Boxing has historically been primarily associated with head injuries, particularly concussion. More recently, it has become clear that hand injuries may be as common, if not even more common. Indeed, injury surveillance reporting by the British Amateur Boxing Association suggests that the incidence of hand injury does exceed that of head injury. An understanding of the common types of hand injury in boxing is therefore important for the sports medicine physician working with boxers and athletes in other similar contact sports.

THE NATURE OF BOXING INJURIES

To date, only one study has explored the incidence of different types of boxing hand injuries. Noble assessed 100 consecutive boxing hand injuries in 86 boxers presenting either post-match or in the office of the South African Boxing Board of Control. In this study, Noble reported that:

- 23% of hand injuries involved tears of the ulnar collateral ligament (UCL) of the metacarpophalangeal (MCP) joint of the thumb (also called ‘skier’s thumb’).
- 10% involved carpometacarpal (CMC) joint injuries of the thumb (Bennett’s fracture and dislocation).
- 12% involved damage to the extensor hood of the second to the fifth MCP joints (also called ‘boxer’s knuckle’).
- 12% involved inflammation of the second to fifth CMC joints.
- 12% involved subluxation of one or more metacarpal bases (traumatic carpal boss).
- 8% involved metacarpal fractures of the second to fifth metacarpals, with the majority of these occurring in the neck of the fifth metacarpal (‘boxer’s fracture’).

This article therefore sets out an overview of the definitions, anatomy, injury mechanism, diagnoses and treatments for these five injuries from the perspective of both the research literature and current clinical practice.

UCL TEAR OF THE MCP JOINT OR ‘SKIER’S THUMB’

Definition
‘Skier’s thumb’ is the popular name for a tear of the UCL of the first MCP joint following an acute injury. The UCL is most commonly torn at its distal insertion to the proximal phalanx. This injury is distinct from ‘gamekeeper’s thumb’, which refers rather to an overuse injury of the UCL.

Anatomy
The MCP joint of the thumb is a synovial joint situated between the proximal phalanx and the first metacarpal. Structurally, the capsule and several other soft tissues, including the ulnar collateral
ligament, provide stabilisation. The UCL of the thumb is composed of two discernible components, the accessory and the proper. The proper UCL is taut in flexion and loose in extension, whereas the opposite is true for the accessory UCL. The UCL provides lateral support and prevents volar subluxation of the MCP joint.

**Injury mechanism**

The UCL is most commonly injured as a result of impacts causing excessive thumb hyperabduction or hyperextension. Traditionally, injuries at this location have been observed in skiers. The thumb is vulnerable to hyperabduction following falls in which a hand remains on a planted pole, which could be exacerbated by the presence of the pole strap. This has led to the popular designation ‘skier’s thumb’. However, these injuries can also occur as a result of falls in any population where the thumb is subjected to excessive hyperextension or hyperabduction. It is thought that boxers sustain such injuries as a result of the thumb being caught to one side during punching or in defence.

**Diagnosis**

Boxers who have sustained an injury to the UCL of the MCP joint of the thumb typically present with swelling and haematoma around the joint. Where an injury to the UCL of the thumb is suspected, it is necessary to explore whether the damage involves a partial or a complete tear and whether a Stener lesion is present. A valgus stress test with the thumb in full extension should be performed. Valgus laxity >30 degrees (or an increase of 15 degrees compared to the uninjured side) suggests a complete tear of the UCL. Establishing the presence of a Stener lesion is more difficult on clinical examination. A Stener lesion occurs when the aponeurosis of the adductor pollicis moves into the space between the avulsed ulnar collateral ligament and the insertion of the ligament at the base of the proximal phalanx of the thumb (Figure 1).

The interposed adductor aponeurosis separates the ruptured ends of the ligament and thus prevents ligamentous healing and restoration of joint stability. Palpation of a lump on the ulnar aspect of the thumb MCP joint is strongly suggestive of a Stener lesion; however, the absence of a mass does not exclude a Stener lesion. Anteroposterior and lateral radiographs are recommended to assess the presence of avulsion fractures. Other methods of diagnosis, such as stress radiography, ultrasound and MRI have been used in diagnosing Stener lesions.

