

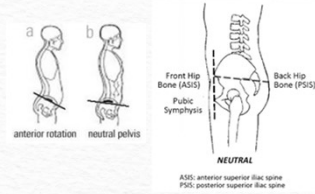
# Ergonomics

The Art Of Protective Balancing



1

## Stand Up



2

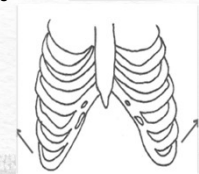
## Stretch



3

## Core Breathing

- Stand – heels together, toes ~4" apart
- Elongate spine, neck (be tall)
- Pull belly button to spine
- Contract lower & upper abdominals
- Hand on chest
- Inhale deeply, expanding ribs laterally
- Exhale
- Repeat 3 times



4

## Arms Clasped Behind

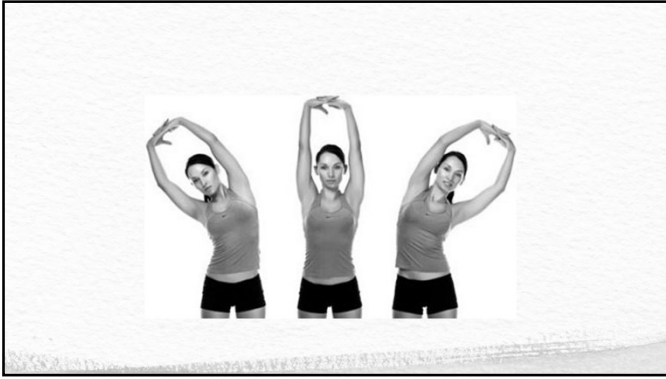


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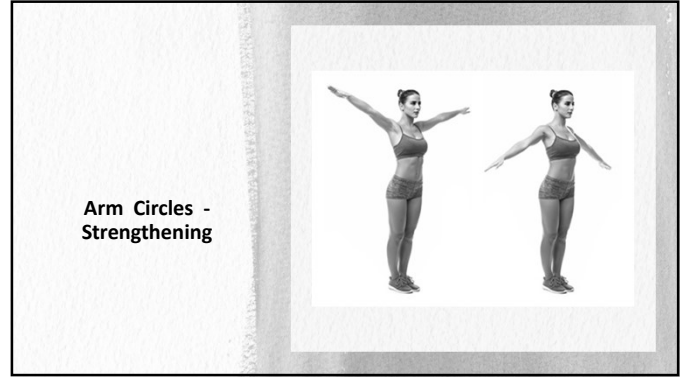
## Mountain Pose; arms up, hands clasped



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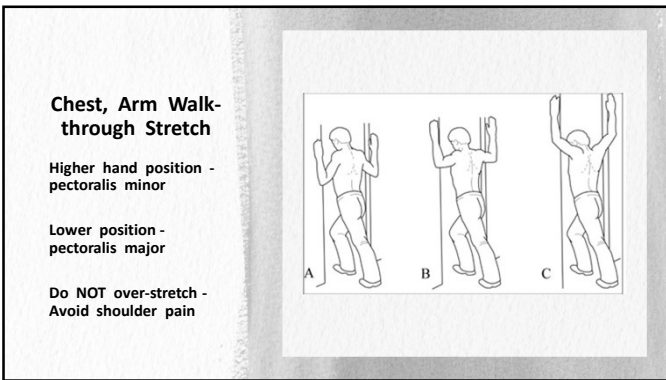


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Arm Circles -  
Strengthening

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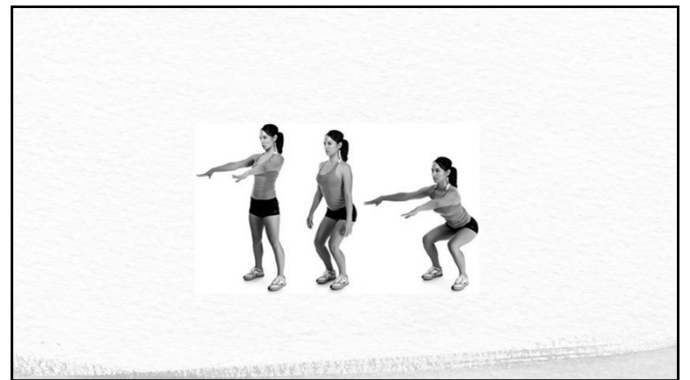
**Chest, Arm Walk-  
through Stretch**

