Gout and Foot Ulceration

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Disclosure Information

• The author has no conflicts of interest
Introduction

- Be temperate in wine, in eating, girls, & sloth; Or the Gout will seize you and plague you both”
  
  • Benjamin Franklin (1734)

- People with gout have been caricatured and laughed at throughout the centuries – even today!!!

  » but for people living with this chronic metabolic inflammatory arthritis, it is anything but funny.
Global Problem

- Nearly half of Pacific men and over one-third of Maori over 65 years of age have been identified with gout in New Zealand.

- Over 8.3 million Americans diagnosed with gout and further 43.3 million with hyperuricemia (precursor to the development of gout).

Prevalence Rates

Disease Progression

Asymptomatic Hyperuricaemia → Acute Gout → Intercritical Gout → Chronic Arthropathy/Tophaceous Gout
Pathological processes in Gout
“a metabolic disease characterised by painful inflammation of joints, especially of the big toe and foot, caused by an excess of serum uric acid $< 360$ μmol/L and deposits of urate crystals in joints and soft tissue”
Monosodium Urate Crystals

Demonstration of MSU crystals in synovial fluid or tophus aspirates permits a **definitive diagnosis of gout**

Zhang et al 2006 Ann Rheum Dis 65:1301
Impact of Tophi

• The presence of tophi impacts many aspects of patients life, including pain, restricted joint range of motion, joint deformity and complications such as ulceration [1-7]

Case Study

• A 53-year-old-Samoan male with a history of chronic gout attacks from the age of 25 years.
• He has been treated with Colchicine and Allopurinol.
• His BMI is 31 and he drinks no alcohol, but he smokes 30 cigarettes a day.
• His first tophaceous lesions appeared at around the age of 40 years old.
• In the last five years, he has had surgical interventions to his fingers, hands, forearms, elbow joints, ankles and big toe.
• Patient reported pain on walking over 3rd toe.
• Upon examination gouty tophi present on the distal interphalangeal joint.
Removal of Tophi
Case Study Summary

- The patient is fully mobile again and the lesion has not flared to date.
- Foot pain has reduced and footwear advice was accepted by the patient.
- He started smoking again after three weeks, though a limited number of cigarettes per day.
- The challenge is now to keep his serum urate levels in such a tight range that flare can be prevented.
- He has been referred back to the GP who will now take over the management of this patient.
Aim was to describe the wound and clinical characteristics of foot ulceration in people with chronic tophaceous gout
**WOUND CHARACTERISTICS**

- The TIME wound assessment tool was used to assess the clinical features of the wound.

- The wound margins were traced onto Opsite Flexigrid™ film, after debridement and the wound area was calculated.

- The wound bed was also described as epithelial, granular, sloughy or necrotic.

T— for tissue: non-viable or deficient  
I— for infection/inflammation  
M— for moisture imbalance  
E— for edge, which is not advancing or undermining.
**Foot and Ankle Assessment**

- A 10g monofilament was used to detect sensory loss.
- Data from Ankle brachial pressure index (ABPI) measurements was collected using a hand-held Doppler ultrasound to assess for lower limb arterial disease.
- A Biothesiometer was used to assess vibration thresholds.
- General pain, foot pain, foot impairment and general function were also measured.
- Footwear assessment.
Main Findings

• Six participants were predominantly older men with a long duration of gout, high rates of obesity and co-morbidities such as kidney disease, diabetes and cardiovascular disease.

• Subcutaneous tophi affecting the 1MTPJ were observed in most participants.

• High-to-moderate scores of foot pain, foot disability and impairment were observed.

• Most participants wore shoes deemed as inadequate due to poor control, cushioning and support, which included Crocs, slippers and flip-flops.
# Cardiff Scale – Quality of Life

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Life</td>
<td>61 (24)</td>
</tr>
<tr>
<td>Well-being</td>
<td>73 (15)</td>
</tr>
<tr>
<td>Physical Symptoms and Daily Living</td>
<td>66 (29)</td>
</tr>
</tbody>
</table>

0 = poor quality of life; 100 = excellent quality of life

Price P, Harding K: 2004; Int Wound J 1: 10-17
Wound Characteristics

- The mean duration of wounds was 4 months.
- All participants presented with ulceration or previous ulceration of at least one toe.
- In 5 of the 6 cases the dorsal aspect of the 3\textsuperscript{rd} distal interphalangeal joint was ulcerated or had previously been ulcerated.
- Gouty tophi were evident in most of the wounds.
Multiple, small areas of ulceration appear to be typical of gouty arthritis, particularly chronic tophaceous polyarticular gout, although larger single areas of ulceration have also been observed.
**DISCUSSION**

- Previous single case studies have reported foot ulceration over the 1MTPJ. Our study observed ulceration of the 1MTPJ in one case and ulceration of the apex and dorsal aspect of the distal interphalangeal joint of 3rd toe in four cases.

