Chapter 11

'Offloading' taping to reduce pain and facilitate movement

Dylan Morrissey

CHAPTER CONTENTS

INTRODUCTION

These are exciting times for clinicians and researchers interested in taping for therapeutic effect. First, the emergence of Kinesio-taping ('K-taping') has made an impact in our clinics and on our sports fields. Second, the quantity and quality of research about taping in general has accelerated exponentially and research on K-taping is increasing (Fig. 11.1). What does this mean for the clinician? More importantly, what does this mean for patients?

The positive outputs are many and varied. First, patient outcomes should improve as therapeutic paradigms evolve and mature. Second, exploration of a diversity of mechanisms underlying observed effects should enhance understanding of presenting pathology, optimize clinical reasoning and enable further innovation. This chapter presents some taping techniques, and makes some observations about the available evidence. Some of these observations may challenge some emerging accepted truths, or perhaps re-state some clinically proven 'facts'. Hopefully they will stimulate thought, and be tested rigorously, as were some of the hypotheses presented in earlier editions.

There are ways to make sense of, and translate into clinical practice, the research explosion. Scientific method utilizes systematic review, which is powerful evidence when performed well, with clinical insight, drawing on and analysing high quality rigorous evidence. Alongside systematic review, a theoretical framework for finding ways to categorize emerging evidence is useful. We need to use both as befits maturing professions driving forward clinical and academic innovation in parallel.

A recent systematic review we carried out of patellar taping for patellofemoral pain (PFP) is an example of how much the evidence, and the resultant clinical translation has progressed (Barton et al. 2014). Jenny McConnell innovated with an empirical approach to taping to reduce PFP, which revolutionized conservative management of PFP and has withstood the quantification test. Time and again these approaches have been evaluated and both effects and mechanisms explored. We now have level 1 evidence that patellar taping has positive effects on

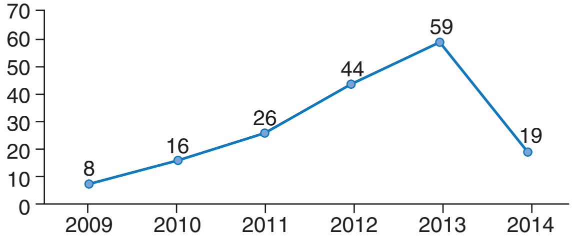

Figure 11.1 The frequency of K-taping research featured in *Web of Science*. *(Thanks to PhD student, Jack Shih-fan Tu for providing this graph and support with writing.)*

symptoms, and detailing the mechanisms underlying those effects, a number of studies have identified moderate evidence that:

- Tailored (customized to the patient to control lateral tilt, glide and spin) and untailored patellar taping provide immediate pain reduction of large and small effect, respectively, while tailored patellar taping promotes earlier onset of vastus medialis oblique (VMO) contraction (relative to vastus lateralis contraction).
- Tailored patellar taping promotes the capacity to tolerate increased internal knee extension moments (mechanisms). Further, and in-keeping with how taping is applied clinically, there is limited evidence that:
  - Tailored patellar taping combined with exercise provides superior pain reduction compared with exercise alone at 4 weeks
  - Untailored patellar taping added to exercise at 3–12 months has no benefit.

The value of 'offloading' soft tissue and articular structures has been proven. The clinical translation is therefore clear – although there is always room for further exploration.

What further categorization over and above effects and mechanisms could we apply? How can we make sense of new research without the benefit of systematic review?

First, we need to be clear about the aim of a given technique in a specific patient at a particular time.

- Can we produce an effect with our hands that could be reproduced with tape, thus extending the treatment window beyond immediate contact?
- How does the proposed technique fit with the rest of the multimodal treatment approach being applied?
- Never apply taping techniques 'off the shelf' – there is so much more to be gained from innovation, applied clinical reasoning, then proving effects immediately by testing and re-testing comparable signs.
- Clearly explain to the patient the rationale for the technique, how it fits with the rest of the treatment programme and what they should expect (if possible, recording this as a video on the patient's mobile phone), so they have a verbatim record of what has been planned that they can review as required.
- Consider effects on both tissue and whole organism levels, therefore applying the full range of clinical reasoning in expert application of a biopsychosocial approach.
- Choose the type of tape according to its properties, and match these to specific goals, while also considering mechanisms.
- Finally, complete the loop – have we made best use of existing research? Keep up-to-date with conference proceedings, the literature and new reviews.

The situation with systematic reviews of K-taping is not clear and perhaps the field is a little young to facilitate clinically meaningful reviews. Five recent systematic reviews found little in the way of consistent effects except on short-term pain and range of movement (Kalron & Bar-Sela 2013; Morris et al. 2013; Mostafavifar et al. 2012; Taylor et al. 2014; Williams et al. 2012). This is valuable in itself, especially in the context of designing and delivering a treatment package, but a feature of the source materials is of taping techniques typically being applied in a standardized fashion, as was the case with early studies on patellar taping, perhaps because this approach seems consistent with typical research methods. Further, many studies are done in asymptomatic subjects rather than patients, thus limiting external validity. What is required, and has resulted in stronger evidence for patellar taping, is evaluation of tailored taping in relevant groups with carefully chosen outcome measures. Assessment of mechanisms alongside such effects studies would be even more useful. Until we have such studies, it is unlikely that evidence synthesis will be able to fully reveal the place of such approaches in our clinical armamentarium. At present, we have to, as it were, accept the null hypothesis of no effect, but keep on working to address the absence of evidence.

As a final observation, there is no reason in the literature to regard 'Kinesio-taping' as any different to any other taping techniques. This may sound controversial but the same effects can be delivered using different tape in the same situations.

Montalvo's review found little difference between K-taping and a McConnell type approach, suggesting therefore that the application and reasoning is more important than the actual tape used (Montalvo et al. 2013). Kinesio-tape itself is typically beautifully made, has a particular adhesive mass and costs more than most other common types of tape. One can probably do more with this type of tape than with any other due to its excellent qualities, but there is nothing intrinsically special or new about a particular weave or adhesive mass. It was Rose

MacDonald who opened the eyes of many therapists in the UK to the need for therapists to understand the synergy that could be achieved by a detailed understanding of tape properties alongside clear taping goals and detailed overt clinical reasoning, in order to maximize results. It is that evidence-informed synergy, applied with a good knowledge of the literature and explicit clinical reasoning, that is the real goal. That said, if one was allowed only one type of tape, it would be good quality K-tape, because of the versatility its excellent manufacture offers. We do simply need to regard it as one of the tools of the trade, and not be beguiled by extravagant claims of its effects.

APPLICATION

Unloading taping to reduce musculoskeletal pain, and proprioceptive taping to improve movement patterns, are useful empirical adjunctive treatment approaches. It is probable that they operate by similar mechanisms, the precise nature of which remain as yet unproven, despite an increasing evidence base. Particular attention has been paid to the effects of taping on muscle recruitment (Kuo & Huang 2013; Lumbroso et al. 2014); bone loading in people with medial tibial stress syndrome (Griebert et al. 2014); calf pain in endurance athletes (Merino-Marban et al. 2014); postural stability (Semple et al. 2012); pain scores during functional tasks; fascial and upper limb dystonia (Pelosin et al. 2013) and neuromuscular recruitment and movement patterns (An et al. 2012). Since the last edition, some progress has been made in understanding mechanisms by which taping effects are mediated. The particular effects of taping along the line of a muscle have been explored (Alexander et al. 2008; Kuo & Huang 2013). Hypotheses regarding mechanisms based on the available literature are revisited in this chapter. These concepts are accompanied by clinical guidelines for the application of taping in a variety of situations with illustrative case histories.

Taping can be used in a number of ways to reduce movement-associated pain. Based on a thorough assessment of presenting movement patterns and pain mechanisms, taping can be used as a useful treatment approach in itself, or as a means of maintaining treatment effects. It can be used to provide a physical effect on the tissues that lasts for hours or even days, supplementing the relatively brief therapist–patient contact. Taping can be used to affect pain directly by offloading irritable myofascial and/or neural tissues. Taping can also be indirectly used to alter the pain associated with identified faulty movement patterns (Table 11.1). These effects are both proprioceptively and mechanically mediated, depending on the approach used. This is easily demonstrated in the shoulder girdle, with this area therefore being particularly used to demonstrate taping approaches in the following text.

Table 11.1 Means of pain reduction by taping

Direct	Indirect (proprioceptively mediated)
Longitudinal offload (Box 11.1)	Inhibition or excitation of movement synergists dependent on direction and individually proven effects as shown by assessment
Transverse offload (Box 11.2)	Facilitation of underactive movement synergists Promotion of optimal interjoint coordination Direct optimization of joint alignment during static postures or movement

DIRECT METHODS

Longitudinal offload

Painful tissues that are held in tension either because of the unrelieved influence of gravity or because of chronically increased background muscle tone, e.g. due to habitual postures, can often be effectively helped by taping if the tissue can be passively supported in a shortened position. This is particularly useful when addressing symptoms associated with adverse neural dynamics (Fig. 11.2). It is suggested that free nerve endings and c-fibre end-organs, which intertwine with the tissues are irritated by the mechanical and chemical effects of the tissue under tension. This is reduced by holding the tissue in a shortened position, therefore reducing pain fibre stimulation (Fig. 11.3). It is important to test this with a patient prior to taping application.

Transverse offload

A transverse offload approach can be used particularly for myofascial tissues that may be mediated either by similar means to that described above or by a more mechanical effect. This type of technique has been shown to be effective in reducing elbow pain associated with lateral epicondylalgia (Vicenzino et al. 2003). Transverse offloading of muscle structures effectively lengthens the muscle being used and may be inhibitory (Figs 11.4, 11.11) or may alter the free nerve endings position in connective tissue (Fig. 11.3).

A number of suggested techniques mix the two approaches effectively, and it may be that the combination of methods reduces the load on tissues within the taped area (Fig. 11.5).

