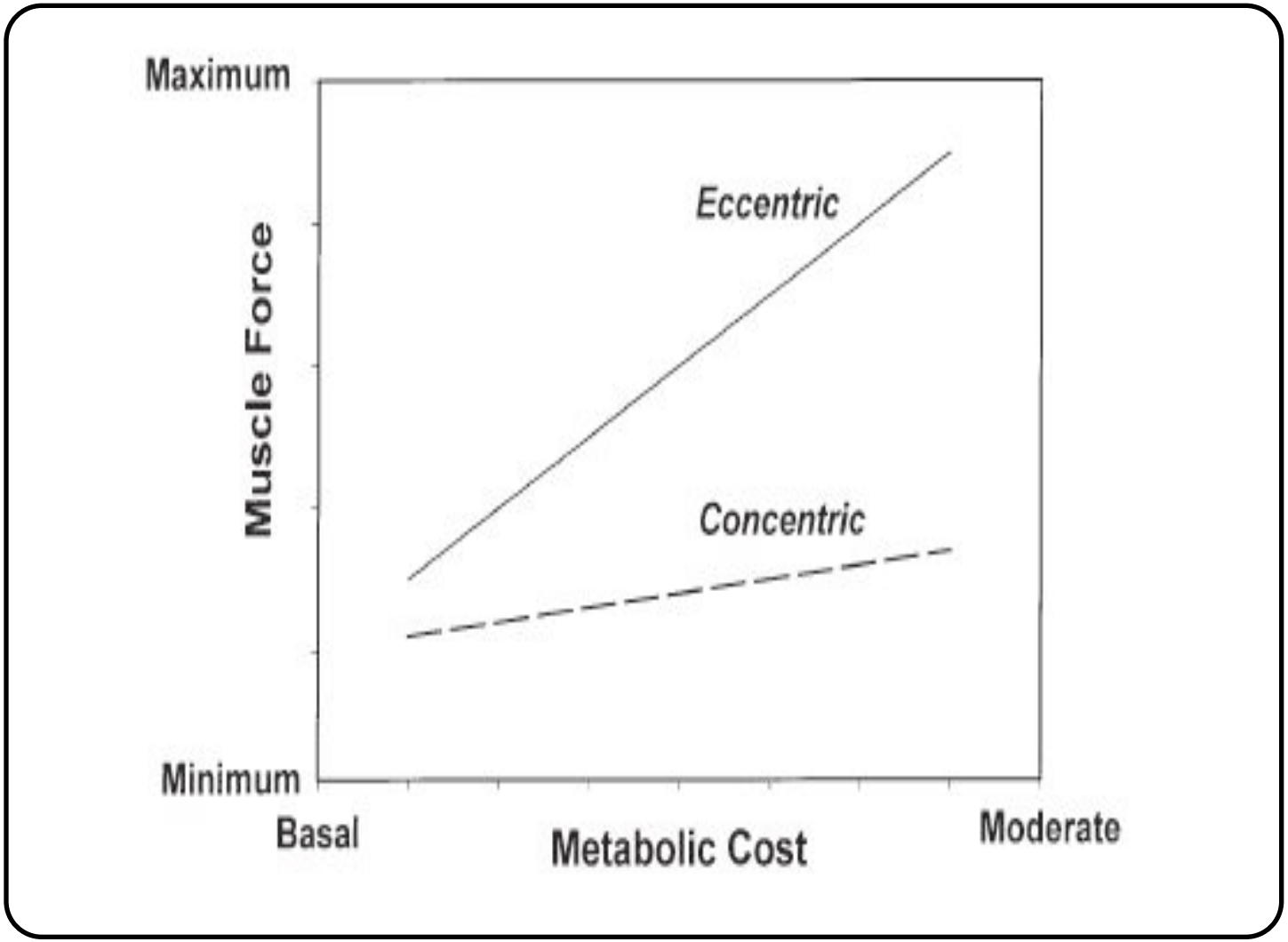
Eccentric exercise is thought to optimize the alignment of myofibrils (contractile elements within muscle fibers) allowing maximum leverage.

