Pedal lameness in the dog
Mike Guilliard MA VetMB CertSAO MRCVS

Introduction

Pedal lameness is the poor relation of canine orthopaedics with few publications and little research, yet it is a common cause of lameness in first opinion practice. All orthopaedic clinical examinations should include a thorough and systematic examination of the foot. Lameness can usually be localised to the foot by inducing a reproducible pain response to manual examination.

Clinical examination:

- Visual inspection of the standing dog. This may be impeded by a long coat.
  Look for:
  - Swelling
  - Abnormal carriage of the digits
  - Abnormal nail wear
  - Tumours

- Visual inspection of the ventral foot
  Look for:
  - Abnormal pad wear or hyperkeratosis
  - Wounds
  - Interdigital inflammation
  - Tumours

- Palpation of the digits and joints. Palpation is probably the most sensitive diagnostic tool and requires skill and patience. ALWAYS compare with the same digit on the contralateral limb and with the other digits on the same foot. To truly detect slight swellings general anaesthesia may be necessary.
  Look for:
  - Swelling – compare with the other digits
  - Instability
  - Pain

- Palpation of the pads, interdigital skin and nails
  Look for:
  - Swelling
  - Pain
  - Fractured nails

Paw pads

The pads act as interface between the ground and the animal, functioning as cushions to protect the subdermal structures. Any damage or abnormality can cause marked pain and lameness during weight bearing.

- Foreign body penetration

Clinical examination will show an entry wound often with a serous exudates. If the foreign body is present a pain response will be elicited with digital dorsoventral pressure across the pad. With a scalpel blade gentle paring of the surface of the pad...
over the wound can detect a penetrating thorn or a superficial foreign body. Deep probing is not recommended.

A mediolateral radiograph will show grit and glass but not wood. Positioning for this view is achieved with the dog in lateral recumbancy with the affected pad isolated using radiolucent tape. The dorsoventral view is rarely informative.

Foreign bodies embedded in the subdermis need surgical removal (operating technique 1). If no foreign body is present then the entry wound will require a protective dressing to prevent further penetrations.

- **Corns**

A corn is a circular area of hyperkeratosis usually found in the centre of the digital pad (figure 1). It can cause a severe progressive lameness where the dog typically is less lame walking on softer surfaces. It can be confused with a chronic foreign body penetration wound. Diagnosis is made by its physical appearance and by a pain response to dorsoventral pressure. In a recent study of 40 corns in 30 dogs (Guilliard and others 2010) corns were found exclusively in Greyhounds, Whippets and Lurchers. In 85% of cases the corn was sited in the digital pads three and four of the thoracic limbs.

The aetiopathogenesis appears to be mainly mechanical as the central digital pads of the thoracic limbs have the highest ground reaction forces and are the first point of contact with the ground during the gallop. 40% of corns were the result of abnormal weight bearing from other foot problems such as carpal hyperextension and rupture of the deep digital flexor tendon.

Foreign body penetration may be implicated as the histology in some cases shows a sinus tract lined with epithelial tissue. However it is rare to find a foreign body on surgical removal. There is no evidence to suggest a viral aetiology (Balara and others 2009).

Treatment in the majority of cases is by surgical excision (operating technique 1) and gives a success rate of 74% up to one year but recurrence is common and the success rate drops to less than 50% after one year. However the surgery can be repeated if necessary. Distal digital ostectomy (operating technique 2) is successful in selected cases with a natural resolution of the corn. All other reported treatments are palliative.

Conservative management involves regular paring of any exuberant pad tissue. Digital amputation through the metacarpal/tarsal phalangeal joint is also an option.

**Conjoined, hyperplastic and false pads**

An exuberance of pad and adjacent skin as a result of abnormal weight bearing, can lead to chronic painful inflammation of the ventral interdigital skin and is typically seen in overweight Labradors. Resection of the hyperplastic tissue by separation podoplasty (operating technique 3) usually resolves the lameness. Fusion podoplasty is described in the literature but is difficult surgery and has a long recovery period. It is not recommended by the author.
Nails

Damage to the nails can result in shelling where the nail bed is left exposed, splintering where torn nail remnants remain, or fracturing of the underlying ungual crest. Loose remnants of nail can be very painful and must be removed. Exposed tissues generally heal rapidly and the nail will regrow. However abnormal nail growth can damage the pad or lead to a chronic infection of the nail bed necessitating permanent nail removal (operating technique 4).

