MINI-SYMPOSIUM: THE WRIST

(i) Examination of the wrist—soft tissue, joints and special tests

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Abstract Despite the advances in imaging, clinical examination remains the most important means of diagnosis in the wrist. This is especially important in soft tissue injuries after which the radiological changes are subtle and the pathology is dynamic and cannot be appreciated on static images. The wrist joint, however, is complex involving four joints, eight bones, over 20 articulations and numerous ligaments, so a meticulous examination and attention to detail is important in arriving at an accurate diagnosis. We describe a sequence of examination of the wrist, which we routinely use and have found both easy to perform and remember.

Introduction

In a previous article we described the use of clinical examination in the diagnosis of carpal fractures and the surface anatomy of the carpal bones. Clinical acumen is even more important in diagnosing injuries involving the soft tissues of the wrist, for instance in tears of the carpal ligaments after which X-rays and more advanced techniques like MRI can look virtually normal. This is particularly relevant in injuries where there is little or no static dislocation or displacement of the carpal bones for instance in tears of the scapholunate or lunotriquetral ligaments.

Equally, non-traumatic pathology can affect all or only a part of the carpus and localising the source of the pain or instability requires a reasonable knowledge of the anatomy and how to examine each area. Unfortunately the anatomy of the carpus is complex.

The wrist joint is formed by at least four joints, the radio-carpal, the midcarpal, the pisotriquetral and the distal radio-ulnar, even if one doesn’t include the five adjacent carpo-metacarpal joints. Though there are only eight carpal bones there are at least 20 articulations between the bones as well as the adjacent radius, ulna and metacarpals. In addition to the above, there are intraarticular soft tissue structures including the intrinsic intercarpal ligaments and the triangular fibrocartilage (TFCC) complex (TFCC). Also running through the capsule are another set of ligaments known as extrinsic ligaments, which are important stabilisers of the
carpal bones. Overlying these are the tendons and their sheaths that cross the carpus to insert distally and either directly or indirectly move the wrist. These include twelve tendons in six separate extensor compartments on the dorsum of the wrist as well as eleven on the volar side.1

When it comes to examination, though, it would be ideal to know exactly the anatomy of the wrist. Unfortunately even so-called experts still argue on the ligamentous anatomy. Practically, a reasonable knowledge of where the bones and hence the joints are, as well as the overlying tendons, should suffice for examination of most conditions. A little knowledge of the ligaments is a dangerous thing, since it confuses rather than helps. If one is keen to go against this advice we would recommend one should only look at ligament anatomy as described in the last few years. One of the recent textbooks on wrist surgery is a good starting point rather than the more classical anatomical texts. The latter, however, are ideal for the rest of the structures. We would recommend before reading this article that one should have read our previous article on examination of the carpal bones and the surface anatomy of the wrist. It is also important that one’s knowledge of the overlying tendons is not too rusty and may need refreshing.

Classically examination has been taught using the steps, Look, Feel and Move. We believe that for the wrist (and in other joints used as short cases in exams) a different sequence is useful. We recommend one should,

1. Ask patients to point to (with a single digit) the most painful area.
2. Look. (And describe in exams.)
3. Test movements.
   (a) Ask the patient to do the passive movements that he/she can demonstrate themselves. (Giving clues to pain without causing consternation of examiners by hurting the patient.)
   (b) Ask patients to actively move joint in all directions.
   (c) Demonstrate passive movements not previously tested.
4. Feel and do special tests and manoeuvres. (In logical sequence of anatomy.)

Special tests for clinical examination of the wrist have been considerably expanded in recent years and a careful examination usually suggests the diagnosis of the lesion provided time is taken to seek out the signs.2 The examination must always be made in comparison with the other side, looking for deformity but also, especially in the wrist, looking for laxity since there is a large degree of normal variability in the joint. It goes without saying that the limbs are exposed to the elbow so that these too can be examined.

The correct positioning is with the examiner seated opposite and quite close to the patient (Fig. 1). The patient must be able to rest forearms and elbows on the corner of the desk or on the arms of a chair with the shoulder and rest of the body relaxed.

Since we have described palpation of the wrist in our previous article we will emphasise the three other main components of the examination process. Look, Move and Special Tests.

**Inspection**

It is worthwhile asking, as the first step in examination, for the patient to indicate, using one finger, the exact location of maximum pain. This is often very accurate, particularly in chronic mechanical disruptions. It is not so good in acute injuries, when the haemarthrosis spreads the pain across the wrist, or in chronic inflammatory conditions. The senior author finds it helps in distinguishing mechanical problems, which may be amenable to surgery, from the chronic pain syndromes in which the patient fails to localise the pain. In these cases the authors suggest a lot of care when advising surgical treatment. It is also useful to warn a nervous examination candidate where not to grab and thus annoy the examiner!

