
Masterclass

Specific soft tissue mobilization in the management of soft tissue dysfunction

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SUMMARY. Following injury, the ability of soft tissue to tolerate the demands of functional loading decreases. A major part of the management of soft tissue dysfunction lies in promoting soft tissue adaptation to restore the tissue's ability to cope with functional loading. Specific soft tissue mobilization (SSTM) uses specific, graded and progressive application of force by the use of physiological, accessory or combined techniques either to promote collagen synthesis, orientation and bonding in the early stages of the healing process, or to promote changes in the viscoelastic response of the tissue in the later stages of healing. SSTM should be applied in combination with rehabilitation regimes to restore the kinetic control of the tissue. The principles of SSTM are reviewed with regard to the general principles of treating soft tissue dysfunction and areas identified for further research into this field.

INTRODUCTION

Until fairly recently, the majority of physiotherapy-based manual therapies have focused on assessment and treatment philosophies biased towards joint mechanics (Maitland 1991; Edwards 1992; Cyriax 1993). More recently, increasing attention has been given to management philosophies based on soft-tissue physiology and biomechanics aimed at reducing soft-tissue tightness, restoring soft-tissue mobility and correcting muscular imbalances (Butler & Gifford 1989; Norris 1995; Richardson & Jull 1995; Shacklock 1995). Despite this recent trend towards soft-tissue based philosophies, little emphasis has been given to the role that manual therapy has in the treatment of benign soft-tissue pathology such as the inflammatory and degenerative lesions that occur following micro or macro trauma, with the result that treatment of these pathologies tends to be based on electrothermal rather than manual approaches. The notable exception has been Cyriax who advocated the use of deep transverse frictions to 'break down' scar tissue and promoted collagen orientation during the healing process (Cyriax 1993). Although this approach is widely used and has a feasible biological hypothesis regarding the proposed mechanism of action, the evidence regarding the clinical effectiveness of deep transverse frictions

has been negative (Walker 1984; Stratford et al 1989; Schwellnus & Mackintosh 1992; Pellecchia et al 1994). Paradoxically, despite the lack of research evidence supporting the effectiveness of deep transverse frictions, considerable evidence is accumulating to support the importance of carefully applied movement in restoring the tensile strength and functional biomechanical properties of healing tissue (Forrester et al 1970; Burroughs & Dahners 1990; Dahners & Padgett 1990; Karpakka et al 1990; Gomez et al 1991; Javinen & Lehto 1993; Muneta et al 1993). On the basis of this accumulating research evidence, the author proposed an assessment and treatment approach termed specific soft tissue mobilization (SSTM) as an attempt to standardize a way of using manual therapy to treat benign soft-tissue pathology, and to offer a more sensitive and specific approach than the more traditionally used deep transverse frictions (Hunter 1994). SSTM uses graded and progressive applications of force matched as closely as possible to the stage of the healing process, in order to increase the tensile strength of the tissue and to restore the functional biomechanical properties of the soft tissue. This article describes the principles of SSTM in relation to the general principles of managing soft-tissue dysfunction.

GENERAL PRINCIPLES IN THE TREATMENT OF SOFT-TISSUE DYSFUNCTION

The soft tissues of the body are subjected to tensile, compressive and shear forces (Nordin & Frankel 1989).

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Following tissue overload, the ability of the soft tissue to tolerate force decreases, and therefore a major emphasis in the treatment process is to promote tissue adaptation to restore the tissue's ability to withstand the specific demands of functional loading. To achieve this successfully, the manual therapist must base treatment upon a detailed assessment process (Maitland 1991), specifically and progressively load the site of tissue dysfunction (Hunter 1994), and restore 'normal' kinetic control of the area (Norris 1995). In this article, three areas of the assessment and treatment of soft tissue dysfunction will receive specific attention:

1. identification of the aetiology of injury and aggravating factors in relation to the soft tissue dysfunction
2. identification of the site of tissue dysfunction and application of treatment to restore the tissue's biophysical properties in relation to specific functional demands
3. specific progressive rehabilitation programmes to ensure adequate control of the affected area to reduce the risk of injury recurrence.

IDENTIFICATION OF THE AETIOLOGY OF INJURY AND AGGRAVATING FACTORS IN RELATION TO THE SOFT-TISSUE DYSFUNCTION

Soft-tissue dysfunction occurs when:

1. the load is excessive in relation to the mechanical properties of the tissue
2. the biomechanical properties of the tissue have decreased in relation to a 'normal load' (Leadbetter 1992)
3. both 1 and 2 occur together.