Higher hand position -  
pectoralis minor

Lower position -  
pectoralis major

Do NOT over-stretch -  
Avoid shoulder pain

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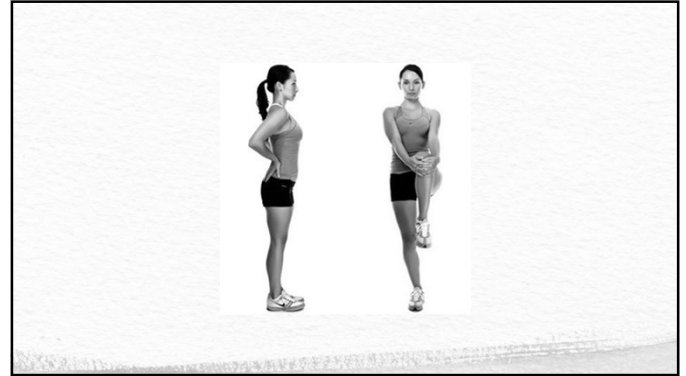
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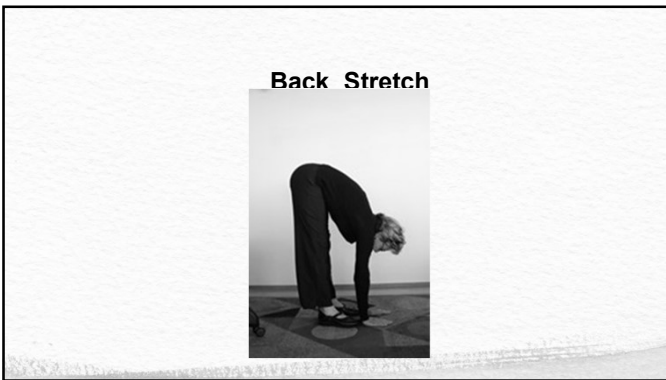
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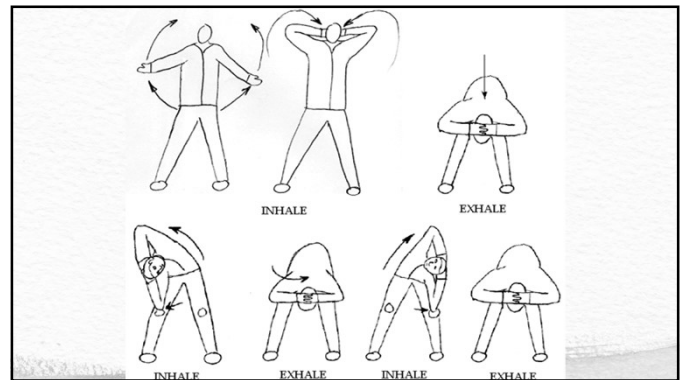
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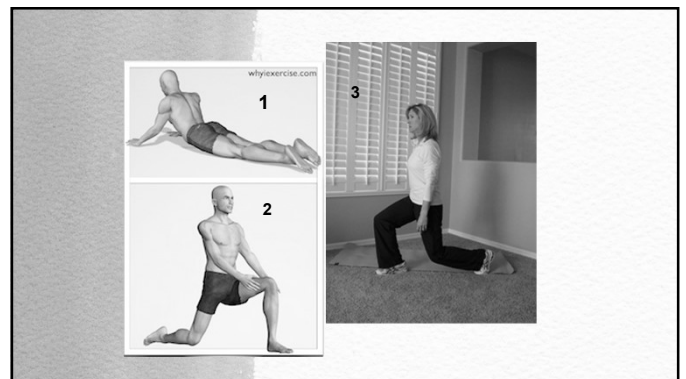
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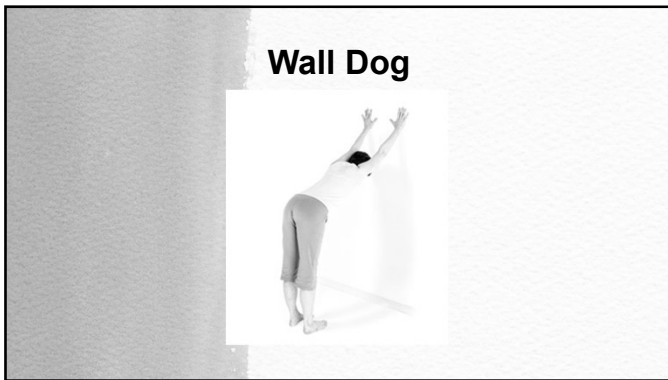
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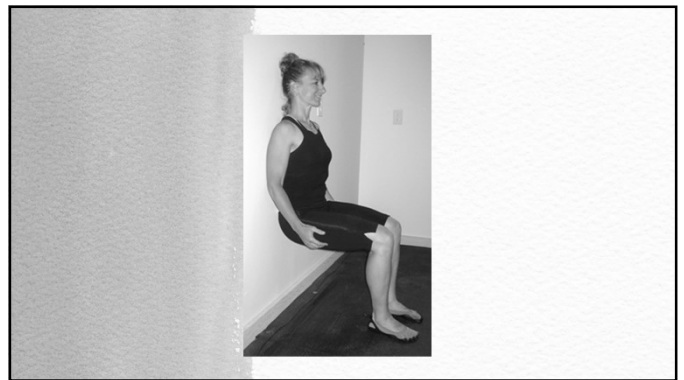
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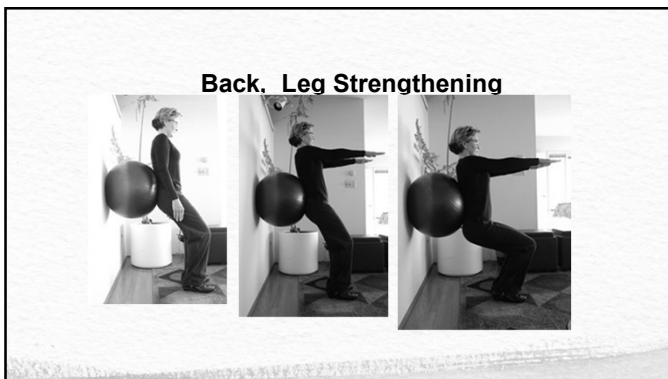
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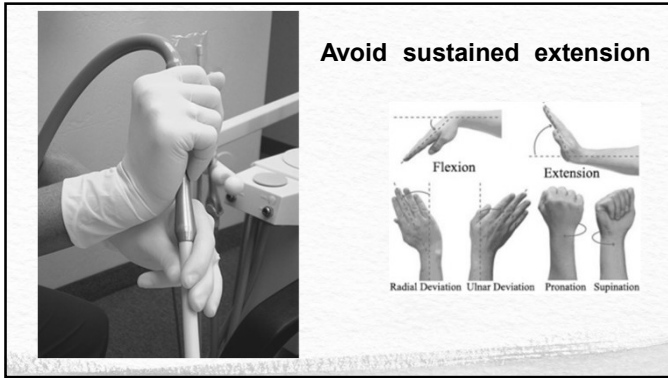
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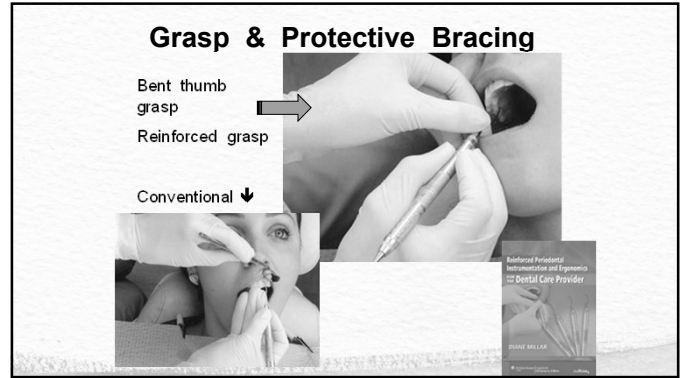
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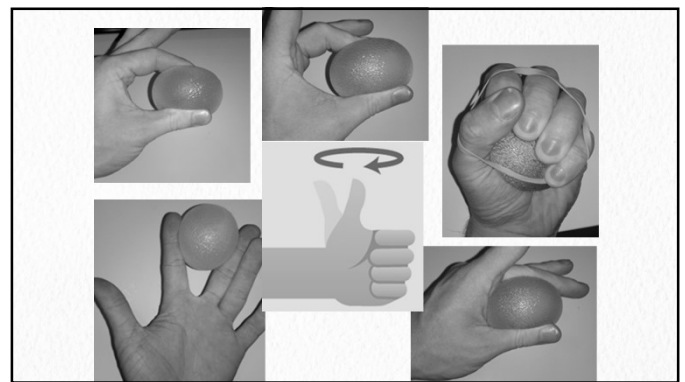
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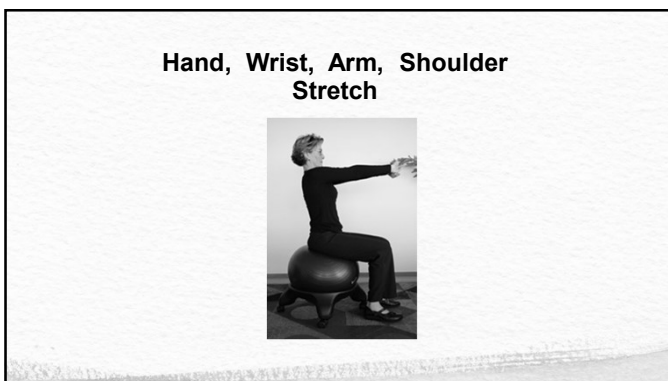
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30

