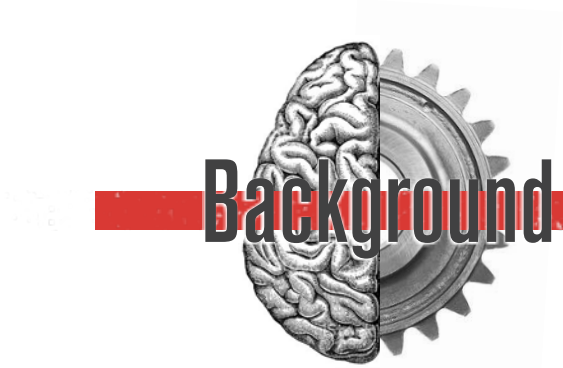
Improving Trunk Stability for Optimal Performance

Closing the gap between Treatment & Training

Created by: Richard Ulm, DC



Background

The Plan

The Plan

- Closing the Gap
- Stability (JPM)
- Proper Stabilization
- The importance of IAP
- Assessment
- Therapeutic Exercises
- Training Trunk Stability
- Programming Trunk Stability
- Training Exercises
- Mastering Trunk Stability

The Plan

AM
- Closing the Gap
- Stability (JPM)
- Proper Stabilization
- The importance of IAP
- Assessment

The Plan

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- Closing the Gap
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PM
- Therapeutic Exercises

The Plan

AM
- Closing the Gap
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- The importance of IAP

PM
- Assessment
- Therapeutic Exercises

Tomorrow
- Training Trunk Stability
- Programming Trunk Stability
- Training Exercises
- Mastering Trunk Stability

What is Stability?

Stiffness

Stability

Strength

Stability
- Ability to be able to precisely manage joint positioning
- Can be static or dynamic
- Stable joints minimize load on the passive tissues no matter the movement.

Stiffness

Strength

Stability

Stiffness
- Resistance to bending
- The stiffer the joint, the greater the resistance necessary to move that joint.
- Maximally stiff is "Rigid"

Strength

Stability

Stiffness

Strength
- The ability to generate force.
- Correlated with the contractile strength of the muscles involved.
- Strength is necessary for stability when the resistance to the movement is high.

Closing the Gap

What are the demands of the sport?

What does the athlete bring to the sport?

Scapular stability, thoracic extension ROM, lumbo-pelvic stiffness, speed, power, endurance, metabolic capacity, etc.

What are the demands of the sport?

What does the athlete bring to the sport?

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What does the athlete bring to the sport?

Does the athlete meet the demands of the sport? Does the athlete possess the functional & performance pre-requisites to compete at the desired level?

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What does the athlete bring to the sport?

Does the athlete meet the demands of the sport? Does the athlete possess the functional & performance pre-requisites to compete at the desired level?

What are the demands of the sport?

The Gap

What does the athlete bring to the sport?

What are the demands of the sport?

The Gap ← Strength Training / Treatment

What does the athlete bring to the sport?

Application Blocks

Application Blocks

- Nociception
- Functional Incompetence
- Lack of Proprioception
- Habit / Training
- Functional Capacity
- Poor Conception of the Movement
- Performance Blocks
- Psychological

In response to nociception, the brain will default into a protective pattern.

Application Blocks

- Nociception
- Functional Incompetence
- Lack of Proprioception
- Habit / Training
- Functional Capacity
- Poor Conception of the Movement
- Performance Blocks
- Psychological

Athlete lacks functional pre-requisites to execute the movement with the correct pattern (e.g. limited thoracic extension blocking proper throwing motion).

Application Blocks

- Nociception
- Functional Incompetence
- Lack of Proprioception
- Habit / Training
- Functional Capacity
- Poor Conception of the Movement
- Performance Blocks
- Psychological

Athlete is unable to feel the joint, position, or movement adequately to execute with a properly strategy.

Application Blocks

- Nociception
- Functional Incompetence
- Lack of Proprioception
- Habit / Training
- Functional Capacity
- Poor Conception of the Movement
- Performance Blocks
- Psychological

Athlete has engrained the wrong movement pattern threw years of practice (e.g. learning to squat with an extension/compression stabilizing strategy. "Butt back. Chest up!"

Application Blocks

Nociception
Functional Incompetence
Lack of Proprioception
Habit / Training
Functional Capacity
Poor Conception of the Movement
Performance Blocks
Psychological

Functional Capacity (FC) is the neurological threshold over which one can move with a proper strategy. If an athlete's FC is low for their sport, they will be unable to move properly and will, therefore, have to move with compensatory patterns.

Application Blocks

Nociception
Functional Incompetence
Lack of Proprioception
Habit / Training
Functional Capacity
Poor Conception of the Movement
Performance Blocks
Psychological

What the athlete is trying to do in the movement is incorrect. This results from either poor communication between the coach and the athlete or no communication at all.

Application Blocks

Nociception
Functional Incompetence
Lack of Proprioception
Habit / Training
Functional Capacity
Poor Conception of the Movement
Performance Blocks
Psychological

Athlete lacks the performance requisites to compete with a proper movement strategy (e.g. metabolic capacity, strength, aerobic capacity).

Application Blocks

Nociception
Functional Incompetence
Lack of Proprioception
Habit / Training
Functional Capacity
Poor Conception of the Movement
Performance Blocks
Psychological

Athlete lacks the psychological prowess to perform. A common block outside the scope of the S&C professional.

Application Blocks

Nociception
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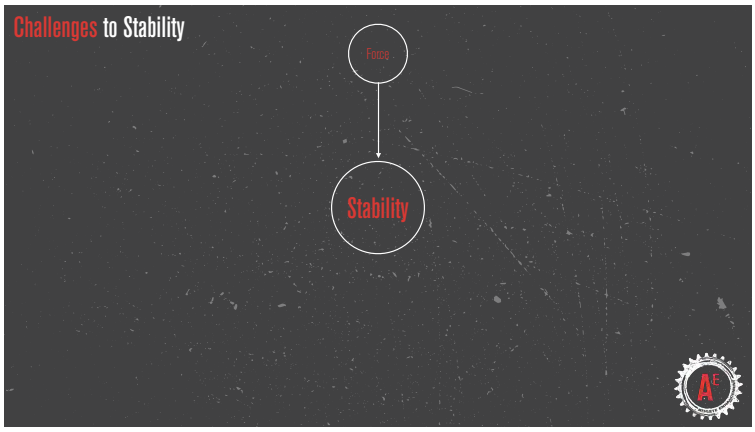
Challenges to Stability

Challenges to Stability
Stability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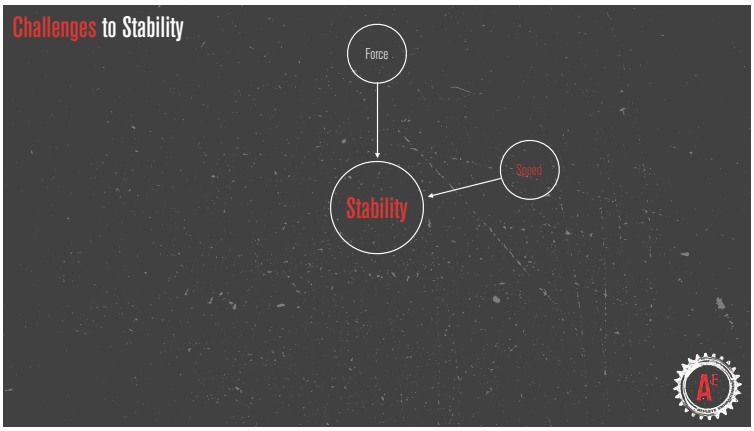
Force
Stability


Challenges to Stability
Force
Speed
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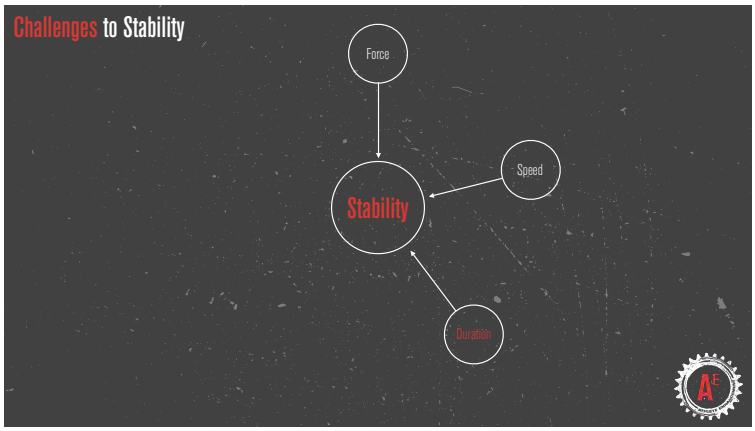
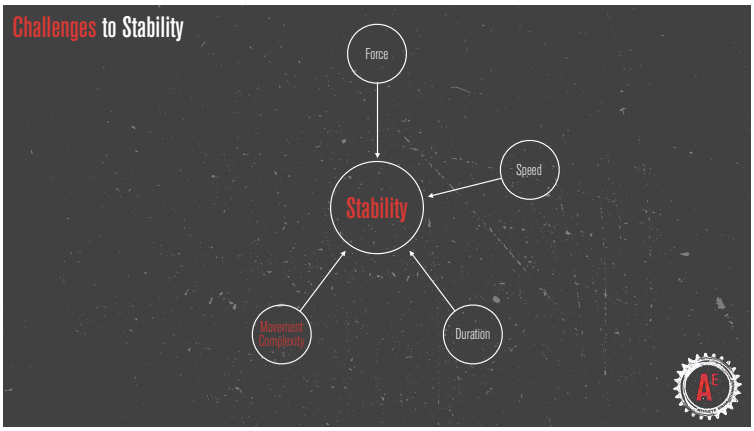
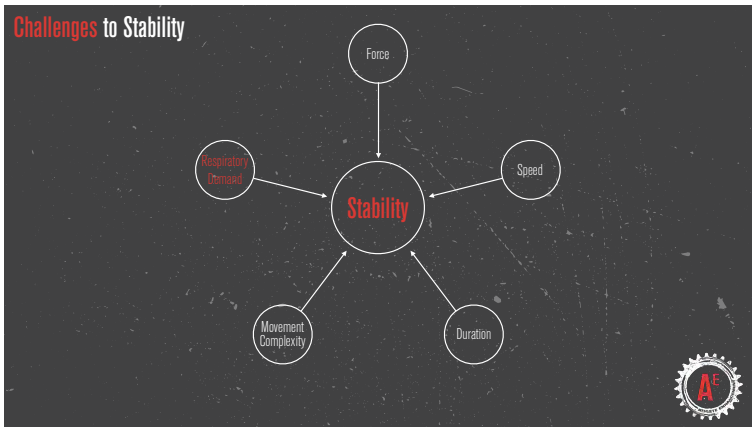

Challenges to Stability
Force
Speed
Stability
Duration


Challenges to Stability
Force
Speed
Stability
Movement Complexity
Duration


Challenges to Stability
Force
Respiratory Demand
Speed
Stability
Movement Complexity
Duration

Challenges to Stability

Why is trunk stability so important?

Trunk Stability

Trunk Stability

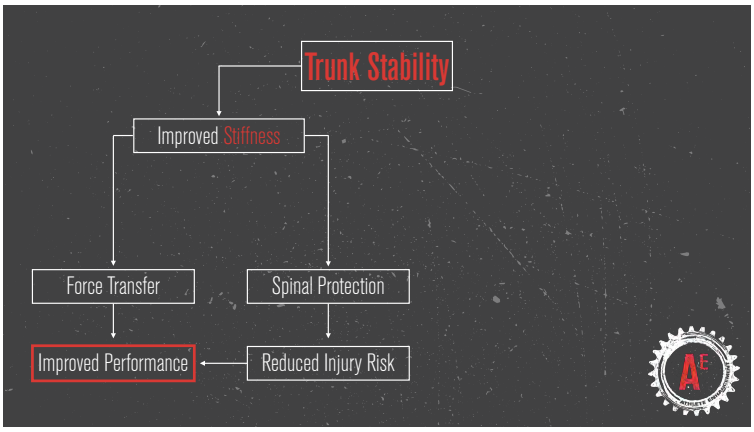
- Improved Stiffness

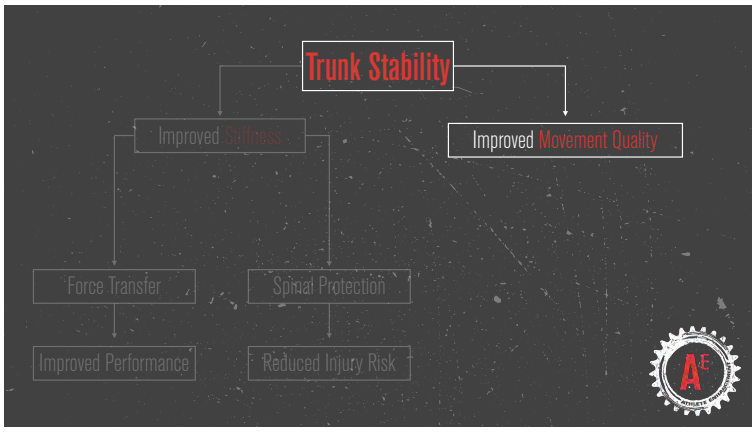
Trunk Stability

- Improved Stiffness
  - Force Transfer
    - Improved Performance

Trunk Stability

- Improved Stiffness
  - Force Transfer
    - Improved Performance
  - Spinal Protection
    - Reduced Injury Risk


Trunk Stability
Improved Stiffness
Force Transfer
Spinal Protection
Improved Performance
Reduced Injury Risk


Trunk Stability
Improved Stiffness
Improved Movement Quality
Force Transfer
Spinal Protection
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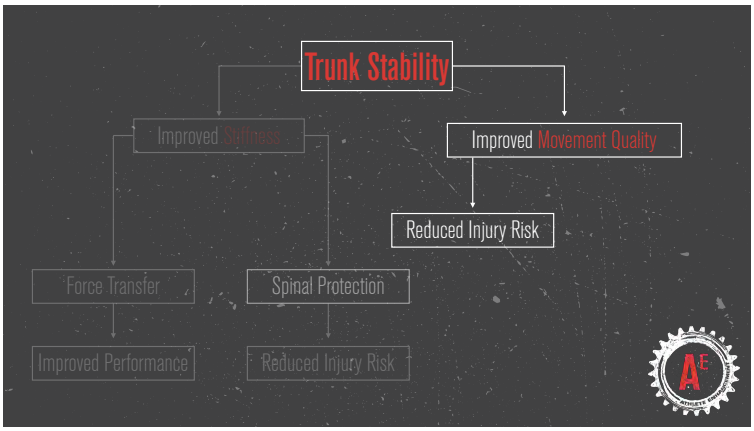
Reduced Injury Risk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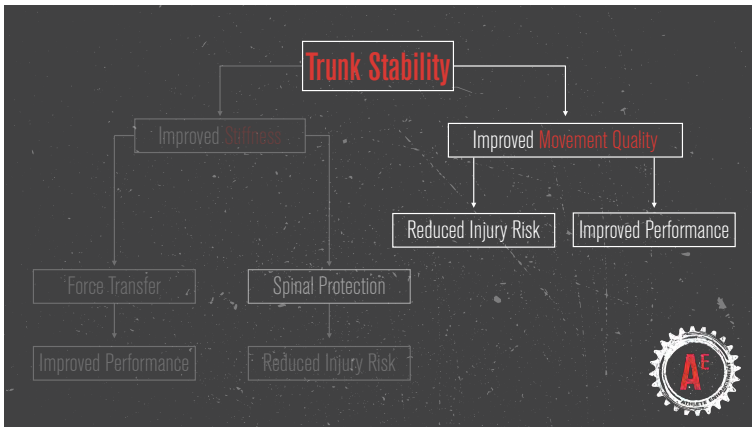
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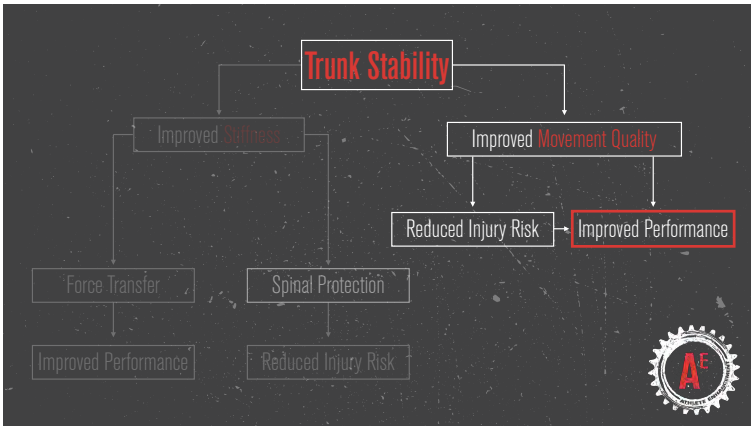
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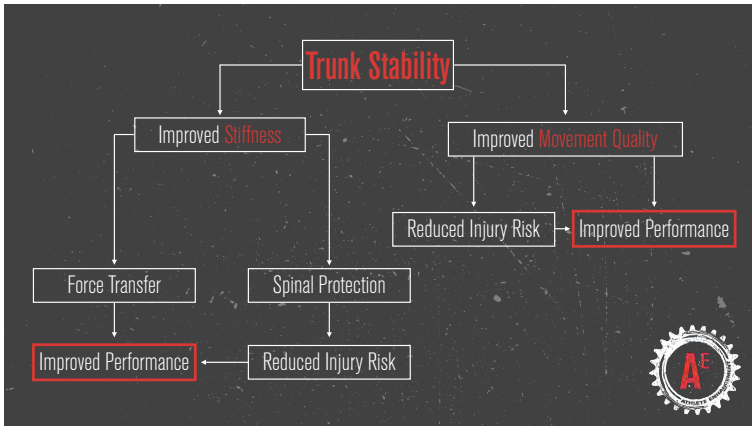
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Improved Stiffness
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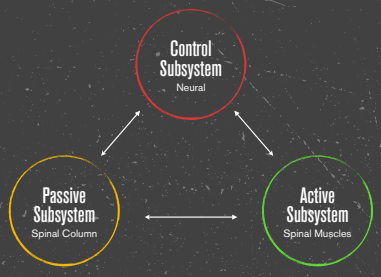
Movement Quality

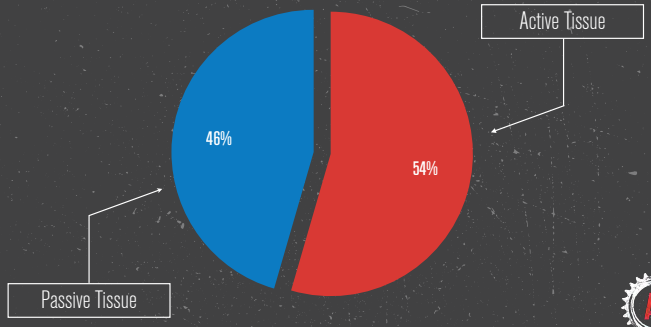
Joint Position Management & Tissue Loading

Joint Position Management

The Stabilizing System of the Spine. Part 1 | Panjabi 1992



Joint Position Management



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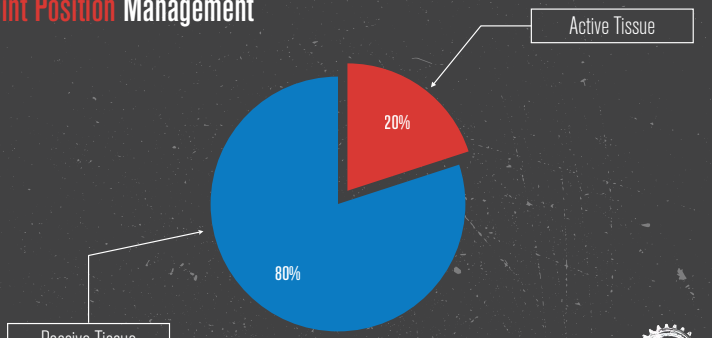
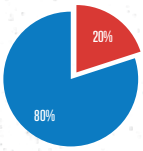
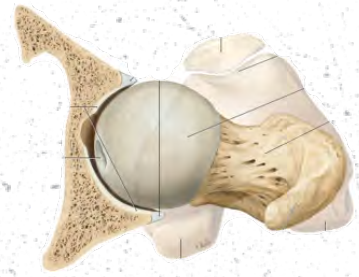


Femoro-Acetabular Joint

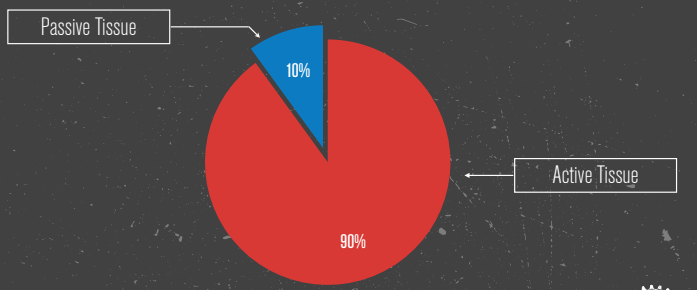
Joint Position Management

Femoro-Acetabular Joint





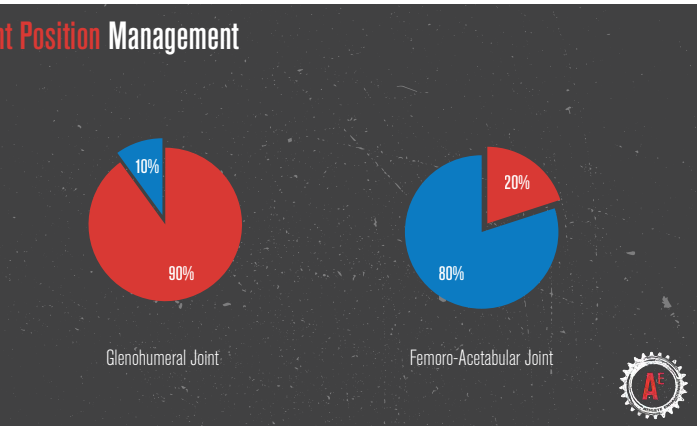
Joint Position Management



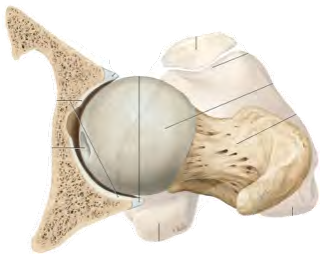
Joint Position Management

Glenohumeral Joint

Joint Position Management



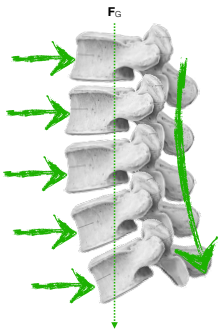
Optimal stability is about managing the micro-positioning of the joint to minimize load to the passive tissues of the body.