Establishing the aetiology of soft-tissue dysfunction is important so that these factors can be corrected during the treatment process to reduce the risk of re-injury. However, many plausible aetiological theories lack substantive evidence in terms of causation because they are based on tests that have dubious validity and poor repeatability (McPoil & Cornwall 1996; Buckley & Hunt 1997). Establishing the validity and repeatability of all clinical tests should be a major research focus in future years to appraise their clinical value.

Even when allowing for a lack of confidence in testing procedures, establishing a causative relationship is extremely conjectural bearing in mind the multi-factorial nature of the forces applied to the tissue and care should be used when interpreting a relationship as being causative (Meeuwisse 1994).

Allowing for these limitations, aetiological factors should be explored in relation to intrinsic, extrinsic, and task related factors (Table 1). Watson (1997) provides an excellent review of this area.

As well as correcting possible aetiological factors, movement patterns that aggravate the current symptoms by loading the dysfunctional site beyond its mechanical capabilities should be controlled during the treatment process to avoid sabotaging any beneficial treatment effect. Taping or bracing is often useful to achieve this effect (Snyder-Mackler & Epler 1989).

IDENTIFICATION OF THE SITE OF TISSUE DYSFUNCTION AND APPLICATION OF TREATMENT TO RESTORE THE TISSUE'S BIOPHYSICAL PROPERTIES IN RELATION TO SPECIFIC FUNCTIONAL DEMANDS

Once the site of tissue dysfunction has been established through careful subjective and physical testing,

Table 1. Factors to consider in determining the possible aetiology of soft-tissue dysfunction. See Caine et al (1996) for a more extensive analysis of this area

Intrinsic factors Factors inherent in the person	Extrinsic factors Factors external to the person	Task related factors Factors relating to task performance
Somatotype	Direct force results in either acute or insidious onset of injury. In sport the force may be legal or illegal	Technique
Age and gender		Preparation, e.g. warm up
Personality (e.g. risk takers)	Environmental factors, e.g. weather – temperature, humidity, wind, type of surface, altitude	Type of task
Posture and body mechanics, for example hypermobility, bone density, leg length, excessive pro or supination, muscle imbalance – strength, power, endurance, control and flexibility, adverse neurodynamics, skill and co-ordination	Equipment, e.g. footwear. Is protective equipment worn? Is protective equipment worn correctly? Is the equipment the correct size and weight?	Adequate coaching or instruction
Poor rehabilitation from previous dysfunction	Social pressures	Temporal factors – how long is the task performed for? How long are the rest periods?
Unsafe manipulation of physiology		Intensity of the task
Genetic predisposition		Ergonomic considerations

progressive tensioning of the tissue is required to restore the mechanical properties to a level compatible with the potential imposed demands (Lehto & Jarvinen 1991; Muneta et al 1993). To do this successfully, tension is applied with respect to a treatment model based on current knowledge regarding soft-tissue biomechanics and the healing process of soft tissues.

Biomechanical properties of soft tissues

The tensile properties of soft tissues are commonly investigated experimentally by applying a progressive tensile load to the tissue and measuring the resultant change in tissue length. This allows the investigator to plot either a load deformation curve, or if the tissue dimensions are taken into account, a stress strain curve (Fig. 1).

The stress strain curve is typically divided into four regions (Fig. 1). The main features relevant to the application of SSTM are as follows:

1. The slope in the linear portion of the curve (the elastic modulus) represents the tissue stiffness (Fig. 2) (Burstein & Wright 1994a). The stiffer the tissue, the steeper the slope and the more resistance experienced on tensioning the tissue, for example following chronic scar tissue formation. Historically, emphasis has been placed on using the ultimate failure point of the tissue to determine its biomechanical properties; however, the slope of the curve may be more informative with regards to the mechanical behaviour of the tissue in vivo as it represents the region of physiological loading (Butler et al 1984).
2. The area under the curve represents the energy stored in the tissue (Fig. 2) (Burstein & Wright 1994). This energy can be useful in improving efficiency as part of the stretch shorten cycle, i.e. eccentric to concentric muscle activity (Blanpied et al 1995; Fukushima et al 1995; Keskula 1996), or may be detrimental in terms of producing tendon pathology (Wilson &

