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- 1 Identify biomechanical demands for playing specific instruments and instrumental groups
- 2 Identify pathologies and injuries specific to each instrument
- 3 Apply customized treatment and prevention strategies specific to the player and instrument

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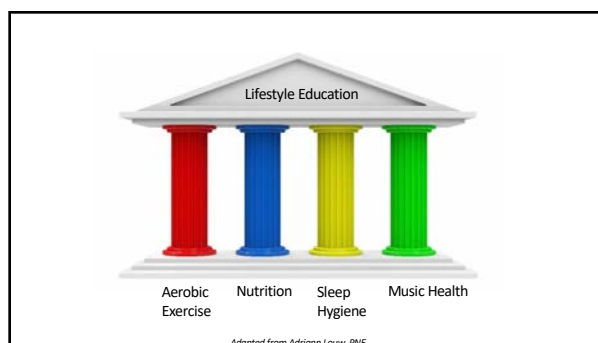
graph TD
    A[MUSIC TEACHER KNOWLEDGE] --> B[PLAYER]
    A --> C[PLAYING POSTURE]
    A --> D[PLAYING HABITS]
    A --> E[Environment]
    B --> B1[MSK]
    B --> B2[Sensorimotor]
    B --> B3[Cognitive/Perceptual]
    B --> B4[Psychosocial]
    C --> C1[Instrument]
    C --> C2[Biomechanics]
    C --> C3[Force]
    D --> D1[Performance]
    D --> D2[Practice]
    E --> E1[Sound]
    E --> E2[Lighting]
    E --> E3[Temperature]
  
```

The diagram illustrates the components of a music teacher's knowledge, organized into four main categories:

- PLAYER** (Red box):
 - MSK (Musculoskeletal)
 - Sensorimotor
 - Cognitive/Perceptual
 - Psychosocial
- PLAYING POSTURE** (Green box):
 - Instrument
 - Biomechanics
 - Force
- PLAYING HABITS** (Purple box):
 - Performance
 - Practice
- Environment** (Teal box):
 - Sound
 - Lighting
 - Temperature



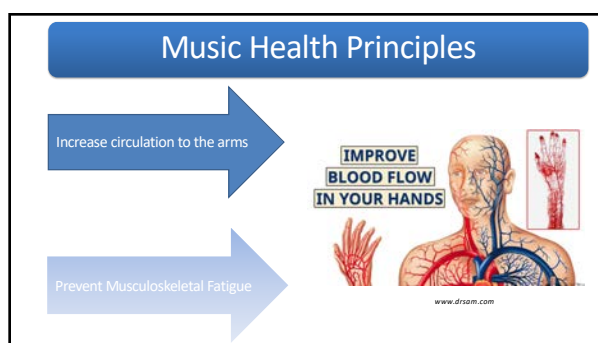
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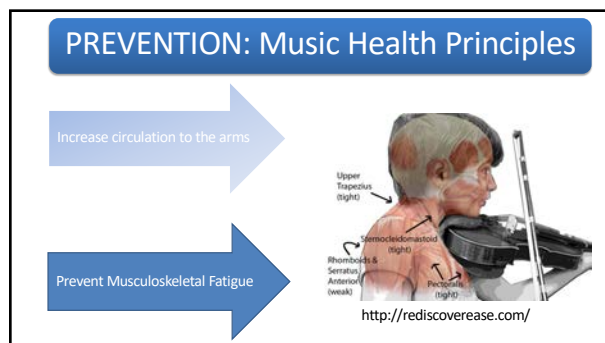
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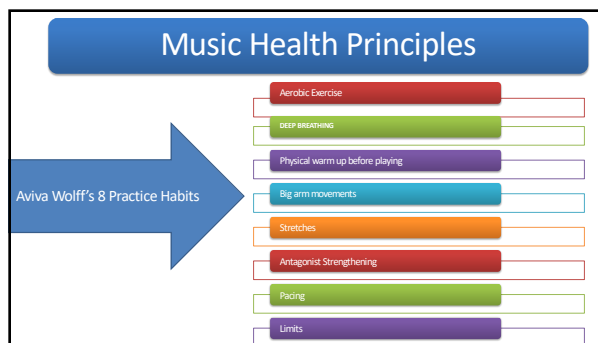
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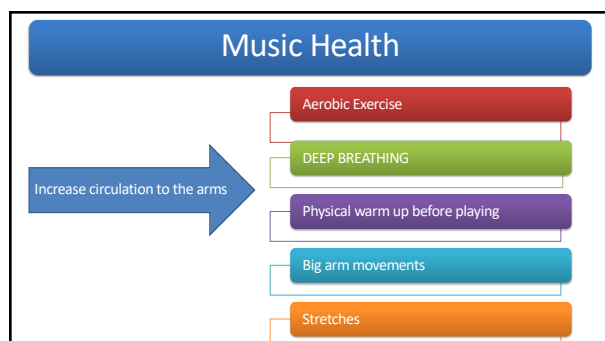
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Aerobic Exercise

15-20 minutes

3-5x/week

Something you like

<http://kinogalibrary.com>

14

Physical Warm-up before Playing

2-3 minutes before playing

To increase heart rate, circulation, blood flow

Allow for: Playing longer with less pain and fatigue

<http://kinogalibrary.com>

15

Warm Up: Big Arm Movements

15-20 Reps

Before Playing

Before Practice

<http://kinogalibrary.com>

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Stretches – to elongate short Muscles

Chest/Shoulders