Loading Strategies

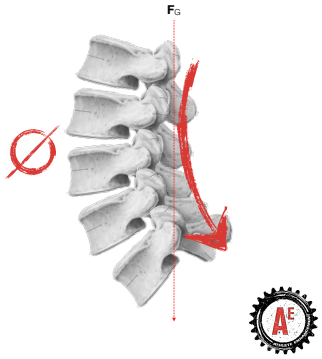
Active Loading Strategy (ALS)

- Balanced co-activation of dorsal and ventral stabilizers (specifically paraspinals and IAP)
- Spine maintained in a mid-range position
- Force loading through the vertebral bodies
- Minimal load on the passive tissues

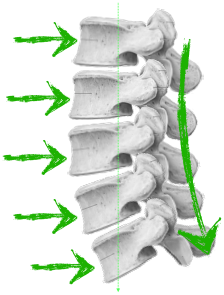


Passive Loading Strategy (PLS)

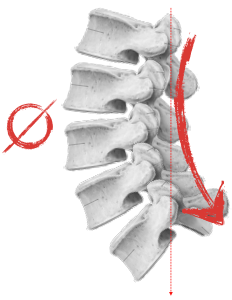
Hyperactivity of the spinal extensors
Minimal IAP
Increased spinal compression forces
Spine locked in hyperextension
Force loading through the neural arch
Increases facet loading



Active Loading Strategy



Passive Loading Strategy



"The task of the coach is to find a balance between pushing the athlete sufficiently hard so as to stimulate the desired adaptation without causing permanent damage to the passive tissues."

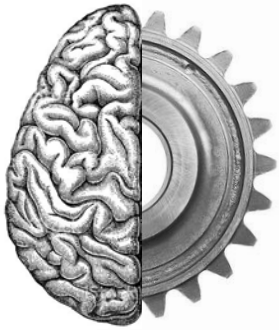
Damage to the passive tissues permanently compromises the athlete's ability to stabilize, stiffen, and generate force; therefore, lowering the ceiling of the athlete's potential.

A stable joint is able to move with minimal load on the passive tissues.

So how are we supposed to stabilize?

Biomechanics of Stabilization

Neurological

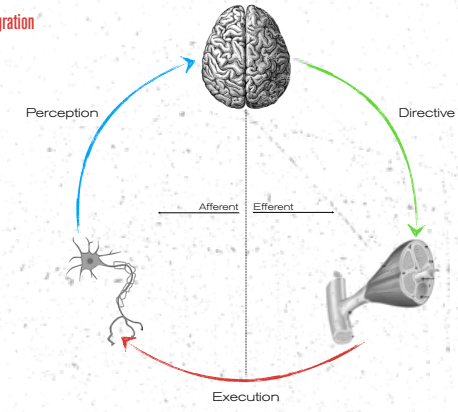


Mechanical

Neurological

1) Subcortical Motor Programs
2) Subcortical Modulation
3) Subcortical Anticipation
4) Conscious Activation

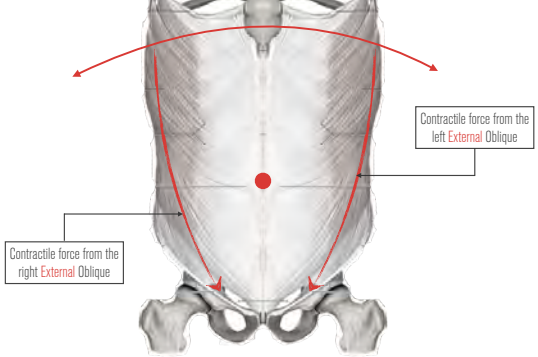
Sensory-Motor Integration

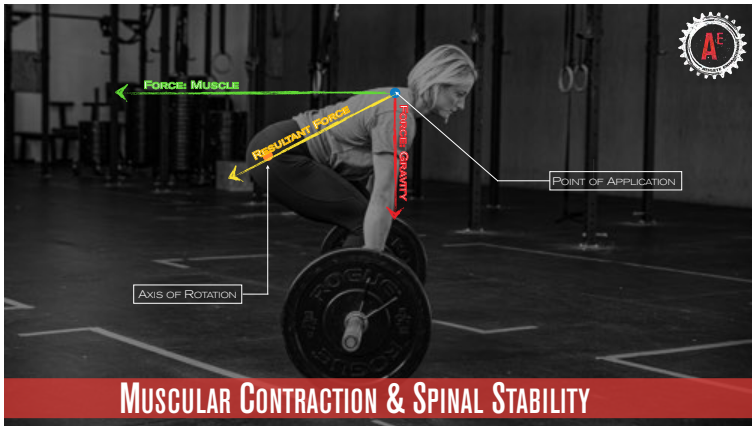


1) Contractile force of the torso musculature (Active Tension).
2) Intra-Abdominal Pressure

Mechanical

Muscular Contraction & Spinal Stability

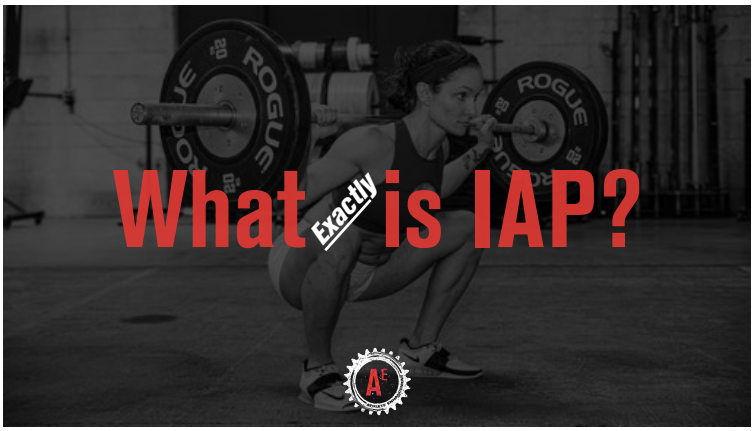




Optimal stabilization maximally leverages intra-abdominal pressure (IAP), whilst utilizing minimal activation of the spinal extensors.

"Without the diaphragm, there is no pressure; without pressure, there is no stability."

Paul Hodges, PhD, PT
World-Leading Researcher



Technical Definition:

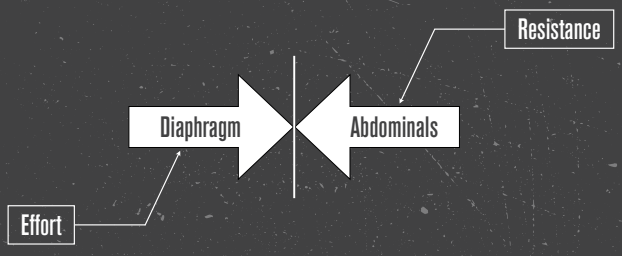
IAP is the summation of the mechanical forces created by the the diaphragm and opposing trunk musculature.

Practical Definition:

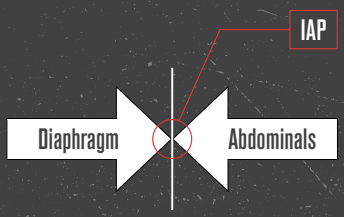
IAP is an outward-pushing force within the abdomen.

What is IAP?

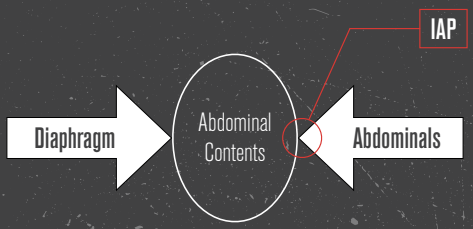
What is IAP?



What is IAP?



What is IAP?

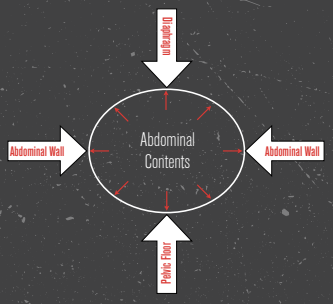


Abdominal Contents | Physical Properties

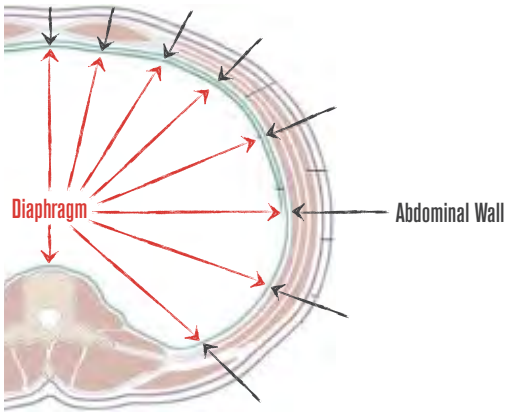
The abdomen is filled with a semi-solid, semi-liquid substance that behaves more like a solid than a liquid.

Application of force to this object has both magnitude & vector.

What is IAP?



What is IAP?

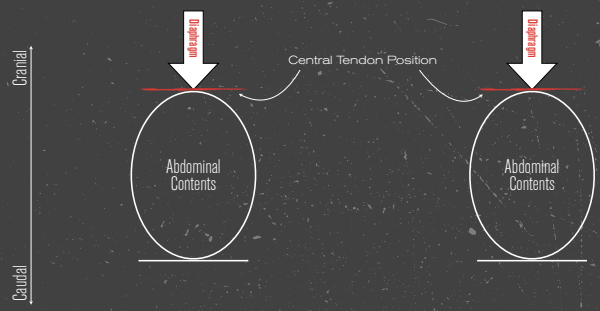


IAP | Central Tendon Positioning

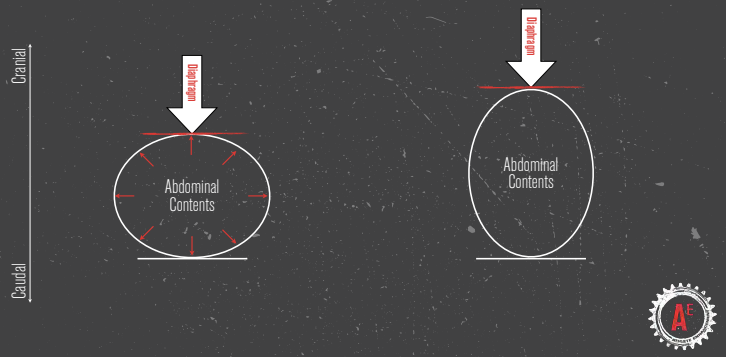
The relative position of the diaphragm's central tendon is directly correlated to the potential amount of IAP to be generated.

The more caudal its position, the greater the potential IAP.

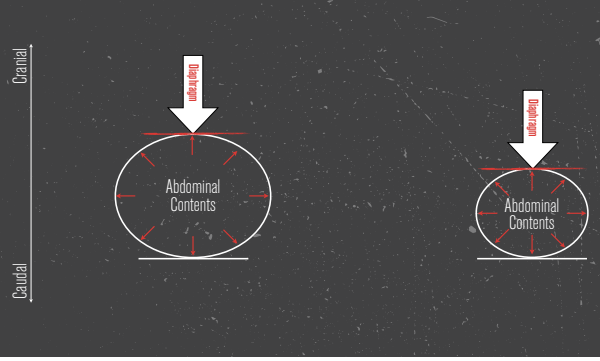
IAP & Central Tendon Positioning



IAP & Central Tendon Positioning



IAP & Central Tendon Positioning



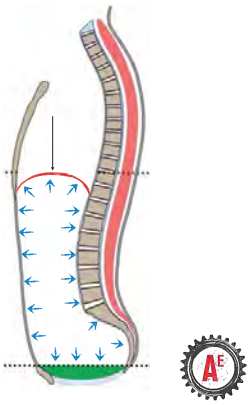
Central Tendon Positioning: Caudal

Inspiratory position of the diaphragm

Caudal positioning of the central tendon (inspiratory position) results from a concentric contraction of the diaphragm. This pulls the central tendon caudally towards the pelvis; thereby, applying a compressive force to the contents within the abdomen. These contents are then pushed outward against the abdominal wall, caudally into the pelvic floor, and dorsally against the spine. The resistance to this outward-pushing force results in generation of IAP.

Caudal positioning of the diaphragm is the strongest potential position - a prerequisite for maximal stiffness of the spine.

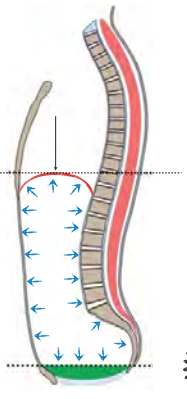
With the central tendon in the caudal position, spinal stability and stiffness are achieved via a combination of IAP and co-activation of the torso musculature, separate but interdependent forces.



Central Tendon Positioning: Caudal

Inspiratory position of the diaphragm

Caudal (inspiratory) position of the diaphragm increases the compressive force on the abdominal contents



Central Tendon Positioning: Cranial

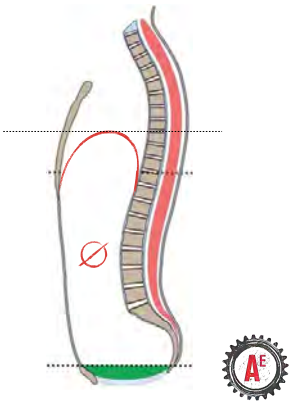
Expiratory position of the diaphragm

Cranial positioning of the central tendon (expiratory position) results from a weakening of the contractile force produced by the diaphragm, allowing it to elevate. This reduces the magnitude of the compressive force applied to the abdominal contents by the diaphragm. This reduces the magnitude of the force pushing outward against the abdominal wall, caudally into the pelvic floor, and dorsally against the spine.

IAP being the summation of mechanical forces created by the diaphragm and surrounding torso musculature, reduction of the outward-pushing force created by the diaphragm reduces the potential IAP that can be generated.

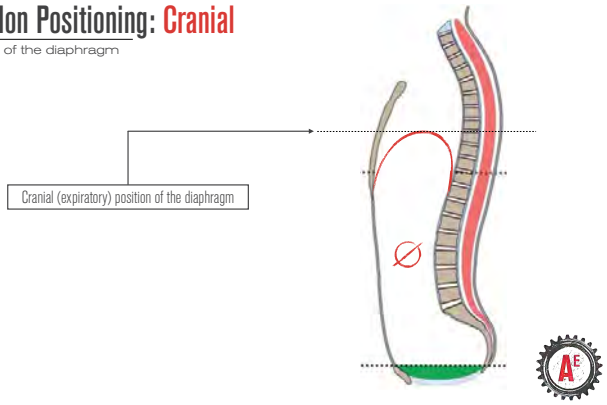
Cranial positioning of the diaphragm is the weakest potential position.

In this position, IAP is incapable of contributing significantly to the stability and stiffness of the trunk (if at all). Here, the trunk's stability and stiffness is established predominantly by the co-contraction of the the torso musculature.

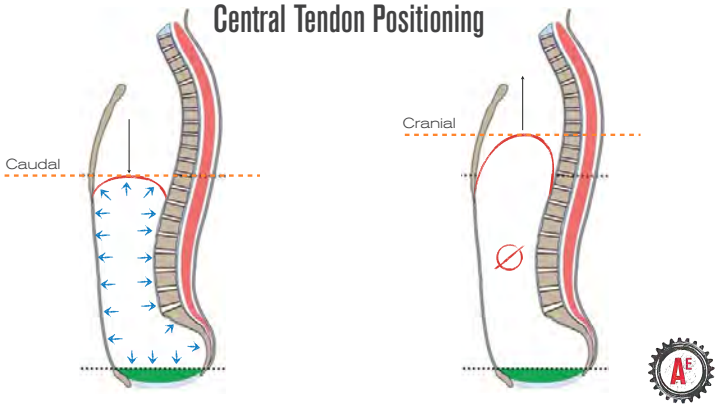


Central Tendon Positioning: Cranial

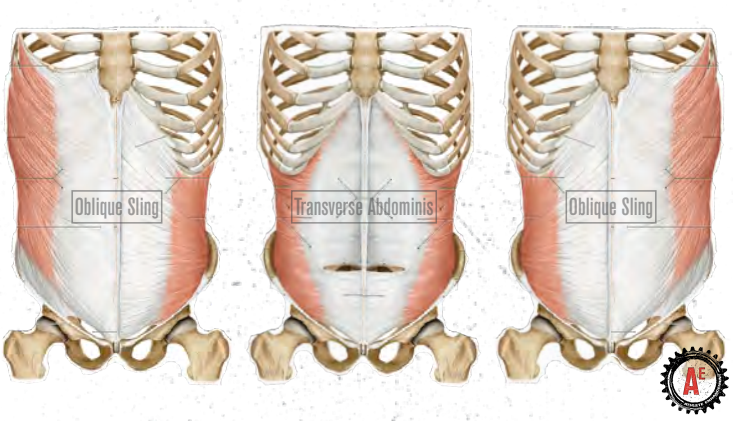
Expiratory position of the diaphragm



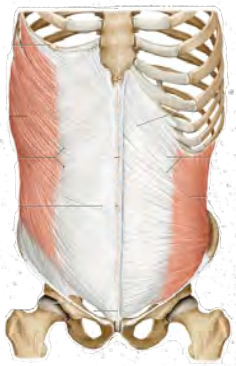
Central Tendon Positioning



The roll of the abdominal wall in the stabilizing process.



Function of the Abdominal Wall



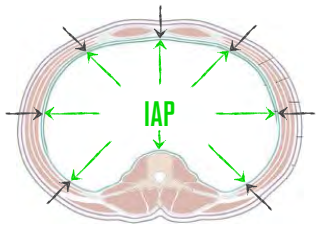
- Creates Intra-Abdominal Pressure
- Improved Spinal Stiffness
- Force Transfer
- Accessory Respiration
- Manages Ribcage Position
- Manages Pelvis Position
- Stabilizes the Lumbar Spine
- Tri-Planar Control of the Torso
- Improved Diaphragm Function

Compensatory Stabilizing Strategies

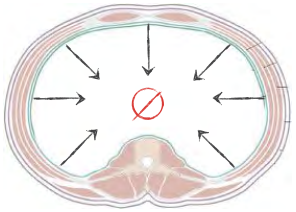
Compensatory Strategies | Tensing

- Tensing is stabilization/stiffening via co-contraction of the torso muscles (concentric).
- "Get ready receive a punch"
- May or may not involve IAP. If IAP is present, it is generated after the co-contraction.
- Does increase spinal stiffness via muscle contractile force.
- High amounts of muscle contractile force vs. optimal stabilizing (greater internal forces acting on the body & increased overall stiffness of the body, which may hinder performance).
- High amounts of spinal compression, increasing likelihood of injury.
- Effective strategy for stiffening the spine, not optimal for stabilizing it during motion.
- Athlete/patient maintains high amounts of tension in the abdominal wall.

