New Advances and Techniques for Injury/Illness Prevention and Wellness Protection.

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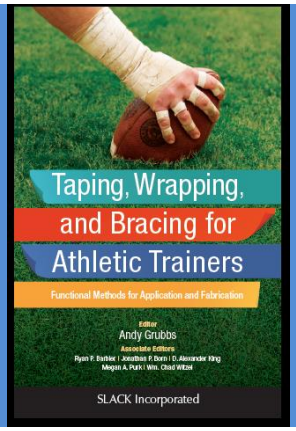
Disclosure

- Financial Relationship
  - Slack Books – Publication contract
- Nonfinancial Relationship
  - Breg Inc.
  - Gatorade
  - DonJoy
  - Medco
  - Dragonfly Max



Stats vs Clinical Practice

- Numbers vs People
- **Statistically significant BUT NOT clinically important**.
- Larger sample size
- If you have enough participants, even the smallest, trivial differences between groups can become statistically significant. It's important to remember that, just because a treatment is statistically significantly better than an alternative treatment, *does not necessarily mean that these differences are clinically important or meaningful to patients.*

Section 1

- Preventing injuries thru pre-activity screenings

Literature Review

- Use of a functional movement screening tool to determine injury risk in female collegiate athletes.
- *North Am Journal of Sports PT.* 2010
- 38 DII Female Athletes
- Score of less than 14, showed 4 times the chance of injury.

Literature Review

- NATA Position Statement: Preparticipation physical examinations and disqualifying conditions.
- *Journal of Athletic Training*. 2014
- Guidelines for orthopedic examination

Literature Review

- Gait retraining to reduce lower extremity loading in runners.
- *Clinical Biomechanics*. 2011
- Gait retraining in runners with recognized faults, reduced tibial load by 50%
- Can help reduce occurrence of further injury

Literature Review

- Eighteen years' experience applying old and current strategies in the pre-participation cardiovascular screening of athletes.
- *Hellenic Journal of Cardiology 2014.*
- *Group 1 – 12 lead, echo, hx, and exam*
- *Group 2 – same but no echo*
- *Both Methods found similar findings*
- *49.6% Group 1 and 48.9% for Group 2*

Literature Review

- Neuromuscular training for sports injury prevention: a systematic review.
- *Med. and Science in Sports and Exe.* 2010
- Lit Review
- Balance training can reduce occurrence of ankle sprains
- Especially for those with hx of ankle injury

Literature Review

- Functional movement screen and aerobic fitness predict injuries in military training.
- *Medicine and Science in Sports and Exe.* 2013
- 874 men in OCS
- PFT and FMS eval
- 3 mile RT >20.5 was 1.7 times more likely to have injuries in training
- Further look into FMS and PFT variables

Literature Review

- Application of next generation sequencing for personalized medicine for sudden cardiac death.
- *Frontiers in Genetics*. 2015
- Can use genetic testing to find abnormalities
- Costs is prohibited for large groups

Preliminary Conclusions

- Pre-Screening athletes can help indentify risk factors and conditions that with treatment can help reduce the likelihood of injury.

Objectives

- Identify and Breakdown components of pre-activity screening models.
- Identify different types of orthopaedic evaluations.
- Identify different types of body/movement screenings.
- Identify different cardiac testing methods.
- Identify different methods for gait assessment.
- Identify different methods for balance assessment.

What do you do?

Pre-Activity Screenings

- Pre-Participation Exam
- Specific Orthopedic Examinations
- Neck Strength
- Cardiovascular Examinations
- Gait Testing
- Balance Testing
- Movement / Activity Screenings

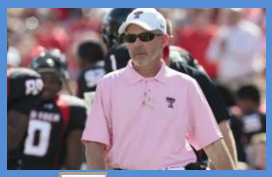
What are you looking for?

Pre-Participation Exams

- 2014 NATA Position Statement
- Breaks in recommended stations
  - Med and Family Hx
  - Health Screening – Ht. Wt. BP Pulse
  - Cardio Screening – 14 Element AHA Screening
  - Orthopedic Screening – 90 Second Ortho Screening
  - Final Checkout

Ortho. Examinations

- 90 Second Eval
- 2 Minute Eval
- Hughston Ortho Eval
- "Me Test"

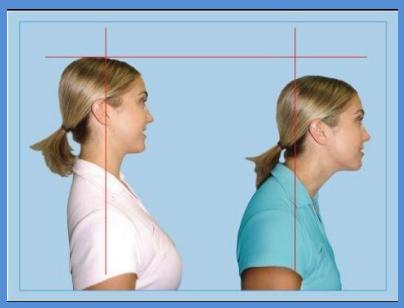


TABLE

THE 90-SECOND MUSCULOSKELETAL SCREENING EXAMINATION

INSTRUCTION	OBSERVATION
Stand facing examiner.	Acromioclavicular joints: general habitus
Look at ceiling, floor, over both shoulders, touch ears to shoulder.	Cervical spine motion
Shrug shoulders (resistance).	Trapezius strength
Abduct shoulders to 90° (resistance at 90°).	Deltoid strength
Full external rotation of arms.	Shoulder motion
Flex and extend elbows.	Elbow motion
Arms at sides, elbows at 90° flexed; pronate and supinate wrists.	Elbow and wrist motion
Spread fingers; make fist.	Hand and finger motion, strength, and deformities
Tighten (contract) quadriceps; relax quadriceps.	Symmetry and knee effusions, ankle effusion
"Duck walk" away from and toward examiner.	Hip, knee, and ankle motions
Back to examiner.	Shoulder symmetry; scoliosis
Knees straight, touch toes.	Scoliosis, hip motion, hamstrings tightness
Raise upon toes, heels.	Calf symmetry, leg strength

From: Carek P.J. et al.[12]



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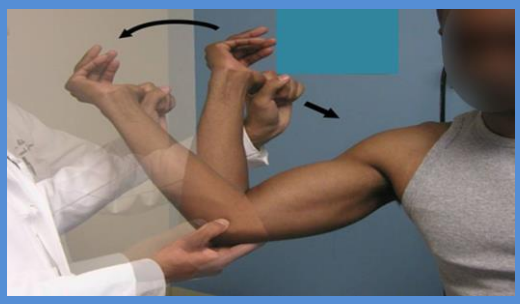

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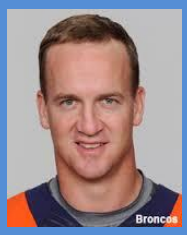
Does it work?

