How to Preserve & Protect the Knee

EXERCISE ETC. INC.

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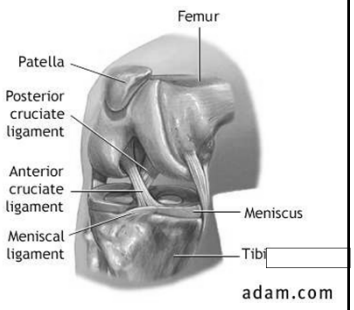
PART 1:
The Functional Knee

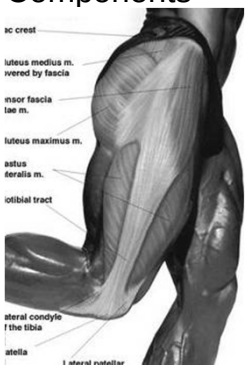
Understanding Knee Anatomy & Mechanics

- Bones
  - Femur, Tibia, Fibula, Patella
- Ligaments
  - ACL, PCL, LCL, MCL
- Meniscus



Series Elastic Components

- Quadriceps
- Quad tendon
- Patella tendon
- IT band
- Gluteus medius/ maximus
- Hamstrings
- Gastrocnemius



Range of Motion

- Functional
  - 0° to 120 ° flexion
- Active/Passive
  - 0° to 135° flexion
  - 10° hyperextension is common

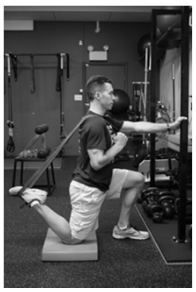
How To Maintain Healthy Knees

- Improve Knee Flexion & Extension
- Improve Ankle and Hip mobility
- Increase Glute strength
- Improve hamstring strength and reaction time
- Improve landing mechanics
- Build co-contraction relationships with "closed-chain" exercises
- Strengthen and Re-educate the "core" musculature
- Avoid large quadriceps forces and increased knee flexion

Knee Flexibility Issues

- Flexion
  - Quad/IT Band
- Extension
  - Hamstrings
- Hyperextension

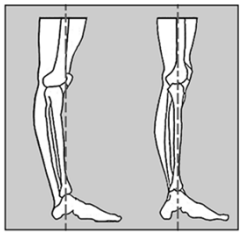
Superband Stretching for Quads & Hamstrings



Stretch & Strengthen the Quads

What Is “Locking the Knee”?

- Hyperextension vs. Straightening



Functional Exercises for Strong Knees

- Squats
- Lunges
- Step-Ups
- Jump Training

Squat for Strong Knees

- A body weight Squat below “parallel” is a great example of balanced strength & flexibility at the knee
- Depth for strength training and mobility are different

ACL Strain During Squats

- ACL is compromised when the hamstrings are allowed slack during knee flexion
  - Too much lumbar flexion
  - Increasing depth
- ACL is under more stress when stopping at 70° vs. 110°

Other Concerns Regarding Deep Squats

- Meniscus Injury of Greater Concern w/ Increased Depth
- Advise body-weight squat with increasing depth for flexibility & mobility
- Parallel squat under load

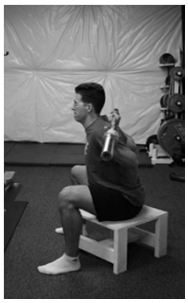
Controversies in Squatting: Knees Past Your Toes?

Correcting Knee Position

Squeezing a Ball

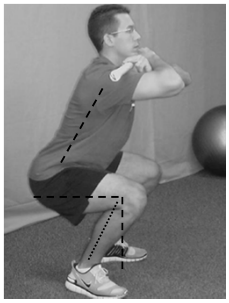
Pressing a Band

The Box Squat



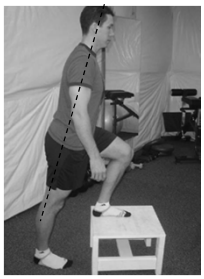
Front Squats

- Front loading reduces risk of lumbar spine injury
- Parallel is desirable
- Progressing depth too quickly can result in strain due to high P-F compression



Step Down – Facing Step

- Descend under control
- Avoid using the non-working limb to push-off
- Start with a 6-8 inch step height
- Avoid progressing to a high step too soon
  - Generates high P-F compression forces



How do we achieve
"Functional Knees?"