Forearms

Lateral Trunk

<http://kinogalibrary.com>

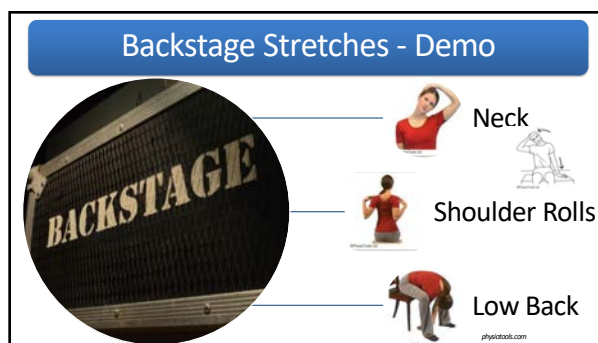
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Soft tissue release after playing

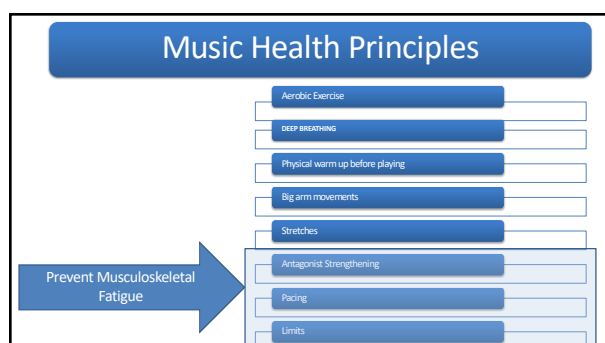
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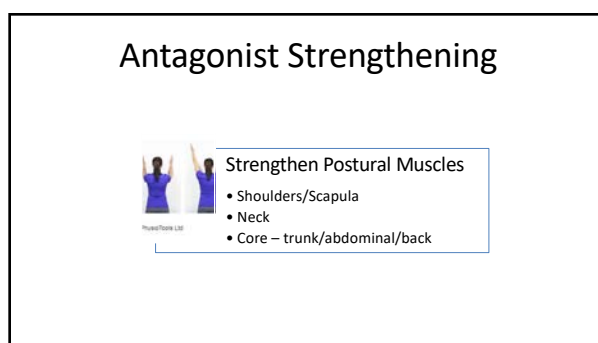
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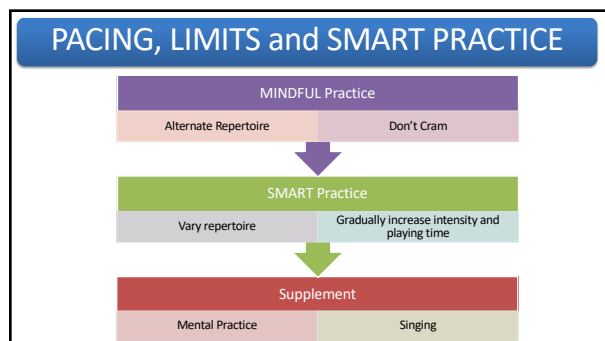
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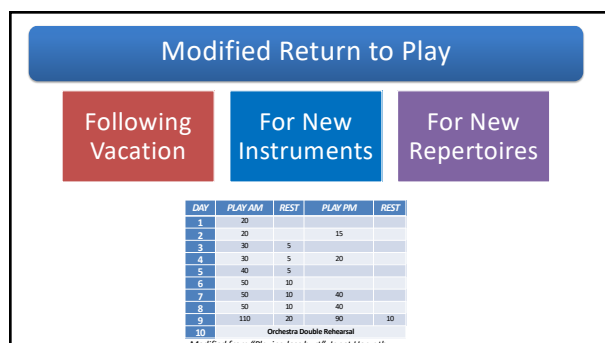
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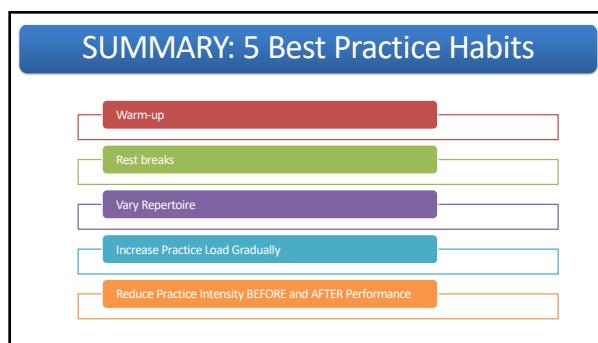
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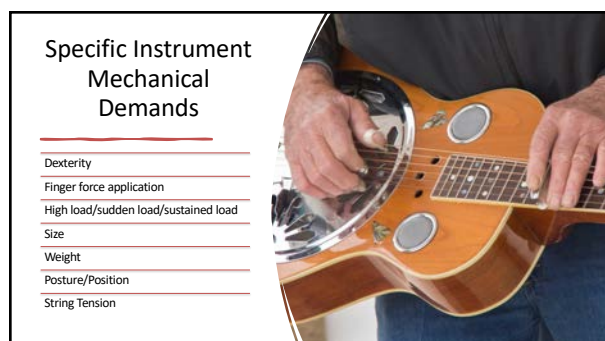
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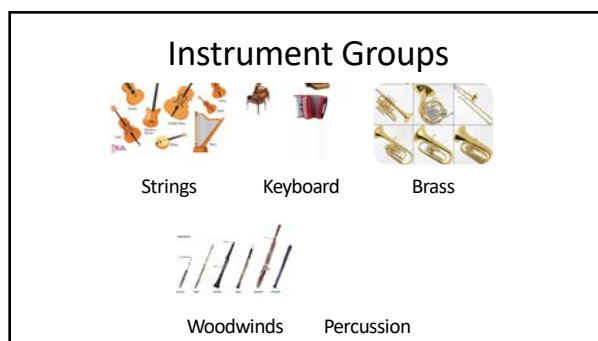
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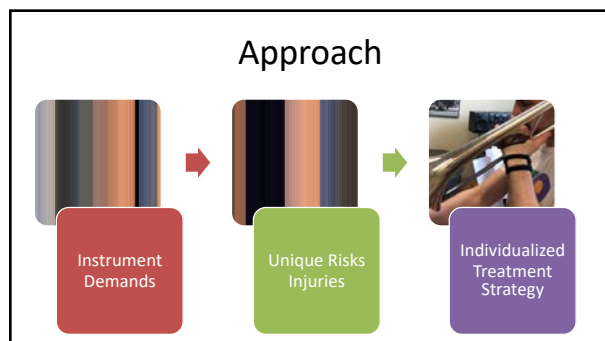
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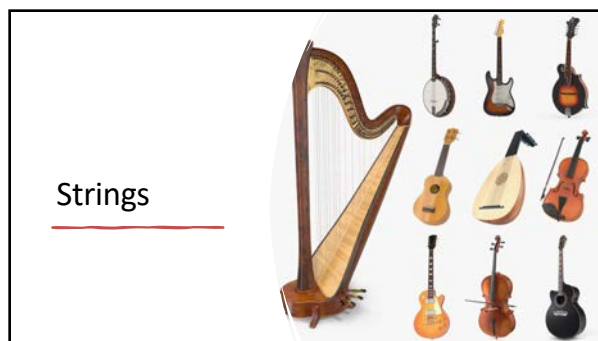
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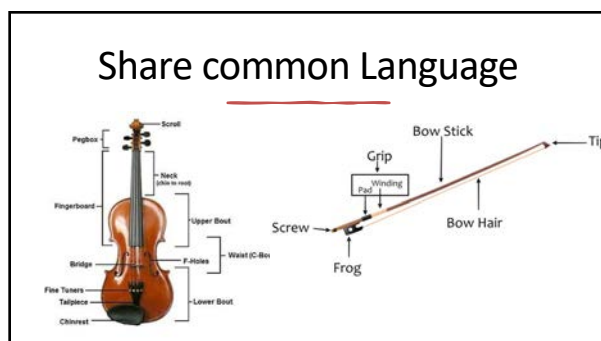
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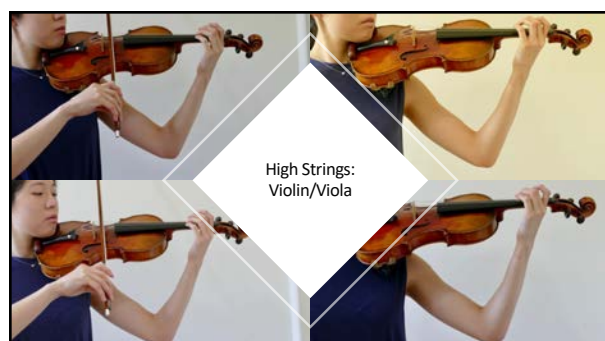
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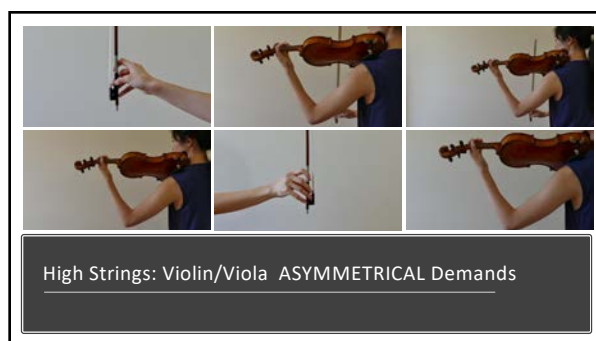
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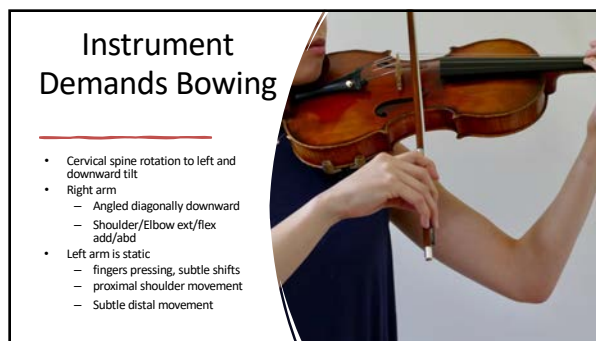
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Additional Playing Techniques

- Bowing Techniques
 - Legato
 - Detache
 - Martele
 - Staccato
 - Spicatto
 - Tremolo
- Pizzicato
- Vibrato



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Common Risk Factors/Injuries

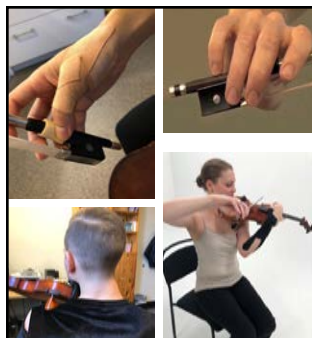
- Left hand/arm injury/pain more common
- Neck and Shoulder Pain
- Scapular Dyskinesia
- Tight cervical extensors
- Prolonged elbow flexion posture
- Tight flexors
- Weak Lumbricals
- Ulnar nerve tension



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Treatment and Prevention Strategies

- Proper chin-rest/shoulder rest set-up
- Stretches to address tight muscles
- Strengthening of weak muscles
- Lumbrical/Interossei Strengthening
