HAND AND WRIST PROBLEMS IN GOLF

– Written by Fiona C. Campbell and Douglas A. Campbell, UK

INTRODUCTION

The hand and wrist along with the lower back are the most frequent body areas to cause symptoms and performance-limiting problems in the elite golfer (Gosheger et al[3]). Hand and wrist problems are relatively more common in the elite or professional golfer compared to the recreational golfer who is more frequently affected by lumbar spine and elbow issues. This likely reflects an increase in volume of golf practice and strength and conditioning, as well as different and more consistent biomechanics in the elite golfer.

The complicated anatomy can often perplex the clinician when assessing patients with problems in the hand and wrist. However, little progress can be made in establishing diagnoses and arranging successful treatment strategies for the golfer without a fundamental understanding of some of the key anatomical factors in this area. In addition, the movement patterns specific to golf forms the basis on which an understanding of the problems that are encountered can be identified and managed successfully. We trust this article, exploring these issues in elite and professional golfers, is of relevance to golfers, their coaches, their physical preparation coaches, physiotherapists and medical staff.

ANATOMICAL FACTORS AND MOVEMENT PATTERNS

The anatomy of the symptomatic area can be studied in any textbook. However, an understanding of how those structures interact with each other to produce a particular movement pattern (and function) can be difficult to grasp. Golf is a 'sideways-on' sport, where the right and left sides of the body perform different and complementary movements in order to generate a shot. The non-dominant hand faces the target and is referred to as the 'lead' hand. The dominant hand faces away from the target and is referred to as the 'trail' hand. The majority of golfers wear a single golfing glove on their non-dominant (lead) hand, which assists the observer in the visual assessment of swing movement patterns.

Observation of the movement patterns of the lead and trail hands has revealed reliable, but different, planes of motion. The arbitrary division of a complete golf swing into four phases (address, backswing, downswing and follow-through) is helpful in visualising these planes and also in describing the movement patterns, but is of additional relevance when players frequently report symptoms that are limited to one of these specific swing phases.

Description of the movement patterns is best undertaken from two viewpoints. Firstly, the observer stands opposite the player to obtain a view of the front of the golfer. Secondly, the observer stands behind the line of the golf shot, obtaining a view of the intended path of the ball (and the relevant changes in wrist position during each swing). Although these positions provide different and important viewpoints, it must be acknowledged that the actual hand and wrist movement patterns during a complete golf swing are three-dimensional, involving flexion, extension, radial deviation, ulnar deviation and rotational movements in both forearms and wrists.

At address, the wrists assume an almost neutral flexion/extension position (although the lead wrist usually sits in marginal extension) with both wrists in ulnar deviation (Figure 1a and 1b). At the top of the backswing (Figure 2a and 2b), the lead wrist remains neutral in its flexion/extension movement plane but radially deviated, whilst the trail wrist moves into extension (which can often be at the end of a normal active range). Changing the angle of the lead wrist to either extension or flexion will alter the plane of the clubface by a similar degree, leading to a generally less favourable impact plane of clubface on ball.

The downswing generally produces a similar movement pattern of the backswing in the opposite directions but, close to impact, the hands/wrists are usually moving in front of the club, resulting in an extreme hyperextension of the trail wrist at that moment (Figure 3). The degree of loaded extension is enough to restrict blood flow on the back of the hand, resulting in temporary blanching of the skin. This highlights the enormity of load in that plane at that moment (Figure 4a and 4b).

At impact, the wrists once more assume a similar position to that at address (although some prefer a technique where the lead wrist retains a minor degree of flexion through impact). Since both hands grasp the club handle throughout the swing, any flexion in one wrist will produce extension to a similar degree in the other wrist.

As the moment of impact passes, the lead forearm resists the passive tendency for the lead wrist to move into extension with the momentum of the club movement, retaining a relatively neutral flexion/extension plane in both wrists. The club continues into the final 'follow-through' position with the lead wrist in mild extension and radial deviation and the trail wrist in more noticeable extension and radial deviation to assume the finishing position (Figure 5). Different individual techniques end in a high or less high finishing position that has a clear impact on the degree of these separate finishing joint positions.