Pressurizing vs. Tensing



Pressurizing

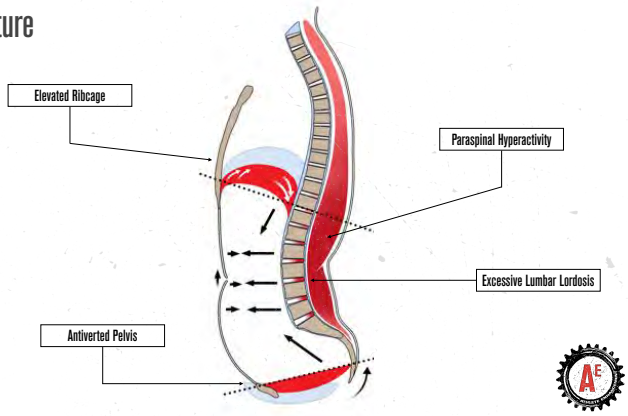


Tensing

Compensatory Strategies | ECSS

- Extension/Compression Stabilizing Strategy is overactivity of the posterior chain.
- Aka Lower Crossed Syndrome, Open Scissor, Posterior Extensor Chain (PEC)
- Driven by a neurology
- Involves massive amounts of spinal compression
- Increased incidence of spine pathology (osteogenic & discogenic)
- Effective stabilizing strategy for movements within the sagittal plane
- Poor tri-planar control of the spine (bad at coronal plane, terrible at transverse plane)
- Ubiquitous in sports, more pronounced in sagittal plane sports (e.g. powerlifting, CrossFit, Weightlifting); less pronounced in rotational sports (e.g. golf).
- The more time one spends in the sagittal plane, the more pronounced this becomes (barbell movements, bilateral hip-hinging movements, etc.)

ECSS Posture



ECSS Symptoms

Chronically tight back (worse with prolonged standing)
Consistent back pain/tightness after training (particularly posterior chain work)
Morning back pain/stiffness (worse the morning after training)
Back "locks up" or gets crazy tight with high volume/low rest hinging
Overly sensitive glutes with foam rolling
Tight hamstrings and/or calves, not responsive to stretching
Gastric reflux (GIRD)

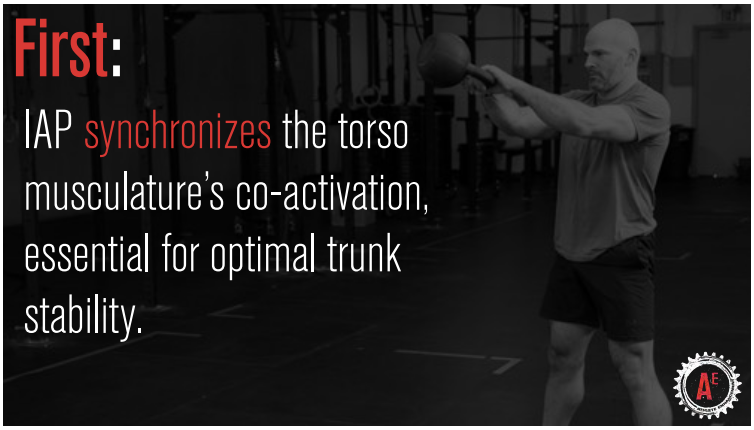
The Extension/Compression Stabilizing Strategy is considered pathological by many of the leading physicians and therapists in the medical profession, and yet it is often intentionally coached by the strength training community.

Lower Crossed Syndrome - Vladimir Janda, MD, PhD
Open Scissor Posture - Pavel Kolar, PT
Posterior Extensor Chain - Ron Hruska, PT

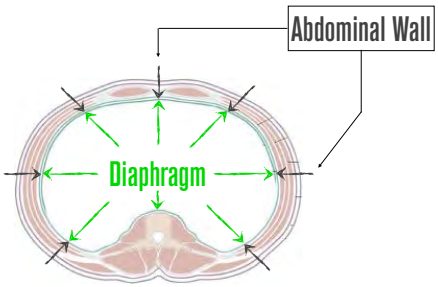
Why is IAP so vital to stability?

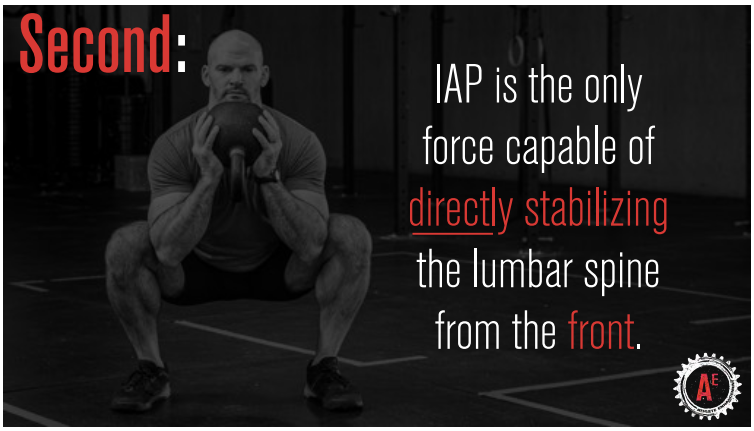
First:

IAP synchronizes the torso musculature's co-activation, essential for optimal trunk stability.



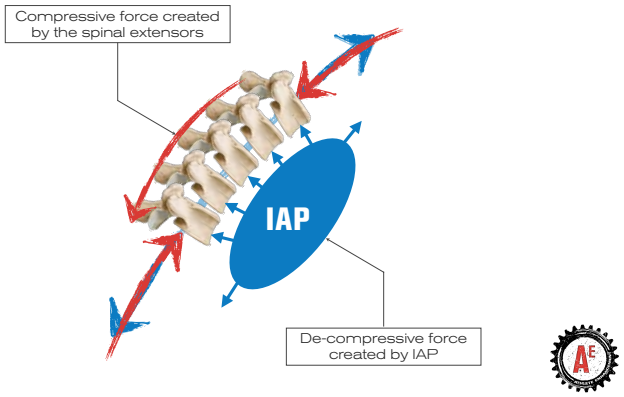
Synchronization:



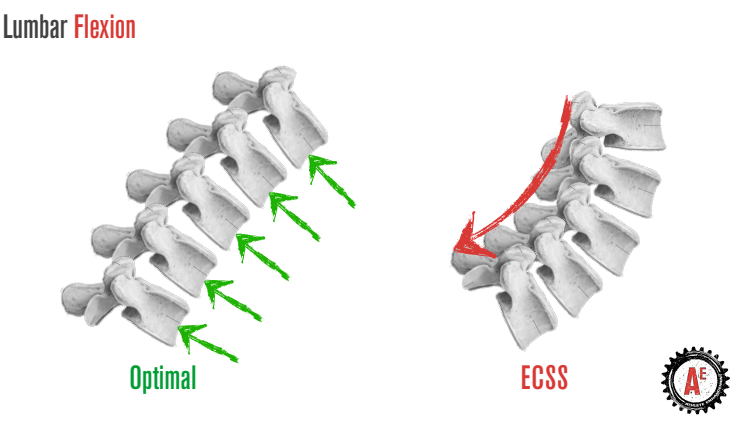

Second:
IAP is the only force capable of directly stabilizing the lumbar spine from the front.

IAP

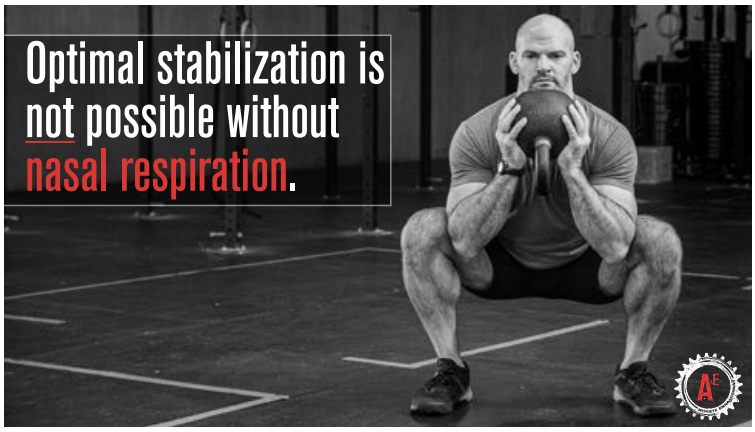
Third:
IAP is a compression-resistant force capable of stabilizing the spine.

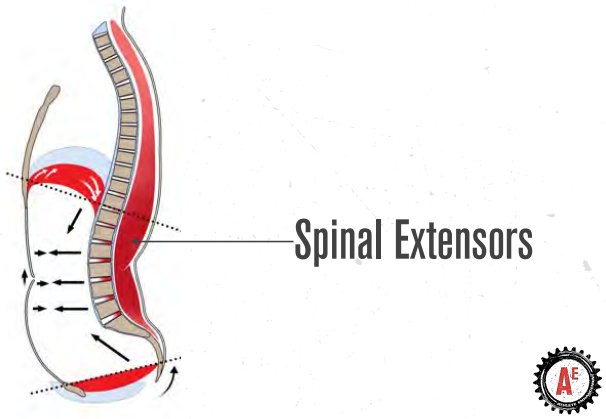

Compressive force created by the spinal extensors
IAP
De-compressive force created by IAP

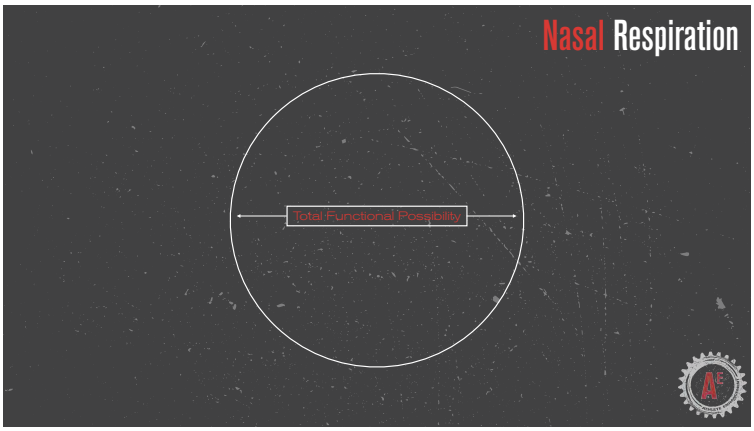
Fourth:
IAP preserves optimal spinal mechanics.

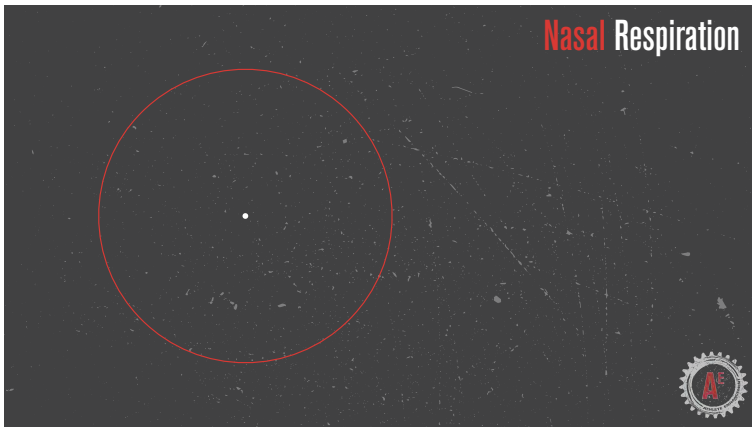

Lumbar Flexion
Optimal
ECSS

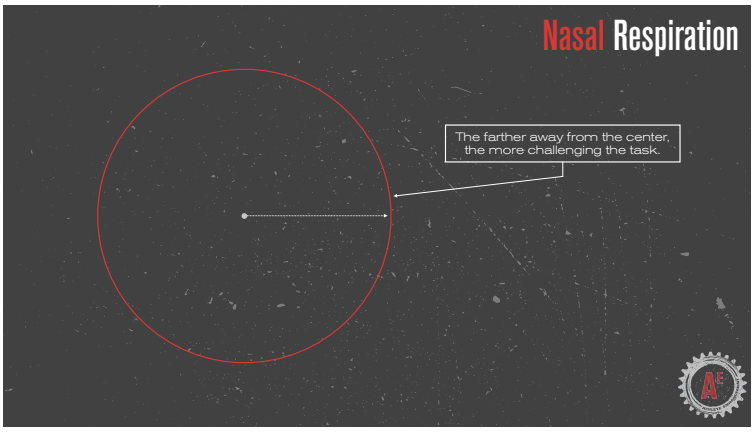
Optimal stabilization maximally leverages intra-abdominal pressure (IAP), whilst utilizing minimal activation of the spinal extensors.

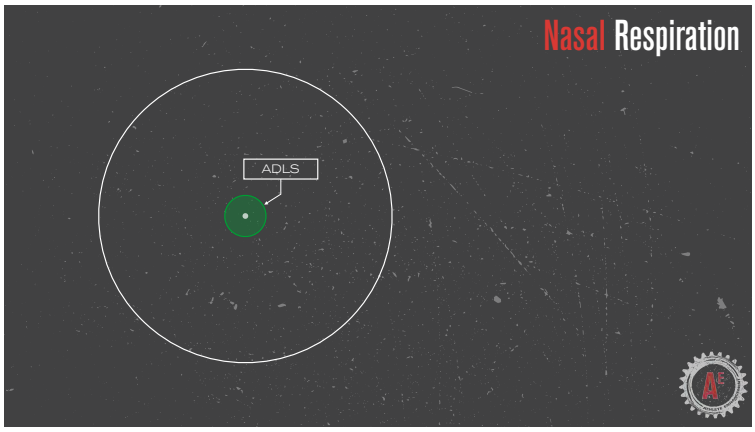


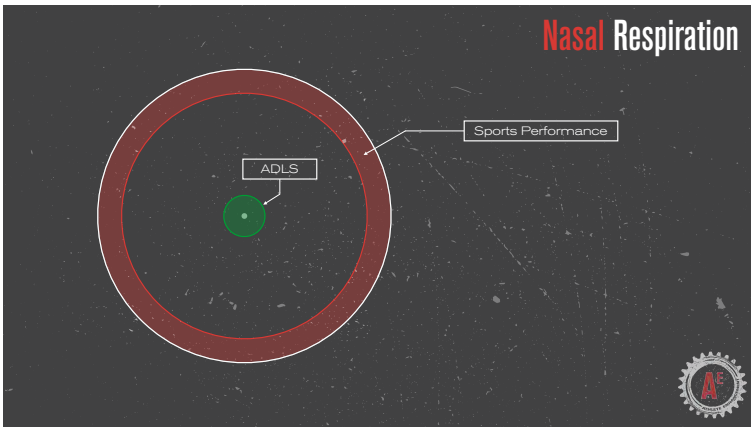


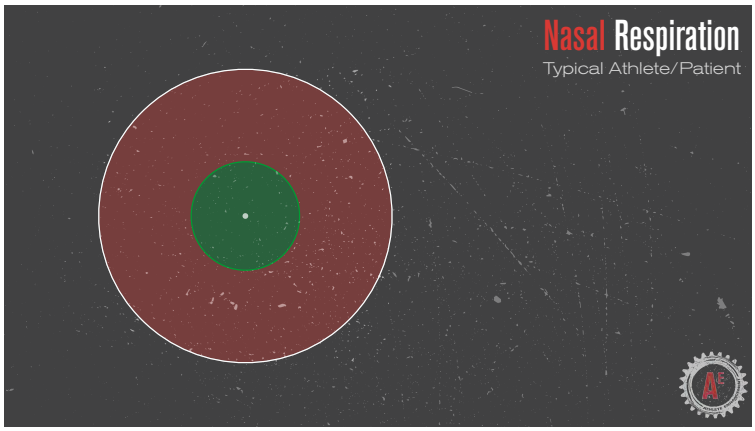


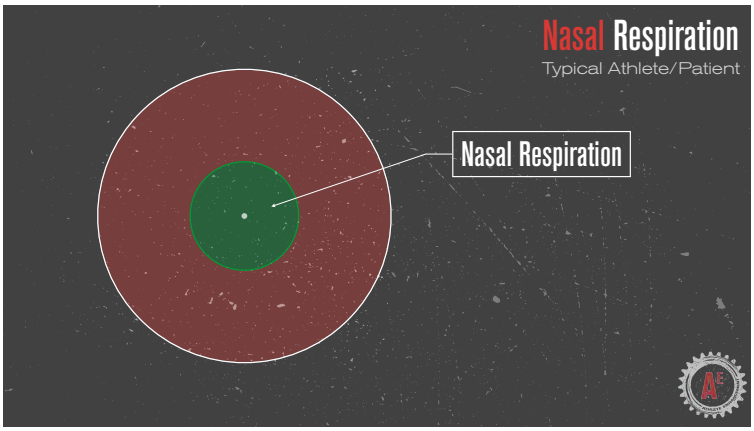


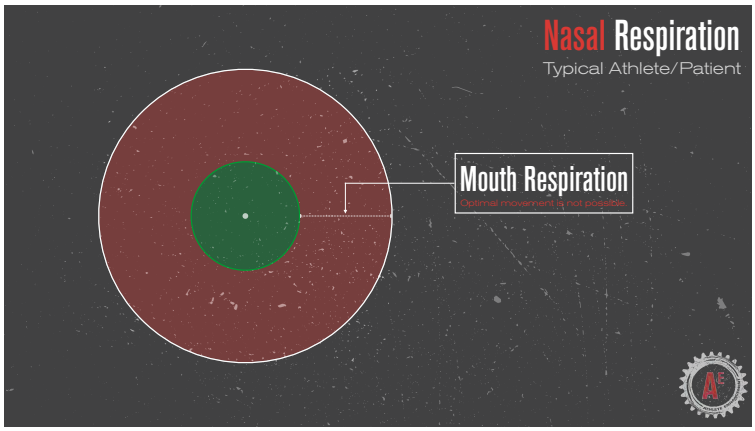

Nasal Respiration
The farther away from the center, the more challenging the task.


Nasal Respiration
ADLS


Nasal Respiration
Sports Performance
ADLS

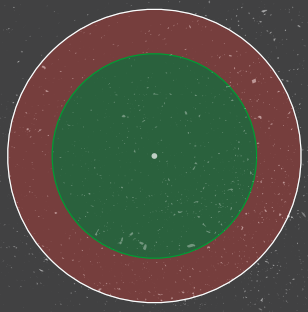

Nasal Respiration
Typical Athlete/Patient


Nasal Respiration
Typical Athlete/Patient
Nasal Respiration


Nasal Respiration
Typical Athlete/Patient
Mouth Respiration
Optimal movement is not possible

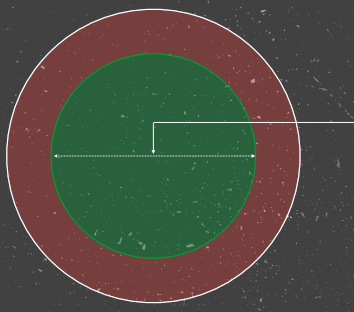
Nasal Respiration

Athlete/Patient with training



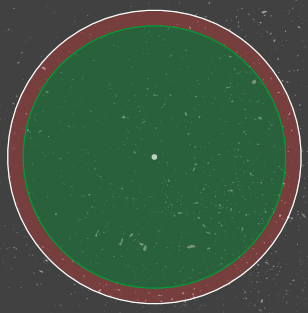
Nasal Respiration

Athlete/Patient with training



Nasal Respiration

Typical Athlete/Patient



The greater the range of nasal respiration, the greater the potential to move properly.

How is optimal trunk stability achieved?

