CHAPTER 1

Introduction to Musculoskeletal Medicine

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OVERVIEW

- This chapter will review the structure of the musculoskeletal system and how the 'human machine' works.
- How the musculoskeletal system is modified by age and illness.
- A *system* is outlined for history, examination, investigations and note taking.
- The principles of management of injury to muscles, tendons, ligaments and nerves are examined.
- How best to restore function is discussed.

Introduction

Musculoskeletal conditions are one of the commonest presentations in general practice. One in four people at any one time will have a musculoskeletal problem. Such conditions are responsible for one in seven primary care consultations. Almost 50% of the population will have back pain in 1 year. The cost to society is huge.

These conditions are often regarded by doctors as 'minor' problems, but to patients they are often painful and disabling. Very occasionally apparently minor problems can be life threatening.

Structure and function: the body as a machine

The skeleton

Any machine needs a rigid framework. The main functions of this framework are to overcome the effects of gravity, to protect vital parts and to provide a network of levers to enable the effective application of force.

A crane shows these functions as well (Figure 1.1). It has a network of steel girders to give it height (overcome gravity) and a very long arm to provide a means of reaching and for the effective application of force. It has specialized areas for protection, for example the driver's cab (skull). The human skeleton is much more complex but the principles are the same. The 'girders' of the skeleton are the bones, designed by evolution to be strong, to have some elasticity but still to be light.

ABC of Common Soft Tissue Disorders, First Edition.
Edited by Francis Morris, Jim Wardrope and Paul Hattam.

Joints

The crane has a few simple joints that allow movement, flexibility and a degree of shock absorption. At the base there is a circular joint to allow 360° motility in one plane. It comprises load-bearing surfaces, lubrication and constraining structures that hold the joint in place. The nearest human equivalent would be a ball-and-socket joint such as the shoulder. There are also hinge-type joints allowing motion in one plane (e.g. the elbow).

Human joints are much more complex and of greater variety (synovial, symphyseal and syndesmotic). These joints all have articular surfaces, and ligaments that connect the bones together, and also contain stretch receptors and associated muscles. They may also have specialized structures such as intra-articular cartilages that may assist in shock absorption or in joint stability.

Muscles and tendons

The powerhouse needs a fuel supply, oxygen, a method of converting the energy in the fuel to mechanical energy and a method of transmission of that energy to the skeleton. Skeletal muscle uses sugar as its main energy source backed up by glycogen to meet the peak action of the 'pistons' of the actin and myosin filaments that cause contraction (and relaxation).

The muscle exerts its force through tendons. Tendons are immensely strong yet also have elastic stretch. This stops them breaking at times of sudden loading (see Figure 1.2).

Reciprocal groups of muscles

An important concept is that with many active muscle movements there are opposing muscles which contract to allow a stable platform for the active muscle. Using the crane analogy, the large counterbalance weight is essential to prevent the crane toppling over when lifting a load (see Figure 1.1). A good example of this is tennis elbow. There is pain at the extensor origin when gripping. The main active muscles are the finger flexors; however, the extensors of the wrist have to contract to stabilize the wrist. Without this reciprocal action the wrist would flex and grip strength would be lost. This powerful