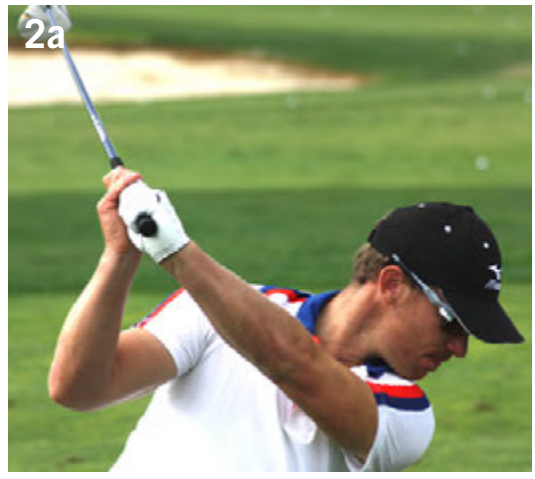


Figure 1: Position at address a) from behind b) from face-on.

Figure 2: Position at the top of the backswing a) from behind b) from face-on.

Figure 3: Position immediately pre-impact.

Figure 4: Extreme hyperextension of the trail wrist a) from behind and b) from face-on.

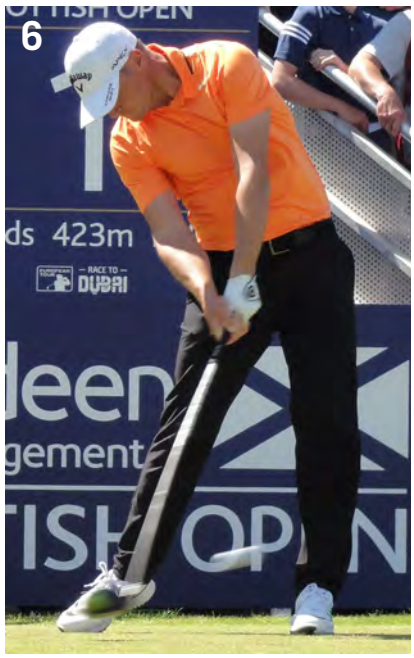


Figure 5: Position at end of follow-through.

Figure 6: Full elbow extension in the lead arm prevents any rotation in the forearm.

Figure 7: Partial elbow flexion in the lead arm permits forearm rotation.

Forearm rotation (pronation and supination) also contributes to the movement pattern. The lead forearm cannot rotate if the elbow remains in full extension (Figure 6). Any 'rotation' of the lead upper limb must occur at the shoulder in these circumstances. If the lead elbow assumes even a minor degree of flexion (Figure 7), rotational movements become possible within the forearm joint itself, producing mechanical changes at the wrist that particularly relate to the position of the tendon of extensor carpi ulnaris (ECU) and the load on the ulnocarpal joint.

Each wrist moves in a different and opposing yet predictable pattern. The lead wrist moves primarily in a plane of radial and ulnar deviation ("side-to-side" between the thumb and small finger sides of the wrist) until the end of the follow-through, whilst the trail wrist generally adopts a flexion/extension ("front-to-back") path. This series of repeatable (different) movements produces different load patterns on each wrist, leading to the development of different clinical issues and problems.

It must be remembered that the aim of the golf swing is to initially place the clubhead in the correct position (and at the correct angle) at the top of the backswing to permit a downswing that brings the face of the club into contact with the ball at the optimal angle (in both side-to-side and up-and-down planes) to achieve the best strike and subsequent ball flight. A spectrum of different movements involving core, spine, hip, pelvis, lower limbs, scapulae, shoulders and elbows must occur in a specific sequence in order to permit the wrists and hands to control the interface between player and equipment. Any abnormality, restriction or limitation in any of these proximal movements will result in the wrists and hands having to change their intended functional movement pattern in a split-second and, importantly, adapt subconsciously to align the clubface with the ball in time for the strike.