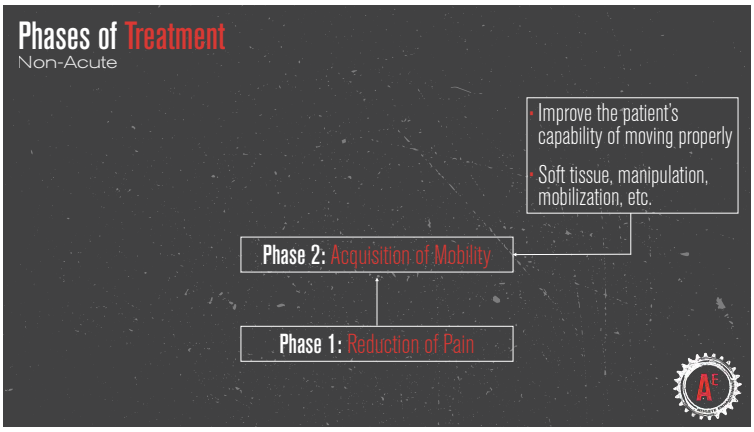
Phases of Treatment

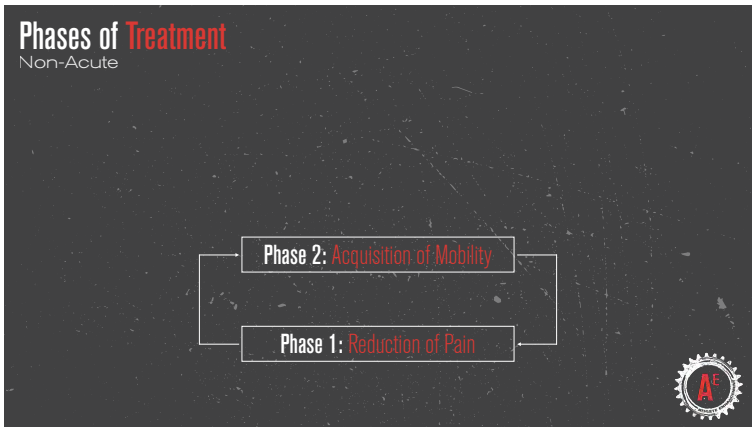
Phases of Treatment

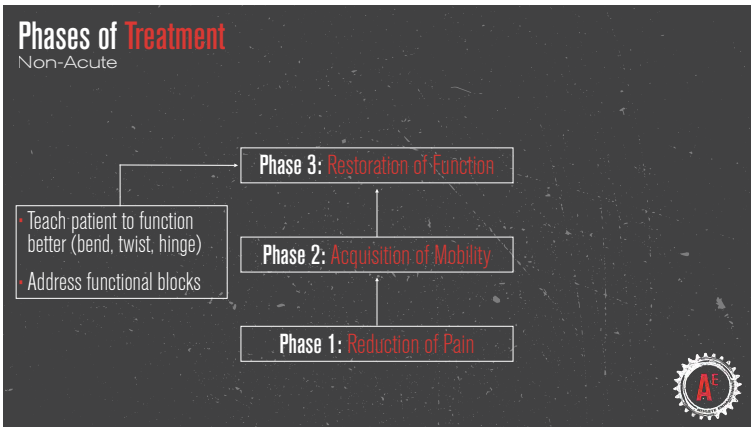
Non-Acute

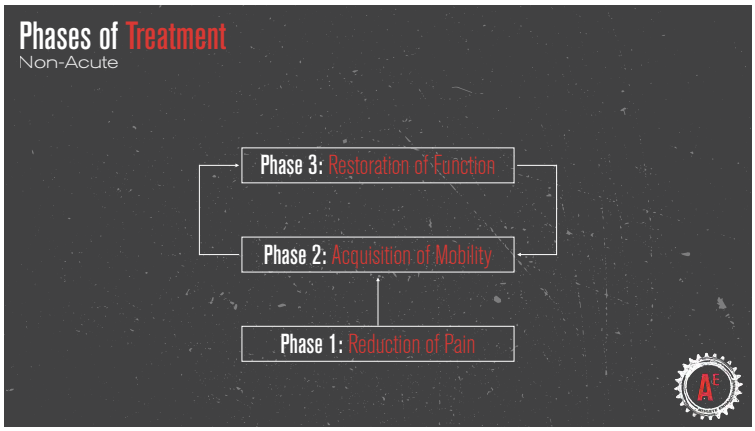
- Empower the patient to have control over their symptoms.
- Get the patient out of pain

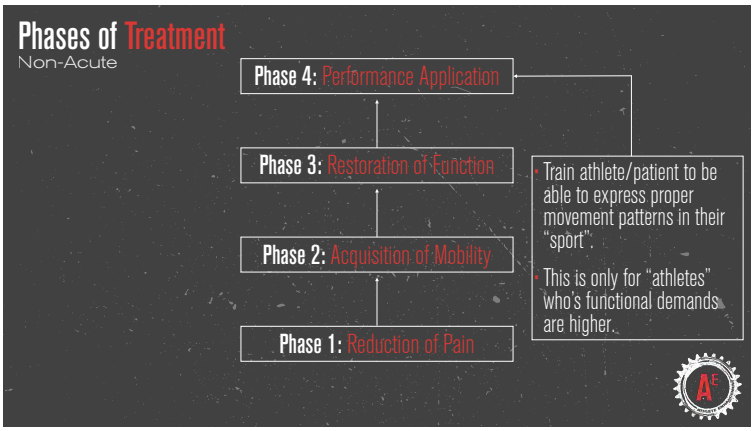
Phase 1: Reduction of Pain

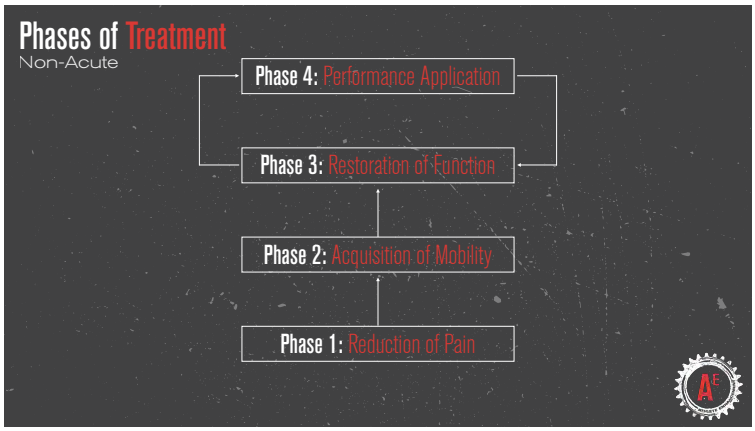

Phases of Treatment
Non-Acute
Improve the patient's capability of moving properly
Soft tissue, manipulation, mobilization, etc.
Phase 2: Acquisition of Mobility
Phase 1: Reduction of Pain


Phases of Treatment
Non-Acute
Phase 2: Acquisition of Mobility
Phase 1: Reduction of Pain

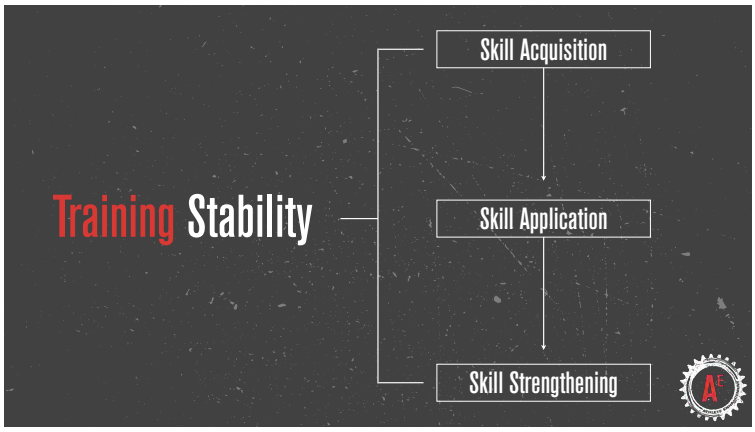

Phases of Treatment
Non-Acute
Phase 3: Restoration of Function
Teach patient to function better (bend, twist, hinge)
Address functional blocks
Phase 2: Acquisition of Mobility
Phase 1: Reduction of Pain


Phases of Treatment
Non-Acute
Phase 3: Restoration of Function
Phase 2: Acquisition of Mobility
Phase 1: Reduction of Pain

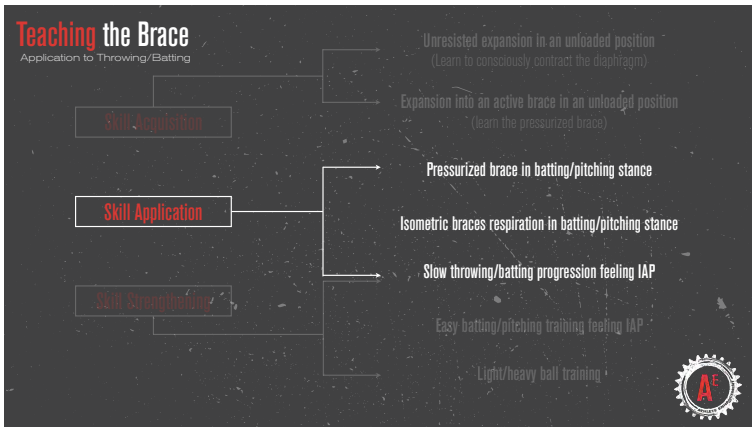

Phases of Treatment
Non-Acute
Phase 4: Performance Application
Phase 3: Restoration of Function
Phase 2: Acquisition of Mobility
Phase 1: Reduction of Pain
Train athlete/patient to be able to express proper movement patterns in their "sport".
This is only for "athletes" who's functional demands are higher.


Phases of Treatment
Non-Acute
Phase 4: Performance Application
Phase 3: Restoration of Function
Phase 2: Acquisition of Mobility
Phase 1: Reduction of Pain

Training Stability


Training Stability
Skill Acquisition
Skill Application
Skill Strengthening

Teaching the Brace
Application to Throwing/Batting
Skill Acquisition
Skill Application
Skill Strengthening
Unresisted expansion in an unloaded position
(Learn to consciously contract the diaphragm)
Expansion into an active brace in an unloaded position
(learn the pressurized brace)
Pressurized brace in batting/pitching stance
Isometric braces respiration in batting/pitching stance
Slow throwing/batting progression feeling IAP
Easy batting/pitching training feeling IAP
Light/heavy ball training


Teaching the Brace
Application to Throwing/Batting
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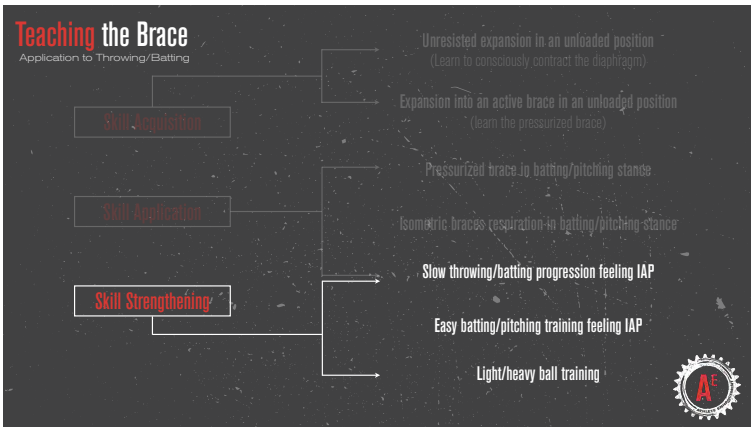
Teaching the Brace
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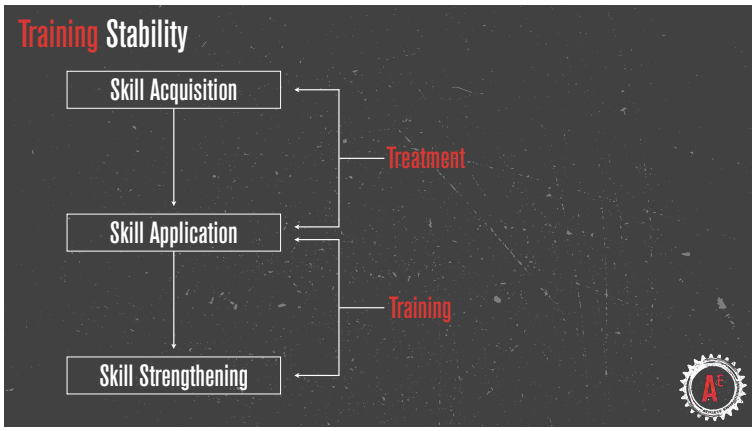
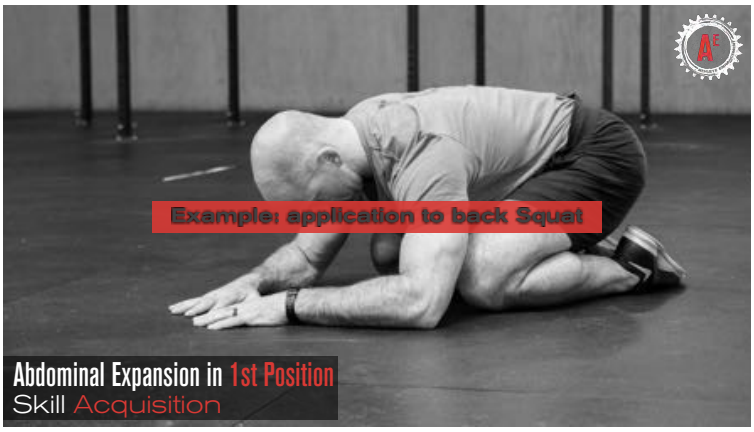
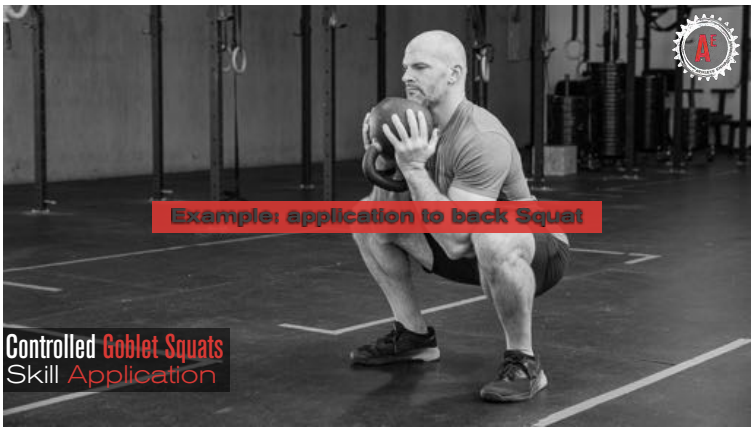

Training Stability
Skill Acquisition
Skill Application
Skill Strengthening
Treatment
Training


Example: application to back Squat
Abdominal Expansion in 1st Position
Skill Acquisition

Abdominal Expansion in Supported 3 Months
Skill Acquisition
Example: application to back Squat

Example: application to back Squat
Isometric Brace in Supported Deadlift
Skill Application

Example: application to back Squat
Kettlebell Deadlift with Pressurized Brace
Skill Application


Example: application to back Squat
Controlled Goblet Squats
Skill Application

Example: application to back Squat
Controlled Front Squats
Skill Application/Strengthening

Questions?

Assessment: Trunk Stability

Assessing Trunk Stability
Seated Diaphragm Test

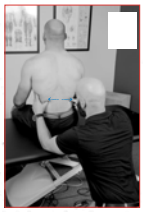
Assess:
- Ability to contract diaphragm
- Ability to generate IAP
- (A)Symmetry between sides

Assessing Trunk Stability
Seated Diaphragm Test

How to Perform:

- **First**: Have the patient push their abdomen outward against your fingers: just below the inguinal ligaments & just lateral to the QL.
- **Second**: See if the patient can expansively breathe into these areas.

Compare:
- Amplitude of outward abdomen movement.
- Symmetry of amplitude.
- Strength of contraction at the end of the expansion.



Assessing Trunk Stability
Seated Hip Flexion Test

Assess:
- Natural stabilizing strategy
- (A)Symmetry between sides

Assessing Trunk Stability
Seated Hip Flexion Test

How to Perform:

First: Have the patient lift one leg 2" off the table.

Second: Observe what happens to the torso, spine & pelvis.

- Does the the torso shift away from the lifting leg?
- Does the lumbar spine extend or flex?
- Does the pelvis torsion toward the lifting leg?
- Does the abdomen move inward or outward?

Assessing Trunk Stability
Pelvic Tilt Test

Assess:
- Motor control of the pelvis
- (Over)Activity of the spinal extensors.

Assessing Trunk Stability
Pelvic Tilt Test

How to Perform:

With the patient in partial (1/4) squat, have them perform anterior and posterior pelvic tilting.

- Observe the total range of pelvic motion.
- Observe patient's ability to control and isolate movement of the pelvis.
- Note smoothness of the movement. Shaking is an overt fail!!

Treatment: Manual Techniques

Remember . . .

"Optimal stabilization maximally leverages intra-abdominal pressure (IAP), whilst utilizing minimal activation of the spinal extensors."

3 Months Supported
Teach patient to expand (push) their abdomen out in all directions
Teach patient to expand their abdomen during inhalation
Teach patient how to maintain IAP during respiration

Abdominal Expansion in 1st Position
Good position to teach posterior expansion
Good to reduce hyperactivity of the spinal extensors

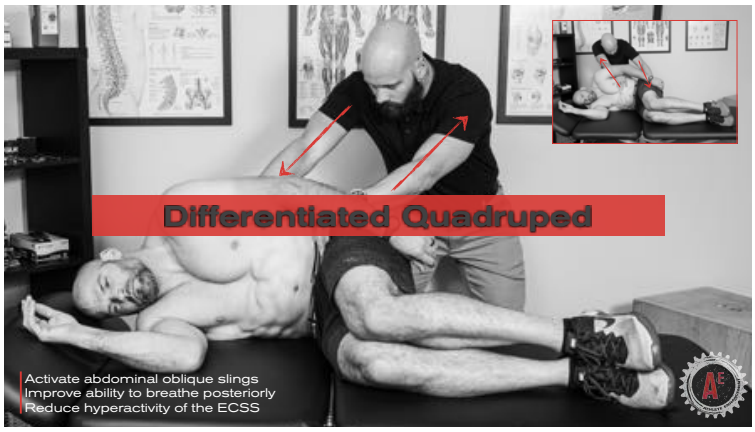
Rib Mobilization in 3 Months
Increase mobility of the ribcage
Bring ribcage into caudal position
Centrate the diaphragm

Lateral Breathing in RT2
Integrate IAP into Scapular Stabilization
Powerful to train proper Scapular Stabilization

Rolling in RT2
Integrate IAP into Scapular Stabilization
Powerful to train proper Scapular Stabilization

Scapular Loading in 1st Position
Integrate IAP into Scapular Stabilization
Powerful to train proper Scapular Stabilization

Scapular Loading in Low Bear
Integrate IAP into Scapular Stabilization
Powerful to train proper Scapular Stabilization


Differentiated Quadruped
Activate abdominal oblique slings
Improve ability to breathe posteriorly
Reduce hyperactivity of the ECSS

Differentiated Quadruped
Powerful position to teach proper stability
Good "skill application" position

RT2 with Resisted Stepping Forward
Integrate IAP into the oblique slings
Sport specific position for throwing

RT2 in Throwing Position
Integrate IAP into the oblique slings
Sport specific position for throwing

RT3 with Torsion Overpressure
Train pressurized respiration
Activate trunk rotators
Reduce hyperactivity of the ECSS

Treatment: Exercises

Low Oblique Sit

High Oblique Sit

Back Breathing in Low Quadruped

Back Breathing in Quadruped

Back Breathing in Bear Position

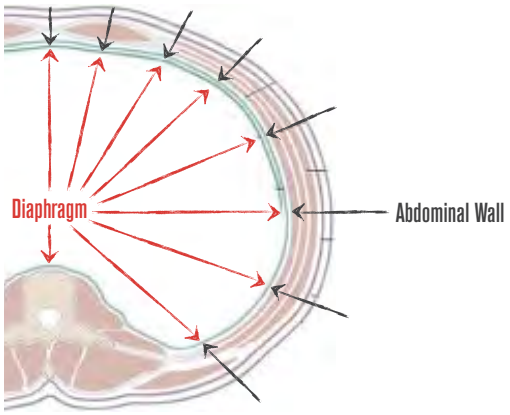
Hollow Back Breathing in Low Quadruped
Double Arm Support

"How the athlete executes a movement is often more important than the movement itself."

#QualityMatters

End of Day 1

Questions?



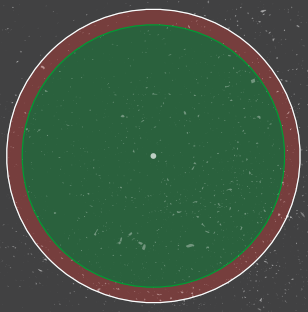
What is IAP?

Why is IAP so vital to stability?