- Elastic taping to decrease neural tension
- Isometrics to antagonists – Triceps/forearm rotators, wrist extensors
- Proper bow-hold
- Replace wood bow with lighter carbon fiber and graphite compound



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Low String - Cello/Upright Bass



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Baroque vs Modern Cello

- Shorter more upright neck
- Shorter fingerboard
- Shorter thinner bass-bar
- Thinner sound post
- Lower/different shape bridge
- No end pin
- Supported by legs

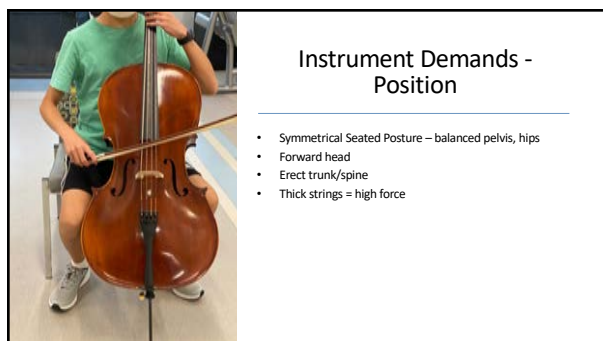


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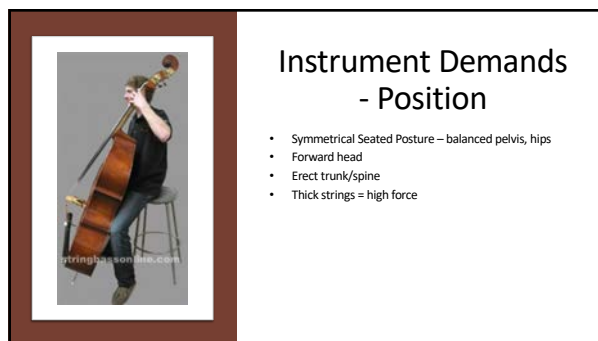
Low Strings: Upright Bass/Cell ASYMMETRICAL DEMANDS



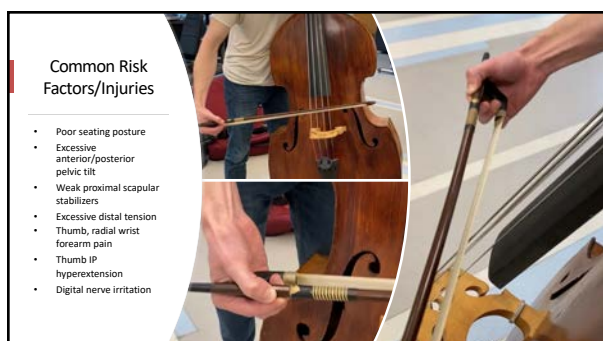
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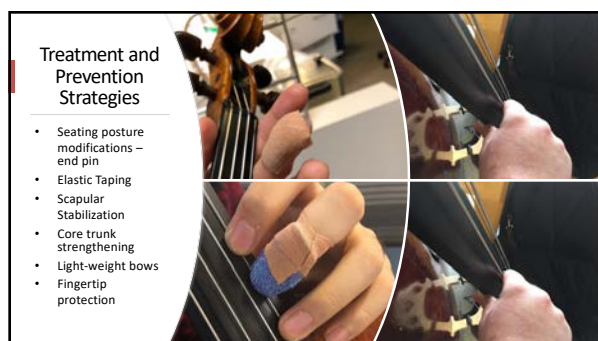
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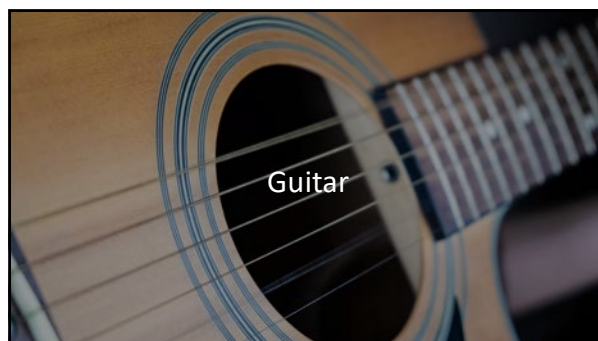
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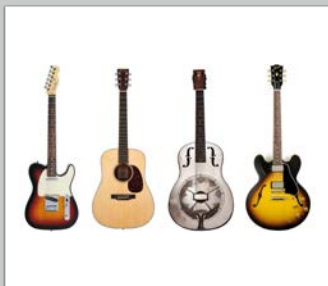
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Types of Guitar

- Classical
- Acoustic
- Electro-Acoustic
- Electric
- Bass



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Share Common Language



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Guitar: Instrument Demands

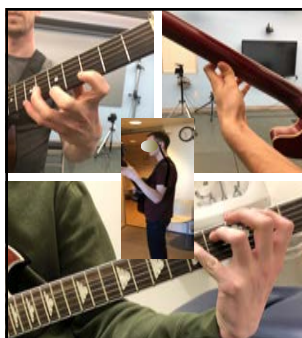
- Asymmetrical Posture
- Seated/Standing
- Prolonged sustained elbow flexion
- Repetitive forceful finger flexion
- Nylon strings wide gauge = lighter
- Steel strings – need callus
- Finger pick – sustained 2 pt pinch
- Guitar rests/Straps



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Common Risk Factors/Injuries

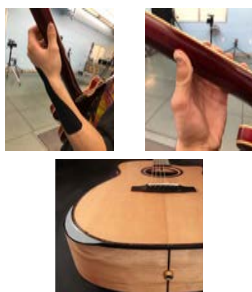
- Forward head
- Poor scapular control
- Right elbow ulnar nerve irritation
- Excessive overuse of flexors (digit/FCU)
- Excessive Left wrist flexion
- Excessive Left thumb tension
- Left thumb IP hyperextension



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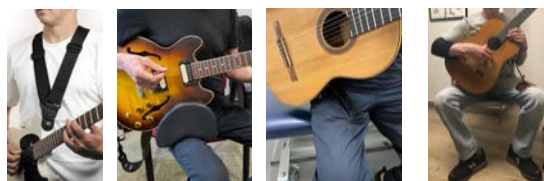
Treatment and Prevention Strategies

- Proper support/straps
