



Quick Start Guide

FOR PROFESSIONAL USE ONLY



Aim of the Quick Start Guide

This guide has been developed to provide clinicians with a quick introduction to Dynamic Taping. By the end of this guide it is hoped that the clinician will:

- understand the basic concept of Dynamic Tape and how it differs significantly from rigid tapes and kinesiology tapes
- be aware of the risks associated with improper application and be able to safely and effectively apply some basic techniques
- be aware of the options for developing their Dynamic Taping skills

Remember, Dynamic Taping is a skill and just like any other it requires practice to perfect. Even if you have a lot of taping experience you will find that it takes some time to perfect your handling.

Why Dynamic Tape?

- Other tapes will often restrict movement particularly if taping multiple joints, crossing the midline or introducing rotation and spiralling techniques.
- Other tapes offer very little in the way of mechanical assistance. They can provide a passive block to end of range motion but do not provide a deceleration (load absorbing) force to assist eccentric muscle contraction. Similarly they do not provide strong elastic recoil to assist weak muscles and still allow full range of movement.
- Dynamic Tape has been designed to allow full, unrestricted range of motion even when taping multiple joints, crossing the midline, bringing in rotation and performing complex athletic tasks through multiple planes of movement. Dynamic Tape has no rigid end point like a kinesiology tape, can stretch over 200% and stretches in all directions.
- Furthermore, Dynamic Tape uses strong elastic energy to absorb load to decelerate movement, just as a bungee cord decelerates the jumper. Energy is then stored in the form of elastic potential energy and reinjected as kinetic energy once shortening commences. In this way it will help weak, injured and fatigued muscles.
- It is based on first principles of physics - if the arm is to be lifted in the air, a certain amount of force must be generated to overcome the resistance of gravity. If some of this force is contributed by the strong elastic recoil of the Dynamic Tape, the muscles do not need to generate as much. The same is true when lowering the arm. The tape provides some resistance and therefore reduces the eccentric demand on the muscles.

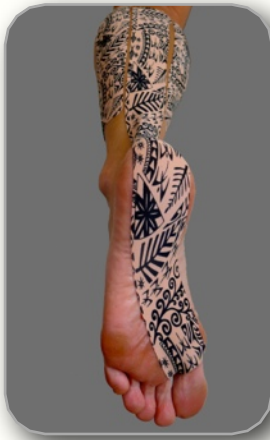


Gives you springs !



Types of Applications

1. **Direct Techniques** – mimic the action of the musculo-tendinous unit. E.g. calf application would assist function of the gastrocnemius/soleus/medial longitudinal arch complex and could be used for calf tears, achilles tendon injuries or plantar fasciitis. This technique would be applied with the foot in plantar flexion such that it would help decelerate dorsiflexion (eccentric calf) and then assist plantar flexion (concentric calf action). Additional, parallel strips (shown) can be added to offload the soft tissue in the case of a muscle tear.



Calf/achilles/plantar fascia

Other examples include:



Wrist Extensors e.g. acute tennis elbow or wrist drop - apply in wrist & finger extension



Hamstrings - apply in approx 135° of knee flexion so that it decelerates terminal extension to assist eccentric hamstrings

2. **Indirect Techniques** – do not copy the action of a particular muscle or group of muscles but may be used to correct movement patterns, provide an accessory motion (such as a Mulligan glide or rotation) or offload by supporting the weight of the limb e.g. a subluxed glenohumeral joint.

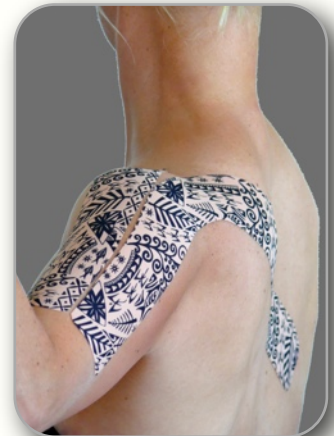
Examples include:



Patellofemoral Joint



Hallux Valgus



Upper Limb Offload

The IMPORTANT stuff - Adverse Reactions

There are generally three common types of reactions that occur with all adhesive tapes. The adhesive used on Dynamic Tape has been tested and rated as non-sensitising, non-irritating and non-toxic and is considered a very low allergy tape. The three reaction types most likely to occur with any adhesive tape include:

1. **ALLERGIC** reaction: These are rare but can and do happen. This is generally a reaction to the adhesive and despite our adhesive being one of the more hypoallergenic on the market we still see the occasional reaction estimated in the one per several hundred applications. **Allergic reactions** will:
 - a. happen quickly - usually within 15 to 30 minutes
 - b. will be irritated all over, anywhere that has been covered with tape
 - c. get hot and itchy
 - d. cause red, raised skin and welts if left too long.



WARNINGS must be given to **ALL** patients and the tape **must** be removed **immediately** should any signs of allergic reaction appear (hot, itching, burning, stinging, irritation or redness). Failure to remove the tape can result in extremely nasty reactions. The reaction above occurred when a tape was left in situ for TWO DAYS despite signs of allergic reaction commencing after a short period.

DO NOT tell people that they MUST keep it on for a certain period of time. If all is going well and it is not causing irritation, they may leave it on for up to five days.

2. **CONTACT DERMATITIS:** this generally occurs with the cotton based products that become moist and remain in contact with the skin for several days. We do not tend to see these with Dynamic Tape due to the fabric being breathable and quick drying.
3. **MECHANICAL** irritation: these can occur with any tape if excessive tension or shearing on the skin occurs. Due to the energy contained within Dynamic Tape and the way in which it is used these can occur if the Directions for Use (Appendix A) are not followed. Mechanical reactions generally occur in the form of traction blisters.

TRACTION BLISTERS will:

- a. occur at isolated points on the tape - usually at the ends
- b. commence after about 10 hours(may be sooner) up until a few days depending on the amount of tension on the skin
- c. commence by stinging, burning or itching or just a very sensitive feeling under the end of the tape

If the tape is removed when these symptoms occur usually a little redness is all that results. Blisters should **NOT** occur. If the patient has been WARNED appropriately, UNDERSTOOD this warning and COMPLIED with these directions they will remove the tape before a blister results.

These can and do occur if too much tension is present and the patient is not properly warned or ignores this warning. It is USER error and not an allergic reaction to the tape. They are EASY to avoid if the application guidelines are adhered to.

EXAMPLE WARNING - If you experience any itching, burning, stinging, heat or redness or an increase in pain, please remove the tape immediately. Failure to do so could result in a nasty allergic reaction, blisters and skin breakdown.



Application Guidelines – Directions for Use (see Appendix A)

This is possibly the most important part of starting out with Dynamic Taping. It is important to know how to apply the tape correctly to get optimal adhesion and to reduce the risk of adverse reactions. If adverse reactions occur, it is important that you can differentiate an allergic reaction, which happens rarely to a mechanical irritation which can happen often due to faulty technique (but should not happen at all).

The adhesive on Dynamic Tape is stronger than most kinesiology tapes and should therefore stick well if applied correctly. It is however designed to lift away if too much tension is applied, to reduce the risk of traction blisters.

The **Directions for Use** are explained thoroughly in **Appendix A. Please study these pages carefully.**

Of particular importance are:

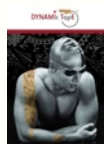
- preparing the skin correctly
- removal of backing sheet by tearing paper so that fingers do not come into contact with adhesive
- the need to leave adequate anchor points with no tension - three to four fingers' width
- the need to anchor the tape at the point three to four fingers' width away from the end then apply gentle tension to the skin in the opposite direction so that tension is not transmitted to the skin - this will also remove any skin creases from under the tape
- the need to only tension the tape to the very ONSET of resistance. This is almost IMMEDIATE. DO NOT STRETCH STRONGLY. Familiarize yourself with the Dynamic Tape. Practise gently stretching the tape until you have a good appreciation of the point at which the resistance commences.

Resources

Below you will find some photos of commonly used techniques. For instructions on how to apply these and many more, please visit the following resources:



www.facebook.com/dynamictape : This is the most frequently updated source of information and contains numerous photos and videos that have been provided by Dynamic Tape Instructors and Users. We also welcome your questions and any contributions that you would like to make.



www.dynamictape.com : The Dynamic Tape website contains a number of useful resources including:

- Videos
- eLearning - Two programs can be found - 'A Brief Introduction' and the comprehensive 'Getting Started'
- Lists of upcoming workshops and distributor details



Looking for a workshop in the USA? Contact the Institute of Advanced Musculoskeletal Treatments - www.iamt.org. For workshops in other countries visit www.dynamictape.com or contact your local distributor.



Contact your local distributor - Many of the representatives have a clinical background or are very knowledgeable about our products. They are a great, local resource. Distributor details are listed on www.dynamictape.com.



Sample Techniques



Quadriceps Mechanism – this simple technique is applied in full knee extension. It passes anterior to the axis of the knee joint and will therefore tension and absorb load during flexion (assisting eccentric quads) and then assist knee extension. It is useful for muscle tears, patella tendinopathy, PFPS, Osgood Schlatters and Fat Pad Syndrome. A PowerBand technique can be used to provide additional force.

Note: the close up shows the 'pinch' or 'gathering' offload of the soft tissue held in place by the elasticity of the tape. Observe that there is no convolutions of the tape or skin lifting like in kinesiotaping but rather a deeper gathering up of all the soft tissue to reduce firing of sensitized nociceptors.

Deceleration of pronation – velocity of pronation has been shown to be of significance with Exertional Lower Leg Pain or 'shin splints'. This technique is applied in dorsiflexion, inversion and forefoot adduction. The tape commences under the first and second metatarsal to invert the forefoot.

Once under the foot, the line of pull passes on an angle from the base of the fifth metatarsal to the tubercle of the navicular. As a result there is a longitudinal force vector acting to shorten the medial longitudinal arch and adduct the forefoot.

The tape is then directed supero-laterally across the anterior talocrural joint line to maximise the rotation and dorsi flexion components to provide a deceleration force to the navicular drop.

There are a number of variations of this technique. Other techniques can be used in combination with this to control the rearfoot, provide an artificial windlass mechanism, assist FHL and much more.

A PowerBand (2 x 3" or 2 x 2" with a 3" cover strip) is often best due to the larger forces involved.



PowerBands

In some situations or with some clinical conditions it may be necessary to introduce more force into the kinetic chain. This can be done by using a wider strip of tape (e.g. 3" instead of 2") or by applying additional strips in parallel. Another method is to create a Dynamic Tape PowerBand. This provides a simple way to graduate the amount of force introduced into the system while still permitting full range of motion.

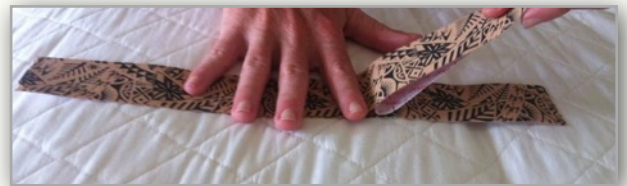
PowerBands are particularly useful for lower limb applications, particularly on larger clients or for providing additional deceleration forces in the cases of instability e.g. previous glenohumeral joint dislocation.

What is a PowerBand?

A PowerBand is created by laminating two or three layers of Dynamic Tape together before applying it to the body. It is then applied as one piece of tape possessing far stronger resistance and improved elastic recoil properties. It is also easier to handle.