- NATA PS
- In conjunction w/ accurate hx, >90%
- 51% Sensitive and 97% Specific

Neck Strength

- Bring back the neck machines!!!!!!!
- Also looking at measuring girth



2014 Neck Strength Study

- Developed low cost neck strength measuring device

2014 Neck Strength Study

- Measured 6,662 high school athletes
- Of those 179 were diagnosed w/ Concussion
  - 107 girl, 72 boys
- Gaining 1 pound of neck strength can reduce likelihood by 5%

Cardiac Testing

- Chest X-Ray
- EKG
- Echo
- TransEsophageal Echo (TEE)
- Stress Test- Treadmill, Echo (used in unstable patients), Nuclear(used in unstable patients)
- Chemical (Isotope) Stress Test
- Tilt Table Test
- Holter Monitor
- Cardiac Cath/Angiogram

NCAA Statement

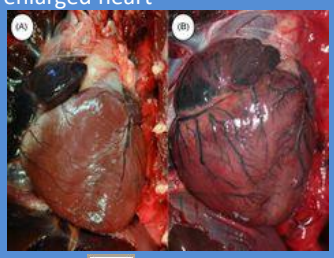
- Pre-Participation Evaluation of Student-Athletes
- The purpose of the evaluation, as stated in the 2014-15 NCAA Sports Medicine Handbook, is explained to the student-athlete.
- The cardiac evaluation includes, at minimum, a comprehensive personal and family history, and physical examination, such as the American Heart Association 14-point evaluation or the Pre-Participation Physical Evaluation Monograph, Fourth Edition.
- The pre-participation evaluation either is conducted on campus under the supervision of the institution's director of medical services or is reviewed by a process that is supervised by the institution's director of medical services.

NCAA Statement

- If an electrocardiogram (ECG) is included in addition to history and physical screening, best practices include:
- Pre-ECG screening planning is performed with a multidisciplinary team.
- The student-athlete is provided an in-depth explanation for the rationale of ECG screening and the possible risk vs. benefit of adding ECG screening.
- Modern athlete-specific ECG interpretation standards are used.
- Skilled cardiology oversight is available.

Chest X-Ray

- Looking for enlarged heart



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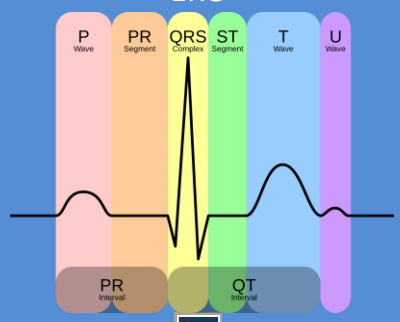
EKG


P
Wave
PR
Segment
QRS
Complex
ST
Segment
T
Wave
U
Wave
PR
Interval
QT
Interval

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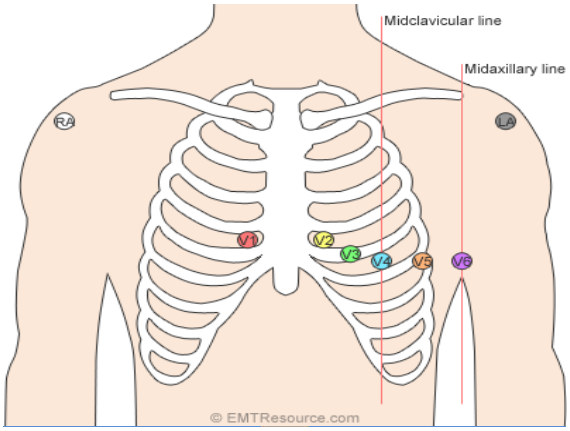
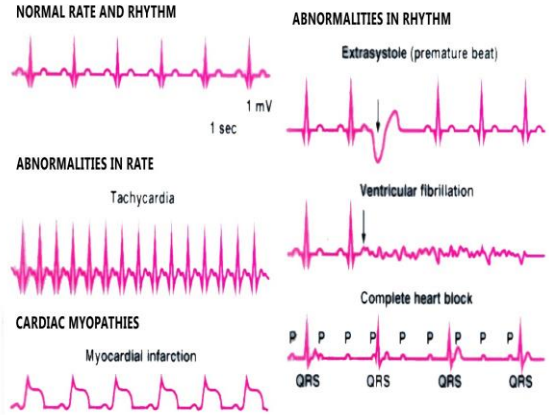
EKG

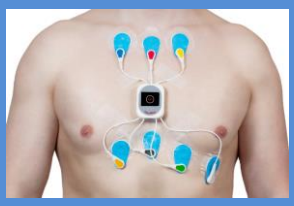
- Looking at electrical activity of the heart
- 10 connections
- 6 on chest
- 4 on limbs





Holter Monitor

- Records EKG readings over an extended time period.



Does it work?

- Studies are mixed
- 2014 Helleric Study showed EKG was more valuable to excluding athletes than echo.
  - 13 to 1
- What is abnormal to gen pop is not abnormal in athletes…
  - Circulation Journal article, 2011

Echo

- Ultrasound test to determine size, structure, and movement of the heart

What does it look for?

- Look for the cause of abnormal heart sounds (murmurs or clicks), an enlarged heart, unexplained chest pains, shortness of breath, or irregular heartbeats.
- Check the thickness and movement of the heart wall.
- Look at the heart valves and check how well they work.
- Measure the size and shape of the heart's chambers
- Check the ability of your heart chambers to pump blood (cardiac performance)
- Detect a disease that affects the heart muscle and the way it pumps

Does it work?

- Depends on what they are looking for…
- But generally research shows they are 80 to 100% accurate

DNA Profile

- Can DNA testing become a predictor for cardiac abnormalities?

Next Generation Sequencing

- 2015 Frontiers in Genetics Article
- Also known as high-throughput sequencing, is the catch-all term used to describe a number of different modern sequencing technologies including:
  - Illumina (Solexa) sequencing
  - Roche 454 sequencing
  - Ion torrent: Proton / PGM sequencing
  - SOLiD sequencing

Does it work?