- Angle neck diagonally
- Scapular stabilization
- Flexor Stretches
- Isometric Triceps/ECRL, ECRB, ECU
- Techniques to decrease thumb tension
- Light gauge strings
- Beveled edge or silicone sleeve



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Guitar Supports/Straps



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Other Strings HARP



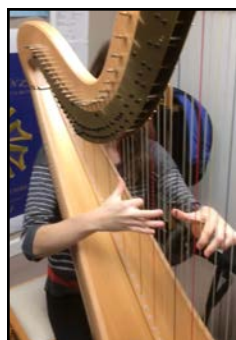
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Harp Playing Position

www.harpnotation.com

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Instrument Demands

- Symmetrical
- Rests on right shoulder
- Right hand plays notes in high register
- Left hand plays notes in lower register
- Left hand far reach
- Curved fingers
- Wide span

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Common Risk Factors/Injuries

- Overuse of long flexors (fingers/FCU)
- Excessive ulnar deviation at wrists
- Poor scapular control/Scapular protraction
- Anterior pelvic tilt/low back pain
- Poor trunk control
- Tight neck extensors/weak flexors
- Forward head posture



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Treatment and Prevention Strategies

- Intrinsic strengthening
- Isometric radial deviation
- Isometric ECU
- Deep neck flexor strengthening
- Neck extensor stretches
- Core postural control
- Seating modifications (wedge cushion)



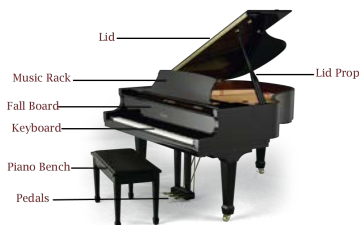
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Piano/Keyboards



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Share Common Language



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Instrument Demands

- Symmetrical
- Prolonged/Sustained elbow flexion
- Curved finger posture
- Strong proximal control
- Proper seated position
- Erect head and spine



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Common Risk Factors/Injuries

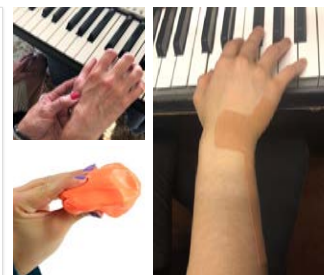
- Overuse long flexors
- Weak intrinsic
- Excessive ulnar deviation
- Insufficient rebound on keys
- Thumb joint pain
- Poor proximal stability
- Excess tension upper traps
- Improper bench height and bench distance
- Small hand span