Interdigital skin

The interdigital skin is a common site for interdigital cysts and chronic fibrosing pyoderma lesions (figure 2) that are poorly responsive to antibiotic treatments. Excision separation podoplasty (operating technique 3) can result in a permanent cure.

Lacerations to the interdigital skin in the racing Greyhound

- **Split web**
  This can vary from a small cut in the cranial edge to a complete tear. Reconstruction often results in the cut reopening at each race. If left to heal without reconstruction, the cut will again open after racing. Successful treatment is by complete incisional separation podoplasty (operating technique 3).

- **Split foot and sand burn**
  A sand burn is a superficial cut of the ventral skin over either of the flexor tendons to digits three and four in the hind feet. It is caused by the abrasive action of sand on the skin over the taut tendons. A full thickness cut of the skin is a split foot (figure 3). This injury heals rapidly with or without suturing, but will always reopen with further racing. An incisional separation podoplasty to the interdigital skin abaxial to the wound is usually successful in preventing recurrence.

Operating technique 1: Pad surgery for foreign body removal or corn excision

Haemostasis is achieved by an assistant pinching the pad between finger and thumb. Foreign body removal requires a linear incision through the entire dermis over the entry wound. An elliptical excision is needed for corns (figure 4). The pad is closed with simple sutures several millimetres away from the wound margins. It is imperative that the foot has a protective dressing, changed weekly for three weeks, at which time the sutures are removed.

Operating technique 2: Distal digital ostectomy

This involves the removal of the third phalangeal bone (P3), the nail and the condyles of the second phalangeal bone (P2) but with the preservation of the pad. An incision is made in the skin around the base of the nail enabling the disarticulation and removal of P3 and the nail. The condyles of P2 are exposed and removed with bone cutters.
The pad is pulled dorsally and sutured to the skin. An elliptical piece of ventral skin is then excised just caudal to the pad and its edges sutured together. This pulls the pad ventrally over the stump of P2 and ensures weight bearing through the pad.

Operating technique 3: Separation podoplasty

This can be incisional or excisional. With the incisional separation podoplasty the interdigital skin is cut from the cranial border to the metacarpal/tarsal pad and the dorsal skin is sutured to the ventral skin to create a permanent separation of the digits (figure 5). Excisional separational podoplasty involves the excision of an interdigital lesion with the closure the same as the incisional technique. The adjacent digits are not weakened.

Operating technique 4: Ungual crest ostectomy

The ungual crest is the cranial portion of P3 over which grows the nail. Removal of this together with the nail bed results in permanent nail removal without altering the weight bearing relationship of P3 to the pad.

An incision is made in the skin around the base of the nail and the dorsal joint capsule of the P2/P3 joint exposed. Bone cutters are used to cut through the nail and underlying bone close to the joint. The nail bed will now be exposed and is nibbled away with rongeurs together with any remaining ungual crest. The ostectomy is complete when no nail bed remains and the skin can be easily closed over the bone.

References:


Figure 2. A chronic fibrosing interdigital pyoderma treated by excision separation podoplasty.

Figure 3. A split foot in a racing Greyhound. Treatment is by incisional separation podoplasty in the abaxial interdigital skin.
Figure 4. Corn excision.

Figure 5. A healed incisional separation podoplasty in a racing Greyhound.
Pedal lameness
Instabilities and fractures

The digits comprise of three bones, the most distal is the third phalanx (P3) that articulates with the second phalanx (P2). This articulation is the distal interphalangeal joint (P2/P3). The proximal articulation of P2 is with the first phalanx (P1) and is the proximal interphalangeal joint (P1/P2). P1 articulates proximally with either the metacarpus or metatarsus.