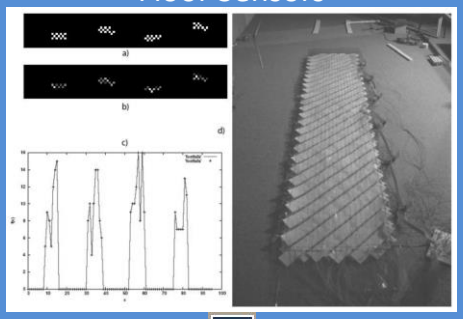
- Initial research shows it is effective but cost prohibited at this moment
  - No Hx but abnormal EKG
  - Family Hx, looking for specific sequencing

Gait Testing

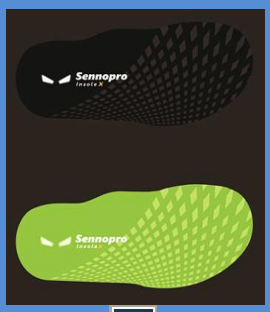
- 3 Common Assessment Methods
  - Image Processing
  - Floor Sensors
  - Wearable Sensors
- *Sensors* ***2014, 14, 3362-3394***

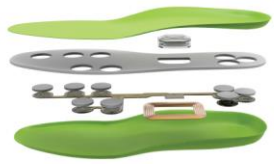
Image Processing

Floor Sensors



Wearable Technology





footlogger.

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What are you looking for?

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What are you looking for?

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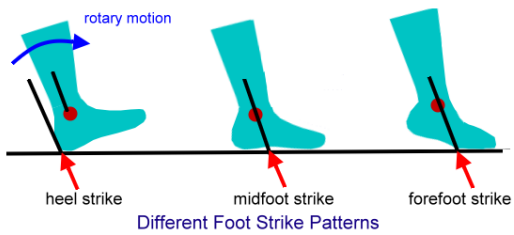
What are you looking for?



Who still looks at shoes?

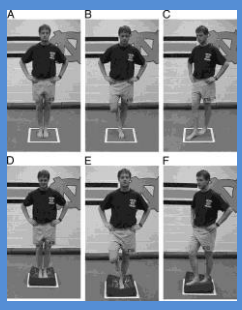
Does it work?

- 2011 Clinical Biomech Study - Military
- Took ten runners w/ predisposing problem
  - Tibial Acceleation > 8g "Stomp Running"
- 2 weeks – 8 sessions of retraining
- Reduce forces by 50%
- Maintained at 1 month recheck

Balance Testing

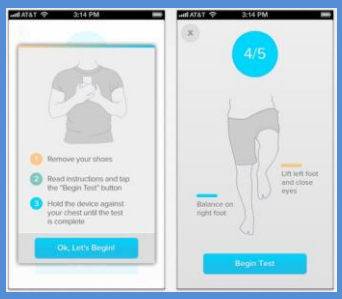
Methods

- BESS
- 6 Positions



Methods

- Sway

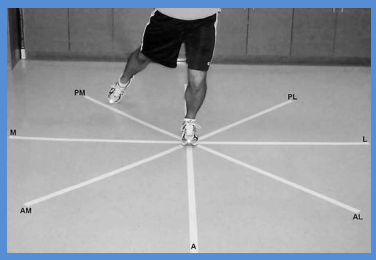


Methods

- Biodex

Methods

- Star Test



Methods

What are you looking for?

[redacted]

What you aren't looking for?

Does it work?

- 2010 Lit. Review
- 7 Balance Studies
- Balance training can help reduce ankle and knee injuries
- Especially for those w/ hx of previous injury

FMS

- Functional Movement Screening
- Utilizing seven motion patterns
- Looking for limitations or imbalances

Scoring of the FMS

3 -Perform pattern as directed

2 -Perform pattern with compensation/imperfection

1 -Unable to perform pattern

0 -Pain with pattern regardless of quality

FUNCTIONAL MOVEMENT SYSTEMS FMS FUNCTIONALMOVEMENT.COM

FMS

THE FUNCTIONAL MOVEMENT SCREEN

SCORING SHEET

NAME DATE DOB

ADDRESS

CITY, STATE, ZIP PHONE

SCHOOL/AFFILIATION

SSN HEIGHT WEIGHT AGE GENDER

PRIMARY SPORT PRIMARY POSITION

HAND/LEG DOMINANCE PREVIOUS TEST SCORE

TEST		RAW SCORE	FINAL SCORE	COMMENTS
DEEP SQUAT				
HURDLE STEP	L			
	R			
INLINE LUNGE	L			
	R			
SHOULDER MOBILITY	L			
	R			
IMPINGEMENT CLEARING TEST	L			
	R			
ACTIVE STRAIGHT-LEG RAISE	L			
	R			
TRUNK STABILITY PUSHUP				
PRESS-UP CLEARING TEST				
ROTARY STABILITY	L			
	R			
POSTERIOR ROCKING CLEARING TEST				
TOTAL				

Raw Score: This score is used to denote right and left side scoring. The right and left sides are scored in five of the seven tests and both are documented in this space.

Final Score: This score is used to denote the overall score for the test. The lowest score for the raw score (each side) is carried over to give a final score for the test. A person who scores a three on the right and a two on the left would receive a final score of two. The final score is then summarized and used as a total score.

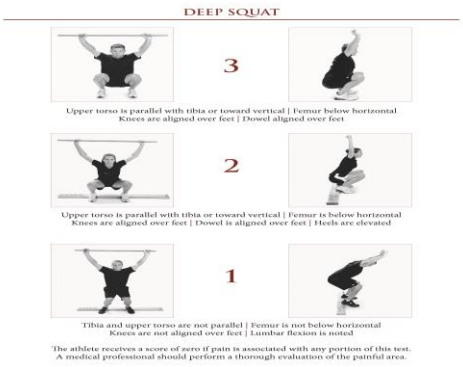
What is the purpose?

- Identify individuals at risk, who are attempting to maintain or increase activity level.
- Assist in program design by systematically using corrective exercise to normalize or improve fundamental movement patterns.
- Provide a systematic tool to monitor progress and movement pattern development in the presence of changing fitness levels.
- Create a functional movement baseline which will allow rating and ranking movement for statistical observation.

Conducting the Test

- Each movement has 3 attempts
- Move around to score
- Don't coach the test taker
- Can repeat instructions as needed
- When in doubt, score low

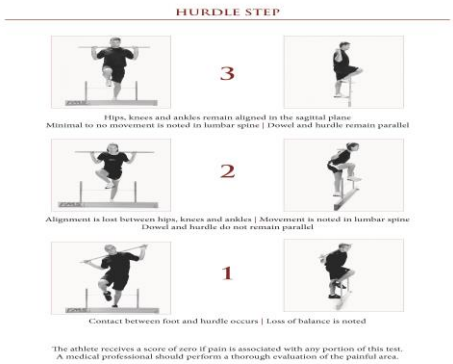
Pattern One – Deep Squat



Script

- Stand tall with your feet approximately shoulder width apart and toes pointing forward.
- Grasp the dowel in both hands and place it horizontally on top of your head so your shoulders and elbows are at 90 degrees.
- Press the dowel so that it is directly above your head.
- While maintaining an upright torso, and keeping your heels and the dowel in position, descend as deep as possible.
- Hold the descended position for a count of one, then return to the starting position.
- Do you understand the instructions?