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Treatment Strategies

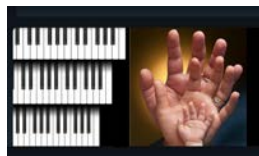
- Taping avoid excessive ulnar deviation
- Using forearm to roll into position
- Avoid holding tension – quick rebound – “bounce”
- Proximal scapular control
- Strengthening posterior shoulder muscles
- Isometrics – triceps, ECU, thumb
- Pronator/flexor stretches
- Chest Stretches



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Piano Ergonomic Keyboard

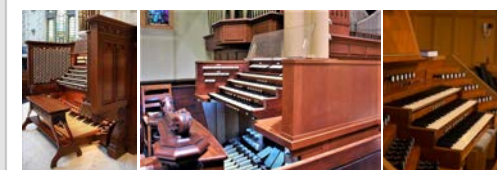
- 7/8 piano keyboard insert
- Small hands
- Customized to fit inside piano



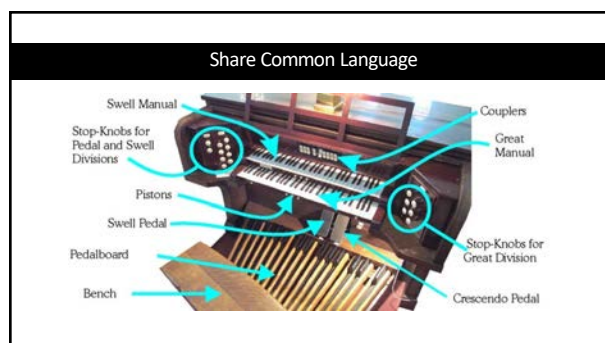
www.kmfa.org

65

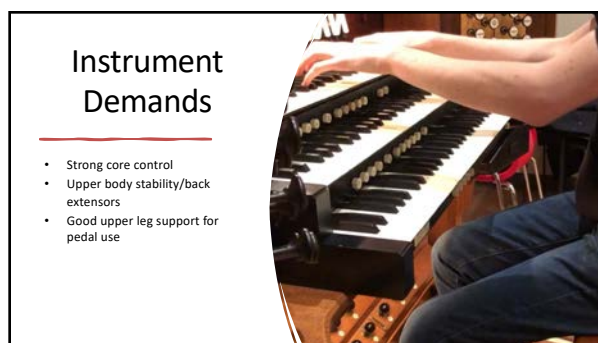
Organ



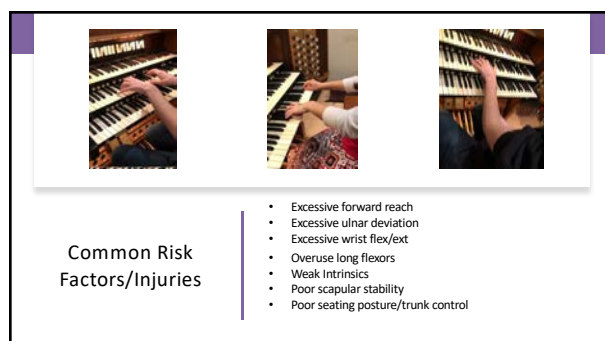
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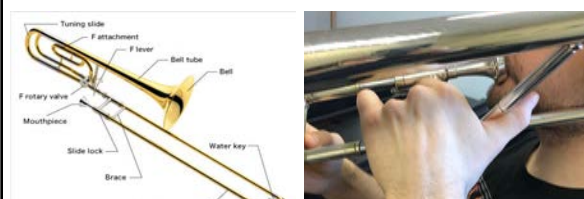
72

Share Common Language - Trumpet



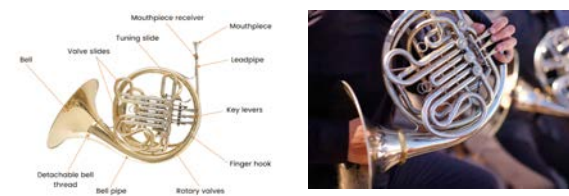
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Share Common Language - Trombone



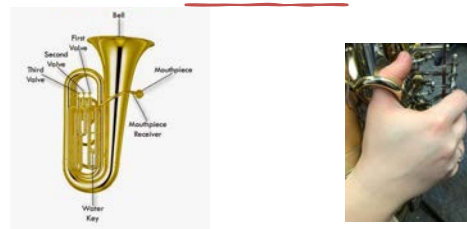
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Share Common Language - Horn



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Share Common Language - Tuba



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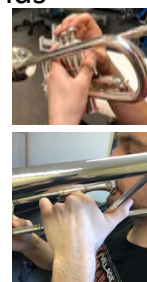
Other Brass Instruments



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Instrument Demands

- Vary in size and weight
- Asymmetric demands
- Weight support hand and thumb
- Requires proper balance and support
- Good head/neck upper body/trunk control
- Strong wrist stabilization



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Instrument Demands: Breath

Long airflow

Big sound

- free neck, flexible eyes, free ears, flexible jaw

Fast articulation

- light long arms, wide chest, collarbone, free and flexible shoulders, erect head

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Posture and Breath

80

Common Risk Factors/Injuries



- Wrist and thumb pain
- Digital nerve irritation
- Tenosynovitis of first dorsal compartment
- Bilateral ulnar nerve tension/tight anterior chest muscles
