Case Studies

THE EFFECT OF FUNCTIONAL FASCIAL TAPING ON MORTON'S NEUROMA

A Case Report

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Abstract:
Objective and Background: Morton's neuroma is essentially a benign tumor in the foot, which may cause extreme pain and disability. Both conservative and surgical modalities have been used, but as yet, neither has been successful in resolving the condition. This report introduces Functional Fascial Taping (FFT) developed by Alexander, as a new treatment regime and examines its effectiveness in the management of Morton's neuroma.
Discussion: Functional Foot Index (FFI) was used to assess the effectiveness of this taping modality demonstrating both amelioration of pain and improvement in functionality. Although there is anecdotal evidence to support the benefits of Functional Facial Taping (FFT) in the treatment of Morton's Neuroma, a more detailed study is warranted using larger numbers of participants to examine its long and short-term benefits.

Key words: Morton's neuroma, taping, disability, pain, foot.

INTRODUCTION

Morton's neuroma, while a rare condition, is the most common cause of neuralgia in the foot not only in athletes, but also the general public. It commonly afflicts young females, resulting in significant pain and disability. Diagnosing Morton's neuroma is equivocal, with many stipulating that a case history is all that is required, whilst others believe various imaging modalities and cortisone injections provide the best confirmation for a diagnosis. Etiology is still a mystery. Many theories have been proposed, and treatment modalities have been many and varied, ranging from conservative therapy to surgery.

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Recently, a new taping technique, Functional Fascial Taping (FFT)ä has been implemented in the treatment of Morton's neuroma with outstanding anecdotal results. This report introduces FFT ä as a new treatment regime and examines its effectiveness in the management of Morton's neuroma.

MORTON'S NEUROMA

Not a true tumor, Morton's neuroma has been described as a "perineurofibrosis" of the common digital nerve[1-13]. It commonly effects the second and third interspace, occasionally the fourth and rarely the first interspace. Neuromata occur bilaterally in 15% of affected individuals, but multiple neuromas in one foot are extremely rare[14]. It has been found to be more prevalent in women under 50 years due to the delicate and pliable nature of the foot[4,6,10,14,15].

Histological examination of neuromata revealed perineural fibroma, which postulated traumatic origin[6]. It's believed that tethering of the nerve occurs from repetitive pinching of the plantar nerve between the metatarsal heads during abnormal movements. Many authors[4,15,16] argue that the third nerve is more vulnerable to trauma due to its larger diameter, as well as the relatively smaller spaces between the metatarsal heads/transverse ligament region in the second and third web[12,17-19].

Force on the nerve may be exaggerated by failure of the normal function of the first ray (eg. bunion formation), the presence of pes cavus, or disorders associated with increased loading of the second or third ray[8]. Laxity of the intermetatarsal ligament allows the interdigital nerve tissue to rise up between the metatarsal heads where it is subject to compressive trauma[14,16,20]. Other possible causes of neuromata are flattening of the medial arch, and ischemic changes within the nerve[12,14,17].

The classic symptom of interdigital neuromata is sharp stabbing, burning, cramping or throbbing pain in the forefoot, which is relieved by removing the shoe and massaging the area. The pain tends to recur on weightbearing[3,8,12,14,21,22]. In the early stages generalised pain is felt in the forefoot, but normally by the time the symptoms have been present for 5-6 months, the pain

becomes localised to a specific interspace. Paresthesia, numbness, and hyperesthesia of adjacent toes may be present, and patients have described a hard pea sensation or lump when walking[14,22]. Some patients describe that they feel a "click" or "catch" on weightbearing, associated with acute pain[3,14]. The pain is usually intermittent, dependant on the shoe type. Most patients will have greater symptoms in tight shoes, although a few have more symptoms in wide shoes.

DIAGNOSIS OF MORTON'S NEUROMA

The most useful clinical test for the diagnosis of Morton's neuroma is to perform a web space compression test which produces severe pain by squeezing the metatarsal heads together with one hand and simultaneously compressing the involved web space with the thumb and index finger of the opposite hand. This can also produce a painful and palpable click known as Mulder's sign[4,6,9,12,16,23,24], which may result in the mass being pinched for a moment between the metatarsal heads causing characteristic pain, as the tumor escapes into the sole of the foot. A palpable click with reproduction of the patient's symptoms is considered a positive finding, highly suggestive of a neuroma[9]. Palpation of the involved web space may not only cause pain locally, but it may also radiate along the involved digits distally[23,25]. A positive Tinel's sign[4,21] upon examination may confirm the diagnosis of neuroma, but it cannot determine the type of lesion or the tissues involved. Diminished sensation to pinprick in the third and fourth interspace is occasionally found, and less often there is hyperesthesia in the cleft, however, sensation often appeared normal, possibly because of the "take over" from adjacent normal nerves[7]. No motor symptoms are experienced because the nerve affected is sensory.