- Synchronizes the 'Core'
- Anterior Stabilization
- Lumbar Decompression
- Proper Flexion Mechanics

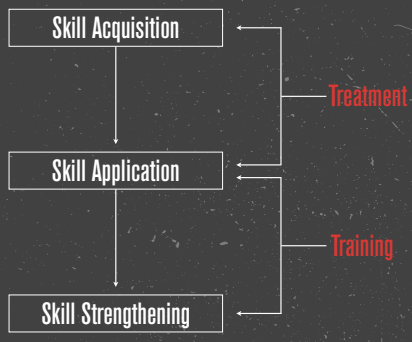
Nasal Respiration

Typical Athlete/Patient

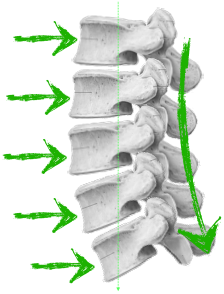


The greater the range of nasal respiration, the greater the potential to move properly.

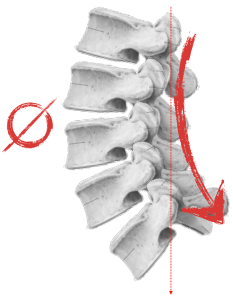
Training Stability



Active Loading Strategy



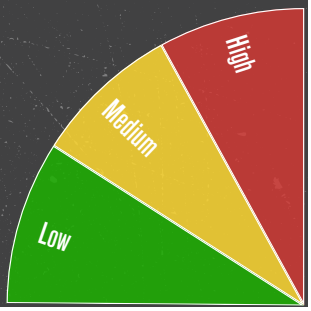
Passive Loading Strategy



"The task of the coach is to find a balance between pushing the athlete sufficiently hard so as to stimulate the desired adaptation without causing permanent damage to the passive tissues."

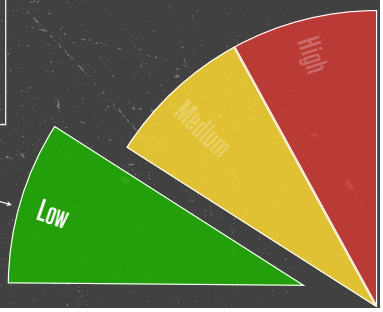
Damage to the passive tissues permanently compromises the athlete's ability to stabilize, stiffen, and generate force; therefore, lowering the ceiling of the athlete's potential.

Training Load (TL)



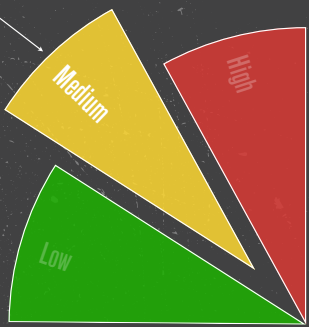
Training Load (TL)

- Sub-optimal stimulus for adaptation
- Used predominantly for recovery, post injury, return-to-play and immediately post season.
- Very low risk of injury.



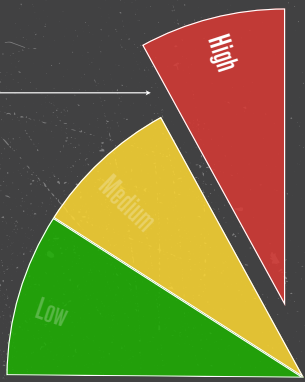
Training Load (TL)

- Optimal stimulus.
- TL stimulates an adaptation, but the the athlete is able to recover sufficiently.
- Most training should occur in this range.
- Minimal risk of injury in the lower end of this range.



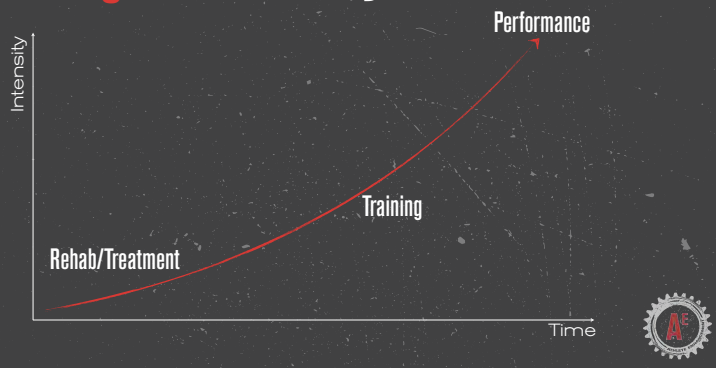
Training Load (TL)

- Strong stimulus
- Higher risk of injury
- The higher into this range, the higher the risk for injury
- Despite the risk of injury, tapping into this range is necessary to achieve maximal physical potential
- Off season training



Training Trunk Stability

Training Trunk Stability

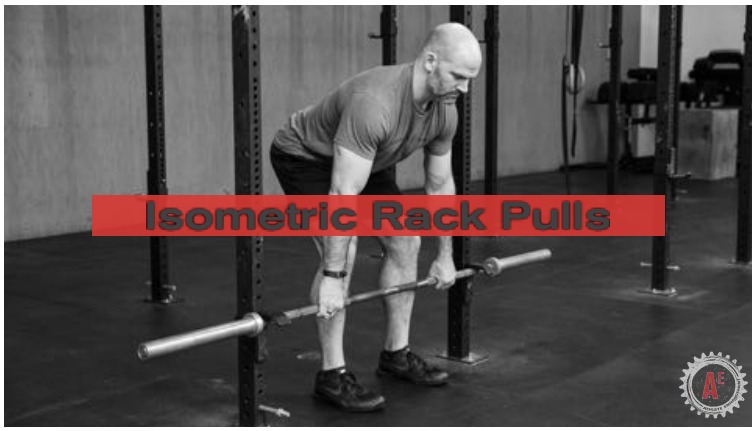


Training Trunk Stability

Step #1: Teach/train abdominal expansion in an unchallenging environment.

Training Trunk Stability

Step #2: Teach the ability to maintain a brace isometrically against varying loads.

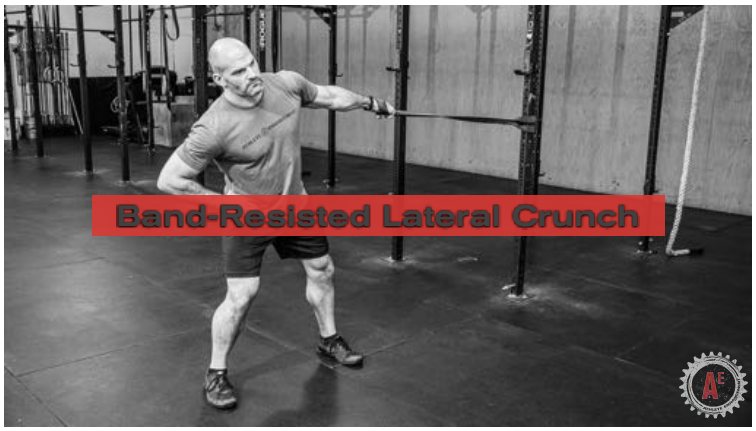


Training Trunk Stability

Step #3: Teach the ability to maintain an isometric brace with hip movements.

Training Trunk Stability

Step #4: Teach the ability to maintain a brace with spinal movement.



Training Trunk Stability

Step #5: Teach the ability to modulate the brace.

Training Trunk Stability

The brain's ability accurately predict the strategy and effort required to execute a given movement.

Modulation vs. Anticipation

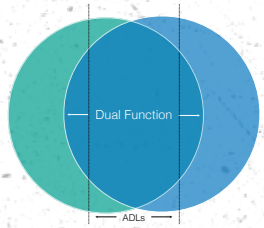
The brain's modifying the strategy & effort in account of the changing resistance.

Training Trunk Stability

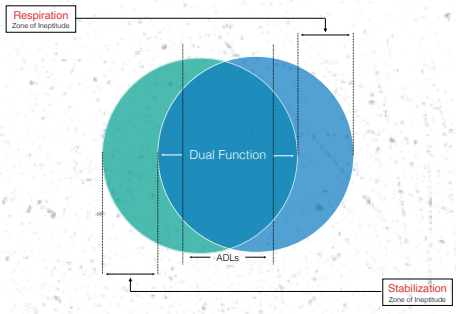
Step #6: Teach the ability to maintain a brace with and elevated respiration rate.

Dual Function of the Diaphragm

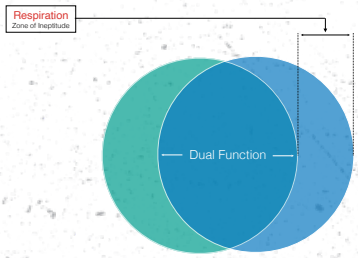
Dual Function of the Diaphragm



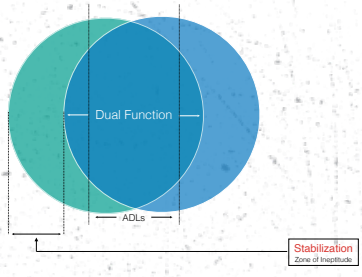
Dual Function of the Diaphragm



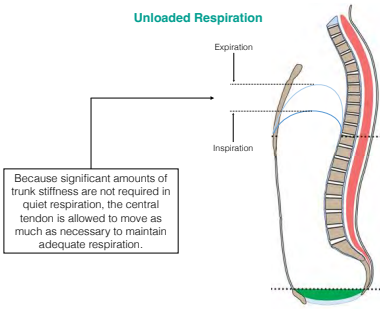
Dual Function of the Diaphragm



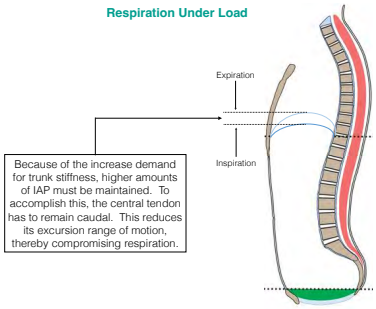
Dual Function of the Diaphragm



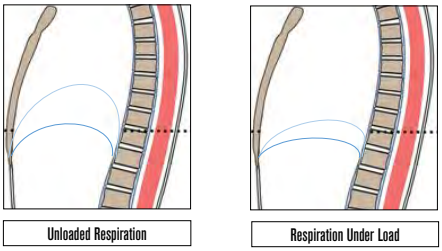
Dual Function of the Diaphragm



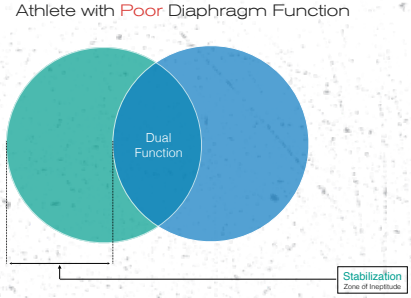
Dual Function of the Diaphragm

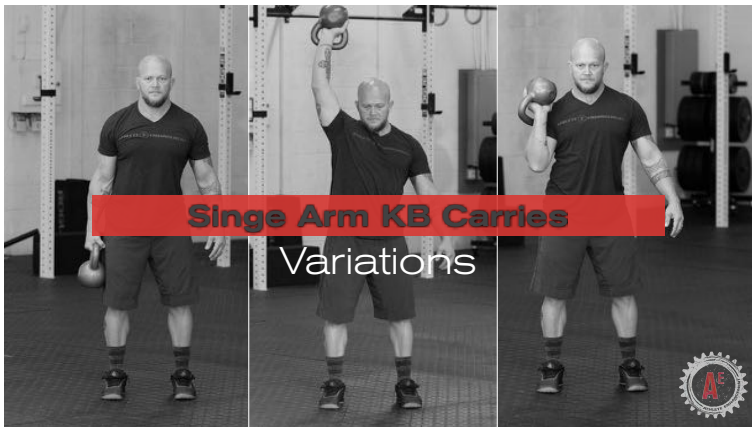


Dual Function of the Diaphragm



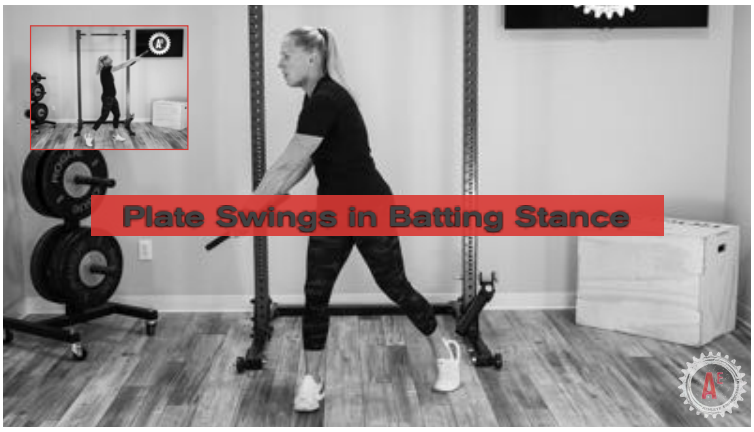
Dual Function of the Diaphragm





Training Trunk Stability

Rule #7: Use sport-specific positions/movements.



Training Trunk Stability

Step #1: Teach/train abdominal expansion in an unchallenging environment.

Step #2: Teach the ability to maintain a brace isometrically against varying loads.

Step #3: Teach the ability to maintain an isometric brace with hip movements.

Step #4: Teach the ability to maintain a brace with spinal movement.

Step #5: Teach the ability to modulate the brace.

Step #6: Teach the ability to maintain a brace with and elevated respiration rate.

Step #7: Use sport-specific positions/movements.

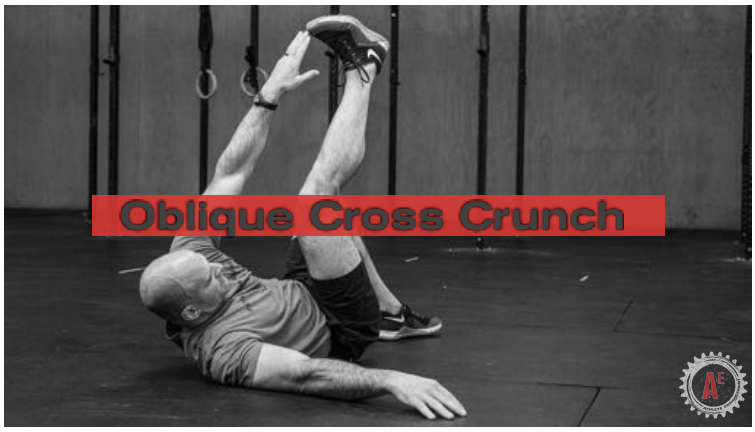
Programming Stability

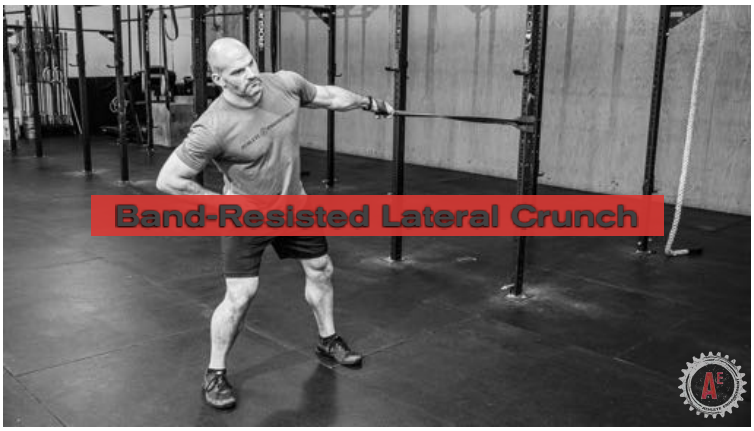
Programming Trunk Stability

Rule #1: Cue the athletes properly during their traditional strength training movements.

Programming Trunk Stability

Rule #2: Program overt trunk stability exercises





Programming Trunk Stability

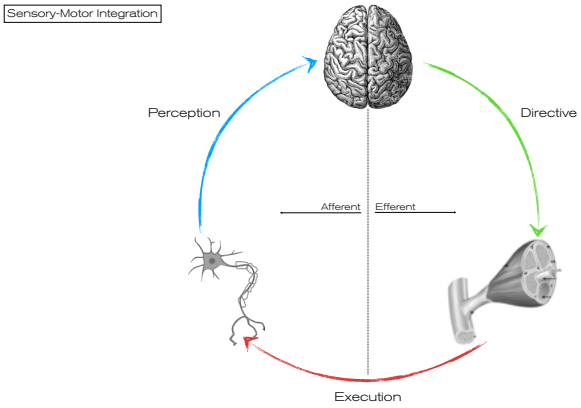
Rule #3: Use more unilateral movements.

Programming Trunk Stability

Rule #4: Utilize odd objects more frequently!

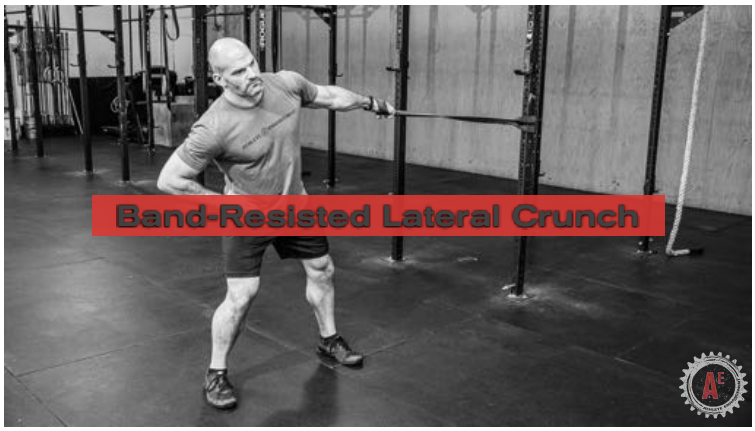
Programming Trunk Stability

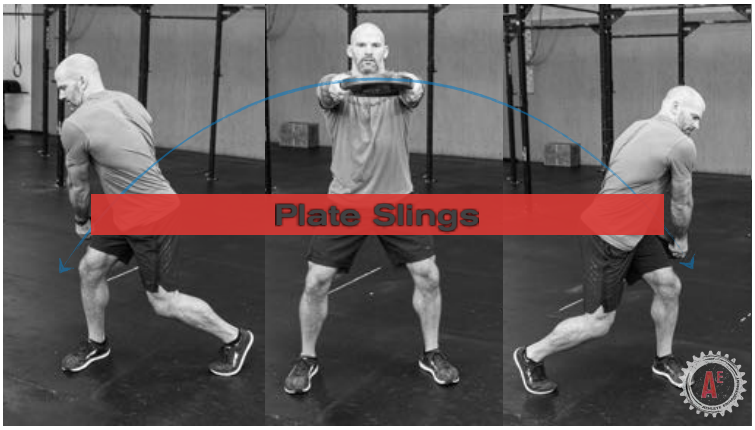
Rule #5: More barefoot training!



Programming Trunk Stability

Rule #6: Train in all three planes!





Programming Trunk Stability

Rule #1: Cue athletes properly (emphasis IAP).

Rule #2: Program overt trunk stability exercises.

Rule #3: Implement more unilateral movements.

Rule #4: Utilize more odd objects.

Rule #5: More barefoot training.

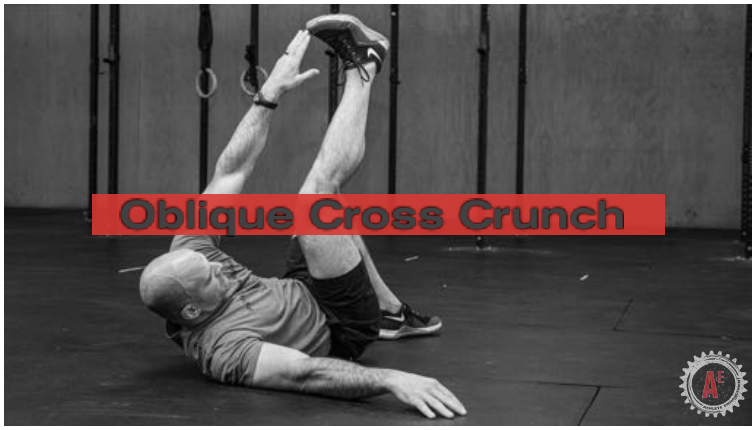
Rule #6: Train in all 3-planes.

Questions?

Training: Exercises

Don't conflate stability & strength. Training stability & training strength are related, but they are not the same.

When training stability, the load must be light(er) and the focus must be on the quality of the movement. When training strength, the load must be greater and the focus is on the output.