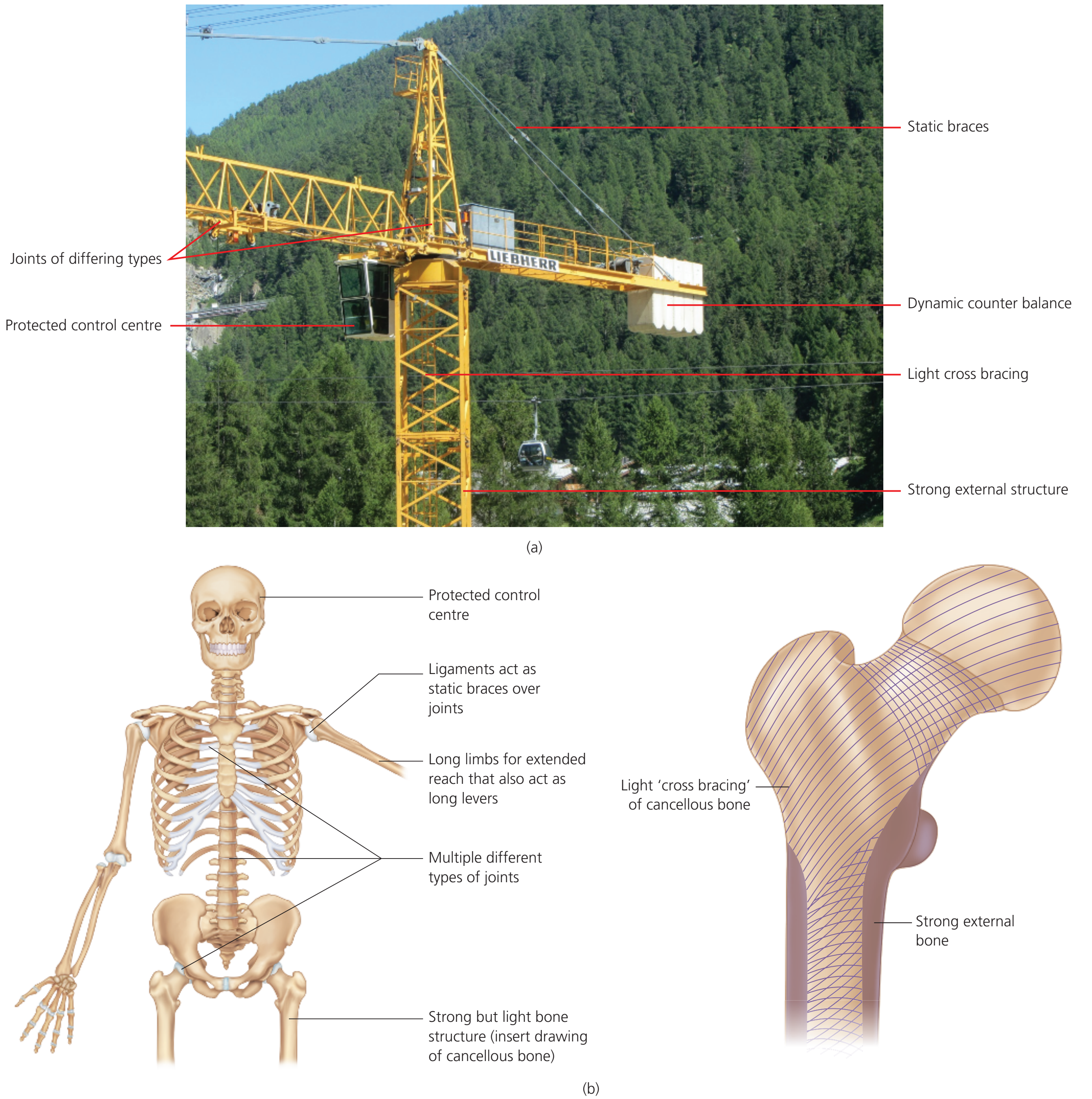

Figure 1.1 A crane is a very simple machine but has many elements in common with the human body. The human body is subject to the laws of mechanics like any other machine.

reciprocal contraction causes stress at the origin of the wrist extensors at the lateral epicondyle (see Figure 1.3).

Nerves

All machines need a control system. The brain, the spinal cord and the motor and sensory nerves provide that control system.

Much of the control of movement is carried on at an unconscious level. The simplest example of unconscious control is the spinal stretch reflex. If a muscle is stretched, then receptors in the muscle and tendon are activated, and signals are passed up the sensory nerves to the spinal cord and hence to the motor neurones that fire to cause the reflex contraction. This reflex arc is subject to many other influences, both from within the spinal cord and descending from the cerebellum and the cerebral cortex and associated nuclei. However, it is a key concept in understanding the importance of muscle power and the neural control in maintaining joint stability (see below).

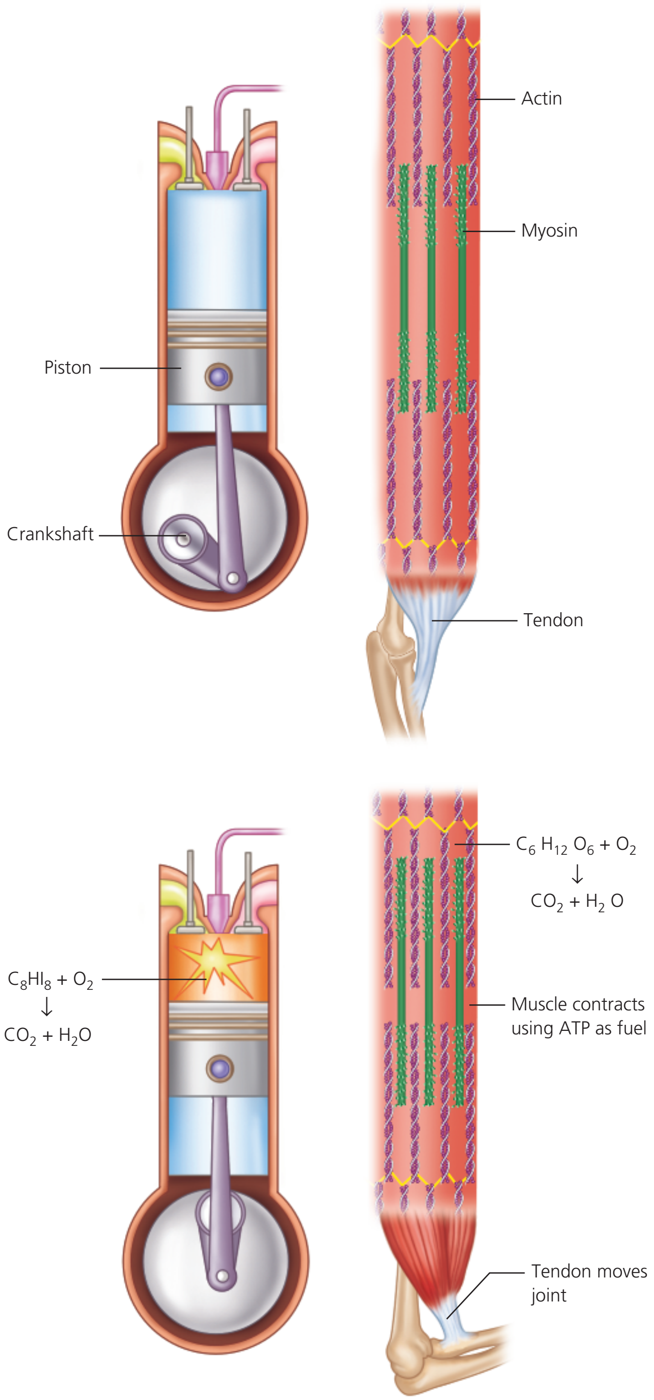

Figure 1.2 The human 'combustion engine'. (a) Fuel in a car engine is combusted with oxygen to create a force that moves the piston and turns the crankshaft. (b) Glucose in muscle cells is respired to create the ATP that drives muscle contraction.

