Overuse Injuries in Children and Adolescents









Overuse Injury - Epidemiology

Adults:

Overuse is seen in sport and occupation

Children:

- Increasing incidence due to
 - increased sport specialization
 - year round training
 - multisport participation

www.fisiokinesiterapia.biz

Definition of an Overuse Injury in Children & Adults

Repetitive micro trauma to tissue, where the ability of the tissue to repair itself is outpaced by repetition of the insult.

e.g. Sever's Apophysitis, Osgood-Schlatters









Osgood-Schlatter Lesion

Overuse in Children (they are not little adults)

- Children have different tissues and issues than adults
 - Tissue
 - Children: thin bone, soft cartilage, open physes,
 - Adolescents: rapid growth, motor incoordination
 - Issues
 - Physiologically more sensitive to environment
 - External motivational forces Parents, Coaches





Rapid Growth: Inflexibility

Decreased flexibility may contribute to excessive stress mechanics at joint and physes

- Especially muscles that cross 2 joints
 - Hamstrings, Gastrocs







"Hamstrings" (posterior thigh)



Rapid Growth:

Motor incoordination

Poor joint proprioception – loose kinetic chain







Upper Extremity



Lower Extremity



History & Physical

- History of repetitive and prolonged activity
 Pain
 - pain after activity
 - pain with activity which affects performance
 - pain at rest
- Physical
 - Generally tender on area of growth plate/bone
 - Requires x-ray
 - Try reproducing pain

History & Physical

- First signs of overuse problems that adults should be aware of in younger children:
 - Poor performance
 - Fatigue
 - Vague pain

Consider overtraining and burnout

General Treatment for Overuse Syndromes

- A long period of relative rest
 - weeks to months,
 - rehabilitation and adjustments of modifiable factors
- Modifiable risk factors include
 - improper technique
 - training errors
 - poorly fitting equipment including shoes,
 - muscle weakness and imbalance.

General Treatment for Overuse Syndromes

- Treatment and rehabilitation and return to play decisions should be guided by a team including the
 - physical therapist
 - musculoskeletal physician or PCP
 - parents
 - coach and
- the child or adolescent



Developing Tissues of Children are Susceptible to MSK Injury

Bone

- Open Physis
- Articular cartilage
- Tendon-Bone junctions

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Developing Tissues of Children are Susceptible to Injury

Bone is thinner and more pliable

- Buckle fractures
- Plastic deformities





Developing Tissues of Children are Susceptible to MSK Injury

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- Articular cartilage
- Tendon-Bone junctions

The Open Physis

- 2 types of stresses
 - Traction
 - apophyses Contributes to bone shape not longitudinal growth
 - Tibial Tuberosity Osgood Schlatter's
 - Calcaneus Sever's Dz
 - Pressure
 - At end of long bones, contributes to longitudinal growth
 - Gymnast's wrist





Open Physis

Growth plate can be 2-5 times weaker than surrounding fibrous tissue (tendon, ligament, joint capsule)







Figure 4 Fifteen year old male football place kicker. (A) Frontal radiograph and (B) magnetic resonance image of right knee showing physeal widening of lateral aspect of distal femoral physis (arrow). (C) Frontal radiograph obtained three months after immobilisation showing near complete resolution of physeal widening. From Laor *et al.*¹²¹ Reprinted with permission from the *American Journal of Roentgenology*.

Open Physis Injury: Little Leaguer's Shoulder

- Avg age 14, tenderness to palpation over the proximal and lateral humerus physeal injury
- Hx Seen mostly in pitchers, present after several (7) months of pain. Pain localizing to the proximal humerus during the act of throwing
- Radiographic widening of the proximal humeral physis on x-ray views with internal and external rotation (comparison films)
- Tx rest from baseball throwing for an average of 3 months with gradual return