The diagnosis of interdigital neuroma can usually be made by careful recollection of case histories and physical examination, however localization of the neuroma may be difficult[5,13,26,27]. Although Mulder's sign is trusted clinically, its accuracy has yet to be reported. A valid and reliable method for identifying, localizing and quantifying Morton's neuroma is lacking. Other means of diagnosing neuromata include cortisone injections and various imaging modalities (plain radiographs, MRI, CT and ultrasonography).

Cortisone injections are often used as part of physical examination, to confirm the diagnosis and for therapeutic treatment of Morton's neuroma[10]. Although expensive, the best imaging modality is MRI, as it produces excellent soft-tissue contrast without ionising radiation[1,3,5,6,10,13,21,23,26]. However it must be noted that MRI scans are not infallible, and can produce false negative results[22].

Ultrasound examination for soft tissue pathology in the foot and ankle has become a valuable adjunct to the history and physical examination[6,10,27]. Although ultrasound is a highly accurate technique in diagnosing the presence, location, and size of interdigital neuromas, occasionally, an interspace is so narrow that ultrasound may be inconclusive.

TREATMENT OF MORTON'S NEUROMA

Morton's original treatment for this condition was amputation of the fourth toe and fourth metatarsal[16]. Modern treatment of Morton's neuroma is less radical, and encompasses both conservative and surgical approaches. Conservative treatment comprises low-heeled wide, comfortable shoes with large toe boxes, metatarsal bars, and metatarsal pads (adhesive backed felt pads) placed proximal to the symptomatic interspace. Arch supports, custom-made foot orthoses, physical therapy, NSAIDS and injections of a combined corticosteroid and local anesthetic into the involved web space are also used[2-4,10,12,14,15,20,22,27-29].

Although surgery, whether it is excision, neurolysis or release of the intermetatarsal ligament, is often the only option once conservative treatment has failed, it has many associated complications. There have been reports of post-surgical infection, keloid formation and recurrent neuromas after initial surgery[5,10,14,15,28,30]. Gaynor[27] demonstrated that conservative treatment was beneficial in acute cases which are prevalent in young persons, whilst surgical management was five times more successful than conservative treatment in chronic cases involving older persons.

Recurrent interdigital neuromas appear to develop more rapidly than primary neuromas, with the recurrent neuroma being located proximal to the primary neuroma. Greater than 30% of the patients have continued paraesthesia and positive Tinel sign. Pain from recurrent neuroma may never go away only change locations[2].

FUNCTIONAL FASCIAL TAPING

Unlike conventional taping which is used to limit motion or support injured sites, functional fascial tapingä is employed to increase range of motion and decrease/ alleviate pain in parts of the body where fascial dysfunctions are present. There are three main types of fascia: superficial, deep and subserous. The fascial system is a vast network of fibrous connective tissue, which envelops the entire body, and is continuous from region to region[31-34].

Muscular or visceral action of one part may exert tension or a pull on neighbouring parts through the connective tissue[32,34]. Excessive force, due to strain or repetitive motion against the restriction barrier, may cause local inflammation and pain, due to the release of pain-producing chemical mediators. Inflammation can result in adhesive

fibrosis, which leads to the development of an area of restriction and reduced elasticity (ie. fascial tension)[31].

Alexander[35-39] demonstrated the use of FFTä for the treatment of interdigital neuromas among ballet dancers, with astounding anecdotal results. Immediately following application of the tape, the dancers reported no neural pain. The author reapplied the tape two days after the initial consultation, and reassessed the dancers every six months for three years, finding that they were asymptomatic. He argued that by applying the tape in a functional range of motion, where fascial dysfunction is prevalent, the contracture and fibrotic process maybe arrested or reversed.

CLINICAL MEASURES

The Visual Analogue Scale (VAS) is a line 10cm long, the ends of which are labeled as extremes of pain, from no pain to the worst pain the participant has ever experienced. There is much evidence supporting the internal validity and reliability of the VAS as a self-reported measure of pain intensity[40-46]. VAS is extremely sensitive to treatment effects[47-50]. There may be some confusion with patients understanding and using VAS, but explanation and practice should decrease the risk of error[40-46].

The Foot Function Index (FFI) measures the quality of life impact of the neuroma in terms of pain, disability and activity restriction. FFI consists of 23 items in three sub-scales: Foot pain, Disability and Activity limitation. All items are rated using the VAS. FFI has good test-retest properties ($r = 0.87$) and has been shown to be an excellent practical means of measuring foot function in an outpatient setting, over relatively short periods of time ($r = 0.96$)[51].