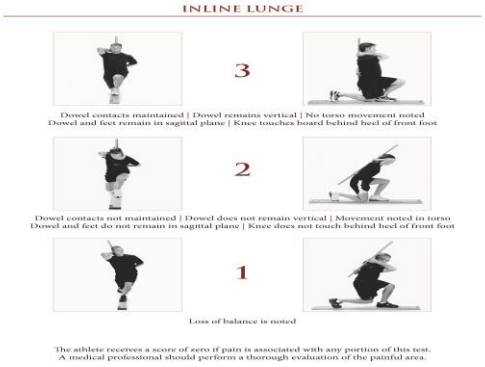
Pattern 2 – Hurdle Step



Script

- Stand tall with your feet together and toes touching the test kit.
- Grasp the dowel with both hands and place it behind your neck and across the shoulders.
- While maintaining an upright posture, raise the right leg and step over the hurdle, making sure to raise the foot towards the shin and maintaining foot alignment with the ankle, knee and hip.
- Touch the floor with the heel and return to the starting position while maintaining foot alignment with the ankle, knee and hip.
- Do you understand these instructions?

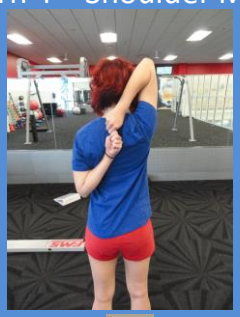
Pattern 3 – Inline Lunge



Script

- Place the dowel along the spine so it touches the back of your head, your upper back and the middle of the buttocks.
- While grasping the dowel, your right hand should be against the back of your neck, and the left hand should be against your lower back.
- Step onto the 2x6 with a flat right foot and your toe on the zero mark.
- Both toes must be pointing forward, with feet flat.
- Maintaining an upright posture so the dowel stays in contact with your head, upper back and top of the buttocks, descend into a lunge position so the right knee touches the 2x6 behind your left heel.
- Return to the starting position.
- Do you understand these instructions?

Pattern 4 – Shoulder Mobility



SHOULDER MOBILITY

3

Fists are within one hand length

2

Fists are within one-and-a-half hand lengths

1

Fists are not within one and half hand lengths

The athlete will receive a score of zero if pain is associated with any portion of this test. A medical professional should perform a thorough evaluation of the painful area.

CLEARING TEST

Perform this clearing test bilaterally. If the individual does receive a positive score, document both scores for future reference. If there is pain associated with this movement, give a score of zero and perform a thorough evaluation of the shoulder or refer out.

Script

- Stand tall with your feet together and arms hanging comfortably.
- Make a fist so your fingers are around your thumbs.
- In one motion, place the right fist over head and down your back as far as possible while simultaneously taking your left fist up your back as far as possible.
- Do not "creep" your hands closer after their initial placement.
- Do you understand these instructions?

Clearing Script

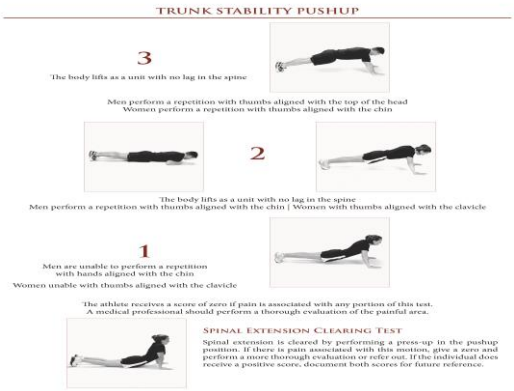
- Stand tall with your feet together and arms hanging comfortably.
- Place your right palm on the front of your left shoulder.
- While maintaining palm placement, raise your right elbow as high as possible.
- Do you feel any pain?

Pattern 5 – Active SLR

Script

- Lay flat with the back of your knees against the 2x6 with your toes pointing up.
- Place both arms next to your body with the palms facing up.
- Pull the toes of your right foot toward your shin.
- With the right leg remaining straight and the back of your left knee maintaining contact with the 2x6, raise your right foot as high as possible.
- Do you understand these instructions?

Pattern 6 – Trunk Stability Pushup



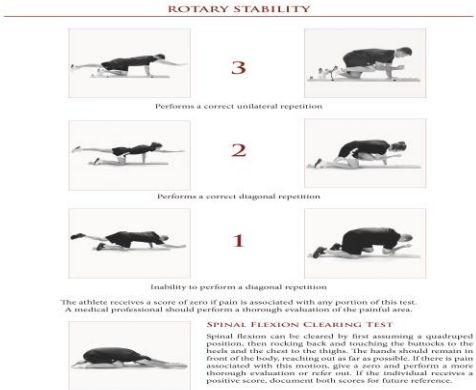
Script

- Lie face down with your arms extended overhead and your hands shoulder width apart.
- Pull your thumbs down in line with the ___ (forehead for men, chin for women).
- With your legs together, pull your toes toward the shins and lift your knees and elbows off the ground.
- While maintaining a rigid torso, push your body as one unit into a pushup position.
- Do you understand these instructions?

Clearing Script

- While lying on your stomach, place your hands, palms down, under your shoulders.
- With no lower body movement, press your chest off the surface as much as possible by straightening your elbows.
- Do you understand these instructions?
- Do you feel any pain?

Pattern 7 – Rotary Stability



ROTARY STABILITY

3

Performs a correct unilateral repetition

2

Performs a correct diagonal repetition

1

Inability to perform a diagonal repetition

The athlete receives a score of zero if pain is associated with any portion of this test. A medical professional should perform a thorough evaluation of the painful area.

SPINAL FLEXION CLEARING TEST

Spinal flexion can be cleared by first assuming a quadruped position, then rocking back and touching the buttocks to the heels and the chest to the thighs. The hands should remain in front of the body, reaching out as far as possible. If there is pain associated with this motion, give a zero and perform a more thorough evaluation or refer out. If the individual receives a positive score, document both scores for future reference.

Script

- Get on your hands and knees over the 2x6 so your hands are under your shoulders and your knees are under your hips.
- The thumbs, knees and toes must contact the sides of the 2x6, and the toes must be pulled toward the shins.
- At the same time, reach your right hand forward and right leg backward, like you are flying.
- Then without touching down, touch your right elbow to your right knee directly over the 2x6.
- Return to the extended position.
- Return to the start position.
- Do you understand these instructions?