How to make a PowerBand

- Cut two or three pieces of identical length Dynamic Tape.
- Place one piece on a firm surface and spray the fabric side of the tape lightly with adhesive spray. DO NOT remove the backing sheet.
- Take the second piece of tape and carefully remove the backing sheet from one end. It is best to avoid finger contact with the adhesive surface. This can be done by tearing the backing sheet about 2" (5cm) away from the end.
- Apply this end to the back (fabric side) of the first piece making sure that the strips are aligned.
- Gently peel off the backing sheet as you progressively apply the second strip to the back of the first, smoothing it down as you go.
- **IMPORTANT** - there must be no stretch between the layers. Stretch will result in shearing and is more likely to cause the PowerBand to delaminate.
- Repeat with a third strip if necessary. Please note that three strips contain a lot of force and are not required often.
- Hold the completed PowerBand and rub thoroughly to generate heat and activate the glue.



CAUTION - The increased strength of the PowerBand carries with it the potential to create greater tension on the skin and the additional risk of traction blisters if not applied correctly. It is therefore intended for SHORT DURATION wear only e.g. a training session or a match. The Directions for Use with regard to large anchor points, minimal tension and a clearly understood WARNING must be strictly adhered to.

How to Apply a PowerBand

- The usual guidelines with regard to site preparation and application MUST be adhered to (Appendix 1).
- Only use on strong, healthy skin for short durations.
- An adhesive spray may be required due to the increased elastic recoil.
- Leave larger than normal anchor points (3" to 4") to accommodate the increase in elastic recoil.
- No or very minimal tension is required when applied in the shortened position
- Using a 2" (5cm) tape for the PowerBand allows for a 3" (7.5cm) cover strip to be applied. This will secure the PowerBand and ensures that there is only one layer of tape at the interface with the skin. This will reduce lifting or peeling, particularly in contact sports.
- **Give a comprehensive and clearly understood warning.**

Sample PowerBand Techniques

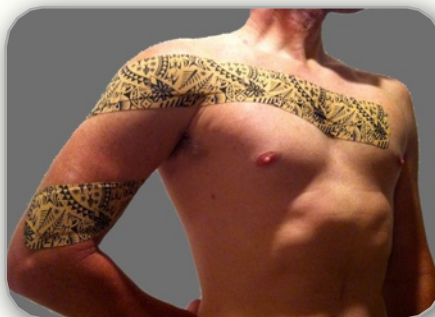
Many of the usual techniques can be used with PowerBands also. The quadriceps and deceleration of pronation techniques outlined above are two examples of this.

In many cases, using a PowerBand simplifies the technique as sufficient force is achieved with one PowerBand rather than having two or three single strips.

Shoulder Internal Rotation – strongly decelerates into end range external rotation and transitions back into internal rotation. Can be used in those with unstable shoulders or for late stage cocking problems in throwers. The PowerBand is a variation on the single layer technique however we generally do not bisect the tape to create sternal and clavicular branches.



2" (5cm) PowerBand - crosses the humeral head anteriorly and has a strong effect on rotation and horizontal extension. Often, a PowerBand consisting of 2 x 3" layers is used. A cover strip would not be required.



3" (7.5cm) cover strip in place. This attaches to skin on all sides of the PowerBand to anchor it down and reduce the chance of peeling, especially in contact sports. It will also provide an additional layer of strong elastic energy.



The tape will now strongly decelerate at end range external rotation - ideal for those with previous dislocations or cocking problems in the throwing athlete.

Upper Limb Offload – provides several functions by supporting the weight of the upper limb, upwardly rotating the scapula and resisting anterior humeral head translation. Middle and Lower trapezius along with the rotator cuff have less load to deal with and are at a better length to be recruited. Can be used for A/C joint, cuff, biceps, glenohumeral subluxations and more.



2" (5cm) PowerBand positioned anteriorly to support the weight of the upper limb, approximate the joint and resist anterior translation of the humeral head and posteriorly to assist scapula upward rotation and retraction



3" (7.5cm) cover band in place. In many cases 2 x 3" PowerBand can be used without a cover strip

CAUTION

This product requires careful and skilful application. Failure to follow the Directions for Use available on the product packaging or at www.dynamictape.com can result in skin irritation, blisters and poor adhesion.

1- Remove hair



2- Clean & Dry (e.g. alcowipe)



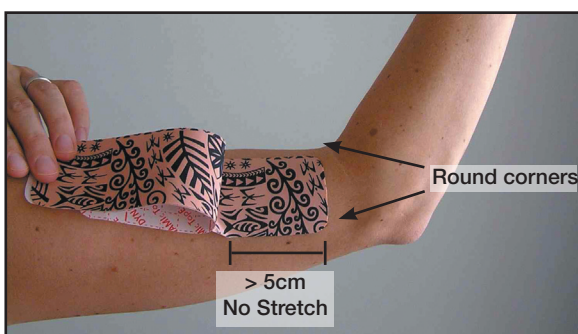
3- Rub to heat skin



4- Apply Adhesive Spray*



5- Anchor Point – No Stretch



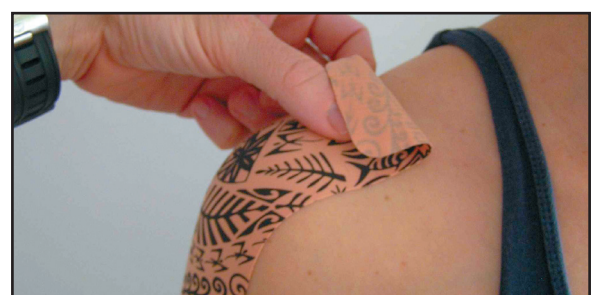
6- Anchor with thumb and tension in opposite direction to tape. This will remove skin folds and reduce tension on the skin at the end of the tape



7- Apply Gentle Tension



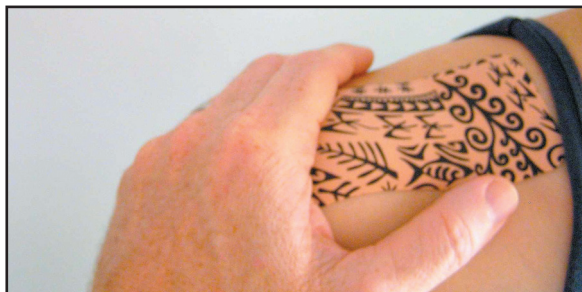
8- Apply other anchor point with no tension



* Very good results can be obtained without the use of an adhesive spray provided that all other guidelines are adhered to and sufficient time (> one hour) is allowed before participating in vigorous exercise, swimming or bathing or strongly stretching the tape.

Continued overleaf

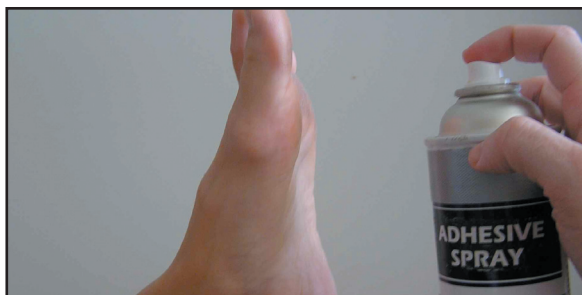
9- Rub thoroughly to activate glue



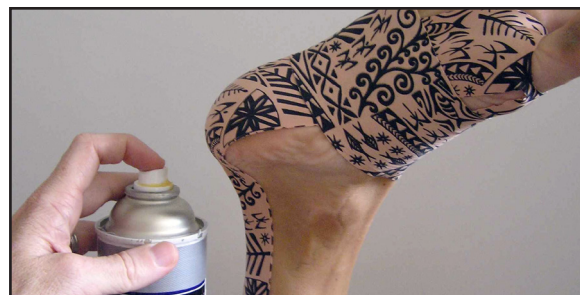
10- Allow 45 - 60 minutes before engaging in vigorous exercise, swimming or bathing.



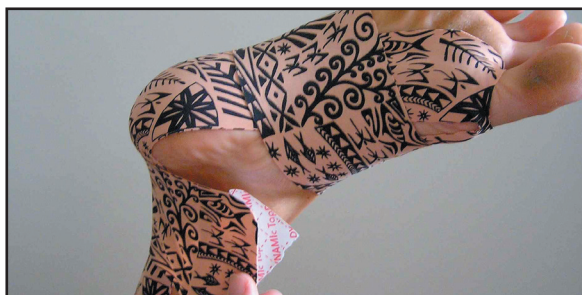
11- Always use spray on feet and ankles *



12- Spray back of first layer before applying the next layer when overlapping tape*



13- Always lock over foot and achilles to increase load absorption as well as adhesion



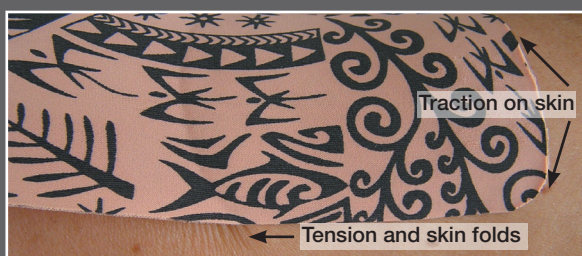
14- Cover and protect



WARN – Remove tape immediately if itching, stinging, burning or irritation occurs as you may be developing a reaction which can lead to skin breakdown.



Poor application will result in poor adhesion, tension, shearing and blisters



Contra-indications

- Do not use on frail, broken or sunburned skin or on those with known sensitivity

Caution

- Apply strictly according to directions for use
- Accredited Dynamic Tape training recommended prior to use
- DO NOT stretch strongly. Excessive stretch will result in blisters
- Remove immediately, discontinue use and seek medical advice if itching, burning, stinging, rash, redness or irritation occurs
- Circumferential applications should be applied on an angle to prevent compression of blood vessels and nerves
 - Remove if pins and needles or numbness occurs
- Check product thoroughly if packaging is damaged

Application

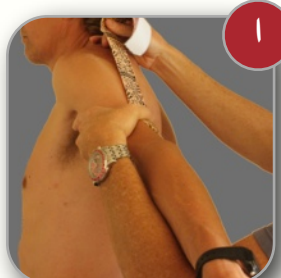
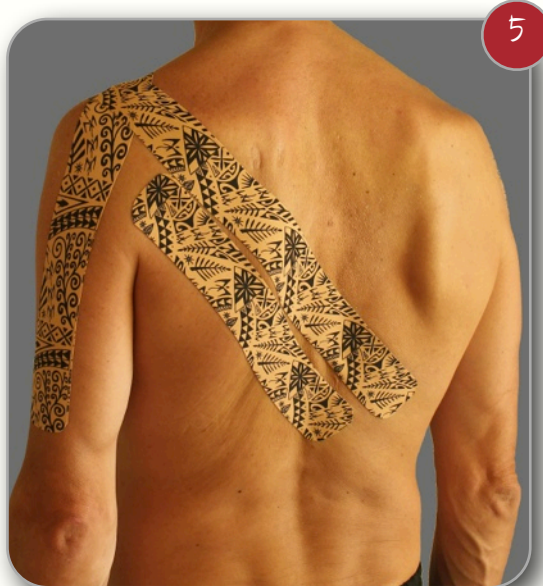
- Remove hair (clippers recommended)
- Clean and dry skin (remove creams, lotions & oils)
- Round off the corners of the tape to reduce lifting
- Place the body part in desired position
- Apply an anchor point of > 4cm with no stretch to avoid tension on skin
- Hold anchor (4cm from end) to minimise traction on the skin and gently stretch tape until resistance is first felt – DO NOT stretch strongly
- Apply the final 4cm of tape with no stretch
- Rub thoroughly to activate the heat sensitive glue
- Allow 45 – 60 minutes before swimming, showering or vigorous exercise
- May remain in place for up to five days as directed
- Remove tape in the direction of hair growth. Hold down skin and peel tape back along itself
- Do not remove when wet