### Sit Tall!

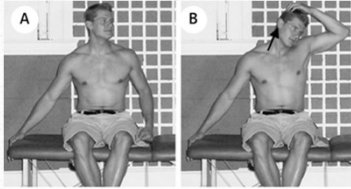
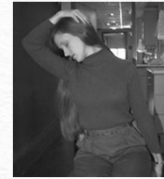


Figure 1. Stabilizing the scapula, turn your head/neck to the contralateral side (A), and slowly lateral flex to the contralateral side (B). You can use the other hand to pull and hold the head and neck position. You should feel a pull from the superior angle of the scapula to the lateral side of the cervical spine (arrow).

31

### Stretch Back of Neck



- Turn head away from tight side
- Look down, feel stretch
- Hold chair on tight side
- Pull head forward with other hand

32

### Stretch Side of Neck



- Repeat looking up to stretch front of neck

33

### Stretch Chest



- Clasp hands behind head
- Inhale slowly, bringing elbows back
- Exhale slowly, bring elbows together, bend head forward

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### Shoulder, Arm Stretch



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### Back, Neck Stretch



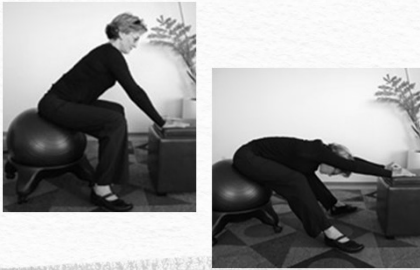
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**Back, Hip Stretch**

37



38

**Back, Shoulder, Arm Stretch**

39

**Chest, Shoulder Arm Stretch**

40

**Flexion & Extension increases range of motion, strength & circulation**



41

**Shoulder Shrugs**

- Keep both arms at sides
- Shrug shoulders toward ears
- Hold 3 sec
- Roll & lower shoulders backwards
- Keep elbows straight throughout exercise

42

### Neck Rotation Stretch



43

### Increase Your Range of Motion Look Over Your Shoulder Assist With Your Hand



Hold 10 sec.  
Repeat 6 times

44



45

### Keep shoulders down: Elbows straight & Clasp hands or Hold your chair seat in front between your legs –



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47

### Isometric Exercises Do not tip your head



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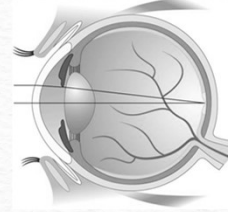


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### Exercise Your Eye Muscles!



50

### Focus Near & Far (blink)



51

### Bicep stretch

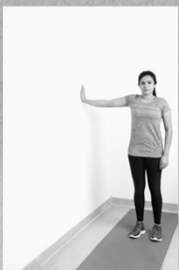
Slowly, do NOT over-stretch  
Avoid shoulder pain



52

Feet hip-width apart  
Arm - 90 degrees

Chin tucked  
Blades & core set.  
Breathe out,  
Rotate body in opposite  
direction of arm.  
Feel stretch in front chest.  
Hold.  
Breathe in  
Release the stretch.



