



# Orthotic Medico Legal Report

Prepared for the Court by

Mr Martin Middleton  
HCPC Registered Orthotist

RE: Mr Joe Bloggs

Commissioned by:

Xx Solicitors

Yy Solicitors

Date of report – 01/01/01

IN ? COUNTY COURT

Claim Number: 123456

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**Orthotic Report of Mr Martin Middleton**  
**Dated: 01/01/01**

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Claimant: Mr Joe Bloggs  
Date of birth: 01/01/01  
Claimants address: 1 street lane  
Address line 2  
Address line 3  
Post code  
  
Date of accident: 02/02/02  
  
Location of examination: Claimant's home address  
Date and duration of Examination: 03/03/03; 2 hours  
  
Middleton Medicolegal Ref: MM/J.BLOGGS/123456

On the joint instructions of:  
Solicitor 1 representing the Claimant Ref:  
Solicitor 2 representing the Defendant Ref:

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## **1. Introduction**

### **1.1 The Author**

I am Mr Martin Middleton; my specialist field is Orthotics. I hold a BSc (Hons) degree in Prosthetics and Orthotics and have been practising as an Orthotist since 2003. I am currently registered with the Health and Care Professions Council; I am a member of the British Association of Prosthetists and Orthotists and I hold an Expert Witness Certificate from Bond Solon/Cardiff University. I have extensive clinical experience in orthopaedic and neurological conditions having held a long-term post at the Royal National Orthopaedic Hospital NHS trust in addition to consultant appointments at several other independent neuro-rehabilitation facilities. Full details of my qualifications and experience entitling me to give expert opinion evidence are in Appendix B.

### **1.2 Technical terms and explanations**

I have indicated any technical terms in **bold type** and defined these terms in a glossary in Appendix C.

### **1.3 Summary of conclusions**

This report has shown that in my professional opinion, orthotic treatment can play an essential role in this case. Mr Bloggs presents with an acutely painful foot/ankle which greatly limits his ability to mobilise. The key examination findings include:

- There is a consistent strand of factors which demonstrate that the pain is primarily associated with dorsiflexion strain at the end of range position. **Inversion** and **eversion** strain is also painful.
- The ankle joint was unable to dorsiflex past 90° and any attempt to do so elicited acute pain.
- Walking function is greatly compromised. Mr Bloggs employs gait deviations consistent with avoidance of the painful end of range position of dorsiflexion; he externally rotates the leg and avoids normal mid-late stance phase progression.
- The current ankle brace is insufficient to normalise gait or achieve significant pain relief.

In my opinion orthotic treatment has the potential to significantly improve Mr Bloggs's mobility level. The focus of orthotic treatment is in the prevention of end of range ankle pain and the most comprehensive manner to achieve this goal is to use a carbon fibre **AFO** designed to immobilise the ankle/foot joints. Due to the alignment of the ankle it is a requirement to implement a slightly increased pitch in order to optimise the gait pattern. Finally, I recommend a rocker sole footwear adaption to further minimise the resistance to forward progression. In the event that Mr Bloggs undergoes successful pantalar arthrodesis I expect that the AFO will no longer be required but continuation of pitch/rocker sole footwear adaptations and foot orthoses would be beneficial.

## **2. The issues to be addressed and a statement of instructions**

I received joint instructions requesting that I use my expertise in Orthotics to provide a medical legal report detailing the current and future Orthotic requirements for Mr Bloggs. In addition, it is appropriate to consider associated topics including the relevant pre-accident medical history; the Claimant's present condition; the extent and duration of any continuing disability arising from the injuries sustained; any potential deterioration in the Claimant's condition in the future and the consequence of surgical treatment; any further investigation or treatment considered appropriate.

## **3. Investigation of the facts**

### **3.1 Documents supplied by instructing party**

#### 1. Expert evidence, Claimant

- a) Report of Mr x, Consultant Trauma & Orthopaedic Surgeon, dated xxxx.
- b) Supplementary reports of Mr x dated xxx
- c) Report of Dr x, Consultant Psychiatrist, dated xxx.