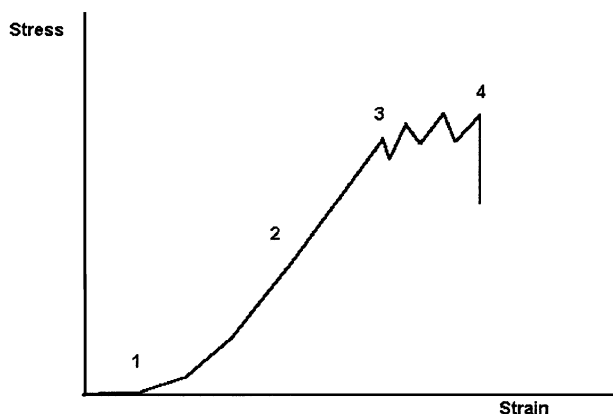


Fig. 1—Stress strain curve illustrating the four main informative regions of the curve. 1: toe region; 2: linear region; 3: fibre failure point; 4: ultimate failure point.

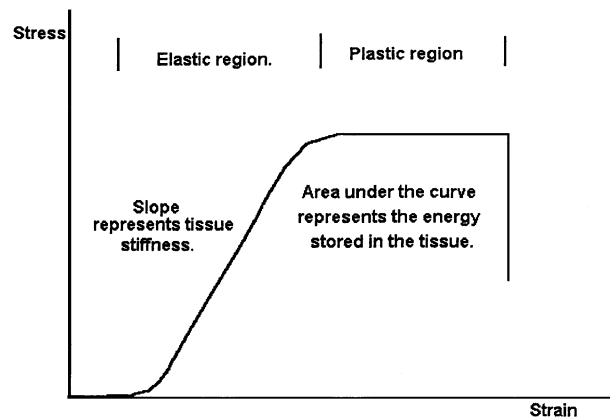


Fig. 2—Stress strain curve illustrating key areas of interest regarding the application of SSTM. SSTM may reduce tissue stiffness and therefore the inclination of the slope. This in turn affects the viscoelastic response of the tissue and its ability to store energy. Force applied into the plastic region results in permanent tissue elongation.

Goodship 1994). However, the greater the energy stored in the tissue, the greater the demands placed upon the tissue architecture. Following injury, the tissue architecture is less able to withstand the stress of tensile loading, hence the need to avoid excessive immobilization and to encourage early specific tissue loading to restore the tissue's ability to withstand and 'store' the applied energy (Akeson et al 1980; Woo et al 1987).

3. The stiffness of the tissue and the energy stored is influenced by the tissue's viscoelastic properties (Threlkeld 1992). Viscoelasticity is a property of soft tissues whereby the strain induced in the tissue is dependent on the rate of loading of the applied stress (Burstein & Wright 1994). It is thought to be due to biochemical interaction between the collagen fibres and the ground substance (Binkley 1989). In general, the faster the rate of loading, the stiffer the tissue becomes and the more energy is 'stored' in the tissue. This allows the tissue to withstand larger forces when the force is delivered more rapidly, a valuable attribute in tendons (Oakes 1994).
4. The stress strain curve can be divided into elastic and plastic regions (Fig. 2). Loading the tissue within the elastic region results in a return to its original length once the load is removed. Loading the tissue within the plastic region results in permanent deformation of the tissue, which is therapeutically desirable when a decrease in tissue motion relates to the patients symptoms.
5. Hysteresis is a phenomenon associated with energy loss exhibited by viscoelastic materials when they are subjected to loading and unloading cycles (Soderberg 1997). An elastic material demonstrates identical stress strain curves during loading and unloading; however, with viscoelastic materials the curves of the two phases are not identical (Fig. 3). The area between the unloading and loading curves

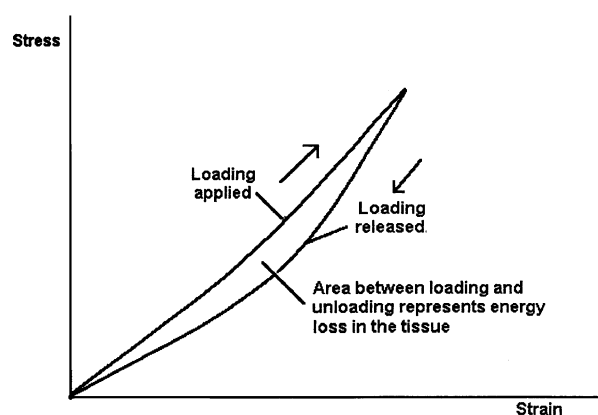


Fig. 3—Hysteresis is a property exhibited by viscoelastic materials whereby energy loss occurs in the tissue during loading and unloading cycles. This energy loss is believed to occur due to structural damage and internal friction.

represents the energy that is lost due to mechanical damage to the tissue and from internal friction (Burstein & Wright 1994b). Inducing hysteresis in the tissue helps to reduce tissue stiffness and restore the tissues' 'normal' mechanical response to loading (Garde 1988).