Avoid



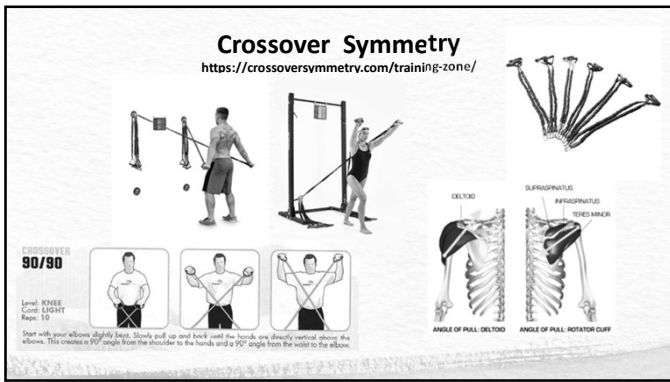
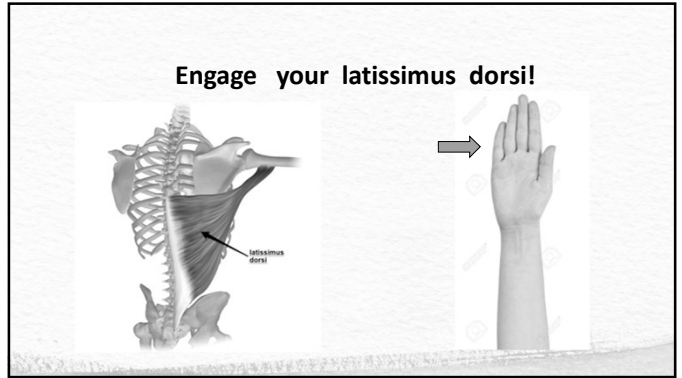
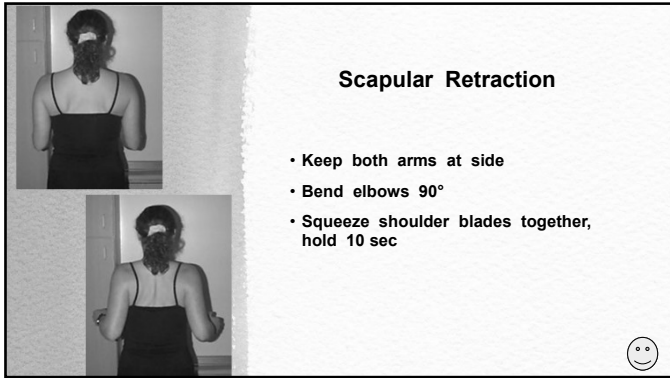
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### Chin Tucks

- Touch chin to chest
- Should feel stretch in back of neck
- Bring it up
- Make a double chin in forward position
- Hold 5 sec
- Balanced strength



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61



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### Stretch Shoulder & Chest

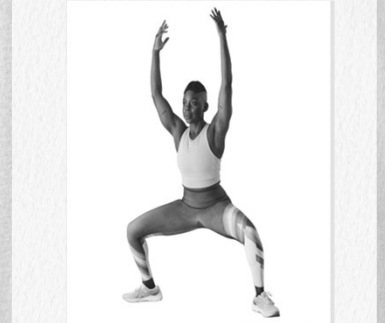


- Place arm on table edge
- Slide arm forward, moving head level with table
- OR: against the wall

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### Deep Squat

Feet a little wider than shoulders, toes out 45 degrees.  
Chest lifted, core braced, pelvic floor engaged, back flat.  
Slowly inhale + bend knees,  
Butt back & down - thighs parallel to ground  
Hold 3 breaths



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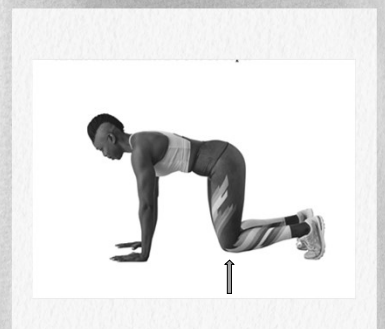
### Get Down



65

### Quadruped Plank

Hands & knees on ground  
Shoulders directly above wrists, hips above knees.  
Tuck pelvic floor muscles, draw in abdomen.  
Press hands down, lift knees off ground ~2", 5-10 seconds.  
Breath & repeat



66

### Shoulder Bridge

On Back, knees bent, feet flat hip-width apart  
Press lower back into floor.  
On inhale, lift hips off floor, squeezing glutes at top.  
Pull abs in and pelvic floor up.  
Exhale as you lower hips  
Repeat