#### 2. Expert evidence, Defendant

- a) Report of Mr x, Consultant Orthopaedic Surgeon, xxx.

b) Supplementary letters/reports of Mr x dated xxx

3. Witness statements

a) Witness statements of the Claimant dated xxx

b) Witness statement of the x dated xxx.

4. Correspondence of treating orthopaedic surgeon, Mr x

a) Letters from Orthopaedic Clinic to x dated xxx,

b) Clinic notes prepared by Mr x dated xxx.

**3.2 Accident details and subsequent events**

3.2.1 I understand that Mr Bloggs was injured during the course of his employment as a x on xxx. He is reported to have been carrying a scaffolding pole whilst descending a grass embankment when he slipped and fell, twisting the left ankle. He was in severe pain and was unable to stand. An ambulance attended the scene and conveyed him to the Accident and Emergency department of x Hospital and later to x Hospital for surgery. He underwent examination and was diagnosed with a fracture dislocation of the left ankle.

3.2.2 The injury was treated by open reduction and internal fixation but Mr Bloggs suffered ongoing pain and mobility restriction. In November 2014 an ankle fusion operation was undertaken. Unfortunately this too has been unsuccessful in resolving the symptoms and even after Exogen bone growth stimulation, a CT scan in November 2015 shows that there is no bony bridging across the ankle. A comprehensive resume of Mr Bloggs's injuries and subsequent medical intervention is presented in the expert orthopaedic reports of Mr x and Mr x and will therefore not be reiterated here.

### **3.3 Excerpts from the medical evidence relevant to orthotic opinion**

Supplementary report of Mr x dated 07/03/2016:

#### **3.3.1 Page 2-3, paragraph 5:**

*“Based on the results of this I do not think that isolated revision fusion of the ankle joint will obliterate his pain, he would still have significant pain from the talonavicular and subtalar joints. Pantalar arthrodesis would be very likely to significantly alleviate his pain, but it is quite a major undertaking. Having spoken to Mr Bloggs today, this is not an undertaking he wishes to consider at present, but if things do deteriorate in the future, he would consider it.”*

### **4. Interview of Mr Bloggs**

#### **4.1 Pre and post-accident lifestyle**

Occupation:

4.1.1 Mr Bloggs tells me that at the time of the accident he was employed on a full time basis as a scaffolder, a profession he had been in for ~20 years. This is understandably described as a manual occupation which requires a substantial level of strength and agility. Mr Bloggs reports that he did not have any physical issues completing his duties prior to the index accident.

4.1.2 Mr Bloggs returned to work 3 months after the accident on full time hours but with reduced duties. He suffered with pain and swelling around the ankle and found he was physically exhausted after work. He would need to rest with his leg up when possible. Following surgery in November 2014 Mr Bloggs has not been able to return to work, citing that he feels physically incapable of conducting his duties.

#### **4.1.3 Socio-recreational activities:**

Mr Bloggs tells me that he enjoyed an active family and sporting lifestyle engaging in a variety of pursuits prior to the index accident. All of his preferred activities have been negatively affected

including the following:

- **Fitness training:** Prior to the accident Mr Bloggs would complete cardiovascular exercise 3 times per week; including running, rowing and use of an elliptical trainer. This has completely ceased.
- **Motocross:** Prior to the accident he would ride a motocross bike and compete in amateur races on a regular basis. This has completely ceased.
- **Rugby:** Prior to the accident he would play recreational games of rugby and generally socialise at the local x x rugby club. Rugby and social attendance to the club has ceased.
- **Family activities:** Mr Bloggs finds that his ability to fully interact with his family and young children in a physical manner has been compromised. For example, he was unable to teach them how to ride a bicycle and cannot play football.