- Why the predominance of the 3rd toe: possible due to biomechanical factors relating to toe-off.
Peak Pressure beneath the hallux:

Control: 264 KpA
Gout: 143 KpA

(p = 0.004)
Discussion

• The majority of patients had high rates of Type 2 diabetes with peripheral arterial disease and diagnosed cardiovascular disease. These underlying co-morbidities may impede wound healing and increase the risk of infection.

• We found that foot pain scores were moderate. The findings suggest that foot-related pain may be a constant feature in patients with chronic foot ulceration.
Limitations

• The study was limited due to the sample size and study design.
• Biomechanical factors were not assessed such as foot function and it is possible that abnormal biomechanical loading may have contributed to the delays in wound healing.
• It was not always possible to determine whether the wounds assessed in this study were progressing, deteriorating or static.
Take Home Messages

• Ulcerative tophaceous gouty lesions are not common but can cause foot pain, impairment and disability.

• Ulceration over tophi in patients with gout can be conservatively treated but there remains a challenge to clinicians due to risk factors that may prevent adequate wound healing.
Acknowledgements

• The podiatry and rheumatology team at Counties Manukau District Health Board, Auckland
Thank You
Are ultrasound features at the first metatarsophalangeal joint associated with clinically-assessed pain and function?

A study of people with gout, asymptomatic hyperuricaemia and normouricaemia

Sarah Stewart, N. Dalbeth, A. C. Vandal, B. Allen, R. Miranda, & K. Rome
Background: gout & hyperuricaemia

Hyperuricaemia

MSU crystal formation & deposition

Inflammatory response → painful flares of acute arthritis

Asymptomatic Hyperuricaemia

Symptomatic Gout
Background: the 1MTP

• Most common joint affected

• Meta-analysis: 73% of patients with gout experience acute arthritis at the 1MTP [1]

[1] Stewart S. BMC Musculoskelet Disord 2016;17:69
Background: ultrasonography

• Visualisation of soft tissue, bone & urate crystals

Double contour sign

Tophus

Power Doppler signal
Background: 1MTP ultrasonography

- People with **gout** demonstrate 1MTP urate deposition, inflammation and erosion in the absence of current flares [1]

- People with **asymptomatic hyperuricaemia** demonstrate 1MTP urate deposition [1]

Background: 1MTP clinical characteristics

• People with **gout** demonstrate [1-2]:
  - 1MTP pain
  - increased 1MTP temperature
  - reduced 1MTP ROM
  - greater hallux valgus severity
  - reduced 1MTP muscle strength
  - slow, apropulsive, antalgic gait strategies

• People **asymptomatic hyperuricemia** also report high levels of foot & lower limb related pain and impairment [1]

Aim

To determine the association between ultrasound features and clinically-assessed pain and function of the 1MTP in people with gout, asymptomatic hyperuricaemia and normouricaemic individuals.
Methods: study design

- Cross-sectional observational study
- \( N = 86 \rightarrow 3 \) age- and sex-matched groups

![Diagram](image_url)

- Gout [1]
  - \( n = 23 \)

- Serum urate testing
  - \( \geq 0.41 \text{ mmol/l} \)
    - Asymptomatic hyperuricaemia
      - \( n = 29 \)
  - \( < 0.41 \text{ mmol/l} \)
    - Normouricaemia
      - \( n = 34 \)

Methods: participants

• Inclusion criteria
  - > 20 years old
  - No other inflammatory arthritis
  - No recent foot/ankle surgery or injury
  - No current flare (gout participants)

• Ethical approval obtained (AUTEC 13/100 & ADHB A+5891)

• Written informed consent was gained from all participants
Methods: ultrasound image acquisition

• Single experienced blinded musculoskeletal radiologist

• Bilateral 1MTPs

• Dorsal, medial, plantar aspects

• Transverse & longitudinal planes

• B-mode grey scale and power Doppler
Methods: ultrasound image interpretation

- Two blinded musculoskeletal radiologists
- Reviewed static images
  - Double contour sign
  - Tophus
  - Erosion
  - Synovitis
- Inter-reader reliability: moderate to excellent [1]
Methods: pain and function

- 1MTP Pain
- Foot pain and disability
- 1MTP temperature
- 1MTP dorsiflexion ROM
- Gait velocity
Methods: statistical analysis

• Differences in clinical characteristics between participants with ultrasound features present vs. those with ultrasound features absent

• Linear mixed-models regression
  • Fixed effects: sonographic feature, interaction effect between sonographic feature & diagnostic group
  • Random effects: repeated measures from right and left feet