6. Creep is characterized by a continued deformation at a fixed load (Taylor et al 1990). The material continues to deflect until an equilibrium point is reached (Fig. 4). The clinical application of a constant low load over a prolonged period takes advantage of the creep response and is useful for increasing soft-tissue mobility (Carlstedt & Nordin 1989).

On the basis of the above principles it is possible to hypothesize that changes in the mechanical properties of soft tissue induced by SSTM may occur due to creep, plastic deformation and hysteresis which alter the viscoelastic response and tissue architecture.

The healing process of soft tissues

Soft-tissue dysfunction usually arises with regard to either inflammatory or degenerative pathology. For a more extensive review see Woo & Buckwalter (1987).

Inflammatory pathology

Following injury the tensile strength of the tissue decreases, and a major component of the healing process is to restore tensile strength to the damaged tissue. During the healing process the tensile strength of the tissue passes through three phases, the lag, regeneration and remodelling phase (Fig. 5). These phases are not clearly delineated in terms of time, and the length of each phase is influenced by many factors and is highly variable.

Lag phase

Typically this phase lasts between 4–6 days. During this time the inflammatory reaction prepares the wound for

the regeneration phase (Barlow & Willoughby 1992). The wound is fragile, being stabilized by a weak fibrin bond, and tension applied during this time period may disrupt the fibrin and exacerbate the inflammatory response (Wahl et al 1989). Specific tension should not be applied to the site of tissue dysfunction during this vulnerable time period, and this should be a period of control with regard to the inflammatory reaction. The principles of rest, ice, compression, elevation, and taping to restrict motion appear to be valuable during this time period (Knight 1995). Ice may be more effective during this time if its use was based around the principle of preventing secondary hypoxia rather than the vasodilation/constriction model commonly applied in physiotherapy (Knight 1995). Ultrasound may be useful during the lag phase (Webster et al 1978).

Regeneration phase

This is the period of the greatest increases in tensile strength due to the degree of collagen synthesis. The tendency for the formation of randomly orientated collagen fibres that restore structure but hinder function (Gomez et al 1991), can be reduced by careful tensioning of the healing tissue during the regeneration phase (Arem & Madden 1976). Specific tension may increase

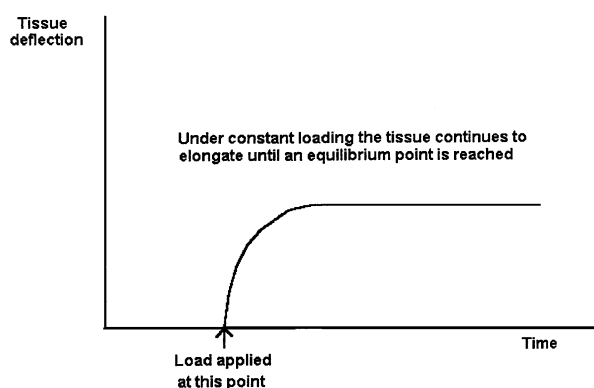


Fig. 4—Creep occurs when a tissue that has been subjected to constant loading elongates until an equilibrium point is reached. The change in tissue length is of value if the decrease in motion is related to the patient's symptoms.

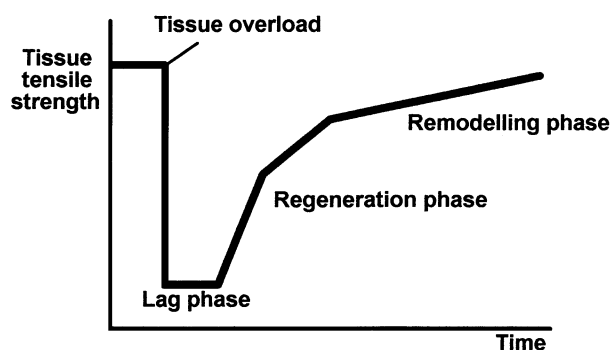


Fig. 5—Hypothetical model of the three stages of the healing process in relation to the tensile strength of the healing tissue. (Modified from Hunter 1994, with permission).

collagen synthesis, promote functional collagen alignment and increase collagen cross linkages so that they become more stable. This promotes a greater increase in tensile strength and reduces the time of the remodelling phase that follows (Currier & Nelson 1992).