Clearing Script

- Get on all fours, and rock your hips toward your heels.
- Lower your chest to your knees, and reach your hands in front of your body as far as possible.
- Do you understand these instructions?
- Do you feel any pain?

Does it work?

- 2010 Journal of Sports Physical Therapy
- 38 D2 Female Athletes
- Score of 14 or less had 69% chance of injury
- Sensitivity was 58%
- Specificity was 74%

Physical Fitness Test (PFT)

Pull Ups – 2 min

H

Abdominal Crunches – 2 min

H

3 Mile Run

H

Does it work?

- 2013 Med and Science in Sports and Exe
- Utilized FMS and PFT
- 874 candidates entering 6 or 10wk training
- RT >20.5 min were 1.7 times more likely
- Combine RT with FMS <14 4.2 more likely

Clinical Question #1

- Can a research based pre-activity screening model accurately find and distinguish factors that need treatment or correction to limit injury and death from involvement in sports?
- P –Individuals participating in athletic practices and competitions.
- I – Implementation of a Pre-Activity Screening Model.
- O – Finding pre-existing conditions or other restrictions that could pre-dispose the individual to injury.

What does it all mean?

- Breaking the old standards
- Cross your arm test…

Section 2

- Taping, Wrapping, and Bracing for injuries

Literature Review

- Immediate effect of forearm Kinesio taping on maximal grip strength and force sense in healthy collegiate athletes.
- *Physical Therapy in Sport*. 2010
- 21 Collegiate Athletes, all male
- Max Grip Strength, then retest w/ No tape, Placebo tape, or kinesiology tape
- No change in max grip strength

Literature Review

- Comprehensive testing of 10 different ankle braces: evaluation of passive and rapidly induced stability in subjects with chronic ankle instability.
- *Clinical Biomechanics*. 2002
- Tested 10 different ankle braces.
- Made recommendations based on what motions you want to restrict

Literature Review

- The effect of taping versus semi-rigid bracing on patient outcome and satisfaction in ankle sprains.
- *BMC Musculoskeletal Disorders*. 2012
- 100 patients w/ Grade II or III, tx for 4 weeks
- Brace had better comfort and less skin irritation to tape
- Both were similar when looking at final outcome and pain

Literature Review

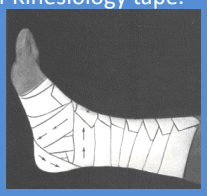
- A systematic review of prophylactic braces in the prevention of knee ligament injuries in collegiate football players.
- *Journal of Athletic Training*. 2008
- Lit Review of 7 studies
- 4 showed increase in injury
- 3 showed decrease

Literature Review

- Kinesio taping in treatment and prevention of sports injuries.
- *Sports Medicine*. 2012
- KT shows small effect on strength, prop., and AROM
- No benefit to pain or support

Preliminary Conclusions

- Taping and Bracing for athletic injuries can help provide support and function in injured and non-injured athletes. Research is varied about the effectiveness of Kinesiology tape.



Objectives

- ❖Identify commonly used Kinesiology tape applications and evaluate their merit.
- ❖Identify commonly used protective braces and evaluate their merit.
- ❖Identify commonly used tapping applications and evaluate their merit.

Kinesiology Tape

Methods

- Muscle Inhibition vs. Facilitation
  - Inhibition: Tape-stretch
    - Insertion to Origin
    - To relax tired or overused muscles (therapy)
  - Facilitation: Tissue-stretch
    - Origin to Insertion
    - To stimulate weak or underused muscles (rehabilitation)

Methods

- Tension Guidelines
  - Anchors: 0%
  - Light: 15-25%
  - Moderate: 25-50%
  - Severe: 50-75%
  - Full: 75-100%

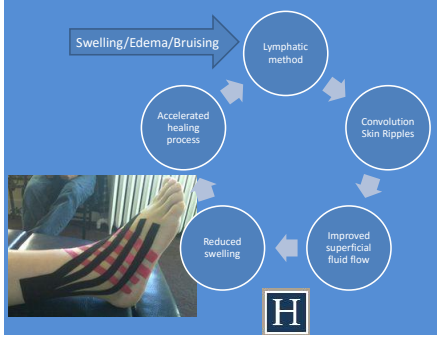
Methods

Therapeutic Effects	Application	Outcomes
Microcirculatory Effect	Microcirculatory Application Stretch the muscle AND the tape	Reduces swelling, edema, and bruising
Neurosensory Effect	Neurosensory Application Stretch the muscle NOT the tape	Maximally reduces pain and improves muscle activation
Structural Effect	Structural Application Stretch the tape NOT the muscle	Improves static or dynamic posture and prevents potentially harmful ROM

Theory

- Theorized to:
  - Stimulate surface receptors
  - Increase joint kinematics
  - Increase muscle strength
  - Improve proprioception
  - Facilitate joint and muscle realignment
  - Improve circulation
  - Decrease pain

Theory



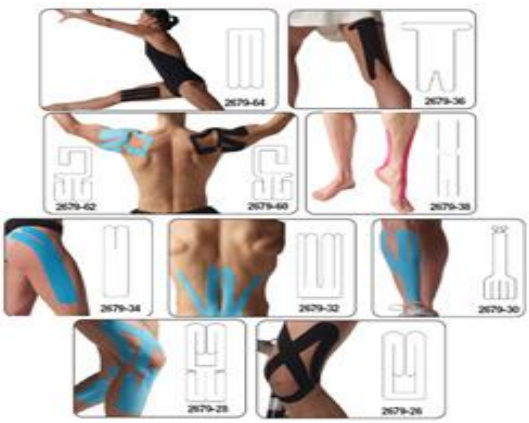
Description

- 100% Cotton
- Stretch up to 40% of original length
- Hypoallergenic glue
- Latex-free
- One application should last 3-5 days
- Mimic elastic properties of skin
- Water resistant

Pre Cut vs Patterns

Power Strips Pieces

- Y Shaped- Larger muscles such as the deltoid
- I Shaped- Small or linear places such as teres minor or rhomboids
- X Shaped- Large and long muscles such as biceps femoris