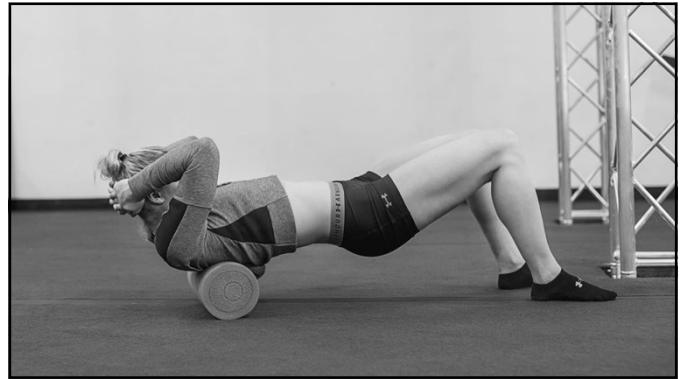
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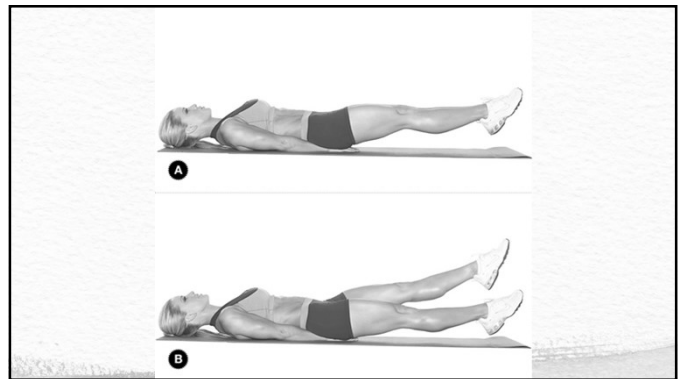
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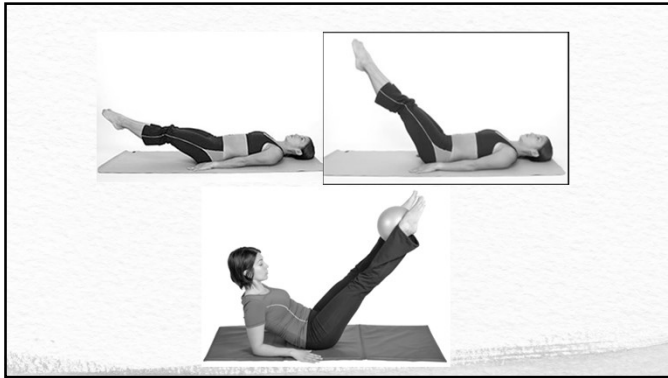
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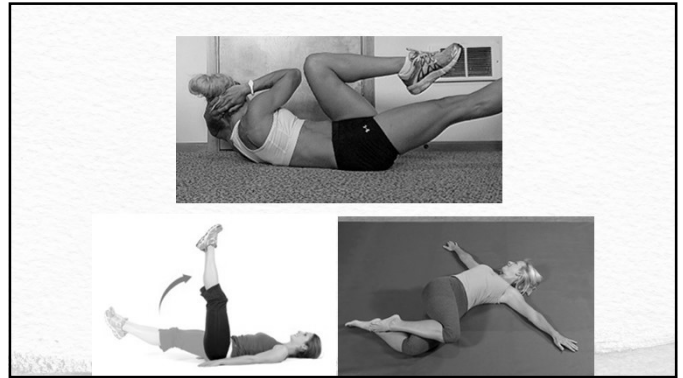
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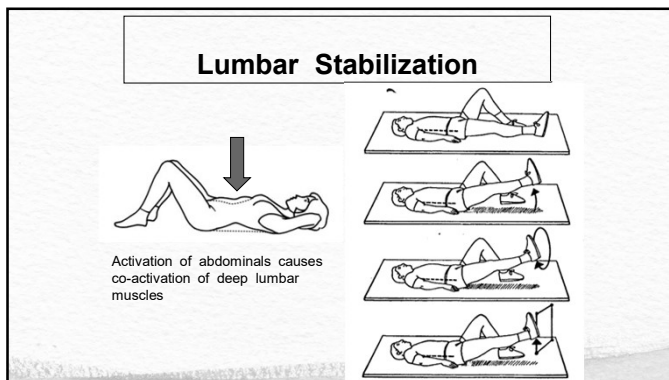
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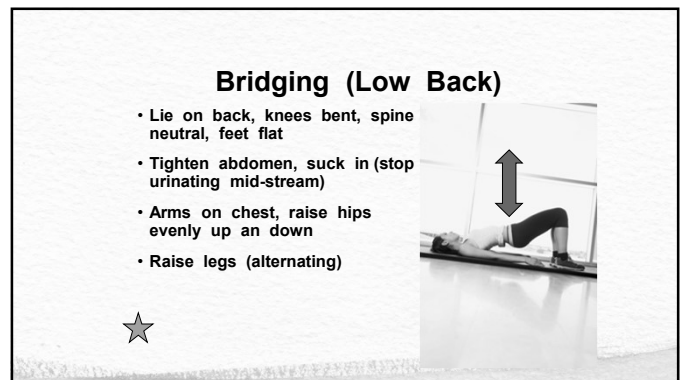
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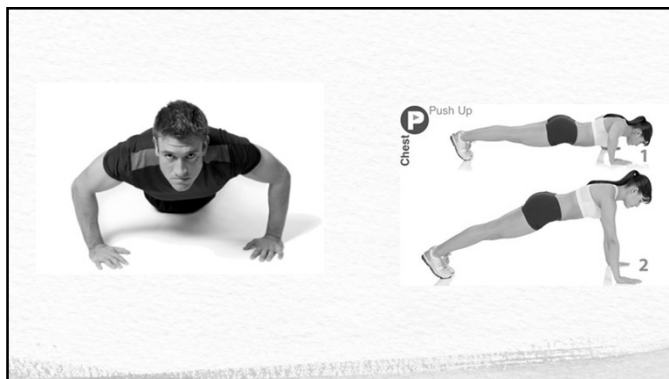
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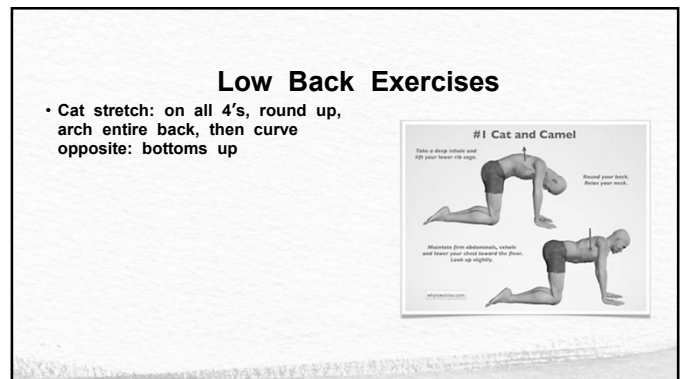
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### Bird-dog: on all 4's



- Flat table-top back
- Raise arm (front), alternate, hold
- Raise leg straight back, alternate, hold
- Raise opposite arm & leg, alternate

