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## PREVENTION &amp; REHABILITATION: EDITORIAL

## Dynamic tape. Is it all about controlling load?

An athlete making an explosive movement puts extremely high loads through the contractile and non-contractile musculo-tendinous elements attached to their skeletal structure. The ensuing movement of their skeleton accelerate their trunk or limbs, which, during a change in direction, need to tolerate a rapid deceleration while maintaining appropriate balance, dynamic joint position and control, placing stress on capsules, ligaments and fascia...and this continues through out the duration of their event or training session.

Once control becomes compromised due to fatigue, repetition, or a loss of focus, amongst a plethora of other factors, the control of movement or load may result in injuries that can range from minor to major, painless to painful, micro to macro. As long as motivation is still present, and the stakes are high enough, an athlete can choose to put their pain aside, and continue. 'It is not pain that finally stops them, elite athletes are often able to move beyond pain,' says Musculoskeletal Physiotherapist Ryan Kendrick, when interviewed in Leiden, Netherlands in November 2015,' what stops them is tissue failure and tissues don't fail because of pain, they fail because of overload. In the literature there is a poor correlation between tissue damage and pain.' (Beecher, 1946; Moseley, 2007). Kendrick says, 'The inability to adequately dissipate or accommodate load is strongly implicated in conditions such as tendinopathy and may also result in compensation strategies and maladaptive behaviour' (Soslowsky et al., 2002, Cook and Purdham, 2009).

The role of a physical therapist in sport not only encompasses preparation of the athlete in training, managing current injuries to reduce the risk of exacerbation prevent and the rehabilitation post injury, but it is also significantly focused at the field of play, providing strategies to solve the problems that present during the event.

Kendrick, while working in the United Kingdom identified a problem. How to manage load. Kendrick says, 'Certain measures such as building in adequate adaptation and recovery periods into the training schedule, manipulating

equipment and the environment could yield some benefit but I felt there was limited capacity to directly remove load from the athlete during the performance of their activities.' The lack of tools available to him in this area he felt was restricting his ability to reduce risk to his professional sports clients, who included Tennis Players and English County Cricket Players. 'It is often possible to assess where an athlete is experiencing over-load, and, for certain conditions there is a strong correlation with various kinematic parameters.' In other words, Kendrick is suggesting that the evidence of tissue overload may be visible in movement patterns, or it could present as a common overuse injury consistent within their sport. The cumulative load may be influenced by the athletes' size, shape and bio-metrics, but all will relate to the movement tasks within the sport. He says, 'What is difficult is to be able to do something as a therapist that adequately manages load. To do something that does 'just enough' to offload compromised tissues, yet not interfere with the movement patterns through range, that have contributed to their sporting success. A therapist still needs to use load as it is also essential for recovery but the specificity of loading is critical.'

In a musculoskeletal physical therapists' kit bag there is sports tape, Kendrick describes two choices of types of taping approaches open to him; a 'biomechanical approach' such as rigid strapping tape and 'neuropsychological approach' such as the Kinesio-tape range of manufacturers and products. Would either of these taping solutions help with his quest to reduce load within the bodies of his injured or at risk athletes?

### Biomechanical tape, common use and suitability for off loading through range

The ubiquitous tape combination 'Leukotape P,' and its under-tape, 'Fixomull' (designed to reduce the risk of skin reactions due to its hypoallergenic adhesive) and manufactured by BSN medical, was marketed to therapists treating patello-femoral pain syndrome using the McConnell patella taping techniques she first described in the Australian Journal of Physiotherapy (McConnell, 1986).

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Leukotape P is a rigid, cotton, high tensile strength, zinc oxide tape and when applied to the patella may alter the patella's position and alignment while still allowing the knee to move (with some restriction towards the end of knee flexion). The rationale suggested that the tape medially glides the patella so it is better able to resist lateral glide during loaded knee flexion/extension, such as when descending or ascending stairs. With appropriate angling to counter patella tilt and correct anchors to minimise the risk of skin traction injuries this taping technique can reduce pain instantly. [Smith et al. \(2013\)](#), however, refers to a controversy where some research suggests patella taping is a valuable adjunct in therapy while a Cochrane review ([Callaghan and Selfe, 2012](#)) concluded that pain outcomes comparing patella taping and a co-intervention – often exercise, and exercise without patella taping did not significantly favour patella taping. In the Clinic the taping method is known to reduce pain – this is not under debate, but research ([Gigante et al., 2001](#)) does not clearly indicate the biomechanical mechanisms at work. Smith quoting [Lan et al. \(2010\)](#) suggests that sub-groups of patients with a higher body mass index or a smaller Q-angle, might not do well with patella taping, creating a washout effect in the research, therefore use of rigid tape in treating patella issues still has many questions to answer. Callaghan and Selfe as late as 2010 still call for consensus on the diagnosis of PFPS (patellofemoral pain syndrome), out come measurement standardisation and acceptable patella taping technique as this may improve the research design in this area.