Instabilities

Instabilities of the phalangeal joints are causes of lameness with permanent subluxation causing toe deformity and abnormal weight bearing on the paw pads and ventral interdigital skin. Clinical signs include joint swelling and deformity but a definitive diagnosis is made under general anaesthesia by palpation. A radiograph will determine if any fractures are present.

Instabilities are classified as stable, where the joint remains congruent but subluxation can be induced, and unstable. The difference depends on the degree of tearing of the collateral ligaments and joint capsule. An avulsion fracture of either the origin or insertion of a collateral ligament may be present.

In the P2/P3 joint an open subluxation can occasionally occur and appears as a small cut over the joint on the lateral aspect (figure 1). This cut will heal with rest but opens up exercise. Ungual crest ostectomy is curative (operating technique 4). Open subluxations can occasional occur at P1/2 and in the dew claw.

All treatments are aimed at restoring joint congruity to allow sufficient periarticular fibrosis to form stabilising the joint. Stable joints may be treated with external coaptation alone, but if in doubt a surgical option should be considered.

• Distal interphalangeal joint

The differential diagnosis of swelling of the distal digit includes nail bed infection, osteomyelitis of P3, fractures and an infection of the P2/P3 joint as well as a joint instability. Careful examination will determine if the joint is involved and confirmation of an unstable joint is made under general anaesthesia (figure 2).

Septic arthritis is common in this joint and a joint tap is mandatory if the joint is stable. A lateral approach using a 23 gauge needle will allow a small quantity of joint fluid to be withdrawn. The presence of polymorphic nucleated white cells will give a presumptive diagnosis and antibiotic therapy instigated.

Treatment depends on the degree of instability. Stable joints can be treated by external coaptation; moderately stable joints by ungual crest ostectomy (operating technique 4); grossly unstable joints by ungual crest ostectomy and a support suture. This normally comprises of a single mattress suture of any absorbable suture material, placed through the periarticular tissues and ruptured collateral ligament remnants. Its
aim is to hold the joint in normal congruity. Ungual crest ostectomy removes the lever arm of the nail and promotes periarticular fibrosis.

The prognosis following surgical treatment is excellent.

- **Proximal interphalangeal joint**

The history of treatments for damage to P1/P2 joint makes interesting reading and none of these treatments has given consistently good results for the author. In the early days of Greyhound racing barbaric treatments included pin firing and blistering, shortly followed by injecting sclerosing agents around the joint. The rationale was to promote periarticular fibrosis but the issue of joint congruity was not addressed.

Prosthetic ligament replacement came into vogue using wire, nylon and carbon fibre. The collateral ligaments are broad structures and the isometric points vary with flexion making accurate placement of the prosthesis difficult.

Recent texts promote ligament reconstruction as the definitive treatment, but trying to accurately stitch together the torn ends is not possible due to fraying and avulsion. All these treatments are likely to be successful only if joint congruity is maintained with periarticular fibrosis giving subsequent support.

Maintaining joint congruity with an external fixator was described (Guilliard 2003) and this has proved to be consistently successful (operating technique 5). A prospective study on 20 cases in racing dogs by the author has had no failures. In addition to the fixator many cases had an ungual crest ostectomy to shorten the lever arm. Selection for this procedure is:
- grossly unstable joints.
- instability in the digits three and four.
- pet dogs, as they tend to have long nails.

Subluxation of P1/P2 may involve an avulsion fracture of the collateral ligament. If the fragment is large enough internal fixation may be possible. The author’s preferred treatment is to apply an external fixator only.

- **Tarsometatarsal and carpometacarpal phalangeal joint (MT/P and MC/P)**

These joints are more complex due to the presence of two large sesamoid bones. Three types of instability are seen and these involve either digit two or digit five:
- Rupture of the axial collateral ligament causing a valgal deformity or an outward rotation of the digit.
- An abaxial luxation of P1 together with either both sesamoid bones or with just the lateral sesamoid.
- Internal rotation of the digit where the joint be made to jump in and out of congruity (figure 3). This is common in racing Greyhounds in the MT5/P joint and appears to be predisposed by torsion of distal MT5.