It can therefore be more easily understood that wrist and hand symptoms can often be a reflection of range limitation or movement pattern disturbance in other parts of the kinetic chain. In essence, the 'last link in the chain' has to do the work that the earlier 'links in the chain' have been unable to achieve. Wrist symptoms do not always reflect wrist pathology.

THE EVIDENCE

For recreational players, (who play less golf and have less consistent biomechanics/ swing patterns), hand and wrist symptoms are as likely to be due to playing other sports or life activities than playing golf[2]. Recreational golfers are on average older than elite/ professional golfers, and are more likely to have osteo-arthritis of the hand/wrist that affects their golf.

A study of 128 elite golfers (from a field of 153) at a sub-major professional golf tournament in 2009 (Hawkes et al)[3] reported the prevalence, nature and impact of wrist issues in the year prior to sampling. The study described 43 wrist problems in 38 golfers, with 25 golfers experiencing issues of sufficient severity that they were forced to miss at least one tournament.

The majority of issues occurred in the lead wrist (67%) with many fewer in the trail wrist (28%) and a few (5%) who had problems in both wrists. High-level golfers who describe symptoms commencing at a single point in time following a traumatic event (for example hitting a tree root) are more likely to miss training and competition than those with a subacute or more chronic presentation. Most symptoms can be traced to either an increase in volume of balls hit, to a change in surface the player is practicing on, or to a technique modification. Small changes to these variables can often decrease and even eliminate symptoms. Wrist symptoms are generally more common when players have been practicing extensively from hard golf mats (common in winter) or on hard links turf in summer months.

ULNAR SIDED PAIN

Ulnar sided problems mostly involve the extensor carpi ulnaris (ECU) tendon or the ulnocarpal joint. The ECU tendon can experience tenosynovitic problems or instability (Campbell et al[4]) when it tears out of its retaining sheath and subluxes– often following a traumatic shot when a golfer contacts a hard object like a cart path or a tree root at impact (Figure 8).

Imaging (ultrasound or MRI) can reveal tendon changes including longitudinal split tears as well as abnormal excessive

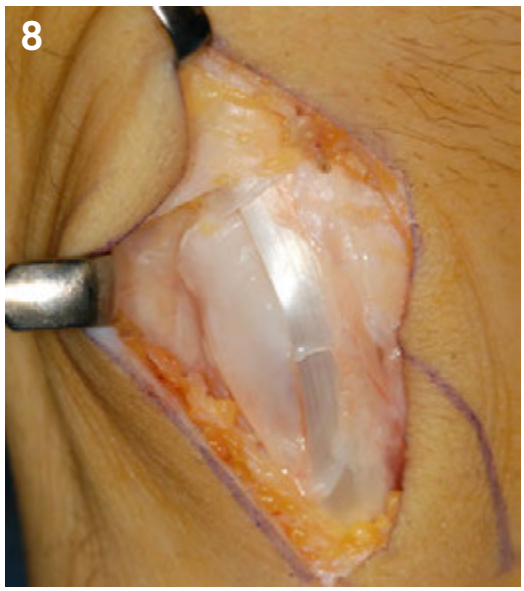


Figure 8: The extensor carpi ulnaris (ECU) tendon tears from its retaining sheath and subluxes.

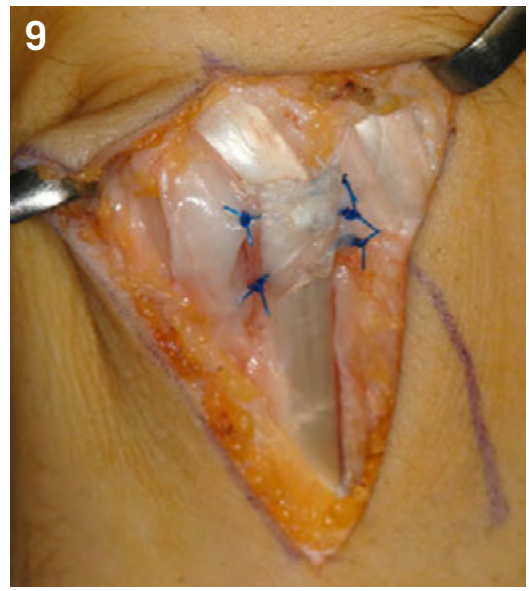


Figure 9: Surgical reconstruction of the sheath using a non-anatomic repair.