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### Lower Back Stretch



81

### Leg Stretches



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## ● Ergonomics

- The Art Of Protective Balancing
- What's So Special About Dentistry?
- We sit
- We lean forward > 1/2 of working hours
- We have high stress
- Muscles fatigue, we compensate
- We age, life happens
- Dentistry literally reshapes us!
- Goals of Ergonomic Training
- We want:
- Balanced strengthening
- Symmetrical muscles
- > Balance, flexibility, mobility, stability
- > lean muscle mass, endurance, bone density
- < injuries; chronic & acute
- To optimize neutral, protective postures
- Avoid CTD's, muscle imbalances, pain
- Long, pain-free career
- Training & Habits
- Initial training - step-by-step
- Practice "Muscle memory"
- Brain combines steps to form "chunks" of memory (act as one without conscious direction) = habit
- Still subconscious oversight
- Change habits?
- Remove prompts, engage cortex
- Deconstruct "chunks"
- Rebuild habits
- Change takes commitment & effort
- Problem Areas – They're All Connected!
- Hands, arms
- Shoulders
- Necks
- Backs
- Cumulative Trauma Disorders (CTD's)
- Musculoskeletal disorders
- Repetitive use injuries to:
- Tendons, tendon sheaths
- Bones
- Muscles
- Nerves
- Dentistry: upper extremity CTD's = most common

- Carpal Tunnel Syndrome
- The Nature of Carpal Tunnel Syndrome
- Anatomy
- Narrow, unyielding carpal tunnel contains:
  - Median nerve
  - 9 flexor tendons
  - Blood & lymph vessels
  - Swelling, inflammation causes compression within tunnel
  - Tenosynovium Thickening
  - Irritation or inflammation → ischemia,
  - Over time damage becomes permanent
- Carpal Tunnel Symptoms
  - Hand, wrist numbness, first noticed at night
  - Thumb, forefinger, part of middle finger (NOT little finger!)
  - Progresses to weakness, pain, swelling – may manifest in forearm
  - If prolonged: loss of motor control of areas innervated by median nerve: clumsiness, burning
  - Nerve compression progresses from sensory to motor nerve fibers
- Who Has Symptoms of Carpal Tunnel Syndrome?
- Causes of Median Nerve Symptoms
  - Cervical alignment, pathology
  - Median nerve impingement, compression, entrapment along length of nerve
  - Thoracic outlet syndrome
  - Carpal tunnel syndrome
  - Thenar Muscle Loss
  - Weakness, atrophy
  - Wrist Postures
  - Deviated wrist positions increase pressure in Carpal tunnel:
    - Flexion: two fold
    - Extension: four fold
- CTS is More Likely With:
  - Wrist injury
  - Arthritis
  - Pregnancy
  - Diabetic neuropathy
  - Hypothyroidism
  - Smoking
  - Obesity
  - Caffeine intake
- Work-related Risks for CTS
  - Force
  - Posture
  - Wrist alignment
  - Repetition
  - Temperature
  - Vibration

- Pressure Related to Glove Fit
- Non- Surgical Treatment
- Anti-inflammatory meds
- Oral steroids
- Vit. B-6
- Exercises
- Remove traumatic activity
- Alter habits
- Treat medical conditions
- CTS Surgery
- Open release
- Endoscopic release

- Core “Girdle” Muscles:  
Deep Lumbar / Abdominal

- Lumbar Multifidi
- Core Breathing
- Stand – heels together, toes ~4” apart
- Elongate spine, neck (be tall)
- Pull belly button to spine
- Contract lower & upper abdominals
- Hand on chest
- Inhale deeply, expanding ribs laterally
- Exhale
- Repeat 3 times
- Joint Hyperlaxity
- Joints have unusually large range of motion (arch your hands, thumbs to wrist)
- Causes:
- Bone shape at ends
- Weak, stretched ligaments: collagen / protein problems, habits, genetics
- Poor muscle tone
- Dental hand risks:
- Thumb may collapse, stress joints
- Dull Instruments
- Sharp Instruments
- Grasp & Protective Bracing
- Bicep stretch
- Slowly, do NOT over-stretch
- Avoid shoulder pain
- Feet hip-width apart
- Arm - 90 degrees
- Chin tucked
- Blades & core set.

- Breathe out,
- Rotate body in opposite direction of arm.
- Feel stretch in front chest.
- Hold.
- Breathe in
- Release the stretch.
- 
- Chin Tucks
- Touch chin to chest
- Should feel stretch in back of neck
- Bring it up
- Make a double chin in forward position
- Hold 5 sec
- Balanced strength
- Shoulder Shrugs
- Keep both arms at sides
- Shrug shoulders toward ears
- Hold 3 sec
- Roll & lower shoulders backwards
- Keep elbows straight throughout exercise
- Scapular Retraction
- Keep both arms at side
- Bend elbows 90°
- Squeeze shoulder blades together, hold 10 sec
- Shoulder Anatomy
- Improper scapular movement leads to shoulder pathology
- Muscles hold bones in alignment
- (normal scapular plane shown)
- Shoulder Ligaments
- Connect bones to bones
- Main source of shoulder stability
- Prevent dislocation
- Joint Capsule
- Watertight sac around joint formed by capsular ligaments
- Bursa
- Fluid-filled sacs (lubricant)
- Rotator Cuff
- Capsule where head of humerus sits
- 4 major muscles stabilize rotator cuff, hold humerus in glenoid fossa
- Tendons attach muscles to bones
- Training goal: work to equalize muscle support of joint
- Engage your latissimus dorsi!