Functions and stresses

The human body is a complex system of levers. In clinical practice we tend not to think of the physics of movement and function but understanding the rudiments of biomechanics is key to the practice of musculoskeletal medicine. We can only skim the surface of this subject but further information can be found in *The human machine* (McNeill 1992) or *Physics in biology and medicine* (Davidovits 2008).

Take the example of lifting a simple weight. If incorrect lifting technique is used, then the spine becomes a very long arm of a lever that has to support not only the weight being lifted but the weight of the upper body (Figure 1.4). The fulcrum of this lever is the lumbosacral junction. The forces across this joint are huge: lifting a 10 kg weight with an extended spine results in 0.5 tonne of force.

If the forces are so huge, why do we not fall apart? The musculoskeletal system has many modifications that allow it to withstand these forces. Many of the structures are immensely strong yet have a certain degree of elasticity that prevent failure with sudden peak loading. However, it is the 'dynamic stability' of muscle power that provides the majority of joint stability. For example:

- ankle is inverted,
- stretch receptors in the ligaments, evertor tendons and muscles are activated,
- a reflex contraction of the evertor muscles corrects the deforming force,
- ankle stability is protected (see Figure 1.5).

This contraction can be so strong that it may pull off the evertor attachment (fracture of the fifth metatarsal styloid process) or the tendon may snap.

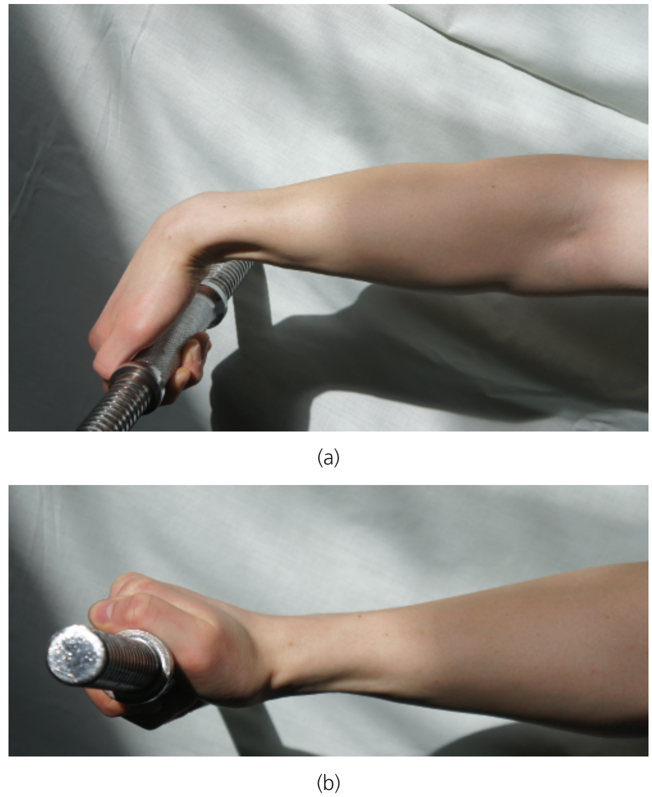

Figure 1.3 Reciprocal muscle contraction. In gripping the finger flexor muscles contact strongly. If the wrist extensors do not 'brace' the wrist then the wrist would also flex and grip would be very weak (a). Strong contraction of the wrist extensors allows the finger flexors to exert maximum power (b).

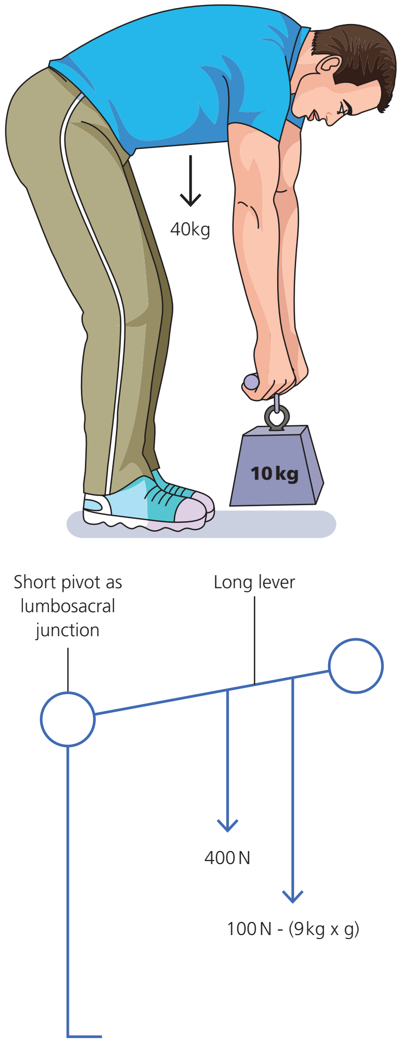

Figure 1.4 Lifting a 10 kg weight the wrong way, with a bent back. Upper body weight is 40 kg. The resultant force is weight in kg × acceleration of gravity: (40 kg + 10 kg) × 10 m/s^2 = 500 N. This force is acting over a 1 m lever (distance between the fulcrum at the lumbosacral joint and the shoulders), giving a resulting moment of 500 Nm. The opposing lever at the lumbosacral joint is much shorter, approximately 10 cm. The moment that needs to be generated over this short 10 cm lever is 500 Nm, thus requiring 5000 N of force over the lumbosacral joint.

