

# Kinesiology tape

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The popularity and use of kinesiology tape (k-tape) has increased dramatically over the last seven years. Despite the fact that it was invented in the 1970's by Dr. Kenzo Kase, k-tape rose to prominence following the Beijing Olympics in 2008. K-tape is increasingly being used by athletes at all levels, ranging from Olympians to weekend warriors. While k-tape's popularity continues to grow, there is still significant debate about k-tape's clinical efficacy. This is due in part to the historical beliefs of many practitioners who cling to out-dated and unsupported theories about the purported benefits of k-tape. At Rocktape, we are committed to furthering the body of scientific knowledge on the effects of k-tape and to demonstrating the positive benefits that we see clinically every day. We are actively supporting research that is currently being conducted around the world, and we promote "evidence-informed" education in all of our courses. As emphasized by Sackett et al<sup>1</sup>, we understand that evidence-based practice relies not only on the scientific literature, but also on the clinical experience of the provider and patient expectations (Figure 1).



**Figure 1.** Evidence based approach to rehabilitation.<sup>1</sup>

The Centre for Evidence Based—Medicine (CEBM) encourages clinicians to make decisions based on the best evidence available.<sup>2</sup> High levels of evidence on the effects of k-tape as specified by the CEBM are lacking. While systematic reviews and meta-analyses, among the highest levels of evidence, do exist, they are divided in their conclusions. Additionally, a lack of high quality reviews stems from a lack of

high quality individual studies on the effects of k-tape. As such, the literature remains divided on its efficacy.

Regardless of literature available, it has become clear that some of the original beliefs about k-tapes are simply not grounded in science. Most notably is the idea that the direction in which the tape is applied results in facilitatory or inhibitory effects on the targeted muscle. Vercelli et al<sup>3</sup> compared the effects of no tape, origin to insertion tape, and insertion to origin tape on quadriceps strength and limb performance in healthy individuals. They found that there were no differences between groups with regard to strength or performance.<sup>3</sup> This finding supports the common sense view that direction of application does not play as great a role in performance improvement as simply having tape on the skin does.

Another commonly held belief about the application of k-tape is that a large amount of tension is needed to elicit a response. However, studies that utilized sham, or placebo, k-tape application, indicate that this is not the case. It is important to note that, with regard to the k-tape literature, “sham” refers to the application technique and not to the tape itself. Gonzalez-Iglesias et al<sup>4</sup> compared the effects of traditional k-tape application to a sham application on neck pain and range of motion in individuals with whiplash. They found that these measures improved significantly regardless of the amount of stretch applied to the tape.<sup>4</sup> Additionally, Thelen et al<sup>5</sup> compared the effects of k-tape application and sham tape on shoulder pain, disability, and pain free range of motion in individuals with shoulder impingement. They found that both k-tape and sham improved pain and pain free range of motion.<sup>5</sup> These findings suggest that, once again, tension does not appear to be as important as cutaneous stimulation in improving outcomes.

Currently, it is unclear if the effect of k-tape application on the muscle are excitatory or inhibitory, as studies show conflicting results. It is possible that k-tape may have different effects on different muscle groups. For example, Lumbruso et al<sup>6</sup> compared the effects of k-tape on the gastrocnemius and on the hamstring on force production. They found that KT showed an immediate, significant, and sustained (two days post-application) increase in force production in the gastrocnemius group.<sup>6</sup> While there was no immediate effect of k-tape on force production in the hamstring, following two days of application force increased significantly as well.<sup>6</sup> And while Wong et al<sup>7</sup> showed no change in peak torque production of the quadriceps with the application of k-tape, they did show that quadriceps with k-tape were able to achieve peak torque more quickly compared to a no tape condition. Chen et al<sup>8</sup> investigated the effects of k-tape application on vastus medialis oblique and vastus lateralis activation during stair descent in individuals with knee pain. They found that both muscles had had earlier onset activation, which suggests that k-tape improves functional control during stair descent when compared to controls without tape.<sup>8</sup> It is important to note the, despite these findings, results among studies still conflict.