CASE STUDY

A 36-year-old female, who is a full-time student, was referred to the clinic by a podiatrist, with a diagnosis of Morton's neuroma. The pain was described as deep dull ache, which had the propensity to escalate to a sharp, stabbing pain, in the third interspace of the left foot. The patient also experienced intermittent pins and needles over both dorsal and plantar aspects of the left foot.

The patient reported the pain began insidiously two years ago, when she was running. At the time, she sought no treatment, because the pain spontaneously resolved. The pain seemed to recur during summer, when the patient wore sandals with straps that compressed the forefoot, and ever since, has been restricted to wearing one type of footwear. The pain prevented the patient from carrying out her usual activities including, walking (especially without shoes), kneeling down gardening with toes curled under foot, and wearing various other footwear. She rated the pain at its worst, according to the FFI as 79%. The patient rated her pain at the time of the first consultation according to FFI as 5%, as she had been frequenting a podiatrist for treatment, which included taping and orthotics with a metatarsal bar. Aggravating factors included walking especially long distances, footwear with straps or firm toe box, plantarflexion, and at times light pressure, such as bed linen touching the foot. Relieving factors were dorsiflexion and orthotics, which were prescribed by the podiatrist. No anti-inflammatories or cortisone injections had been administered. The patient's general health was reported as good, although the patient appeared a little stressed due to workload at university. She did not have any hobbies or participate in any regular leisure activities.

Assessment and examination procedures revealed decreased range of active plantarflexion of the left ankle with associated pain. All other active ranges of motion were full and pain-free. Passive ROM at the left ankle also revealed decreased plantarflexion with provocation of the patient's familiar pain. The patient had a positive Mulder's sign or Mulder's click which also reproduced the patient's familiar pain. Palpation in the third interspace revealed exquisite tenderness with pins and needles radiating proximally along dorsum of left foot. The patient was asked to plantarflex her foot, the painful ROM, whilst the digital fascial tension test (DFTT) was performed. DFTT involves engaging the skin and underlying tissue where the pain is experienced, and with a draw/drag effect pull the local tissue away from the painful site. Dragging the skin inferiorly relieved the patients' pain. With the patients' foot still plantarflexed, Fixomull â was placed on the skin with overlying rigid Leuko sportstape â. With one end of the tape adhered to the painful site, the tape was applied in the direction predetermined by the DFTT, inferiorly, using a gathering technique to take up the slack in the skin and underlying tissue. This process was repeated three times. The tape was anchored both proximally and distally. All active ROM were re-tested, and it was found that all ROM were pain-free, including plantarflexion. The patient was advised to perform plantarflexion exercises, and to keep the tape dry at all times.

Two days later the patient returned for re-taping. The patient commented, that she had been pain-free since the initial taping session, however she had been experiencing "shin-splint" type pain around the mid-shaft of the tibia over tibialis anterior. The neuroma was re-taped as previous, as well as a second area of taping over the tibialis anterior. The DFTT was performed over tibialis anterior, and the pain free direction was found to be on a diagonal, inferomedial. Upon taping these two consecutive areas, the patient was again, pain-free.

The patient presented for re-taping every second day for a period of two weeks. Each taping session required reassessment for pain-free ROM. The tape was removed

on every third taping session to allow the patient to wash her foot. The skin was properly cleansed to remove all glue from previous taping. On the third taping session the patient had relief from the majority of her pain, with only slight pain felt when wearing other footwear and after gardening all day. On the final taping session, the patient reported her pain, according to FFI, as 0%.

INTERPRETATION OF CLINICAL OUTCOME MEASURES

The patient reported that the clinical measures used were easy to understand and complete. Measures were administered pre and post-treatment. The patients' FFI scores pre-treatment for pain were 46%, for disability 18%, and for activity limitation 9% (see table 1).

	Pre-treatment	Post-treatment
Pain	46%	0%
Disability	18%	1%
Activity limitation	9%	0%

Table 1: Patient's FFI scores

At the initial consultation the patient reported her pain as 5%, however the patient reported her worst pain, according to the FFI as 79%. All that can be deduced from these scores is that at the initial consultation, she was only experiencing mild pain due to previous treatment from the podiatrist, and by the second week of taping, the patient experienced no pain.

	Pre-treatment	Post-treatment
Walking barefoot	44%	1%
Standing barefoot	6%	0%
Pain at its worst	79%	0%
Beginning of day	78%	0%
End of day	79%	0%
Walking with orthotics	5%	0%
Walking without orthotics	51%	1%
Walking with shoes on	27%	1%

Table 2: Pain Subscale

On closer examination of the Pain Subscale, the main improvements were walking barefoot, severity of pain at its worst and throughout the day (Table 2).