If a joint is immobilized then two things happen: the speed of the stretch reflex is delayed and muscle bulk and power are lost. This is a key concept that demonstrates the absolutely vital importance of rehabilitation in the management of many musculoskeletal injuries. A simple grade 1 ankle sprain can result in wasted calf muscles and an unstable ankle if immobilization or non-weight bearing is prolonged.

Effects of age, other morbidity, drugs and training

Unlike machines the human body does not come to an exact specification. While it is true that machines will age and the various parts will become prone to failure, they are not subject to the huge variation in that is seen in the population attending the clinic or surgery.

As the population ages the burden of illness in the community rises exponentially. Age-related changes affect the structure and functioning of the musculoskeletal system.

- The skeleton becomes more brittle, resulting in an increase in fractures, often with little or no trauma.
- Muscle bulk is lost, resulting in a loss of capacity to withstand stresses across joints.
- Reflexes slow, resulting in less stability as a whole and a higher incidence of falls.
- Tendons lose strength, resulting in more tendon ruptures such as quadriceps tendon.
- Diabetes now affects 2% of the population. These patients are at very significantly increased risk of infections and vascular disease. The early stages of severe foot infections or peripheral vascular disease (PVD) can often present as a musculoskeletal problem. Always take extra care in the assessment of patients with diabetes.
- Anticoagulant drugs, for example warfarin, can result in significant bleeding complications such as muscle haematomas.
- Children have a number of specific types of problem not seen in adults, such as slipped epiphysis, and greenstick and epiphyseal fractures.

Effects of weight

In an 80 kg individual the upper body weight is estimated to be 40 kg. In a 160 kg person with an estimated upper body weight of 80 kg the forces across the lumbosacral junction increase markedly. Another example is the patellofemoral joint. In climbing stairs the quadriceps acts by pushing the patella back against the lower end of the femur (Figure 1.6). The mechanics of this action suggest that the force on the joint is three times the body weight: for a 70 kg individual this is a 2100 N force and for a 150 kg individual it is a 4500 N force. A heavier, fit individual who has stronger structures, stronger muscles and faster reflexes will be able to resist these forces, but if the weight is due to inert fat in an inert individual the chances of injury will be much increased.

Structured assessment

Structured clinical assessment is basic building block of musculoskeletal medicine. A good history and methodical examination are the standard of care expected in this discipline. You may already have a system that works but it should cover the elements set out below. If you use the same system to write up your notes, it acts as a checklist (see Table 1.1). In the complex and busy world of clinical medicine such checklists help reduce error. Pilots use this method and they work with relatively straightforward machines that are all built to the same specification and which are serviced regularly, and they have detailed information about each part of the aeroplane. We work with machines (humans) that come in all shapes and sizes, and many are not well cared for and have parts that are not in proper working order; hence there is even more need for a structured approach.

Figure 1.5 The ankle inverts, stretch receptors activate (a), there is a reflex contraction of the evertor muscles, the deforming force is overcome and the ankle returns to the normal position (b).

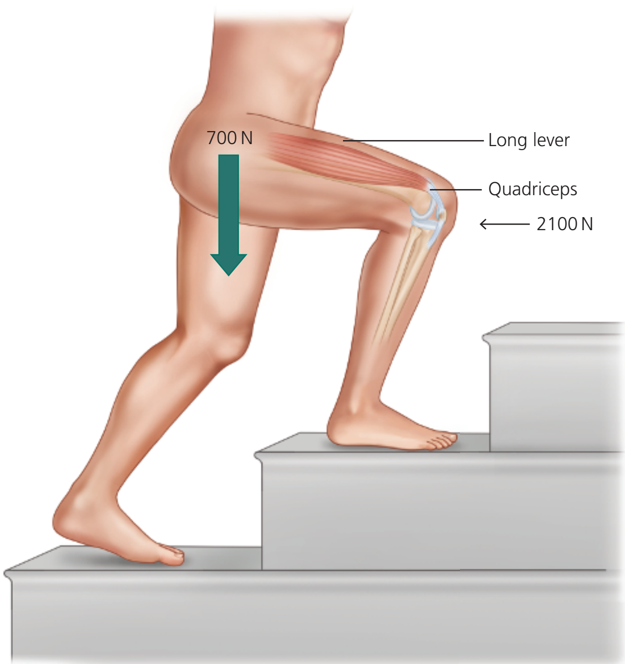

Figure 1.6 In climbing stairs the forces acting on the patellofemoral joint are three times the body weight.

Table 1.1 Musculoskeletal assessment checklist.