• Bonferroni-adjusted significance level of 1%
## Results: participants

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Gout</th>
<th>Asymptomatic hyperuricemia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>34</td>
<td>23</td>
<td>29</td>
</tr>
<tr>
<td>Gender, male, n (%)</td>
<td>34 (100)</td>
<td>23 (100)</td>
<td>29 (100)</td>
</tr>
<tr>
<td>Age, years, mean (SD)</td>
<td>58 (14)</td>
<td>58 (14)</td>
<td>58 (19)</td>
</tr>
<tr>
<td>Ethnicity, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>30 (88)</td>
<td>14 (61)</td>
<td>24 (83)</td>
</tr>
<tr>
<td>Māori</td>
<td>1 (3)</td>
<td>1 (4)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Pacific</td>
<td>0 (0)</td>
<td>4 (17)</td>
<td>3 (10)</td>
</tr>
<tr>
<td>Asian</td>
<td>3 (9)</td>
<td>4 (17)</td>
<td>2 (7)</td>
</tr>
<tr>
<td>BMI, kg/m², mean (SD)</td>
<td>0.32 (0.06)</td>
<td>0.35 (0.10)*</td>
<td>0.46 (0.05)*</td>
</tr>
<tr>
<td>Serum urate, mmol/l, mean (SD)</td>
<td>5.4 (1.0)</td>
<td>5.9 (1.7)</td>
<td>7.7 (0.8)*</td>
</tr>
</tbody>
</table>

* significantly different from controls ($P < 0.05$)
## Results: gout participants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystal-proven gout, n (%)</td>
<td>6 (26%)</td>
</tr>
<tr>
<td>Disease duration, years, mean (SD)</td>
<td>18 (11)</td>
</tr>
<tr>
<td>Acute flare in preceding 3 months, n (%)</td>
<td>15 (63%)</td>
</tr>
<tr>
<td>1MTP flares in preceding 3 months, n (%)</td>
<td>6 (26%)</td>
</tr>
<tr>
<td>History of 1MTP flares, n (%)</td>
<td>19 (83%)</td>
</tr>
<tr>
<td>Presence of subcutaneous tophi, n (%)</td>
<td>17 (74%)</td>
</tr>
<tr>
<td>Presence of 1MTP tophi, n (%)</td>
<td>6 (26%)</td>
</tr>
<tr>
<td>Urate lowering therapy, n (%)</td>
<td>22 (96%)</td>
</tr>
</tbody>
</table>
## Results: ultrasound

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Gout</th>
<th>Asymptomatic hyperuricemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MTP double contour sign</td>
<td>9 (13%)</td>
<td>17 (37%)</td>
<td>21 (36%)</td>
</tr>
<tr>
<td>1MTP tophus</td>
<td>0 (0%)</td>
<td>6 (13%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>1MTP erosion</td>
<td>2 (3%)</td>
<td>15 (33%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>1MTP synovitis</td>
<td>5 (7%)</td>
<td>20 (44%)</td>
<td>2 (3%)</td>
</tr>
</tbody>
</table>
## Results: pain and function

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Gout</th>
<th>Asymptomatic hyperuricemia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MTP pain VAS, mm</td>
<td>1.6 (4.0)</td>
<td>8.5 (15.6)</td>
<td>6.9 (15.1)</td>
</tr>
<tr>
<td>MFPDI</td>
<td>1.8 (6.0)</td>
<td>13.4 (10.8)</td>
<td>3.4 (4.8)</td>
</tr>
<tr>
<td>1MTP ROM °</td>
<td>77.6 (17.4)</td>
<td>59.0 (19.6)</td>
<td>76.5 (16.9)</td>
</tr>
<tr>
<td>1MTP temperature, °C</td>
<td>25.3 (2.1)</td>
<td>27.4 (2.8)</td>
<td>26.1 (2.2)</td>
</tr>
<tr>
<td>Gait velocity, m/s</td>
<td>1.05 (0.19)</td>
<td>0.88 (0.17)</td>
<td>1.05 (0.24)</td>
</tr>
</tbody>
</table>
Results: 1MTP double contour sign

<table>
<thead>
<tr>
<th></th>
<th>Present</th>
<th>Absent</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MTP pain VAS, mm</td>
<td>3.4</td>
<td>7.0</td>
<td>0.12</td>
</tr>
<tr>
<td>MFPDI</td>
<td>10.1</td>
<td>4.8</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>1MTP range of motion, °</td>
<td>68.8</td>
<td>72.2</td>
<td>0.40</td>
</tr>
<tr>
<td>1MTP temperature, °C</td>
<td>26.8</td>
<td>26.0</td>
<td>0.018</td>
</tr>
<tr>
<td>Walking velocity, m/s</td>
<td>1.02</td>
<td>1.00</td>
<td>0.52</td>
</tr>
</tbody>
</table>