	Pre-treatment	Post-treatment
Climbing stairs	10%	0%
Walking around house	11%	0%
Walking outside	24%	0%
Descending stairs	26%	1%
Standing tiptoe	50%	8%
Walking 4 blocks	30%	0%
Rising from chair	1%	0%
Stepping up a curb	10%	0%
Walking fast	16%	0%

Table 3: Disability Subscale

From the above table, one is able to note the disability parameters, which improved the most, were standing tiptoe, walking outside and for considerable distance, as well as descending stairs. The patient also showed notable improvements in her daily activities (Table 4).

	Pre-treatment	Post-treatment
Staying indoors	2%	0%
Staying in bed	1%	0%
Limited daily activities	40%	0%
Assistive devices indoors	0%	0%
Assistive devices outdoors	0%	0%

Table 4: Activity Limitation Subscale

DISCUSSION

Clinically, Morton's neuroma is of great interest because of the high incidence of disabling pain in patients who are young, and often, professional athletes. Much research has been conducted in the area of Morton's neuroma, and its many varied treatment modalities. It is the view of many that conservative treatment should be exhausted prior to any surgical intervention. However, others advocate surgery if conservative measures fail to significantly reduce the patient's pain and disability[12,15,52,53]. Surgical intervention has involved surgical excision of the neuroma via a plantar or dorsal approach and division of the transverse intermetatarsal ligament. The success of surgery is varied with some authors stipulating 80% or better success rate, whilst others comment that the patient is fortunate to receive 75% relief from their symptoms, with the average relief between 50-60%. Scarring during the healing process frequently interferes with the functions of support, movement, and lubrication. Soft tissue changes, which also occur, lead to persistent symptoms long after healing of the acute tissue injury[46].

The patient was pain-free after the third taping session and remained so, for the remainder of the treatment period. The reduction in pain and improved ROM, enabled the patient to participate in daily activities pain free, and for the first time in several years, she was able to wear a variety of footwear. There was marked improvement in the patient's diurnal pain pattern, with pain in the morning at the initial consultation rated 78%, whilst pain at the end of the day rated 79%. At the final consultation the patient's pain in the morning and at the end of the day rated 0% on the FFI. The patient was also able to walk barefoot without considerable pain, as at the final consultation the pain rated 1%, as opposed to 43% at initial consultation. There was also a notable improvement on the disability subscale, with the patient indicating no difficulty walking outside (Pre: 24%; Post: 0%), descending stairs (Pre:26%; Post: 1%) or walking long distances (Pre: 30%; Post: 0%) and minimal difficulty standing tip toe (Pre: 50%, Post: 8%). The reason for these improvements is not well understood, but it is a known fact that once the acute trauma has resolved, there is residual scarring of the

surrounding tissues which leads to restricted motion and fascial tension. It is plausible that the load applied by the tape stretched the scar tissue surrounding the nerve, alleviating compression on the nerve, and thus resulting in pain free movement. Fascia has the capacity to change when subjected to stress, and as such, when a load is applied to this viscoelastic tissue, over a prolonged period of time, the tissue will progressively deform until a new resting length is achieved[57-61]. Tillman and Herling[54] also showed that by gently stretching scar tissue, collagen fibers are laid down parallel to the lines of stress, thus changing the shape, strength and pliability of the connective tissue[55]. This was supported by Kottke, Pauley and Ptak[56] who stipulated when there is little motion at a particular area of the body, collagen is laid down as a dense network, however if there is considerable motion, the connective tissue will be remodeled so that it is loose and extensible. It was also noted that when a load is applied to fascia, connective tissue deformation increases with fluid loss. Thus as the fluid volume in the connective tissue decreases, the collagen configuration becomes floppy and more elastic, therefore allowing reorganisation of the fibers along the lines of stress[57,58,60].

At six weeks follow-up, the patient noted minimal discomfort, which was dependent on the amount of physical activity she performed during the day. While rapid recovery is the immediate aim of any therapeutic modality, it would be beneficial to assess the possible long-term benefits of FFTä. It is also imperative that future studies of Morton's neuroma utilise imaging modalities, specifically MRI, to visualise the size of the neuroma pre and post-treatment, to eliminate the possibility of placebo.

CONCLUSION

Morton's neuroma is a painfully debilitating condition, which often presents to Podiatrists. Conservative therapy is an essential component of the treatment of Morton's neuroma, as most patients can be treated non-operatively, and only a few that don't respond to these measures, undergo surgical intervention. At present there is little research to explore the potential benefits of FFT ä to alleviate pain and disability in patients suffering from Morton's neuroma. This study does suggest that FFT ä has beneficial effects, however a larger random controlled study needs to be conducted, examining both long-term and short-term effects of FFT ä.

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