Rotational Kicks

5 Months (Unilateral Load)

Hollow Breathing
Variations

Parellette Holds

Dip Holds

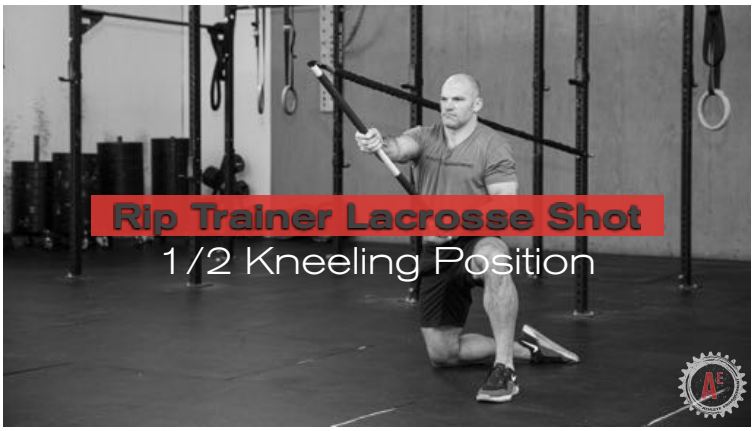
Hanging Squat Breathing

IAP in Pitcher's Stretch

Isometric Rotational Press

Isometric 1/4 Squats

Isometric Rack Pulls


Rip Trainer Lacrosse Shot
1/2 Kneeling Position

Rip Trainer Rotational Press
1/2 Kneeling Position

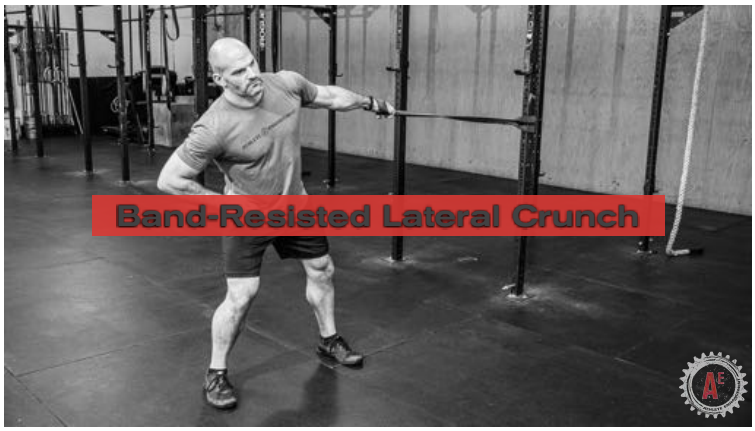
Rip Trainer Rotational Press
Standing Position

Rip Trainer Lacrosse Shot
Standing Position

Paloff Press
Variations

Singe Arm Row
Variations

Singe Arm Press
Variations


Band-Resisted Lateral Crunch

S.A. Overhead Reverse Lunge

Bench Press in 3 Months

Rotational MB Throw
Variations

Medicine Ball Lean-Backs
Variations

Medicine Ball Side Leans

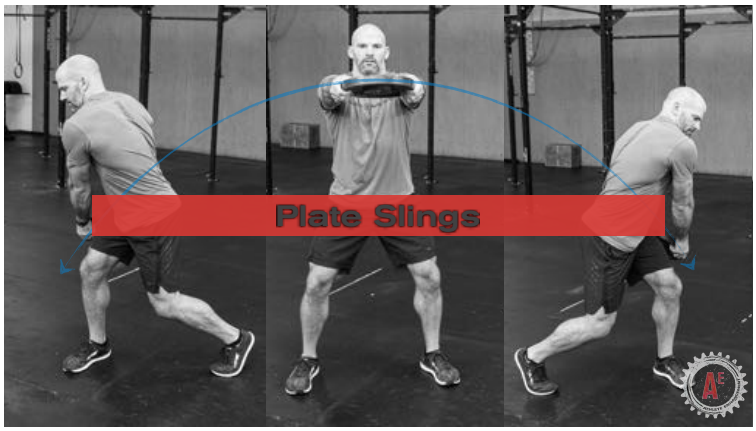


Plate Slings

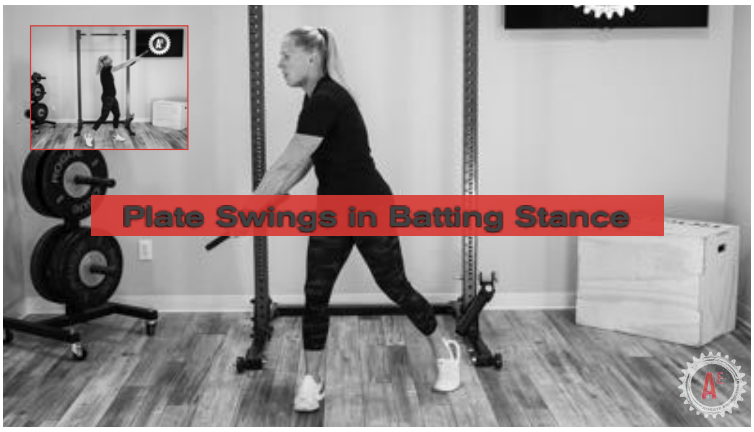


Plate Swings in Batting Stance

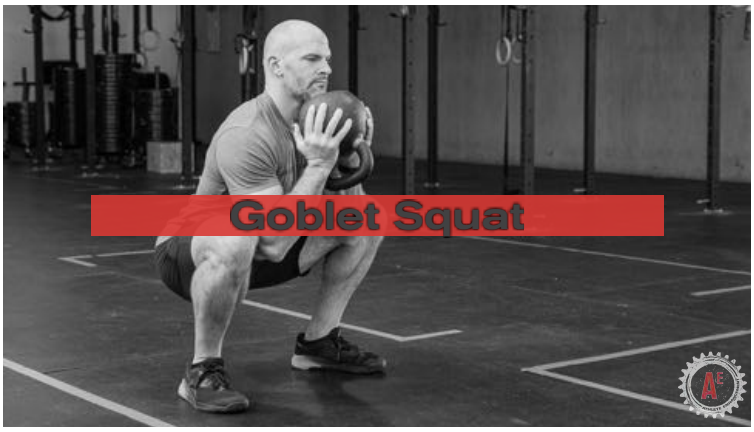
Kettlebell Pass-Overs

Turkish Punch-Up

Czech Roll-Up

Hip Hinging
Variations

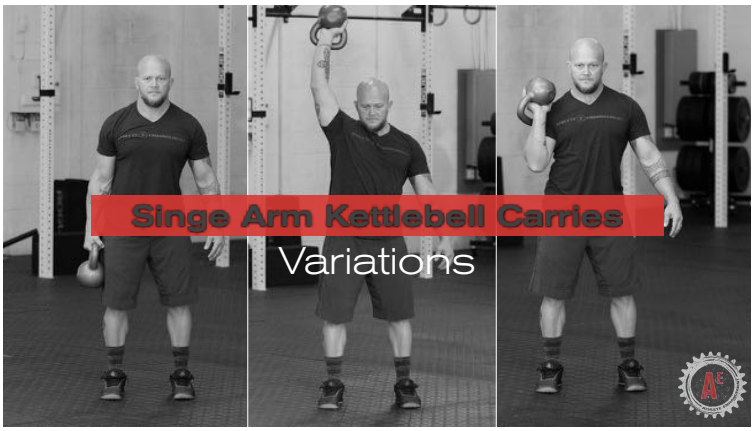
Kettlebell Deadlift
Variations


Goblet Squat

Tombstone Sandbag Squats

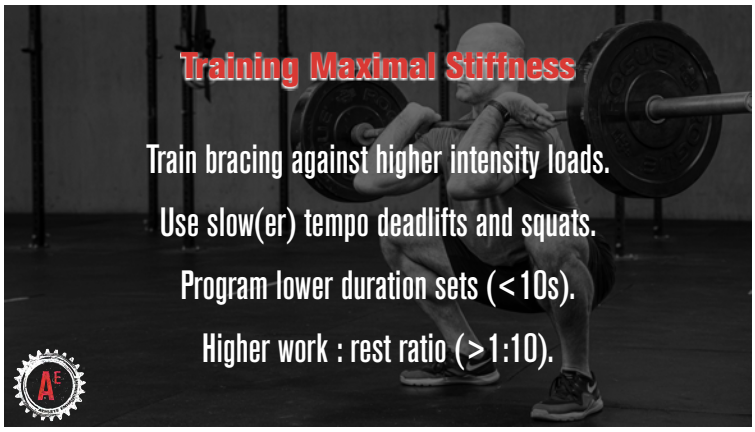
Single Arm KB Front Squats

Double KB Front Squats

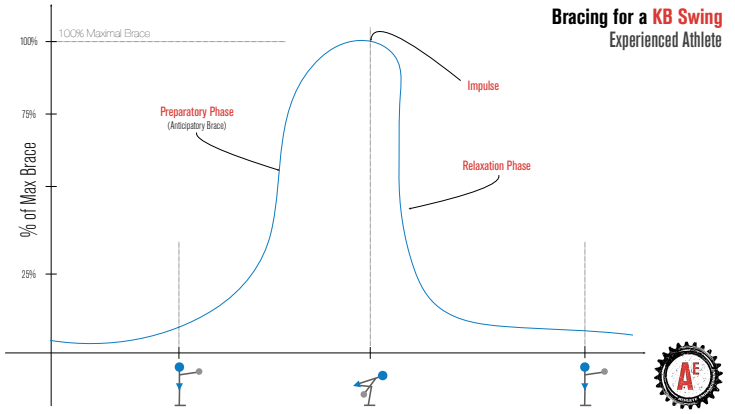

Singe Arm Kettlebell Carries
Variations

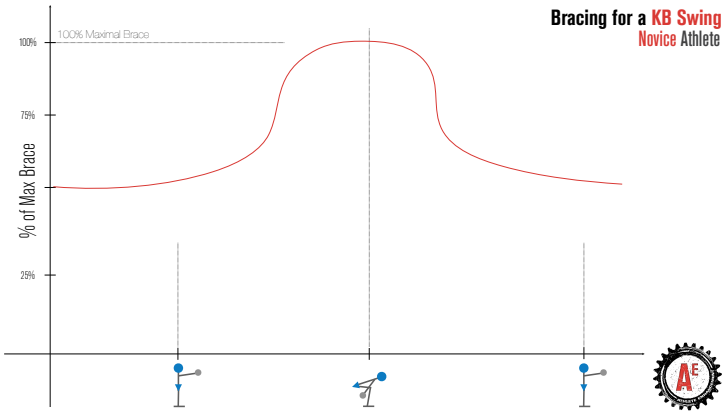
Mastering Stability

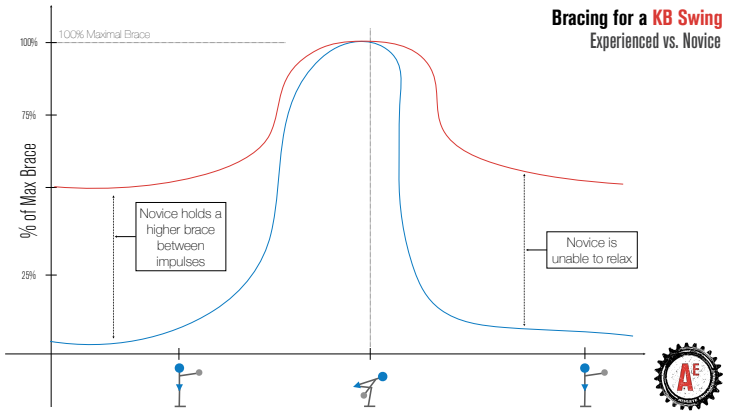
Maximal Stiffness
The ability to stiffen the trunk sufficiently against high magnitudes of resistance.


Training Maximal Stiffness
Train bracing against higher intensity loads.
Use slow(er) tempo deadlifts and squats.
Program lower duration sets (<10s).
Higher work : rest ratio (>1:10).

Toggling the Brace
The ability to (quickly) turn the brace on and off.


Bracing for a KB Swing
Experienced Athlete
100% Maximal Brace
100%
75%
25%
% of Max Brace
Impulse
Preparatory Phase
(Anticipatory Brace)
Relaxation Phase


Bracing for a KB Swing
Novice Athlete
100% Maximal Brace
100%
75%
25%
% of Max Brace


Bracing for a KB Swing
Experienced vs. Novice
100% Maximal Brace
100%
75%
25%
% of Max Brace
Novice holds a higher brace between impulses
Novice is unable to relax

Toggling is an essential skill for generating speed & power.

Training Brace Toggling

Program hip-hinging with increasing hip-extension speed.

Slow tempo RDL (2:0:2:)

KB Swing without impulse

KB Swing with impulse

KB Snatch

Modulating the Brace

The ability to accurately modulate the brace during movement.

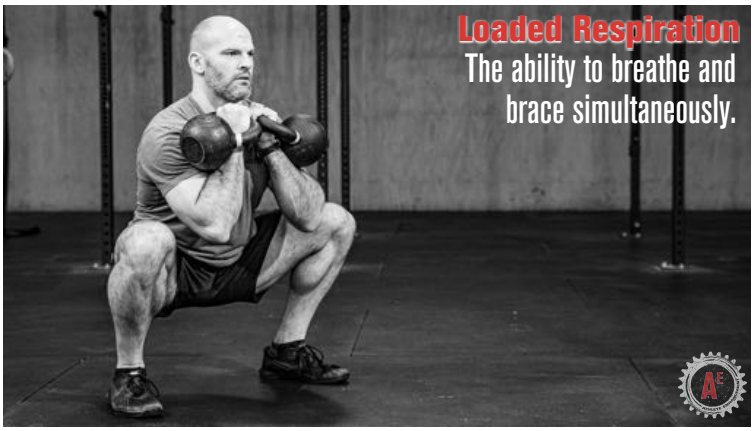
Training Modulation

Program more odd-objects such as atlas stones or sandbags.

Train on more unstable surfaces.

Program more unilateral movements.

Wake up the feet before all training sessions.



Loaded Respiration

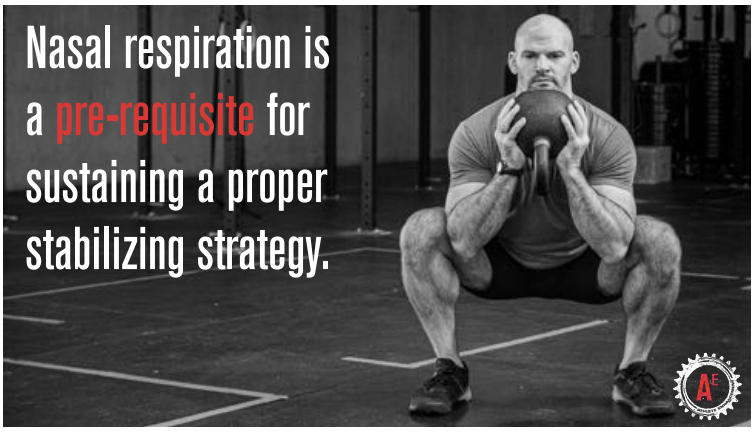
The ability to breathe and brace simultaneously.

Training Loaded Respiration

Program more carries
(be sure to vary the duration and intensity)

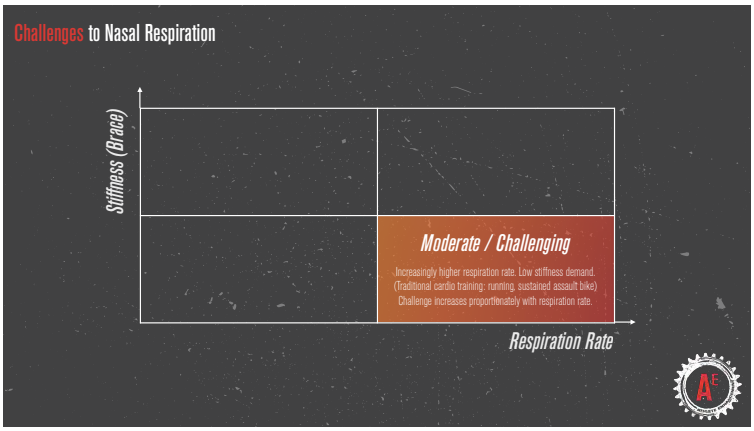
Program longer duration trunk exercises.

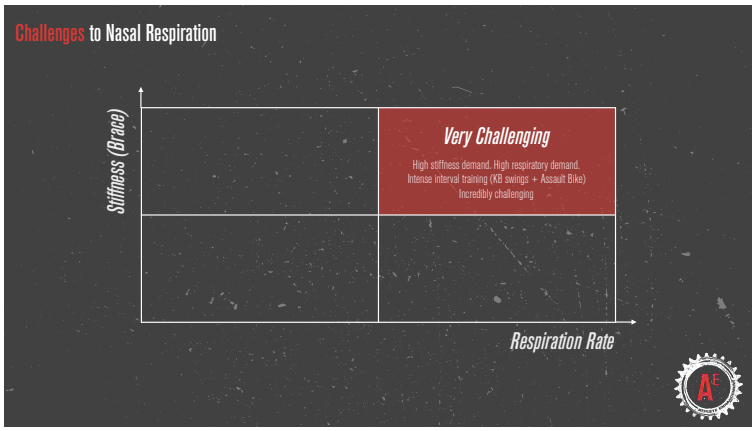
Utilize nasal respiration.