- Posture determines strength & weakness of muscles
- Nerves
- All hand and arm nerves travel through axilla (armpit)
- Radial, Ulnar, Median
- Sensory: pain, temperature, proprioception
- Motor: movement, muscle stimulation
- Blood vessels follow nerves
- Brachial Plexus Impingement
- Neurovascular bundle:
- Brachial plexus (network of motor & sensory nerves innervating arm, hand, shoulder)
- C8 & T1 nerve roots
- Subclavian artery & vein
  
- Thoracic Outlet Syndrome (TOS)
- Group of disorders
- Nerve & vascular compression
  
- TOS SIGNS
- Anterior scalene (tightness, pain)
- Costoclavicular approximation
- Clavical changes position
- Pectoralis minor tightness
- TOS Symptoms
- Pain, numbness, weakness, tingling in neck, shoulder, face, head
- Clavicle, shoulder, inside arm, hand: ring & pinky
- Symptoms worsen with use, arms lifted
- TMD, migraines
- Vascular symptoms = serious!
- Arm, shoulder = heavy, cold, blue, swollen
  
- Causes of TOS
- Sustained static postures
- Drooping shoulders / forward head posture
- Osteoporosis
- Carrying heavy loads
- Luggage, briefcases, shoulder bags
- Repetitive over-head arm movement
- Extra rib
- Car accidents
- Seat belts
  
- TOS is Difficult to Diagnose
- Confused with other disorders
- CTS (hand), cervical spine dis. (neck), nerve root compression (spine), tumors, bursitis (shoulder)
  
- Ulnar Nerve Neuropathy

- Dysfunction affects distal 2 1/2 fingers
- Caused by: injury, entrapment, compression
- Symptoms: pain, weakness
- Pick a partner
- One of you stand up
- Stand behind the seated partner
- Do 4 tests on seated person
- Switch places & repeat
- Look for a loss of pulse in 2 positions for each arm
- Scalene Maneuver
- Locate radial pulse
- Rotate head toward arm, tilt head backwards
- (+) = loss of pulse
- Allen Test
- Flex elbow to 90 degrees, shoulder extended horizontally & rotated laterally
- Turn head away
- (+) = loss of radial pulse
- Find a pulse.  
Look for a loss of pulse in both positions
- Chest, Arm Walk-through Stretch
- Higher hand position - pectoralis minor
  
- Lower position - pectoralis major
  
- Do NOT over-stretch - Avoid shoulder pain
- Trigger Points
  
- Group of muscle fibers – in constant contraction
- “knot”
- Pain = local or referred
- Active trigger point = painful
- Latent trigger point ➔ stiffness, limited range of motion
  
- Trigger Points are caused by:
  - Whiplash
  - Falls
  - Fractures
  - Dislocation
  - Sprains
  - Excessive exercise
  - Muscle overload, poor posture, muscle imbalances
  - Emotional stress
  
- Upper Trapezius Tension
  - Caused by:
    - Prolonged elevated shoulder (s)

- Rotated neck
- Raised arm(s)
- Emotional stress (ischemic pain)

- **Women's Head & Neck Issues**
- Women report 2- 4 x more muscle pain than men
- Women's muscles are narrower, & must exert 2/3 more force
- Bra straps compress upper trapezius
- Modesty: separation from patient's head: must extend neck & arms
- So.....
- Relax
- Position patient correctly
- Stretch
- Sit correctly
- Heat, massage
- Drink water!

- Remember.... Increase your range of motion, flexibility, circulation
- Stretches
- Perform slowly, carefully, smoothly
- Feel stretch intensely, but NO PAIN
- No bouncing
- Hold for 30 secs, slowly release
- Preventive Exercises
- Stop if you feel pain
- Warm & loosen muscles first
- Breathe
- Start easy: 2 sets of 10
- Don't exceed 3 sets of 20
- Stretching Tips
- Frequent micro-breaks = better than infrequent longer
- Stretching increases endurance & decreases micro-trauma
- Frequent breaks aid tissue repair
- Infrequent breaks do not!
- Seize the micro-moment!
- Sustain 15-30 sec., (2-3 breaths)
- How To Stretch
- Starting position
- Breath in
- Exhale as you reach stretch intensity
- Hold 2-3 breathing cycles
- Slowly release
- Return to neutral
- Find TRUE NEUTRAL
- Repeat (sets)

- Spinal Anatomy
- 33 vertebrae:
- Protect spine, vertical support
- 7 cervical
- 12 thoracic attached to ribs
- 5 lumbar
- 5 sacral: fused, hip region
- 4 coccygeal: fused, tailbone
- Kyphosis (Hunchback)
- Increase in normal kyphotic curvature – thoracic spine
- Causes: prolonged poor posture, osteoporosis, age
- Symptoms:
- prominent round back,
- head forward,
- neck strain,
- chest / lung compression
- Pain, stiffness, loss of range of motion
- Lordosis (Swayback)
- Increased curvature of lumbar spine: excessive arching, prominent buttocks
- Causes:
- Congenital, poor posture, abnormal positioning
- Symptoms:
- Lower back pain
- Sciatica / leg pain
- Less mobility
- Scoliosis
- S shaped curvature, thoracic region
- Causes:
- Congenital
- Prolonged lateral / rotated positioning
- Results:
- Muscle shortening, 1 side
- Muscle spasms
- Chronic pain, nerve impingements
- Adolescent scoliosis:
- Mostly young teenage girls
- Degenerative:
- 50 – 60 y/o males / females
- Back posture directly impacts spinal disc degeneration & herniation
- Prolonged pressure on discs prevents inflow of nutrients
- Like a sponge
- Disc requires alternate compression & decompression (relaxation)
- Lumbar disc compression increases 40% without lumbar support
- Lumbar disc pressure - always less with lumbar support!
- Low Back Pain