Prevention: Pitch counts

Pitch counts per day

- 17-18 years 105 pitches per day
- 13-16 years 95 pitches per day
- 11-12 years 85 pitches per day
- 10 and under 75 pitches per day
- Rest recommendations (16 years and under)
 - 61 pitches or more in a day 3 days rest
 - 41-60 pitches in a day 2 days rest
 - 21-40 pitches in a day 1 days rest
 - 1-20 pitches in a day 0 days rest
- Rest recommendations 17-18 years 76 or more pitches in a day 3 days rest
 - 51-75 pitches in a day 2 days rest
 - 26-50 pitches in a day 1 days rest
 - 1-25 pitches in a day 0 days rest

www.Littleleague.org/media/pitch_count_publication.pdf

Open Physis Injury: Osgood-Schlatters

- Hx & Px– growing active child (10-15 y.o), tender Tibial Tuberosity, overuse or direct trauma (x-ray to r/o avulsion), tight quads, hams, adductors and ITB, Treatment
 - Rest relative,
 - PT stretches (4-5x/day), Muscle strengthening and balance, ice, heat, massage
 - Medications NSAIDs.
 - Supports -





Osgood-Schlatter Lesion

Open Physis Injury: Osgood-Schlatters

x-ray to rule out avulsion fracture





Open Physis Injury: Sinding-Larsen-Johansson

- Apophysitis of the distal pole of the patella
- Hx & Px- growing active child (10-15 y.o), tender distal pole, overuse or direct trauma (x-ray to r/o avulsion), tight quads, hams, adductors and ITB
 - Treatment
 - Rest relative,
 - PT stretches (4-5x/day), Muscle strengthening and balance, ice, heat, massage
 - Medications NSAIDs,



Open Physis Injury Sever's Apophysitis



- Hx & Px early adolescent, active, activity, tight calf (and other lower extremity) muscles, flat feet,
- Mgmnt
 - Rest relative
 - PT stretches (4-5x/day), ice, heat
 - Medications NSAIDs



Supports – good shoes with heel and arch support

Open Physis Injury: Gymnast's Wrist

- Compression of the distal radius growth plate
- Young gymnasts with chronic wrist pain over the distal radius
- Tx prolonged rest





Open Physis Injury: Gymnast's Wrist

- Premature closure of the radial growth plate, causing the radius to be shorter than the ulna (ulnar positive wrist)
 - Abnormal wrist mechanics and chronic pain







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Developing Tissues of Children are Susceptible to Injury

- Articular cartilage less resistant to reptitive microtrauma than adult cartilage
 - Osteochondritis Dessicans (OCD)
 - avascular necrosis (AVN)



Open Physis & Cartilage Injuries: Elbow tensile and compressive forces



<u>Tension</u> (Medial)- traction load on the medial elbow structures.

- accelerated growth of the epiphysis from repeated stimulation
 - Apophysitis, Avulsion, UCL laxity or rupture

<u>Compression</u> (Lateral) – chronic compressive forces on capitellum
 Panners Dz, OCD of capitellum

Open Physes & Cartilage Injuries: Lateral Elbow Panner's Disease

Compressive Forces:
 osteochondrosis of the capitellum
 younger than age 10 years





Open Physis Injuries: Medial Elbow tensile forces

Tension (Medial)- traction load on the medial elbow structures. accelerating growth from repeated stimulation of the epiphysis

 Associated injuries – Apophysitis, Avulsion, UCL laxity or rupture







Open Physes Injuries: lateral elbow compression

- Same mechanism as Panner's
- OCD osteochondritis dissicans of capitellum
 - Seen in adolescents





Developing Tissues of Children are Susceptible to MSK Injury

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Developing Tissues of Children are Susceptible to MSK Injury

tendon-bone junctions

Same mechanism that causes muscle strain or tendon rupture in adult can cause growth plate injury or separation - avulsions

Tendon-Bone Junctions: Avulsion Fractures



Tendon-Bone Junctions: Avulsion Fractures

- Young adolescent
- Mechanism of acute stretch of hamstring with running, jumping, hurdling
- "Pop" heard
- Tx Non-weightbearing
 - Crutches, donut





Tendon-Bone Junctions: Avulsion Fractures

Prompt diagnosis to avoid chronic pain





Snapping Hip Syndrome





lliopsoas tendon over femoral head and iliopectineal eminence.