Remodelling phase

The tensile strength of the tissue improves due to the formation of intra- and extra molecular cross linkages between the collagen fibres (Currier & Nelson 1992). The tissue may become stiffer and less able to tolerate the demands of functional loading. SSTM may alter the mechanical properties of the tissue in terms of its viscoelastic response by promoting hysteresis, creep and plastic deformation.

In summary, SSTM has no role during the lag phase, but in the regeneration and remodelling phase may be effective in re-orientating collagen fibres, increasing collagen number, and affecting the viscoelastic response of the tissue. This may result in an earlier restoration of tensile strength in the tissue, and therefore an earlier return to 'normal' function (Fig. 6).

Degenerative pathology

Evidence is accumulating that many 'inflammatory lesions', e.g. achilles tendonitis and patella tendonitis may, in certain cases, be degenerative rather than inflammatory (Kannus 1997). Kannus & Jozsa (1991) suggest that degenerative tendon changes are evident in one third of the healthy urban population aged 35 or more. In this degenerate state, hypoxic degenerative tendinopathy, mucoid degeneration, tendolipomatosis, calcifying tendinopathy or their combination may be found at biopsy (Kannus & Jozsa 1991). The absence of inflammation means that there is no stimulus for the normal healing response, and the application of SSTM in this case may produce an inflammatory response that initiates healing (Fig.7). There is some evidence that eccentric training regimes to promote tendon remodelling may be of value

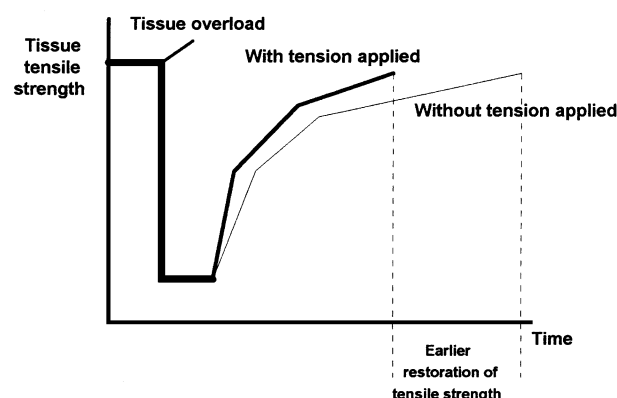


Fig. 6—Hypothetical effect of specific and progressive SSTM during the regeneration and remodelling phases. Promotion of collagen synthesis, orientation and bonding may result in an earlier restoration of tensile strength to the tissue.

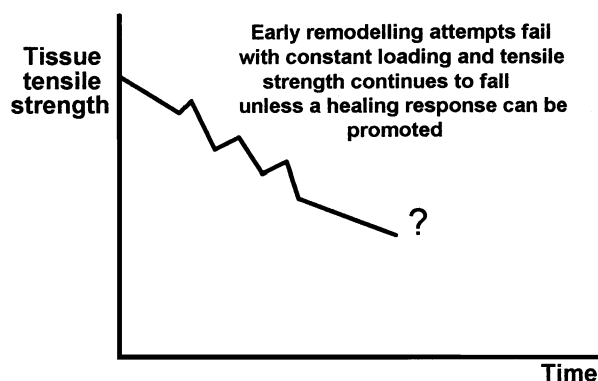


Fig. 7—Hypothetical model of the effect of degenerative pathology on tissue tensile strength. The lack of research into degenerative pathology prevents the outcome of degenerative pathology from being depicted in this model.

in the treatment of degenerate tendon dysfunction (Stanish et al 1986); however, this approach has yet to be subjected to prospective randomized studies to evaluate clinical effectiveness with regard to other treatment approaches.

SSTM techniques

The aim of SSTM varies depending on the stage of the healing process during which it is applied. Immediately following the lag phase the aim is to promote collagen synthesis, orientation and bond stability. In the later stages of the healing reaction, the aim is to alter the mechanical properties of the tissue with respect to its viscoelastic response to loading, based on the principles of hysteresis, creep and plastic deformation.

To apply tension to the specific site of tissue dysfunction, the author has suggested the following classification of techniques (Hunter 1994):

1. physiological SSTM
2. accessory SSTM
3. combined SSTM.