History	
Mechanism of injury: trauma versus non-trauma	✓
Symptoms and progress of the symptoms	✓
Previous injury/problems	✓
Past medical history including drugs and allergy	✓
Occupation, sport and hobbies	✓
Examination	
General exam	✓
Limb problems	✓
Function	✓
Joints above and below	✓
Look	✓
Feel	✓
Movement (active/passive/resisted/stress/special tests)	✓
Nerves and vessels	✓

Forces have magnitude, direction and duration. In most injuries the time element is hard to quantify, except in repeated minor forces causing overuse and stress injuries. Having a clear idea of the size and direction of the forces applied gives you a head start in reaching an accurate diagnosis.

Where there is no real history of an injury, the clinician needs to explore the onset and progress of symptoms in great detail, including other symptoms, past medical history and drug history.

Mechanism of injury: trauma versus non-trauma

There is a great difference in the diagnostic spectrum (Table 1.2) between traumatic injuries and non-traumatic musculoskeletal problems. An injury is caused by a force, commonly a single episode of abnormal loading of part of the musculoskeletal system.

Symptoms and progress of the symptoms

Serious injuries usually result in immediate loss of function with significant signs. A good example of this is an acute knee injury (e.g. 'getting carried off' during a football match), with a knee that has swollen immediately. This is a good sign that a serious

Table 1.2 Spectrum of injury in non-traumatic musculoskeletal problems.

Red conditions	Yellow conditions	Green conditions
Potentially life-/limb-threatening: very time-sensitive for treatment	*Potentially limb-threatening/ disabling: may be time-sensitive for treatment*	*Chronic conditions: may be disabling but no time-sensitive element to treatment*
Referred pain	Inflammatory arthropathy	Osteoarthritis
Ischaemia/thromboembolic disease	Crystal arthropathy	Tendonitis
Sepsis	Nerve root/nerve compression	Mechanical back pain
Childrens' problems (e.g. slipped upper femoral epiphysis)	Tumour (primary, secondary, non-metastatic)	
Spinal compression	Stress fractures/tendon ruptures	
	Polymyalgia rheumatica	

intra-articular injury has occurred. In contrast, 'getting a knock' (also during team sport), continuing to play and presenting 2–3 days later with a limp and mildly swollen knee often allows a more leisurely approach to diagnosis.

Ask what treatments have been tried and how these have affected symptoms.

Previous injury/problems

The approach to a single episode of trauma will be different to that for repeated injuries to one part of the body. A single episode of 'I went over on my ankle' is different to 'I keep going over on my ankle'. Patients with repeated problems often require more investigation and treatment.

Past medical history including drugs and allergy

It is always best to ask these questions. Giving a non-steroidal anti-inflammatory drug to a patient with a history of peptic ulcers is contraindicated. Warfarin can turn a minor injury into a major problem because of joint or muscle bleeding.

Occupation, sport and hobbies

Would you treat a knee injury in a professional football player differently from the same problem in a patient with a sedentary job and no active hobbies? Some may say no, but realistically we all would have a different approach. The footballer needs 100% knee function but the person with no active demands may cope well with 80% function or less. Appreciation of the expectations of the patient and the effects of a less-than-perfect recovery are an important dimension to your assessment and treatment plan.

Examination

General exam

Where there is a specific mechanism of injury a general examination is usually not required unless the patient looks unwell, the history is inconsistent or there is a suspicion that the injury was not a straightforward 'mechanical' event (e.g. a dizzy episode, a faint or fit, or non-accidental).

If there is no specific history of injury note the general state of the patient and record at least temperature and pulse. Depending on the clinical situation a more detailed general medical exam, including blood pressure and examination of the major body systems, may be needed, for example in a patient with an injury after a collapse.

Limb problems

Consider the following aspects: function, joints above and below, look, feel, movement (active/passive/resisted/stress/special tests) and nerves and vessels.

- Function: it is usually easy to note if the patient is weight bearing, holding a limb in an awkward way or not using a limb. This can be especially important in children.
- Joints above and below: it is best to screen the rest of the limb for injury. Pain can be referred, the classic error being not to examine the hip in a patient presenting with knee pain. Some injury patterns involve more than one joint (e.g. Maisonneuve injury).
- Look: always compare limbs. Subtle swelling or deformity may be missed if comparison is omitted. Look for swelling, bruising, erythema and deformity (Figure 1.7a).
- Feel: use a single palpating digit to define exact points of tenderness (Figure 1.7b).
- Movement: different types of movement test different structures and can lead to a more accurate diagnosis. Active and passive ranges of movement mostly involve joint function (although pain on passive stretching of a muscle is sign of muscle of muscle or tendon problems (Figure 1.7c). Resisted movement is where the joint is not moving but the muscle, its attachments and tendons are being tested (Figure 1.7d). Stress testing (gentle!) applies force to a joint to check for ligament laxity (Figure 1.7e). There are many special tests that have to be done in certain given clinical presentations; for example, the calf squeeze (Simmond's) test in a patient with sudden onset of pain behind the heel (Figure 1.7f). Such tests may be diagnostic of the injury and failure to perform them might lead to significant errors in management.
- Nerves and vessels: neurovascular exam should be a routine part of the limb examination.

Indications for investigations

We now have the ability to define injuries with a much greater degree of accuracy than before. Ultrasound and magnetic resonance

(f)

Figure 1.7 (a) Look: always compare sides. (b) Feel: use a single palpating digit to localize tenderness accurately. (c) Active and passive range indicates joint function. (d) Resisted movement indicates muscle/tendon/insertion function. (e) Stress tests indicate ligament function. (f) Special tests may be the only way of making a clinical diagnosis in some conditions.

