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**Why does treatment fail?**

The Neuroma Timeline Phenomenon is not new

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This article is not about surgery but about prevention of surgery and so should appeal to a broad church of podiatrists rather than one group. The topic emphasises the importance of upskilling and focuses on ‘timeline’. This is an aspect I started to discuss with patients after reflecting upon the effect of Morton’s neuroma.

Morton’s neuroma has often been recorded incorrectly as a disease. It is not. The condition is a reactive change to a digital nerve brought about by localised damage and pathological changes that take a period of time to manifest with symptoms sufficient to cause concern. (Author)

# **Background evidence**

It might be rather obvious but even when a diagnosis has been made, different treatments work better for some patients than others. When presented with any foot problem several key questions should be asked, these include, what helps and what treatment have you had already, what makes it worse and of course how do you think this might have happened? A colleague told me that she believed patients with plantar digital neuroma went to podiatric or orthopaedic surgeons not podiatrists. This is not universal by any means and there are plenty of podiatrists able to do much to help patients with this painful crushing, cramping and shooting entity associated with paraesthesia.

There are two objectives behind this article. Firstly, podiatrists should upskill and aim to bring more effective care for neuroma problems.

 Secondly, surgery is not guaranteed and for the surgeon, a dorsal approach, while bearing much merit has an incidence of stump neuroma for some 15% of patients. The plantar approach is no more reliable, **Akermark, C et al 2013, Habashy, A, 2016**.

## **Tests & Investigations**

When seven clinical tests were carried out by **Mahadevan et al (2015)** he identified the thumb and forefinger compression test within the web space as being most reliable with a 96% [sensitivity](#SPC). **Mallina et al (2016)** suggested that taking routine samples for histology was not required and had an economic disadvantage. The reliance on clinical examination and its value has been considered significantly reliable to reach a diagnosis without ultrasound in the first case.

compression tests are better than percussion or sensory tests

**Pastides et al (2012)** found ultrasound (US) to be more sensitive than magnetic resonance imaging (MRI), 90% to 88% respectively. **Bignotti et al (2015)** carried out a meta-analysis using 277 studies finding 14 of value, concluding that there was little difference between MRI and US. **Xu et al** (2015) found US more sensitive and **Claassen (2014)** took a more supportive view of MRI. Given the cost, the equipment space, reliability and discomfiture of noisy environments, as with MRI, US comes out as the preferred tool. However, Mahadevan and Pastides considered that clinical tests were just as reliable as imaging but Pastides put the Mulder’s click at 98% sensitive.

Any disagreement can be forgiven as these two workers, one from Leicester, one from London had different population groups although similar cohort sizes.

## **Size of neuroma**

We are left with the fact that compression tests are better than percussion or sensory tests, but of course what is often missed is the size of the lesion. Both MRI and US can measure neuroma and it is often this element that is attractive to establish a positive diagnosis. **Mahadevan (2016)** in a later paper studied size and found some lesions could measure 10mm without discomfort giving credence to the fact that size alone is not diagnostic. Bencardino, J 2000 indicates that 33% of MRI investigations demonstrated lesions without symptoms.

It may well be that podiatrists find neuroma type presentations when undertaking their own screening where symptoms do not arise. The ovoid hypoechoic (darker area) presentation is best visualised on dynamic screening with US static views being less helpful. The positioning of the probe and patient foot also carries some variability between prone, lateral or supine. This means size may not be wholly accurate or uniform between observers.

## **Location**

Most papers that discuss neuroma will talk about the location and whether one intermetatarsal space or more are involved, or whether it is bilateral or unilateral foot presentation.

In an early podiatry case study, **Robinson et al (2003)** discussed the confusion in a foot with rheumatoid arthritis as a differential diagnosis.