Physiological SSTM

Physiological joint movement is used to apply tension to the specific site of tissue dysfunction. This is achieved by finding the correct sequence of physiological joint motion that relates to soft-tissue tension based on the degrees of freedom occurring at the joint or joints over which the soft tissue has an influence. For example, in a patient with dysfunction at the musculotendinous junction of the biceps femoris, combinations of hip flexion, medial rotation and adduction along with knee extension and medial tibial rotation should be explored to locate the tension to the dysfunctional site (Fig. 8). The use of uniplanar physiological techniques that are commonly recommended in relation to 'stretching exercises' or assessing soft tissue 'length' fail to acknowledge that different parts of a soft tissue are tensioned by different combinations of joint motion. On this basis, there is no single physiological stretch for all parts of a

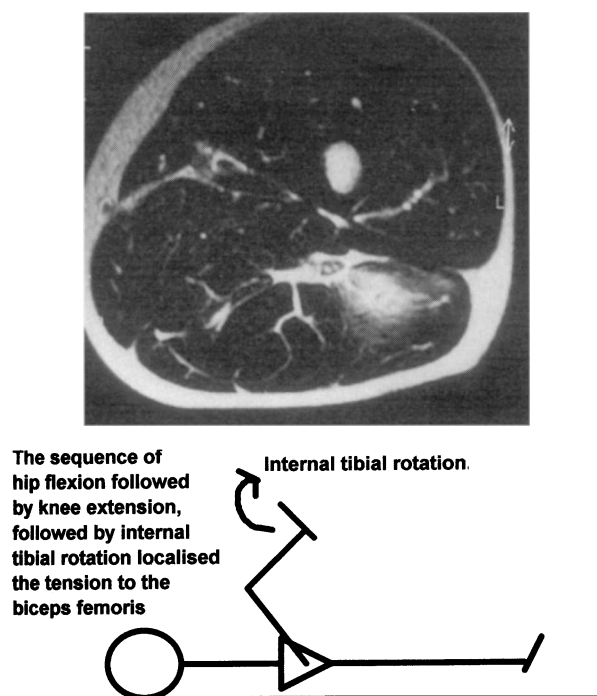


Fig. 8—T2 weighted MRI scan of a muscle tendon unit strain of the biceps femoris. This patient's symptoms were reproduced by the sequence of hip flexion with the knee flexed, followed by knee extension, followed by internal rotation of the tibia. Without tibial internal rotation the hip and knee sequence of physiological SSTM was relatively asymptomatic.

soft tissue, only for parts of a soft tissue. It is only when all areas of the soft tissue have been subjected to tension by varying combinations of physiological SSTM that a tissue can be claimed to have full physiological extensibility and clinical tensile strength.

In assessing the correct sequence of physiological SSTM, the concept of the order effect is important, as the same physiological movements applied in a different order affects the perceived location of stretch (Ayre et al 1996). This may relate to the fact that the muscle tendon unit does not behave homogeneously when under tension (Best 1993).

Careful attention should be paid to the shoulder and pelvic girdles in relation to tensioning associated tissues. Lack of stabilization at these sites results in a decreased ability to tension the more proximal aspect of the tissue, for example, when tensioning the rectus femoris with the sequence of either hip extension followed by knee flexion or vice versa, the pelvis will tend to tilt anteriorly which decreases the tension at the proximal attachment of the rectus femoris. Therefore a posterior pelvic tilt is important during this procedure if the stretch is to be more localized in the proximal aspect of the tissue.

Provided no joint instability is evident, physiological SSTM is used to tension ligamentous tissue by applying the same principles as above. For example, inversion at various degrees of plantarflexion is used to tension the specific site of dysfunction in the anterior talofibular ligament (Fig. 9). Tensioning the ligament through the

available joint range is important as different ligamentous fibres are tensioned at different degrees of joint motion.

In certain areas, physiological SSTM can be made more specific by the addition of accessory joint motion after the tissue has been tensioned using physiological SSTM. For example, a posterior glide of the lateral malleolus following plantarflexion and inversion to further tension the anterior talofibular ligament, or an anterior glide of the humeral head after the physiological movement of abduction and medial rotation have been used to tension certain fibres in the infraspinatus (Fig. 10).

During the assessment of physiological SSTM, the range, quality and limiting factors are noted. Specific attention should be paid to the perceived area of sensation so that this can be related to a 'normal' pattern for that movement sequence.