#### Activities in the home:

4.1.4 Mr Bloggs states that he is limited in the home environment and highlighted the following activities:

- **DIY and decorating:** Prior to the accident he would have undertaken the majority of domestic DIY and decorating duties. He has largely ceased these activities and has required professional help.
- **Cooking:** He was previously the lead cook in the family and would enjoy preparing meals. It is now difficult to stand for more than 5-10 minutes so cooking is challenging. He does use a high stool which is of assistance.

4.1.5 Driving ability has been compromised. Mr Bloggs reports that clutch use results in intolerable ankle pain and therefore he avoids driving. He is reliant on his partner and therefore feels less independent. He is hopeful that in the future, with an automatic vehicle, he will be able to re-establish this acidity. As a passenger he is able to tolerate prolonged periods but likes to have space to keep the ankle mobilised.

## 4.2 Mobility and function

In this section, I will detail the issues identified by Mr Bloggs in relation to his current level of mobility and function.

4.2.1 Mr Bloggs states that his mobility has been greatly reduced by the accident injuries and currently he feels at a plateau in terms of function. He does not use a walking stick but wears a supportive ankle brace consistently which offers a modest degree of help; the following description of function is taken with the use of this brace. Walking tolerance is limited to 15-20 minutes of continuous but slow paced walking. He is aware of an awkward limp and he employs external rotation of the limb to decrease strain at the ankle. Pain increases with time walking until it becomes intolerable and he will need to sit and rest with the foot elevated for up to 30 minutes before restarting. On the whole Mr Bloggs avoids walking when possible and he has utilised a mobility scooter for extended periods out in town. The primary limiting factors to mobility, in order of severity, are described to be:

### 4.2.2 Primary Complaint: Left foot/ankle pain

Mr Bloggs describes a severe, constant pain, encompassing the whole ankle region and spanning underneath the **medial** arch. This is felt to be a skeletal type of pain as though the joints “need to click”. Pain is variable depending on the direction of strain. Pain intensity increases with time spent standing/walking. When standing he will offload the foot, transferring his weight through the right leg instead. Changes in gradient and camber further aggravate symptoms and can trigger a shooting pain. Using the **visual analogue scale** (where 0 denotes no pain and 10 the worst pain imaginable) Mr Bloggs selected a pain score of 5 at rest, increasing to 7 on average, and 10 at the limit of his walking tolerance. Pain is managed with activity reduction, analgesic medication and to a minor extent footwear selection. This pain also disturbs sleep.

#### 4.2.3 Secondary issue: Left hip discomfort

When lying down a dull aching pain is experienced in the hip region and when walking there is an audible click. This is only an occasional occurrence which Mr Bloggs states is “nothing major” but he feels that it may be associated with his abnormal gait pattern.

4.2.4 **Footwear** selection can have a minor effect on ankle pain. Mr Bloggs has identified that the usual 1cm pitch (heel elevation) of footwear provides him with some additional ankle freedom. He wears trainers most commonly but can also wear casual boot styles; both accommodate the additional volume of the current ankle brace. He has not thoroughly trialed formal footwear styles because this is not his usual preference in any event.

4.2.5 **Stairs** are reported to be very difficult and are avoided where possible in favour of lifts. If he needs to tackle them he will employ a catch-up gait pattern holding the banister for support. He takes care to only load the heel of the injured foot to minimise pain and this involves turning sideways when ascending.

## 5. **Orthotic Treatment History**

Mr Bloggs reports that he has not received any formal orthotic treatment. He has however been exposed to 2 types of orthosis:

- i. **Aircast boot:** A rigid post-operative boot was provided following surgery but was also found to be of benefit in general mobility. Mr Bloggs found that this device immobilised the ankle and offered protection. It was however very cumbersome.
- ii. **Ankle braces:** Following the recommendation of Mr Goodier, Mr Bloggs sourced 2 types of ankle brace. He has been wearing the preferred ankle brace for 3 months now and finds that it gives him some increased confidence, stability and a minor degree of pain relief. The benefit of this orthosis is that he can wear it with his normal footwear.