*significantly different (P < 0.01)
## Results: 1MTP tophus

<table>
<thead>
<tr>
<th></th>
<th>Present</th>
<th>Absent</th>
<th>(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MTP Pain VAS, mm</td>
<td>2.4</td>
<td>6.0</td>
<td>0.50</td>
</tr>
<tr>
<td>MFPDI</td>
<td>19.8</td>
<td>5.9</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>1MTP range of motion, °</td>
<td>55.1</td>
<td>71.2</td>
<td>0.021</td>
</tr>
<tr>
<td>1MTP temperature, °C</td>
<td>28.6</td>
<td>26.2</td>
<td>0.005*</td>
</tr>
<tr>
<td>Walking velocity, m/s</td>
<td>0.88</td>
<td>1.00</td>
<td>0.001*</td>
</tr>
</tbody>
</table>

*significantly different (\(P < 0.01\))
Results: 1MTP erosion

<table>
<thead>
<tr>
<th></th>
<th>Present</th>
<th>Absent</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MTP pain VAS, mm</td>
<td>3.1</td>
<td>6.3</td>
<td>0.49</td>
</tr>
<tr>
<td>MFPDI</td>
<td>6.6</td>
<td>5.6</td>
<td>0.75</td>
</tr>
<tr>
<td>1MTP range of motion, °</td>
<td>66.2</td>
<td>71.2</td>
<td>0.32</td>
</tr>
<tr>
<td>1MTP temperature, °C</td>
<td>25.1</td>
<td>26.2</td>
<td>0.040</td>
</tr>
<tr>
<td>Walking velocity, m/s</td>
<td>0.95</td>
<td>1.00</td>
<td>0.53</td>
</tr>
</tbody>
</table>
Results: 1MTP synovitis

<table>
<thead>
<tr>
<th></th>
<th>Present</th>
<th>Absent</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1MTP pain VAS, mm</td>
<td>5.7</td>
<td>5.7</td>
<td>0.99</td>
</tr>
<tr>
<td>MFPDI</td>
<td>8.4</td>
<td>5.8</td>
<td>0.21</td>
</tr>
<tr>
<td>1MTP range of motion, °</td>
<td>66.3</td>
<td>71</td>
<td>0.20</td>
</tr>
<tr>
<td>1MTP temperature, °C</td>
<td>26.8</td>
<td>26.2</td>
<td>0.13</td>
</tr>
<tr>
<td>Walking velocity, m/s</td>
<td>0.94</td>
<td>1.01</td>
<td>0.29</td>
</tr>
</tbody>
</table>
Discussion

• 1MTP urate deposition, rather than soft tissue inflammation or bone erosion, is associated with foot pain and disability

• 1MTP tophaceous disease → chronic persistent joint inflammation → temperature increases

• Reduced walking speed in those with 1MTP tophus may be secondary to an inability to achieve efficient sagittal plane motion
Future directions

• Further exploration of directional relationship between sonographic and clinical findings
  • Identification of clinical factors which lead to urate deposition/symptomatic gout → early intervention → improved outcomes

Conclusion

Are ultrasound features at the first metatarsophalangeal joint associated with clinically-assessed pain and function? A study of people with gout, asymptomatic hyperuricaemia and normouricaemia

Sarah Stewart1*, Nicola Dallbeth2,3, Alain C. Vandal4,5, Bruce Allen6, Rhian Miranda7 and Keith Rome1
Thank you.
Foot and ankle characteristics associated with falls in people with rheumatoid arthritis: a prospective longitudinal study

Angela Brenton-Rule, Nicola Dalbeth, Hylton B. Menz, Sandra Bassett, Keith Rome.
Disclosures

• This study was funded by the Health Research Council of New Zealand (13/012) and Arthritis New Zealand (R212).

• The authors declare that there are no commercial relationships or conflicts of interest to disclose in relation to this presentation.
Background: Falls in older adults

• Falls represent an important burden to healthcare resources worldwide.  

• 30% over 65 years and 50% over 85 years fall each year.

• Loss of confidence and independence, as a consequence of falling, can significantly reduce quality of life.

• Treatment of fall related injuries accounts for a significant portion of healthcare spending and falls prevention is a major healthcare focus in developed countries.