In certain areas of the body, physiological SSTM is unable to specifically tension the site of tissue dysfunction, for example in relation to the deeper muscles of the adductor region, and in these cases accessory SSTM is utilized to make the technique more specific.

Accessory SSTM

Accessory SSTM is performed by applying direct pressure on the same tissue plane and at 90 degrees to the site



Fig. 9—Plantarflexion followed by inversion tensions the anterior component of the lateral ligament of the ankle joint. The inversion stress should be applied through the range of plantarflexion that tensions the specific site of tissue dysfunction.



Fig. 10—Physiological movements of gleno-humeral abduction and medial rotation are applied to tension the site of dysfunction in the infraspinatus. An anterior glide of the humeral head may be used to make the tension more specific.

of soft-tissue dysfunction. Unlike deep transverse frictions that exert a compressive and transverse force on the superior surface of the tissue, accessory SSTM pushes against the tissue displacing the tissue axis, resulting in increased longitudinal tension within the tissue (Fig. 11). The transverse pressure on the same plane as the tissue dysfunction allows the therapist to assess the range, quality and limiting factors of the tissue motion and to grade the application of force to the tissue's biomechanical capabilities in relation to the stage of the healing process. The palpatory information relating to the quality of tissue motion is richer with accessory SSTM in relation to deep transverse frictions, and therefore clinically more informative; however, a clinical trial is required to substantiate any differences in relation to clinical effectiveness between the two approaches.

Usually accessory SSTM is applied with the tissue relaxed; however, in the later stages of the treatment of musculotendinous dysfunction, accessory SSTM is used in combination with isometric, concentric or eccentric muscle activity to localize the tension more specifically to the site of tissue dysfunction (Fig. 12).

Combined SSTM

The specific site of soft-tissue dysfunction is placed under tension by the use of physiological SSTM and then accessory SSTM techniques are used to increase the specificity of the tension. Because combined SSTM exerts the most tension at the site of dysfunction, it is generally used towards the later stages of the treatment process, and also often with functional or weight bearing loading (Fig. 13).

Technique application

The difficulty in applying force to dysfunctional tissue lies in establishing how much force is required to promote adaptation but not failure (Leibovic & McDowell 1994). The lack of research into this area means that SSTM application is based on experience rather than formula, under the guidance of severity, irritability and

underlying pathology as well as subjective and physical re-testing (Maitland 1991). The variables that must be considered are as follows.

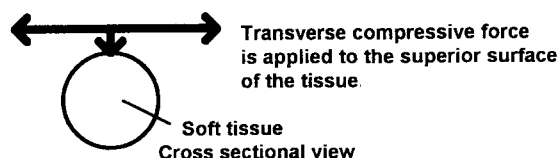
Type of force

An oscillatory force is recommended in the early stages of the healing process (from approximately days 6–14 for a mild to moderate lesion) to facilitate dispersal of inflammatory exudate and gently tension the lesion. After this time period a sustained force with slow oscillation into resistance is recommended to promote hysteresis, creep and plastic deformation.

Grade of force

In the early stages of the healing process an oscillatory movement, equivalent to a grade 2 (Maitland 1991), is recommended. Beyond the early stages (day 6–14) a sustained technique with slow oscillation into resistance, equivalent to a grade 4 (Maitland 1991) is recom-

Deep Transverse Frictions



Accessory SSTM

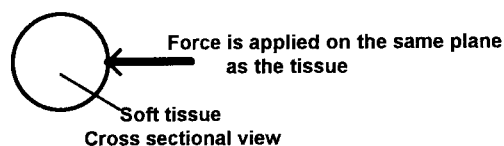


Fig. 11—Comparison between the method of force application for deep transverse frictions and accessory SSTM.



Fig. 12—In the later stages of treating muscle-tendon unit dysfunction, accessory SSTM is applied while the tissue undergoes either isometric, concentric or eccentric muscle activity. Here the bicipital aponeurosis is treated with accessory SSTM while the patient performs a concentric biceps contraction.



Fig. 13—Combined SSTM applied to the Achilles tendon during functional weight bearing activity.

mended. In both cases the therapist aims to apply the force with the correct grade to promote physiological but not pathological adaptation (Fig. 14).

Direction of application

The tissue response to movement should be assessed in all directions, and treatment applied on the basis of the direction of motion that presents the most symptomatic response, comparable sign, or the most beneficial changes in terms of subjective and physical re-testing.