## **6. Clinical Examination**

I conducted a physical examination of Mr Bloggs with particular focus on his lower limbs non-weight bearing, standing and whilst walking. My Findings are presented in this section.

### **6.1 Skin appearance**

Both lower limbs present with normal skin colouration. Examination of the soles of the feet finds no excessive callus formation. At the left ankle there is minor oedema and the following scars were identified:

- A 9.5cm vertical line on the **anterior**.
- A 12.5cm vertical line on the **lateral** side.
- 3.5cm and 4.5cm vertical lines on the medial side.

### **6.2 Static stance alignment**

When standing Mr Bloggs adopts an asymmetrical posture as a result of habitual avoidance of left lower limb pressure; weight bearing distribution is estimated to be 70:30 (Fig.1). The left leg is positioned anteriorly and in external rotation with minimal pressure taken through the forefoot. The upper body leans to the right side. Leg length was examined and found to be equal.

### **6.3 Balance**

Mr Bloggs was able to stand individually on his right leg with normal balance; he was unable to stand on the left leg due to pain.

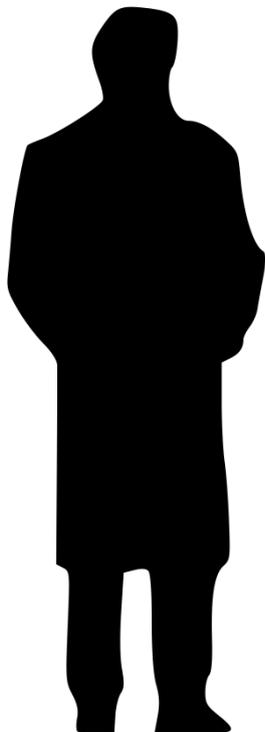


Fig.1



Fig.2

#### 6.4 Foot alignment and function

When weight bearing both feet show normal, symmetrical alignment with neutral hindfoot, defined medial arches and neutral forefoot alignment (Fig.2). Foot function tests were performed:

- **Supination resistance test:**
  - Right side –low resistance.
  - Left side – low resistance.
- **Hurbscher Manoeuvre:**
  - Right –normal function.
  - Left – normal function.
- **Single heel raise test:**
  - Right – achieved, normal function.
  - Left – failed due to pain.

#### 6.5 Range of Motion

Range of motion was examined for both lower limbs using passive stretches and compared against the expected norm as presented in Appendix D, Diagram 4.

	Movement	Right	Left
Hip joint	Flexion	full	90° discomfort
	Extension	full	full
	Abduction	full	full
	Adduction	full	full
	Medial Rotation	10°	10°
	Lateral Rotation	75°	75°
Knee joint	Flexion	full	full
	Extension	full	full
Ankle joint	Dorsiflexion	full	0° PAIN
	Plantarflexion	full	10° PAIN
Subtalar joint	Inversion	full	20% PAIN
	Eversion	full	20% PAIN
Midtarsal joint	Inversion	full	30% PAIN
	Eversion	full	30% PAIN
1 <sup>st</sup> MTPJ	Extension	full	full

In summary these measurements demonstrate that Mr Bloggs has a major restriction at the left foot/ankle complex in all directions and pressure at the end of range position elicits severe pain. See Fig.3&4 for the maximally dorsiflexed and plantar flexed position available. There was a minor restriction at the left hip with discomfort elicited at the 90° position.



Fig.3



Fig.4

## 6.6 Muscle Power

Muscle power was assessed using the Modified Medical Research Council Scale (Appendix C) in which 0 denotes no muscle contraction and grade 5 denotes full power. Mr Bloggs scored:

	Movement	Right	Left
Hip joint	Flexion	5	4+
	Extension	5	4+
	Abduction	5	4+
	Adduction	5	4+
Knee joint	Flexion	5	4+
	Extension	5	4+
Ankle joint	Dorsiflexion	5	4
	Plantarflexion	5	4
	Inversion	5	n/a
	Eversion	5	n/a

In summary these grades demonstrate that the muscles of Mr Bloggs's left hip, knee and ankle are slightly weak in comparison to the expected normal functional state. Testing of left ankle dorsiflexion and plantarflexion triggered pain. Testing of inversion and eversion power was not possible due to limited range of motion.