- **This process helps explain the benefits of eccentric exercise in the treatment of tendonitis.**
- **Eccentric exercise causes hypertrophy of tendons and connective tissue increasing the tendons strength, resistance to injury, and ability to store energy during movement.**

Eccentric vs Concentric Training

- Eccentric Training causes more rapid increases in muscle size and strength!
- Strength from eccentric training carries over to concentric training but NOT the other way around!
- Since a muscle can produce much more force eccentrically simply lowering your weights slowly does not do much to overload or improve eccentric strength!

Metabolic Cost of Eccentric and Concentric Exercise



Eccentrics and Metabolic Demand

- Eccentric Training requires a much lower level of oxygen and cardiovascular work/ stress and a lower rate of perceived exertion for any given level of force production/ workload.
- Eccentric exercise has been proven to be ideal for seniors and those with decreased cardiovascular capacity because it quickly and safely builds muscles and decreases fall risk significantly!

Concerns with Eccentric Training

Eccentric Training can cause significant delayed onset muscular soreness, acute decreases in strength, and acute reduction in proprioceptive ability.

These negative effects can be eliminated by:

- Gradual introduction and increases in interval and total eccentric loading time
- Slow and gradual increase in intensity/load and during eccentric training.

DOMS and Training

- **MYTH: training a sore muscle hurts recovery.** All 3 studies below come to the same conclusion: training sore muscles does NOT hurt recovery. In fact, done properly, doing so can speed up recovery by shuttling blood to recuperating muscle tissue.
- Nosaka K, Clarkson P.M. Muscle damage following repeated bouts of high force eccentric exercise. Med. Sci. Sports Exrc., 27(9):1263-1269,1995.
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Eccentric Training and Anterior Cruciate Ligament Injury

- ACL tears are serious frequently requiring surgery, and rehabilitation of ACL injury is challenging!
- Research shows that appropriate eccentric exercise for ACL rehab is well tolerated and greatly accelerates increases in muscle mass, strength and in hopping ability compared to regular exercises!

Effects of Eccentric Rehabilitation

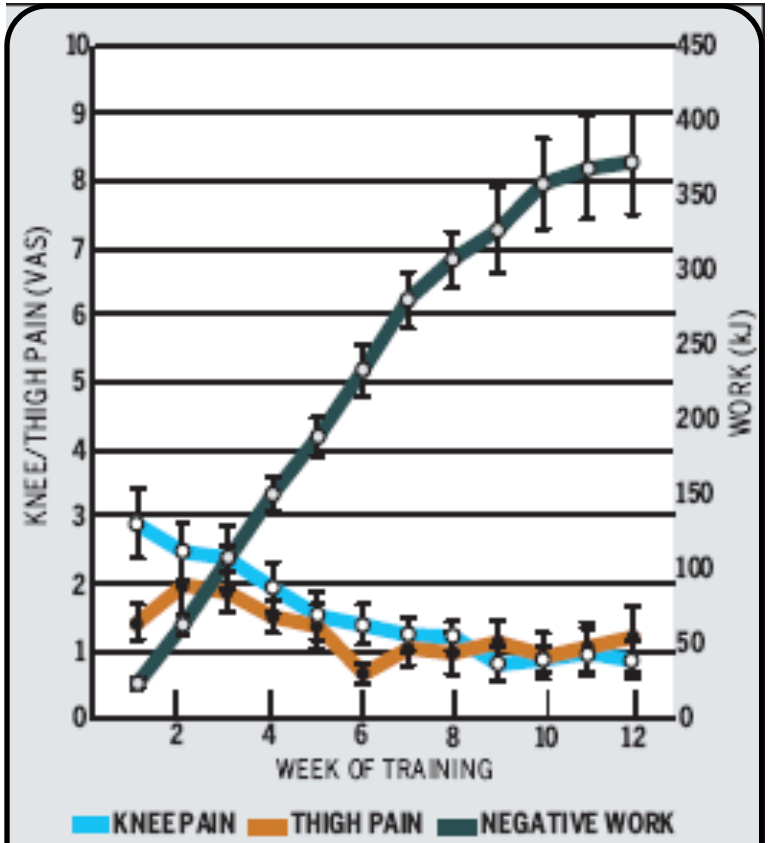


FIGURE 4. Both knee and thigh pain remained at low levels in individuals who trained eccentrically while negative work dramatically increased.

