Golf Injuries
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- Swing mechanics
- Epidemiology
- Injuries
  - Shoulder
  - Elbow
  - Wrist
  - Low back
  - Hip
  - Knee
  - Ankle
  - Other injuries
- Prevention Strategies
2009 - National Golf Foundation reported 25.6 million people in the US participate in the sport

Enjoyed by many regardless of age, gender, socioeconomic status

Tend to play more as age increases

Swing Kinematics and Biomechanics

- Five phases
  - Takeaway
  - Forward swing
  - Acceleration
  - Early follow-through
  - Late follow-through

Zouzias et al, JAAOS 2018
Swing Kinematics and Biomechanics

- Rotator cuff muscles
  - Protect the glenohumeral joint
  - Contribute to rapid rotation of the shoulder
- Trapezius
  - Scapular retraction during takeaway
- Serratus anterior
  - Scapular protraction during acceleration and early follow-through

Trunk muscles are active during acceleration
- Gluteal musculature contributes to pushing-off and stabilization
- Abdominal oblique muscles active throughout early follow-through
Swing Kinematics and Biomechanics

- Forearm muscle activity differs between amateur and professional golfers
  - Extensor carpi radial brevis
    - Active in lead arm during acceleration phase in amateurs, forward swing phase in professionals
    - Active in trail arm during acceleration phase in amateurs and professionals
  - Pronator teres
    - Increased activity in lead arm in professionals compared to amateurs (pull the golf club with lead arm rather than push with trailing arm)
  - Flexor carpi radialis
    - Active in lead arm during forward swing in amateurs and acceleration in professionals
    - Active in trail arm during forward swing in both
  - Flexor carpi ulnaris
    - Active in forward swing in lead and trail arm in both

Swing Kinematics and Biomechanics

- Similar to baseball swing, experience rotational velocities about the hip in a closed kinetic chain during swing phase
  - Hip extensors
  - Hip abductors
  - Adductor magnus
  - Hamstrings
Swing Kinematics and Biomechanics

Epidemiology

- Overall incidence - 15.8 injuries per 100 golfers
- Most commonly overuse injuries, followed by injuries related to poor swing mechanics
- Gosheger et al - increased risk of injury in golfers who hit more than 200 balls or played 4 or more rounds per week
- 46.2% of injuries sustained during swing, 23.7% at point of ball impact
- Low back > elbow/forearm > shoulder/upper arm > foot/ankle
- Professional golfers more likely to be injured compared to amateurs
- Most common reason for hospital admission:
  - Adults - struck by golf ball
  - Children - struck by golf club
Shoulder

Subacromial impingement

- Can lead to rotator cuff tendinitis or partial tears
- Presents as pain at the extremes of motion
- Nonsurgical management
  - NSAIDs, physical therapy, cortisone injections
- Surgical management
  - Acromioplasty, rotator cuff repair
  - Vives et al. - 26/29 golfers returned to prior level of play at 3 year follow up after undergoing surgery

Internal impingement

- Commonly seen in overhead athletes, also in golfers
- Humeral head and rotator cuff impinge against glenoid and labrum
- Can result in rotator cuff tears, labral tears, and articular cartilage lesions of the humeral head
Shoulder

- Acromioclavicular (AC) joint pain
  - Causes by repetitive adduction of lead shoulder during takeaway
  - May be associated with anterior glenohumeral instability and hitting a large number of balls per day
  - Nonsurgical management
    - Physical therapy
    - Swing modification
    - Steroid injections
    - Mallon and Colosimo - 34/35 golfers with shoulder pain (53% AC joint pain) returned to competition with nonsurgical management
  - Surgical management
    - Distal clavicle excision

- Glenohumeral instability
  - Caused by repetitive microtrauma to capsulolabral tissues during shoulder turn
  - Can be anterior or posterior
  - May experience a painful “popping” or “clunking” sensation during swing
  - Nonsurgical management
    - Physical therapy with rotator cuff and scapular stabilizer strengthening
  - Surgical management
    - Arthroscopic or open capsular plication or labral repair
Shoulder

