

Case Study: Diabetes Mellitus: Ulcer Prevention

CASE STUDY PRESENTATION by Resonance Podiatry and Gait Labs





# THE PATIENT



- 57yo female, T2DM (ddx 1996)
- Longstanding Hx plantar first MTPJ pain
- Past Medical Hx
- Hx of bilateral Achilles tendinopathy
- Hx of paraesthesia digits 3-5 right foot
- Hx heel burning right foot
- Hx of previous ulceration to the plantar IPJ of the hallux bilaterally



# THE PATIENT



#### Goals

Walk pain-free
Increase walking for exercise
Weight loss







#### **KEY EXAMINATION FINDINGS**





- Pain to palpate the medial and lateral sesamoids of both feet
- Achilles tendon midportion thickening present bilaterally

- Lateral forefoot squeeze positive for neuritis +/neuroma
- Capillary refill test 3sec bilaterally (WNL)
- DP/PT pulses slightly diminished, bilaterally

- Monofilament testing 10/10, bilaterally (WNL)
- Reflexes WNL bilaterally



#### **KEY EXAMINATION FINDINGS**



- True pes cavus foot structure
- STJ varum, forefoot in valgum
- Forefoot plantarflexed on rearfoot bilaterally

- Very plantarflexed first rays
- Retracted digits
- Limited STJ eversion



Formthotics

- Limited weightbearing ankle dorsiflexion
- Lateral instability and weak resupination
- Thoracic kyphosis, posterior pelvic tilt



#### **KEY EXAMINATION FINDINGS**



 General right side hyperloading, statically  Hyperloading 2<sup>nd</sup> and 5<sup>th</sup> MT heads, statically

 Low weightbearing surface area, statically and dynamically





Custom Medical Orthotics

## **BIOPOSTURAL ANALYSIS STATIC PRESSURE**



#### Static Footprint



- R>L general hyperload
- Peak hyperloading in R>L 5th MT head
- Hyperloading R>L 2nd MT head
- No lateral column contact at all
- Minimal to no contact of the digits
- Low weightbearing surface area bilaterally



#### BIOPOSTURAL ANALYSIS DYNAMIC PRESSURE







- No lateral column contact
- High plantar metatarsal head hyperloading
- Low weightbearing surface area
- Minimal contact of digits



Footprint Averages





Video gait analysis revealed

- Narrow base of gait
- EHL and EDL hyperactivity bilaterally throughout swing phase



Frontal plane camera view





#### Video gait analysis revealed

• Lesser digits elevated and not contacting throughout stance







## Video gait analysis revealed

 Neutral heel strike, neutral at early stance and midstance, no pronation moments, large abductory twist owing to poor ankle dorsiflexion, no windlass propulsion and low gear toe off







### Video gait analysis revealed

• No hip extension, short stride length









#### Video gait analysis revealed

• Trendelenburg at mid-stance







#### Video gait analysis revealed

- Postural sway to the right side, excessive frontal plane sway
- No arm swing



#### ANALYSIS



This patient has the following risk factors that predisposes them to future ulceration risk:

- - T2DM managed via Metformin
- - History of ulceration to the plantar aspect of the hallux, bilaterally
- - Pes cavus foot structure, retracted digits
- - Structural joint limitations and foot deformity
- Focal areas of high pressure in the forefoot both statically, and throughout walking gait
- - High BMI
- - Lack of exercise
- - Poor diet
- - Diminished dorsalis pedis and posterior tibial pulses, bilaterally
- - Mild par aesthesia onset



#### MANAGEMENT



#### **BIOMECHANICAL MANAGEMENT**

#### Customised Formthotics Footwear changes



#### **BIOMEDICAL MANAGEMENT**

Education regarding daily foot checks
Annual Diabetic Foot checks
Referral to Dietician
Education regarding regular exercise
HbA1c testing
Annual Medication review



#### **MANAGEMENT** Formthotic Modifications



**Dual Density Formthotics**- modifications including bilateral lateral posting extending from rearfoot to toes. Bilateral poron metatarsal domes. Bilateral plantar covers with winged cut outs at the first MTPJ, and the fifth MTPJ on the right foot. Additionally, a thin PPT topcover was added.

The lateral posting modification aims to shift the subtalar joint axis medially in the rearfoot, to decrease supinatory forces, it additionally aims to accommodate the forefoot valgum position and increase weightbearing surface area across the lateral column of the foot, and the lateral forefoot.

The metatarsal dome unloads aims to dorsiflex the metatarsal heads to decrease hyperloading, and evenly distribute pressure across the forefoot. The metatarsal domes aim to decrease pressure on the first metatarsal head, in addition to lateral wedging in the forefoot. Additionally, dorsiflexion of the metatarsal heads aims to reduce contracture of the extensor tendons and reduce retraction of flexible digits.

The plantar cover with the cutouts under the first and fifth MTPJs directly offload the areas of high pressure revealed on dynamic and static pressure analysis.

The PPT topcover (polypropylene thermoplastics) acts as a cushioning slow release shock absorber to also improve comfort and aid in pressure distribution.



#### MANAGEMENT



**Brooks Dyad walking shoe** is a structured neutral shoe option, ideal for stabilising the lateral column to decrease supinatory forces. It has a 12mm heel drop, to increase ground contact in the rearfoot and accommodate the pseudoequinus, and increase weightbearing ankle dorsiflexion. Additionally, the full contact outsole of the shoe increases weightbearing surface area and thus shock absorption.

"Maximum peak pressure and time of peak pressure on the foot during gait increases with peripheral neuropathy present"

"Patients with a history of previous pressure ulceration have higher maximum peak pressures"

"High plantar pressure variants in conjunction with diabetes duration, smoking, poor glycaemic control, and neuropathy are risk factor for ulceration" "Pedobarographic high pressures correlate directly to the site of ulceration, thus high plantar pressures are a useful predictor for foot ulceration in the presence of other comorbidities"



## **OUTCOME AT ONE MONTH**

- Resolved plantar first MT pain with Formthotics and Footwear
- Weightbearing on Formthotics resulted in increased lateral column loading, increased weightbearing surface area. No metatarsal head overload, better weight distribution across the forefoot





Static pressure standing on Modified Formthotics



#### **OUTCOME AT ONE YEAR**



- No ulceration to the plantar aspect of the hallux over 1 year
- Increased weight loss- down to 90kgs
- Walking- daily
- Maintained healthy HbA1c for year
- No changes in vascular status, no changes in neuropathic status, vascular and neuro testing all same as previous



#### **About Us**

# resendence<sup>®</sup>

Resonance are a team of specialist Podiatrists with an evidence-based, multidisciplinary approach to patient management.

Utilising leading edge technology, our Podiatrists manage a wide array of biomechanical injuries, functional ailments, and medical conditions.

http://www.respod.co.nz



**Custom Medical Orthotics** 

A world-recognised selection of customisable foot orthoses that give ultimate support and comfort to the patient. Formthotics<sup>™</sup> provide the clinician with a versatile tool to fit the patient's foot and shoe, assisting treatment of lower extremity problems.

http://www.formthotics.com