

Throwing injury of elbow

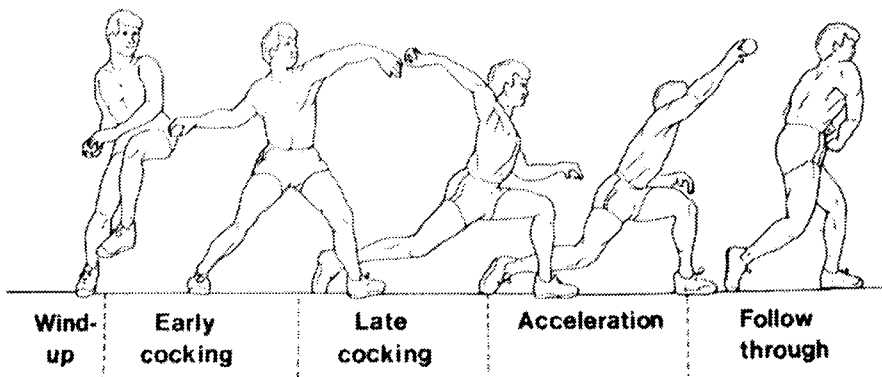
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최창혁

성장기 야구선수의 주관절은 이차 골화 중심이 완전히 유합되지 않아 반복적인 투구 시 정상적인 골연골 발달의 저해 뿐만 아니라 손상의 빈도가 높은 것으로 알려지고 있다^{7,9,11}). 주관절 주위 이차 골화 중심의 출현은 2세 경 상완골 소두에서부터 시작하고, 남자의 경우 내상과 골화중심은 7세에 출현하여 17세 경 유합 하며, 척골 주두는 각각 10세 및 16세로 알려지고 있다¹³). 투구동작 중 주관절에 주로 영향을 미치는 시기는 late cocking phase, early acceleration phase 및 follow-through phase이다. late cocking 및 acceleration phase에는 주관절 부위에 외반 응력이 가해지며 이는 내측관절에는 신전력을, 외측관절에는 압박력을 유발하게 되고, 상완척골관절에는 전위력을 발생시키게 된다. follow-through phase에는 외반된 주관절이 펴지며 주두 및 주두와의 후내측에 압박력이 발생하게 되고, 이때 뒤쪽 관절에는 삼두박근의 수축으로 인한 신전력이, 전방부에는 상완골 소두에 대해 요골두가 압박력 및 전단력을 받게 된다¹⁷). 투구시 주관절에 가해지는 외반 응력에 대해 성인의 경우 내측측부 인대가 주로 작용하며, 만성적인 스트레스가 가해질 경우 내측 측부인대의 장력손상이 주가 되지만, 청소년기에는 내측측부인대는 상대적으로 이완되어 있으며 투구시 굴곡회내전근군이 내측 안정성에 주 역할을 하게 된다. 따라서 성장기에 주관절의 내측에 과도한 스트레스가 가해질 경우 외반력에 따른 내측 신전력에 의해 내상과의 골편형성, 불규칙성 변화, 비후, 성장판 분리 및 건열골절 등을 유발 할 수 있으며, 이때 외측에는 상완골 소두 및 요골두에 외상성 골연골증을 유발할 수 있다^{1,5,19}). 이러한 골변화 및 관절인대 등의 연부 조직 손상으로 인한 통증은 경기력을 저하시키며, 심할 경우 영구적인 변형을 유발하여 선수 생활을 조기에 포기하게 하기도 한다.

Anatomy & Biomechanics of throwing motion

- 1) 5 phase of throwing: windup, early cocking, late cocking, acceleration, follow-through



Greatest valgus stress : late cocking & acceleration phase

30° of elbow flexion, angular velocity: 3,000(/sec

Follow-through phase: Posterior - triceps contraction

Anterior- compressive & shearing force of radial head on the capitellum

- 2) Primary elbow stabilizer: anterior oblique band of MCL (Callaway⁶, Morrey¹²)

- 3) EMG analysis for muscle function

Fastball & curveball(Sisto¹⁶)