## 6.7 Lower Limb Proportions

6.7.1 Standard anatomical measurements which directly relate to footwear fitting were recorded to document any disparity in proportions of the feet/ankles which may be attributable to the index accident. In this case I believe that the measurements show that the dimensions of the feet remain within normal parameters but in comparison to each other, on the left, the forefoot is smaller in circumference whereas the hindfoot and ankle are larger.

	Right	Left
Foot length	9UK	9UK
Forefoot width	104mm	102mm
Forefoot circumference	27.5cm	26.8cm
Waist circumference	26cm	25.5cm
Instep circumference	28cm	27.3cm
Short Heel circumference	35cm	36cm
Ankle circumference	26cm	30cm

6.7.2 Mr Bloggs presents with signs of muscular atrophy in the left lower limb; circumference measurements were recorded to document this asymmetry:

	Right	Left
Calf circumference	39.5cm	38cm

### 6.8 Lower Extremity Functional Scale (LEFS)

The Lower Extremity Functional Scale (LEFS) is a questionnaire containing 20 questions about a person's ability to perform everyday tasks. The LEFS can be used by clinicians as a measure of patients' initial function, ongoing progress and outcome, as well as to set functional goals. The LEFS can be used to evaluate the functional impairment of a patient with a disorder of one or both lower extremities. It can be used to monitor the patient over time and to evaluate the effectiveness of an intervention. The lower the percentage score (0-100) the greater the disability. A copy of Mr Bloggs's questionnaire can be found on Appendix E, **he scored: 22.5%**

## 7. Gait Analysis

Mr Bloggs was examined walking in the home environment today. He walked barefoot and with his current ankle brace so that an accurate picture could be captured of the current state. A diagram showing the phases of gait can be found in appendix D, diagram 2.

### 7.1 Barefoot:

In general terms I believe that Mr Bloggs demonstrated a tentative, **antalgic** walking gait characterised by reduced pace and step length. I observed that he showed signs of pain. He has adopted a gait pattern which reduces dorsiflexion strain on the left ankle, characterised by premature offloading in mid to late stance phase and an absence of a true push off; he deliberately externally rotates the leg by 50° and rolls over the medial aspect of the foot. Right side swing phase is shortened in order to permit premature reloading of the right foot before any substantial pressure is borne

through the forefoot. The upper body sways laterally with each stride.

7.2 Gait with ankle brace:

Gait is essentially consistent with the barefoot state. Although the ankle brace design offers moderate inversion/eversion stability it does not offer any control of plantarflexion/dorsiflexion. As a result, the inability to pressurise the forefoot persists and Mr Scott continues to employ the same gait deviations.

**8. Findings and Orthotic opinion**

Following my examination of Mr Bloggs, and reading the related documentation, I make the following observations.

8.1 I am of the opinion that the physical issues detailed in this report are consistent with the diagnosis and injuries sustained by Mr Bloggs and will now be similar for the foreseeable future; I also expect the orthotic prescription to remain consistent. Should Mr Bloggs undergo arthrodesis in the future I would expect that orthotic treatment will be required but to a lesser extent.

**Scenario 1: Continuation of the current state or failure of pantalar arthrodesis**

8.2 The treatment Mr Bloggs has received, that falls within my area of expertise namely orthotics, has been of a basic standard. I believe that improvements in function and comfort can be achieved by implementing an orthotic prescription which will accurately tackle the current functional issues.