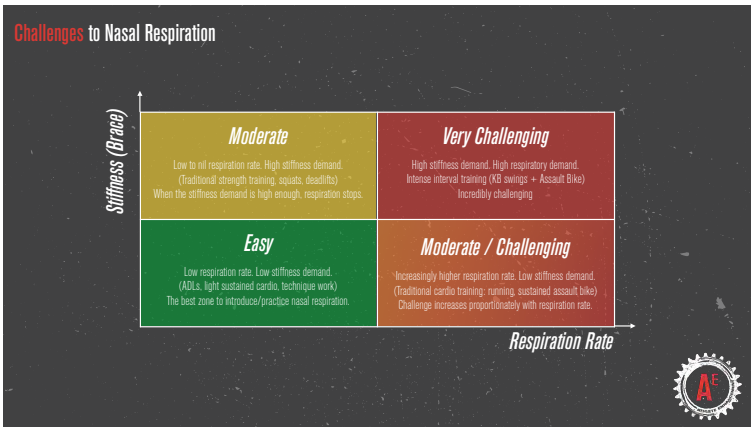


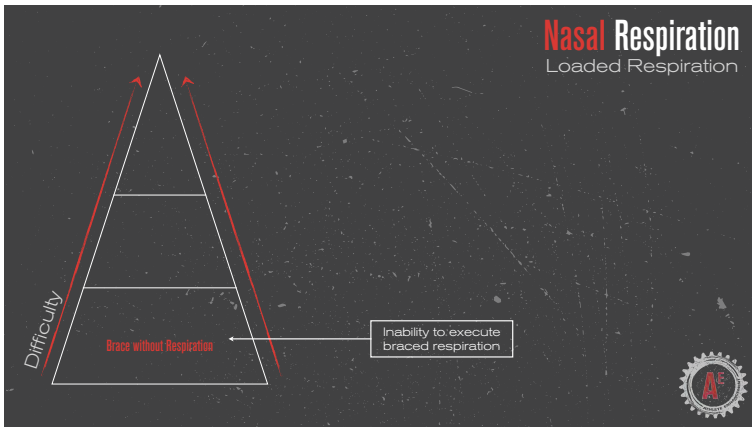
Challenges to Nasal Respiration

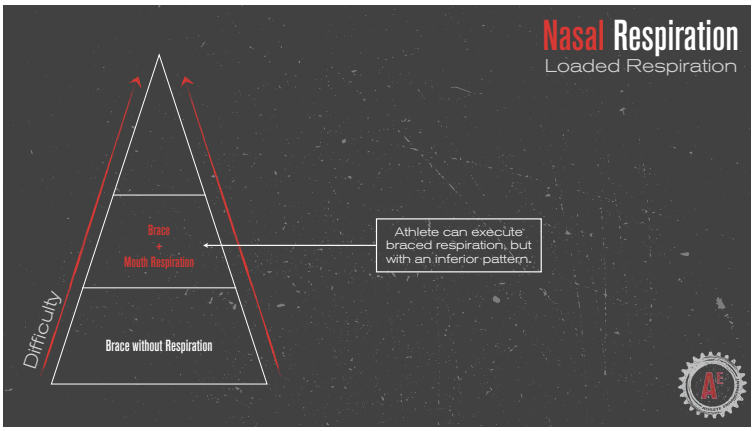
Trunk Stiffness & Respiration Rate

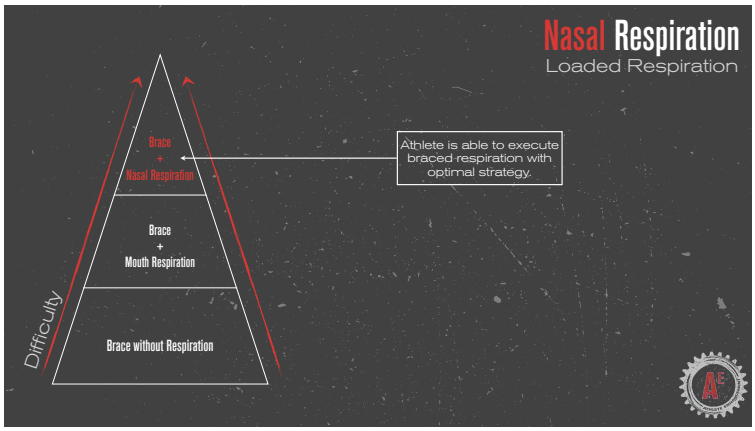


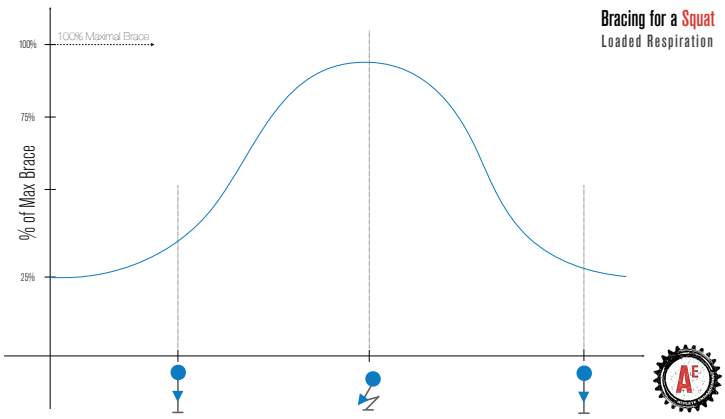


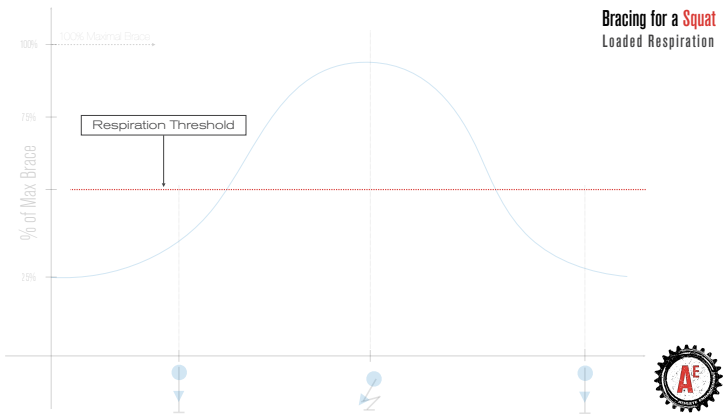

Challenges to Nasal Respiration
Stiffness (Brace)
Moderate
Low to nil respiration rate. High stiffness demand.
(Traditional) strength training, squats, deadlifts)
When the stiffness demand is high enough, respiration stops.
Very Challenging
High stiffness demand. High respiratory demand.
Intense interval training (KB swings + Assault Bike)
Incredibly challenging
Easy
Low respiration rate. Low stiffness demand.
(ADLs, light sustained cardio, technique work)
The best zone to introduce/practice nasal respiration.
Moderate / Challenging
Increasingly higher respiration rate. Low stiffness demand.
(Traditional cardio training: running, sustained assault bike)
Challenge increases proportionately with respiration rate.
Respiration Rate

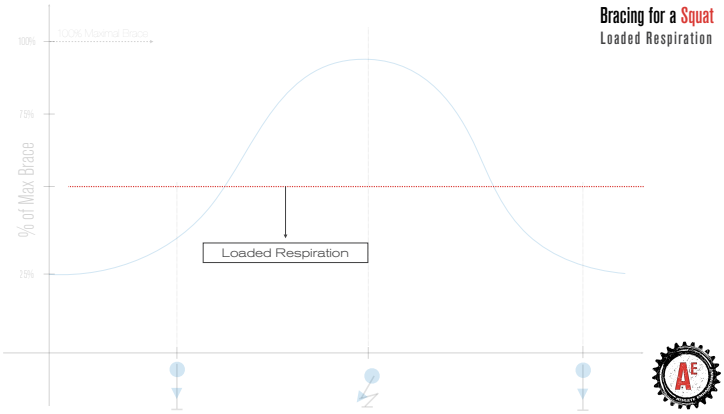

Nasal Respiration
Loaded Respiration
Difficulty
Brace without Respiration
Inability to execute braced respiration

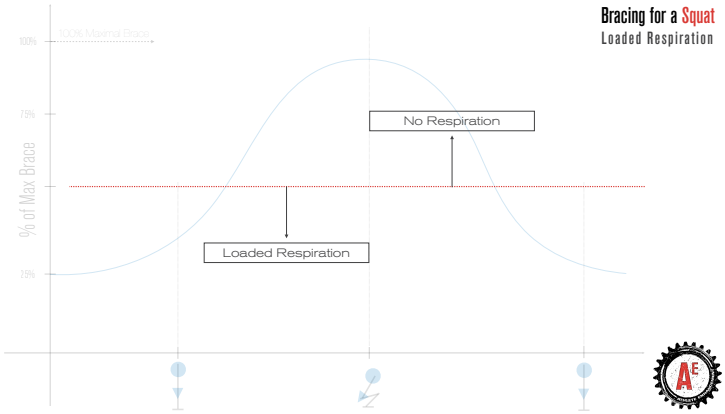

Nasal Respiration
Loaded Respiration
Difficulty
Brace + Mouth Respiration
Brace without Respiration
Athlete can execute braced respiration, but with an inferior pattern.

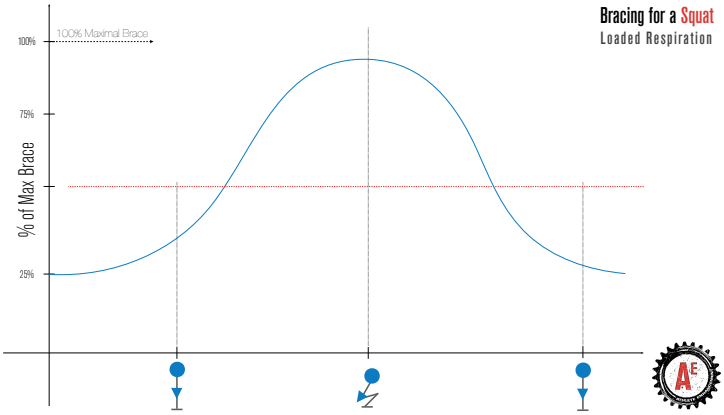

Nasal Respiration
Loaded Respiration
Difficulty
Brace + Nasal Respiration
Brace + Mouth Respiration
Brace without Respiration
Athlete is able to execute braced respiration with optimal strategy.

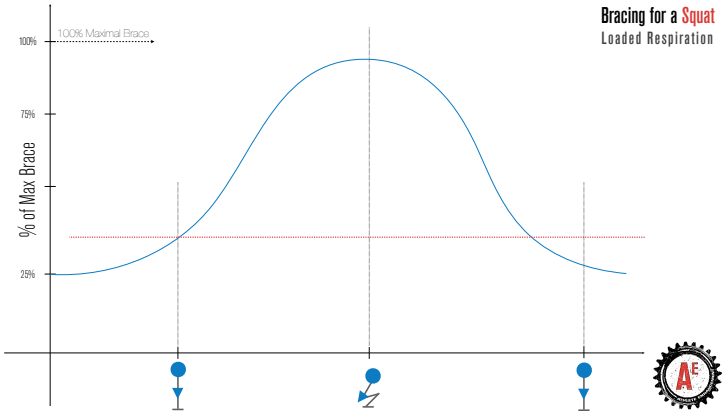

Bracing for a Squat
Loaded Respiration
100% Maximal Brace
100%
75%
25%
% of Max Brace

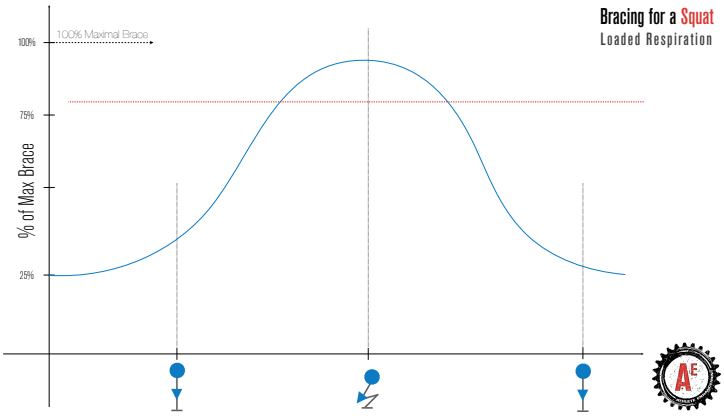

Bracing for a Squat
Loaded Respiration
Respiration Threshold
% of Max Brace


Bracing for a Squat
Loaded Respiration
100% Maximal Brace
75%
% of Max Brace
25%
Loaded Respiration

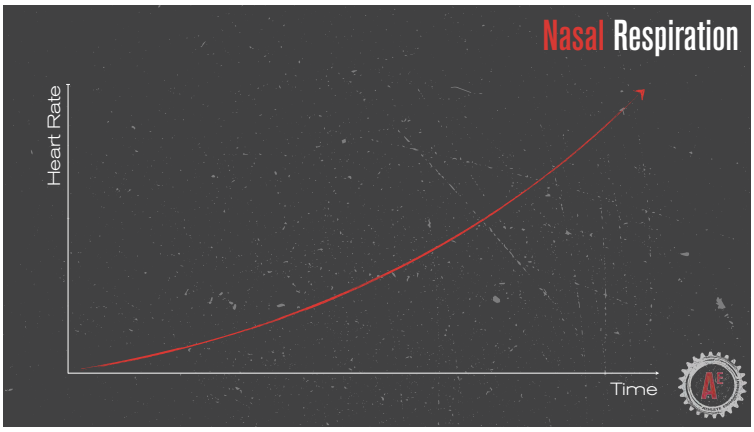

Bracing for a Squat
Loaded Respiration
100% Maximal Brace
75%
% of Max Brace
25%
No Respiration
Loaded Respiration

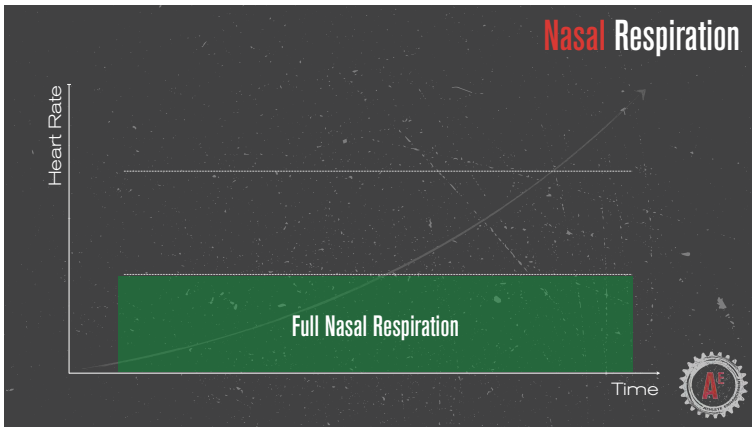

Bracing for a Squat
Loaded Respiration
100% Maximal Brace
100%
75%
% of Max Brace
25%

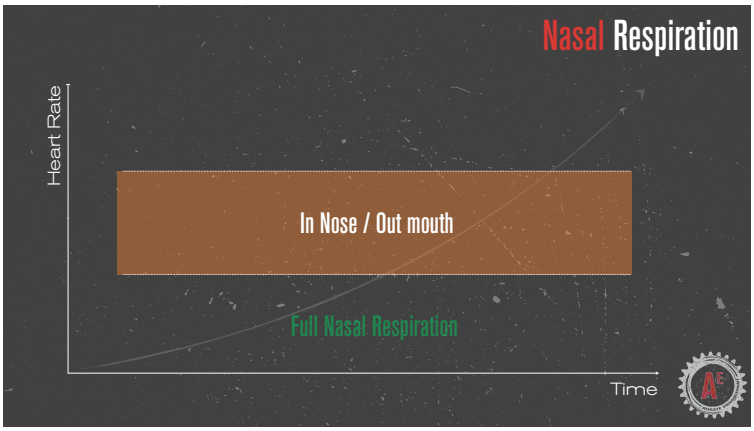

Bracing for a Squat
Loaded Respiration
100% Maximal Brace
100%
75%
% of Max Brace
25%

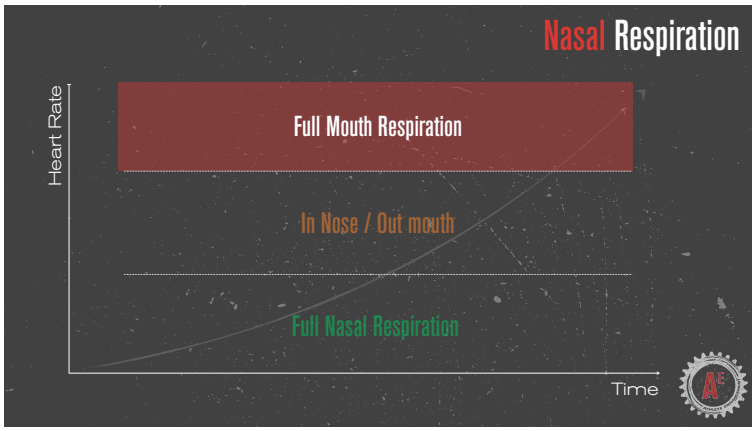

Bracing for a Squat
Loaded Respiration
100% Maximal Brace
100%
75%
% of Max Brace
25%

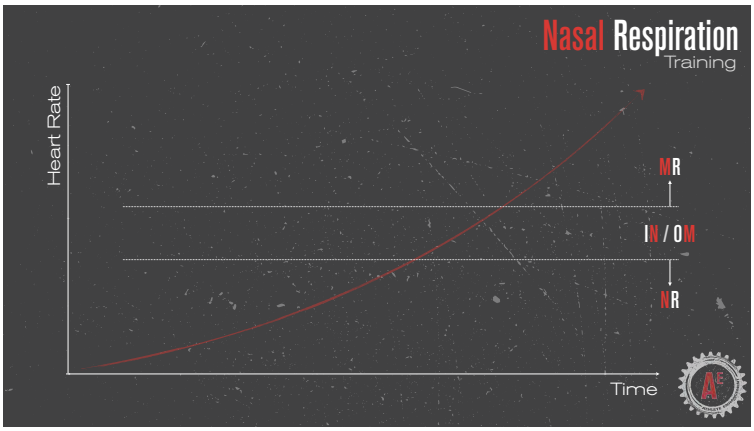
An athlete's respiration rate is the biggest challenge to sustained nasal respiration.
Nasal respiration must be trained.

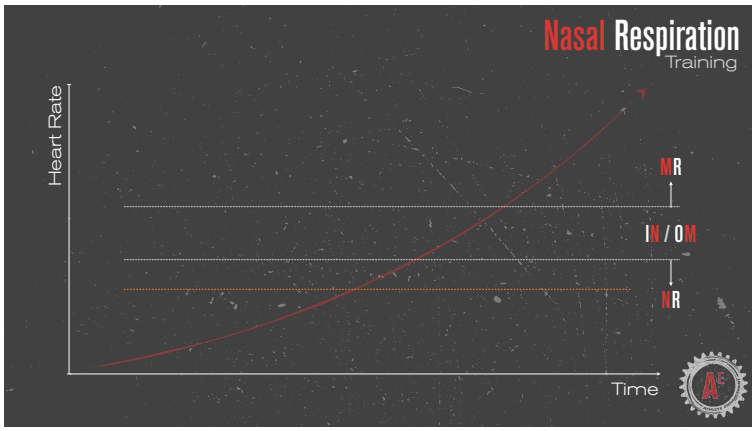

Nasal Respiration
Heart Rate
Time

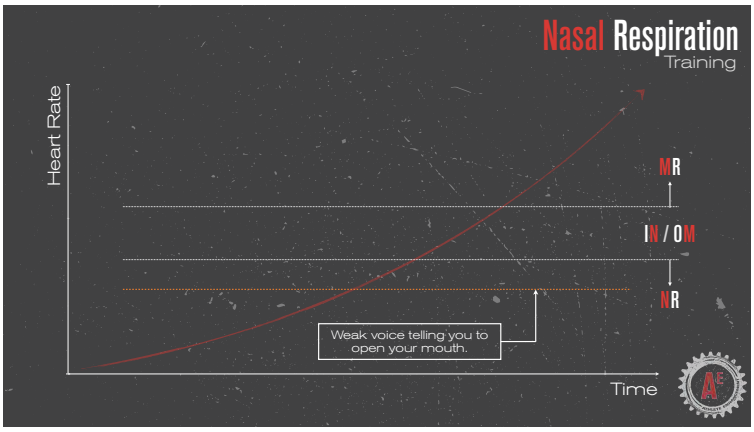

Nasal Respiration
Heart Rate
Full Nasal Respiration
Time

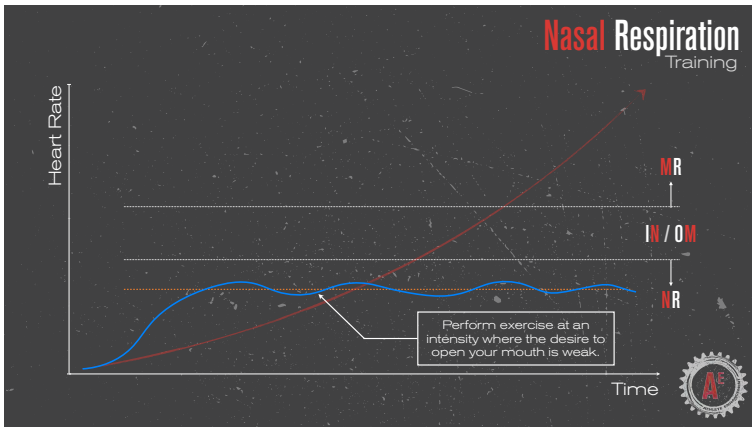

Nasal Respiration
Heart Rate
In Nose / Out mouth
Full Nasal Respiration
Time

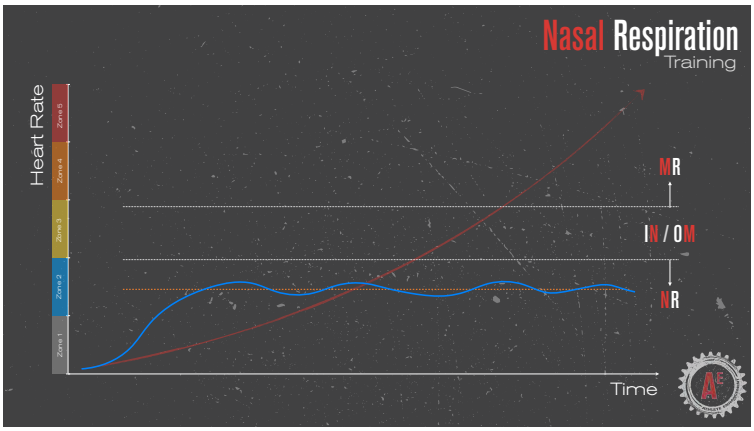

Nasal Respiration
Heart Rate
Full Mouth Respiration
In Nose / Out mouth
Full Nasal Respiration
Time