Treatment can be by external coaptation for stable joints or by the application of an external fixator for unstable joints. The prognosis for a return to racing is very good.
Fractures

Phalangeal fractures are very painful with gross swelling of the digit. Diagnosis is by radiography. In general these fractures heal rapidly. The aim of treatment is to ensure good alignment to prevent toe deformity. Fractures involving a joint are generally considered to be problematic due to subsequent osteoarthritis but phalangeal joints with articular fractures tend to ankylose and often become pain free.

External coaptation is suitable for stable fractures with good alignment. Internal fixation, usually with cortical screws, is often possible but is difficult surgery. An external fixator provides good support and alignment and should always be considered.

- **P3 fractures**

Fractures involving the ungual crest or body of P1 (a loose nail) can be treated by ungual crest ostectomy. Comminuted and articular fractures may need a distal digital ostectomy (operating procedure 2)

- **P2 fractures**

These present as spiral, comminuted or condylar. External coaptation will often result in poor alignment with an elevated nail. An external fixator with pins in P1 and P3 gives good alignment.

- **P1 fractures**

Both simple and comminuted fractures heal rapidly with external coaptation. Articular fractures of both P1 and P2 involving the P1/P2 joint heal with a joint ankylosis.

Arthrodesis

This has been described for the MT and MC/P joints and the P1/P2 joints. It is rarely performed and the application of a dorsal plate is the recommended procedure.

Amputation of the digit

A complete or partial digital amputation should always ensure that any bone stump is well protected from contact with the ground. The sites are either through the distal P2 (distal digital ostectomy) or through the MT or MC/P joint with removal of the condyles in digits two and five. With digits three and four the joint is disarticulated and the sesamoids left in situ. The author does not remove the articular cartilage.

Closure is the same as an excisional separation podoplasty (operating procedure 3). The prognosis is generally excellent and loss of a digit in a Greyhound should not affect its racing.

Operating technique 5: application of an external skeletal fixator
This procedure is used for fractures of P1 and P2 and for instabilities of MT and MC/P joints and P1/P2 joints. 1.4mm and 1.6 mm arthrodesis pins are used and are driven into the bone on the dorsal abaxial aspect at about 30 to 50 degrees from the vertical. Ideally three pins should penetrate both cortices of each bone but two pins will generally suffice. The ends are bent over and an acrylic connecting bar moulded over the pins (figure 4).

A prophylactic course of antibiotics is given for 10 days. For instabilities the frame is removed after a maximum of three weeks. Fractures may require longer but usually gross swelling of the digit rapidly develops and maintains reduction without other support.

Complications:

- Over-penetration of the pins
- Impingement of the frame on the surrounding tissues
- Pin loosening. Some pin loosening is almost inevitable after 3 weeks.
- Intolerance by the patient. A protective bandage is not necessary but the occasional dog will chew off the acrylic.
- Pin tract infection and osteomyelitis. This is very common but resolves rapidly after frame removal.

Dogs generally tolerate these frames very well and soon walk with no or mild lameness. Pin loosening and infection results in lameness.

Reference:

Figure 1. An open subluxation of P2/P3 in a pet Greyhound treated by ungual crest ostectomy.
Figure 2. A luxated P2/P3 joint that was treated by ungual crest ostectomy and an abaxial tacking suture.
Figure 3. A rotational instability of MT5/P in a racing Greyhound. Note the torsion in MT5 rotating the sesamoids axially.
Sesamoid problems

In the four main digits there is a pair of sesamoid bones on the palmar/plantar surface of each of the MC/P and MT/P joints and a single small sesamoid on the dorsal surface. The paired sesamoids are separated by a sharp-edged sagittal crest and the proximal ends are embedded in the interosseous muscles. The digital flexor tendons run over the top of the sesamoids.

Bipartite, multipartite and fragmented sesamoids.
Commonly seen in Rottweiler and Greyhound.
Sesamoids 2 and 7 are the most commonly affected.
Have been reported as a cause of lameness in young dogs!!!
Can result in reduced joint flexion.

Sesamoid fracture
- Rare. Seen in racing Greyhounds.
- Painful on palpation with lameness lasting several weeks.

Treatment:
- Surgical removal of one or both fragments.
- Excellent prognosis
- Conservative management is probably equally effective.