Base of 5th Metatarsal

- Common area of overuse, basketball, runners
 - Lateral foot pain slowly increases over time
 - pain after activity
 - pain with activity which begins to affect performance and finally
 - pain at rest or acute Jones Fracture







Base of 5th Metatarsal





Normal apophysis, parallel to Metatarsal shaft





Overuse Injury

- Overuse injuries progress from
 - pain after activity
 - pain with activity which affects performance

pain at rest







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Sports Specialization Training for Children

- Discouraged before adolescence
- Adverse Effects
 - overuse injuries (such as stress fractures)
 - over-training syndrome (physiologic burn out)
 - delayed menarche, amenorrhea,
 - disordered eating
 - injuries to growth plates (gymnast wrist)
 - depression, anxiety, conversion reactions



Intensive Training and Sports Specialization in Young Athletes Committee on Sports Medicine and Fitness *Pediatrics* 2000;106;154-157 recommendations based on committee opinion and/or expertise.

Burnout or Overtraining Syndrome



CLINICAL REPORT

Overuse Injuries, Overtraining, and Burnout in Child and Adolescent Athletes

Guidance for the Clinician in Rendering Pediatric Care

Joel S. Brenner, MD, MPH, and the Council on Sports Medicine and Fitness Pediatrics 2007;119;1242-1245

"... a series of psychological, physiologic, and hormonal changes that result in decreased sports performance."

Burnout or Overtraining Syndrome: Symptoms

fatigue, lack of enthusiasm about practice or competition, or difficulty with successfully completing usual routines Burnout or Overtraining Syndrome: prevention guidelines

- Keep workouts interesting
 - age-appropriate games and training
 - keep practice fun
- Take 1 to 2 days off per week from organized or structured sports participation
 - To allow the body to rest
 - To participate in other activities.

Burnout or Overtraining Syndrome: prevention guidelines

- 2 to 3 months scheduled breaks from training and competition
 - focus on other activities and cross-training to prevent loss of skill or level of conditioning.
- Focus on wellness and teaching athletes to be in tune with their bodies
 - Look cues to slow down or alter their training methods.

Tables from future 6th edition of Berman's Pediatric Decision Making

Pelvic Overuse Syndromes	History	Exam Findings	X-ray	Treatment
•Illiac Apophysitis	overuse history, especially running	Tenderness on illiac crest	x-rays usually normal	PT evaluation, ice, NSAIDs
•ITB tendonitis oGreater trochanteric bursiitis	Patient points to outside of hip at greater trochanter as area of pain. May have a snapping or "hip popping out" history	+ Ober's sign	Normal bony anatomy	Ice, NSAIDs, PT evaluation
●Illiopsoas tendonitis ○Snapping hip	History of deep snapping in groin. Overuse in dancers, runners	Patients may reproduce snap: while standing, have patient forward flex hip and rotate out to side	Normal hip and pelvic bony anatomy	NSAIDs, PT evaluation
•Adductor tendonitis	Overuse history of lower extremity involving adduction: running, cutting, skating	Increased tenderness at area of strain with adductor stretching – "doing the splits"	Normal anatomy. Acute injuries should have x-rays to rule out avulsion fractures.	NSAIDs, PT evaluation

* PT evaluation should include treatment of acute pain and dysfunction, evaluation of mechanics, prescription of appropriate stretches, balance and strength exercises, equipment/shoe wear evaluation and a maintenance program