Inspection is best undertaken with the patient sitting opposite the examiner. It is worth holding the hands gently so one can turn the hands over to inspect both sides (Fig. 1). As with all joints one should look for universal changes such as scars and skin changes; however, there are some
particular aspects unique to the wrist. Alignment and attitude are important. Radial deviation of the wrist can, for instance, indicate radial shortening or loss of radial slope following malunion of fractures. It can also indicate scapholunate dissociation in which the flexed scaphoid shortens the radial side of the carpus. Radial deviation of the carpus is also common in inflammatory arthropathies.

Ulnar deviation is uncommon but prominence of the ulnar head is an important indicator of distal radio-ulnar joint (DRUJ) or ulnar-sided carpal pathology. The prominent ulnar head can be due to dorsal dislocation of the DRUJ but more commonly it indicates a normally placed ulnar head with a subluxed ulnar side and pronation of the carpus. In the rheumatoid wrist this latter situation is known as the Ulnar Caput Syndrome but similar deformity can be seen in TFCC tears. The overlying extensor carpi ulnaris (ECU) tendon is often more pronounced in this situation though even in the normally shaped wrist it is worth looking for this tendon since it is a common site of pathology.

Looking at the wrist from the side, it is worth noting if there is either a dinner fork or reverse dinner fork deformity. Though this obviously can indicate malunion of distal radial fractures it can also indicate either a dorsal or volar intercalated segmental instability with carpal collapse or the subluxation found in inflammatory arthropathies.

Some lumps are more common in the wrist than other joints, for instance ganglions and rheumatoid synovitis, which can be quite visible dorsally. Other lumps are less common but worth a search for. These include metacarpal bosses, which are bone prominences overlying most commonly the 2nd and 3rd carpo-metacarpal joints and the prominent proximal pole of the scaphoid seen in scapholunate dissociation, which is more prominent with the wrist flexed.

**Practice points: inspection**

- Ask patient to point at the most painful point.
- Observe alignment.
- Observe general conditions, scars, etc.
- Observe and describe lumps.

**Movements**

Following inspection of the wrist the authors believe that with the wrist it is best practice to observe movement next. Passive extension and flexion is first assessed by sitting opposite the patient and asking them to follow the demonstrated actions. These demonstrated movements are tested by asking the patient to place his or her palms together and pushing, thus extending the wrists (Fig. 2A). This is repeated placing the back of the hands together and testing flexion (Fig. 2B). By doing this one can observe not only movement but also the limit due to pain and directly compare both sides.

Next active movement is tested by again asking the patient to follow the demonstrated actions. Both wrists are assessed simultaneously and if necessary measured with a goniometer, though in most situations comparative movement is all that is needed. All movements are tested with the elbows flexed to about 90° and should include flexion/extension, ulnar/radial deviation and pronation/supination (Figs. 3A–3F).

Extension should be observed with the metacarpo-phalangeal (MCP) joints flexed at 90° to negate the tenodesis effect of the flexor tendons. Likewise flexion should be tested with the MCP joints in extension to relax the long extensors.

Radial and ulnar deviation are tested with the forearms placed in full supination and the hands rested on the table. Pronation and supination are tested with the elbows at right angles and tight into the patient’s side. Having tested these motions actively the passive range is assessed.

It is sometimes useful to observe the patient making a fist and also circumducting the wrist.
watching for ease of movement and listening for clicks.

**Palpation and special tests**

Palpation and special tests in the wrist are probably best done at the same time. It is important to do the examination in a logical and repeatable sequence so as not to miss any part of the joint. Though in principle it is recommended to start with the pain-free regions, we believe that it is best to stay to the same tried and tested order. The authors recommend the following:

**Distal radio-ulnar joint (DRUJ) and extensor carpi ulnaris (ECU) tendon**

Examination of the DRUJ involves testing for range of movement, pain, tenderness, instability and crepitus. The DRUJ is most lax in the mid range of pronation and supination. This is best elicited with the arm in the position as shown in Fig. 4A. The radius and the carpus are stabilised in mid rotation with the elbow on the desk and the distal ulna is held between thumb and forefinger. Ballottement elicits laxity, crepitus and pain. It must be compared with the other side since there is a wide range of normality. 1,3