- Superior labral tears (SLAP lesions) and biceps pathology
  - Pain in lead shoulder during takeaway or forward swing
  - Isolated biceps tendinitis - pain during late follow through
- Nonsurgical management
  - Physical therapy
  - NSAIDs
  - Cortisone injections in glenohumeral joint and biceps tendon sheath
- Surgical management
  - Arthroscopic labral debridement vs. repair
  - Biceps tenotomy or tenodesis

Shoulder

- Glenohumeral arthritis
  - Seen uniquely in golf due to elderly population
  - Shoulder arthroplasty successful in this population
  - Jensen and Rockwood - 23/24 patients with total shoulder replacement returned to golf at mean 4.5 months postoperatively (mean age of 52 years)
Elbow

- Most commonly overuse injuries
- Strain from gripping club too tightly
- Trauma from hitting the ball “fat” or hitting through heavy rough
- Females may be at greater risk secondary to increased carrying angle

Lateral epicondylitis

- Caused by hitting the ground firmly at impact and over-gripping the club
- Tenderness at the origin of the extensor carpi radialis brevis
- Pain with resisted long finger extension
- Nonsurgical management
  - Limit play
  - NSAIDs
  - Physical therapy
  - Cortisone/PRP injections - varied results
  - Forearm straps/wrist splints
  - Change in equipment - stiffer shaft, wider grip
- Surgical management
  - Extensor origin debridement and reattachment
Elbow

- Medial epicondylitis
  - “Golfer’s elbow” - though much less common than lateral epicondylitis
  - Caused by hitting the ball fat, repetitive hitting of artificial mats, pushing the club through swing with trail arm
  - Tenderness at the flexor-pronator origin
- Nonsurgical management
  - Rest
  - NSAIDs
  - Physical therapy
  - Bracing
  - Injections
- Surgical management
  - Debridement of common flexor origin and repair

Wrist

- Most common in the lead wrist
- Amateurs hitting the ball “fat”
- Professionals hitting the ball out of very heavy rough or off firm ground
- Overuse injuries
Wrist

**Tendinitis**
- Commonly involves the flexor carpi ulnaris and extensor carpi ulnaris
- Top of takeaway phase when lead wrist moves into extensive radial deviation
- Nonsurgical management
  - Rest
  - NSAIDs

**ECU instability**
- Caused by forceful impact of the wrist when striking the ground before the ball
- Results in disruption of ECU tendon sheath
- Painful snapping sensation with wrist supination, ulnar deviation, and flexion
- Nonsurgical management
  - Rest
  - Splinting wrist in extension, radial deviation, and supination
- Surgical management
  - Repair of ECU tendon sheath

[www.drbadia.com](http://www.drbadia.com)
[www.orthobullets.com](http://www.orthobullets.com)
Wrist

- Triangular fibrocartilage complex (TFCC) tears
  - Caused by repetitive rotation about the wrist
  - Ulnar-sided wrist pain, palpable click with forearm rotation
- Nonsurgical management
  - Rest
  - Immobilization
  - NSAIDs
  - Steroid injections
  - Physical therapy
  - Taping/bracing during play
- Surgical management
  - Wrist arthroscopy with debridement vs. repair

Fujioka et al, Journal Hand Surgery, 2000

Wrist

- Hook of hamate fractures
  - Caused by forceful strike to the ground with club
  - May also present with stress fracture
  - Seen in hand holding the end of club
  - Point tenderness over the hook of hamate
  - Obtain radiographs (carpal tunnel view) and possibly CT
- Nonsurgical management
  - Wrist immobilization
  - Rest
- Surgical management
  - Excision of hook of hamate

Fujioka et al, Journal Hand Surgery, 2000
Low Back

- Most common source of injury
- Swing produces large asymmetric loads in the spine and back musculature
  - Compressive loads equivalent to 8x body weight
  - Cumulative loads lead to insidious onset of pain
- Injuries may include muscle strains, herniated nucleus pulposus, vertebral body and pars interarticularis stress fractures, spondylolisthesis, and facet arthropathy
Low Back