Further Tips

- Use adhesive spray to hasten bonding, around foot and ankle or if overlapping tape (apply on back of first layer)
- Apply a locking strip over foot and ankle applications to improve adhesion and load absorption
- A rigid locking strip (zinc oxide) may be useful around the ends of the tape. This is especially useful on fingers

For videos, specific techniques, tips and disclaimer please visit www.dynamictape.com

Upper Limb offload – simplified



Tape: Dynamic Tape 5cm (2")

Position: Glenohumeral abduction 45° to 70°
20° horizontal extension for step 1
30° - 45° horizontal flexion for step 3
Scapula in upward rotation, retraction and slight shrug
Neutral rotation

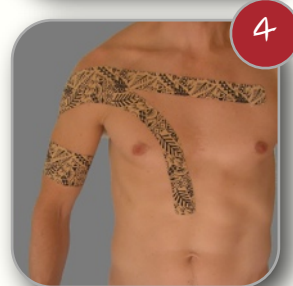
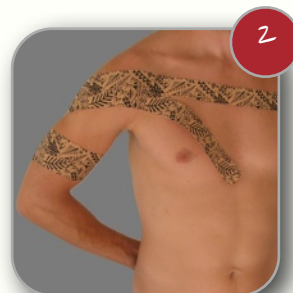
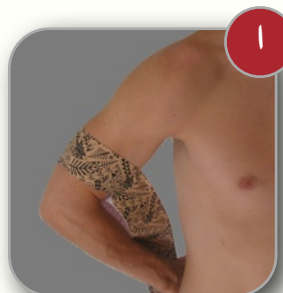
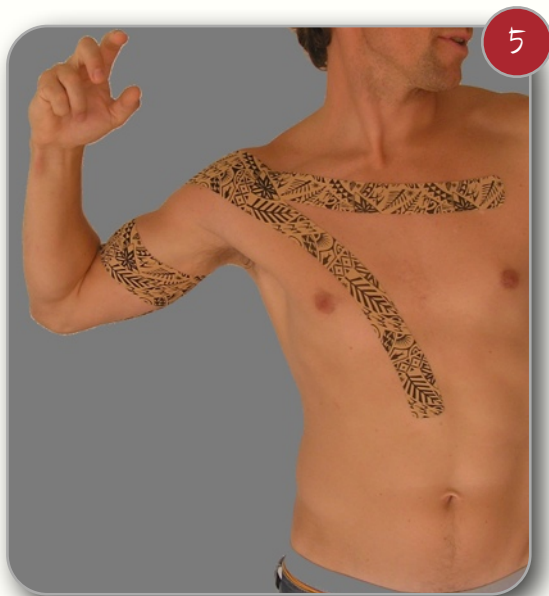
Actions: Supports the weight of the upper limb to reduce load on injured structures and weak muscles
Upwardly rotates the scapula to provide some passive support to the humeral head due to the architecture of the glenoid and labrum
Approximates the GH joint and improves cuff and scapula muscle function due to improved length-tension relationship (not elongated and have less load to overcome)
Resists anterior translation of the humeral head
Reduces load on neural tissue, biceps tendon, capsule, cuff and A-C joint

Indications: Rotator cuff injuries and 'impingement' type issues, biceps tendinopathy, radiculopathy and sensitized UL neural tissue, A-C joint subluxation and degeneration, acute GH dislocations or post-op for pain relief (in sling), hemiplegic shoulder subluxations

- 1 & 2 As the arm returns to the side, the tape tensions and provides a superiorly directed force vector. As the arm moves into flexion, the tape will tension and also encourage scapular upward rotation.
- 3 & 4 Place anteriorly to resist anterior translation of the humeral head. A posterior glide and scapula correction can be applied with the hands positioned as shown. A lift is created as the arm returns to the side.
- 5 The anterior strip continues over the scapula and is directed over the middle and lower fibres of trapezius to assist upward rotation. Additional strips can be applied if required.



Shoulder Internal Rotation



Tape: Dynamic Tape 7.5cm (3")
PowerBand can be used for greater force

Position: Shoulder Internal Rotation (Hand behind Hip)
Shoulder Horizontal Flexion (bring elbow forward but try to maintain good scapula position)

Actions: Provides a rotation component to decelerate into external rotation and horizontal extension, particularly terminal cocking phase of throwing or the apprehensive position in unstable shoulders
Absorbs load and then transitions back into internal rotation
Resists anterior translation of the humeral head
Approximates the glenohumeral joint and supports the weight of the upper limb due to a force vector being directed superiorly

Indications: Late cocking or early acceleration problems
Late stage rehab of glenohumeral dislocations and instabilities
Weakness, fatigue or inhibition of internal rotators
Pectoral muscle tears or strains

Commence on the lateral part of the arm, just proximal to the elbow to create a longer lever. Direct the tape superiorly at about 45° to make it easier to spiral around the limb, avoid circulatory compromise and to create a force vector up the limb to take the weight of the arm and approximate the glenohumeral joint, in turn allowing superior scapula control, rotator cuff recruitment and reduced load.

1

2

3 & 4

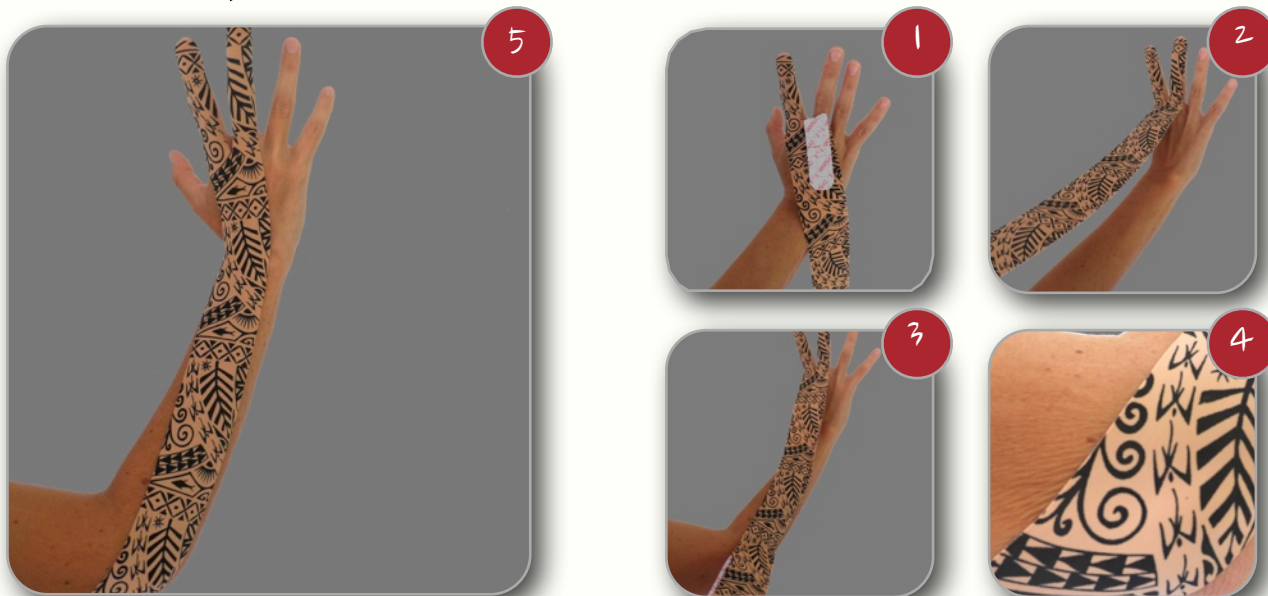
Direct the inferior band more vertically.

5

The horizontal band will tension under lower degrees of elevation and the vertical band will tension during higher degrees of elevation.



Wrist & Finger Extensors



- Tape:** Dynamic Tape 5cm (2")
Dynamic Tape 7.5cm (3") can be used - split into three and commence on three fingers
PowerBand can be used for greater force
- Position:** Wrist and finger extension, pronation and radial deviation
Elbow extension (if wish to assist elbow extension also - pronation and elbow extension most sensitive position in classic tennis elbow)
Slight elbow flexion can relax the soft tissue and allow for a better 'pinch' offload
- Actions:** Assists the function of the wrist and finger extensors - assists isometric holding, eccentric control and concentric contraction
Provides a 'pinch' or 'gathering' offload of the soft tissue over the lateral epicondyle
- Indications:** Lateral Epicondylalgia (tennis elbow) - to reduce loading through common extensor origin and to reduce firing of sensitised nociceptors via offload
Wrist and/or finger extensor weakness e.g. wrist drop

1 & 2 Split the tape in two and commence on the distal phalanx of two fingers. Determine which fingers during examination i.e. if resisted muscle test of index finger is not painful - may start on 3rd & 4th digits.

3 & 4 Create an anchor point just distal to the elbow. Gather the tissue together as you apply the proximal end of the tape to create a 'pinch' offload. Carefully take the wrist into flexion to bring the remaining tape into contact with the wrist and then smooth down.

5 The completed application will assist wrist and finger extensor function and provide a soft tissue offload at the lateral epicondyle. If the line of pull is posterior to the axis of the elbow and applied in elbow extension, it will also aid triceps function.



DeQuervain's Tenosynovitis



Tape: Dynamic Tape 5cm (2")
Split one end down the middle

Position: Wrist radial deviation and slight extension
Thumb and 1st metacarpal extension and abduction

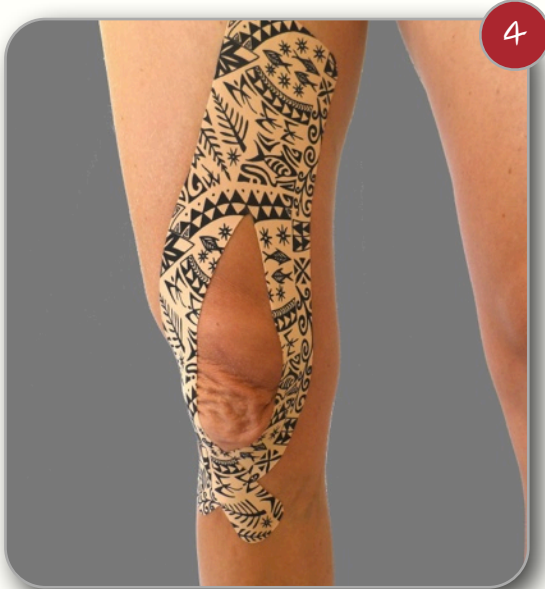
Actions: Assists eccentric control of thumb flexion and assists extension and abduction
The split 'V' formation creates an effective lift, enhanced by the transverse strip, to provide a soft tissue offload through the anatomical snuff box.
Approximation force to enhance proprioception and joint stability
Reduce loading of APL, EPB and EPL, decreased pain, enhanced tendon gliding and improved function

Indications: DeQuervain's Tenosynovitis, positive Finkelstein's test
Weakness or fatigue of thumb extension and abduction
Osteoarthritis of the first CMC joint

- 1 Split most of the tape in half leaving approximately 1" as full width. Commence on the distal phalanx of the thumb to maximize the lever arm. Lock off around the end with a sports tape if required.
- 2 Maintain the thumb and wrist position and apply the first strip along the Abductor Pollicis Longus and Extensor Pollicis Brevis tendons.
- 3 Direct the remaining half of the tape along the Extensor Pollicis Longus tendon. The elastic energy in the tape will create a longitudinal gathering of the soft tissue.
- 4 A transverse strip and 'pinch' offload can be applied to increase the soft tissue offload if desired.
- 5 Note that as the transverse strip is also applied with the thumb in extension, abduction and radial deviation, full range is only permitted due to the tape's 4-way stretch.