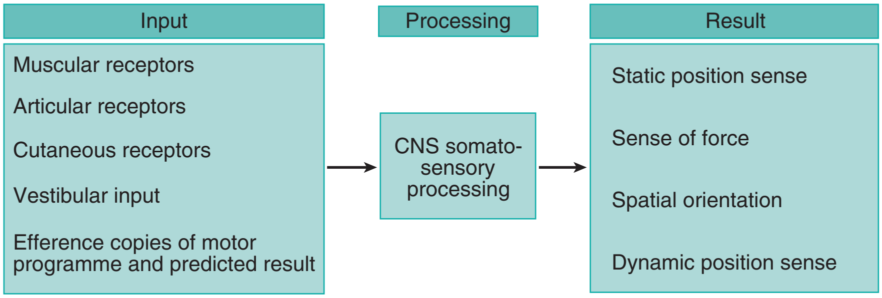

Figure 11.2 Proprioceptive summary. Input from a number of peripheral sources is integrated with expected movement patterns and the commands sent to the periphery with the result being a CNS representation of movement parameters.

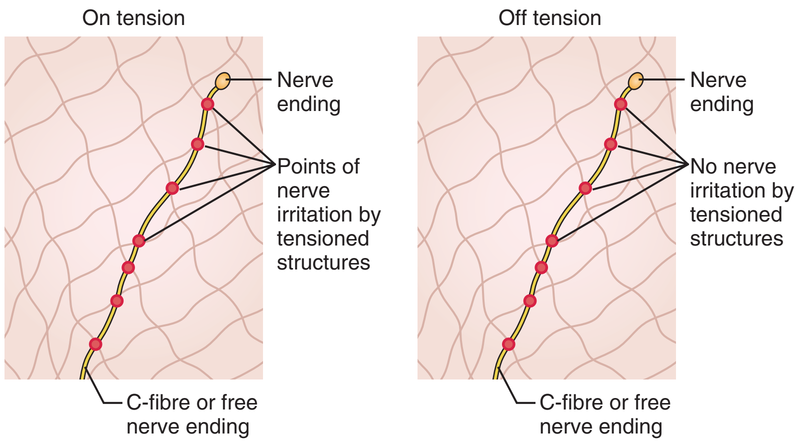

Figure 11.3 Free nerve endings piercing the multidirectional fascial planes may be irritated when there is sustained significant tension placed on the tissues. Taping that holds these tissues in a shortened position helps to reduce symptoms associated with movement.

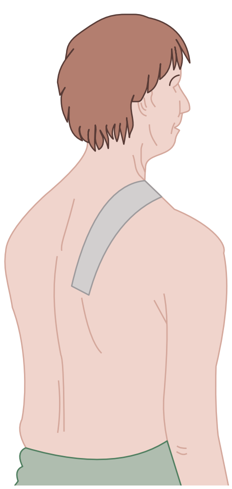

Figure 11.4 Upper trapezius inhibition. From anterior aspect of upper trapezius just above the clavicle over the muscle belly to approximately the level of rib 7 in a vertical line. Once partially attached a firm downward pull is applied and the tail of the tape attached.

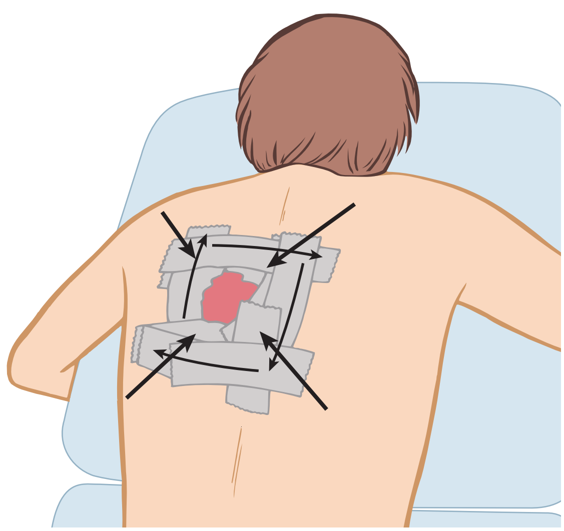

Figure 11.5 The skin over the thoracic spine is gathered centrally in the direction of the large arrows and the skin taped in the direction of the small arrows (see Taping guidelines).

INDIRECT METHODS: WITH REFERENCE TO THE SHOULDER GIRDLE

Normal upper limb function is dependent on the ability to statically and dynamically position the shoulder girdle in an optimal coordinated fashion (Glousman et al. 1988; Kibler 1998).

Movement faults, for example of the scapulothoracic 'joint', have been shown to be strongly associated with common pathologies (Hébert et al. 2002; Ludewig & Cook 2000; Lukasiewicz et al. 1999; Michener et al. 2003).

Physiotherapy that aims to improve joint stability, optimal interjoint coordination and muscle function has been shown to be clinically effective in the management of a variety of shoulder presentations (Braun et al. 2013; Ginn et al. 1997). Proprioception is a critical component of coordinated shoulder girdle movement, with significant deficits having been identified in pathological and fatigued shoulders (Carpenter et al. 1998; Forwell & Carnahan 1996; Voight et al. 1996; Warner et al. 1996). It is an integral goal of rehabilitation programmes to attempt to minimize or reverse these proprioceptive deficits (Lephart et al. 1997; Magee & Reid 1996).

Taping is clinically seen to be a useful adjunct to a patient-specific integrated treatment approach aiming to restore full pain-free movement of the shoulder girdle, although the evidence that taping affects scapular muscle recruitment patterns is mixed – suggesting that the optimal techniques to use for given presentations remain to be fully established and evaluated (Ackermann et al. 2002; Alexander et al. 2003; Cools et al. 2002). It is very clear from the literature that shoulder taping must be fully integrated into the overall treatment approach, so that its effects can be realized.

Initial studies of the effects of taping on motoneuron pool excitability have shown physiological effects that conflict with clinical experience, but these are early days in the exploration of the pathophysiological effects of taping on musculoskeletal dysfunction, so little could be taken from this work (Alexander et al. 2003). Extensions of that work have shown that motoneuron pool excitability is likely reduced by rigid tape (Alexander et al. 2008) but there may be some post-removal facilitation following removal of loosely applied K-tape (Firth et al. 2010). This mechanistic work would seem to contradict the findings of Semple (2012), who found improved postural control with calf taping; Merino-Marban et al. (2014), who showed reduced calf pain in duathletes and Lumbroso (2014), who showed increased calf force.

Furthermore, it is likely that the lack of tailoring of taping to an individual, and a lack of clear rationale for a given taping approach in a given person explains the lack of consistent effects.

Taping is particularly useful in addressing movement faults at the scapulothoracic, glenohumeral and acromioclavicular joints. Recent work has shown that scapular taping, of various kinds, can increase the scapular external, upward and posterior tilt rotations during elevation (e.g. Shaheen et al. 2013; Van Herzeele et al. 2013), precisely the movements associated with reversal of dyskinesia and improvement of symptoms in shoulder conditions (Worsley et al. 2013). Further, the acromiohumeral distance may be increased by simple taping procedures, described in previous editions but evaluated using K-tape by Luque-Suarez in 2013. The effects on pain tend to be short term (Thelen et al. 2008), with the clinical rationale therefore being of allowing a window of opportunity to rehabilitate dynamic function. The kinematic effects shown on acromiohumeral distance and scapular rotation are likely to improve shoulder impingement presentations.

Possible physiological mechanisms

Proprioception is a complex process that is difficult to define (Jerosch & Prymka 1996). Essentially, information from mechanoreceptors in the skin, muscles, fascia, tendons and articular structures is integrated with visual and vestibular input at all CNS levels in order to allow perception of:

- position sense (static)
- kinaesthesia (dynamic)
- force detection.

Proprioception is particularly important for upper limb interjoint coordination (Sainburg et al. 1993) due to the complexity of the kinetic chain, the relative lack of osseous stability and the precision of the tasks performed. The literature focusses on the role of articular and myofascial structures in contributing to shoulder girdle proprioception, while cutaneous input is regarded as having a lesser role (Carpenter et al. 1998; Jerosch & Prymka 1996; Lephart et al. 1997; Warner et al. 1996).

Proprioception has been shown to be compromised in upper limb pathologies, such as subacromial impingement (Machner et al. 2003) and glenohumeral instability (Barden et al. 2004). Full return to sport is dependent on reversal of these deficits. These deficits can be normalized after long periods of rehabilitation and recovery following surgery (Pötzl et al. 2004), while immediate improvements have been shown in pathological shoulders when cutaneously mediated proprioceptive feedback is augmented by compressive bracing (Ulkar et al. 2004).

Taping as a form of proprioceptive biofeedback

A potential mechanism by means of which proprioceptive shoulder taping may be effective is via augmented cutaneous input (Figs 11.5–11.7).

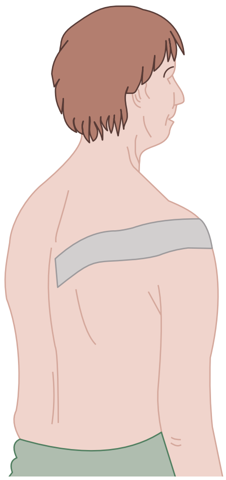

Figure 11.6 Retraction of the shoulder: from the anterior aspect of the shoulder, 2 cm medial to the joint line, around deltoid muscle just below acromial level to T6 area without crossing the midline. Tape pull is into retraction.

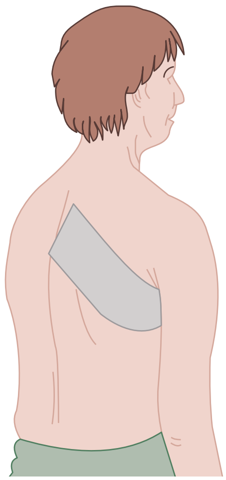

Figure 11.8 Serratus anterior facilitation and inferior angle abduction: from 2 cm medial to the scapula border, following the line of the ribs down to the mid-axillary line. Four one-third overlapping strips are applied with the origin and insertion pulled together and bunching the skin.