Is a knee extension "functional?"
How about a hamstring curl?

Part 2:
The Dysfunctional Knee

REMINDER

Obtain medical clearance and physician's release prior to beginning
an exercise program
for clients with medical or orthopedic concerns.

The Role of the Fitness Professional in Injury Prevention & Rehabilitation

- May "SCREEN" clients for risk of injury based on written/verbal injury history
- If PAIN is current, MUST refer
  - i.e. Family Doctor, Orthopedic Surgeon, Physical Therapist, Certified Athletic Trainer
- May **NOT** "EVALUATE" injury based on symptoms present
- May Incorporate Exercises to Improve Function if Client is not experiencing Pain or Acute Injury

POST-INJURY

- Maintain and further progress client according to Physical Therapist's and/or Orthopedic Surgeon's recommendations

Specific Causes of Knee Pain & Injury

- Compression
- Shear
- Structural & Functional Limitations
- Muscle Imbalances

Compressive Forces on the Knee

- 0 - 60 ° = 1X BW
- 90 ° = 3X BW
- 120 ° = 6X BW
- 135 ° = 9X BW

- Deep flexion potentially wears away articular cartilage beneath the patella

Understanding Shear forces

- The Seated Knee Extension
  - Rehab exercise or general conditioning exercise?
  - Do the risks outweigh the benefits or vice versa?

Structural & Functional Limitations

- Structural Limitations
  - Leg length discrepancy
  - Bowed legs vs. Knocked Knees
  - Q-angle
  - Flat Feet
- **Functional Limitations**
  - Movement & Gait Mechanics
  - Mobility at the Hip & Ankle
  - Landing Mechanics
  - Muscle Imbalances

Common Muscle Imbalances Leading to Knee Pain/Injury

- Leg Length Discrepancy
- Weak or Inhibited Glutes
- Weak Hamstrings and/or Quadriceps
- Medial/Lateral Imbalances
- Synergistic Dominances
- Recruitment Issues

Contributing Factors to Knee Pain and/or Injury

1. Poor Hip Mobility or Strength
2. Poor Ankle/Foot Proprioception

1) Maybe it's All in the Hips?

- Hip Strengthening Improves Pain Faster in Women w/ Runner's Knee
  - August 2011, JOSPT
- Imbalances b/w Internal & External Hip Rotation Increasingly Common

“The Clamshell Exercise”

- Hip Lateral Rotation with Knees Flexed
- Generate awareness upon palpation of glute medius during hip rotation

Hip Abduction Training

- Begin with Side-Lying Hip Abduction Isometrics and
- Progress to Dynamic Hip Abductor Activities using Elastic Rings

Side Lying Hip Adduction

- Lower portion of Gluteus Maximus is a Hip Adductor
- Extend the Active Hip while Adducting to best engage Glutes
- Progress to standing Hip Adduction with Extension
  - PNF Patterns

2) Ankle/Foot Proprioception

- Visual input must be accounted for in order to optimize proprioceptive challenge
- Shift weight laterally maintaining the hip, knee, and foot alignment
  - Lateral Weight Shifts
  - Unstable Surface Standing

How to Improve Ankle/Foot Proprioception

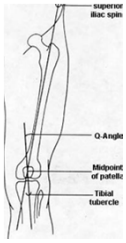
- Weight Shifting
- Single Leg Balance
- Eyes Closed
- Stable Surfaces 1st
- Unstable Flat-top Surfaces w/ Progression

Understanding Knee Injuries & How to Work With/Around Them

1. Runner's Knee
2. Jumper's Knee
3. Ligament Sprain
4. Meniscus Tear
5. Osteoarthritis

"*Runner's Knee*"

- Anterior-Lateral Knee Pain
  - The Most Common Form of Knee Pain
- Causes
  - Leg length discrepancy
  - Knock-knees
  - Flat feet
  - Q angles
  - Muscle imbalances



How to Prevent or Manage *"Runner's Knee"*

- Stretching:
  - Quadriceps, IT Band, Gastroc/Soleus
- Strengthening:
  - Quadriceps & Glutes
- Braces and Supports

Superband Stretching for Quads

- ½ Kneeling Position Stretches both Illiopsoas, and Rectus Femoris
- Keep Glute Engaged
- Incorporate Contract-Relax Technique