Patellofemoral Joint Loop



Tape: Dynamic Tape 7.5cm (3")

Position: Full knee extension
Patellofemoral joint medial glide
Patellofemoral rotation as required

Actions: Provides resistance to lateral tracking of the patella
Lifts and gathers tissue to provide a soft tissue offload for patella tendon and fat pad
Provides a focal stretch on soft tissue to facilitate VMO activity
The elastic energy of the tape absorbs load during knee flexion (assists eccentric quads contraction) and reinjects it to aid knee extension (assists concentric quads contraction).
Loops around the patella to encourage a superior and medial glide

Indications: Patellofemoral Pain Syndrome, lateral patella subluxation or dislocation, Fat Pad Syndrome, Patella Tendinopathy
These conditions may also benefit from other taping techniques depending on the biomechanics displayed by the person e.g. hip external rotation, pronation deceleration, tibio-femoral de-rotation

1

Place on the VM or adductors about half way between the hip and knee. Commence on an angle aiming inferiorly and laterally so that once completed the tape will impart a superior and medial force on the patella.

2

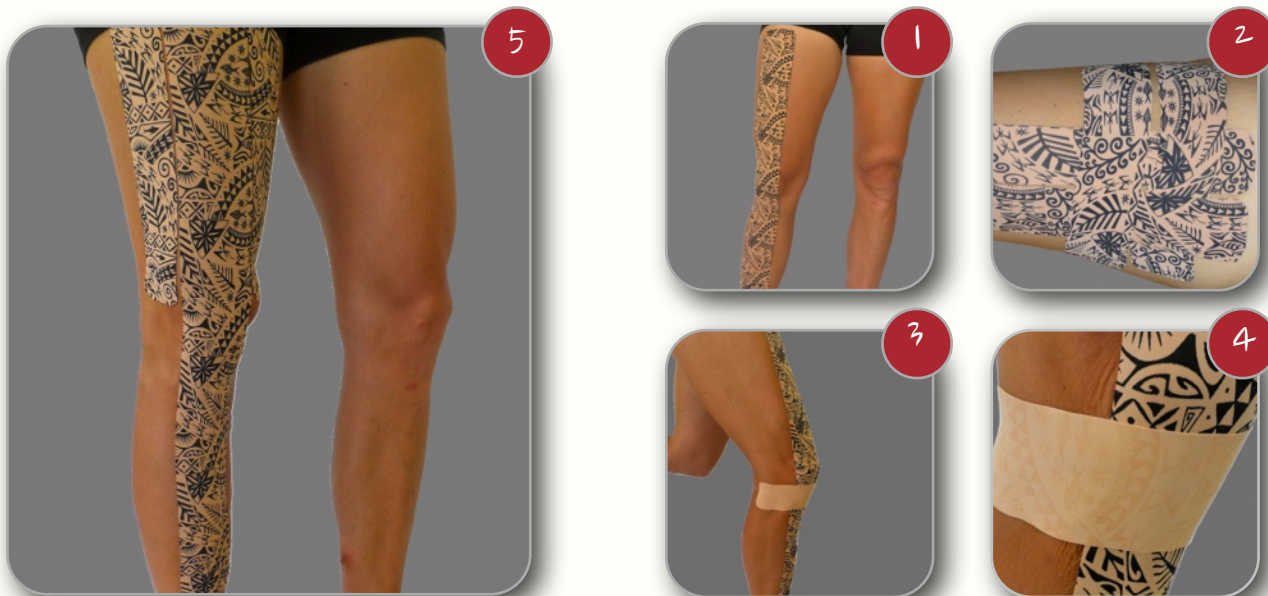
Bring the medial strip down through the VMO region (ensuring that it does not contact the patella) and sweep laterally to finish level with the tibial tuberosity.

3 & 4

Place a medial glide on the patella then hook the lateral strip around the lateral edge of the patella. The distal end sweeps medially to anchor. As the knee flexes the tape will tension and provide further resistance to lateral translation.



Quads Mechanism



Tape: Dynamic Tape 5cm (2")
Dynamic Tape 7.5cm (3")
Several combinations can be developed including PowerBands (2" or 3") and offloading strips

Position: Knee extension

Actions: Tensions under knee flexion to absorb eccentric load
Recoils during extension to assist concentric contraction
Reduces load through Quads, patella tendon/ligament and patellofemoral joint
'Pinch' soft tissue offloads can be directed towards tendon, fat pad, muscle tear or tibial tuberosity
More compressive/pre-tensioning straps can be applied to more degenerative tendinopathies.

Indications: Any condition exacerbated by loading of the quadriceps mechanism. This may include but is not limited to quadriceps muscle tears, patella tendinopathies, fat pad syndrome, Osgood-Schlatter's disease, patello-femoral pain syndrome, osteoarthritis, weakness. Other techniques may be the preferred choice for these conditions depending on assessment findings or a combination of techniques may be used.

1

Depending on the size of the limb being taped, 2" or 3" strips may be used. PowerBands are often preferred due to the large loads involved - particularly for more vigorous activities. Start and finish well away from the knee joint to maximize the leverage effect. Ensure that the line of pull stays anterior to the axis of the knee joint.

2

Gather the soft tissue longitudinally in the region of a muscle tear (5). Alternate with transverse strips to offload the soft tissue further if desired.

3

&

4

A 'pinch' offload strip can be directed towards the tendon or fat pad as shown or moved to the tibial tuberosity for Osgood-Schlatter's disease. This gathers all of the soft tissue to create a soft, spongy area to reduce firing of peripherally sensitized nociceptors.



Calf/Achilles/Plantar Fascia – PowerBand



Tape: Dynamic Tape 5cm (2") PowerBand
Dynamic Tape 7.5cm (3")

Position: Ankle plantar flexion, inversion, forefoot adduction and shortening of the medial longitudinal arch

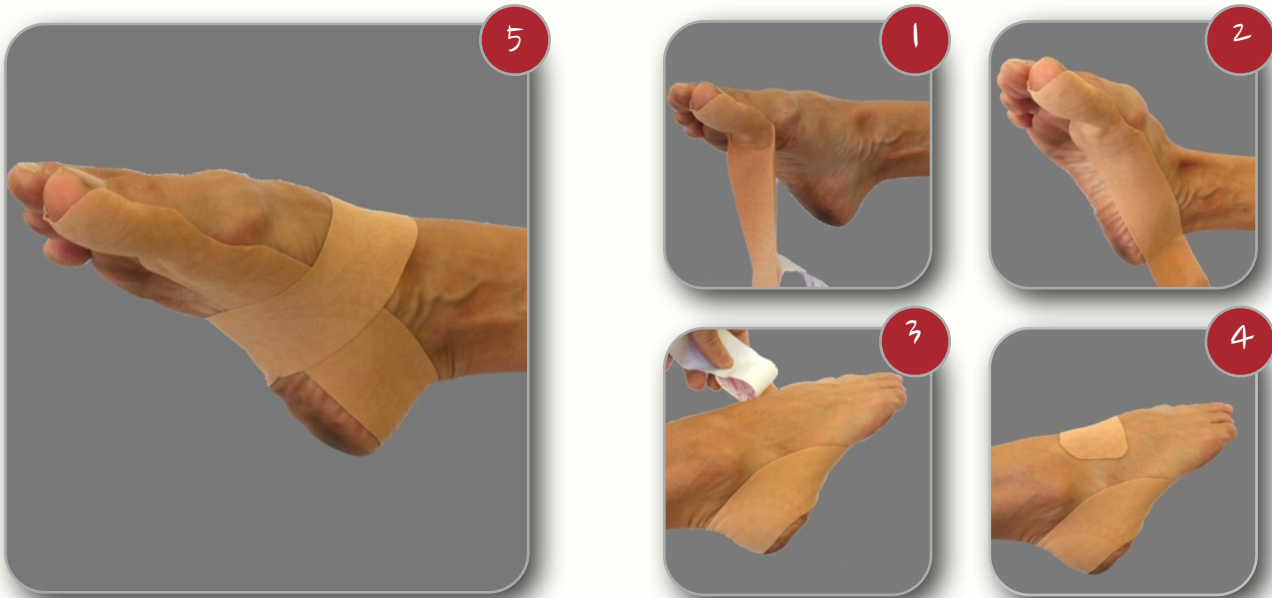
Actions: Decelerates the navicular drop
Promotes shortening of the foot and elevation of the mid tarsal joint
Has four layers of elastic energy to absorb load as weight is taken through the foot to reduce load on the plantar fascia
Resists dorsiflexion to reduce eccentric loading through calf, achilles and plantar fascia which may reduce elongation if overly compliant e.g. degenerative tendinopathies
Stores energy in dorsiflexion and assists transition into plantar flexion
Soft tissue offload for pain relief either at achilles for tendinopathy or through calf for muscle tears

Indications: Calf strain, muscle tear, weakness or fatigue, achilles tendinopathy, post-op support and swelling reduction, plantar fasciitis, calcaneal apophysitis (Sever's Disease), shin splints, hallux valgus or other lower limb conditions requiring that the navicular drop is addressed.

- 1 & 2 Create a PowerBand using two or three layers of 5cm tape. Commence at the metatarsal heads leaving sufficient room to anchor the 7.5cm cover strip distal to the PowerBand. Position in plantarflexion and inversion then apply the tape with minimal stretch. Slightly dorsiflex to allow the tape to stick around the achilles tendon.
- 3 Cover with a 7.5cm cover strip. Cut small wedges out of either side to shape around the heel.
- 4 & 5 Apply an offload over the achilles and a lift to the navicular using 7.5cm tape. This will also lock off over the underneath layers. Parallel soft tissue offloads can be applied through the calf region for muscle tears and further offloading can be obtained with alternating transverse strips (not shown).



Arch Support



Tape: Dynamic Tape 5cm (2") - PowerBand often useful
Dynamic Tape 7.5cm (3") - for cover strip if required (not shown)

Position: Ankle plantar flexion, inversion, forefoot adduction, calcaneal varus, great toe flexion

Actions: Creates a windlass effect to shorten foot, raise transversal tarsal joint, support the medial longitudinal arch and reduce load through the plantar fascia
Decelerates the navicular drop and actively resupinates the foot.
Resists calcaneal valgus

Indications: Any condition where reduced or decelerated navicular drop is desirable and indicated
Examples include but are not limited to plantar fasciitis, hallux valgus, 'shin splints', patellofemoral dysfunction, achilles tendinopathy, ITB 'friction' syndrome

This technique is often performed in association with other techniques e.g. navicular deceleration or hip external rotation and alternative techniques may be more indicated for the conditions above depending on assessment findings.

1

Cut out a small wedge to allow the tape to conform well to the proximal phalanx of the big toe as it passes this region. Ensure that the toe is flexed and the medial longitudinal arch shortened to maximize the windlass mechanism. Lock around the toe with rigid sports tape if required.

2

Continue along the medial, plantar aspect of the foot then track slightly more proximally onto the medial aspect of the calcaneum.

3 & 4

Sweep around the calcaneum and cross the lateral aspect obliquely. Sweep under the foot from just proximal to the base of the 5th metatarsal ensuring the calcaneum is in varus. Emerge under the navicular. Lift the navicular and anchor the tape on the dorsum of the foot as shown.