1. Lamb J Am Geriatri Soc 2005
Background: Falls in RA

- Fall risk is increased in people with rheumatoid arthritis \(^1\)

- Previous studies reported falls incidence ranging from 10-50\% \(^2,3\)

- Fall risk factors common to older people have been identified in adults with RA \(^4\)

  - History of a previous fall
  - Fear of falling
  - Impaired general health
  - Co-morbid conditions
  - Fatigue and dizziness
  - Psychotropics

Background: Falls in RA

- RA disease-specific fall risk factors have also been reported
  - Activity limitation
  - Tender & swollen joint count
  - 28 joint disease activity score
  - Increasing number of medications
  - Corticosteroids
  - Decreased lower extremity muscle strength
  - Impaired standing balance

Background: The foot in RA

• Foot problems are common in people with RA

• Many people report foot symptoms at initial diagnosis \(^1\)

• Up to 100% of people with established RA experience foot problems at some stage \(^2\)

• People with RA have decreased postural stability resulting in difficulty maintaining postural control \(^3\)

Aim

• Studies in non-RA populations identified foot and ankle characteristics associated with falls in older adults \(^1-3\)

• The aim was to determine whether foot and ankle characteristics are associated with falls in people with RA
  
  ▶ Compare RA fallers and non-fallers on a range of clinical and foot and ankle characteristics
  
  ▶ Identify clinical and foot and ankle characteristics that are independent predictors of falls

Methods: Baseline measures

• Adults recruited with RA according to 2010 ACR/EULAR classification criteria

• RA characteristics, common fall risk factors and foot and ankle variables measured at baseline

• Participants followed for 12 months to record falls occurrence using monthly falls calendars and telephone calls

• ProFaNE definition of, “an event that results in a person coming to rest unintentionally on the ground or other lower level” used to identify falls

1. Lamb J Am Geriatri Soc 2005
Methods: Baseline foot and ankle assessments

- Deformity
- Joint swelling and tenderness
- Sensation
- Muscle strength
- Range of motion
- Gait speed
- Plantar pressures
- Postural stability
- Foot pain
- Self-reported foot impairment
Methods: Statistical analysis

• Participants were grouped as fallers or non-fallers based on falls reported during the 12-month follow-up

• Univariate parametric (t tests) and non-parametric (Chi-square tests, Mann-Whitney U tests) analysis compared fallers and non-fallers on baseline variables to determine significant differences

• Logistic regression analysis identified baseline variables which were independent predictors of falls over the 12-month follow-up period

• All tests were two tailed and p<0.05 was considered statistically significant
Results: Falls

• 201 participants completed baseline assessment

• 196 (98%) completed follow-up to 12 months

• 84 (42%) reported ≥1 falls

• 39 (19%) reported ≥2 falls
## Results: Participant characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>65 (11)</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>150 (75)</td>
</tr>
<tr>
<td>European, n (%)</td>
<td>161 (80)</td>
</tr>
<tr>
<td>Disease duration, mean (SD)</td>
<td>16 (14)</td>
</tr>
<tr>
<td>Non-biologic DMARDs, n (%)</td>
<td>175 (87)</td>
</tr>
<tr>
<td>Biologics, n (%)</td>
<td>33 (16)</td>
</tr>
<tr>
<td>Psychotropic medication, n (%)</td>
<td>37 (18)</td>
</tr>
<tr>
<td>Tender joint count, mean (SD)</td>
<td>11 (12)</td>
</tr>
<tr>
<td>Swollen joint count, mean (SD)</td>
<td>5 (7)</td>
</tr>
<tr>
<td>Presence of any foot problem, n (%)</td>
<td>170 (85)</td>
</tr>
<tr>
<td>Presence of foot or ankle tender joints, n (%)</td>
<td>125 (63)</td>
</tr>
<tr>
<td>Uses an assistive device, n (%)</td>
<td>57 (28)</td>
</tr>
<tr>
<td>History of ≥1 fall, n (%)</td>
<td>119 (59)</td>
</tr>
</tbody>
</table>
## Results: Univariate analysis

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>Non-fallers n=116</th>
<th>Fallers n=84</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of medications, mean (SD)</td>
<td>3.8 (2.1)</td>
<td>4.5 (2.3)</td>
<td>0.039</td>
</tr>
<tr>
<td>Psychotropic medications, n (%)</td>
<td>15 (13)</td>
<td>22 (26)</td>
<td>0.028</td>
</tr>
<tr>
<td>Tender joint count, mean (SD)</td>
<td>9 (11)</td>
<td>14 (14)</td>
<td>0.005</td>
</tr>
<tr>
<td>Uses an assistive device, n (%)</td>
<td>24 (21)</td>
<td>33 (39)</td>
<td>0.007</td>
</tr>
<tr>
<td>History ≥1 falls in preceding 12 months, n (%)</td>
<td>59 (51)</td>
<td>59 (70)</td>
<td>0.009</td>
</tr>
</tbody>
</table>

### Foot and ankle features

| Presence foot or ankle tender joints, n (%)            | 65 (56)           | 60 (72)      | 0.028   |
| Eyes-closed anteroposterior postural sway, mm, mean (SD)| 27.7 (10.6)       | 31.8 (15.5)  | 0.040   |
| Eyes-closed mediolateral postural sway, mm, mean (SD)  | 16.1 (7.6)        | 19.2 (11.9)  | 0.042   |
Results: Logistic regression analysis