**8.3 Issue 1: Painful and restricted ankle joint**

Mr Bloggs reports that the primary limiting factor to mobility is severe ankle pain, specifically at the end or range position of dorsiflexion. Inversion and eversion motions are also acutely painful. On examination I found that there is a major restriction of joint range of motion in all directions and

strain at the end of range positions triggers pain. The most impactful loss of function in terms of walking is the inability to pressurise the forefoot and cope with dorsiflexion strain. The observed gait deviations are all expected consequences of this issue and the reported effects of footwear pitch and walking on inclines are also to be expected and are consistent with my assessment of the biomechanical state.

#### 8.4 **Orthotic prescription: Custom made carbon fibre AFO**

I recommend that the whole foot and ankle region is shielded from the pain inducing strain with the use of a rigid ankle foot orthosis (AFO). This type of device effectively transmits dorsiflexion strain from the forefoot, through the device, to the anterior proximal tibial region and will also immobilise the subtalar and midtarsal joints. This bypasses the injured structures and commonly achieves a marked reduction in pain. This orthosis has the potential to improve mobility tolerance and gait to a substantial degree. It should become possible for Mr Bloggs to rotate the limb back to a neutral position and progress forward over the foot with a symmetrical stride. For Mr Bloggs this will be a slightly plantar flexed alignment and as such a compensatory pitch alteration will be required to compensate for this and re-establish normal gait kinematics.

8.5 I recommend that Mr Bloggs is supplied with 2 custom made carbon fibre AFOs so that continuity of wear can be achieved during periods of refurbishment or in the event of failure. I expect that 1 new AFO will be required every 2.5 years to keep pace with general degradation. A half-life refurbishment allowance is also required. See Appendix A for a costing schedule.

#### 8.6 **Associated Orthotic component 1: Pitch alteration**

I have presented above that the ankle requires an increased pitch height (which will be in the region of 15mm) in order to minimise pain and to place the rest of the limb in a function alignment for standing and gait. This pitch height must be implemented along with the AFO in order to reinstate a

neutral heel strike and normal stance phase progression. The preferred footwear of Mr Bloggs has a 10mm pitch height as standard and therefore a further minor heel elevation needs to be applied by way of internal and/or external heel raise. It will be necessary to complete a contralateral raise in order to maintain equal leg length.

#### **8.7 Associated Orthotic component 2: Rocker sole adaption**

When locking the ankle in a rigid alignment there is additional resistance to forward progression in the latter portion of stance phase. I recommend that this is addressed with the use of a rocker sole footwear adaption. The function of a rocker sole is to facilitate mid to late stance progression by mimicking absent joint motion. This orthosis will yield a benefit when combined with the AFO and pitch orthoses. I believe that 3 pairs of footwear adaptations per year will be sufficient to deliver the recommended pitch and rocker adaptations to appropriate shop bought footwear.

#### **8.8 Footwear considerations:**

I have presented measurements of the feet in paragraph 4.4.1 which demonstrate that the ankle region of the injured foot is larger than the contralateral side. However, Mr Bloggs is able to wear a selection of his preferred style of footwear with the current ankle brace without significant issues. The recommended AFO will take up some space inside footwear, but this will not be any more than the current brace and therefore I do not believe that bespoke footwear is expressly indicated. It is correct to state that Mr Bloggs will be somewhat restricted in his selection of formal styles but if he takes a practical approach to brand selection and is guided by an Orthotist he will be able to source a suitable selection of styles from the shops to cover all social and professional needs.

#### **8.9 Barefoot option:**

The carbon AFO is the only method which has the potential to substantially advance mobility but it needs to be worn with footwear to function. I recommend that for indoors use Mr Bloggs could

continue with an ankle brace, of a similar style to the current orthosis. This will offer some stability and confidence and is better than nothing when indoors without shoes on. 1 new ankle brace per year should be sufficient to keep pace with a regular wearing regime.