Figure 11.7 Retraction/upward rotation. From anterior shoulder just below the coracoid to low thoracic (T10) area. The initial pull on the tape is up and then back as the tape comes over the midline.

Tape is applied in such a way that there is little or no tension while the body part is held or moved in the desired direction or plane. The tissues will therefore develop more tension when movement occurs outside these parameters. This tension will be sensed consciously, thus giving a stimulus to the patient to correct the movement pattern. Over time and with sufficient repetition and feedback, these patterns can become learned components of the motor engrams for given movements. This process therefore represents cutaneously mediated proprioceptive biofeedback.

Taping as a means of altering muscle function

Mechanically, if taping can be applied in such a fashion that a chronically inhibited (underactive) muscle is held in a shortened position (Fig. 11.8), there will be a shift of the length–tension curve to the left, and greater force development in the inner range through optimized actin–myosin overlap during the cross-bridge cycle (Fig. 11.9).

Similarly, if taping can be applied in such a fashion that a relatively short, overactive, muscle is held in a lengthened position, there will be a shift of the length–tension curve to the right, and lesser force development through decreased actin–myosin overlap during the cross-bridge cycle at the point in joint range at which the muscle is required to work (Fig. 11.4).

The taping method used to inhibit upper trapezius activity (as in Fig. 11.4) has been investigated in a pilot study (O'Donovan 1997) and shown to have a significant inhibitory effect on the degree of upper trapezius activity in relation to lower trapezius during elevation (Morin et al. 1997). Alexander (2003) has also shown inhibition of lower trapezius, by means of H-reflex latency and amplitude, with scapular taping albeit with a counter-intuitive procedure.

Inhibition is demonstrated as soon as the tape is applied. Clinical effects of taping the shoulder girdle can

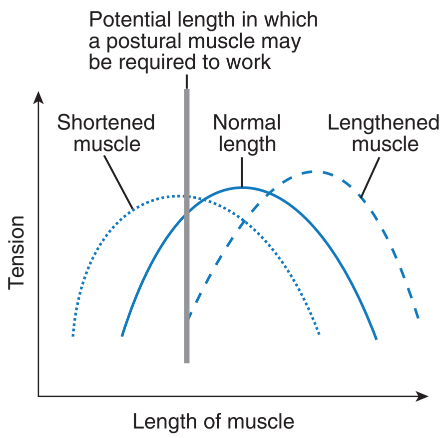

Figure 11.9 Length–tension curves. Although lengthened muscle has the capability to generate more force, postural muscles frequently need to be able to generate most force in inner range positions in which case it is often desirable that they are relatively short.

be significant and immediate, especially in promoting altered movement patterns and allowing earlier progression of rehabilitation. A recent study has shown that the pull involved in applying the second of the two tapes is critical to the electromyographical and mechanical positional changes observed during successful taping application (Brown 1999). The mechanisms by which the above study results, and the clinical effects seen during application, still merit further investigation.

Taping guidelines: shoulder as an example

It is essential to be clear about the aims of taping in order to ensure optimal results:

- In the case of the shoulder this would be assessed for its habitual resting position and for movement faults contributing to the symptom presentation.
- The skin would then be prepared by removal of surface oils and body hair.

Box 11.1 **Case history: direct longitudinal offload**

A 34-year-old woman presented with acute discogenic low back and long leg sciatic pain, due to an exacerbation of existing low back pain caused by sleeping awkwardly on a long-haul plane journey.

The presentation was both severe and irritable, to the extent that she had to be examined side-lying, in order to avoid exacerbation.

A key comparable sign was a 20° straight leg raise reproducing all her leg and back pain symptoms.

Application of longitudinal offload taping along the course of the sciatic nerve, and its common peroneal branches, reduced her symptoms on SLR and increased the pain-free range to 45° in conjunction with manual therapy techniques. The tissues had been supported in this way during assessment and the 'offload' was shown to be effective in terms of reduced pain and increased range of movement.

This allowed her to walk far more normally, with markedly reduced pain.

The V-shaped tapes were placed at the base of the fibula, at the head of the fibula, two-thirds of the way down the posterior aspect of the thigh and at the top of the posterior aspect of the thigh. These were applied in the order stated. Interestingly, an initial attempt to apply the tape in a reverse order was not successful (Fig. 11.10).

This taping was used throughout the first 2 weeks of her management, by which time she was significantly better and able to discontinue that aspect of her treatment.

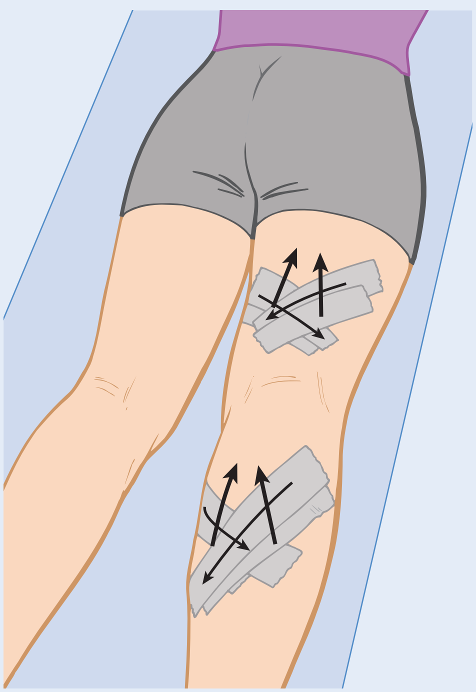

Figure 11.10 The tissues over the sciatic nerve are offloaded superiorly in the direction of the large arrows and the skin taped in the direction of the small arrows (see Taping guidelines).

Box 11.2 **Case history: direct transverse offload**

A recreational racquet sports player presented with lateral elbow pain with clear local soft tissue components, as well as a positive radial nerve tension test and low cervical facet joint stiffness.

Static resisted contraction (SRC) of the common extensor origin muscles and extensor carpi radialis brevis in particular was comparable (Fig. 11.11).

As part of the management, a transverse offload tape was applied to the common extensor origin with immediate reduction of symptoms from SRC and improved grip strength, through reduction of pain inhibition.

This remained part of her management until return to sport, when it was replaced with an 'Aircast' lateral epicondyle brace, which can be used to similar effect.

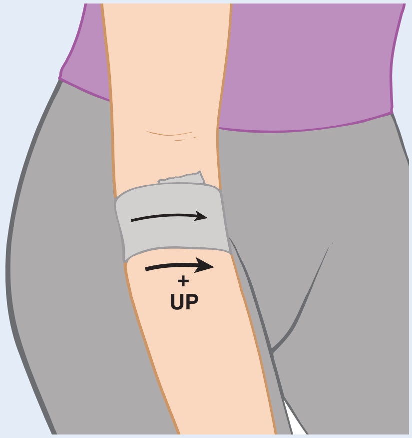

Figure 11.11 The skin and muscle tissue overlying the common extensor origin is lifted and pulled medially in the direction of the large arrows and the skin taped in the direction of the small arrows (see Taping guidelines).

Box 11.3 **Case history: shoulder pain**

This case represents a particular example of inhibition of overactive movement synergists and antagonists and facilitation of underactive movement synergists.

A 33-year-old cricketer presented complaining of persistent and progressive shoulder pain of nonspecific onset but particularly related to bowling and throwing. He had experienced episodes of pain towards the end of the previous season, which had not interfered with participation nor persisted after the end of the season. He had experienced problems from the start of the current season, which had progressed to the extent that he was no longer able to bowl or throw overarm, had pain persisting between games, while overhead activities of daily living were compromised.

Assessment showed clear impingement features, including:

- Localized pain to the front of the shoulder
- A painful arc on mid-range elevation that was associated with marked protraction and tipping of the scapula and accentuated on slow eccentric elevation
- Generalized loss of thoracic extension and rotation focussed at T5±T7
- A positive empty-can test (Magee & Reid 1996) (a static resisted contraction of abduction with the arm medially rotated and held at 90° of abduction in the scapular plane)
- General restriction of glenohumeral accessory joint glides
- Restricted medial rotation with scapulothoracic relative flexibility on the kinetic medial rotation test
- Painful, weak static resisted abduction and lateral rotation
- Tight overactive pectoralis minor as demonstrated by the shoulder girdle not being able to lower to the supporting surface when the patient was supine and gentle pressure was applied antero-posteriorly through the coracoid process.

An initial treatment plan was formulated, including: thoracic manipulation (HVLA thrust) to increase the available thoracic extension during elevation; pectoralis lengthening using trigger point treatment and specific soft-tissue mobilization to decrease the active scapula tipping; local soft-tissue deinflammation with ice; and scapula setting – initially in neutral but then incorporated into dynamic movement. It was decided to emphasize upward rotation and retraction as he demonstrated an excessively protracted, tipped scapula during elevation.

The scapula setting (Box 11.4) proved difficult for the patient to master, so the shoulder was taped (Figs 11.5, 11.7). This resulted in an immediate improvement in the patient's ability to set the scapula and an improved scapulohumeral rhythm associated with a marked decrease in the painful arc symptoms. The taping was reapplied for 3 weeks while his treatment and rehabilitation were progressed to the extent that he had achieved satisfactory control of scapula movement during functional activities and had begun to resume some of his sporting activities

Box 11.4 Scapula setting

Scapula setting has been defined as 'Dynamic orientation of the scapula in a position so as to optimize the position of the glenoid and so allow mobility and stability of the glenohumeral joint' (Mottram 1997).

- The shoulder would be actively positioned in the desired position by the patient with the guidance of the therapist, or passively if the patient is unable to maintain the desired position.
- A hypoallergenic mesh tape would be applied without tension (e.g. Mefix, Molnlycke, Sweden).
- A robust zinc oxide tape (Strappal, Smith and Nephew, UK) would then be applied.
- Further tapes may then be applied as necessary.

The taping is continued until the patient has learnt to actively control movement in the desired fashion, or the effects on symptoms are maintained when it is not worn.