Curveball creates more stress in ECRL & ECRB: acceleration & follow through

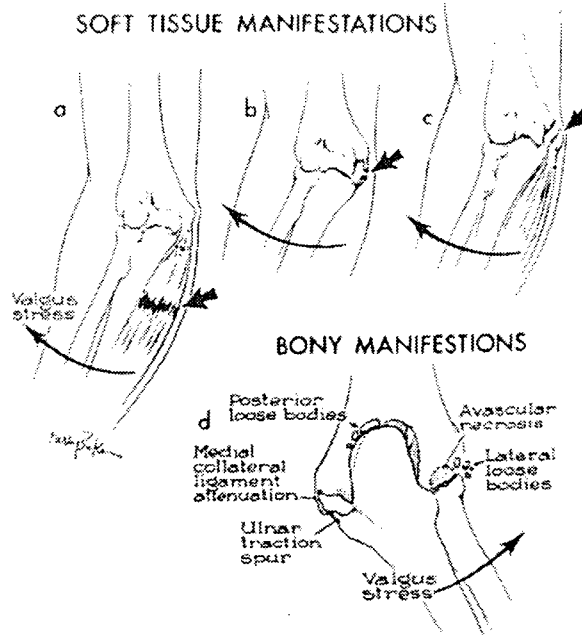
Normal & MCL - deficient elbow(Glousman⁸)

Major difference : late cocking & acceleration phase

Pathophysiology of elbow injury

Common injury pathway: valgus extension overload(Barns⁴, Wilson¹⁸)

Tension on the medial side and compression on the lateral side



Prevention of injuries

1. Proper conditioning: maintain flexibility & endurance
2. Avoid pain & inflammation: icing, gentle stretching program, light tossing
No competitive throwing until full ROM gain

Throwing elbow injuries

A. Lateral elbow pain

1. Osteochondritis dissecans

common cause of lateral elbow pain : 10 to 15 years old throwing athlete

Symptom: insidious and progressive pain

Clicking, catching, or locking by cartilage flap or loose body

Radiograph: rarefaction and crater formation in the capitellum

D.Dx: Panner's disease(osteochondrosis of the capitellum, Singer¹⁵)

self-limited disease, age of 4 to 8 years

different stages of the same disease process

- Treatment:
- 1) rest with cessation of the offending activities
 - 2) Non-surgical treatment: intact overlying cartilage
conservative care for 3 to 6 weeks
brace for protection
gradual and progressive therapy program
 - 3) Surgical treatment: Excision of loose lesion with drilling or curetting
Removal of loose body
Reattachment of osteochondral fragment
Closed-wedge osteotomy of capitellum

2. Lateral epicondylitis

Prevalence: 50% of recreational tennis players, fourth decade of life

PE: pain with resisted wrist extension, tennis backhand stroke

Pain localization- 5mm distal & anterior to lateral epicondyle

Risk factors: heavy racquets, inappropriate grip size, too tight strung, poor backhand technique

Pathology: microtear of ECRB origin → mucoid and/or hyaline degeneration

Radiology: normal or calcific deposit

Treatment:

- 1) Nonsurgical treatment: effective in more than 80%
Coordinate rehabilitation : activity modification & exercise
Ice & NSAID, Injections
- 2) Surgical treatment: refractory to conservative treatment 2 to 4 months
Return to full activities in 85% to 90%
Release of extensor aponeurosis
Debridement with repair of defective tendon

3. Radial nerve entrapment

Sx: distally radiating pain during active rotation of forearm

Entrapment site: arcade of Frohse, ganglion, radiocapitellar joint
synovitis

Tx: rest & activity modification

Surgical decompression

4. Radiocapitellar overload syndrome

: result of chronic medial instability and posteromedial impingement
loose body and flexion contracture

B. Medial elbow pain

1. Medial epicondylitis

Pathology: microtear of flexor-pronator muscle group(P. teres and FCR)