- Small stature/Tuba

81

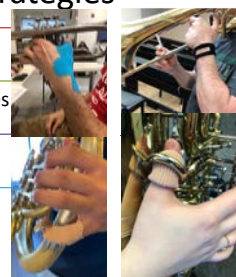
Treatment Strategies

Harnesses and straps

Gel caps/sleeves to pad digital nerves

Ulnar wrist support

Radial wrist isometrics



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Treatment Strategies: Supports



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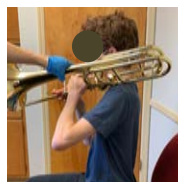
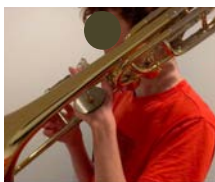
Treatment Strategies: Supports



www.ergobrass.com

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Treatment Strategies: Position



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Woodwinds



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Share Common Language: Bassoon



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Contrabassoon

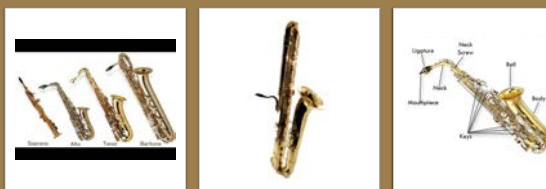


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Share Common Language: Oboe/Clarinet

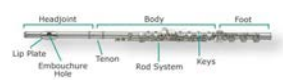
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Share Common Language: Saxophone

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Share Common Language - Flute



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Share Common Language - Reeds

- Bassoon
- Oboe
- Saxophone
- Clarinet
- Double vs Single



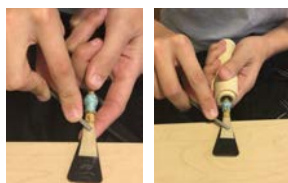
energy input strategies



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Reed Making

- Instrument specific
- Activity modification:
 - Position modification
 - Instrument modification



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Instrument Demands

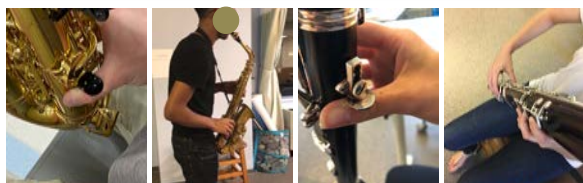
- Lip seal and position
- Blowing pressure
- Proper breathing
- Balanced neutral pelvis
- Weight distribution
- Strong postural and trunk control
- Strong upper body control
- Stable neutral wrists
- Stable curved thumb and fingers
- Mostly symmetrical
- Asymmetrical = flute



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Common Risk Factors/Injuries

- Forward Head
- Excessive hand span (Bassoon)
- Thumb tension/IP hyperextension (Flute, clarinet)