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www.dynamictape.com.au

POSTUREPALS PTY LTD

PO Box 1312

Port Vila, VANUATU

Tel: +61 (0)2 8011 3823

Email.: admin@dynamictape.co

PosturePals Pty Ltd

Europe

Nigel Kaufman

Evenaristr 10

64293 Darmstadt

Germany

Tel.: +49 (0)6151 397 5899

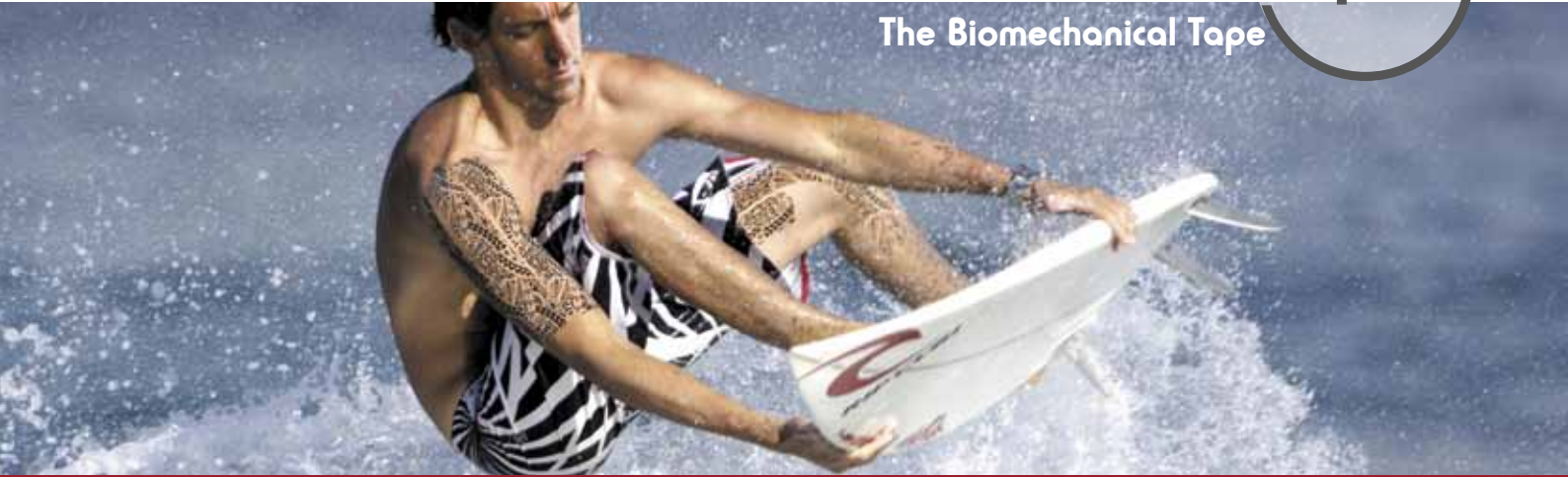
Email.: europe@dynamictape.de

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The Science Supplement

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■ INTRODUCTION

Dynamic Tape has been designed with a specific purpose in mind - to address certain mechanical deficits which have been identified clinically and supported by the scientific literature. Understanding the rationale will improve your application of Dynamic Tape and allow you to very quickly begin to develop your own techniques based on your individual client's requirements and stemming from your knowledge of anatomy, biomechanics and assessment procedures. Just as you prescribe appropriate exercises or manual therapy, you will also be able to create appropriate Dynamic Taping techniques.

Mechanisms of Action

The mechanisms of action of Dynamic Taping can be broadly divided into two categories;

Mechanical – exerting influence on the mechanical properties of the tissues or influencing kinematics

Physiological – providing stimulus to effect changes in neurophysiological processes involved with pain perception and the motor control system.

For convenience, these will be discussed as discrete entities however a combination of effects are most likely to account for the positive outcomes observed clinically and some modes of action fall under both categories e.g. motor control and timing of activation.

■ PART 1 – MECHANICAL MECHANISMS

Mechanical Mechanisms can be further divided into Direct and Indirect techniques.

Direct Techniques – exert their influence directly on the target musculo-tendinous unit (MTU)

Indirect Techniques – are concerned with modification of gross movement patterns without concern for particular muscles or tendons.

To understand the Direct Mechanical Mechanisms, a quick review of some definitions and three important biomechanical concepts is necessary.

Definitions:

Lever: A rigid or semi-rigid body that when subjected to a force whose line of action does not pass through its pivot point, exerts force on any object impending its tendency to rotate.

Moment arm: (also called force arm, lever arm or torque arm) – the perpendicular distance from the line of action of the force to the fulcrum. The line of action of the force is an infinitely long line passing through the point of application of the force, orientated in the direction in which the force is exerted

Torque: (also called moment) the degree to which a force tends to rotate and object about a specific fulcrum. It is defined quantitatively as the magnitude of a force times the length of its moment arm.

Mechanical advantage: the ratio of the moment arm through which an applied force acts to that through which a resistive force acts. For there to be a state of equilibrium between the applied and resistive torques, the product of the muscle force and the moment arm through which it acts must equal the product of the resistive force and the moment arm through which it acts. Therefore a mechanical advantage of greater than 1.0 allows the applied (muscle) force to be less than the resistive force to produce an equal amount of torque. A mechanical advantage of less than 1.0 is a disadvantage in the common sense of the word.

■ Biomechanical Principles

1. Levers

There are three classes of levers. The class of lever is determined by the orientation of resistance and effort relative to the fulcrum.

1st Class Lever – the effort and resistance are positioned on either side of the fulcrum (Fig. 1) e.g. see-saw. or triceps producing elbow extension in the human body (Fig. 2)

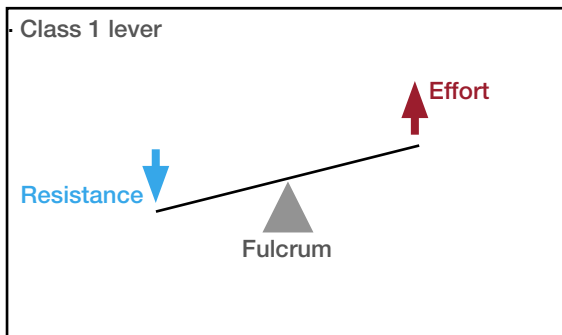


Fig. 1 Class 1 Lever

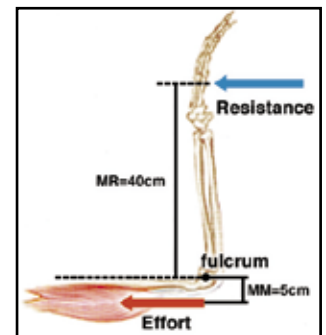


Fig. 2 Triceps as a Class 1 Lever

2nd Class Lever – the resistance is positioned between the effort and the fulcrum (Fig. 3) e.g. wheel-barrow or gastrocnemius producing plantar flexion (Fig. 4)

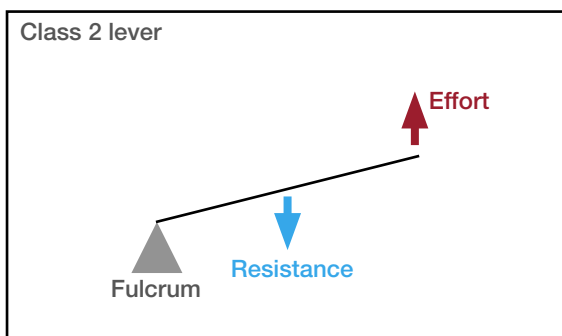


Fig. 3 Class 2 Lever

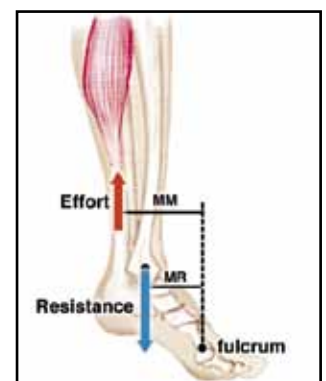


Fig. 4 Gastrocnemius as a Class 2 Lever

3rd Class Lever – the effort is positioned between the resistance and the fulcrum (Fig. 5) e.g. tweezers or tongs or biceps producing elbow flexion (Fig. 6)

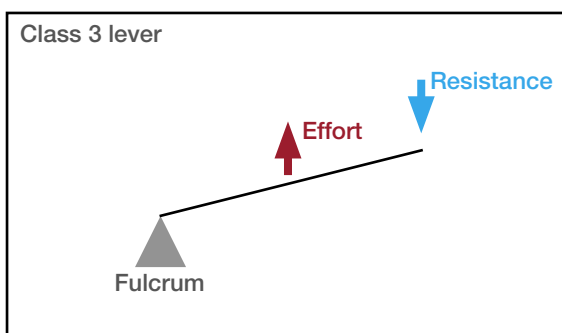


Fig. 5 Class 3 Lever

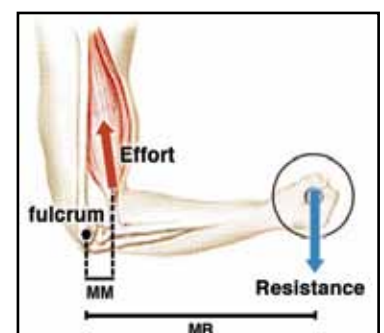


Fig.6 Biceps as a Class 3 Lever

Third class levers do not confer a mechanical advantage as the load arm is always longer than the effort arm however they do allow for the load to be moved over a greater distance or for greater speed to be developed albeit requiring increased effort to produce. There are numerous examples of third class levers throughout the musculoskeletal system e.g. biceps.

Most human muscles that rotate the limbs about body joints operate at a mechanical disadvantage. This is why internal muscle forces are much greater than the forces exerted by the body on external objects. For example in Triceps extension, if the length of the force arm (MR) in the figure above is 40cm, while the muscle moment (MM) arm is 5cm, then there is a Mechanical advantage of 0.125 ($MM/MR = 5/40$) which being less than 1.0 is a disadvantage in the common sense. Because MM is much smaller than MR the force exerted by the muscle FM must be much greater than the resistance. This illustrates the disadvantageous nature of this arrangement, i.e. a large muscle force is required to push against a relatively small external resistance. The extremely high internal forces experienced by muscles and tendons account in large part for injury to these tissues.

All movements and muscle forces in the body require a level of acceleration (concentric muscle action), holding a position (isometric muscle action) and deceleration (eccentric muscle action). Gravity acting on an object provides most deceleration or inertial force, however, this added load (9.81 m/s^2) increases the work requirements of the muscle. This increases the internal muscle force and therefore the stress on the MTU and the tendon to transfer that muscle force. For a more thorough discussion on leverage refer to Harman, 2008 ⁴³.

2. Hysteresis

Viscoelastic tissues exhibit elastic hysteresis which can be defined as the lagging of a physical effect on a body behind its cause (force or load). A simple example is the behaviour of a memory foam pillow. The deformation that is produced by applying a load (e.g. your hand or head) is not immediately reversed on removal of the load but rather the pillow gradually returns to its original form over time.

This can be represented on a graph (Fig 7)

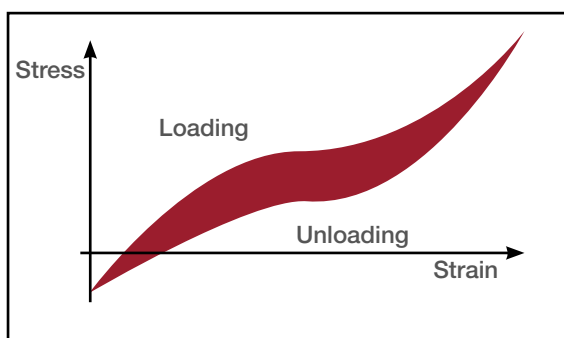


Fig. 7 Hysteresis - the area between the two curves represents the energy absorbed or dissipated generally in the form of heat.

Hysteresis is more pronounced when loading and unloading occurs quickly and at higher temperatures. In other words, under these conditions, the tissue will elongate more when subjected to an equivalent load.

3. Influence of muscle length and velocity of movement ⁴⁴

As already mentioned all muscles have the ability to concentrically shorten, isometrically hold a position and eccentrically lengthen, in so doing they all provide proprioception back to the CNS.