An example of how taping can be used in the management of a patient with excessive tipping of the scapula is presented in the case history in Box 11.3 An example of how taping can be used to elevate a depressed scapula and stabilize a traumatically unstable acromioclavicular joint is presented in the case history in Box 11.5.

The case histories have been deliberately chosen to show a range of taping techniques that can be used either in conjunction with other modalities and methods, or in isolation.

Skin reactions

If the client develops a skin reaction, this can either be due to an allergic reaction, a 'heat rash' or because the tape is concentrating too much tension into one area. Tension concentrations usually occur around the front of the shoulder.

Heat rashes tend to be localized to the area under the tape and settle quickly. Allergic reactions are more irritating and widespread, and must be treated with great caution as reapplication is likely to lead to a more severe reaction due to immune sensitization.

Scapulohumeral function

The scapulothoracic joint gains some stability in relation to medially directed forces from the clavicular strut via the acromioclavicular joint. This still allows a large range and amplitude of translatory and rotary movement that is primarily produced, controlled and limited by the axioscapular myofascial structures (Kibler 1998).

Compromised thoraco-scapulohumeral rhythm results in the potential for impingement due to downward rotation of the glenoid associated with tipping or winging (Ludewig & Cook 2000; Lukasiewicz et al. 1999). An anterior tilt of the glenoid, resulting from adverse scapula positioning, is regarded as being a significant occult instability risk (Kibler 1998) (Box 11.6).

The scapulohumeral joint relies heavily on the passive stability provided by the capsulo-ligamentous structures and the dynamic stability provided by the rotator cuff (Glousman et al. 1988; Harryman et al. 1990, 1992; Payne et al. 1997; Terry et al. 1991). This stability is crucially dependent on intact proprioception (Nyland et al. 1998). Disruption by trauma or repetitive disadvantageous movement patterns is associated with impingement or instability (Barden et al. 2005; Machner et al. 2003).

CONCLUSION

Management of complex neuromusculoskeletal dysfunction and pathology and pain syndromes requires a multifactorial approach based on individual assessment. Strategies used to reduce pain, increase mobility, improve movement coordination and improve strength may be augmented by the use of taping used to offload tissues or to improve movement patterns by proprioceptive and mechanical means. The evidence for this approach is growing, both in terms of mechanisms and effects.

Taping is a particularly useful treatment adjunct, as it has the particular advantage of lasting well beyond the patient–therapist contact, thus extending the duration of therapeutic stimulus. Repetition and long duration experience of altered movement is essential in altering established motor engrams and overcoming the effects of established inhibition or pain presentations.

Box 11.5 **Case history: shoulder injury**

This case represents a particular example of promotion of optimal interjoint coordination as well as direct optimization of joint alignment during static postures or movement.

A 23-year-old rugby player presented 2 weeks after a shoulder pointer (fall onto the point of the shoulder causing an inferior blow to the acromion) and resultant acromioclavicular joint sprain.

Assessment showed a visible joint step with upper trapezius spasm accentuating this via its attachment to the lateral third of the clavicle. Range of movement was markedly reduced and the patient complained of constant pain aggravated by any movement. He was still using a sling. The scapula was noted to be in a downward rotated, depressed position, thus accentuating the step and resultant acromioclavicular joint pain.

The initial treatment therefore aimed to decrease the resting joint pain using large amplitude joint mobilizations and interferential therapy, which was partially successful.

In order to further reduce the resting pain and affect the pain on movement, it was necessary to improve the symmetry of the joint by decreasing upper trapezius activity and facilitating upward rotation and elevation of the scapula. This was done using tape (Figs 11.12, 11.13) and reinforced with soft-tissue techniques (trigger point massage and specific soft-tissue mobilization) to the upper trapezius (see Figs 11.4, 11.6, 11.12, 11.13).

An immediate improvement in symmetry was noted and a marked increase in pain-free ROM. He was able to discard the sling. Taping remained an integral part of the treatment until he was able to actively set the scapula independently.

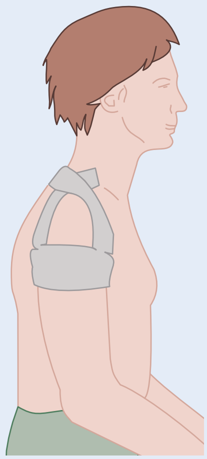

Figure 11.12 Elevation of the shoulder girdle. Apply tape in the following order: (1) Anchor strip applied at level of deltoid tuberosity, encircling two-thirds of the circumference of the arm; (2) elevatory strips applied from posterior arm/deltoid to the anterolateral aspect of the base of the neck; (3) elevatory strips applied from anterior arm/deltoid to the posterolateral aspect of the base of the neck; (4) locking strip over tape 1.

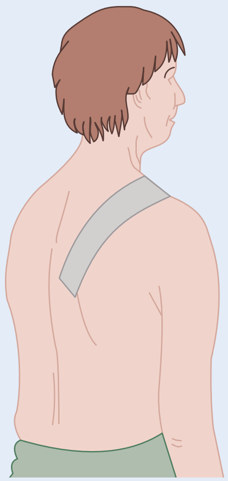

Figure 11.13 AC joint relocation; from coracoid process over the distal end of the clavicle with a downward pull applied just before the tail of the tape is attached to level of rib 6 in a vertical line. Only ever applied after successful application of elevatory taping (Fig. 11.12).

Box 11.6 **Downward rotation and tipping**

Downward rotation occurs about an axis located one-third of the length of the spine of the scapula lateral to the proximal end of the spine of the scapula. Tipping is when the inferior angle protrudes from the chest wall and the coracoid is pulled down and medially as compared to winging, where the entire medial border of the scapula lifts off the chest wall.

THIS CHAPTER

This chapter has contained details of the use of ‘unloading’/Kinesio-taping as a form of positional release.

NEXT CHAPTER

The next chapter by Anthony Pusey, DO and Julia Brooks, DO, describes the application of positional release techniques in the treatment of animals.

REFERENCES

Ackermann, B., Adams, R., Marshall, E., 2002. The effect of scapula taping on electromyographic activity and musical performance in professional violinists. Australian Journal of Physiotherapy 48, 197–203.

Alexander, C., Stynes, S., Thomas, A., et al., 2003. Does tape facilitate or inhibit the lower fibres of trapezius? Manual Therapy 8, 37–41.

Alexander, C.M., McMullan, M., Harrison, P.J., 2008. What is the effect of taping along or across a muscle on motoneurone excitability? A study using triceps surae. Manual Therapy 13, 57–62.

An, H.M., Miller, C.G., McElveen, M., et al., 2012. The effect of kinesio tape® on lower extremity functional movement screen™ scores. International Journal of Exercise Science 5, 196–204.

Barden, J.M., Balyk, R., Raso, V., et al., 2005. Atypical shoulder muscle activation in multidirectional instability. Clinical Neurophysiology 116, 1846–1857.

Barden, J.M., Balyk, R., Raso, V.J., et al., 2004. Dynamic upper limb proprioception in multidirectional shoulder instability. Clinical Orthopaedics and Related Research 420, 181–189.

Barton, C., Balachandar, V., Lack, S., et al., 2014. Patellar taping for patellofemoral pain: a systematic review and meta-analysis to evaluate clinical outcomes and biomechanical mechanisms. British Journal of Sports Medicine 48, 417–424.

Braun, C., Bularczyk, M., Heintsch, J., et al., 2013. Manual therapy and exercises for shoulder impingement revisited. Physical Therapy Reviews 18, 263–284.

Brown, L., 1999. The Effect of Taping the Glenohumeral Joint on Scapulohumeral Resting Position and Trapezius Activity During Abduction. Unpublished MSc Thesis. University College London.

Carpenter, J.E., Blasier, R.B., Pellizzon, G., 1998. The effects of muscle fatigue on shoulder joint position sense. American Journal of Sports Medicine 26, 262–265.

Cools, A., Witvrouw, E., Danneels, L., et al., 2002. Does taping influence electromyographic muscle activity in the scapular rotators in healthy shoulders? Manual Therapy 7, 154–162.

Forwell, L.A., Carnahan, H., 1996. Proprioception during manual aiming in individuals with shoulder instability and controls. Journal of Orthopaedic and Sports Physical Therapy 23, 111–119.

Firth, B.L., Dingley, P., Davies, E.R., et al., 2010. The effect of kinesiotape on function, pain, and motoneuronal excitability in healthy people and people with Achilles tendinopathy. Clinical Journal of Sport Medicine 20, 416–421.

Ginn, K.A., Herbert, R.D., Khouw, W., et al., 1997. A randomized, controlled clinical trial of a treatment for shoulder pain. Physical Therapy 77, 802–809.

Glousman, R., Jobe, F., Tibone, J., et al., 1988. Dynamic electromyographic analysis of the throwing shoulder with glenohumeral instability. Journal of Bone and Joint Surgery 70, 220–226.

Griebert, M.C., Needle, A.R., McConnell, J., et al., 2014. Lower-leg Kinesio tape reduces rate of loading in participants with medial tibial stress syndrome. Physical Therapy in Sport [Epub ahead of print].

Harryman, D.T. 2nd, Sidles, J.A., Clark, J.M., et al., 1990. Translation of the humeral head on the glenoid with passive glenohumeral motion. Journal of Bone and Joint Surgery. American Volume 72, 1334–1343.

Harryman, D.T. 2nd, Sidles, J.A., Harris, S.L., et al., 1992. The role of the rotator interval capsule in passive motion and stability of the shoulder. Journal of Bone and Joint Surgery. American Volume 74, 53–66.

Hébert, L.J., Moffet, H., McFadyen, B.J., et al., 2002. Scapular behavior in shoulder impingement syndrome. Archives of Physical Medicine and Rehabilitation 83, 60–69.

Jerosch, J., Prymka, M., 1996. Proprioception and joint stability. Knee Surgery, Sports Traumatology, Arthroscopy 4, 171–179.