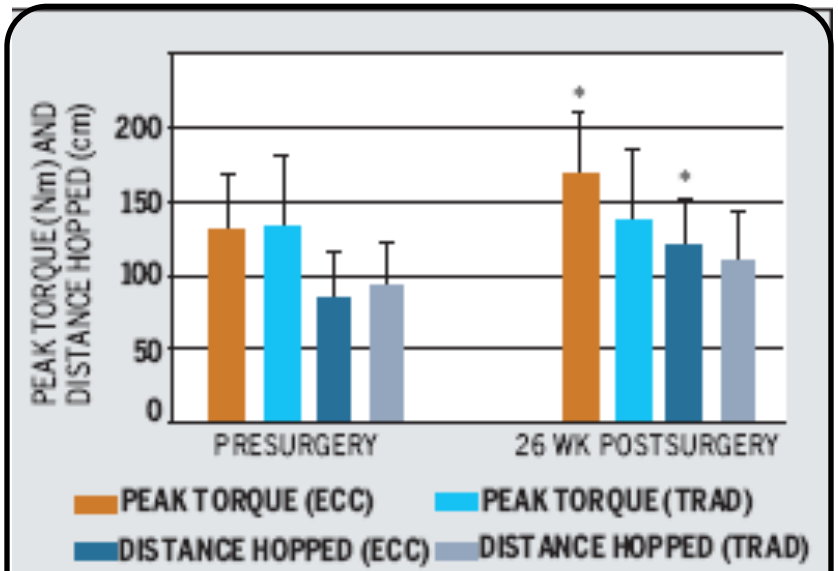


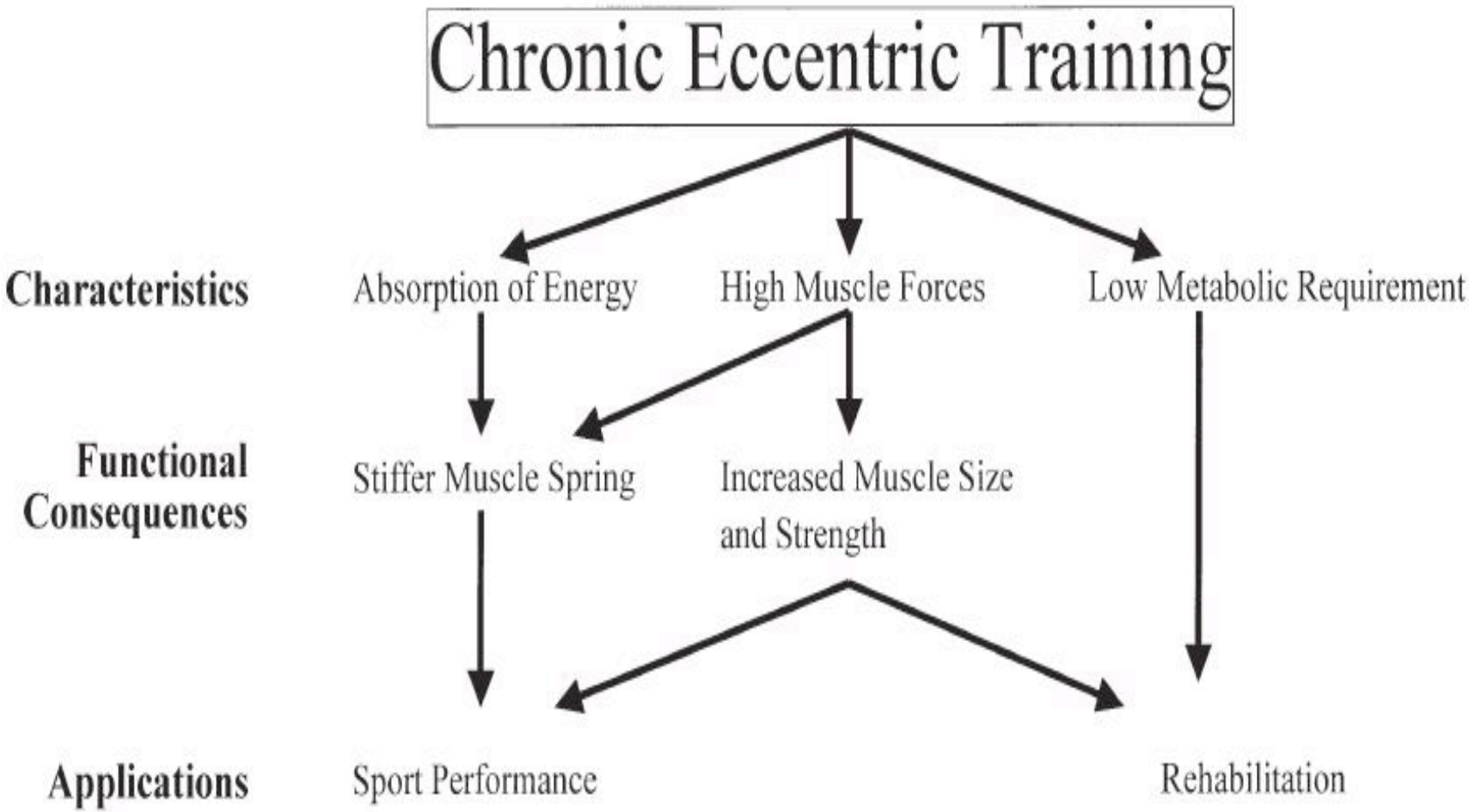
FIGURE 5. Quadriceps peak torque and distance hopped of the involved lower extremity before surgery and 26 weeks after surgery. *Quadriceps peak torque and hopping distance increased significantly from pre-surgery to 26 weeks post surgery in the ECC group ($P<.01$). (Error bars = 1 SD)