- Low back pain more common on the trial side
- Risk of low back pain is influenced by type of golf swing
  - Modern swing
    - Large shoulder turn, restricted hip turn
    - Increased torsional loads, lateral bending, and hyperextension of spine
  - Classic swing
    - Increased hip turn, erect follow-through
    - Less torque on spine, less low back pain

McHardy et al., Sports Med 2006

Low Back

- Management of low back pain
  - Ice
  - Rest
  - NSAIDs
  - Stabilization exercises
  - Active stretching
  - Pre-round activation and mobility of scapular, trunk, and hip musculature
  - Post-round flexibility programs for low back and hip muscles

www.breakingeighty.com
Low Back

- Early rehabilitation after back injury
  - Core strengthening
  - Breathing exercises
  - Functional Movement Screen
    - Used to identify poor movement patterns placing players at risk for injury
- Late rehabilitation
  - Scapular and hip stabilization
  - Training on unsteady surfaces

Low Back

- Compression fractures
  - May be seen in older females with osteoporosis
  - Secondary to stress at the thoracolumbar region during swing
Hip

- Low incidence of hip injuries secondary to golf
- Mainly due to overuse
- Vad et al. - correlation between limited lead hip internal rotation and history of low back pain in professional golfers
- Injuries include chondral defects, labral tears, loose bodies, arthritis

Hip

- Acetabular labral tears
  - Caused by joint stress secondary to rotational velocities about the hip
  - Groin pain, mechanical symptoms
  - Management
    - Hip arthroscopy with labral debridement vs. repair
      - Byrd and Jones - return to sport 3 months postoperatively in recreational golfers with labral damage
Hip

- Arthritis
  - Total hip arthroplasty remains treatment of choice for debilitation hip pain secondary to arthritis

Knee

- Relatively rare in golfers
- Mainly overuse injuries and mechanical failure
Knee

- **Meniscal injuries**
  - Secondary to repetitive internal and external rotation of the tibia on the femur

- **Nonsurgical management**
  - NSAIDs
  - Physical therapy
  - Corticosteroid/viscosupplementation injections

- **Surgical management**
  - Arthroscopic repair vs. partial meniscectomy

Knee

- **Arthritis**
  - Total knee arthroplasty for debilitating arthritis has good results with minimal golf restrictions
  - Mallon and Callaghan - 87% golfers with a total knee replacement had no pain while playing, 35% had mild pain
    - Handicap increased by 1.9 strokes at an average of 4.7 years postoperatively (though may be secondary to increased age)
Ankle

- Mostly due to accidental injury
  - Slipping, tripping
- Stability of ankle joint provided by several structures
  - Static - anterior talofibular ligament, posterior talofibular ligament, calcaneofibular ligament
  - Dynamic - peroneal tendons
- Injuries include ankle sprains and tendinopathies
  - Managed with rest, ice, NSAIDs, proprioceptive training, and bracing

Head/Eye

- Extremely rare but can be serious injuries
- Majority of injuries due to being struck by club or ball
  - More common in the pediatric population
- Case reports include
  - Skull fracture
  - Cerebral contusion
  - Epidural hematoma
  - Orbital fracture
  - Optic nerve avulsion
  - Ruptured globe
Stress Injuries

- Uncommon in golf
- Secondary to overuse
- Case reports have described stress fractures in the ribs, ulnar diaphysis, hook of hamate, tibia/fibula
  - Several reports of tibial stress fractures progressing to complete spiral fractures while hitting a drive

Prevention strategies

- Failure to warm up for at least 10 minutes prior to playing more than doubles risk for injury
- Preventing low back pain
  - Maintaining straight posture throughout swing
  - Controlling speed of swing
  - Reduction of shoulder range of motion and trunk angular motion
  - Lumbar flexibility and strengthening exercises
  - Lumbar corset
  - Proper fitting clubs
  - Playing consistently
  - Pushing cart as opposed to pulling
  - Using a long putter
  - Dual strap bag
  - Weight loss
References