Rotating the wrist into full pronation and supination results in tightening either of the volar or dorsal components of the TFC, respectively. This stabilises the DRUJ. Laxity on ballottement (Fig. 4B and 4C) in full rotation is abnormal and indicates loss of the stabilisers of the distal ulna. 4

**Practice points: stabilisers of the distal ulna**

The main soft tissue components necessary for stability are:

1. TFCC.
2. DRUJ capsule.
   Other extrinsic components that play a lesser role in stability include:
3. ECU tendon and its sheath.
4. Interosseous membrane.
5. Extensor retinaculum.
6. Pronator quadratus.
In many patients, however, instability is difficult to reproduce clinically. One often finds lack of rotation because further movement would produce pain and is resisted. This is similar to the provocation tests one sees in shoulder instabilities. The true extent of the instability may not be apparent until the patients are anaesthetised.

When testing the DRUJ one should palpate the ECU tendon running in the sixth extensor compartment.\(^5\)

**Figure. 4** Examination of the distal radio-ulnar joint (DRUJ test) with forearm in different positions: (A) forearm in mid prone position, (B) forearm in full pronation and (C) forearm in full supination.

**Practice points: extensor tendon compartments**

Fibrous septae pass from the deep surface of the extensor retinaculum to the bones of the carpus, dividing the extensor tunnel into six compartments. From the radial (lateral) to the ulnar (medial) aspect, the compartments contain the following:

1. Abductor pollicis longus and extensor pollicis brevis. These tendons lie over the lateral aspect of the radius.
2. Extensor carpi radialis longus and extensor carpi radialis brevis. These tendons run on the radial aspect of the lister’s tubercle.
3. Extensor pollicis longus. This tendon passes ulnar to the lister’s tubercle.
4. Extensor digitorum communis and extensor indicis.
5. Extensor digiti minimi. This tendon overlies the DRUJ.
6. ECU. This tendon passes near the base of the ulnar styloid process.

The ECU is an unusual tendon in that it not only moves longitudinally but also sideways over the ulnar styloid when the forearm rotates. It is a common site of pain especially when there is a prominent ulnar head due to a subluxed carpus. One should palpate and feel it move with one’s fingertip by asking the patient to rotate the wrist. Tenderness, swelling, instability and snapping can be observed.

**Flexor carpi ulnaris, the pisiform bone and piso-triquetral joint**

The next part of the wrist to be examined is the ulnar-sided flexor mechanism which includes the flexor carpi ulnaris (FCU), the pisiform and the piso-triquetral joint. The piso-triquetral joint is a site of pathology, which is often missed and readily treatable. One also has to exclude pain in this joint before testing the lunotriquetral joint since both joints are stressed when testing the latter.

The pisiform is similar to and has all the pathologies of the patella. These include fractures, chondromalacia osteoarthritis and instability. The bone lies within the tendon of flexor carpi ulnaris. The tendon is easily felt with the tip of the finger, which moves distally, testing for tenderness until the pisiform is encountered. The easiest position in
which to do this is by holding the patients hand palm down and feeling the tendon and pisiform with the tip of the index finger (Fig. 5A). Pushing the ulnar border of the pisiform towards the mid line can test the piso-triquetral joint. This is helped by slightly flexing the wrist to increase the mobility of the joint. Equally feeling the tendon and asking the patient to push against resisted flexion and ulnar deviation the FCU tendon can be tested. The pisiform can also be palpated with the palm up and using the thumb and forefinger. The pisiform lies just distal to the ulnar end of the distal wrist crease. Examination (Fig. 5B) is performed by applying gentle thumb pressure on the pisiform towards the mid line or by grasping the bone between thumb and forefinger and moving it transversely both ways.¹

Lunotriquetral joint: Having tested the piso-triquetral joint, the next site of examination is the lunotriquetral joint which is tested for pain, tenderness and instability. This is assessed by using Masquelet’s Ballottement test (Fig. 6). In this test the examiner’s thumbs are used to apply dorsal pressure on the lunate and the triquetrum while counter pressure is applied to these bones on the volar aspect by the examiner’s index fingers. The index finger below the triquetrum will be on the pisiform so both bones are held in one hand and balloted against the lunate. A shear force is applied across the joint. Painful shearing or instability demonstrates ligamentous injury.¹,³

Ulnar abutment: At this point it is worth testing for ulnar abutment. In this syndrome the distal ulnar head, impinges on the proximal and ulnar corner of the lunate in ulnar deviation. This is tested by forced ulnar deviation of the wrist producing pain in this area. The syndrome normally includes a central tear of the TFC, which is caught between the two bones. The abutment is tested in various degrees of flexion and extension. A visibly prominent ulnar head often does not cause abutment since it actually overrides rather than impinges on the carpal bones. It tends to occur in wrists where there is radial shortening but no tilt and occurs most commonly after trauma though it is also common in the congenital ulnar plus wrist.