It is theorized that injured individuals and individuals in pain have distorted sensory awareness of the affected body part and, in some cases, in the contralateral limb. It is theorized that by stimulating the mechanoreceptors in the skin and subcutaneous tissue, k-tape may provide the brain with additional input regarding the body's position in space, thereby making the wearer more cognizant of the taped

area. In individuals with chronic low back pain, Bae et al<sup>9</sup> found that k-tape in conjunction with usual care resulted in a better pattern of abdominal muscle recruitment compared with pre-treatment measures. Additionally, Parreira et al<sup>10</sup> found that regardless of the technique of application, k-tape was helpful in reducing pain and disability in individuals with chronic low back pain. This effect was even somewhat maintained eight weeks after the treatment ceased.<sup>10</sup> Griebert et al<sup>11</sup> showed that k-tape can have a positive effect on biomechanics in individuals either with or prone to medial tibial stress syndrome, or shin splints. K-tape application in this group improved their foot loading patterns as they walked across a force plate, yet the same application made no difference to a control group with normal biomechanics.<sup>11</sup> These findings highlight one of the most exciting developments with regard to k-tape: the powerful effect that the tape may have on correcting abnormal movement patterns and postures.

It may also be the case that healthy, asymptomatic individuals, who are often subjects in k-tape research, are less likely to show an effect from taping. This may be because any additional input to the brain the tape provides could be quickly dismissed as unimportant since the system is not compromised. In states of pain or fatigue when the system is compromised, it is possible that additional afferent input may be considered more meaningful. This may result in a positive effect on efferent output. For example, Thedon et al<sup>12</sup> compared the effects of two conditions (control and k-tape) applied to the Achilles tendon on standing balance before and after exercise to fatigue. While subjects demonstrated similar sway patterns before fatigue, they swayed significantly less in the k-tape condition following fatigue.<sup>12</sup> The authors surmised that individuals preferred to use their muscle spindle input when this input was reliable.<sup>12</sup> However, when muscle spindle input was degraded through fatigue, the brain utilized information provided by the k-tape on the skin, which results in better standing balance compared to the control condition. Similarly, Konishi<sup>13</sup> compared quadriceps strength before and after the application of k-tape following fatigue. He found that subjects had greater quadriceps strength with the k-tape condition compared to baseline.<sup>13</sup> There were no differences in strength before fatigue for no tape and k-tape conditions.<sup>13</sup> Cortesi et al<sup>14</sup> found that standing balance improved in subjects with multiple sclerosis who had their Achilles' tendons taped. These findings support the notion that tape can provide substantial improvements in balance in individuals with compromised sensory input. Supplementary information applied to the cutaneous mechanoreceptors k-tape may help improve outcomes.

The exact physiological mechanism of action for k-tape remains unknown. While many studies have investigated the effect of k-tape on various parameters, such as pain, inflammation, muscle function, and joint position sense, there is very little research on how it may alter these parameters. In a recent, unpublished study from the US, researchers used ultrasound imaging to show that k-tape does have a lifting effect on the subcutaneous tissue layers. By imaging and comparing pre- and post-tape applications, researchers demonstrated a visible change in the interstitial space. This early finding is in line with the long-held belief that k-tape's mechanism of action is partially achieved through decompression of local tissues. Clinically, this may be the reason we often see dramatic changes in the reduction of swelling and in the reduction of hematomas with k-tape application. This lifting effect creates convolutions on the skin that may potentially decompress the lymphatic vessels and allow exudates to be removed from the area more easily. The same lifting effect is also thought to improve

circulation to the area, allowing ecchymosis to be cleared more efficiently. Finally, the lifting effect may simultaneously decrease the pressure on the superficial nociceptors and stimulate the mechanoreceptors, leading to less perception of pain in the underlying tissue. All of these factors combined may allow injured individuals to return to proper form and function more quickly. Research seems to support this idea as it relates to inflammation. Tsai et al<sup>15</sup> demonstrated k-tape application in conjunction with usual therapy was equally effective with regard to control of breast cancer related lymphedema when compared with traditional short stretch bandaging and usual therapy. Additionally, subjects with k-tape displayed greater compliance, decreased difficulty in use, and greater self-reported comfort compared with subjects with the short stretch bandages.<sup>15</sup> These findings suggest that k-tape may be a valuable tool in the management of lymphedema. In this study, it provided similar benefits to short stretch bandaging over a one month period and was associated with greater patient comfort.

