## Differential Diagnosis of Adolescent Conditions

**Conditions**

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<th>Condition</th>
<th>Pathology</th>
<th>Population affected</th>
<th>Mechanism of onset</th>
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<tr>
<td><strong>WRIST</strong></td>
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<td>Scaphoid fractures¹</td>
<td>Fracture generally at waist or distal pole of scaphoid</td>
<td>13 to 15 years</td>
<td>FOOSH</td>
<td>Snuffbox tenderness</td>
<td>Radiographs, standard PA, lateral views also a posteroanterior view in ulnar deviation. Non-displaced fractures may be undetectable on plain radiographs so MRI may be required</td>
<td>Scapholunate ligament injuries</td>
<td>Non-operatively with a thumb spica cast. Displaced scaphoid fractures are treated with an ORIF</td>
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<tr>
<td>Distal Radius Fractures¹</td>
<td>Fracture</td>
<td>Inline skaters or snowboarders</td>
<td>FOOSH</td>
<td>Swelling Tenderness to palpate over distal radius Limited wrist movement</td>
<td>X-rays are required every 2 weeks to ensure reduction is maintained</td>
<td>Scaphoid fracture Triangular fibrocartilage complex (TFCC) tear.</td>
<td>Immobilisation for up to 6 weeks in a cast Displaced distal radius fractures are treated with an ORIF</td>
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<td>Scapholunate ligament injuries¹</td>
<td>Tear or sprain of scapholunate ligament/Scapholunate dissociation</td>
<td>Physically active individuals</td>
<td>FOOSH, High energy trauma</td>
<td>Persistent wrist pain Tenderness 2cm distal to Lister’s tubercle on the radial side of the lunate Watson’s ligament test</td>
<td>Stress radiographs, MRI, and arthroscopy can aid in diagnosis</td>
<td>Scaphoid fracture Other carpal ligament damage</td>
<td>Conservative treatment: immobilisation in a brace Partial ligament injuries can be debrided arthroscopically Complete tears can be diagnosed arthroscopically and treated with open repair and pinning.</td>
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<td>Triangular fibrocartilage injuries¹</td>
<td>Sprain or tear of the triangular fibrocartilage discus, the radioulnar ligaments and the ulnocarpal ligaments</td>
<td>Physically active individuals</td>
<td>A twisting injury to the wrist</td>
<td>Ulnar-sided wrist pain and swelling</td>
<td>MRI with or without intraarticular contrast, or arthroscopy</td>
<td>Carpal ligament damage Distal ulnar fracture Dorsal carpal impingement</td>
<td>-Hand therapy -Splinting or casting can be used -arthroscopic repair in large tears</td>
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<td>Gymnast wrist¹</td>
<td>Growth disturbance in the distal radius (can lead to distal radius deformity or distal ulna overgrowth)</td>
<td>Growing gymnasts</td>
<td>Repetitive axial loading of the wrist causes cumulative injury to the distal radius physis</td>
<td>Vague, chronic, activity-related wrist pain</td>
<td>Radiographic physeal widening or irregularity indicates physeal damage/ dysfunction</td>
<td>Intersection syndrome TFCC injury Acute physeal fracture</td>
<td>Epiphysiodesis or ulnar shortening osteotomy to prevent or treat distal ulna overgrowth</td>
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¹FOOSH: Fall on outstretched hand
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| Dorsal Carpal Impingement¹        | Dorsal radiocarpal/ synovial impingement| Those repeatedly loading wrist extension i.e. push-ups and bench-pressing | Weight-bearing on a hyperextended wrist | • Dorsal wrist pain  
• Pain with end of range wrist extension | • Plain x-rays often normal  
• TFCC injury  
• Intersection syndrome  
• Gymnast wrist | • Elimination or modification of activities to prevent wrist hyperextension  
• If conservative treatment fails, arthroscopic debridement of the dorsal synovitis along with excision of the articular branch of the posterior interosseous nerve may be necessary |
| Generalized Chronic Wrist Pain²   | Persisting pain without structural explanation | Adolescents often girls between the ages of 13 and 16. No history of specific trauma but sometimes a history of heavy participation in grip intensive sports, such as racquet sports or fencing | • Vague, chronic, activity-related wrist pain – Ligamentous laxity is a common finding  
• Other physical findings are usually nonspecific. | • Radiographs and MRI are typically normal.  
• TFCC injury  
• Intersection syndrome  
• Gymnast wrist  
• Dorsal Carpal Impingement | • Formal hand therapy focusing on grip strengthening (isometric wrist flexor/extensor strengthening) without wrist isokinetic or range-of-motion exercises is effective at reducing or eliminating the pain in most patients. |

**WRIST**

*Osteochondritis Dissecans of elbow²*

Adolescent athletes especially male basketball players and female gymnasts

Repetitive lateral compression across the radiocapitellar joint

**Clinical Features**

**Radiological Features**

**Differential Diagnosis**

**Management**

**Panner’s disease²**

Younger children aged 4-8.