Time of application

The absence of research evidence regarding the correct time for force application means that the therapist must select this parameter on the basis of tissue irritability, degree of tissue stiffness, and subjective and physical changes. As a general rule the author applies each force for between 30–60 seconds, with the number of repetitions of this force being guided by physical and subjective changes. The patient must regularly tension the area between treatment sessions and the author suggests a frequency of every 2 waking hours to patients.

Extensive research is needed to provide more objective data regarding the parameters of force application mentioned above.

SPECIFIC PROGRESSIVE REHABILITATION PROGRAMMES TO ENSURE ADEQUATE CONTROL OF THE AFFECTED AREA TO REDUCE THE RISK OF INJURY RECURRENCE

The mechanical model presented above focuses on the primary site of tissue dysfunction. The changes facilitated by SSTM are only successful in restoring 'normal' function, if the tissue functions within the control of a kinetic environment which matches the imposed functional demands (Norris 1995). Specific and progressive rehabilitation programmes should proceed hand in hand with SSTM, to restore parameters relating to muscle control, proprioception, co-ordination, fitness and psycho-social factors.

CLINICAL EXAMPLE OF SSTM IN THE TREATMENT OF 'TENNIS ELBOW'

The pathology of tennis elbow is commonly multifactorial (Nirschl 1986; Yaxley & Jull 1993). However, dysfunction of extensor carpi radialis brevis (ECRB) is proposed as a common mechanism of pain production in this multifactorial model (Stoeckart et al 1989). The principles of SSTM applied to the treatment of ECRB dysfunction is illustrated as follows.

Physiological SSTM

Combinations of forearm pronation, wrist flexion, ulna deviation and individual finger flexion with the elbow in extension should be explored. The order effect of finger flexion followed by wrist flexion and vice versa should be evaluated to establish the most symptomatic pattern.

Physiological SSTM can be made more specific by direct pressure to the head of the third metacarpal. This accessory movement may localize the stretch more specifically to the ECRB (Fig. 15).

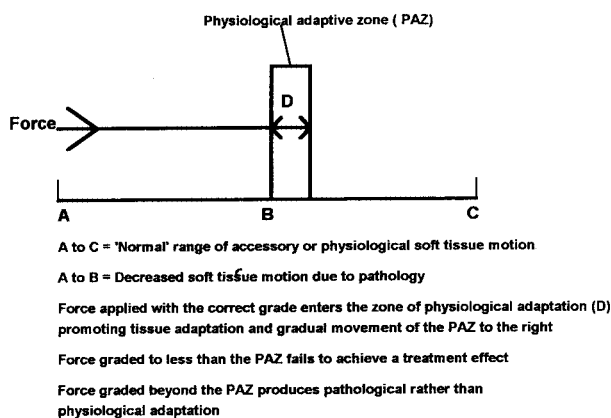


Fig. 14—Diagrammatic representation of the zone of physiological adaptation with regards to grading SSTM force application.



Fig. 15—Physiological movements of elbow extension, forearm pronation, wrist flexion and ulnar deviation are used to localize the tension in the ECRB. Pressure applied to the third metacarpal may increase the specificity of the technique.

Accessory SSTM

With the wrist and fingers in neutral, the accessory motion of the tissue at the site of dysfunction is established; note range, quality and limiting factors (Fig. 16).

Combined SSTM

The correct sequence of physiological SSTM is applied followed by accessory SSTM at the site of tissue dysfunction. As treatment progresses, resistance by means of elastic bands or tubing is incorporated into the treatment programme (Fig. 17).

CONCLUSION

An approach to the treatment of benign soft-tissue dysfunction has been presented. Although the application of specific, graded and progressive force to influence the healing process and mechanical properties of soft tissue appears to be based on sound biophysical principles, much of the supporting evidence is drawn from in vitro rather than in vivo data, and from animal rather than human tissue. Empirically, SSTM has important clinical value in the treatment of soft-tissue dysfunction,



Fig. 16—Accessory SSTM is applied on the same plane as the tissue dysfunction in the ECRB.



Fig. 17—Combined SSTM is applied to localize the force to the site of tissue dysfunction. From this position resisted exercises are used to facilitate the tissue's ability to withstand the demands of functional loading. Note: the elastic tubing applied to third finger.

but empiricism deservedly has little credibility in the scientific environment in which practice takes place. It is the author's hope that this article is not seen just as a model on which to base treatment, but as an enticement to encourage discussion and research into the clinical value of manual therapy applied to soft-tissue dysfunction so that research into this area can extend beyond its current level of infancy.

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