**Hewitt et al (2007)** looking at reliability in the earliest British podiatry study on the subject of Morton’s neuroma using ultrasound and confirmed the higher occurrence between the 3/4th intermetatarsal space. The 3-4 space has a range 38-86% incidence, 2-3 has a range of 14-42%, so around ½ as common. When the two spaces are considered together, the incidence is around 33% and bilateral around 25% chance. The incidence of the other spaces having a true neuroma is negligible with the 1-2nd space unlikely to be affected and 4-5th space with a 4% incidence **Pastides et al (2014)**.

Taking one paper alone for epidemiological purposes leads to confounding factors and so overall meta-analysis is better in the absence of large data and is more representative of a population. Recent literature studies include **DiCaprio et al 2018** from Italy and **Valisena et al 2017** from Switzerland. An even more recent paper covering the effectiveness of non-surgical methods is worthy of review because it uses meta-analysis critically to identify the low number of randomised and controlled approaches used in studying effectiveness over a span of 180 years. The treatments that have greatest evidential value are corticosteroid injection and manipulative techniques. Ideas about ECWST, cryosurgery and radiofrequency ablation, amongst others mentioned fair less well and fail to meet the higher standards required of modern research (**Matthew et al 2019).**

## **Historical Podiatric Treatment in the UK**

The podiatrist requires knowledge, diagnosis and skills to manage the condition. These three ingredients matter and guide the plan upon our treatment protocol. When I trained in 1975-78 we had one tool, the scope was limited to a clinical pad; an insole or footwear education. Today scope is accessible to any podiatrist who wishes to extend their training. Schools are limited in providing an extension to prescription drugs and so it is important to upskill. The first podiatry steroid report suggested that <40% of patients benefitted beyond 6 months or longer after injection, [**Tollafield & Williams (1998).**](http://consultingfootpain.co.uk/wp-content/uploads/2018/08/Ref.Pod-Pr.-2018-7The-use-of-two-injectable-corticosteroid.docx) Ideally such medication should have eradicated the condition, but surgery was still required.

![](data:application/pdf;base64...)

Figure 1. Adapted from Bennet et al (1995) Clinical Timelines n=115 (lecture slide- author)

# **Case History emphasising ‘Timeline’ (methodology)**

A 54-year old male started to use orthoses for his foot discomfort. The odd twinge reminded him of Morton’s neuroma as the patient was a podiatrist himself, but he felt the symptoms were not frequent enough to warrant further attention. He acquired a pair of bespoke orthoses taken on an oasis cast bed and used these with some success. Upon purchasing a pair of cycling shoes that locked down onto the pedal with a twist, his pain grew exponentially to a point where he realised his shoes were tight. These were changed for the next size up and some improvement was noticed. By winter the symptoms went through the characteristic phases of pain under the ball, paraesthesia, crushing discomfort and surprisingly increased cramp, especially at night. Such were the symptoms he sought an ultrasound that was positive and showed a lesion >5mm. This was injected and the effect lasted as long as the local anaesthetic took to wear off. Knowing he had come to the end of his treatment plan he found a foot surgeon to undertake a dorsal approach surgery. The timeline for this whole event took from 2008-2016, estimated as a period of 7 years. ***That patient was me***.

Timelines include how long a condition has been present for, but also can be applied to the follow up after treatment. **Mahadevan et al 20162** considered the cumulative failure of corticosteroid injection over 12 months. He found little difference between US guided injections and non assisted US injections. By 6 months some 38-40% of injections had failed. This concurs with my 1996 study of 20 years earlier. By 12 months 55% of his cohort were failing to respond. The lack of difference shown suggested that perineural placement was not as important perhaps.

The point at which deformation starts, the extent of the fibrosis and the consequent enlargement of the nerve leads to symptoms

In his significant study, **Bennett et al (1995)** removed all additional conditions such as hallux valgus from his 340 cohort to end up with 115 carefully selected, pure Morton neuroma patients.

Bennet probably exemplifies best the importance of timelines and demonstrates 40% of cases reported symptoms for a period above 1 year. If the clinical evaluation is considered reliable, (Pastides 2014, Mahadevan 2015) then it is reasonable that a diagnosis can be made to initiate treatment. Of all the referrals made to me by podiatrists, majority showed positive on US and again on histological confirmation.