Kalron, A., Bar-Sela, S., 2013. A systematic review, of the effectiveness of Kinesio Taping® – Fact or fashion? European Journal of Physical and Rehabilitation Medicine 49, 699–709.

Kibler, W.B., 1998. The role of the scapula in athletic shoulder function. American Journal of Sports Medicine 26, 325–337.

Kuo, Y.L., Huang, Y.C., 2013. Effects of the application direction of kinesio taping on isometric muscle strength of the wrist and fingers of healthy adults – a pilot study. Journal of Physical Therapy Science 25, 287–291.

Lephart, S.M., Pincivero, D.M., Giraido, J.L., et al., 1997. The role of proprioception in the management and rehabilitation of athletic injuries. American Journal of Sports Medicine 25, 130–137.

Ludewig, P.M., Cook, T.M., 2000. Alterations in shoulder kinematics and associated muscle activity in people with symptoms of shoulder impingement. Physical Therapy 80, 276–291.

Lukasiewicz, A.C., McClure, P., Michener, L., et al., 1999. Comparison of 3-dimensional scapular position and orientation between subjects with and without shoulder impingement. Journal of Orthopaedic and Sports Physical Therapy 29, 574–586.

Lumbroso, D., Ziv, E., Vered, E., et al., 2014. The effect of kinesio tape application on hamstring and gastrocnemius muscles in healthy young adults. Journal of Bodywork and Movement Therapies 18, 130–138.

Luque-Suarez, A., Navarro-Ledesma, S., Petocz, P., et al., 2013. Short term effects of kinesiotaping on acromiohumeral distance in asymptomatic subjects: a randomised controlled trial. Manual Therapy 18, 573–577.

Machner, A., Merk, H., Becker, R., et al., 2003. Kinesthetic sense of the shoulder in patients with impingement syndrome. Acta Orthopaedica 74, 85–88.

Magee, D., Reid, D., 1996. Shoulder injuries. In: Zachazewski, J.E., Magee, D.J.Quillen, W.S. (Eds.), Athletic Injuries and Rehabilitation. Saunders, Philadelphia, PA, pp. 509–539.

Merino-Marban, R., Fernandez-Rodriguez, E., Mayorga-Vega, D., 2014. The effect of kinesio taping on calf pain and extensibility immediately after its application and after a duathlon competition. Research in Sports Medicine 22, 1–11.

Michener, L.A., McClure, P.W., Karduna, A.R., 2003. Anatomical and biomechanical mechanisms of subacromial impingement syndrome. Clinical Biomechanics 18, 369–379.

Montalvo, A.M., Buckley, W.E., Sebastianelli, W., et al., 2013. An evidence-based practice approach to the efficacy of kinesio taping for improving pain and quadriceps performance in physically-active patellofemoral pain syndrome patients. Journal of Novel Physiotherapies 3, 151.

Morin, G.E., Tiberio, D., Austin, G., 1997. The effect of upper trapezius taping on electromyographic activity in the upper and middle trapezius region. Journal of Sport Rehabilitation 6, 309–318.

Morris, D., Jones, D., Ryan, H., et al., 2013. The clinical effects of Kinesio® Tex taping: a systematic review. Physiotherapy Theory and Practice 29, 259–270.

Mostafavifar, M., Wertz, J., Borchers, J., 2012. A systematic review of the effectiveness of kinesio taping for musculoskeletal injury. Physician and Sports Medicine 40, 33–40.

Mottram, S., 1997. Dynamic stability of the scapula. Manual Therapy 2, 123–131.

Nyland, J.A., Caborn, D.N., Johnson, D.L., 1998. The human glenohumeral joint. A proprioceptive and stability alliance. Knee Surgery, Sports Traumatology, Arthroscopy 6, 50–61.

O'Donovan, N., 1997. Evaluation of the Effect of Inhibitory Taping on EMG Activity in Upper and Lower Trapezius During Concentric Isokinetic Elevation of the Upper Limb. Unpublished MSc Thesis. University College London.

Payne, L.Z., Deng, X.H., Craig, E.V., et al., 1997. The combined dynamic and static contributions to subacromial impingement. A biomechanical analysis. American Journal of Sports Medicine 25, 801–808.

Pelosin, E., Avanzino, L., Marchese, R., et al., 2013. Kinesiotaping reduces pain and modulates sensory function in patients with focal dystonia: a randomized crossover pilot study. Neurorehabilitation and Neural Repair 27, 722–731.

Pötzl, W., Thorwesten, L., Götze, C., et al., 2004. Proprioception of the shoulder joint after surgical repair for instability: a long-term follow-up study. American Journal of Sports Medicine 32, 425–430.

Sainburg, R.L., Poizner, H., Ghez, C., 1993. Loss of proprioception produces deficits in interjoint coordination. Journal of Neurophysiology 70, 2136–2147.

Semple, S., Esterhuysen, C., Grace, J., 2012. The effects of kinesio ankle taping on postural stability in semiprofessional rugby union players. Journal of Physical Therapy Science 24, 1239–1242.

Shaheen, A.F., Villa, C., Lee, Y.N., et al., 2013. Scapular taping alters kinematics in asymptomatic subjects. Journal of Electromyography and Kinesiology 23, 326–333.

Taylor, R.L., O'Brien, L., Brown, T., 2014. A scoping review of the use of elastic therapeutic tape for neck or upper extremity conditions. Journal of Hand Therapy 27, 235–246.

Terry, G.C., Hammon, D., France, P., et al., 1991. The stabilizing function of passive shoulder restraints. American Journal of Sports Medicine 19, 26–34.

Thelen, M.D., Dauber, J.A., Stoneman, P.D., 2008. The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. Journal of Orthopaedic and Sports Physical Therapy 38, 389.

Ulkar, B., Kunduracioglu, B., Cetin, C., et al., 2004. Effect of positioning and bracing on passive position sense of shoulder joint. British Journal of Sports Medicine 38, 549–552.

Van Herzeele, M., Van Cingel, R., Maenhout, A., et al., 2013. Does the Application of Kinesiotape Change Scapular Kinematics in Healthy Female Handball Players? International Journal of Sports Medicine 34, 950–955.

Vicenzino, B., Brooksbank, J., Minto, J., et al., 2003. Initial effects of elbow taping on pain-free grip strength and pressure pain threshold. Journal of Orthopaedic and Sports Physical Therapy 33, 400–407.

Voight, M.L., Hardin, J.A., Blackburn, T.A., et al., 1996. The effects of muscle fatigue on and the relationship of arm dominance to shoulder proprioception. Journal of Orthopaedic and Sports Physical Therapy 23, 348–352.

Warner, J.J., Lephart, S., Fu, F., 1996. Role of proprioception in pathoetiology of shoulder instability. Clinical Orthopaedics and Related Research 330, 35–39.

Williams, S., Whatman, C., Hume, P.A., et al., 2012. Kinesio taping in treatment and prevention of sports injuries a meta-analysis of the evidence for its effectiveness. Sports Medicine 42, 153–164.

Worsley, P., Warner, M., Mottram, S., et al., 2013. Motor control retraining exercises for shoulder impingement: effects on function, muscle activation, and biomechanics in young adults. Journal of Shoulder and Elbow Surgery 22, e11–e19.

Chapter 12

Application of positional techniques in the treatment of animals

J. Brooks and †A. G. Pusey

CHAPTER CONTENTS

INTRODUCTION

One of the myths in musculoskeletal medicine is that humans are uniquely susceptible to back pain because they have risen onto their hind legs by adapting a structure designed for four legs. A chat with any veterinary surgeon will dispel this impression, as they frequently encounter animals presenting with physical problems involving the spine and associated structures (Fig. 12.1) (Jeffcott 1979).

On further consideration, this is unsurprising. The forces of gravity and the potential effects of injury are common stressors for humans and animals alike. Animals have the added complication of interacting with people, and may be subjected to dietary changes, specialized exercise regimes and unnatural breeding programmes.

The clinical challenge for those working with animals is to make a diagnosis without the benefit of direct verbal communication. Veterinary surgeons use their clinical expertise and use of special investigations, such as imaging techniques and blood tests, to identify pathology. However, difficulties arise for vets confronted with cases where there is obviously discomfort and dysfunction, despite there being no identifiable pathology. Such cases are likely to be the product of an altered physiological state, rather than of frank pathology (Williams 1997). Osteopathy adds another dimension to addressing such problems, by using observation and palpatory skills to identify areas of disordered function, along with a range of physical treatments to influence possible disturbances in the integration of the peripheral and central nervous systems.

HISTORY OF ANIMAL TREATMENT

The early years of animal osteopathy were distinguished by isolated pockets of activity, where individuals experimented with techniques. In the 1970s, Arthur Smith in Leicestershire pioneered an approach for treating horses under general anaesthetic, encouraged by a veterinary surgeon whose back he had successfully treated. Elsewhere, racehorse trainers looking for optimum performance recruited osteopaths, such as Gregg Currie in Epsom,

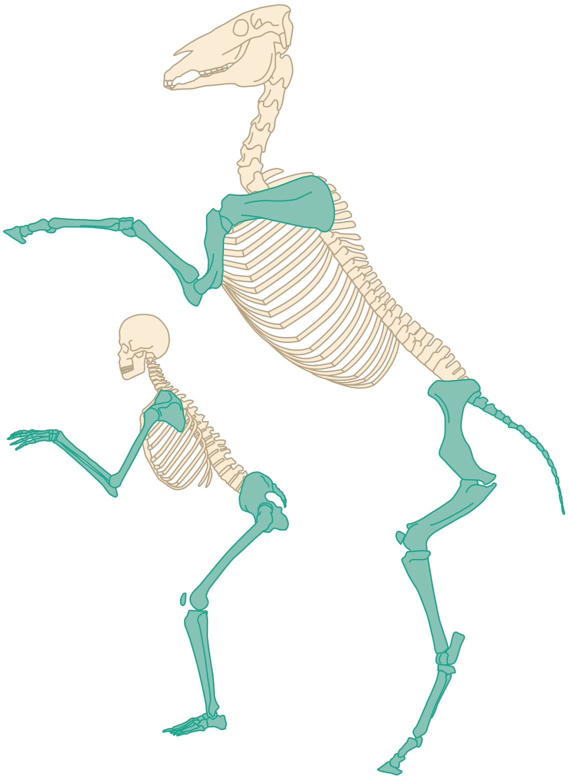

Figure 12.1 Animals and humans are similar in structure.

and those working in rural areas were approached by local farmers. Latterly, special interest groups have provided a forum for disseminating information and formal studies leading to postgraduate qualifications are available in this field. At the present time, osteopaths in the UK work alongside many forward thinking veterinary surgeons wishing to offer another approach to musculoskeletal problems, and their services extend to organizations such as the Household Cavalry and zoos.