Some muscles are more efficient at one of these roles and less efficient at other roles. Even within a group of synergists, some muscles are better suited to a role than others. Not all muscles are equally force efficient and some muscles generating high force can be at the detriment to good function.

Muscles are most efficient and generate optimal force when they operate in their mid range. They are inefficient and can appear functionally weak when they are required to function in a shortened or lengthened range relative to their normal or habitual length (Fig.8).

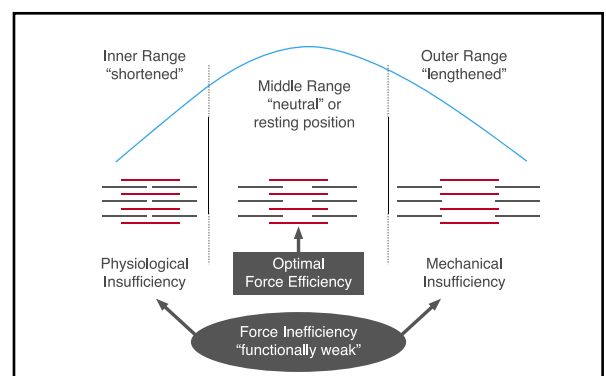


Fig. 8 Relative position of crosslinking filaments at various muscle lengths (Adapted from Leiber, 2002)

However, when a muscle habitually functions at an altered length (either lengthened or shortened) its length-tension relationship adapts accordingly so that the position in range where it generates optimal force efficiency changes to follow the relative lengthening or shortening (Fig. 9).

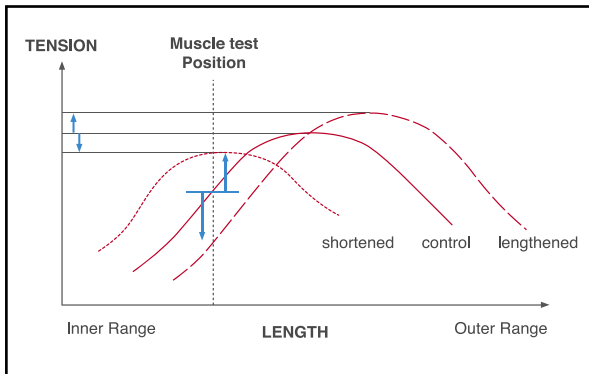


Fig. 9 Changes in muscle function within a Length-tension curve (Adapted from Leiber, 2002)

A muscle's structure also affects its ability to generate force. Muscles with long levers are biomechanically very efficient to produce range of movement. They are not particularly efficient at preventing excessive movement at the axis of the joint or in eccentric movements. Conversely muscle with short levers are efficient at controlling the axis to limit excessive movement and therefore protect against over strain.

The length tension relationship describes a muscle behaviour at a constant length, however, much of a muscle's use involves movement that is better described by the force-velocity relationship. This does not have a precise anatomical basis. The force-velocity relationship describes the force generated by a muscle as a function of velocity under conditions of constant load.

Muscles are strengthened based on the force placed across them during exercise. The force-velocity relationship of muscle indicates that high velocity movements correspond to low muscle force and that low velocity movements correspond to high muscle force. Since strengthening requires high muscle force then velocity must be necessarily low. High velocity movements may have other beneficial effects (e.g. improve muscle activation by the nervous system) but not at the muscle tissue level. From the above it is apparent that muscle force changes because of changing length and or due to changing velocity. So we can conclude that if muscle velocity is high, force will be low no matter the length. In other words at high velocity length is not that important. At low concentric velocities muscle length becomes an important force modulator. At eccentric velocities, again muscle velocity dominates length as the determinant of force. This relationship is important in neuromotor control.

Tendinopathy

In order to elaborate further a tendinopathy model will be used by way of example to explain the mechanical modes of action and to demonstrate their clinical relevance during various stages of pathology or the rehabilitation process.

The **mechanical changes** observed in chronic, painful tendinopathies are of particular relevance to the Dynamic Taping methodology.

Affected tendons demonstrate a shift to the right on the stress-strain curve indicating a reduction in tendon stiffness¹². This means that the tendon will deform (elongate) more when subjected to a given load or in fact, to less load (Fig.10).

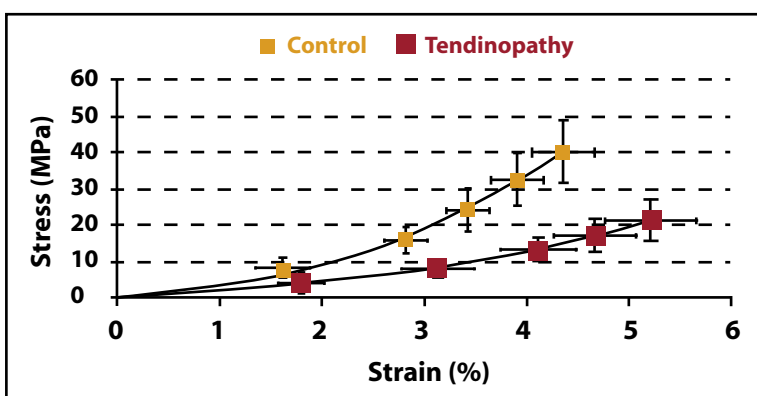


Fig.10. Typical stress-strain curve demonstrating shift to the right in Tendinopathy - Adapted from Arya and Kulig, 2010

The 'toe region' of the stress-strain curve is the relatively flat area at the left of the curve and is due to the flattening or straightening out of the crimped fibres of the tendon. This can be thought of as 'taking up the slack' or 'taking the strain' in a Tug o' War. This 'toe region' is longer in symptomatic tendons which means that it takes longer for the force generated by the muscle to be transmitted via the tendon to the bone to effect movement at a joint³.

The muscle must also shorten further to effect the same change. In our Tug O' War analogy it is like the teams standing the same distance apart but having a rubber band in place of the rope. Team A must walk back much further before they can generate sufficient tension to shift Team B from their mark. In fact, the further they walk back, the more the rubber band lengthens. The same occurs in tendinopathy. The more the myofibrils shorten, the more the tendon elongates.

This will have major functional implications³.

- Transfer of force is much less efficient (as described above)
- Myofibrils must shorten further to generate the same force
- This takes longer to occur resulting in a delay in execution of the motor task
- Alterations in timing of activation and force generation can adversely affect co-ordination of fine motor and balance tasks due to the lag time in response to feedback regarding a perturbation
- Reduced performance – reproduction of high levels skills e.g. sprinting, a tennis serve or golf swing rely heavily on rhythm which can only result from certain, precise timing and force generation. Deficits lead to compensation strategies like 'muscling' the tennis ball.



Affected tendons also demonstrate a reduction in mechanical energy absorption and a redistribution of net joint movement away from the affected joint, presumably to reduce load on the symptomatic tendon^{4 5}.

Similar changes 'softening' of tendons and reduced stiffness have been identified in Extensor Carpi Radialis Brevis (ECRB), Tibialis Posterior, Rotator Cuff, Plantar Fascia etc^{3 6 7 8 9 10 11}. The notion of stress shielding within tendons has also been raised¹² and unloading studies show a similar effect on the tendon to tendinopathy^{3 13}.

KEY POINTS

1. Tendons become less stiff/more compliant
2. This leads to poor force transmission, increase work of muscle, delays in timing, reduction in shock absorption and compensation strategies

Despite many factors having been identified, many questions remain regarding the pathological processes involved in tendinopathy^{14 15 16 17}. In an attempt to mesh the various observations into a coherent and clinically useful model Cook and Purdham (2009)¹⁸ propose a continuum of tendon pathology comprising of three stages:

1. Reactive Tendinopathy
2. Tendon Dysrepair
3. Degenerative Tendinopathy

An understanding of this model combined with the mechanical alterations outlined above permits a thorough appreciation of the Dynamic Taping rationale across a range of clinical presentations. The three stages of the continuum of tendon pathology are summarised in the table (Fig.11) and flow chart below (Fig.12). Review of the original article¹⁸ is recommended for a more complete description.

	Cause	Response	Prognosis
Reactive Tendinopathy	Acute tensile or compressive overload - burst of unaccustomed activity - direct blow such as fall onto patellar tendon	Non-inflammatory, proliferative response in cell and matrix resulting in thickening of tendon possibly to reduce stress by increasing cross sectional area or to allow adaptation to compression	Can return to normal if overload is reduced or adequate recovery time between loading sessions
Tendon Dysrepair	Chronic overload of tendons in young but may appear across age and loading spectrums	Represents an attempt at healing similar to above but with greater matrix breakdown, increased cells (chondrocytic and myofibroblasts) resulting in increased proteoglycans and collagen leading to separation and disorganisation of the matrix. Increase in vascularity and neuronal ingrowth	Some reversibility possible with load management and exercise to stimulate matrix structure
Degenerative Tendinopathy	Primarily in older (middle age) person or chronic overload in young or elite athlete	Further progression of matrix and cell changes including cell death due to apoptosis, trauma or tenocyte exhaustion, large areas of disordered matrix, little collagen and increase in vessels.	Potential for rupture Less capacity to reverse pathological changes Exercise

Fig. 11 Summary of Continuum of Pathology in Tendinopathy as proposed by Cook & Purdham, 2009

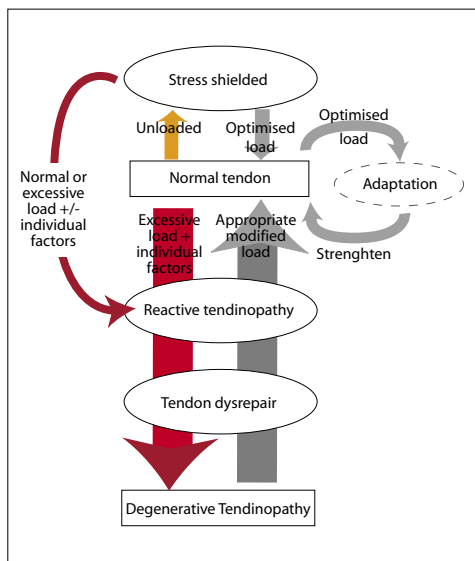


Fig. 12 Continuum of Tendon Pathology - adapted from Cook & Purdham, 2009

Management

The treatment approach described by Cook and Purdham¹⁸ will vary depending on the stage. It is worth noting that different areas of the tendon may exhibit changes indicative of a different stage in the continuum.

Reactive Tendinopathy/Early Tendon Dysrepair

- Load Management (reduction) – reduce pain, allow tendon to adapt and cells to become less reactive
- Assess intensity, frequency, duration and type of load and contributing biomechanical factors
- Avoid high load, elastic or eccentric loading (energy store and release activities)

Late Tendon Dysrepair/Degenerative Tendinopathy

- Stimulate cell activity and matrix restructuring
- Eccentric exercise can assist

KEY POINTS

1. Load is the stimulus that drives the process forwards or backwards along the continuum
2. Tendinopathic pain is induced by load and is dose dependent – more load = more pain
3. Specificity of loading is critical – ballistic or heavy resistance eccentric loading in reactive tendinopathy/early tendon dysrepair likely to exacerbate, unloading in late dysrepair likely to be ineffective
4. Evaluation of biomechanical contributors to overload important

How does Dynamic Tape help?

With regard to the tendon changes highlighted above, it is postulated that Dynamic Tape may impart a beneficial effect in a number of ways.

Direct Techniques – target the specific MTU

1. Reduce compliance - Dynamic Tape places additional elastic forces in parallel to the series elastic components. Directly effecting the mechanical properties of the tissues results in a shift of the stress-strain curve back to the left.