Improvements in circulation may also result in improvements in Delayed Onset Muscle Soreness (DOMS) demonstrated in a study by Bae et al<sup>16</sup>. They found that DOMS symptoms resolved faster in individuals with k-tape application compared to a sham tape control group. Tsai et al<sup>17</sup> investigated the effect of k-tape application on pain and plantar fascia thickness in individuals with plantar fasciitis. The k-tape group showed a significantly greater reduction in pain scores compared to controls. More interestingly, the k-tape group demonstrated a significantly greater reduction in the thickness of the plantar fascia at the insertion site as measured by a blinded ultrasonographer compared to controls. Additionally, Karwacinska et al<sup>17</sup> showed a positive effect of k-tape application in children with hypertrophic and keloid scarring over a twelve week period. The reduction in scarring may also be suggestive of changes in circulation to the taped area and also to the benefits of low threshold skin shear on a scar over long periods of time. These findings suggest that k-tape allows for an increase in circulation that facilitated tissue remodeling.

### **Future Directions for Kinesiology Taping Research**

There is much to do regarding further research into the effects of kinesiology taping.

- To begin, we need small, well designed efficacy trials to further define what needs investigating in future larger, randomized controlled studies.
- We need large, randomized controlled studies to validate the findings of recent, smaller pilot studies. These smaller studies include those that have demonstrated decreases in subjects' pain, improvements in performance, and reductions in the negative performance effects of fatigue.
- We need to determine the optimal length of time of application of the tape. There have been some interesting findings, such as by Lumbroso et al<sup>6</sup> previously described. They found an immediate increase in excitability of the gastrocnemius in healthy individuals following k-tape application and a delay in a similar excitability in hamstrings. Many studies have not found significant benefits from immediate k-tape application, but have not re-tested 24-48 hours later. It is possible that the tape has a delayed effect resulting from slow adapting mechanoreceptors. Kaya et al<sup>18</sup> compared physical therapy with either the use of modalities or k-tape in individuals with shoulder impingement with regard to pain and disability. They found that pain in the k-tape group decreased significantly more than pain in the modality group after the first week of treatment.<sup>18</sup> Following two weeks of treatment, the k-tape group had significantly lower disability than the modality group.<sup>18</sup> These findings indicate that pain decreased first and that

functional scores improved later. A delayed effect may have implications for methods of future studies.

- The effect of k-tape in certain populations needs further study. There have been some interesting case studies published on the effects of k-tape in individuals with cerebral palsy investigating the effect of various taping techniques on function; however, larger, randomized studies could follow.
- Further research should be done to build upon early positive findings of the effects of k-tape on inflammation and lymphedema management. This area of study should be expanded to investigate the application of k-tape on inflammation resulting from orthopedic injury, surgery, and high intensity exercise.
- Can k-tape play a role in the prevention of injuries through improved neuromuscular control? Many studies have identified risk factors for certain injuries that could be addressed with taping. For example, Cameron et al<sup>19</sup> studied the hamstring muscle group in Australian Rules football. They postulated that hamstring injuries could occur through errors in position sense during foot contact with the ground while running.<sup>19</sup> Some studies into k-tape have demonstrated improved position sense or force sense in taped subjects, including those by Chang et al<sup>20</sup>. It would be interesting to know if k-tape has benefits in athletes prone to hamstring injuries. Greg Myer's group out of Cincinnati Children's hospital has produced numerous papers looking at the risk factors for ACL injuries and patellofemoral pain in adolescent girls. The main risk factor identified by these studies is the valgus collapse that often occurs in landing and cutting actions.<sup>21</sup> This is the result of decreased hamstring recruitment and poor trunk control leading to increased hip adduction and internal rotation.<sup>21</sup> The effect of spiral taping of the lower limb would be interesting in this group of female athletes identified as having high risk for ACL rupture or patellofemoral pain.

There is much work to be done before k-tape can be considered as having a rigorous basis in evidence. However, it is often said that the lack of evidence does not constitute evidence of lack. Anecdotally, practitioners around the world continue to see benefits in their patients following k-tape application. It may be that we as clinicians need to avoid being blinded by old theories about k-tape's mechanism of action and embrace the role of the central nervous system in pain and movement disorders before we can truly understand the role of this family of tapes.

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