Leukotape P when applied in non-sesamoid situations is designed to provide rigid joint immobilisation and is often used to stabilise at risk or injured ligaments, it is used very regularly at the shoulder.

For the 'off-loading' applications that Kendrick was looking for, rigid tape was a poor match. When athletes were taped their ligaments may have been protected but their skin was compromised because of the very nature of the rigidity of the tape. The zinc oxide fixative itself can cause allergic reactions, movement can create traction injuries on the tape ends – 'anchors' and the manufacturers recommend removal of the tape in 18 h. The tape fatigues after a while and permanently stretches potentially losing its desired effect. A key issue is that athletes performance is likely to decrease wearing a rigid tape due to restrictions in joint range, altered balance and unnatural movement patterns. Kendrick had to look elsewhere.

### Neurophysiological tape, intended use and suitability for off loading through range

American trained Japanese Chiropractor Dr. Kenso Kase developed Kinesio-taping (KT) in the 1970's. During its development phase Kase looked for a material that mimicked the stretch of skin ([Kase et al., 2003](#)). So when handling the tape (without it's backing) it is easy to stretch the tape longitudinally (2-way stretch), increasing its length by about 40% at which point the tape does have a sudden end point. [Kuni et al. \(2015\)](#), compared three products for use in ankle instability; KT, non-elastic (rigid) tape and bracing. The study showed that KT did not show

any significant relevant stabilising effects on foot kinematics. It is clear that Kase was not looking to mechanically fixate a joint, KT was a definite and conscious move away from rigid taping. His idea was to use the application of tape to create a change in the pain, proprioceptive, motor control or lymphatic systems as a result of the sensory input created via the tape on skin contact. KT is applied with the muscle on stretch and when the joint moves back into mid range the altered shape of the ribbed material, referred to as 'convolutions' in the tape, then 'lifts' the skin. It is hypothesised that this action creates space in the tissue to enhance circulation or reduce pressure on pain sensitive structures.

Kinesio Tape 'is made of tightly woven elasticized cotton fibers and the glue on the back is acrylic, highly durable and waterproof so the tape can be worn for up to a week, during which time it will withstand vigorous movement, sweat and total immersion in water' ([Taylor et al., 2014](#)). Taylor et al.'s article is a 'scoping review' which is a type of review that creates a 'map' of a topics evidence base, without quality assessment or extensive data synthesis and helps formulate the questions for later systematic reviews ([Armstrong et al., 2011](#)). This choice of review type, in this case looking at Kinesio type tapes (which they refer to as 'elastic therapeutic tape') for neck or upper extremity conditions appropriately indicates that the research in this area is still relatively nascent. Walker comments that only 3 papers on 'elastic therapeutic taping' in the neck and upper limb area have been suitable for inclusion in the 3 high quality systematic reviews since 2010 in this area. They found that this type of taping may help reduce short-term neck and upper extremity pain and be convenient to apply, but they comment that there are not yet enough adequately powered studies to provide satisfactory evidence for the clinical claims being made about elastic therapeutic taping. This is reflected through out the current literature on KT research, that guarded positive findings are being made, but not necessarily validating the original hypothesis of the developers. A look through recent research found that: there is evidence KT could have a positive effect on muscle fatigue resistance ([Zhang et al., 2015](#)), KT doesn't reduce postoperative pain following anterior cruciate ligament (ACL) reconstruction ([Laborie et al., 2015](#)), and, published later in this Prevention and Rehabilitation section of the JBMT, 'assumptions suggesting that peripheral to distal application of KT stimulates muscle and distal to peripheral relaxes the muscle, seem to be false but application of KT in various directions can affect muscle strength' ([Vered et al., 2015](#)).

Again, for the 'off-loading' applications Kendrick was looking for Kinesio-tape was also a poor match. When athletes are K-taped as the developers intended there may well be neurophysiological effects in play perhaps affecting pain or proprioception, but certainly little of the easily measurable, firmly elastic biomechanical assistance Kendrick was looking for, KT's elastic response is weak, measuring in grams. Kendrick was looking to control excessive deceleration loads, perhaps measuring in kilos, and provide assistance in the movements return. He realised this type of product wasn't yet in the market. He relates on courses that he tried to approximate what he was looking for by attaching theraband to his clients, but he

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