(MR) scanning have revolutionized the investigation of soft tissue problems. Musculoskeletal problems are so common that to scan everyone would result in vastly increased costs and very long delays in management. Some degree of triage and selection of cases for investigation are needed.

X-rays

In patients with an injury it is often necessary to obtain x-rays to exclude a bony injury. Fortunately there are good-evidence based guidelines to assist the decision, for example the Canadian ankle, knee and C-spine rules. There is also good guidance from the Royal

College of Radiology on the appropriate use of x-rays. However, the decision is ultimately a clinical judgement taking into account the mechanism of injury, examination factors and patient factors such as age.

Computed tomography (CT) scanning

Although seldom a first-line investigation, CT scanning is very good at providing detail in complex bony injury, for example complex mid-foot fractures and dislocations. It also may be necessary to image areas that are technically difficult such as the lower cervical spine.

Ultrasound and MR scanning

There are very few indications for immediate scanning in soft tissue problems. Exceptions would be suspected spinal cord compression. However, where an injury is not responding as it should to first-line management, and where clinical re-assessment indicates a significant problem, further imaging is indicated.

Other tests

In non-injury presentations there is a large variety of tests that might be indicated. For example, a patient presenting with shoulder-tip pain with no history of trauma may need one or more of the following: an electrocardiogram (ECG), chest x-ray, plain x-ray of the shoulder, a C-reactive protein (CRP or erythrocyte sedimentation rate (ESR), a pregnancy test, a CT abdomen and amylase. We are not advocating a barrage of tests on any one patient; this list is to illustrate the breadth of diagnosis that might be encountered. The selection of tests is wholly dependent on the clinical evaluation.

Patients on warfarin can present a problem. In the presence of excessive pain or swelling, check an International Ratio (INR).

Types of injury and treatment

Muscle body

Muscle body tears are common. The medial head of the gastrocnemius, hamstrings and biceps are particularly prone to this type of injury. They are usually caused by contraction against resistance. Most of these tears are not complete and settle with advice, initial rest and then graded rehabilitation including gentle stretching. Complete tears are more likely in the tendon or at bony origins and insertions. In very athletic individuals or those with high occupational demands careful follow up and perhaps further imaging might be indicated.

Direct blows or a muscle tear can cause a haematoma. These are mostly treated conservatively. It is important not to overstretch the muscle during healing or myositis ossificans might result.

One of the most serious muscle problems is compartment syndrome. Muscles are contained within myofascial envelopes that are relatively non-expandable. Any condition that results in swelling within the compartment (direct trauma, muscle tear, ischaemia) may result in an increase in the pressure within the compartment leading to ischaemia and eventual muscle death. *The* symptom of compartment syndrome is severe pain, often unresponsive to opiates and seemingly out of proportion to the severity of the injury. The sign of compartment syndrome is severe pain at rest and on passive muscle stretch.

Tendon/muscle origin and insertion

Tendon injuries tend to be more severe than muscle belly problems. Tears are often complete and more commonly require surgical intervention, especially in sportsmen or those with high occupational demands. These can be difficult to diagnose and if an injury is not settling then further imaging may be required. Sometimes a tear can pull off a piece of the bony attachment. An x-ray might be diagnostic but often ultrasound or MR are required. See Table 1.3.

Ligament

Ligament injuries are very common but represent a spectrum of injury from being minor and self-limiting to those that result in a mechanically unstable joint. The classification of these injuries into grade 1/2/3 tears is an inexact science but is a useful concept to emphasize the need to make some type of assessment of the severity of ligament injury (see Figure 1.8).

Taking the example of the lateral ligament of the ankle, a grade 1 tear would be a partial tear of one component of the lateral ligament complex, a stable injury that will resolve with conservative management. A grade 2 tear would be a complete tear of the anterior talo-fibular ligament, usually a stable injury but requiring more intensive follow up and management. A grade 3 tear would be a complete tear of the whole lateral ligament complex, an unstable injury that would require careful follow up, perhaps further imaging and consideration of a surgical repair. However, it is difficult to grade these injuries by clinical assessment alone, especially at the time of injury.

Functional impairment

One of the commonest problems with soft tissue injury is the loss of mobility, muscle bulk and slowing of protective reflexes caused

Table 1.3 Tendon tears that may require surgical treatment.

Tears at insertion	Tears in tendon	Tears at origin
Biceps insertion to radius at elbow Flexor digitorum profundus to the distal phalanx	Extensor pollicis longus at wrist Quadriceps tendon Patellar tendon Achilles tendon Tibialis posterior tendon	Long head of biceps Hamstrings at the ischial tuberosity Biceps femoris at the anterior inferior iliac spine