**Treatment**

Acute injuries to the ulnar collateral ligament of the thumb can be treated conservatively or surgically, depending on the severity of the injury. Partial tears without Stener lesions are typically treated non-surgically with immobilisation for 4 to 6 weeks with removable thermoplastic splint of the thumb; while complete tears with Stener lesions are always treated surgically. However, the presence or absence of avulsion fractures and the degree of joint stability are also key factors in determining the precise course of treatment. There are several different surgical methods available, which may depend on the exact circumstances of each case, but so far no studies have explored the optimal methods. Postoperatively, immobilisation lasting 6 weeks is frequently recommended, followed by physical therapy.

**‘BOXER’S KNUCKLE’**

**Definition**

‘Boxer’s knuckle’ is the popular term given to extensor hood disruption of the second to fifth MCP joints. The term was originally used by Gladden in 1957 and referred to cases of damage to the extensor mechanism or hood, of which a proportion also involved damage to the underlying joint capsule. While some studies have continued to use this definition, some authors have limited the term to cases where the joint capsule is damaged (with or without damage to the extensor tendon mechanism or hood) and others refer only to damage to the extensor tendon mechanism or hood.
Anatomy
Extension of the hand and fingers occurs through the actions of both extrinsic and intrinsic muscles. The tendons of the extrinsic extensor muscles in the hand run over the top of the MCP joint, which is situated between the phalanges and the metacarpals and forms the knuckles of the hand. The extensor tendon mechanism of the MCP joint lies on top of the joint capsule and comprises the longitudinal central tendon and transverse peripheral fibres, called sagittal bands, which act to stabilise this longitudinal central tendon. They originate from the volar plate and the deep intermetacarpal ligament.

Injury mechanism
In boxing, the extensor tendon mechanism – or hood – and the underlying joint capsule of one of the second to fifth MCP joints is damaged by direct impact to the knuckles, as occurs frequently in punching. Whether the soft tissues of the damaged MCP joint are injured purely by a distinct, acute trauma or whether the damage is the result of progressive weakening following repeated impacts is currently unclear. While some authors have assumed that such progressive weakening is routine, this has not yet been demonstrated and consequently remains the subject of investigation. Similarly, whether the extent of the impact is a key factor in determining the nature of the damage to the soft tissue is also unclear, although some authors have assumed that a greater impact is responsible for damage to the underlying joint capsule than to the extensor tendon mechanism or hood.

Diagnosis
Boxers who have sustained an injury to either the extensor tendon mechanism or hood and/or the underlying joint capsule of one of the second to fifth MCP joints typically present with pain, swelling and usually some degree of extensor tendon instability, usually involving either a snap or a loss of full range of motion (ROM) during finger extension. Where the sagittal bands are disrupted, this can occur radially or ulnarly. The subluxation direction of the longitudinal central tendon also varies and is typically displaced in the direction opposite to the disruption of the sagittal bands. Where the joint capsule is disrupted, the individual may display a defect over the joint that can be palpated, even where there is no tendon subluxation. There are some indications that MRI scans or ultrasound may be useful for exploring the nature of the damage to the extensor tendon mechanism, but most authors do not mention the need for imaging or consider it superfluous.

Treatment
Acute injuries to the soft tissues of the MCP joints can be treated conservatively or surgically, depending on the severity of the injury, the extent of inflammation, the population injured and exactly which tissue has been injured (i.e. sagittal bands only, joint capsule only or both), although the literature is limited regarding the most effective treatments in each case. Some authors recommend always performing surgical repair on injuries where the underlying joint capsule has been damaged and suggest non-surgical management for damage to the extensor tendon mechanism or hood. In all cases, non-surgical treatment typically involves immobilisation for 6 to 8 weeks with either neighbour strapping for minor injuries or a splint for those involving subluxation. In non-athletic populations, surgical treatment is usually only indicated in cases where non-surgical treatment fails. While a similar procedure is often recommended for athletes, surgery is usually considered necessary for boxers because of the unique demands of the sport on the knuckles. Surgery in all cases can involve direct repair or grafts, depending on the extent and nature of the damage.

BENNETT’S FRACTURE
Definition
Fractures of the base of the first metacarpal which extend into the CMC joint are relatively common in boxing and are known as Bennett’s fractures. They are unstable, intra-articular fractures and typically involve at least some subluxation.

Anatomy
The CMC joint of the thumb is situated between the first metacarpal and the trapezium and is also called the...
trapeziometacarpal joint. There are several ligaments that stabilise it². The dorsoradial ligament is the most important stabiliser of this joint, although the superficial and deep anterior obliques, intermetacarpal, ulnar collateral and posterior oblique ligaments also have key roles⁶.