## **Pathogenesis**

There has been something of a critical emergence against the accuracy of the material removed from the two key interspaces and examined by histopathologists (unsubstantiated). This appears more of a subjective view seen in expert witness reports **Tollafield (2018-1)** where an orthopaedic surgeon questioned reliability. **Mallina (2016)** certainly did not go far enough to suggest histology had no value. The presence of damaged small blood vessels and

For the podiatrist, the neuroma can be better managed by conservative means than surgery

their lumen does lead to fibrosis of the myelin sheath. Scar tissue in the foot is often the exciting cause of symptoms and accounts for lack of pliability in a nerve that has to move with the remaining foot structure. Repetitive damage, direct pressure compressing the tissue causes further damage. The point at which deformation starts, the extent of the fibrosis and the consequent enlargement of the nerve leads to escalating symptoms. From the evidence shown, failure of conservative care can arise between 3-6 months.

 Structural deformity such as hallux valgus, tailor’s bunion, hammer toe deformity, footwear impingement as well as possible features associated with unstable pronation or rigid cavus will add to the problem. The predilection for the female foot attests to a greater likelihood of footwear being a prime causation. Trauma and injury through activity suggests another reason and would fit in with the case history highlighted.

# **Staged treatment**

### ***Conservative care***

The use of padding and footwear make absolute sense and Bennett used this on a selected group of 115 patients with pure neuroma symptoms, 23% had bilateral neuromata. Fifty-seven patients responded to conservative (orthotic/footwear education). Those who had had the lesion for more than a year did less well than those who had treatment within a year. Seven percent did not improve and exited the study. Forty-percent improved.

### ***Steroid***

Conservative treatment was continued for three months and then changed to an injection. A steroid injection was provided and review set once more at three months. Some 50% improved. The second cohort did well leaving 21% (24) of the original group without satisfactory benefit. Again a group of 12% exited the study not wishing for further treatment.

### ***Surgery***

A dorsal approach with excision of the neuroma was effective for all but 1 patient (4%). This gave a 96% improvement with surgery. Overall however 85% had improved with all of the staged treatment.

## **Difference in timelines**

As with conservative care and steroid, the period of time above 1 year showed less response than if treatment occurred within the 12 months. For conservative care the difference was smaller at 4%, steroid and surgery 8% exemplifying those who responded did better when treated earlier.

# **Learning (Conclusion with discussion)**

Surgery is no longer the only treatment for neuroma. Cryosurgery, injections of alcohol, ligament release and radiofrequency ablation are all performed but invasive treatment should be reserved for those whose lives are affected adversely.

The [Manchester-Oxford Foot Health Questionnaire](https://www.pascom-10.com/information-resources) is a useful reminder of the impact upon patients for three domains. Pain, social impact and walking. The MOXFQ was found to be of significant value in a legal case, **Tollafield (2018-2)** but also provided a baseline assessment of how the patient might perceive pain and the effect of the condition.

At the time of writing, no single study since Bennett has shown the effect of an intelligent use of staging treatment or evaluating the effect of each type of management with a systematic method. **Matthews, B et al 2019** points out the limits imposed when reviewing conservative – non-surgical methods due to the lack of robust evidence to include such approaches to neuroma management. This does not mean non surgical methods should be excluded provided that criteria to implement any strategy considered the length of symptoms, size of symptomatic neuroma and patient’s expectations.

 Podiatry is unique as it has the primary role of ensuring improved mobility through foot health management. ***Identifying pain, preventing tissue deterioration and improving structural deformity*** are the three tenets of podiatric treatment leading to improved mobility (Tollafield 1995, Tollafield 2005). It is clear that these principles do not exist for surgery alone.

For the podiatrist, the neuroma can be managed by conservative means than surgery. The effects of surgery, while very beneficial are by no means reliable. Some patients may be no better, some worse and others will have symptoms altered, albeit tolerated, but nonetheless unpleasant.