Terminal Knee Extensions

Patellar Tendinitis or "*Jumper's Knee*"

- Chronic Degenerative Condition
- Caused by:
  - Repetitive eccentric forces as in jumping, deep squats

Patella Loading During Various Activities

• Walking	0.3 x body weight
• Climbing stairs	2.5 x body weight
• Descending stairs	3.5 x body weight
• Squatting	7.0 x body weight

**150 lb client experiences over 1000 lbs of force on the knees when squatting to parallel*

Preventing *"Jumper's Knee"*

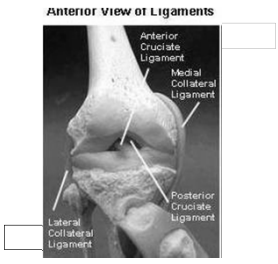
- Strengthen and Stretch Quads
- Manage volume and intensity of Patellar Loading

Management of Patellar Stress

- Limit Squats to "parallel" depth
- Keep maximum knee flexion to 90° during Step Up and Lunging Exercises
- Recommend a professional bike fitting
- Avoid or limit time spent in high gears and hill climbing

LIGAMENT SPRAINS

- Anterior Cruciate
- Posterior Cruciate
- Lateral Collateral
- Medial Collateral



ACL INJURY RISK & WOMEN

- Estrogen
- Femoral Notch
- Hamstring Firing
- Landing Mechanics
- Q-Angles
- Fatigue

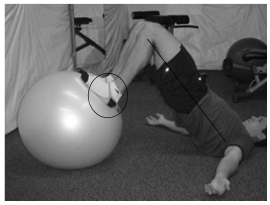
Best Practices to Prevent ACL Injuries

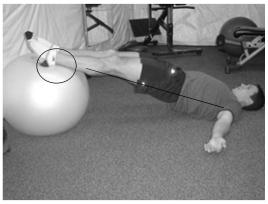
- Strengthen the Hamstrings
- Improve Jump/Landing Mechanics
- Train Change of Direction
  - Running/Jumping

EXERCISE POST-INJURY

- Evaluation and treatment prescribed by an Orthopedic Surgeon or Physical Therapist
- Decrease inflammation
- Improve/sustain mobility
- Stabilize the joint with light strengthening of surrounding muscles

Stability Ball Bridge w/ Leg Curl

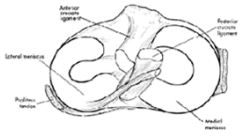




Natural Leg Curl

- Begin with Negatives
- Try Single Leg Variations
- Use Bands for Assistance
- Use DBs, Bands, Weight Vest for Resistance
- Glute-Hamstring Bench

Meniscus Tears

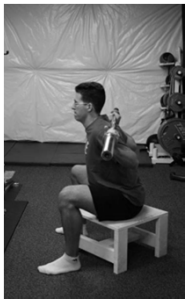


- Meniscus absorbs 30% of impact stress at the knee
- Exercise Modifications
  - Limit impact exercise
  - Restrict range of motion in Squat/Lunge
  - Avoid end-range extension/flexion

Learning to Work Around Pain

- Modifying Exercise Selection
- Reducing/Limiting Range of Motion
- Limit Impact Stress

Adapting the Squat for Clients with Knee Pain



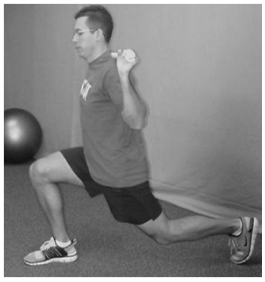
- Half-Squat
- Box Squat
- Stability Ball Squat

Stability Ball Wall Squats

- Older adults experience less knee discomfort while performing this exercise compared to traditional Squats

Prefer the Walking or Reverse Lunge over the Forward Lunge

- Long stride with slight knee flexion on back leg, stretching the psoas & rectus femoris
  - Increases pre-stretch opposite hamstring/glute



Preferred Cardio Exercises for Clients with Knee Pain

- Aquatics
  - Swimming, Jogging, Classes
- Walking/Jogging UP hill
- Cycling
- Upper Body Ergometer
- Rowing

POST-EXERCISE RECOVERY

- ICE massage immediately Post-Workout
  - AKP and ITBS
- Light band or tubing exercises on recovery days
- Regular Soft Tissue Massage
  - Professional & Self-administered

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