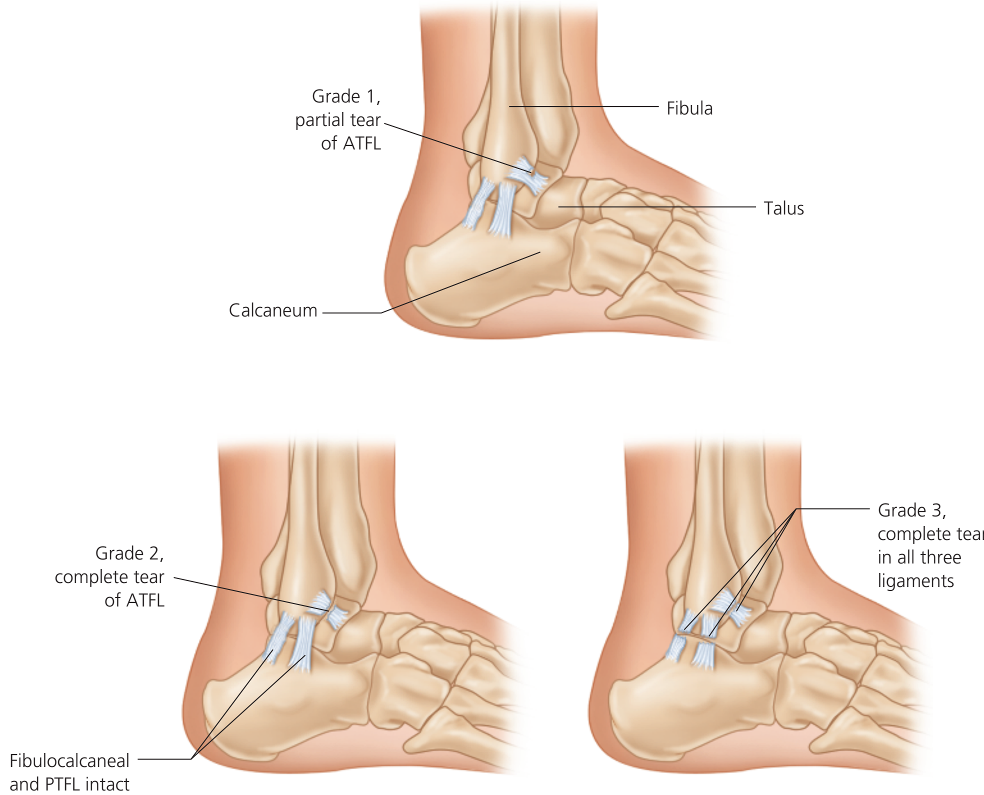

Figure 1.8 Grading of ligament tears. (a) Grade 1, a partial tear of part of the ligament complex (partial tear of the anterior talo-fibular ligament; ATFL). (b) Grade 2, complete tear of part of the ligament (complete tear of ATFL). (c) Grade 3, complete tear of the whole ligament complex (tears of the ATFL, calcaneo-fibular ligament and posterior talo-fibular ligament, PTFL).

by non-use or immobilization of an injured area. For example, the quadriceps muscle visibly losses bulk within a few days of the knee being immobilized. Given the importance of muscle power and reflexes in the maintenance of joint stability (see above), patients often report a feeling of insecurity, and 'giving way'. Equally strong muscles and fast reflexes can compensate for significant ligament tears, for example anterior cruciate injury.

Functional (rather than mechanical) instability is treated by rebuilding muscle bulk and retraining reflexes by intensive physiotherapy.

Joint injury

Dislocation

Dislocation is a serious injury as it always results in damage to the supporting ligaments. The shoulder and the fingers are the most common dislocations. Diagnosis is usually straightforward and treatment is by reduction, early support and then mobilization and rehabilitation.

Instability and recurrent dislocation

Instability is a common symptom. The commonest problem is functional instability due to muscle weakness (see above). Treatment is by good physiotherapy to build up muscle strength and protective reflexes. Recurrent dislocation indicates major damage to supporting structures and will require full investigation and in some cases surgery.

Loose body

Torn menisci, degenerative osteochondral fragments, osteochondritis and osteochondral fractures may all result in loose bodies within the joint. The commonest symptoms are pain, locking and giving way. Locking is where the patient says they are suddenly unable to move a joint through the full range of movement. Usually it is one specific movement that is blocked (e.g. in a truly locked knee the patient is unable to fully extend the knee but can flex well). Pseudo-locking, where a patient reports a global reduction in movement, is often due to pain inhibition or a joint effusion.

The other symptom is giving way, where the joint suddenly and completely fails. In the case of the knee the patient falls to the ground. True giving way is not common; functional giving way due to muscle weakness or pain inhibition usually does not result in total joint failure but more a 'feeling' of instability.

Nerve injury/compression

In closed injury it is uncommon for a nerve to be severed. The main mechanisms of injury are compression or stretching of the nerve fibres. Such injury can occur at the nerve roots (e.g. radiculopathy due to intervertebral disc disease), nerve plexus (e.g. traction brachial plexus injury) or in the peripheral nerve (e.g. radial nerve compression in the mid arm). A list of the common nerve injuries are given in Table 1.4.

Non-injury diagnosis and treatment

Limb pain with no definite single episode of injury is very common. The majority of these patients will have diagnoses that are not serious and most will resolve with good advice and simple treatments. However, sometimes a seemingly routine presentation will be the start of a serious condition where prompt diagnosis, referral and treatment may be life- or limb-saving (see Table 1.2 for the spectrum of injury in non-traumatic musculoskeletal problems).

Non-articular rheumatism

This is a spectrum of disease ranging from the common aches and pains that are experienced by almost all people at some time in their lives, such as mechanical back pain and cramp, through to serious conditions such as polymyalgia rheumatica (PMR). PMR is an inflammatory condition affecting the older population (peak incidence in the early 70s). The classical presentation is of shoulder and hip girdle pain and stiffness.