MECHANISMS OF INJURY

Causes of injury are many and varied. A horse may fall at 30 mph driving its half a ton of bodyweight into the ground (Fig. 12.2), or an elderly dog may relive its boisterous youth by playing with a new puppy. A cat may try to cross the road at an inopportune moment or a hunting owl might be swiped by a car aerial as it makes a low night flight. None can communicate verbally what they are feeling but the pathophysiological effects of injury provide a means of identifying the nature of musculoskeletal injury.

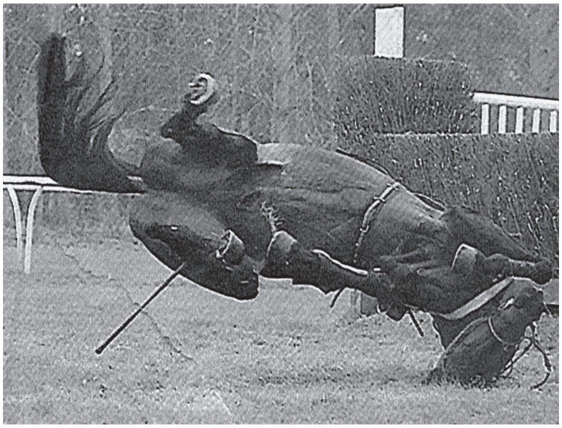

Figure 12.2 A horse may suffer compression rotation injuries that affect the whole spine (with permission from Ed Byrne).

NEUROPHYSIOLOGICAL EFFECTS OF INJURY

These effects are widespread but may be divided for convenience into peripheral responses at the site of the injury (Bevan 1999), and central responses occurring within the central nervous system (Doubell et al. 1999).

Peripheral responses

An injury will result in local tissue changes to give the classic signs of inflammation, pain, heat, erythema and swelling. This site is usually fairly easy to identify clinically by eliciting a pain response by direct pressure over the area and feeling for swelling and increases in temperature. At this juncture, the animal may be treated successfully with anti-inflammatory drugs. However, the injury will also stimulate the small nerve fibres of the nociceptive system, which send warning signals to the dorsal horn of the spinal cord. Here the fibres arborize within the network of the spinal cord, to form a multitude of interconnections.

It is in this central network where changes can occur, that may not respond to first-line drug treatment, but which are accessible to physical treatments, such as osteopathy (Colles & Pusey 2003).

Central responses

On reaching the spinal cord, if the stimulus is of sufficient intensity, it will be relayed to the brain to register as pain. It will also interconnect with motor neurones of the ventral horn to increase muscle tone (He et al. 1988) and, via the lateral horn, increase sympathetic nervous system

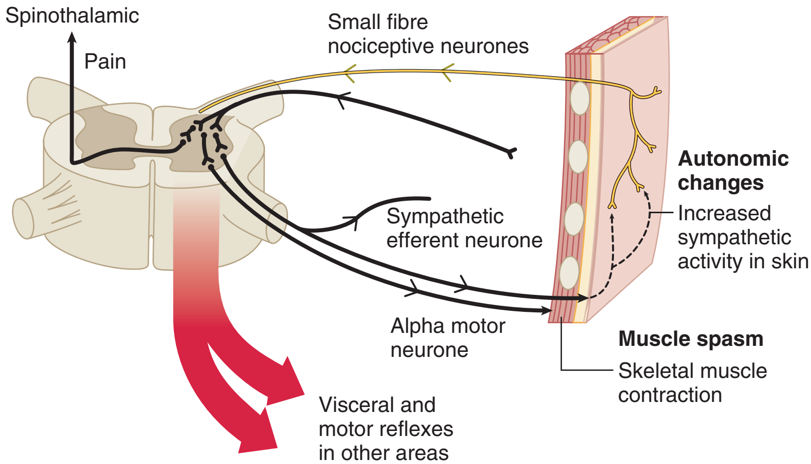

Figure 12.3 Neurophysiological responses to injury.

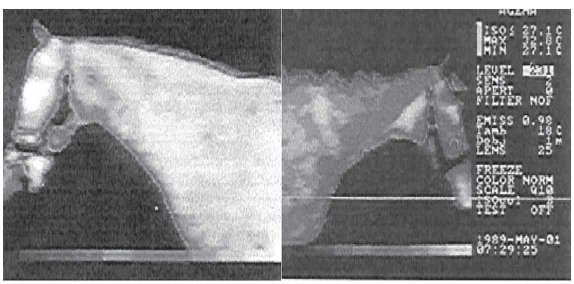

Figure 12.4 Infrared thermography showing reduced blood flow at surface in long-term response to injury. 'Normal' neck (left) and upper cervical dysfunction (right). *Note*: Temperature colour scale runs from left (lower temps) to right. Intervals ≈0.6°C (Colles et al. 1994).

activity to drive blood from the surface to the muscles (Figs 12.3, 12.4) (Sato & Schmidt 1973).

In the short term, this has a protective function by preventing further damage to the injured area. However, the long-term effect may be to leave a neurological footprint of abnormal patterning where the pain circuits maintain their activity after the initial injury has resolved (Patterson & Wurster 1997).

Retaining this abnormal patterning has a number of undesirable consequences. One effect is that the threshold at which the pain circuit fires is lowered, so that a relatively mild subsequent stimulus will fire an inappropriately large pain response. It will also alter the way an animal moves as a result of increased, possibly asymmetrical, tone in the some muscles. This is particularly significant in animals, as there are strong interconnections between spinal segments to support integrated movement between all four limbs. In fact, unlike the human system, these connections are so strong that in experiments on cats, it was found that crude gait patterns could be generated, even when the connection between the spinal cord and brain had been severed (Pearson & Gordon 2000). This integration becomes compromised in the presence of altered patterns of muscular activity.

Another key aspect of muscle function, which is often overlooked, is its role in proprioception. In an unpublished study by Charlotte Frigast and Professor Joe Mayhew at the University of Edinburgh Veterinary School, temporary denervation of upper cervical roots was induced, and when these horses were subsequently turned in a circle, they lost balance or fell, suggesting a close link between neck muscles and other elements of the balance mechanism. Certainly, in horses presenting with upper cervical problems, a common observation is that they are not as coordinated as they were prior to injury.

Such changes may be quite subtle, but they leave the animal vulnerable to a recurrence of symptoms or cause other problems by virtue of the altered mechanics of movement.

This combination of neurophysiological responses to injury may be reflected in the natural history of a presenting problem, which can be summarized in what may be described as the 'traffic light' effect (Fig. 12.5).

These cases are more difficult to identify clinically, as it requires careful observation and palpation of the whole biomechanical structure to detect altered function, as opposed to the more obvious changes noted when acute inflammation exists.

DIAGNOSTIC PROCESS

This is a multistage process structured very much along the lines of the human approach but with particular emphasis

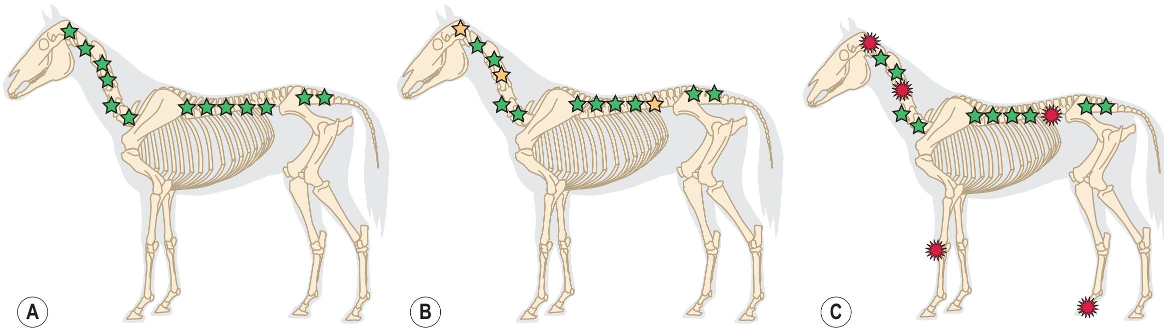

Figure 12.5 The 'traffic light' effect. (A) Green: In the normal horse appropriate screening of sensory input takes place at the level of the spinal cord. (B) Amber: Old injuries have left neurological footprints – regions of spinal cord which, despite being asymptomatic, have retained elements of abnormal patterning, with lowered threshold to external stimuli and altered muscular activity. (C) Red: Minor stresses on the system, such as a slight injury or increasing the amount or level of work, may result in acute symptoms at levels of abnormal patterning.

on the dynamic function of the animal observed in active movements.

Case history

The case history is the starting point of this process. It will often require an open mind and critical thinking, as this is obtained second-hand through the medium of the owner.

Demographics, such as age, breed and work of the animal, are important in building up a picture of the injuries that the animal may have sustained and the problems to which a particular breed may be susceptible.

With this background knowledge in mind, details of the presenting problem are elicited. This may give a picture of a sudden onset acute problem as a result of a specific trauma, such as a dog leaping awkwardly from a stile. More often, there is a history of increasing impairment of movement without a specific date of onset and no reported injury as a cause. However, in such cases, the owner will often mention minor alterations in activity and behaviour, such as a dog which prefers to be lifted from a car rather than jumping, or a horse that is sensitive to grooming on the neck.