Lateral compression forces across the radiocapitellar joint during vulnerable periods of growth can contribute but the actual aetiology is unclear

**Clinical Features**

**Radiological Features**

**Dorsal Carpal Impingement**

**Management**

**Osteochondrosis of the capitellum with avascular necrosis of the ossific nucleus of the capitellum.**

**Clinical Features**

**Radiological Features**

**Dorsal Carpal Impingement**

**Management**

**Medial Distraction Injury² (insertion injury)**

Male baseball players and female gymnasts particularly vulnerable

Repetitive overuse distraction injury to the medial epicondyle apophysis

Acute valgus stress

**Clinical Features**

**Radiological Features**

**Dorsal Carpal Impingement**

**Management**

**Valgus extension overload injury**

Throwing athletes. Olecranon apophysis is unique to the paediatric elbow

Shear stresses across the posterior compartment during the deceleration phase of throwing

**Clinical Features**

**Radiological Features**

**Dorsal Carpal Impingement**

**Management**

**UCL injury**

**Clinical Features**

**Radiological Features**

**Dorsal Carpal Impingement**

**Management**

**RICE treatment, anti-inflammatory medication, Activity modification with graduated return to sport**

**For children active in sports that involve high distraction forces on the medial elbow anatomic reduction and fixation is sometimes considered**