In consideration of levers, the applied tape extends well beyond the insertion of the muscle thereby conferring a mechanical advantage as the effort arm of the tape is longer, approaching the length of the resistance arm. The tape's position on the skin places it further from the axis of rotation. As a result of these factors, the tape stretches further and faster, absorbing and dissipating load thereby reducing the work and energy absorption requirements of the MTU.



Fig. 13 When taping for the hamstrings the tape extends to the distal calf, well beyond the insertion of the hamstrings into the fibular head and proximal tibia. When the tape is applied with stretch and with the knee in flexion, this increased distance from the axis of rotation will result in the tape stretching further and faster than the hamstrings MTU.

Reducing load on the tendon, especially when loading cyclically, results in a reduction in heating of the tendon (heat is produced as a function of hysteresis).

The combination of less stress, reduction in strain rate and lower tissue temperature will result in a decrease in elongation of the overly compliant tendon.

2. Pre-set - Dynamic Tape acts to facilitate muscle activation in the target muscle (possibly by influence on the GTO or by excitation of muscle spindles and subsequent Ia afferent input to the motor neuron pool as seen with vibration or tendon tap). This serves to 'pre-set' the muscle in order to 'take up the slack' in the non-contractile elements. The result is a faster response time, more efficient force generation and transfer and improved performance.

You might argue, why would we want to facilitate muscle activity in muscles that have shown increased EMG activity and that would be a good question. One can postulate that the increase in activity is necessary to overcome the reduction in tendon stiffness in order to transfer the force generated in the muscle to the bone in addition to changes occurring to the motor neuron pool. By reducing the compliance in the system and by pre-setting the muscle to 'take up the slack' there is much more efficient force transmission and an overall reduction in demand on the muscle.

3. Force Generation, energy absorption, storage and release

Via the effect of leverage (the length of tape applied will influence the efficiency of the force applied from the muscle to the lever arm) and the elastic hysteresis properties of the tape outlined in the section on reducing compliance, the taping application can reduce, absorb and re-inject energy into the system.

Furthermore, the elastic energy that is contributed in outer range, when the tape is on most stretch helps to compensate for the mechanical insufficiency of the muscle as demonstrated by the length-tension relationship.

In simple terms, the elastic energy in Dynamic Tape can contribute force thereby reducing force generation requirements of the MTU. In order to bend one's elbow, a certain amount of force (x) must be generated to overcome the resistance applied by gravity. If some of the force is contributed by the elastic recoil of the tape (y), it follows that the muscle does not have to generate as much (z) as it would in the absence of the tape.

No Tape	Force (muscle) =	Total Force required
	z =	x
With DT	Force (muscle) =	Total Force required – Force (tape)
	z =	x – y

This can be enhanced due to the improved tissue compliance and the mechanical advantage obtained through leverage. By this means we can tape to assist injured, weakened, fatigued or inhibited muscle but also can reduce the work requirements of overactive or overloaded muscles.

The elastic recoil of the Dynamic Tape will reduce internal muscle force in early injury to allow movement without excessive load on the MTU. This permits a more functional healing response (e.g. alignment of collagen fibres along lines of stress).

The energy contribution can be increased by adding further strips of tape in parallel.

To illustrate this, wrap an elastic band around your thumb and forefinger. Stretch them apart and observe the resistance. Now place a second, elastic band in parallel and repeat the task. You will note that more resistance or stiffness is now present although each rubber band is materially unchanged.

Through understanding that most muscles actually have a mechanical disadvantage in the common sense and that the use of dynamic tape to go past the joint axis (fulcrum) onto the other limb or (moment arm) can significantly reduce this mechanical disadvantage just by the length of application of the tape it can be seen that this will then reduce the internal muscle force exerted to move the object (resistance arm) reducing the stress on the muscle, tendon and ultimately MTU.

Furthermore, the elastic nature of the tape will help with deceleration and thus reduce the eccentric effort placed on an object. Finally the elastic nature of the tape will aid in returning energy to the movement once deceleration has occurred, thus reducing the concentric nature of the muscle and MTU. The amalgamation of all this reduced work is less energy used to decelerate and accelerate movement, therefore less internal muscle force, and thus less work of strain on the tendon and MTU. This in turn will reduce the metabolic demand on the muscle and thus improve tolerance to fatigue. So in the injury state or returning to fitness or activity, dynamic tape can be extremely advantageous on many levels.

In addition, these effects can be refined in a number of ways.

- target long lever muscle / force efficiency and elastic energy transfer – in a sagittal plane by taping along the lever arm.
- facilitate the isometric stabilising role of the muscles to prevent excessive joint movement by taping across the joint axis
- Both of these can be tied in to the angle of pennation of the muscles you wish to facilitate.
- Then there is a third method, which incorporates both e.g. long spiral taping of the hamstrings from antero-lateral thigh to anterior medial shin and anteromedial thigh to anterolateral shin) thereby altering the line of pull to produce a greater knee flexion moment but also contributing to joint approximation - thus facilitating speed as well as stability

Indirect Techniques

1. Modification of Kinematics

Altered kinematics may be implicated in many injuries. This might be exaggerated by a number of factors like faulty technique or equipment, weakness, inhibition, pain and so on. Dynamic Taping may help to modify the altered kinematics by the methods previously mentioned (increasing stiffness of non-contractile elements, contributing to force generation and pre-setting the muscle) however we can also develop our technique primarily to address the kinematics.

Kinematics describes the motion of objects (in this case the bones) without consideration of the forces or circumstances leading to that motion.

As certain kinematics have been associated with painful conditions or poor performance we can target our technique to simply improve the movement pattern by pulling the body part in one way or another. It is however a good idea to give consideration to the circumstances leading to these kinematics in your overall treatment approach (i.e. address flexibility, strength, stability issues that may be contributing factors).

For example - a runner who drops into internal rotation at the hip contributing to calcaneal eversion and dropping of the medial longitudinal arch (Fig. 14) could present with any number of problems from stress fractures to tendinopathy at many sites along the lower limb biomechanical chain.



Fig. 14 Typical pattern of calcaneal eversion, forefoot abduction and flattening of the medial longitudinal arch.

A Dynamic Taping application can be applied to resist internal rotation and apply a force assisting into external rotation of the hip (Fig.15).

Similarly, someone presenting with Patellofemoral Pain Syndrome may be assisted by the Lateral Sling technique (Fig. 16) which provides an additional, direct force that the patella must overcome to track laterally. In addition, it attempts to facilitate VMO activation to assist on a neurophysiological level.

Someone concerned with slicing their golf ball may benefit from taping to rotate the forearms and encourage a better club head position at ball strike. The aim being that by practising the correct technique, they will begin to groove a new (and better) motor pattern just as one acquires any skill. The applications for technique modification are endless and close co-operation between physiotherapist, coach and athlete can produce outstanding results.



Fig. 15 - Indirect technique for hip external rotation



Fig.16 - Patellofemoral Lateral Sling Technique.

How can we apply this clinically to the Continuum of Tendon Pathology model outlined above?

Reactive Tendinopathy/Early Tendon Dysrepair

Aim: Reduce load, improve biomechanical efficiency, allow to continue activity but with less pain and less load which should also reduce necessary recovery times.

Direct Techniques

- Assist by contributing to force generation thereby reducing load on tendon
- Assist energy absorption, storage and release to offset this requirement of the MTU by using leverage to increase the mechanical advantage

Indirect Techniques

- Optimise biomechanics by modifying the kinematics, offload (e.g. fat pad) or support (e.g. upper limb in rotator cuff or biceps tendinopathy)

If we take the case of Achilles tendinopathy – Direct Technique will mimic the action of the gastrocnemius/soleus/AT complex, assisting plantar flexion and resisting dorsiflexion (Fig. 17). By applying the tape with the foot plantarflexed and the knee flexed (shorten the MTU) the elasticity of the tape will contribute to force generation in concentric and eccentric actions of the calf and absorb energy during dorsiflexion only to re-inject this during plantarflexion.

An Indirect Technique might involve taping the hip to resist excessive internal rotation and the consequent flat arch, calc eversion (Fig. 18 & Fig. 19).

A variation of this technique sees the tape applied in external rotation and hip flexion and passes over the anterior aspect of the hip joint. In this way it will resist internal rotation/ assist external rotation particularly in increasing range of hip extension and will assist hip flexion following toe off.

Late Tendon Dysrepair/Degenerative Tendinopathy

Aim: To reduce compliance of the MTU (to improve efficiency of force transfer, reduce delay in execution of motor task and improve co-ordination of balance and high level skills).

To contribute to force generation, energy absorption, storage and release (due to increase risk of rupture) and permit full range of exercise.

Direct Techniques: The same technique as in the Reactive Tendopathy may be applied although its effect may be different. We are now concerned with ameliorating the deleterious effects of an overly compliant tendon by reducing load, temperature, metabolic demand and strain rate to decrease elongation of the tendon by applying second (and possibly third) parallel, elastic force. The tape also attempts to facilitate the muscle to encourage the 'pre-set' or uncrimping of fibrils and to reduce the overall force generation requirements of the muscle (consider increased activation of Tibialis Posterior and Anterior in PTTD) (Fig. 20).

Indirect Techniques: These techniques are similar to above but would be more heavily biased towards the modification of kinematics to improve the biomechanical efficiency.

In the case of PTTD the hip external rotation technique illustrated might be appropriate (Fig. 18 & Fig. 19).



Figure 17 -
Direct Technique for
achilles
tendon/plantar fascia



Fig. 18 & 19 -
Indirect technique for
hip external rotation



Fig. 20. Direct technique
targeting Tibialis Posterior

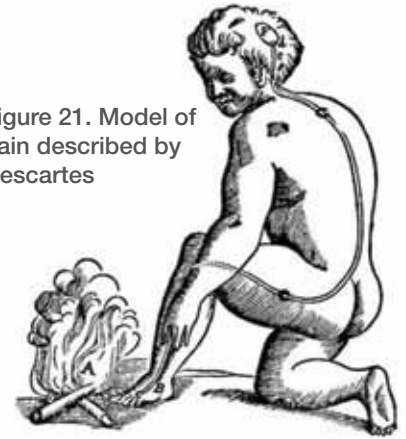
■ PART 2 - PHYSIOLOGICAL MECHANISMS

PAIN PHYSIOLOGY

(in a nutshell and incredibly oversimplified)

Original definitions describe pain as a warning sign of actual or impending tissue damage. Descartes original, hard-wired model likened pain perception to having a rope extending from the point of injury to a bell in the brain (Fig. 21). The more damage at the point of injury, the more the rope is pulled and the more the bell rings thereby increasing the painful experience.

Figure 21. Model of pain described by Descartes



We now know that this is not the case. The level of pain is not in direct proportion to the extent of tissue damage. Minor injuries can result in chronic, debilitating pain and severe injuries can recover completely and with much lower levels of pain.

Different people will experience different levels of pain for comparable injuries. Beecher demonstrated this comparing patients in military and civilian hospitals some 50 years ago ¹⁹.

The structural changes described above with regard to tendinopathy do not fully account for the pain experienced by people with these conditions. Biochemical and neurogenic contributions are suggested in the literature and good evidence is emerging to suggest non-opioid mediated hypoalgesia resulting from some manual therapy techniques ^{20 21 22 23 24}. This is particularly interesting when the technique is applied remotely from the 'source' of the injury such as in the Cervical Spine Lateral Glide technique for lateral epicondylalgia ²⁵.

How is pain perceived?

Pain receptors (nociceptors) send signals to certain areas of the spinal cord. These messages may be acted upon at this level to either dampen them down or ramp them up. The signals then travel along nerves in the spinal cord to the brain where they essentially pass through a number of filters or are weighed up against a number of factors. These include but are not limited to things like beliefs, expectation, past experience, social context & environment to give information regarding perceived threat ²⁶.