The major red flag for this condition is the association with giant cell arteritis. While not common, patients with symptoms of headache with PMR require urgent referral.

The management of mechanical back pain, fibromyalgia and muscle aches is covered in Chapter 3. However, the mainstays of treatment are encouraging mobility, exercise and simple analgesia.

Arthopathy

Degenerative arthopathy

Commonly known as osteoarthritis, this is the commonest joint problem. There is a spectrum of disease from mild single joint symptoms to severe multi-joint disease. Treatment aims at maintaining mobility and muscle strength along with measures to reduce load across the joint, such as weight reduction.

Table 1.4 Nerve root and peripheral nerve injuries.

Nerve	Cause
Spinal nerve root	Compression from prolapsed disc or osteophytes
Brachial plexus injury	High velocity injury, abduction inury
T1 root	Thoracic outlet syndrome
Radial nerve	Compression in radial groove (Saturday night palsy)
Axillary nerve	Shoulder dislocation
Long thoracic nerve	Carrying heavy rucksack, blows to this area
Ulnar nerve, elbow	Compression behind lateral epicondyle
Ulnar nerve, wrist	Cycling
Anterior interosseus	Compression in upper forearm
Posterior interosseus	Compression in upper forearm
Median nerve	Carpal tunnel compression
Lateral cutaneous nerve thigh	Compression near the anterior superior iliac spine
Common peroneal nerve	Blow/fracture fibular head
Tibial nerve	Compression in tarsal tunnel

Autoimmune/reactive diseases

This is a large and diverse group of diseases including rheumatoid, psoriatic, enteropathic, juvenile arthritis and Reiter's disease. There tends to be multi-joint involvement. These patients need a detailed history and often extensive investigations to reach the definitive diagnosis leading to specific treatment. Referral to a rheumatologist is often required.

Crystal arthopathy

Gout (uric acid) and pseudogout (calcium pyrophosphate) arthopathy are common emergency presentations. The presentation of a hot red, painful joint often raises the possibility of sepsis. However, a careful history often reveals previous attacks or risk factors such as excess alcohol consumption or use of certain classes of drugs, obesity and metabolic syndrome. Pseudogout is much more common in the elderly. There are some typical presentations allowing a clinical diagnosis in well, apyrexial patients, for example acute pain and swelling in the first metatarso-phalangeal joint , wrist pain, swelling and erythema in an elderly patient with typical x-ray changes.

Acute attacks respond very quickly to anti-inflammatory drugs or steroids (colchicine is an alternative).

Septic arthopathy

Rightly feared as a diagnosis not to miss, septic arthritis is a limb- and occasionally life-threatening condition that requires fast and accurate diagnosis. The classical presentation is a hot, painful joint. Fever is not always present. The presentation may be atypical. If there is diagnostic doubt then the joint should be aspirated and sent for urgent microscopy and culture. Refer all patients with suspected septic arthritis to rheumatology or orthopaedics.

Diabetic arthopathy

Diabetic arthopathy is more common in older patients with type 1 diabetes and probably due to a number of factors such as micro-vascular disease, neuropathy and abnormal collagen formation. The hands, shoulders and feet are most commonly involved.

Neuropathic arthopathy

Normal proprioception and input from muscle, ligament and joint capsule coupled with good muscle reflexes are essential for normal joint function. Disruption of these functions lead to abnormal joint mechanics that eventually leads to severe joint destruction (Charcot joint). Commonest causes are diabetes, alcohol excess, spinal cord or central nervous system injury. These conditions require specialist referral.

Overuse syndromes

A sudden increase in activity or chronic repeated excess loading of the musculoskeletal system can lead to fractures (stress fracture), tendonitis, enthesiopathy, ligament failure and nerve compression. The level of activity in work/sport/hobbies is a vital part of the history and often is the major pointer to the diagnosis of these conditions. Treatment requires understanding of the biomechanics of the stresses involved, temporary reduction of aggravating factors and physiotherapy advice and education on how to avoid the problem in the future.

Tumour/pathological fractures

While these diagnoses are rare they should be kept in mind where the history is atypical (sudden onset of bone pain with no trauma) or common symptoms fail to improve or get worse (e.g. knee pain in a young individual). Where the patient has a known history of cancer you should have a low threshold for further investigation. The diagnosis with no such history can be difficult. The onset of symptoms is gradual and often indistinguishable from common conditions. There are a number of red flag symptoms that should increase the index of suspicion but these may be unreliable. Older patients, steroid use and history of cancer are the most useful pointers.

Complex regional pain syndrome/neural pain

In this condition there are abnormal vascular and neural reactions. There is often an episode of trauma, often minor. The symptoms are signs are grouped into sensory, vasomotor, sudomotor/oedema and motor/trophic categories. Treatments include patient education, drug treatment, rehabilitation and psychological support. Early referral to a specialist in this area is recommended.

Further reading

Brukner P, Khan K. *Clinical sports medicine*, 4th edn. McGraw-Hill Australia, North Ryde, NSW, 2012.

Davidovits P. *Physics in biology and medicine*, 3rd edn. Elsevier, Burlington MA, 2008.

McNeill AR. *The human machine*. Natural History Museum Publications, London, 1992.

Wardrope J, English B. *Musculo-skeletal problems in emergency medicine*. Oxford University Press, Oxford, 1998.