- Excessive wrist flexion – flute/bassoon
- Digital nerve irritation, instrument weight – saxophone, oboe, clarinet



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Instrument Demands: Breath

Long airflow

Big sound

- free neck, flexible eyes, free ears, flexible jaw

Fast articulation

- light long arms, wide chest, collarbone, free and flexible shoulders, erect head

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Treatment Strategies

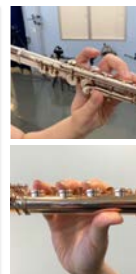
- Silicone caps
- Harnesses/Straps



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Common Risk Factors/Injuries Flute

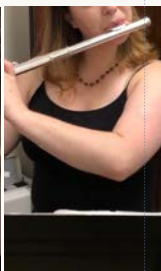
- Wrist extreme extension/deviation - right
- Left index finger awkward posture
- Thumb strain - short stature
- Thumb IP hyperextension
- Digital nerve tension



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Common Risk Factors/Injuries Flute

- Excessive lateral neck bending
- Excessive neck rotation
- Excessive wrist extension - left
- Neck/Shoulder Pain
- Tight Scalenes
- Scapular Protraction
- Weak Scapular Stabilizers



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Treatment Strategies: Flute

- Add levers and extended keys
- Silicone tab to raise key height (index flute)
- Bo-pep thumb guides
- Curved head-joint for short stature/children
- Isometrics to wrist flexors/FCU
- Elastic taping



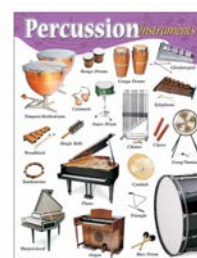
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Percussion



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Percussion Instruments



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Share Common Language

Mallet Percussion



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Share Common Language



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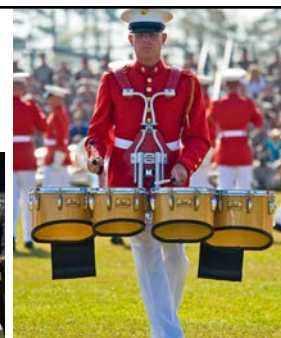
Typical Drum Set-up



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Marching Percussion/Marching Bands

- Weight requirements
- Bass drum = 15lb
- Snare drum = 20lb
- Aux Percussion = 10lb
- Tenors/Quints = 35lb
- Aerobic requirements



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Instrument Demands