Figure 10: CT scan demonstrates a carpal boss at the carpometacarpal (CMC) joint.

tendon mobility (instability). Movement of the ECU tendon out of its bony groove in the dorsal distal ulna can occur in a gentle gliding movement or can be felt as a sudden (often uncomfortable) 'snap'. Those tendons that glide in and out of the groove tend to do so out of a congenitally shallower groove than those that dramatically 'snap' in and out of the groove, and are often seen in both wrists. Consequently, gentle gliding subluxation is usually regarded as a variant of normal – a constitutional subluxation rather than a frank instability that demands treatment. Unstable snapping tendons can go on to develop considerable tendinopathic findings (both symptomatically and on imaging) that resolve once the tendon has been surgically stabilised. Non-anatomic ECU sheath reconstruction surgery (Figure 9) is advised in the elite golfer because simple sheath repair narrows the tendon's retaining sheath, limiting easy gliding of the tendon, often making symptoms of pain worse than prior to surgery.

It would not be unreasonable to propose that those golfers who do not maintain full extension in their lead elbow in their backswing and downswing are theoretically more likely to develop ECU instability due to the additional impact of forearm rotation (and ECU movement) to the ulnar deviation and forcible compression of that side of the wrist seen at impact. This additional vector does not occur within the forearm if the elbow remains in full extension.

The ulnar side of the lead wrist is forcibly compressed in extreme ulnar deviation at impact and, in the trail wrist, just after impact when pronation of the trail forearm causes functional lengthening of the ulna. Both of these situations can lead to the development of inflammation of the soft tissue joint lining between the ulna and carpal bones—ulnocarpal synovitis. This condition most often appears within hours of (usually) prolonged practice on hard surfaces or (less frequently) after a mis-timed impact of the club on hard ground. Course conditions can play a part in injury patterns.

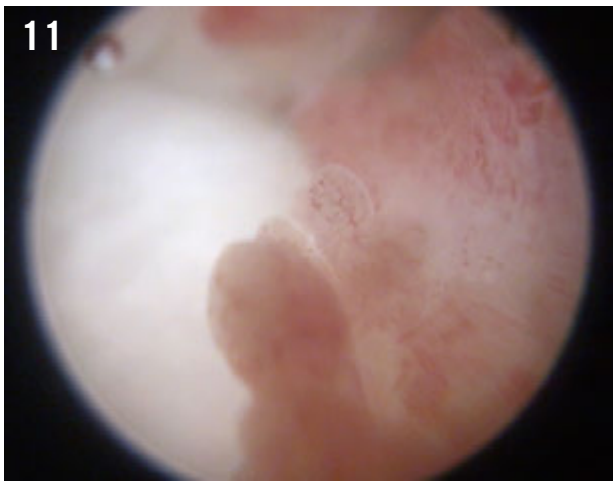
Triangular fibrocartilage complex (TFCC) injuries are rarely seen in the elite golfer and, when present, are usually a degenerative consequence of chronic grinding of the cartilage disc between the ulna and carpal bones. This condition generally responds positively to modification of volume of practice, avoiding play from hard surfaces, image guided steroid injection, rest and strengthening. Frank tears of the TFCC leading to instability of the distal radioulnar joint (DRUJ) are more usually seen after a fall or other traumatic incident that is not golf related.

RADIAL SIDED PAIN

Radial sided pain is unusual in elite golfers and is usually due to de Quervain's tenovaginitis or intersection syndrome. These may be related to golf, but can be unconnected to any identifiable causative factor. Radioscaphoid impingement of dorsoradial synovitis is also seen on occasions. The above are almost always related to an increase in volume of balls hit, or technique modification, and can be managed by load modification, physiotherapy treatments, technique considerations and corticosteroid injection and taping if required.