Armed with this information, examination is the next phase.

Examination

Examination of the animal at rest and in movement is used to identify alterations in whole movement patterns and specific levels of dysfunction.

Static examination

This looks at the animal's weight-bearing and muscle development, which provides a visual record as to how the body is being used. For example, wasted muscle in the hip region of a Labrador may suggest stiffness in this area with the result that it tends to favour other limbs in weight-bearing. A horse with apparently well-developed shoulders and neck, but rather weak hind-quarters, may be compensating for poor hind limb and lumber spine function by overuse of the front half.

Active examination

In order to establish how the animal is using its body, it is observed in active movement from a number of viewpoints and at different speeds. For most domestic animals, a routine can be developed for observing movement from behind, in front and from the side at walk and trot. The osteopath is looking for fluidity and symmetry of motion, as activity is transmitted from one part of the body to another. Where dysfunction occurs, there can be very obvious breaks in the transmission of movement, identified by observations, such as a puckering of the skin or short, stubby action of the limbs.

Balance, coordination and flexibility can be assessed by observing more complex movements, such as tight turns and backing up.

Palpatory examination

Passive motion testing and palpation of the soft tissue are used to detect specific regions of dysfunction. Skin drag, where the fingers are pulled slowly along the paravertebral muscles, will pick up alterations in tissue texture, and regions of muscle spasm (Fig. 12.6). Joints at each level can be tested for the expected range of movement and asymmetries and reduced ranges may be identified.

Figure 12.6 Skin drag test identifies areas of altered tissue texture and muscle tone.

TREATMENT

Once a full diagnostic routine has been completed and a biomechanical diagnosis proposed, treatment can begin.

General considerations

Treatment can take many forms. Some are adapted from human techniques, and others have been developed for a particular species of animal (Brooks et al. 2001). As in the approach to children, for treatment to be effective a degree of cooperation is necessary.

By spending a little time with the owner and animal, a relationship built on trust can be developed. Domestic pets, particularly dogs, are very accepting of treatment and, having assured themselves that you intend to do them no harm, may sink into a trance-like state during the course of treatment. However, herbivores, such as horses tend to be more suspicious and vigilant. Indeed, this characteristic in the wild may be the very key to their survival. In these cases, treatment may be facilitated by giving a light sedative, particularly where refined changes in joint complex movement are required, with a position needing to be held for some time. An effective agent, which allows the horse to remain standing while giving a good level of sedation, is a mixture of opioid and an alpha-2 adrenoceptor agonist. The latter reduces the sympathetic drive so decreasing overlying muscle tone, while making the deeper structures of the joint complex accessible to examination and treatment. The opioid works through the central pain inhibiting pathways, which in combination with inhibitory input from the peripheral large fibre system (Melzack & Wall 1965), provided by osteopathic treatment, gives a dual beneficial effect.

Another consideration when choosing techniques is the complexity of the problem. Unless the problem is very short term and localized, treatment will have to address dysfunction of the animal as a whole, rather than being directed merely to the area that appears to be symptomatic. Positional techniques are particularly useful in complex strain patterns where there is involvement at multiple levels.

Positional release techniques

Positional release techniques in animals employ the idea of 'ease' and 'bind'. A normal joint has a point, usually at the middle of its range of movement, where there is minimum tension on the capsular ligaments and the overlying muscles, i.e. a point of 'ease'. Movement away from this point will increase tension or 'bind'. This information is processed in the central nervous system to map joint position and to generate an appropriate pattern of motor activity. Where abnormal neural patterning is retained following an injury, the relationship between joint structures is disturbed, and this 'point of ease' will be offset. Sensory information from that joint is subsequently changed at rest, as well as for any given movement. Difficulties arise with imposing new reference points on well-established networks, and the joint complex is likely to be less able to react appropriately, or to coordinate movement with other joints.

This new abnormal resting position may be isolated by testing each range of movement – flexion/extension, side-bending, rotation, translocation from side to side, traction/compression. These vectors are combined together at the point of ease (see notes on 'stacking' in Chapter 5). With the joint held in the position of minimum tension, there is minimum sensory input into the spinal cord. This appears to reduce conflicting information entering the network and allows the normal pattern to reassert itself. A change in neural activity is signalled by a relaxation of the muscles surrounding the joint complex, often accompanied by a deep sigh and altered breathing pattern.

This technique of finding the point of balanced 'ease' can be used on whole body parts, such as a limb, or on specific joint complexes, at strategic points of the skeleton.

Regional approaches

Certain regions are more susceptible to injury and have a greater impact on the function of the animal.

Cervical spine

The head and neck are vulnerable, particularly in horses. Huge forces are generated during a fall and occipitoatlantal-axial dysfunction is common.

One way of starting the technique is by lifting the head onto the shoulder and moving along the line of the jaw to find a point of balance. The jaw can then be used as a

Figure 12.7 Using the mandible as a lever, the point of minimum tension in the upper cervical complex can be isolated.

lever to take the cervical joints through their ranges of movement. Often, upper cervical joint complexes are dealt with together by introducing elements of flexion and extension, the main movement of the occipitoatlantal articulation, alongside rotation at the atlantoaxial level. In this way, the point of ease can be isolated. This can be refined further by placing the hands onto the suboccipt, in order to introduce secondary vectors of compression, traction and translocation (also described as translation or shunting) (Fig. 12.7).

Figure 12.8 The temporomandibular joint is an important site of dysfunction.

Temporomandibular joint

Intimately associated with the top of the neck, not only mechanically but neurologically by virtue of trigeminal innervation, is the jaw. Dogs are particularly susceptible to strains in this region resulting perhaps from their predilection for carrying over-large sticks. Using fingers on the medial surface of the mandible, trigger point inhibition can be used while introducing traction or compression through the ramus into the jaw itself (Fig. 12.8). (See notes on Facilitated positional release in Chapter 5.)

The limbs

The limbs are also susceptible to alterations in normal relationships. Dogs move with rapid changes in direction, and strain patterns which reflect these forces may be transmitted up the leg, starting with the phalanges and working up through the limb into the thorax.

Another important area is where the scapula and forelimb connect with the thorax. Unlike humans, there is no actual bony connection between forelimb and rib cage. Instead the muscles of the thorax, notably the pectorals, form a muscular sling in which the thoracic cage can rotate to allow much of the lateral movement occurring in horses and dogs. Fascial binding in this region clamps the scapula to the thorax and restricts limb motion and lateral flexibility. A combination of stretch and fascial unwinding through the foreleg is an arduous, but rewarding, way of improving mobility (Fig. 12.9).

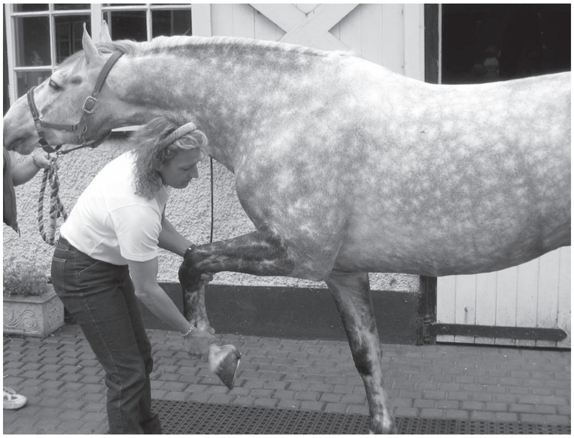

Figure 12.9 Fascial unwinding through the forelimb into the thorax. *(Photograph courtesy of Annabel Jenks DO.)*

A similar procedure can be used for the hind limb. Problems here are often associated with lumbosacral and sacroiliac dysfunction.

Figure 12.10 The horse shifts its pelvic balance in response to functional traction through the tail. *(Photograph courtesy of Jonathan Cohen BSc (Hons) Osteopathy.)*

Figure 12.11 With the shoulder medial to the horse's ischial tuberosity, the fascia, muscles and joints of the sacrum and pelvis can be influenced. *(Photograph courtesy of Jonathan Cohen.)*

Lumbosacral and pelvic region

A method of accessing the lumbosacral and pelvic complex that is not available in human osteopathy involves the tail. The tail is formed by approximately 20 caudal vertebrae which, after the first three, start to lose shape and articulations, to form simple rods joined with cartilaginous discs. The muscles of the tail, particularly the sacrocaudalis dorsalis, link with the multifidus muscles of the lumbar spine and sacrum, which play an important role in the segmental stabilization of the spine (Geisler et al. 1996), as well as provision of proprioceptive information. As these muscles have been implicated in recurrent back pain, the tail provides a good 'handle' on these structures.

By gently holding the root of the tail and taking it through all its possible ranges of movement, an idea of the fascial tension, from the tail into the pelvis can be determined. This can be observed quite clearly, particularly in horses, where the tail may be held to one side of the midline. When a point of ease has been established, traction can be increased, and this is often accompanied by quite dramatic manoeuvring of the pelvic girdle by the animal itself, as it shifts its weight from one hind limb to the other (Fig. 12.10).

The pelvis may also be accessed via the pelvic diaphragm. By using a shoulder, placed medial to the ischial tuberosity in the horse, or fingers in the dog, trigger points can be identified. The animal will often lean into the pressure being applied, and this can be used to introduce ranges of movement in the sacroiliac articulation, using the ischial tuberosity as a lever (Fig. 12.11).

TREATMENT UNDER GENERAL ANAESTHETIC

In a number of cases, the complexity and longstanding nature of the problem may require treatment to be carried out under a general anaesthetic. This is particularly relevant in horses where the speed and weight of the animal means that huge forces are often involved in injury.

The horse is anaesthetized, intubated and supported on its back. In this position, examination and treatment resembles even more closely the procedure used in human practice. It is interesting to note that under these conditions, it is often possible to detect marked restrictions in joint function that were not apparent on examination of the conscious horse. This emphasizes the effectiveness of compensatory mechanisms that may develop over time.