- Wide range instruments, techniques, hand grips
- Rapid/forceful striking with sticks, mallets, bare hands
- Rapid deceleration of fingers and wrists
- Excessive wrist flexion/deviation
- Sustained elbow flexion
- Strong core and erect trunk/spine



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Physiologic Requirements

- Cardiorespiratory Endurance
- Muscular Endurance
- Muscle Strength
- Posture
- Flexibility

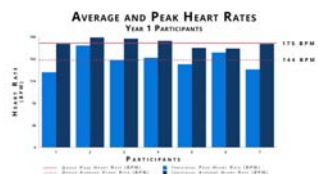
Whiplash Movie, 2014



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Physiologic Demands

• Nadia Azar, DRUMMERLab, University of Windsor



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Grip Types - Traditional

- Unmatched
- Used by Marching Bands
- Jazz drummers



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Other Grips

Matched



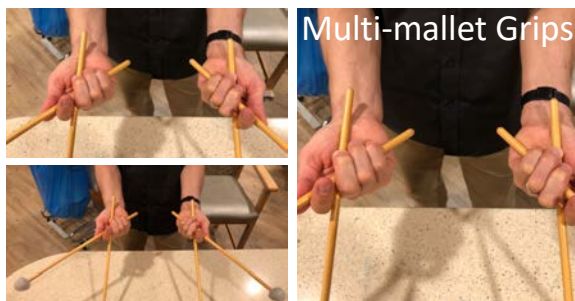
111

4-Mallet Technique



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Multi-mallet Grips



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Common Risk Factors/Injuries

- Excessive gripping
- Alternating instruments increases risk
- Improper height/distance
- Forearm and wrist pain
- Intersection syndrome



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Treatment Strategies

- Modify/Change grip
- Increase stick length/grip size
- Polymer drumsticks to decrease vibration
- Modify seating
- Ergonomic Set-Up



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References

1. Azar N. Rates and Patterns of Playing-related Musculoskeletal Disorders in Drummers. https://www.researchgate.net/publication/329181987_rates-and-patterns-of-playing-related-musculoskeletal-disorders-in-drummers. Accessed 06/30
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7. Ting A, Rocker J. Evaluation and treatment of musicians from a holistic perspective. *Open J Occup Ther*. 2019;7(4):1-10. doi: 10.15453/2168-6408.1581
8. Wolff AL. The musician. In: Jacobs MA, Austin NM, eds. *Orthotic intervention for the hand and upper extremity*. Wolters Kluwer; 2021.
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