#### 8.10 **Prognosis:**

I believe that the recommended orthoses hold the potential to substantially increase Mr Bloggs's gait performance and mobility tolerance. With a protected foot/ankle region pain will be noticeably reduced and he will be able to utilise the injured limb to a greater extent. The AFO will minimise painful strain in a variety of environments, including uneven terrain and changes in gradient and therefore he should enjoy more freedom in his recreational lifestyle. The orthoses will not aid to the extent that he will be able to engage in high impact activities such as running, but he should for example feel more able to walk at a higher pace with a neutral alignment for longer, cycle at a moderate intensity and stand for longer periods of time. I do not believe that this orthosis will facilitate a return to his scaffolding profession. He should be more comfortably able to complete moderate pushing activities such as mowing the lawn. The orthoses will not help him crouch or kneel down because the ankle will still be held in a restricted position.

#### **Scenario 2: Orthotic prescription in the event of successful pantalar arthrodesis**

8.11 It has been presented in the medical evidence that there is a probability of an arthrodesis in the future. Following successful arthrodesis, orthotic treatment, on the balance of probability, will still be required but to a lesser extent. Assuming that the joints are set in a functional alignment and pain is reduced in terms of dorsiflexion, inversion and eversion strain, the AFO will no longer be required. However, it is common that minor pitch alterations and rocker sole footwear adaptations remain relevant and necessary to optimise function in the stance phase of gait. In my experience it is also sometimes necessary to utilise foot orthoses in order to accommodate any fixed inversion/eversion alignment and to stabilise the remaining foot joints which may be placed under increased strain due

to the fusion. I have presented a post-operative costing schedule in Appendix A.

Range of opinion

8.12 A case of this type is likely to have some variance in opinion but it would be expected that the primary issues and the related objectives as set out above would remain consistent and present. I would expect a range of opinion for the following points:

1. **Custom carbon fibre AFO prescription:** This prescription is not commonplace in the UK but is slowly coming to the forefront in the private sector due to the benefits. Some orthotic experts may therefore not be familiar with this technology and continue to recommend a plastic AFO. In my opinion there are clear benefits to the carbon construction method. The strength to weight ratio far exceeds plastic and therefore more lightweight, rigid, aesthetically acceptable and functionally superior orthoses can be produced. Some Orthotists may not even recommend an AFO, simply recommending ankle braces, but in my opinion that would not advance Mr Bloggs's mobility level or reduce his pain by a worthwhile degree.
2. **Footwear prescription:** It is worthwhile considering the effect that AFO use will have on footwear selection due to the additional volume to be accommodated. An orthotic footwear prescription would be regularly seen in combination with a bulky plastic AFO and may even be present in combination with a carbon fibre AFO. In my opinion, the combination of the minimal volume of a carbon AFO and the slightly smaller left forefoot proportions (paragraph 4.4.1) will permit a wide range of footwear to be selected from the shops.
3. **Costing and replacement cycles:** It is normal to see variance in the exact cost and replacement timescales of an orthosis. This is an expected range of opinion due to the subjective nature of the orthotic lifespan which is built on a reasoning of patient weight, mobility level and environment set against the proposed construction methods of the orthoses. In my opinion the costs presented in Appendix A are a fair representation of the industry norms.

## **9. Summary of conclusions**

This report has shown that in my professional opinion, orthotic treatment can play an essential role in this case. Mr Bloggs presents with an acutely painful foot/ankle which greatly limits his ability to mobilise. The key examination findings include:

- There is a consistent strand of factors which demonstrate that the pain is primarily associated with dorsiflexion strain at the end of range position. Inversion and eversion strain is also painful.
- The ankle joint was unable to dorsiflex past 90° and any attempt to do so elicited acute pain.
- Walking function is greatly compromised. Mr Bloggs employs gait deviations consistent with avoidance of the painful end of range position of dorsiflexion; he externally rotates the leg and avoids normal mid-late stance phase progression.
- The current ankle brace is insufficient to normalise gait or achieve significant pain relief.