Another point of interest is that some of these horses are unable to lie squarely on their back. The fascial and muscular patterns developed as a result of injury and subsequent compensation, may produce a functional scoliosis that is maintained even under full anaesthetic.

Such cases are ideal candidates for the 'whole body unwinding' technique. With a practitioner holding each leg, the limbs are put through all ranges of movement to reach a point of minimum tension (Fig. 12.12). This position often reflects the directional forces involved in the

Table 12.1 Duration of symptoms where known in cases presenting to an osteopathic clinic

Duration (months)	<6	6–11	12–17	18–23	24–29	30–35	≥36
Frequency	32	16	21	9	9	0	24
Percentage	29	14	19	8	8	0	22

Note: Three cases were lost to follow-up.

Figure 12.12 Fascial patterns may be 'unwound' by using all four limbs. *(Photograph courtesy of Jonathan Cohen.)*

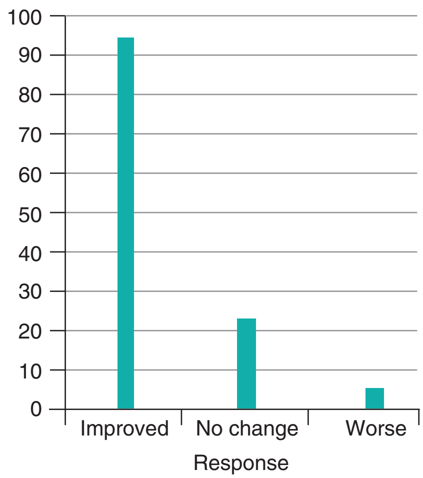

Figure 12.13 Outcome following osteopathic treatment at least 12 months after the last treatment.

original trauma. This is maintained until there is a sense of relaxation often accompanied by a change in breathing pattern.

IS EQUINE OSTEOPATHY (POSITIONAL RELEASE) EFFECTIVE?

While osteopathic treatment of horses appeared to be successful, based on anecdotal evidence, studies were required to establish the effect and effectiveness of the treatment. A clinical audit, carried out in 1995, defined the caseload referred to the clinic in terms of demographics and symptom presentation, as well as whether owners and veterinary surgeons felt that osteopathic intervention had been of long-term benefit to their animals. This retrospective study of 127 cases showed that horses presented to the clinic principally with back pain, nonspecific and shifting lameness and back stiffness, and those who were unable to perform the work expected of them. These problems had been present for over 2 years in 30%, and over 6 months in 71% of cases (Table 12.1). A follow-up at least 12 months after the final osteopathic treatment, showed that 95 (75%) had maintained improvement and were working at the expected level, or above, according to owners and veterinary surgeon reports (Fig. 12.13).

The next step was to consider physiological markers which could be used to identify changes resulting from osteopathic treatment.

One response to injury and pain is muscle hypertonia (He et al. 1988) and this may be expressed as shortened stride length.

A pilot study showed that horses presenting to the clinic had a significantly reduced step length, by a mean of 11.4 cm ($p < 0.001$) in trot, compared with controls (Woodleigh 2003). After osteopathic treatment, there was a significant increase of mean 12.5 cm ($p < 0.05$) in step length in the clinical cases (Fig. 12.14).

Another useful physiological marker is the change in sympathetic nervous system activity in response to a painful stimulus (Sato & Schmidt 1973).

This is manifested by alterations in surface temperature, which can be detected by infrared thermography. In horses, there is general agreement regarding normal patterns of cutaneous heat distribution, with surface temperatures throughout the body remaining consistent to within

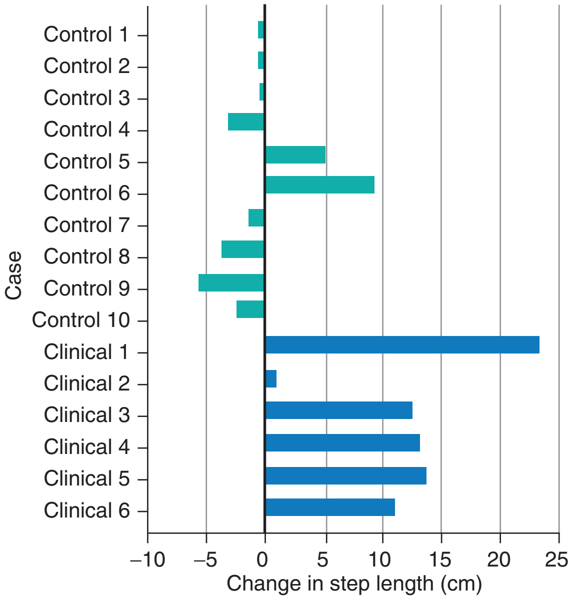

Figure 12.14 Change in step length from initial reading to follow-up for controls and clinical cases.

1 °C. Although acute injuries are detected as 'hot spots' by virtue of local inflammatory changes, increased activity of the sympathetic network in response to pain will act on the arteriovenous shunts to move blood away from the surface to the muscles, that show up as cooler regions (Fig. 12.4). Where this pattern of activity is retained in the network, after the initial injury has resolved, areas of cooling almost along dermatomal distribution, may be detected (Fig. 12.15) (Colles et al. 1994).

A further study of 46 horses looked at thermal patterns in the gluteal region. These were found to be significantly cooler ($p < 0.02$) than expected in cases presenting to the osteopathic clinic. These regions showed a significant increase in temperature following treatment (Brooks 2003).

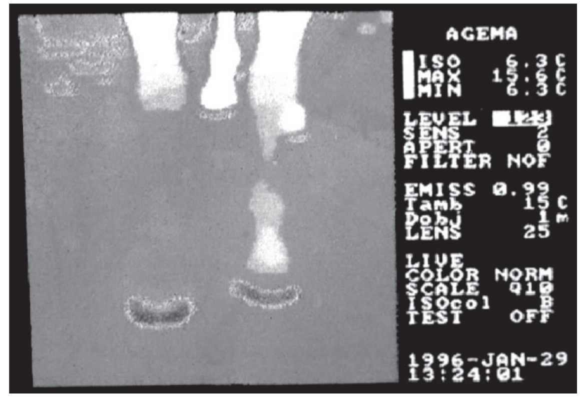

Figure 12.15 Cooling of distal forelimb: abnormal patterns of sympathetic nervous system activity may cause cooling along almost dermatomal distribution.

CONCLUSION

The treatment of animals is a rewarding field for those wishing to extend the boundaries of practice. There are the challenges of working where verbal communication is not possible, and where techniques must be adapted to the highly variable body sizes and shapes existing between species.

There is considerable overlap between human and animal practice and both have something to offer in the areas of clinical reasoning, palpatory skills and technique development – a case of the whole being greater than the sum of the parts.

THIS CHAPTER

This chapter has discussed the application of positional release techniques in the treatment of animals.

REFERENCES

Bevan, S., 1999. Nociceptive peripheral neurones: cellular properties. In: Wall, P.D., Melzack, R. (Eds.), Textbook of Pain, fourth ed. Harcourt, Edinburgh, pp. 85–103.

Brooks, J., 2003. Osteopathy in horses using infra-red thermography as a tool to monitor the effect of osteopathic treatment. In: 4th International Conference on Advances in Osteopathic Research. Royal Society of Medicine, London.

Brooks, J., Colles, C., Pusey, A., 2001. The role of osteopathy in the treatment of the horse. In: Rossdale, P.D., Green, G. (Eds.), Guardians of the Horse II. Newmarket, Romney.

Colles, C.M., Pusey, A.G., 2003. Osteopathic treatment of the axial skeleton of the horse. In: Ross, M.W., Dyson, S.J. (Eds.), Diagnosis and Management of Lameness in the Horse. Saunders, London, pp. 819–824.

Colles, C., Holah, G., Pusey, A., 1994. Thermal imaging as an aid to the diagnosis of back pain in the horse. Proceedings of the 6th European Congress of Thermography, Bath.

Doubell, T.P., Manion, R.J., Woolf, C.J., 1999. The dorsal horn: state dependant sensory processing, plasticity and the generation of pain. In: Wall, P.D., Melzack, R. (Eds.), Textbook of Pain, fourth ed. Harcourt, Edinburgh, pp. 165–181.

Geisler, H.C., Westerga, J., Gramsbergen, A., 1996. The function of the long back muscles; an EMG study in the rat. Behavioural Brain Research 80, 211–215.

He, X., Proske, U., Schaible, H.G., et al., 1988. Acute inflammation of the knee joint in the cat alters responses of flexor motoneurones to leg movements. Journal of Neurophysiology 59, 326–340.

Jeffcott, L.B., 1979. Back problems in the horse – a look at past, present and future. Equine Veterinary Journal 11, 129–136.

Melzack, R., Wall, P.D., 1965. Pain mechanisms: a new theory. Science 150, 971–979.

Patterson, M., Wurster, R.D., 1997. Neurophysiologic system: integration and disintegration. In: Ward, R.C. (Ed.), Foundations of Osteopathic Medicine. Williams and Wilkins, Baltimore, MD, pp. 137–151.

Pearson, K., Gordon, J., 2000. Locomotion. In: Kandel, E., Schwartz, J., Jessell, T. (Eds.), Principles of Neuroscience, fourth ed. McGraw-Hill, New York, pp. 740–747.

Sato, A., Schmidt, R.F., 1973. Somatosympathetic reflexes: afferent fibres, central pathways, discharge characteristics. Physiological Reviews 53, 916–947.

Williams, N., 1997. Managing back pain in general practice – is osteopathy the new paradigm? British Journal of General Practice 47, 653–655.

Woodleigh, M., 2003. Can osteopathic treatment under general anaesthetic increase stride length in horses? In: 4th International Conference on Advances in Osteopathic Research. Royal Society of Medicine, London.

Index

Page numbers followed by '*f*' indicate figures, '*t*' indicate tables, and '*b*' indicate boxes.

S

V

W

This page intentionally left blank