A carpal boss is a small outgrowth of excess bone at the dorsal margins of the carpometacarpal joint (CMCJ) usually seen in the middle ray (Figure 10). The index ray can also be affected. In this condition, the small bony outgrowths impinge on each other at forced end-range extension of the CMCJ (usually on impact with the ground). Guided steroid injection or, in resistant cases, surgical excision will usually resolve the symptoms completely.

The scaphoid bone (situated at the base of the thumb) is often subject to flexion and compression forces as a part of the complex biomechanical movements of the proximal and distal carpal rows against the fixed platform of the distal radius. Stress fractures have been reported in the scaphoid and internal fixation with a small metal screw has been successfully employed in restoring an elite golfer to pain-free performance (Jones et al[5]). An early MRI scan can demonstrate changes of bone oedema consistent with early bone stress- a low threshold for MRI scan is recommended if scaphoid bone injury is suspected.



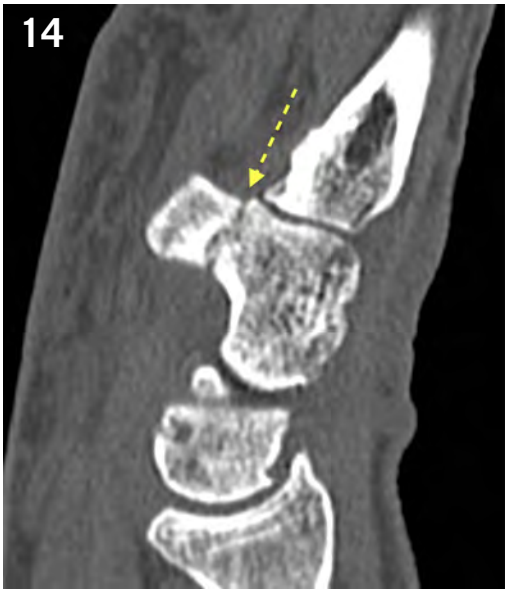


Figure 11: Arthroscopic view demonstrating hypervascular inflamed dorsal radiocarpal synovitis.

Figure 12: Marginal loss of end-range active extension in the left wrist.

Figure 13: Circumferential taping technique to limit hyperextension in the trail wrist.

Figure 14: CT demonstrates non union of a fracture of the hook of the hamate.

DORSAL PAIN

Dorsal wrist pain (pain at the back of the wrist) occurs more frequently in the trail wrist and is likely to be caused by the repetitive forced loading of that joint in extreme hyperextension during the swing. Symptoms usually develop after prolonged or repeated practice off hard surfaces, particularly when using short irons/wedges that demand a steeper angle of attack onto the ground. In these situations, the wrist is persistently pushed beyond natural end-range extension with force, leading to the development of inflamed joint lining (synovitis) in the radiocarpal joint (Figure 11). Dorsal wrist pain that presents in the lead or both wrists is more likely to have been precipitated by strength and conditioning exercises involving wrist extension (for example squats) or loaded extension exercises (push-ups) and is usually unrelated to golf technique.

After questioning about their strength and conditioning regime and the volume and type of their golf practice, the examination of a golfer with dorsal wrist pain in their trail wrist should begin with an assessment of the active range of shoulder adduction in the opposite (lead) limb. A significant lack of lead shoulder adduction can result in difficulty achieving the required position at the top of the backswing – meaning that the trail wrist has to 'catch up' that lost movement by moving beyond its comfortable end-range.

Dorsal radiocarpal synovitis can become chronic, resulting in a subtle loss of end-range active extension (Figure 12) and accurately localised pain on the dorsal central part of the radiocarpal joint line on loaded extension. Ultrasound and MRI scan can visualise this inflamed tissue. Altering volume of practice, and circumferential tape, applied just over the radiocarpal joint margin and distal forearm, can limit end-range extension and improve symptoms (Figure 13). Ultrasound guided corticosteroid injections are effective in all but the most chronic of situations, but the symptoms can recur unless the player considers (and amends) predisposing factors. Arthroscopic synovectomy or, in rare cases, open synovectomy is indicated in resistant or recurrent cases.