- Backwards stepwise logistic regression comparing non-fallers and fallers on all predictor variables, except 12-month fall history, and controlling for age

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio (95% confidence interval)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychotropic medications</td>
<td>2.35 (1.11 - 4.95)</td>
<td>0.025</td>
</tr>
<tr>
<td>Presence of foot or ankle tender joints</td>
<td>1.95 (1.05 - 3.62)</td>
<td>0.034</td>
</tr>
</tbody>
</table>

Variables included in the logistic regression model:

- age
- opiates
- assistive device
- foot or ankle tender joints
- cardiovascular disease
- number of medications
- fear of falling (FES-I)
- psychotropic medications
- patient self-reported pain
- eyes-closed AP sway
- foot or ankle swollen joints
Discussion: Differences between fallers and non-fallers in univariate analysis

• Number of medications
  - Polypharmacy is common in RA and associated with increasing age, RA disease duration and increasing number of co-morbid conditions

• Tender joint count
  - More active disease may reflect increased risk of falls

• Use of an assistive device
  - May reflect increased level of walking disability and increased fear of falling

• Increased postural sway (eyes-closed)
  - Deficits in afferent sensory information
  - Added challenge of maintaining postural control in absence of visual stimuli may increase fall risk in some people with RA
Discussion: Independent predictors of falls

• Psychotropic medication
  - Psychotropics can be used as an adjunct therapy to manage pain and associated depression
  - Psychotropics are associated with falls in older adults

• Presence of tender joints in the foot or ankle
  - Tenderness in the feet may indicate synovitis
  - Synovitis in the feet may be undetected in a clinical setting where DAS-28 is used to monitor disease activity
  - Foot tenderness may also be indicative of abnormal mechanical loading on deformed and prominent joints
Strengths and limitations

• Strengths
  - Large sample size compared to previous RA falls studies
  - Comprehensive range of validated foot and ankle measures including patient-reported outcome measures
  - Attainment of falls data in accordance with ProFaNE consensus guidelines

• Limitations
  - Recruitment strategy may have attracted people with a history of falling
  - Dynamic balance not assessed
Summary

- Fall risk factors in people with RA include those common to older adults and RA disease-specific risk factors.

- Psychotropic medications and tender foot and ankle joints are independent predictors of falls in people with RA.

- Clinical assessment of synovitis in the feet and review of psychotropic medications may be of benefit when considering falls prevention in people with RA.
Acknowledgments

Thank you to:

• The participants who took part in the study

• The rheumatology clinicians who assisted with recruitment

• Arthritis New Zealand and the Health Research Council of New Zealand for research funding and support
CENTRE OF PRESSURE CHARACTERISTICS DURING WALKING IN INDIVIDUALS WITH AND WITHOUT 1ST MTPJ OSTEOARTHRITIS

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ACKNOWLEDGEMENTS

A/Prof Shannon Munteanu  Maria Auhl  Jade Tan  Dr Andrew Buldt

Australian Government
National Health and Medical Research Council
• osteoarthritis of the 1st MTPJ is a common and disabling condition
• affects 7.8% of people aged over 50 years
• risk factors
  – ↑ age
  – female sex
  – manual occupations
  – structural variations of 1st metatarsal / phalanx
• significant impact on health-related quality of life

3. Arthritis Care Res 2012;64:1691
Characteristic features:

- pain and stiffness
- dorsal exostosis
- swelling and erythema
- crepitus
- hard-end feel
- limited 1st MTPJ dorsiflexion
BACKGROUND
Normal

1st MTPJ OA
Centre of pressure (CoP)

- also known as the ‘gait line’
- first described in 1939

1. Arbeitsphysiologie 1939
Centre of pressure (CoP)

• also known as the ‘gait line’
• first described in 1939\(^1\)
• can be determined with plantar pressure systems
• global measure of the load-bearing function of the foot
• may provide useful insights into impaired propulsion associated with 1\(^{st}\) MTPJ OA
Objectives

• to compare CoP characteristics in people with and without 1st MTPJ OA

• to determine whether CoP characteristics are associated with 1st MTPJ dorsiflexion range of motion
Participants

- **20 people with 1st MTPJ OA**
  - pain on most days, ≥ 12 weeks
  - pain at least 20 mm on 100 mm visual scale
  - pain on palpation of 1st MTPJ
  - < 65 degrees of 1st MTPJ dorsiflexion
  - confirmed with x-ray

- **20 controls**
  - asymptomatic
  - matched for age and sex
  - ≥ 65 degrees of 1st MTPJ dorsiflexion
Gait analysis