Kno syn	ee overuse dromes	History	Exam Findings	X-ray (AP, outlet, axillary)	Treatment
•	Patello-femoral pain syndrome	Anterior knee pain, dull radiation to popliteal area. Slow onset, Hurts with bending, going up/downstairs, after sitting long periods of time. Can ache at night. Occurs during period of rapid growth.	Poor quad tone. Tight quads, hams, ITB and adductors. Very tender p-f joint. Pain can be diffuse with joint line tenderness.	Sunrise view usually shows laterally tilted patellae, otherwise normal bony anatomy	Ice, PT evaluation *, NSAIDs, consider temporary bracing with neoprene sleeve or hinged brace
•	Sinding-Larsen- Johansson O Patellar apophysitis at origin of patellar tendon,	Anterior knee pain. Hx of knee overuse activity like running, jumping. Occurs during period of rapid growth.	Tight thigh musculature like in P-F Pain syndrome. Tender at inferior pole of patella	Apophysis of inferior pole of patella may have some irregularity	Ice, PT evaluation, NSAIDs, consider temporary bracing with neoprene sleeve or hinged brace. Consider patellar tendon band
•	Runner's Knee o ITB tendonitis	Pain on lateral knee just below joint line. Can come and go with activity. Dull to sharp bony ache. Hx of overuse of knee.	Tight ITB (+ Ober's sign). May be tender at insertion of ITB on lateral tibial prominence (Gerty's Tubercle).	Severe cases may mimick a medial meniscus injury. If no improvement with usual tx, an MRI can be performed to r/o meinsical injury	PT evaluation, NSAIDs,
•	Osgood-Schlatter Disease O Tibial Tuberosity Apophysitis	Anterior knee pain at Tibial Tubercle. Hx of knee overuse. Occurs during period of rapid growth.	Tight thigh musculature like in P-F Pain syndrome. Tender on Tibial tubercle – insertion point of patellar tendon	Apophysis of tibial tubercle may have some irregularity. Acute severe injury may show avulsion	Ice, PT evaluation, NSAIDs, Consider patellar tendon band
Leg	overuse syndrome				
•	Shin Splints o Medial tibial syndrome	Pain up and down front of leg. Increased with running.	Tenderness up and down medial border of Tibia. Point tenderness could be stress fx	No bony abnormality. X- rays should be done to rule out stress fractures if clinically suspicious.	Ice, PT evaluation, NSAIDs,

Foot and ankle Overuse Syndromes	History	Exam Findings	X-ray	Treatment
•Sever's Disease oCalcaneal Apohysitis	ApohysitisHeel pain hurts with activity, better with rest. Can be bilateral. Associated with lots of running and jumping.Tender heel at insertion of Achilles' tendon. Tight calf musculature. Associated 		Ice, PT evaluation, NSAIDs, calf stretches, arch support, supportive footwear	
•Achilles Tendonitis	Similar to Sever's dz. Pain in heel and lower leg.	Tender Achilles tendon. Tight calf muscles.	`ender Achilles tendon.x-rays usually not necessary`ight calf muscles.	
•Plantar Fasciitis	Pain on bottom of foot, especially with first steps in the morning. Overuse history. Poor foot support in shoes	with ankle maximally dorsiflexed, the Plantar Fascia will be tight and very tender when palpated. Associated with tight calf muscles, flat feet, high arches, pronated heels	X-rays usually not necessary	Ice, PT evaluation, NSAIDs, calf stretches, arch support, supportive footwear
•Peroneal Tendonitis	Pain on lateral ankle. Overuse hx. Can be associated with ankle sprains. Subluxing peroneal tendons can "pop or snap"	Pain behind lateral malleolus up the peroneal tendons. Pain with resisted foot eversion.	Xrays usually normal but may show bone abnormalities from old injuries.	Ice, PT evaluation, NSAIDs,
•Base of 5 th Metatarsal apophysitis	Overuse hx. Pain on lateral side of foot, increased with running and jumping.	Pain at base of the 5 th metatarsal where peroneus brevis inserts. Pain increased with resisted eversion.	ase of the 5thX-rays should be done toal where peroneuslook for stress (Jones)serts. Painfractures in the metaphysisd with resisted.	
•Midfoot pain syndromes oMidfoot sprain oTarsal stress fractures	Overuse history, especially long distance running.	Pain in midfoot when twisting forefoot with one hand and holding calcaneus steady with the other. May have direct tenderness over tarsal with stress fracturesX-ray to rule out stress fractures of tarsals, especially navicular. Consider CT or MRI		Rest, PT evaluation, arch support, supportive footwear
•Fore foot pain syndromes oMetatarsalgia oTurf toe oMetatarsal stress fractures	Overuse history, especially long distance running. Running with cutting may cause turf toe.	Pain in fore foot on metatarsals with stress fractures. 1st MTP tenderness with turf toe. Pain on metatarsal head with matatarsalgis	Xrays to look for stress fractures of metatarsals. Consider CT or MRI	Rest, PT evaluation, arch support, supportive footwear, metatarsal pad