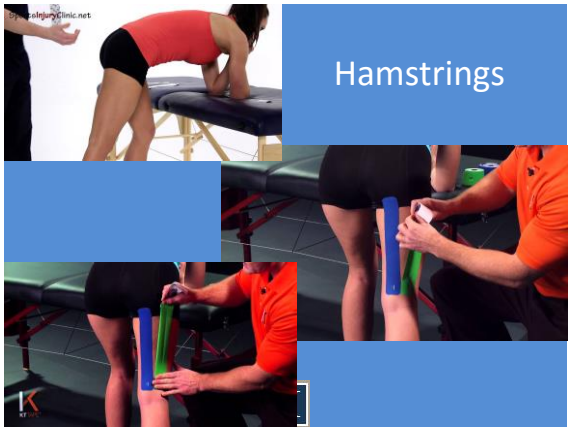


Upper Legs

- IT Band Hips
- Quad
- Hamstring
- Groin
- Hip Flexor
- Glute

IT Band

Quadriceps



Groin

Hip Flexor

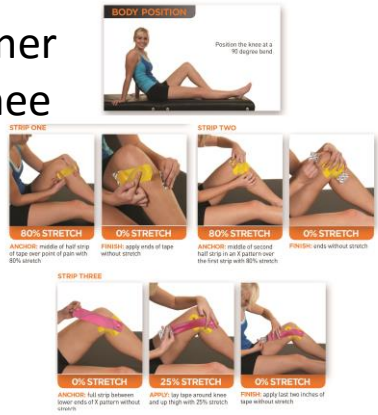
Gluteus

Knee

- Outer Knee
- Inner Knee
- Full Knee Support
- Osgood Schlatter
- Back of Knee

Outer Knee

Inner Knee



Full Knee Support

Osgood Schlatter

Back of Knee

Lower Leg/Ankles/Feet

- Achilles Tendonitis
- Calf Strain
- Ankle Stability
- Peroneal Tendonitis
- Shin Splints
- Posterior Shin Splints
- Ball of Foot
- Top of Foot
- Heel
- Bunion
- Turf Toe
- Plantar Fasciitis

Achilles

Gastroc

Ankle Stability

Peroneal Tendons

Shin Splints

Alt. Shin Splints

Bottom of Foot

Top of Foot

Heel

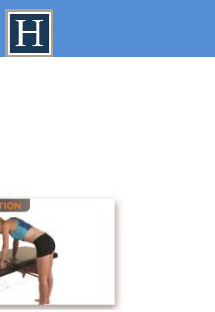
Bunion

Turf Toe

Plantar Fasciitis

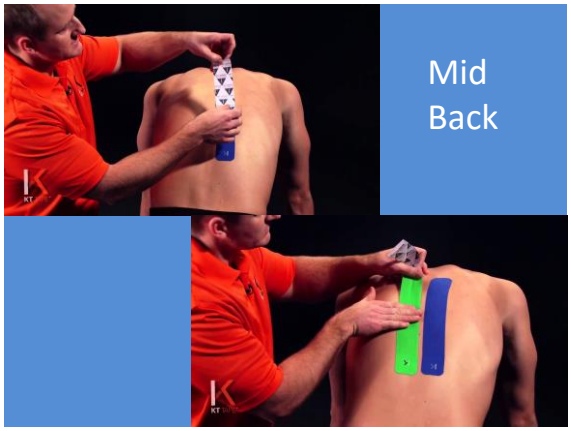
Trunk/Back

- SI Joint
- Low Back
- Mid Back
- Ribs
- Spine
- Abdominals

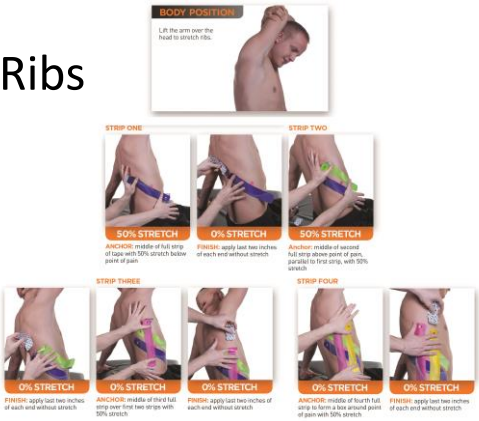


SI Joint

Low Back


Mid
Back

Ribs


BODY POSITION
Lift the arm over the head to stretch ribs.
STRIP ONE
STRIP TWO
50% STRETCH
0% STRETCH
50% STRETCH
STRIP THREE
STRIP FOUR
0% STRETCH
0% STRETCH
0% STRETCH
0% STRETCH
0% STRETCH

Spine

BODY POSITION
Lean forward to stretch spine
STRIP ONE
STRIP TWO
80% STRETCH
0% STRETCH
80% STRETCH
STRIP THREE
STRIP FOUR
0% STRETCH
80% STRETCH
0% STRETCH
80% STRETCH
0% STRETCH

Abs

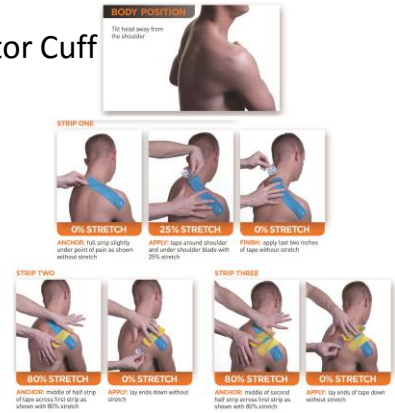
Neck/Shoulder

- Neck & Shoulder
- General Shoulder
- Rotator Cuff
- AC Joint
- Shoulder Stability

Neck and Shoulder

Shoulder

Rotator Cuff



AC Joint

Shoulder Stability

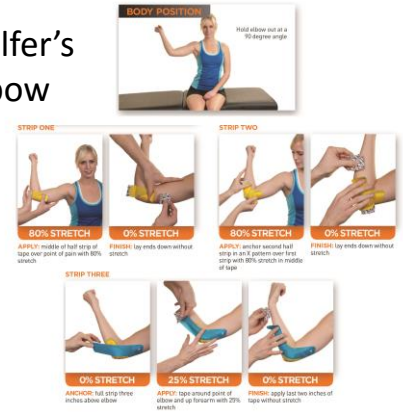
Arms/Hands

- Wrist
- General Elbow
- Golfer's Elbow
- Tennis Elbow
- Finger Jam
- Biceps
- Triceps
- Thumb

Wrist

General Elbow

Golfer's Elbow



Tennis Elbow

Finger Sprain

Biceps

Triceps

Thumb

Does it work

- Small beneficial effect for strength, force sense, and active range of motion
- No substantial evidence to support improvements with pain, proprioception, strength and muscle activity.