Effects of Eccentric Rehabilitation

A study has shown that one weekly half hour bout of eccentric exercise done for 8 weeks produces significant health benefits including:

- Significant improvements in Resting Energy Expenditure
- Increased Fat Utilization
- Improved Blood Lipid Profiles
- Decreased Insulin Resistance!

Chronic Effects of Eccentric Training



S.A.I.D. Principle

- Specific Adaptation to Imposed Demand is the key principle to keep in mind when designing exercise and rehab programs!
- The more specific the program relative to desired outcomes the better results!
- An important aspect of program specificity is to include specific conditioning relative to muscle contraction type based on movement/ sport requirements.

S.A.I.D. Principle

- To properly train a person for activities/ sports requiring eccentric contractions the program must include eccentric training!

- Since most activities and all sports require eccentric strength – eccentric training should be part of everyone's training program!

- However most equipment and programs include NO effective eccentric loading!

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Existing Eccentric Training Methods

Trainers have devised ways to train eccentric muscle strength and endurance.

However these methods pose several challenges to implementation

- Many, such as plyometrics, ballistic training, and heavy negatives pose significant risk of injury and require careful preparation and skilled coaching.
- Others use highly specialized, expensive equipment

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reACT Motion

- Reverse Bicycle Motion/Platform Changes Pitch During Rotation
- Forces Legs to Absorb Energy with no impact
- Vertical Ellipse to Horizontal Ellipse
- No Impact with full Range of Motion
- Full control of movement speed
- Safe and secure