	History	Exam Findings	X-ray (AP, outlet, axillary)	Treatment
Shoulder				
Rotator Cuff Injury	Slow onset Deep shoulder pain Hurts at night Pain increased with use	Hawkin's Sign Neer's Sign Supraspinatus Sign	Normal bony anatomy	Rest, ice, NSAIDs P.T.
Little League Shoulder	Repetitive throwing Proximal arm pain	Pain over lateral shoulder	Widening of proximal humeral growth plate. Comparison views needed	Rest, ice, NSAIDs P.T.
Glenohumeral Instability	Subluxation or dislocation Joint laxity in other joints	Apprehension Test Sulcus Sign	Hill-Sachs or Bankart lesions with dislocations	P.T., surgical consult
Distal Clavicle Oteolysis	Pain on top of shoulder, young adult, weight lifting history	AC joint pain	Osteolysis of distal clavicle	Rest, ice, changes in weight lifting routine: more light weight- multiple reps
Labral Injury/SLAP	Painful "clunks or catching"	O'Briens Sign	Normal bony anatomy MRI with contrast to dx	Surgical consultation
Elbow				
Panners disease	Repetitive throwing	Tender lateral epicondyle	AVN of capitellum	Prolonged rest, ice, NSAIDs P.T.
Lateral Epicondylitis	Lateral elbow hurts with gripping, throwing, opening jars or doors,	Pain increased with resisted hand and finger extension	Normal bony anatomy	Rest, ice, NSAIDs P.T.
Osteochondritis Dessicans	Chronic elbow pain	Bony tenderness	Distal humerus, intra-articular areas of OCD	Surgical consultation
Medial Epicondylitis	Medial symptoms similar to lateral epicondylitis	Pain increased with resisted wrist flexion	Normal bony anatomy	Rest, ice, NSAIDs P.T.

	History	Exam Findings	X-ray (AP, outlet, axillary)	Treatment
Medial Epicondylitis	Medial symptoms similar to lateral epicondylitis	Pain increased with resisted wrist flexion	Normal bony anatomy	Rest, ice, NSAIDs P.T.
Little League Elbow (Medial Apophysitis)	Repetitive throwing	Medial elbow tenderness	Widening of distal humerus medial apophysis	Rest for up to 2 months
MCL strain	Repetitive throwing or Acute valgus mechanism	+ Valgus stress test	Normal bony anatomy	Rest, ice, NSAIDs P.T.
Olecranon Apophysitis	Overuse of Triceps muscle, pain increased with pushing	Resisted extension of elbow increases pain Pain at Olecranon Tip	Possible widening of apophysis	Rest, ice, NSAIDs P.T.
Olecranon Impingement	Hyperextension Injury or Repetitive hyperextension of elbow	Pain increased with hyperextension of elbow	Normal bony anatomy	Rest, ice, NSAIDs P.T. Elbow bracing to prevent hyperextension
Triceps tendonitis	Repetitive pushing or elbow extension	Triceps tendon tenderness at insertion on Olecranon Pain with resisted elbow extension	Normal bony anatomy	Rest, ice, NSAIDs P.T.
Hand/Wrist				
Distal Radius Physeal Stress Injury (Gymnast's Wrist)	Repetitive landing on hands	Pain over distal radius	Widening of distal radial growth plate	Prolonged rest, ice, NSAIDs, P.T., consider repeat x-rays in 6 months
DeQuervain's Tenosynovitis	Pain in "snuff box" area of wrist with use of thumb	+ Finklestein's Maneuver	Normal bony anatomy	Rest, ice, NSAIDs P.T. thumb spica brace, consider steroid injection
Wrist Flexor/Extensor tendonitis	Wrist pain with use or movement	Pain on tendons with resisted flexion/extension	Normal bony anatomy	Rest, ice, NSAIDs P.T.