**Injury mechanism**

Bennett’s fractures are caused by an axial force directed against the partially flexed first metacarpal⁶,16,17. Such forces occur very commonly in boxing because the sport routinely involves impacts on the clenched fist⁶. The dislocation that is commonly associated with Bennett fractures occurs due to the interrelation between the ligamentous and muscle tendon attachments and the location of the fracture. Thus, at the point of fracture, the anterior oblique ligaments remain attached to the small proximal portion of the metacarpal in the normal anatomic position⁶. However, the rest of the metacarpal subluxates dorsally, radially and proximally in response to the action of the thumb extensor muscles⁶,16,17.

**Diagnosis**

Individuals who have sustained a Bennett’s fracture present with pain, swelling, haematoma and loss of first CMC joint function⁶. Diagnosis is performed by radiography to establish the fracture and subluxation. A CT scan may be performed to provide a more detailed picture.

**Treatment**

Bennett’s fractures are treated both surgically and non-surgically⁶,8,16,18, although some recent studies indicate that nonsurgical treatment may lead to poor long-term outcomes⁶,18. These studies have led some authors to recommend always treating Bennett’s fracture surgically⁶. Surgical treatment is not standardised for the treatment of Bennett fractures and successful methods have included closed reduction and percutaneous pinning, open or arthroscopically-assisted reduction with either pins or inter-fragmentary fixation⁶,8,16,17.

**TRAUMATIC CARPAL BOSS**

**Definition**

This hand injury is common in boxing but less recognised. The excessive and repeated trauma of boxing, transmitted from the MCP joints to the bases of the metacarpals, create ligamentous disruption with destabilisation of the CMC joints, the so-called ‘carpal boss’.

**Anatomy**

The CMC joints of the fingers consist of a complex row of articulations formed by numerous uneven facets on the distal aspect of the distal carpal row, connecting with the articular surfaces of the base of the metacarpals⁶. Numerous dorsal and palmar ligaments contribute to the stability of the CMC joints⁶.

**Injury mechanism**

In boxing, the repetitive transmission of detrimental forces from the MCP joints to the CMC joint is prone to causing traumatic ‘carpal boss’ formation. The repeated trauma to the CMC joints creates periarticular hypertrophic bone spurs with concomitant articular subluxation and degenerative changes.

**Diagnosis**

The bony protuberance of carpal boss is more visible on volar flexion of the wrist. The distortion of pathologic CMC joint can be painful. Radiographs are important to determine the intraosseous or extraosseous nature of the mass. A CT scan may be indicated in complicated cases.

**Treatment**

Acute sprains and contusions of these joints respond successfully to classical conservative treatments. However, due to recurrent trauma, progressive CMC instability will be characterised by painful periarticular bony hypertrophy, joint subluxation and articular generative changes⁶. For symptomatic traumatic carpal boss, selective CMC joint fusion constitutes the optimal treatment⁶,8,12.

**BOXER’S FRACTURE**

**Definition**

Fractures of the fifth metacarpal neck were originally thought to be so common in boxing that they have become traditionally known as ‘boxer’s fracture’⁹. In his study of the incidence of different types of hand injury, Noble also reported that such fractures were regularly observed⁶. More recently, however, we have seen clinically that boxers with good technique rarely incur this particular type of hand injury and it appears to be far more commonly seen in fist-fighting between individuals with little or no knowledge of boxing⁶.

**Injury mechanism**

Boxer’s fractures are usually caused by impact on a clenched fist. The application of axial compressive forces to the metacarpals, creates dorsal bend in the bone, ultimately causing fracture⁶,9.
Diagnosis
Individuals who have sustained a boxer’s fracture typically present with pain, swelling and haematoma. Diagnosis is typically performed by radiography to display the fracture and its angulations.

Treatment
Boxer’s fracture is routinely treated non-surgically through traditional closed reduction and immobilisation of the MCP joints using a splint placed in a neutral position, functional neighbour strapping without immobilisation or through no external support. Indeed, reviewers have concluded that fractures of the fifth metacarpal do particularly well when treated non-surgically. Poolman et al carried out a Cochrane review of all controlled trials, comparing functional treatment with traditional immobilisation and found that there was no evidence to support the preferential use of either method. This is mirrored by investigations of current practice, which indicate little consistency. In athletes, some authors recommended using closed or open reduction associated with internal fixation to provide optimum stability to metacarpal fractures, as this allows immediate range-of-motion and earlier return to play. If the bones are misaligned by more than 60 degrees, surgery may be required.

References