Triangular fibrocartilage complex (TFC): Tears of the TFC are common but are often not painful. They can produce either pain due to catching of the cartilage or lesions of the entire complex may cause instability of the ulnar side of the wrist. Examination of the TFC structure has already been alluded to earlier in this article. If one sees a prominent ulna head this could be due to a TFC tear, which has resulted in subluxation of the ulnar side of the wrist. Likewise ballottement of the DRUJ can produce a painful click, which can be from a torn TFC. Unfortunately one cannot directly palpate the TFC due to the overhang of the distal ulna so all testing needs to be indirect.

The TFC is examined (Fig. 7A) by resting the elbow on the table and one hand of the examiner supporting the patient’s forearm at the level of the distal radius and ulna. This hand clamps across both
radius and ulna allowing no movement at the DRUJ. The examiner performs a grinding test on the TFC. The other hand applies axial loading on the patient’s hand, keeping it in ulnar deviation i.e. compressing the TFC. The carpus is then pronated and supinated, and the TFC assessed for pain, clicking or both. If there is subluxation of the carpus reduction by lifting the carpus dorsally can produce pain or clicking from a torn TFC.1,3

The lunate

After examining the TFC, one should palpate the lunate to exclude fractures or Kienbocks disease. As described in our first article, the lunate lies under the 4th extensor compartment and is much better palpated with the wrist in flexion, which brings the bone out from under the overhang of the distal radius.

The scapholunate joint: The next structure examined is the scapholunate joint. Palpation is performed by placing the tip of one’s thumb in the crucifixion fossa. This recess lies about a centimetre distal to Lister’s tubercle. It is best located by holding the patient’s hand palm down and feeling the tubercle with the thumb and then moving the tip distally until it falls into a soft recess, the crucifixion fossa. Flexion of the wrist produces the loss of the recess as the scapholunate joint and adjacent lunate and proximal pole of the scaphoid come out from under the overhang of the radius. Tenderness in this area indicates synovitis associated with either scapholunate joint laxity or disruption, or a proximal scaphoid fracture or non-union. If the crucifixion fossa is difficult to palpate or there is already a hard lump present, this could be either a ganglion or the proximal pole of the scaphoid that is sitting high due to scapholunate dissociation. It must be remembered that small ganglions are the ones most likely to cause pain as they are imprisoned under the extensor retinaculum. Unfortunately both these and scapholunate dissociation are most painful in extension and radial deviation.

Scapholunate pain and instability can be tested in several ways. The shear test (Fig. 7B) is done with one hand of the examiner holding the scaphoid at both ends, distally with the index finger over the scaphoid tuberosity, which is the most prominent lump on the volar and radial side of the wrist, and proximally the thumb over the proximal pole of the scaphoid in the crucifixion fossa. The other thumb is placed over the lunate dorsally and a shear force is applied to detect scapholunate instability.1,3 A grinding test can be used feeling for crepitus or a click and eliciting pain if present. As with any wrist examination the laxity needs to be compared with the normal side.

Another method is Kirk Watson’s test, the scaphoid shift manoeuvre. This is used to test for scapholunate interosseous ligament injury. The patient is seated with the elbow rested on a table surface with the hand placed in full ulnar deviation and stabilised by the examiner holding the metacarpals (Fig. 8A). The examiner’s other thumb is placed firmly on the tubercle of the scaphoid and the wrist is moved into radial deviation (Fig. 8B). The scaphoid cannot flex because of firm pressure; however, this is overcome in the normal wrist by the scapholunate ligament which pulls the proximal pole of the scaphoid smoothly into the scaphoid fossa of the radius. If the ligament is disrupted, the proximal pole remains on the dorsal rim of the radius until it suddenly pops back into place.1,3

The scaphoid. The next part of the examination is to palpate the scaphoid as described in our previous article. This should include the proximal pole already palpated in the crucifixion fossa, the waist in the anatomical snuffbox (more easily felt in ulnar deviation) and the tubercle (Fig. 9A). Painful non-union of the scaphoid can also be
tested by the grinding test, which is the axial loading of the first metacarpal and then twisting it but allowing the wrist to go into radial deviation (Fig. 9B).1,3

By stabilising the carpus the grinding test is also used to test for the 1st metacarpo-trapezial joint pathology. Crepitus can be felt in osteoarthritis of the carpo-metacarpal (CMC) joint of the thumb but infrequently in scaphoid non-union.