Nonsurgical treatment: ice, NSAID, bracing, steroid injection

Surgical treatment: refractory to conservative treatment > 10weeks

2. MCL injuries & physeal injuries in children

Compare to contralateral side

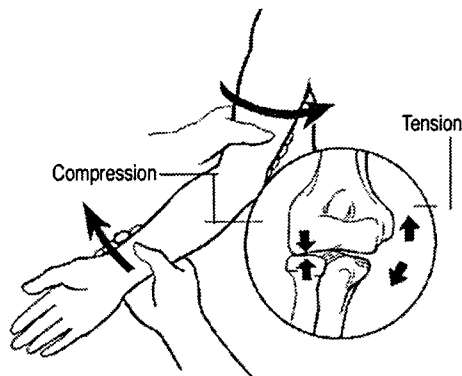
Rest & conservative treatment

3. MCL injuries in adults

Nonsurgical treatment with rehabilitation & activity modification

: Phonophoresis, electrical stimulation, iontophoresis

1) Clinical presentation



Valgus stress test : medial elbow pain & valgus laxity

Moving valgus stress test

Milking maneuver

Extension test

2) Imaging

Radiographic findings of chronic MCL injuries

: a) calcification,

b) Medial spurs

c) spurs on posterior olecranon tip

d) loose bodies in the olecranon fossa

3) Reconstruction

Jobe technique: figure of 8 fashion using palmaris longus tendon

“docking” technique: muscle splitting approach w/o transposing ulnar nerve

4) Results

Jobe technique: Original report¹⁰⁾- 63%(10/16) return to previous level

Andrews²⁾- 86%(12/14) return to previous level

Azar & Andrews³⁾- 81%(48/59) return to previous level

“docking” technique: Rohrbough¹⁴⁾- 92%(33/36) return to previous level

4. Ulnar Neuropathy

1) Cause of injury: compression, friction, traction

Compression: arcade of Struthers, medial intermuscular septum, cubital tunnel fascial origin of FDS, two heads of the FCU

Friction: subluxation or dislocation of ulnar nerve
40% of throwing athletes

2) Clinical presentation

Sx & Sn : Numbness & tingling with medial elbow pain

Snapping at the medial elbow

Ulnar nerve dislocate at 90°

Medial head of triceps dislocate at 110°

3) Treatment

Nonsurgically initially

Surgicval treatment: Decompression or transposition

C. Anterior Elbow pain

1. Pronator teres syndrome

D.Dx: entrapment underneath the lacertus fibrosus

Entrapment by ligament of Struthers

Cervical radiculopathy at C6-7

2. Distal biceps injuries

Cause: sudden overload in the position of midflexion of elbow

D. Posterior elbow pain

Secondary effect of medial sided instability

Triceps apophysitis in pediatrics

1. Posteromedial impingement/Valgus extension overload syndrome

Cause: chronic valgus overload that attenuates the MCL

Sx: pain in the elbow posteriorly with full extension

PE: valgus stress test

Radiology: chondromalacia, osteophyte, loose body at the posteromedial olecranon

Treatment goal: relief pain & inflammation

Increase strength of elbow

2. Stress fractures

Throwing athletes in the middle third of the olecranon

Cause: triceps overload

Transverse fracture: direct triceps overload

Oblique fracture: valgus extension overload

Treatment : Nonsurgical or surgical fixation

요약

반복적인 투구동작은 성장기의 주관절에 손상을 주기 쉬우며 투구 시 통증을 유발할 경우, 투구를 중지하고 관절의 능동적 휴식을 통해 유연성을 회복하고 점차 근력강화운동을 시행해야 한다. 유소년기 Little league elbow의 주된 병변인 상완골 내상과 골단염을 포함한 대부분의 손상은 보존적 요법으로 치료가 가능하며, 굴곡구축 등의 운동제한을 동반한 통증이나 관절 내 유리골편 등의 감입으로 인한 증상이 있을 경우 수술적 치료를 요하며, 성인의 경우 내측 측부인대의 만성 불안정성 등에 대해서 인대 재건술 등의 수술적 치료가 고려된다. 투구 시 주관절의 손상은 대부분의 경우 과 사용으로 인한 것이며, 특히 성장기에 손상의 예방이 무엇보다 중요하다. 따라서 부모와 코치 그리고 경기 관계자 등이 성장기 소년의 근력과 관절의 상태가 성인과 다를 수 있음을 이해하고, 운동의 강도와 횟수를 적절히 조절하며 손상 시 조기치료를 받을 수 있는 환경을 조성하는 것이 필요하다.

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