There is no reliable method to establish an **actual timeline,** and so we are left with **estimated timelines** based on each patient’s recollection. Signs and symptoms drive patients to seek help, but usually at a point when the level of interference reaches a point impacting on daily life.

Unlike infection, which is visible, as is delayed wound healing, pain without visual evidence makes diagnostics challenging. We have to assume that changes to the interdigital branches of the nerves have altered earlier.

Establishing the frequency of interossei spasm is perhaps overlooked as a cause of nerve compression. Until BOTOX is fully explored this use as an intervention is limited to trials. As a patient myself is still a notable problem.

**as podiatrists in general practice we should be trying to ensure promotion of awareness of this condition**

The involvement with the 2/3rd interspace was the original location for Lewis Durlacher’s work (1845). Thomas Morton (1876) wrote his paper and recorded for historical posterity the ‘affectation’ between the 3/4th. Curiously and as is often the case, anything to do with digital nerve pain now is communicated as Morton’s neuroma.

Bennett et al (1995) makes a good case for footwear and orthotic management and this does not appear to have changed. The selection of modalities should be left to those with greatest interest in orthotic management but the caveat must lie with recognising that if more than two designs fail, serious consideration must be given to the next stage i.e steroid injection.

Makki’s (2012) paper falls in line with views held by Mahadevan and Pastides about size of lesions and the benefit of steroid. Makki’s work has credibility as he used two groups of patients elevating the standard of evidence to level II (prospective). Two groups of patients one with lesions measure <5mm and those >5mm. Lesions smaller than 5mm did better.

**Podiatrists now have a golden opportunity**

Steroids fail to work as they cannot overcome the dense fibrosis surround nerve bundles, fibrinoid changes and demyelination. Some arrest of the inflammatory activity arises but cannot be sustained as the size increases with time. With early suspicion, even without symptoms, conservative treatment might offer the way forward. Avoidance of surgery is best in the hands of podiatrists with sufficient upskilling. Sadly at the time of writing it is doubtful that many students leaving their UK University today possess the full skills to offer broad management of Morton’s neuroma

Clearly as podiatrists in general practice we should be trying to improve society’s awareness of this condition. We now have evidence and can reflect on our experience to suggest that in an ideal world with early recognition fewer patients might need surgery. This would meet the aims of restoring and maintaining mobility and minimise any risk from surgery.

## **References & bibliography**

**Bennett, GL,** Graham CE, Mauldin DM. Morton’s interdigital neuroma: a comprehensive treatment protocol. Foot and Ankle International. 1995; 16:760-3

**Bencardino J,** Rosenberg ZS, Beltran J, Liu X, Marty-Delfaut E. Morton’s neuroma: is it always symptomatic? AJR Am J Roentgenol 2000;(175):649-53

**Bignotti, B,** Signori, A, Sormani, MP, Molfetta, L, Martinoli, C, Tagliofico, A. Ultrasound versus magnetic resonance imaging for Morton’s Neuroma. Eur Radiol. 2015; 25:2254-2262. doi.101007/s00330-015-3633

**Claassen, L,** Bock, K, Ettinger, M, Waizy, H, Stukenborg-Colsman, C, Plaass, C. Role of MRI in Detection of Morton’s Neuroma. Foot & Ankle Int. 2014;35(10):1002-1005

**Hewitt SM,** Kilmartin TE, O’Kane, C. A retrospective audit on the role of sonographical interpretation and localisation of intermetatarsal neuroma in the surgical management of Morton’s neuroma. British Journal of Podiatry August 2007; 10(3): 99–103

**Mahadevan, D, Venkatesan, M, Bhatt, R, Bhatia, M.** Diagnostic accuracy of clinical tests for Morton’s neuroma compared with ultrasonography. J. Foot & Ankle Surgery. 2015; 54:549-553