**Posterior fossa syndrome**

**Clinical Features**

**Radiological Features**

**Dorsal Carpal Impingement**

**Management**

**Rest and activity modification with gradual return to throwing**

**Surgical intervention for removal of loose bodies and osteophytes**

**For olecranon apophysis treatment is mainly rest and immobilisation. Delayed or non-union may require surgical fusion**
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<td>Medial Distraction Injury (UCL)</td>
<td>Ulnar collateral ligament injury</td>
<td>Normally in high level skeletally mature throwing athletes (javelin, football quarterback, baseball pitcher). Increased incidence</td>
<td>Atritional – chronic micro trauma to the UCL complex producing micro tears Catastrophic – acute UCL rupture during acute valgus stress</td>
<td>• Attrition al: insidious onset of discomfort over the UCL often associated with throwing. Often recurs with return to throwing even after sustained rest • Catastrophic: A distinct “pop” and immediate pain over the UCL</td>
<td>MRI to view UCL tear or changes</td>
<td>• Medial epicondyle apophysitis or avulsion • flexor pronator tendinosis • ulnar neuritis</td>
<td>• Attritional: Rest • Gradual return to sport including an interval throwing program • Acute rupture with UCL insufficiency: (if skeletally mature) UCL reconstruction using a free tendon graft • Reconstruction only considered in the skeletally immature if 6 months of rest and conservative treatment fails</td>
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<td>Slipped upper femoral epiphysis (SUFU)</td>
<td>Displacement of the upper femoral epiphysis from the metaphysis through the physis</td>
<td>Children</td>
<td>Can be a result of trauma or from accelerated growth spurt. Often the cause is not identified.</td>
<td>• Reduced hip range of motion especially internal rotation • Hip, thigh or knee pain • Gait abnormality – limp or leg held in external rotation</td>
<td>X-ray with lateral or AP views of the hip</td>
<td>Groin strain • Hip sprain • Knee sprain</td>
<td>Surgical management • On diagnosis the child is made non weight bearing and an urgent referral is made to an orthopaedic specialist</td>
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<td>Legg-Calvé-Perthes Disease (Hip pain)</td>
<td>Partial interruption of the blood supply to the immature femoral head</td>
<td>4-8 years of age. Boys are 4-5 times more likely to be affected than girls</td>
<td>Increased incidence with low birth weight, abnormal birth presentation, family history, higher birth order and lower socioeconomic status.</td>
<td>• Hip pain • Traumatic limp • Referred knee pain • Limited hip abduction, internal rotation • Leg length discrepancies</td>
<td>Anteroposterior and frog-leg lateral x-rays demonstrate varying degrees of fragmentation, flattening, sclerosis of the proximal femur growth centre with joint space widening.</td>
<td>Septic arthritis • Osteomyelitis</td>
<td>Physical therapy • Bracing • Surgical reconstruction to improve hip joint congruity.</td>
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<td>Osgood-Schlatter Disease (Knee pain)</td>
<td>Repetitive traction of the patellar tendon on the tibial tubercle ossification centre or apophysis</td>
<td>Between 10-14 years of age</td>
<td>Jumping activities and direct pressure, such as kneeling</td>
<td>• Moderate to severe tenderness, swelling and prominence over the tibial tubercle.</td>
<td>Anterior soft tissue swelling and fragmentation of the tibial tubercle with plain x-rays</td>
<td>Fractures • Tumours • Osteomyelitis</td>
<td>Activity modification • NSAIDs or acetaminophen • Stretching and physical therapy to improve flexibility of lower-extremity muscles • Surgery for mature skeletons who continue to have disabling symptoms</td>
</tr>
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<td>Sinding-Larsen-Johansson Disease (Knee pain)</td>
<td>Inferior pole of patella ossification or apophysis</td>
<td>10-13 years of age</td>
<td>Jumping or direct pressure over the inferior pole of the patella</td>
<td>• Point tenderness is localized to the inferior pole of the patella</td>
<td>Soft tissue swelling and calcification of an avulsed portion of the patella on plain x-ray</td>
<td>• Activity modification • NSAIDs or acetaminophen • Stretching to improve flexibility of the hamstrings, quadriceps and heel cords • Knee immobilisation in severe cases</td>
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| Severs Disease¹ (Heel pain) | Calcaneal apophysitis | Physically active children | Physical activity/ sport e.g soccer | • Symptoms worse at beginning of season or during growth spurt  
• Aggravated by running  
• Point tenderness at Achilles tendon insertion | • Plain x-rays often normal. | • Achilles tendinopathy  
• Plantar fasciitis  
• Calcaneal stress fracture | • Activity and shoe modification  
• Padded heel cups  
• Calf stretches may help (but may also aggravate). |
| Freiberg Disease² (Forefoot pain) | Disordered ossification of the second metatarsal head | Adolescent girls who participate in ballet and dance | Trauma  
Repetitive stress  
Weight-bearing Athletic activities | • Point tenderness and swelling over the affected metatarsal heads | • Sclerosis and varying degrees of flattening of the affected articular surface on plain x-ray | • Activity modification  
• Metatarsal pads  
• Well-padded shoes |
| Köhlers Bone Disease³ (Foot pain) | Osteochondrosis of the navicular bone | 2-8 years of age  
Boys are 3-5 times more likely to be affected | Athletic activities | • Mid foot pain  
• Limp  
• Point tenderness over the navicular  
• Mild swelling and warmth over the dorsal midfoot | • Navicular sclerosis, flattening and fragmentation | • Self-limited condition but short leg casts for up to 8 weeks accelerates resolution |
| **SPINE** |                                               |                                                          |                                        |                                                                                 |                       |                                                             |                                                                                             |
| Scheuermann's Disease⁴ (Back pain) | Disturbance of the vertebral body wedging resulting in kyphosis during a growth spurt | Between 10 and 12 years |                                      | • Back pain  
• Increasing back deformity  
• Rigid, humpback deformity that does not correct with back extension | • AP and lateral x-rays with the patient standing reveal at least 5 degrees of wedging in at least three adjacent vertebrae  
• Disk space narrowing  
• End plate irregularities  
• Scoliosis | • Postural round-back | • Surgical intervention only for patients with mature skeletons who have a curve greater than 75 degrees, pain, rigid deformity and an unacceptable appearance  
• Bracing for the patient with an immature skeleton with an increasing curve |

**ABBREVIATIONS:** FOOSH, fall on outstretched hand; ORIF, open-reduction internal fixation; TFCC, triangular fibrocartilage complex; MRI, magnetic resonance imaging; OCD, osteochondritis dissecans; AP, anterio-posterior; UCL, ulnar collateral ligament; NSAIDs, non-steroidal anti-inflammatory drugs.

**REFERENCES**