- Experienced by 80 – 85% of adults
  - Causes: injuries, arthritis, disc disease, aging
  - Among top 5 worker complaints
  - Prevention:
  - Strengthen key core “girdle” muscles: stabilize spine
  - Abdominals: transversus & rectus abdominus
  - Deep back muscles: lumbar multifidi
  - Pelvic floor
  - Core “Girdle” Muscles:  
Deep Lumbar / Abdominal
  - Lumbar Multifidi
  - Transversus abdominus
  - Lower Back Pain
  - Thoracic cage & abdomen = “hydraulic cylinder”: movement creates pressure
  - When girdle fails, large superficial muscles strain
  - Can’t protect vertebrae
  - Spasm, knot
  - Aberrant hip movement – cascade
  - MD’s rec: anti-inflammatory drugs, surgery
  - Try: acupuncture, phys. therapy
  - Deep Squat
  - Feet a little wider than shoulders, toes out 45 degrees.
  - Chest lifted, core braced, pelvic floor engaged, back flat.
  - Slowly inhale + bend knees,
  - Butt back & down - thighs parallel to ground
  - Hold 3 breaths
- 
- Quadruped Plank
  - Hands & knees on ground
  - Shoulders directly above wrists, hips above knees.
  - Tuck pelvic floor muscles, draw in abdomen.
  - Press hands down, lift knees off ground ~2”, 5-10 seconds.
  - Breath & repeat
- 
- Shoulder Bridge
  - On Back, knees bent, feet flat hip-width apart
  - Press lower back into floor.
  - On inhale, lift hips off floor, squeezing glutes at top.
  - Pull abs in and pelvic floor up.
  - Exhale as you lower hips
  - Repeat
- 
- The Slouch
  - Muscle ligaments accommodate frequent positions
  - stretch, shorten, strengthen or weaken

- “Resets” neutral to unbalanced posture
  - Long term damage:
  - Muscle strain, trigger points
  - Headaches
  - Disc degeneration, herniation
- 
- Is This Your Reality?
  - Fitting worker to equipment
  - Hand-me-downs?
  - Shared with others? (size, preferences...)
  - Who makes equipment decisions?
  - No, wrong, or inadequate adjustments
  - Short cords, limited space
  - Lighting: poor, excess, wrong spectrum, too limited
  - Is there a culture of safety and prevention?
- 
- We Need.....
  - Lumbar support
  - Shoulder freedom
  - Elbow space
  - Adjustability
  - Easy movement
- 
- Chairs
  - Variety of adjustments
  - Height, tilt, arms, back up & down, in & out
  - Models for short, tall workers
  - Best chair design - consider:
  - Automatic seat tilt:
  - Better circulation to legs
  - < back strain
  - Get close to patient
  - Back support
  - Up & down
  - In & out”
  - “floating” back
  - < back strain
  - Better posture
  - 5 Casters
  - Your size
- 
- Get Help!
  - See MD if:
  - pain @ night
  - Pain recurs, persists, increases
  - Leg numbness, tingling, weakness
  - Bowel, bladder dysfunction
  - Numbness in “saddle”

- Loss of movement
- Always ask: Is pain local or referred?
- Enhanced Visualization  
What's important?
- Heads up!  
(bowling ball on a stick)
- Heads weigh 10 – 15 lbs.
- ~42 lbs stress bending forward
- < 1 inch off neutral increases load 10 X
- Body accommodates, gets stuck
- Collagen lengthens: takes 20 min to stretch, 24 hrs to recover
- What's Important When Choosing A Loupe?

- Magnification
- Industry standards in measuring magnification vary
- Manufacturing tolerances vary
- Trade-off: with > magnification -
- need more light
- More weight
- Less depth of field

- Head Lamp Considerations

- Visual spectrum and intensity
- Weight
- Use-life
- Method of activation (ease & asepsis)
- Cost
- Good Luck & happy shopping!
- Myopia: Urban Vision
- N. Amer. & Eur.: 1/3 adults = myopic
- U.S. myopia has increased: in 1970: 25%, 2000: 42%
- (too fast for genetic change)
- Eye shape = determined by
- Genetics
- Growth in infancy, adolescence
- \*\*\*Daily behavior = most important!

- Urban Myopia
- Singapore young men: 80% myopic
- 1980: 43%
- now: "epidemic"
- Myopia is not increasing in rural areas
- Myopia increases risk of:
- Cataracts
- Glaucoma
- Detached retina
- So...Increase outside light exposure

- Blue Light Risks
  - Blue light is higher energy than red, green & yellow
  - Penetrates deep into eye to retina
  - Over exposure to blue light:
  - Reduced visual acuity & contrast sensitivity
  - Causes oxidative retinal damage
  - Can lead to macular degeneration (leading cause of blindness in western world)
- 
- Blue Light Risks
  - Sources of blue light
  - Smartphones: set screen brightness – schedule night levels
  - LED televisions, tablets, computer screens
  - LED/fluorescent indoor lighting
  - Dental risks:
  - High powered LED curing lights
  - LED head-mounted illumination systems
  - Whitening accelerator lamps
  - LED/fluorescent overhead exam lights
  - Blue Light Risks in Dentistry
  - Eye exposure to combined blue light causes oxidative stress, phototoxic effects
  - Mere seconds at close range using high-powered LED's kills cells in retina, inducing pro-inflammatory immune cascade, further damaging cell DNA.
  - Cyclic intense light exposure (light curing reflection) hazardous if exposed  $\geq 6$  seconds / day
  - Damage = irreparable
  - Cell debris builds up in basement membrane of retina
  - Slowly causes blindness
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- Blue Light Precautions
  - Protective eyewear
  - Lens coating filters harmful blue light without impacting color perception
  - Lenses should filter UV and HEV light & improve visual acuity
  - Nutritional supplements:
  - Macular pigments (Lutein, Zeaxanthin & Mesozaexanthin act to internally filter blue light & neutralize free radicals
  - Eat more green leafy vegetables (macular carotenoids & anti-oxidants)