Does it work?

- 2010 Physical Therapy in Sport
- 21 college athletes
- Placed in 3 groups
- KT, Placebo Tape, No tape
- No changes in grip strength

Does it work?

- 2012 Lit. Review – 10 of 97 articles
- Pain = no meaningful change
- ROM = do not recommend use
- Strength = small benefit
- Proprioception = unknown
- Muscle Activity = small benefit

Taping vs. Bracing

Brace Companies

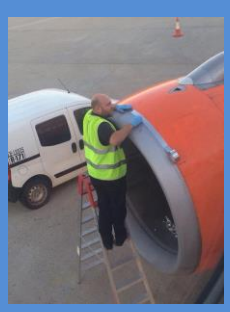
DJO
BREG
Townsend ATHUASNE COMPANY
bledsoe
TEAM ÖSSUR

H

Tape Companies

H

Benefits of Taping



H

Downside of Taping

Benefits of Bracing

Downside to Bracing

Ankle Braces

H

Ankle Braces

H

Ankle Braces

H

Knee Braces

- Ever seen this???

- Lenox Hill Brace
- 1968

H

H

H

H

H

H

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H

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H

H

Patellar Bracing

H

Patellar Bracing

H

Patellar Bracing

H

Hip Flexor

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Shoulder Braces

H

Shoulder Braces

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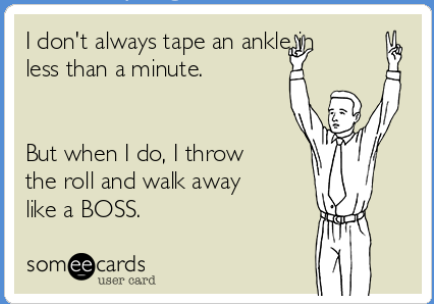
Elbow Braces

Elbow Braces

Wrist Brace

Thumb Brace

Taping Procedures



Does any of it work?

- 2012 BioMed Study
- Treated acute lateral ankle sprains
  - Tape or Brace
- After 4 weeks w/ same rehab plan
  - Brace was more comfortable
  - But both had similar pain and function scores

Does any of it work?

- 2002 Clinical Biomechanics
- Looked at 10 different brace types
- Rated them on effectiveness

Most Effective

- Reduce ROM and Functional Support

Worst

- Limited performance

Average

Does any of it work?

- 2008 JAT Study
- Literature review of 7 studies
- "We cannot conclusively advocate or discourage the use of prophylactic knee braces in the prevention of knee injuries in collegiate football players."

Clinical Question #2

- Can the utilization of these methods decrease the likelihood of acute injury or help in an expedited return to play?
- P - Individuals participating in athletic practices and competitions.
- I – Utilization of common Kinesiology tape, bracing, or athletic taping methods for prevention or protection of athletic injuries.
- O – Decrease the injury rate for athletes with the utilization of the procedures.

Future of Bracing

- Materials – Lightweight and strong
- "Bionic Knee" – adjustable spring loaded tension

Section 3

- Equipment Changes

Literature Review

- Helmets and mouth guards: the role of personal equipment in preventing sport-related concussions.
- *Clinics in Sports Medicine*. 2011
- Lit Review
- Little evidence to support specific helmets or mouth guards to prevent concussion
- Have shown reduction in face and dental

Literature Review

- Protective equipment and player characteristics associated with the incidence of sport-related concussion in high school football players
- *The Am Journal of Sports Med*. 2014
- Looked at thousands of high school athletes
- No correlation between helmet or mouth piece type.
- Only previous injury w/in 12 months was significant

Literature Review

- Development of the STAR evaluation system for football helmets.
- The *Journal of the Biomed Eng. Society*. 2011
- 4 sites = Front, Top, Side, Rear
- 6 Speeds = 0,12,24,36,48,60 inches

Preliminary Conclusions

- Advances in protective equipment have led to a decrease in serious traumatic injuries.

Objectives

- ❖Identify different helmet models and evaluate their effectiveness.
- ❖Identify changes to shoulder pads models and evaluate their effectiveness.
- ❖Identify different types of mouthpieces and rate their effectiveness.

History of Football Helmets

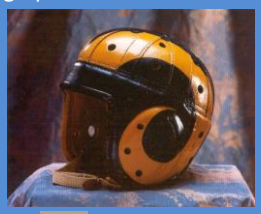
- 1920's
- Soft leather

History of Football Helmets

- 1930's
- Hard leather

History of Football Helmets

- 1940's
- Hard leather w/ graphics



History of Football Helmets

- 1950's
- First integration of plastics

History of Football Helmets

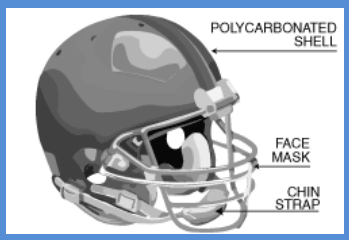
- 1960's
- Double bar facemasks

History of Football Helmets

- 1970's
- Air internal bladder

History of Football Helmets

- 1980's



History of Football Helmets

- 2000's
- Revolution

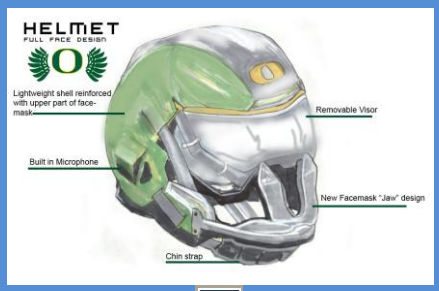
Research on Revolution

- Initial claims of 31% less likely to sustain a concussion
- UPMC disavowed their results
- FTC independent investigation
  - No random distribution to subjects
  - Wide age difference in subjects

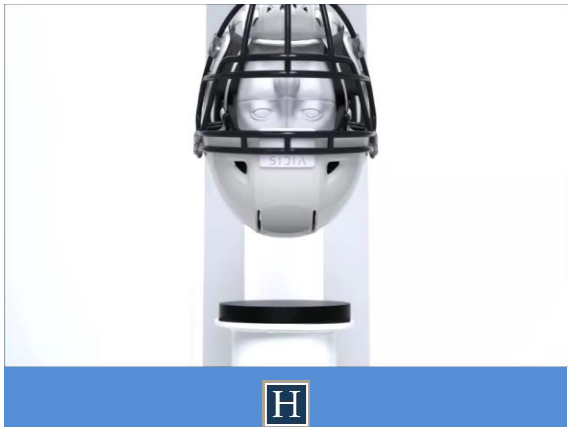
Research on Revolution

- 2000 high school football players
- 5.4% wearing revolution
- 7.6% for other models