Loss of wrist extension should always be fully investigated to exclude other non golf-related causes such as Kienbock's disease.

PALMAR PAIN

Pain in the palm is unusual in elite golfers. When present, it almost exclusively occurs in the lead hand on the ulnar side of the palm due to bone stress, and sometimes fracture and nonunion of the hook of the hamate (Figure 14). This has, historically, been blamed on impact from the 'butt' end of the club shaft on the tip of the hook of the hamate, resulting in acute fracture, but

can also be due to repetitive impact due to volume of practice and technique. Fracture of the hook of the hamate is the second most frequent fracture seen in golfers (after rib stress fractures). These may settle with immobilisation for 6 weeks, while surgical excision of an un-united hook fragment almost always results in complete resolution of symptoms.

A rare cause of palmar wrist pain is tendonitis of the flexor carpi radialis tendon (FCR). This occurs as the tendon enters the hand on the ulnar side of the scaphoid tubercle and usually presents in the trail wrist. The tendon lies within a tight short tunnel at this point and peritendinous fluid is rarely seen on imaging. Modification of training volume, and technique considerations usually resolve this problem, while corticosteroid injection or surgical release of the tight tunnel can be undertaken in resistant cases.

SUMMARY

- The hand and wrist are a frequent site of injury in the elite / professional golfer, and can often result in time lost to training and competition.
- Opposing and predictable planes of motion in the lead and trail wrist mean that radial and ulnar sided problems are more likely in the lead wrist and dorsal problems more likely in the trail wrist.
- 87% of ulnar sided pain and 100% of radial sided pain were reported in the lead wrist, whilst 79% of dorsal pain occurred in the trail wrist[2].
- The majority of wrist pain described by elite golfers is related to volume of practice, strength and conditioning training, variation in practice surface and particular technique.
- Consequently, a full history of the volume of golf training, competition, and strength and conditioning, as well as a biomechanical assessment is essential in understanding and managing issues in elite golfers.
- Hand and wrist issues do occur in recreational players, but are less frequent than lumbar spine and elbow symptoms. Volume of practice is lower in recreational players and technique less consistent.

Recreational golfers are generally older than professionals, and thus they may be more likely to have degeneration of hand and wrist joints, unrelated to golf.

References

1. *Gosheger G, Liem D, Ludwig K, Greshake O, Winkelmann W. Injuries and overuse syndromes in golf. Am J Sports Med. 2003;31(3):438-43.*
2. *Murray A, Junge A, Robinson PG, Clarsen B, Mountjoy ML, Drobny T, Gill L, Gazzano F, Voight M, Dvorak J. Cross-sectional study of characteristics and prevalence of musculoskeletal complaints in 1170 male golfers. BMJ Open Sport & Exercise Medicine. 2023 Mar 1;9(1):e001504.*
3. *Hawkes R. O'Connor P, Campbell DA. The prevalence, variety and impact of wrist problems in elite professional golfers on the European Tour. Br J Sports Med. 2013; 47: 1075-79.*
4. *Sports-related extensor carpi ulnaris pathology: a review of functional anatomy, sports injury and management. Campbell DA, Campbell RSD, O'Connor PJ and Hawkes RA. Br J Sports Med. 2013; 47: 1105-11.*
5. *Jones SW, Campbell FC, Campbell DA. Prophylactic internal fixation of the scaphoid to treat impending stress fracture in an athlete. J Hand Surg (Eur). 2022; 47(E): 870-71.*

Fiona C. Campbell P.T., M.D.
Dept of Medicine
Harrogate NHS Foundation Trust, U.
Health & Performance,
Ladies European Tour, Various

Douglas A. Campbell M.D., Ph.D.
Spire Leeds Hospital, UK
PGA European Tour Health and Performance Institute, Various.

Contact: handandwristclinic@live.co.uk