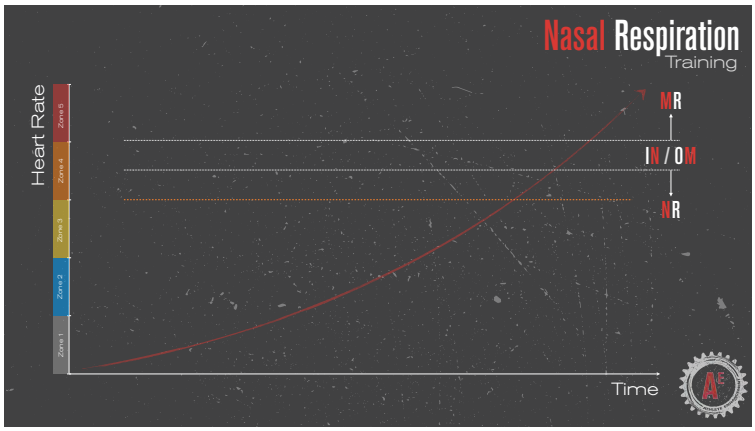

Nasal Respiration
Training
Heart Rate
MR
IN / OM
NR
Time

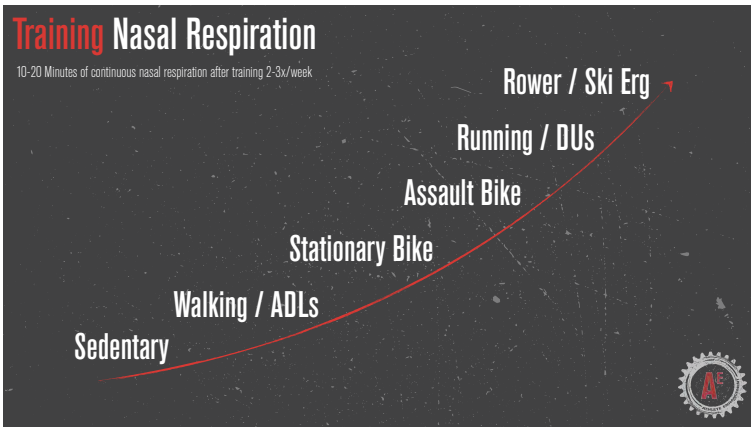

Nasal Respiration
Training
Heart Rate
MR
IN / OM
NR
Time

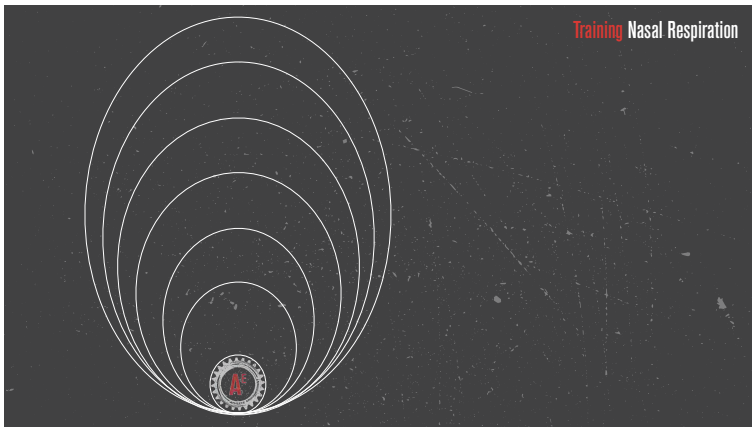

Nasal Respiration
Training
Heart Rate
MR
IN / OM
NR
Weak voice telling you to open your mouth.
Time

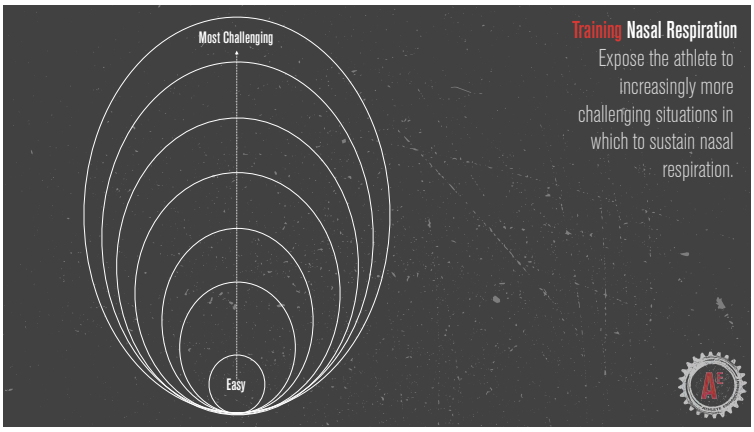

Nasal Respiration
Training
Heart Rate
MR
IN / OM
NR
Perform exercise at an intensity where the desire to open your mouth is weak.
Time

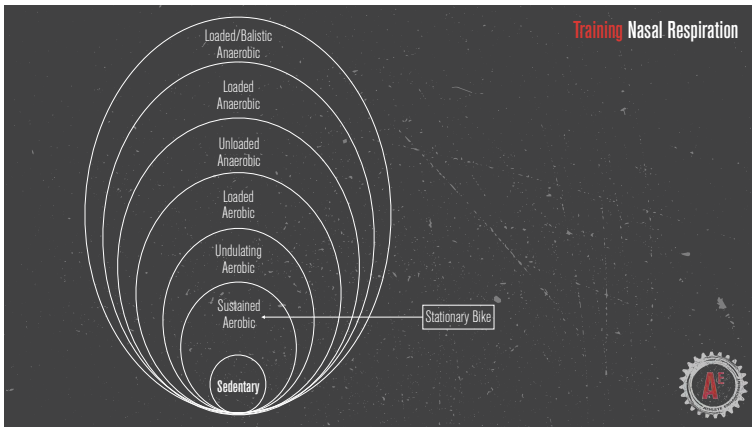

Nasal Respiration
Training
Heart Rate
Zone 5
Zone 4
Zone 3
Zone 2
Zone 1
MR
IN / OM
NR
Time

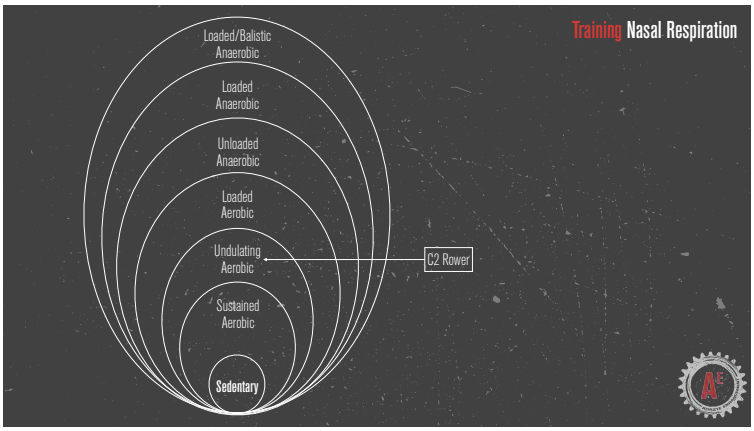

Nasal Respiration
Training
Heart Rate
Zone 5
Zone 4
Zone 3
Zone 2
Zone 1
MR
IN / OM
NR
Time

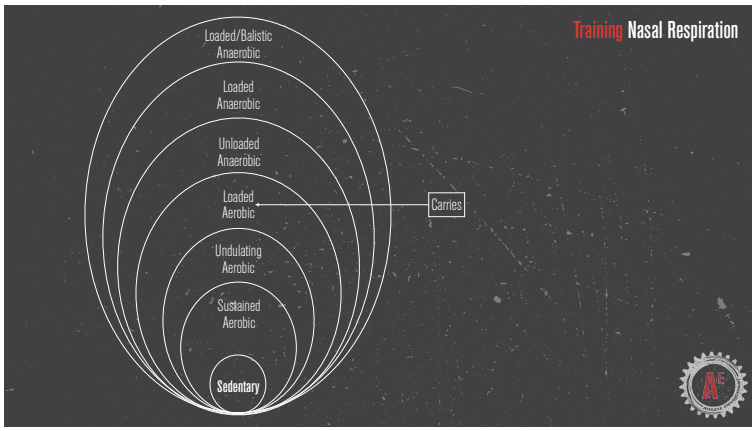

Training Nasal Respiration
10-20 Minutes of continuous nasal respiration after training 2-3x/week
Rower / Ski Erg
Running / DUs
Assault Bike
Stationary Bike
Walking / ADLs
Sedentary

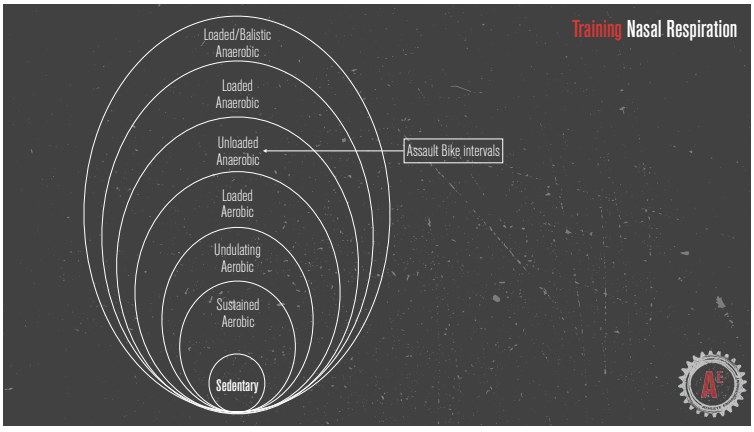

Training Nasal Respiration

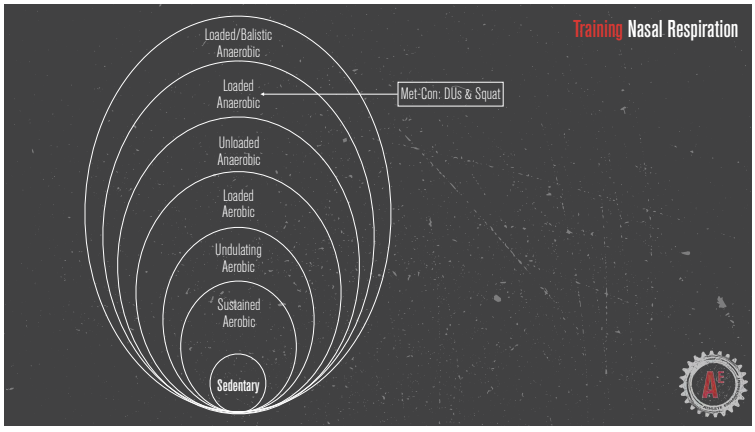

Training Nasal Respiration
Expose the athlete to increasingly more challenging situations in which to sustain nasal respiration.
Most Challenging
Easy

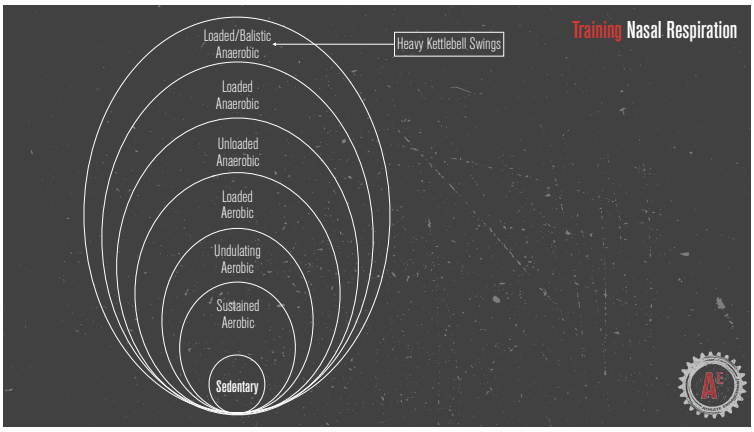

Training Nasal Respiration
Loaded/Ballistic Anaerobic
Loaded Anaerobic
Unloaded Anaerobic
Loaded Aerobic
Undulating Aerobic
Sustained Aerobic
Sedentary
Stationary Bike

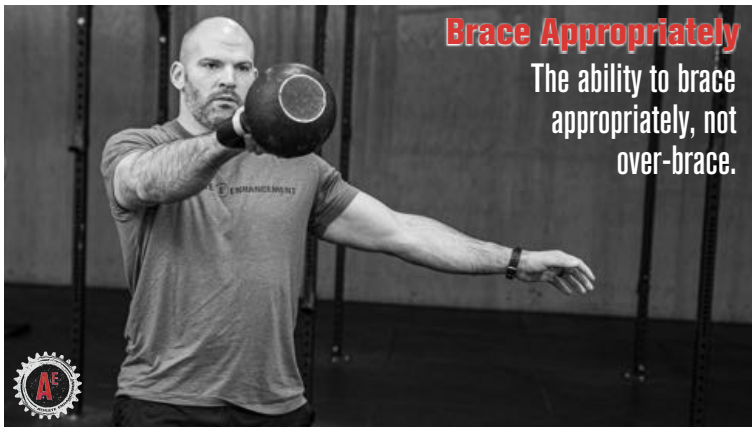

Training Nasal Respiration
Loaded/Ballistic Anaerobic
Loaded Anaerobic
Unloaded Anaerobic
Loaded Aerobic
Undulating Aerobic
Sustained Aerobic
Sedentary
C2 Rower

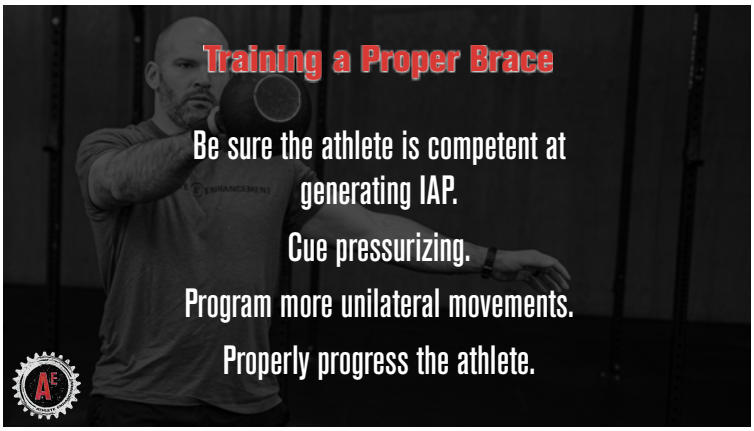

Training Nasal Respiration
Loaded/Ballistic Anaerobic
Loaded Anaerobic
Unloaded Anaerobic
Loaded Aerobic
Undulating Aerobic
Sustained Aerobic
Sedentary
Carries

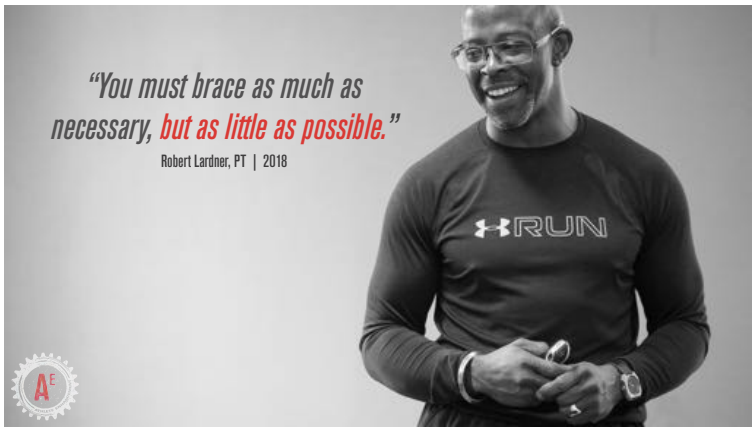

Training Nasal Respiration
Loaded/Ballistic Anaerobic
Loaded Anaerobic
Unloaded Anaerobic
Loaded Aerobic
Undulating Aerobic
Sustained Aerobic
Sedentary
Assault Bike intervals

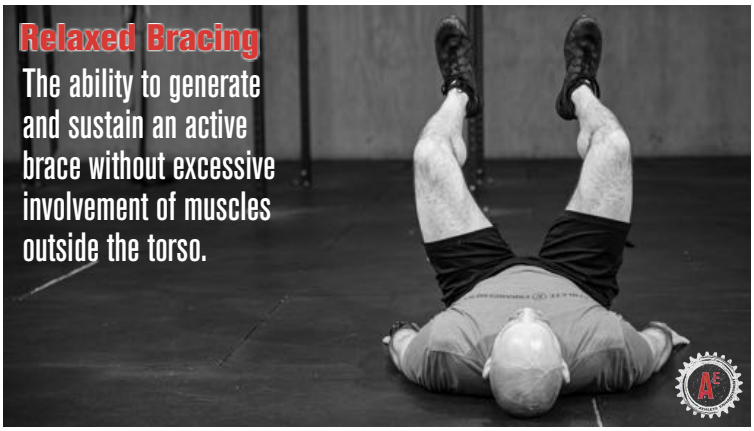

Training Nasal Respiration
Loaded/Ballistic Anaerobic
Loaded Anaerobic
Unloaded Anaerobic
Loaded Aerobic
Undulating Aerobic
Sustained Aerobic
Sedentary
Met-Con: DUs & Squat

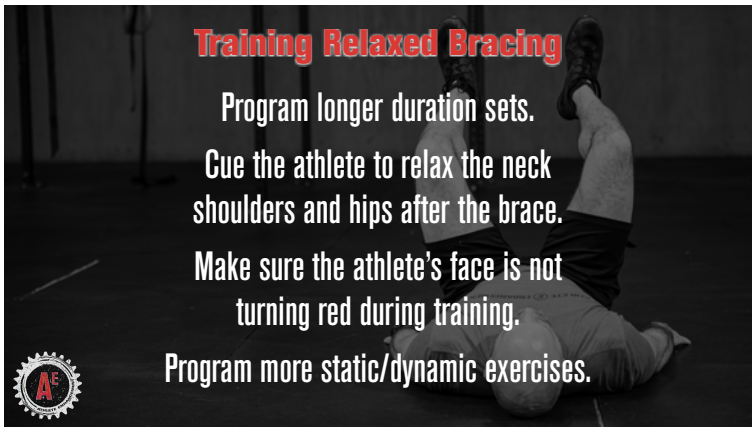

Training Nasal Respiration
Loaded/Ballistic Anaerobic
Heavy Kettlebell Swings
Loaded Anaerobic
Unloaded Anaerobic
Loaded Aerobic
Undulating Aerobic
Sustained Aerobic
Sedentary


Brace Appropriately
The ability to brace appropriately, not over-brace.

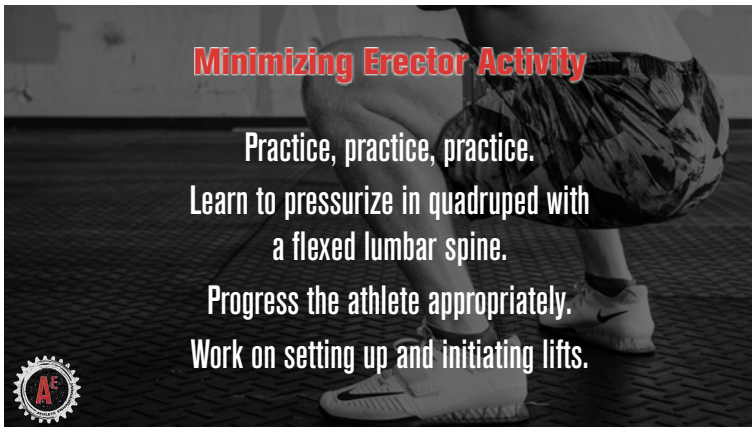

Training a Proper Brace
Be sure the athlete is competent at generating IAP.
Cue pressurizing.
Program more unilateral movements.
Properly progress the athlete.


"You must brace as much as necessary, but as little as possible."
Robert Lardner, PT | 2018


Relaxed Bracing
The ability to generate and sustain an active brace without excessive involvement of muscles outside the torso.

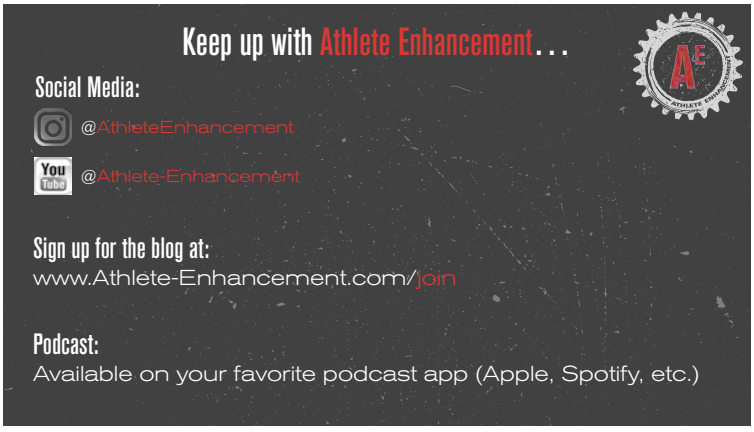

Training Relaxed Bracing
Program longer duration sets.
Cue the athlete to relax the neck shoulders and hips after the brace.
Make sure the athlete's face is not turning red during training.
Program more static/dynamic exercises.

Minimize Erector Activity
The ability to generate IAP with minimal erector spinae activity.


Minimizing Erector Activity
Practice, practice, practice.
Learn to pressurize in quadruped with a flexed lumbar spine.
Progress the athlete appropriately.
Work on setting up and initiating lifts.

Mastering Stability
Loaded Respiration
Minimizing Erector Activity
Relaxed Bracing
Maximal Toro Stiffness
Bracing Appropriately
Modulating the Brace
Toggling the Brace

Thank you for your time!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