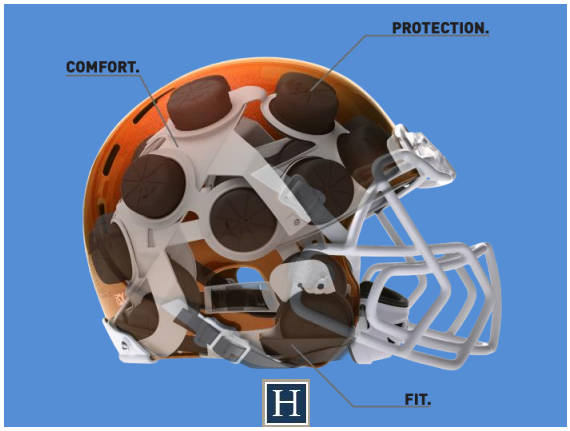
Future of Safety



VICIS ZERO1



Riddell



VA Tech Rating System

Virginia Tech Helmet Ratings™

Adult Football Helmet Ratings - May 2014

A total of 23 adult football helmet models that have been evaluated using the STAR evaluation system are included in the Virginia Tech Helmet Ratings™. All 23 helmets included in the ratings have been made available to consumers at the time of publication. Helmets with more stars provide a reduction in concussion risk compared to helmets with less stars. Group rankings are differentiated by pre-determined thresholds.

5 Stars: Best Available	★★★★★
4 Stars: Very Good	★★★★
3 Stars: Good	★★★
2 Stars: Adequate	★★
1 Star: Marginal	★
NR: Not Recommended	

Virginia Tech Wake Forest Unive

Note: Any player in any sport can sustain a head injury with even the very best head protection. This analysis is based on data trends and probabilities, and therefore a specific person's risk may vary. This variation is likely dominated by genetic differences, health history, and impact factors such as muscle activation.

5 Stars: Best Available ★★★★★	4 Stars: Very Good ★★★★	3 Stars: Good ★★★
Schutt AIR XP Pro VTD	SG Adult	Schutt Air XP
Schutt Vengeance VTD	Schutt ION 4D	Schutt DNA Pro +
Riddell 360	Rawlings Impulse	Schutt Air XP Ultralite
Rawlings Quantum Plus	Xenith X1	2 Stars: Adequate ★★
Rawlings Tachyon	Riddell Revolution	Schutt Air Advantage
Xenith EPIC	Rawlings Quantum	1 Star: Marginal ★
Xenith X2	Schutt Vengeance	Riddell VSR4
Xenith X2E	Riddell Revolution IQ	NR: Not Recommended
Riddell Revolution Speed		Adams A2000 Pro Elite

Research Topics

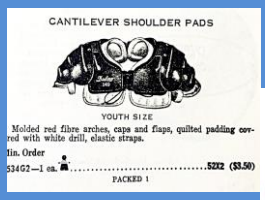
- 2 Studies – Same Results
- 2011 Clinical Journal Sports Med
  - Helmets and Mouth Guards: Role in Preventing Concussion
- 2014 American Journal of Sports Med
  - Protective Equipment and Incidence of Concussion
- Both showed that type of helmet and mouthpiece was not statistically important

2014 Study

- 2081 High School Football Players
- 9% received a sport related concussion
  - 9.1% Riddell
  - 8.7% Schutt
  - 9.2% Xenith

Shoulder Pads

Cantilever Shoulder Pads


CANTILEVER SHOULDER PADS

YOUTH SIZE

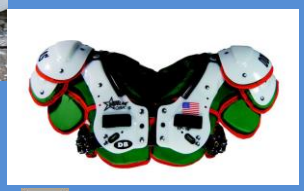
Molded red fibre arches, caps and flaps, quilted padding covered with white drill, elastic straps.

lin. Order

534G2—1 ea. 52X2 ($3.50)

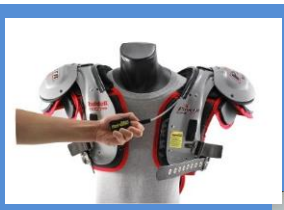
PACKED 1

Non-Cantilever Shoulder Pads



Design Changes

- Stronger Material
- Lightweight
- New Carbon Fiber



Drawback to Changes?

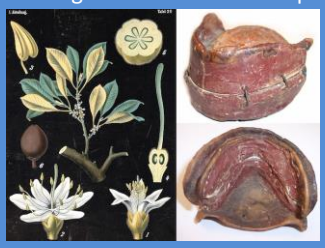
Mouthpieces

History

- First recorded use was the gum shield
- Used by boxers
- Typically made from cotton, tape, sponge, or small pieces of wood.
- Very ineffective

1892 – Woolf Krause

- Made mouthguards from a natural plant resin



EVA

- Ethylene Vinyl Acetate – most common
- Strong and flexible material
- Types
- 1. Stock
- 2. Boil and Bite
- 3. Custom

Stock

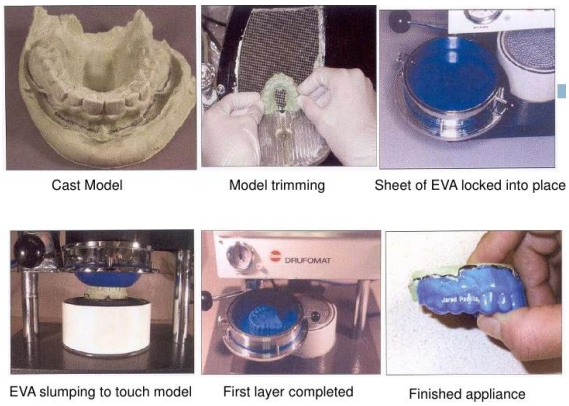
- Worst Fit

Boil and Bite

- 90% of mouth guards in use fall in this category

Custom

- Exact Fit
- More expensive



Cast Model | Model trimming | Sheet of EVA locked into place

EVA slumping to touch model | First layer completed | Finished appliance

Do they work?

- Numerous Studies support the reduction in dental trauma.
- Results are inconsistent when it comes to reduction of concussions between types of mouth guards.

Clinical Question #3

- Are these recent updates and structural changes to protective equipment paying dividends to our athletes or are the injury rates the same?
- P – Football players of all age and skill levels.
- I – Utilization of newer types of protective equipment.
- O – Reduce the likelihood of serious brain, head, and neck trauma.

Thanks