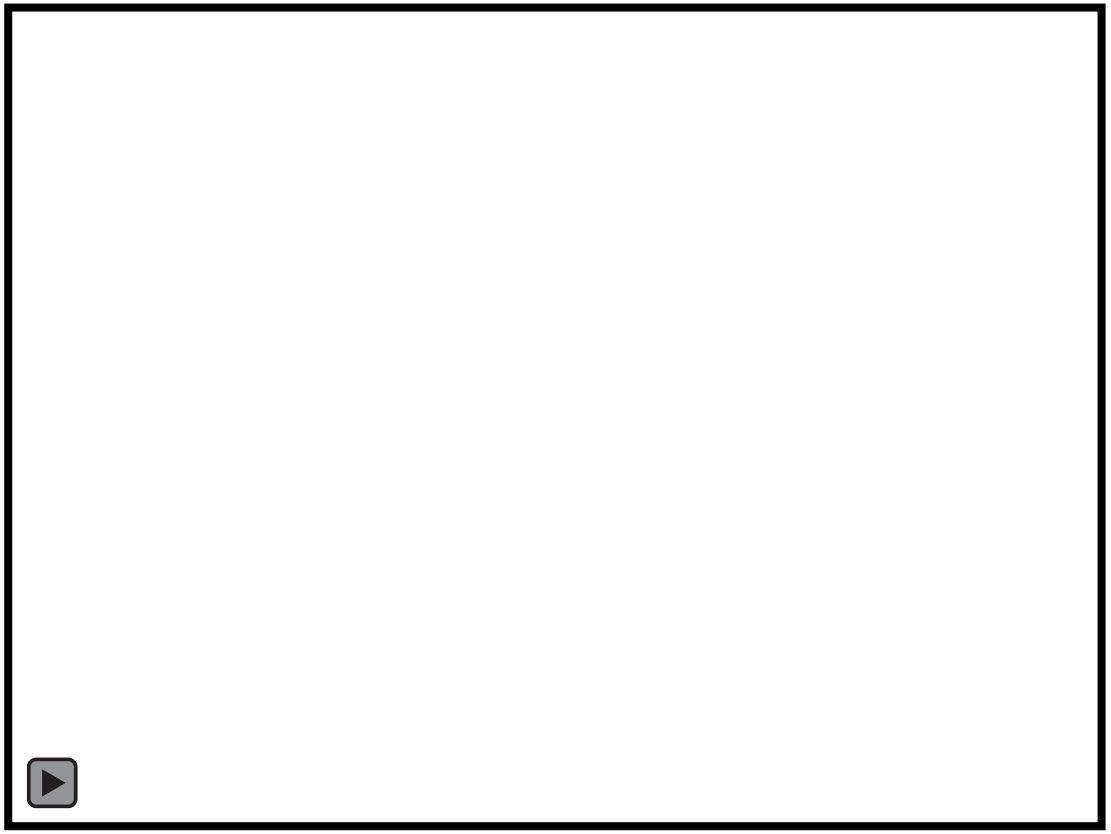
Validation

- 6 NFL Football Teams
- US Olympic Center at Lake Placid
- US Olympic Ski Team at Park City
- Navy SEALS
- Gonzaga University Basketball Team

reAct Pro Sports

- Dallas Cowboys-NFL
- Houston Texans-NFL
- Indianapolis Colts-NFL
- Miami Dolphins-NFL
- New York Giants –NFL
- Tennessee Titan-NFL
- Washington Redskins-NFL
- Chicago Cubs-MLB
- Seattle Sonics (Okalahoma City Thunder) -NBA

reACT Video



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reACT Acute Training Variables

- Volume
  - Acclimatization period
  - Time per set
  - Number of sets
  - Number of Exercises
- Work/Rest Ratio
- Platform Speed
- Level of Compression/ Extension
- Movement Progression
- Load

- Examples of progression
- After Acclimatization
  - Increase time per set
  - Increase # sets
  - Increase # exercises
  - > work/rest ratio
  - > or < Platform Speed
  - Increase level of compression/extension
  - Go from two feet to one foot
  - Add weight vest

Acclimatization for New Client

- Start clients facing forward with two feet parallel and shoulder width apart with firm grip on handrails
- Start using manual program set for intensity/speed of 30 RPM and allow client to “ride” without flexing or extending at hip/knee/ankle so client feels safe on machine.
- After client is comfortable riding progress to having them flex knees/hips/ankles slightly (compress/squat) as platform moves up to absorb while holding on.
- Use short work intervals no longer than 30 Seconds with 1 minute off between sets. Do only 3 - 5 sets initially to avoid excessive DOMS.

Guidelines for Exercise Progressions

- After your client can perform the basic squat comfortably and in good form and can perform 3 – 5 sets for one minute with appropriate rest postural progressions can begin.

- Before progression from the squat holding on with two hands your client should be doing full compressions and extensions (subject to their particular safe R.O.M) with little to no movement from top of head to pubic bone so core is “quiet”.