- Novel emed®-x400
- 6,080 sensors
- 4 sensors/cm²
- 5 trials
- normal walking speed
- two-step protocol
- 2 key parameters

CoP velocity  L-M force index
Data analysis

• stance phase divided into 4 periods
  – loading, midstance, terminal stance an
  – average and maximum values

• differences in CoP characteristics be
  – general linear model
  – adjusting for walking speed
  – effect size (Cohen’s d)

• association between CoP and 1st MTPJ DF ROM
  – Pearson’s r correlation coefficient
## Participant characteristics

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>1st MTPJ OA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age - years</td>
<td>60.7 (8.9)</td>
<td>59.1 (9.6)</td>
</tr>
<tr>
<td>Female - n (%)</td>
<td>10 (50)</td>
<td>10 (50)</td>
</tr>
<tr>
<td>Height - cm</td>
<td>168.0 (8.7)</td>
<td>166.0 (8.5)</td>
</tr>
<tr>
<td>Weight - kg</td>
<td>83.6 (14.1)</td>
<td>82.8 (14.9)</td>
</tr>
<tr>
<td>BMI - kg/m²</td>
<td>29.6 (4.6)</td>
<td>29.8 (4.1)</td>
</tr>
<tr>
<td>Foot posture index</td>
<td>2.4 (2.9)</td>
<td>3.3 (2.4)</td>
</tr>
<tr>
<td>1st MTPJ DF ROM</td>
<td>74.9 (10.4)</td>
<td>34.6 (11.5)*</td>
</tr>
</tbody>
</table>
During preswing, individuals with 1st MTPJ OA have:

- slower maximum CoP velocity \((p=0.003, \ d=1.13)\)
- higher average lateral-medial force index \((p<0.001, \ d=1.36)\)
- higher maximum lateral-medial force index \((p=0.008, \ d=0.98)\)

1st MTPJ dorsiflexion range of motion associated with:

- maximum CoP velocity \((r=-0.538, \ p<0.001)\)
- average lateral-medial force index \((r=-0.443, \ p=0.004)\)
DISCUSSION

• Joint preservation (cheilectomy)
  - ↑ 1st MTPJ ROM\(^1\)
  - ↑ ankle plantarflexor moment\(^2\)
  - *medial* shift in forefoot pressures

• Joint fusion (arthrodesis)
  - ↓ 1st MTPJ ROM
  - ↓ ankle plantarflexor moment\(^3\)
  - *lateral* shift in forefoot pressures\(^4\)

1. Foot Ankle Int 2008;29:265
2. Foot Ankle Int. 2012;33:457
3. Foot Ankle Int. 2002;23:496
4. Foot Ankle Int. 2017;38:181
Strengths

• well-defined and matched case and control groups
• radiographic confirmation of OA
• novel gait parameters

Limitations

• no kinematic data
• only vertical force measured (not shear)
• barefoot measurements
CONCLUSIONS

- 1st MTPJ OA is associated with altered CoP velocity and lateral-medial force distribution
- these changes are correlated with 1st MTPJ DF ROM
- provides plausible explanation for impaired propulsion associated with the condition
- these parameters may be useful therapeutic targets for mechanical interventions
THANK YOU

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Clinical effectiveness and cost effectiveness of foot orthoses in people with established rheumatoid arthritis: an exploratory clinical trial

Keith Rome, H. Clark, J. Gray, P. Meekin, M Plant, & J. Dixon
Disclosure Information

• The author has no conflicts of interest
Presentation overview

1. Background
2. Methods
3. Results
4. Conclusions
• Rheumatoid arthritis (RA) can lead to rapid development of joint damage and significant long term disability.

• Prevalence of foot problems is between 50-90% with studies reporting moderate to severe foot pain, producing a significant clinical challenge and a public health priority.

• Clinically effective management of foot pain and prevention of foot deformity are the chief goals of intervention for people with RA.

• Non-pharmacological interventions that include foot orthoses and footwear can reduce pain and disability and improve long-term outcomes with existing and potential foot problems.
Evidence on the effectiveness of foot orthoses in RA

• Previous studies have reported on the clinical effectiveness of foot orthoses in people with established RA, ranging from simple insoles to customised foot orthoses.

• However, data relating to cost-effectiveness of the use of foot orthoses for people with RA is limited [1-3]

Aim

• The aim of this study was to evaluate the clinical and cost effectiveness of custom-made foot orthoses compared to simple insoles when prescribed for people with established RA.
Research Design

• Single-blinded, exploratory randomised controlled clinical trial conducted over 16 weeks with participants randomly assigned to two intervention arms: custom-made foot orthoses (CMFO) or simple insoles (SI).

• Following the CONSORT statement participants were recruited from a rheumatology outpatients department in the North-East of England, UK.