**Mahadevan, D1**, Salmasi, M, Whybra et al What Factors predict the need for further intervention following corticosteroid injection of Morton’s Neuroma? J Foot & Ankle Surgery. 2016; 22:9-11

**Mahadevan, D2,** Attwal, M, Bhatt, R, Bhatia, M Corticosteroid injection for Morton’s Neuroma with or without ultrasound guidance. The Bone & Joint Journal. 2016;98-B:498-503

**Makki, D,** Haddad, BZ, Mahmood, Z, Shahid, MS, Pathak, S, Garnham, I Efficacy of Corticosteroid Injection Versus Size of Plantar Interdigital Neuroma. Foot & Ankle Int. DOI:10.3113/FAI.2012.0722

**Mallina, RK, Al-Dadah, K** Is histopathological analysis of interdigital Morton’s neuroma necessary? Clinical Research 2017;10(8):520-523

**Matthews, B.G,** Hurn, SE, Harding M.P, Henry, R.A, Ware, R.S**.** The effectiveness of non-surgical interventions for common plantar digital compressive neuropathy (Morton’s neuroma): a systematic review and meta-analysis. Journal of Foot and Ankle Research 2019; 12:12 https://doi.org/10.1186/s13047-019-0320-7

**Naraghi,R,** Bremmer, A, Slack-Smith, L, Bryant, A. [Radiographic analysis of feet with and without Morton’s Neuroma](http://journals.sagepub.com/doi/10.1177/1071100716674998). Foot & Ankle International. 2017;38(3):310-317

**Pastides, P**, Ell-Sallakh, Charalambides, C Morton’s neuroma: A clinical versus radiological diagnosis. Foot and Ankle Surgery 2012; 18:22-24

**Park, EH**, Kim, YS, Lee, HJ, Koh, YG. Metatarsal shortening osteotomy for decompression of Morton’s Neuroma. Foot & Ankle International 2013;34(12):1654-1660

**Rasmussen MR**, Kitaoka HB, Patzer GL. Non-operative treatment of plantar digital neuroma with single steroid injection. Clin. Orthop Relat Res 1996;(33):722-6

**Robinson, C,** Otter, SJ, Bowen, CJ. Clinical misdiagnosis of Morton’s neuroma: a case of early rheumatoid arthritis. British Journal of Podiatry August 2003; 6(3): 85–87

**Sault, JD,** Morris MV, Jayaseelan, DJ, Emerson-Kavchak, AJ. Manual therapy in the management of a patient with a symptomatic Morton’s Neuroma: A case report 2016; 21:307-310

**Tollafield DR, Williams, HA** The Use of Two Injectable Corticosteroid Preparations used in the Management of Foot Problems – a Clinical Audit Report. Tollafield DR, Williams HA. J British Pod. Med. 1996 51(12):171-174

**Tollafield DR** The Changing Face of Consent and Patient Communication. Featuring Risk. Reflective Podiatry Practise. Busypencilcase Communications Ltd 2018:1(10-1):1-10

**Tollafield DR** Defending a case in court (Consent) Part 2. Reflective Podiatry Practise. Busypencilcase Communications Ltd 2018:1(10-2):11-20

**Tollafield DR** Surgery & the Foot in Clinical Skills in Treating the Foot in Tollafield & Merriman. Churchill Livingstone 1997; p108.

**Tollafield DR** Surgery & the Foot in Clinical Skills in Treating the Foot in Turner & Merriman. Churchill Livingstone 2005; p122.

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**Sensitivity versus specificity.** [Gregg Martin](https://www.youtube.com/watch?reload=9&v=FnJ3L-63Cf8) 3minute quick review. Terms used in many papers often express whether a disease is truly positive (sensitive) or truly negative thus excluding a disease (sensitive). E.g MRI, Ultrasound and clinical testing. Expressed as a percentage the higher value is better.

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# This article is based on a talk given to Podiatry branches in England during 2018 and a lecture to the podiatry surgeons conference 2019.

# IF you would like to have a talk on this or another related subject, please contact me - David Tollafield at

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