The outcome of this process or analysis will determine the degree of the pain experience. In other words, ***pain is not simply a sensory input but rather one output resulting from a complex process.***

This concept is illustrated in Lorimer Moseley's diagram (Fig.22) ²⁶.

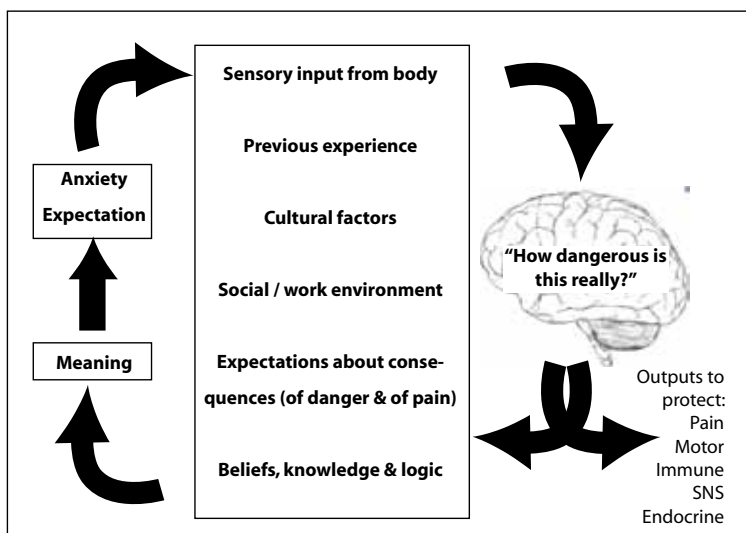


Fig. 22 - Adapted from Moseley 2011

These elements can be powerful modifiers of the pain (and physiological) experience. For example in a study conducted on medical students they placed their arms through a screen and were told that on one side they would be brushed with poison ivy and on the other with straw. In some cases when the straw and poison ivy were administered to the opposite arm than expected, the reaction occurred where the straw was applied and no reaction occurred from the poison ivy.

If someone believes that they will receive a less noxious stimulus they generally report less pain than if they are told that they are going to receive a more painful stimuli even though the stimuli administered are actually the same.

In addition, in *some* chronic pain states, the pain is considered to be centrally mediated. Changes occurring at the spinal cord level (e.g. loss of inhibitory interneurons) and above can amplify the pain (hyperalgesia). Similarly, nerve fibres normally responsible for touch and pressure (mechanoreceptors) can grow into the area of the spinal cord normally occupied by nociceptive fibres. Conversion of nociceptors into wide dynamic neurons occurs. Therefore, stimulation of the mechanoreceptors by touch or pressure can be transmitted up the spinal cord as if it had originated from a nociceptive fibre. Therefore normal light touch can be experienced as pain (allodynia) ²⁷.

Some research into fibromyalgia suggests that the central sensitisation is maintained by peripheral impulse input (nociceptive or otherwise) as injection of local anaesthetic into painful trigger points can reduce the secondary (remote) hyperalgesia. ²⁸ Muscle pain and skin pain do not appear to share the same mechanisms ²⁹.

The exact mode by which many manual therapy techniques work is yet to be fully understood. Do they work by reducing the peripheral nociceptive input, by enhancing descending inhibition, at higher centres by reducing anxiety, giving meaning to the pain and reducing the perceived threat? Hypoalgesia is well correlated with sympathoexcitation and research is starting to fill in some of the pieces of the puzzle however it is likely that many treatments are multimodal

^{22 23 25}.

How might Dynamic Taping influence pain?

Physiological Mechanisms of Action

The application of Dynamic Tape could influence the pain pathways in a number of ways.

1. Reducing stimulation of peripheral nociceptors – in response to injury the threshold of firing of the nociceptors is lowered such that they signal pain more readily (Peripheral Sensitisation). One reason for this is to prevent further damage to the injury site e.g. by over stretching a torn muscle or weight bearing on a sprain ankle.

Dynamic Tape is applied in such a way as to shorten the damaged tissues. This may help to approximate the torn ends of muscle fibres to aid healing as well as to reduce the firing of nociceptors. Indirect support for this hypothesis is emerging with research demonstrating an immediate increase in pressure pain thresholds following the application of strain- counterstrain techniques³⁰ where the aim is to shorten the target tissue to a point where it is not registering as being on strain and then slowly return it to its resting position.

Furthermore, by contributing to force generation (described above) the Dynamic Tape can effectively reduce the load requirements on injured tissue and therefore reduce the stimulation of sensitised nociceptors.

2. Non-opioid mediated hypoalgesia - In addition to reducing mechanical stimulation of nociceptors, the tape may also induce a similar form of (non-opioid) hypoalgesia as that which has been demonstrated with other manual therapy techniques^{22 23 25}.

3. Pain Gate Mechanism - Melzack and Wall's Gate Control Theory of pain suggests that stimulation of large diameter, mechanoreceptors can 'close the gate' or flood the ascending pathways thereby reducing the transmission of pain signals²⁶. This is akin to rubbing your elbow when you bang it. The constant and varying stimulation of this form of tape may stimulate the large diameter fibres to reduce the transmission of painful stimuli.

4. Normal Afferent Input - In centrally mediated, chronic pain states, normal afferent input may serve to modulate pain and possibly reverse some of the changes to the neural pathways. The stimulation of receptors in the skin and enhanced proprioception may provide further 'normal afferent input'.

5. Beliefs, expectation & reduction in perceived threat – this powerful element was illustrated in the poison ivy study and similar studies have been conducted with ice which when believed to be very hot, resulted in burns. If the athlete has strong beliefs or positive previous experience with tape it is likely that it will have a positive effect in managing their pain possibly due to the reduction in perceived threat.

6. Circulation and lymphatics – significant improvements occur with Dynamic Tape in situ as illustrated in Figure 23 even when the tape is not applied according to specific drainage channels. Improving the clearance of waste products and biochemical irritants which may otherwise excite nociceptive pathways may result in pain relief. Similarly, improvement in oxygen supply may relieve pain if hypoxia is thought to be contributing. The effect to which this occurs in deeper structures has not been clearly demonstrated. However the reduction in load attenuation and force generation will result in a reduction in metabolic demand which is likely to have a far greater effect on increasing endurance than the other circulatory improvements.

Fig. 23 - Hamstring tear - In this case, the tape was not applied to assist mechanically, nor did it aim to specifically assist lymphatic drainage by following drainage channels. The subject also had compression in the form of tubigrip over the entire limb. Despite this the photo clearly demonstrates the circulatory improvements following the removal of the Dynamic Tape.



Examples of Clinical Applications

Tibialis Posterior – Neville et al have demonstrated an increase in Tibialis Posterior length in subjects with Posterior Tibialis Tendon Dysfunction (PTTD) when compared to healthy controls.¹⁰ Forefoot abduction and rearfoot eversion appear to exert the most influence over this length change.³¹ In addition, an increase in Tibialis Posterior muscle activity has been observed in the PTTD group³² and similar EMG changes have been identified in the flat arch condition³³.



Fig. 24 - Direct technique for Tibialis Posterior

Dynamic Tape can be applied to augment the role of Tibialis Posterior. The Tape is applied with the foot in plantar flexion, forefoot adduction and inversion (shortened) and must pass posterior to the medial malleolus. In this way, during stance phase and weight-bearing dorsiflexion (when Tib post activity is increased), the tape is under more tension and therefore more closely assists the tibialis posterior muscle. A second strip can be applied to increase forefoot control and to provide further force (Fig.24).

In this way it acts to

- reduce compliance in the system
- further pre-set tibialis posterior to 'take up the slack'
- reduce force generation requirement of the muscle as the elasticity acts in the same direction as the muscle
- provide an additional resistive force opposing the detrimental biomechanical factors i.e. forefoot abduction, rearfoot eversion and navicular drop
- assist the resupination in later stance phase
- resupinate during swing phase in order to produce a better foot position at heel strike
- reduce nociceptive firing by gathering the tissues along the medial border of the tibia, reducing force generation requirement in the sensitised muscle tissue and possibly through circulatory, gate control, metabolic and other mechanisms mentioned previously.

As Augmented Low Dye (ALD) taping with a rigid sports tape has been shown to reduce Tibialis Anterior and Tibialis Posterior muscle activity and to maintain medial longitudinal arch height^{34 35 36} a combined technique may be particularly useful especially in the Reactive Tendinopathy (unloading) phase.

As tibialis anterior is also increased in the flat arch and PTTD groups it may be useful to apply the second strip of tape from the forefoot, under the navicular and over the anterior aspect of the talocrural joint with the foot in dorsi-flexion and inversion. In this way it may provide more assistance to tibialis anterior and more resistance to the navicular drop.

Achilles Tendinopathy (and Plantar-fasciitis)

This condition is characterised by the tendon changes outlined above and a similar picture of internal rotation, calcaneal eversion, flattening of the arch and forefoot abduction³⁷⁻⁴¹. The Dynamic Taping technique (Fig.25) must be applied once again with the target MTU in the shortened position. By commencing the tape on the dorsum of the foot and passing over the toes, a better anchor point is obtained and the tape also acts to resist lengthening of the medial longitudinal arch (associated with PTTD, PF and AT) and aid force transmission from the achilles tendon to the forefoot (the role of the plantar fascia⁴²). The tape is applied with the knee in flexion to further shorten/relax the gastrocnemius. This permits a substantial 'gathering up' of the soft tissues which seems to be particularly effective at relieving pain in the calf muscle tears but may also act to facilitate or preset the muscle.

The beneficial effect of the tape may be provided by:

- decreasing elongation in the overly compliant non contractile elements (Achilles Tendon and/or Plantar fascia).
- contributing to plantar flexion force generation (both eccentric and concentric) therefore reducing muscle work and also load on the plantar fascia (Cheung et al, 2006 demonstrated that increasing tension on the achilles tendon is coupled with increasing strain on the plantar fascia)³⁷
- exerting positive circulatory and neurophysiological effects to reduce pain
- provide mechanical resistance to flattening of the medial longitudinal arch
- facilitate shortening of the longitudinal arch



Figure 25 Direct Technique for calf, achilles tendon & plantar fascia

Shoulder Lift

This is an indirect mechanical, offloading technique (Fig. 26) which can produce good results in a range of conditions e.g. rotator cuff tendinopathy, a-c joint subluxation, sensitized upper limb/brachial plexus neural conditions and even acute glenohumeral dislocations (along with sling etc).

The main objective of this technique is to use the strong elasticity to support the weight of the upper limb thereby reducing load on the injured tissue. This provides weight relief from the injured tissues twenty-four hours per day for a number of days which allows the sensitivity to reduce or for injured tissue to begin to repair. It can be fine tuned to encourage better scapular position or resist anterior translation of the humeral head in impingements or cuff pathologies.

Although not directly targeting the long head of biceps or rotator cuff it may also act to improve the compliance properties of these tendons. It may also assist in maintaining the humeral head centred in the glenoid, thereby reducing load on the cuff musculature.

In summary

- Reduce stretch or load on injured tissues i.e. neural tissue, capsule in the case of GH dislocation, AC and CA ligaments in A-C joint subluxation
- Reduce the work on long head of biceps by improving scapular position, supporting the weight of the upper limb, resisting anterior translation of the humeral head and assisting the cuff to centre the HOH in the glenoid.
- Increase system stiffness with respect to the non-contractile elements (cuff and biceps)
- Reduce fatigue especially in postural holding/scapula muscles by doing some of the work and reducing the metabolic demand.



Figure 26 - demonstrate the shoulder lift, an Indirect offloading technique

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