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Basic Riding Posture

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Basic Squat Two Hands

Speed/Intensity Recommendations

- Initially when learning reACT using a speed of 30 RPM is recommended for short intervals (< 1 Min.)
- Once a person is capable of doing intervals of 1 minute or more a speed of 30 RPM will actually be associated with a much higher RPE (Rate of Perceived Exertion) than faster speeds of 50 – 70.
- So RPE is high for slow speeds of 30 – 40; moderate for speeds of 50 – 70; and then high again at speed of 70 and higher.
- Speeds from 70 – 90 are advanced and not for beginners!

Initial Exercise Progressions

- The first suggested progression is to go from two hands holding on to one hand or two hands lightly touching until your client can perform the basic squat NOT holding on at all.
- Once your client can perform basic squat exercise without support you can begin teaching a staggered forward stance and eventually a full lunge stance.
- Note that it is appropriate to have clients hold on with both hands again when learning new postures.

Squat One Hand

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Squat no hands

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Staggered Stance Two Hands

Staggered Stance One Hand

Staggered Stance No Hands

Lunge Stance Two Hands

Lunge Stance One Hand

reACT™

Lunge Stance No Hands

Side Facing Posture Progressions

- When your client has learned the front facing postures they can begin to learn the side facing squat.

- As with all new postures the side facing snowboard/skateboard/surf squat exercise should be taught with your client holding on again with progression to full compression and extension without holding on.

Side Squat Two Hands

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Side Squat One Hand

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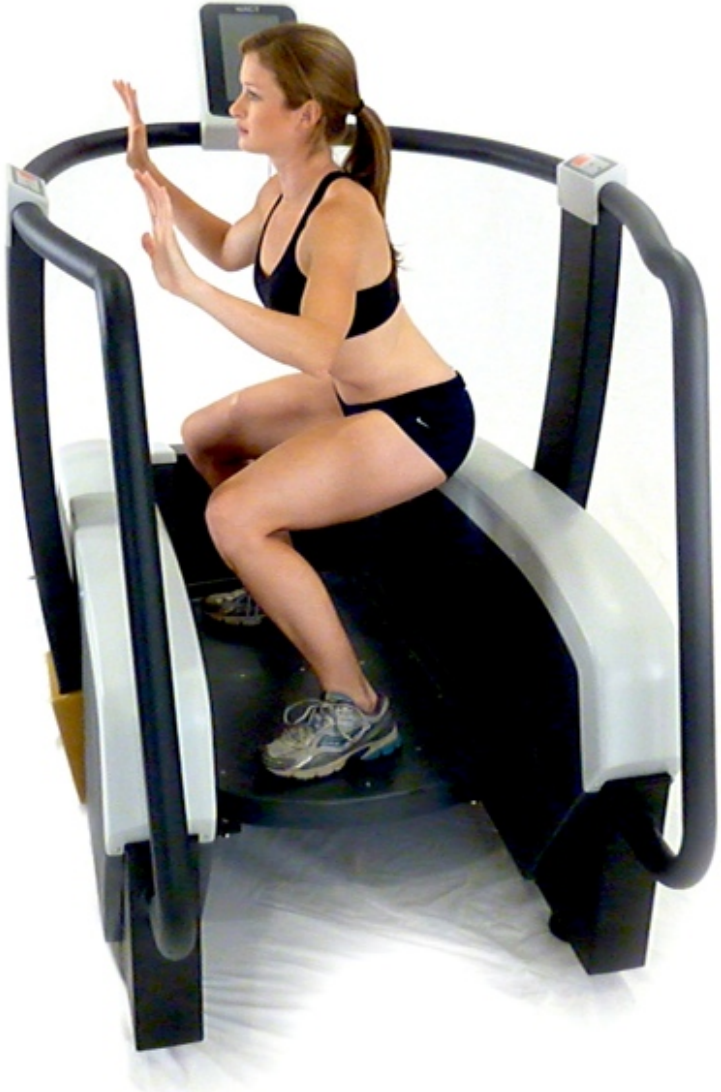
Side Squat No Hands



Single Leg Squat Progression

- After learning forward & side facing postures the last posture progression is the single leg Squat.
- Have your client face forward with one foot on the platform and the other up on the side of the reACT holding on with both hands. The client compresses and extends with one leg from this secure position.
- Progress to point where your client holds one foot up as other leg compresses and extends fully without holding on with hands.