The trapezium. Having tested the scaphoid the trapezium is palpated including the tubercle and ridge as described in our previous article.

Carpo-metacarpal joints (CMC). Once the trapezium has been palpated the CMC joints of all the digits are examined. One should palpate them for subluxation and lumps (bony or ganglions) and test them for movement, pain and in the thumb for instability. The dorsum of the first metacarpal is followed proximally until the overhang at the level of the CMC joint is noted. The joint itself is better identified by opposing the patient’s thumb. Subluxation is noted. If a longitudinal force is now passed through the shaft of the metacarpal, instability may be detected. This can sometimes be enhanced by translation. Testing for instability due to rupture of the Beak ligament is difficult and both sides need to be compared. To test for wear in the joint, a grind test is performed in which the trapezium is stabilised with one hand and the metacarpal is moved transversely and rotated (Fig. 10A), feeling for crepitus.1,3

In a similar fashion the joints between the 2nd metacarpal and trapezoid, the 3rd metacarpal and capitate and the 4th and 5th metacarpals and the hamate are tested for pathology. Unique to the 2nd and 3rd metacarpals are bosses found overhanging the CMC joints. Theses are either just pure bony lumps or have associated ganglions. Though not tender, pain can be elicited from them by extending the relevant metacarpals or by asking the patient to sublux one of their extensor tendons over the lump. Movement of the CMC joints increases from the index to the little finger as does the ability to note crepitus or stability.

Hook of hamate: Even in chronic pain, one should always test for tenderness of the hook of hamate especially if the patient complains of pain in the palm. Pain secondary to an acute fracture or
non-union of the hook of hamate can be an elusive cause of wrist pain. It can be examined (Fig. 10B) by placing the thumb on the pisiform and then moving approximately 1–2 cm distally and radially along a line joining the pisiform to the neck of the 2nd metacarpal. Simultaneous pressure is applied on the dorsal and ulnar aspect of this bone with the index and middle fingers.1

The modified Fisk's forward shift test (Pseudostability test): This test (Fig. 11) is devised to show non-specific pathology in the wrist. The patient must be very relaxed with the wrist in neutral position. Assess the laxity by comparing with the normal side. The examiner firmly grips on the distal forearm and with the other hand grasps the CMC joints. The hand is then pressed firmly palmarwards. Normally there must be palmar translation of about a centimetre and if there is any acute pathology in the wrist, this normal translation will not happen due to spasm of the muscles. The presence of pseudostability is important and is an equivalent to the apprehension sign as seen in patellofemoral instability or in shoulder instability.3

Midcarpal joint stability tests: The last tests performed on the wrist are tests for midcarpal instability. These must always be done in comparison with the normal side and in some cases also looks for general joint instability. The difficulty is that many wrists are naturally very lax and click and thus interpretation is difficult especially in non-traumatic cases. This one is best left to the experts! The tests include:

The anteroposterior drawer test: One of the examiner’s hands holds the patient’s hand and applies axial traction (Fig. 12) while the other hand stabilises the patient’s forearm. An anteroposterior force is applied and a reduction is elicited at the radio-carpal and the midcarpal joint.

Pivot Shift test: This test consists of supinating and volar subluxing the distal row of carpus (Fig. 13A and B). The patient’s elbow is flexed to 90°, hand is fully supinated and the distal forearm is held firmly maintaining the wrist in neutral position. The hand is initially moved into full radial deviation and the ulnar side of the carpus is forced
into further supination and volar subluxed position. The hand is now moved from radial to ulnar deviation, the distal row snaps back painfully into position. Midcarpal instability secondary to excessive ligamentous laxity will allow the capitate to volarly sublux from the lunocapitate fossa and this snaps back painfully into position during this maneuver.\textsuperscript{1,3}

**Practice points: order for palpation and special tests**

- Examine DRUJ and ECU.
- Examine and palpate flexor carpi ulnaris, pisiform bone and pisotriquetral joint.
- Palpate triquetrum
- Perform ballottement test for lunotriquetral joint
- Test for ulnar abutment.
- Examine TFCC.
- Palpate for lunate tenderness.
- Palpate scapholunate joint and perform tests for instability.
- Palpate scaphoid.
- Palpate trapezium.
- Examine CMC joints in order.
- Palpate the hook of hamate.
- Fisk’s forward shift test.
- Perform midcarpal instability tests.

**References**