• Participants were eligible if they were over 18 years old, history of foot pain, ability to walk 5m, not been or currently prescribed foot orthoses and a diagnosis of RA according to the 2010 ACR/EULAR revised criteria.
Foot orthoses
Procedure

• A neutral suspension plaster of Paris cast was taken of participants’ feet to enable provision of the CMFO.

• Participants’ footwear was evaluated to ensure it was suitable to accommodate either type of foot orthoses. A template was taken to determine shoe size.

• To record weekly wear time and adverse events, which occurred during the 16-week study period, participants were issued with a self-reporting diary at the baseline study visit.
Clinical and cost-effectiveness analysis

• Foot Function Index was used to evaluate the clinical effectiveness [1]

• Cost-utility analysis used the results from the EQ-5D to generate a health-related quality of life utility score at baseline and 16 week follow-up, which was used to estimate change across the two groups.

• Incremental cost per quality-adjusted life year (QALY) was calculated.

QALY (quality adjusted life year)

• Commonly used to measure the cost effectiveness of health interventions [1]

• Number of years of life added by a successful treatment or adjustment for quality of life.

• Each year in perfect health is assigned a value of 1 down to a value of 0 for death.

Estimation of costs

• Clinician Costs
  • Total podiatrists time
  • Total costs to the National Health Service (podiatrists time plus intervention costs)

• Patient Costs
  • Total costs of equipment purchased
  • Total costs of journeys
  • Total costs to participants

Total costs to the National Health Service (NHS) and participants that included the rate of inflation (3.5%) over data collection period
Data Analysis

• Descriptive statistics and inferential statistics using ANCOVA were used to assess the impact of the two different foot orthosis interventions on participants scores across the time periods of the trial.

• Differences between and within arms were presented as mean difference with 90%CI.

• QALYS – linear regression analysis.
Results

• 122 potential participants were identified and 41 were randomised.
• Majority of participants were females (n=28, 68%) with a mean (SD) age of 62 (10) years and a mean (SD) disease duration of 14 (9) years.
• All participants were receiving NSAIDS (n=36, 88%) and DMARDS (n=37, 90%).
• At baseline, 20 participants received the CMFO and 21 participants received the SI.
• At 16 weeks, 75% (n=15) of participants in the CMFO-arm and 66% (n=14) participants in the SI-arm completed the study.
• Twelve participants (29%) withdrew over the course of the study.
Results: clinical effectiveness

- There was no difference between the two arms in wearing times over the 16 weeks (p=0.60).
- The pain score reduced significantly in both intervention arms (p=0.000).
- The treatment effect of the intervention at 16 weeks was not significant between the two arms (p=0.14).
- The reduction in foot disability score was significant in the CMFO arm (p<0.000), but not in the SI arm (p=0.40).
Results: Cost-effectiveness ($1.75 = 1£)

• No significant effect of the intervention on QALYs was found between the two arms (p=0.46).

• The amount of time spent for podiatric staff was similar for both interventions at baseline and follow-up time.

• Across the two-arms of the trial, the only significant difference in costs was that the CFMO being more expensive than the SI with a mean difference of £8.53.

• The mean health gain, expressed as a difference in mean QALYs between interventions over the 16 week follow-up period, was -0.03 and the difference in mean cost to the NHS was £8.90.

• From either costing perspective (NHS alone or NHS & patient), the CFMO was both more expensive and less effective than the SI.
Discussion

• NICE have suggested that interventions delivering a cost per QALY of under £20,000 are likely to be an acceptable use of NHS resources.

• The current findings support the concept that FOs for people with established RA delivers a cost-effective intervention and is dominant.

• The cost per QALY gain results would suggest that the average cost per QALY gain is less than the NICE threshold and is therefore, an acceptable use of NHS resources.
Limitations

- Sample size was poor and limited its generalisability.
  - Exclusion criteria too tight?
  - Loss of participants (29%) due to illness, surgery, adverse events of new biologics being introduced and loss of patients

- 16 weeks limits the impact on QALYS.
Strengths and Future Directions

• Exploratory trial was novel as it has undertaken the cost effectiveness evaluation of the use of customised foot orthoses and simple insoles in people with established RA

• A technology appraisal of foot orthoses has also not yet been undertaken and although both interventions are likely to both deliver a cost per QALY of under £20,000 this finding does indicate that further research is necessary to support the prescription of foot orthoses in this cohort of patients as being both cost and clinically effective.

• Future work should also include evaluating people’s acceptability of foot orthoses (willingness to pay) and their personal preferences.
Clinical effectiveness and cost-effectiveness of foot orthoses for people with established rheumatoid arthritis: an exploratory clinical trial

K Rome, H Clark, J Gray, P McMeekin, M Plant & J Dixon
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