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Single Leg Squat Foot Up

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Single Leg Squat Foot in Air

Single Leg Squat Foot in Air
One Hand

Single Leg Squat Foot in Air
No Hands

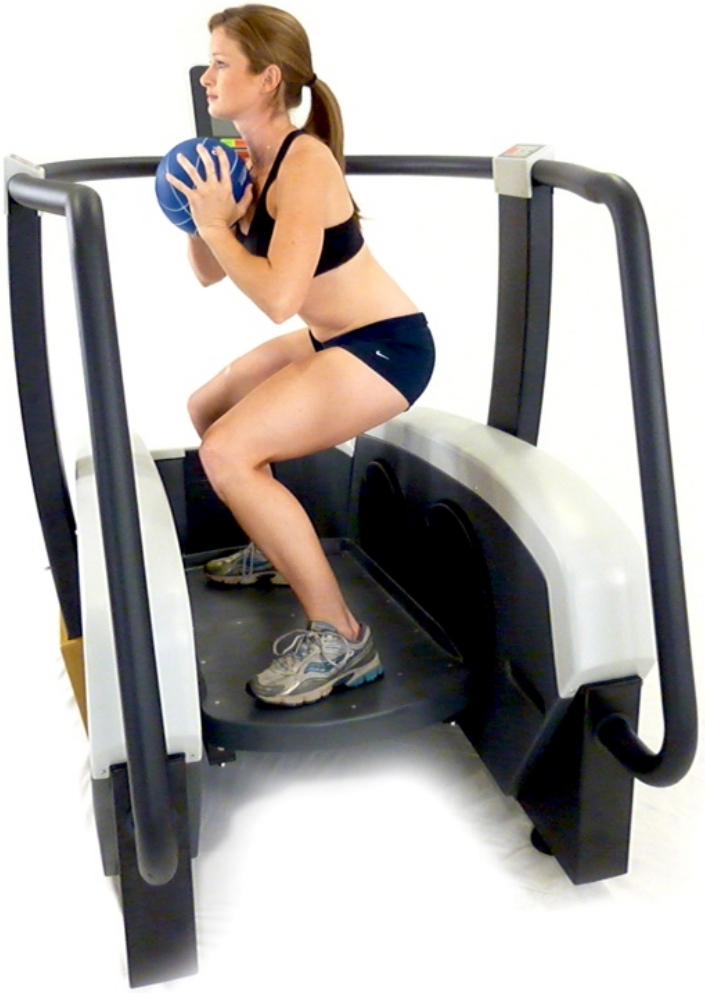
Advanced Exercises

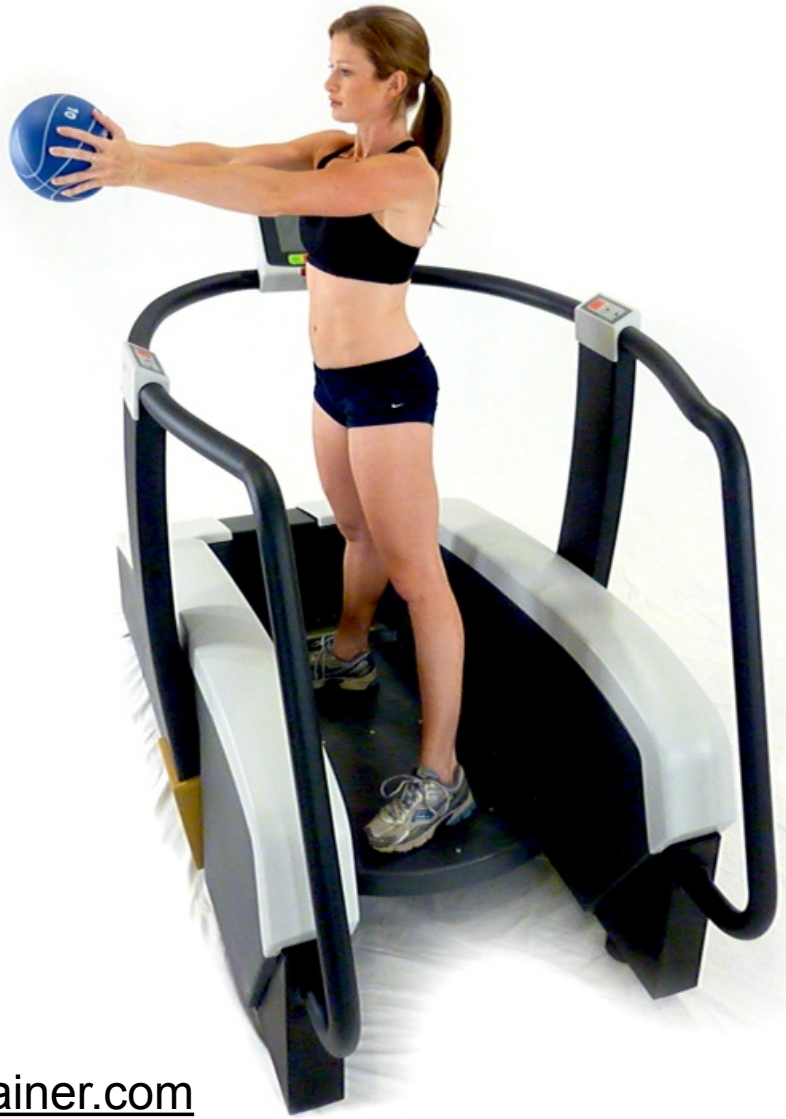
After mastering all front, side facing and single leg squat exercises a client can be progressed through advanced exercises including:

- The squat exercise holding on with eyes closed and hands holding on. Progress slowly so that your client can perform this challenge with one hand and then no hands. Then you can progress to other postures for maximum proprioceptive benefit!

- Begin to teach integrated functional movement patterns with an upper body component like medicine ball throws and catches.

Medicine Ball Throws Side Squat





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Sample reACT Introductory Session

- Warm-up client and give elevator speech on benefits of reACT focusing on their wants, needs, goals and fitness level.

- Teach client basic squat facing forwards and do 3 – 5 thirty second work intervals at 30 – 50 RPM with 1 minute of rest/riding for recovery between intervals.

- After completion explain why we want to slowly build volume and intensity gradually to avoid extreme soreness.

Sample 10 Week Exercise Progression

reACT Sample Workout Template							
Week/s	Weekly Session #	Exercises	Platform Speed	# Sets	Reps/Duration	W/R Ratio	Load
1	1	Basic Forward Squat	Slow	4	30 Seconds	1:2	BW
1	2	Basic Forward Squat	Slow	4	30 Seconds	1:2	BW
1	2	Side Squat	Slow	2	30 Seconds	1:2	BW
2 - 4	1	Basic Forward Squat	Medium	5	45 Seconds	1:1.5	BW
2 - 4	1	Side Squat	Medium	3	45 Seconds	1:1.5	BW
2-4	2	Basic Forward Squat	Medium	5	45 Seconds	1:1.5	BW
2-4	2	Side Squat	Medium	3	45 Seconds	1:1.5	BW
5 - 8	1	Basic Forward Squat	Medium	3	30 Seconds	1:2	25lbs
5 - 8	1	Side Squat	Medium	2	30 Seconds	1:2	25lbs
5 - 8	2	Basic Forward Squat	Medium	3	30 Seconds	1:2	25lbs
5 - 8	2	Side Squat	Medium	2	30 Seconds	1:2	25lbs
8 - 9	1	Single Leg Squat	Medium	4 each	30 Seconds	1:0 alt sides	BW
8 -9	1	Side Squat	Medium	3	60 seconds	1:1.5	BW
8 - 9	2	Single Leg Squat	Medium	4 each	45 Seconds	1:2	BW
8 - 9	2	Side Squat	Medium	3	60 Seconds	1:1.5	BW
10	1	Single Leg Squat	Medium	2 each	30 Seconds	1:2	25lbs
10	1	Side Squat	Medium	2 each	30 Seconds	1:2	25lbs
10	2	Single Leg Squat	Medium	3 each	45 Seconds	1:2	25lbs
10	2	Side Squat	Medium	3 each	45 Seconds	1:2	25lbs
Legend:							
	BW is bodyweight						
	W/R Ratio is Work/Rest Ratio so 1:1.5 means 1.5 times as much rest between sets of work						
	Load refers to external load presumably with weighted vest most of the time						

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