In my opinion orthotic treatment has the potential to significantly improve Mr Bloggs's mobility level. The focus of orthotic treatment is in the prevention of end of range ankle pain and the most comprehensive manner to achieve this goal is to use a carbon fibre AFO designed to immobilise the ankle/foot joints. Due to the alignment of the ankle it is a requirement to implement a slightly increased pitch in order to optimise the gait pattern. Finally, I recommend a rocker sole footwear adaption to further minimise the resistance to forward progression. In the event that Mr Bloggs undergoes successful pantalar arthrodesis I expect that the AFO will no longer be required but continuation of pitch/rocker sole footwear adaptations and foot orthoses would be beneficial.

## **10. Experts declaration and statement of truth**

- I understand my duty as an expert witness is to the court. I have complied with that duty and will continue to comply with it. This report includes all matters relevant to the issues on which my expert evidence is given. I have given details in this report of any matters which might affect

the validity of this report. I have addressed this report to the court. I further understand that my duty to the court overrides any obligation to the party from whom I received instructions.

- I confirm that I am aware of the requirements of Part 35 and Practice Direction 35, and the Guidance for the Instruction of Experts in Civil Claims 2014.
- I confirm that I have made clear which facts and matters referred to in this report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer.
- I confirm that I have no conflict of interest of any kind, other than any which I have already set out in this report. I do not consider that any interest which I have disclosed affects my suitability to give expert evidence on any issue on which I have given evidence and I will advise the party by whom I am instructed if, between the date of this report and the trial, there are any change in circumstances which affects this statement.



**Mr. Martin Middleton**  
**HCPC Registered Orthotist**

## Appendix A

### Orthotic costing schedule

The costs provided below are based on a review of a selected number of private orthotic clinic's current fees. When a custom or generic orthosis is sourced via a 3<sup>rd</sup> party manufacturer the trade price is marked up by 50%. Any product references are as far as possible generic. Products that are referenced are mainly to give an example of what type of orthosis is required and should not be taken as an endorsement of that product unless stated. On occasion, a specific product may be referenced if there are limited options available to fulfil the clinical objective.

Costs for the orthoses exclude VAT. VAT is not normally payable if the equipment is intended for personal use and a VAT exemption certificate is signed by the client. Paramedical services such as physiotherapy are exempt from VAT. No travel or accommodation is included.

#### Scenario 1: Current state

Quantity	Recommended Orthosis/Service	Cost (£)	Replacement Interval (years)	Annualised Cost (£)
2.5	Clinical Time (per hour)	180	1	450
1	Carbon AFO and maintenance	1300	1	1300
3	Footwear adaptations (raise/pitch/rocker)	120	1	360
1	Ankle Brace	110	1	110
			<b>TOTAL</b>	<b>2220</b>

**Note:** Initial provision would include a spare AFO at a fee of £1300



Internal raise



External raise



Rocker sole



AFO

Foot orthosis

**Scenario 2; Post successful arthodesis prescription:**

Quantity	Recommended Orthosis/Service	Cost (£)	Replacement Interval (years)	Annualised Cost (£)
2	Clinical Time (per hour)	180	1	360
1	Custom foot orthoses	220	1	220
4	Footwear adaptations (rocker/pitch)	120	1	480
			<b>TOTAL</b>	<b>1060</b>



Foot orthosis

## Appendix B

### CV

## Martin G. Middleton

BSc (Hons), HCPC, MBAPO, MEWI

#### Qualifications, accreditation and professional memberships:

- BSc(Hons) Prosthetics and Orthotics, University of Strathclyde, 1999-2003
- Expert Witness Certificate, Bond Solon, Cardiff University 2012
- Vetted member of the Expert Witness Institute
- Registered member of the Health and Care Professions Council
- Member of the British Association of Prosthetists and Orthotists

#### Past and present positions:

##### **2015-Present, Middleton Medico-Legal, Nationwide**

###### Consultant Orthotist and Expert Witness

I established a nationwide expert witness service providing impartial, objectively reasoned and evidence based Orthotic reports. I conduct 50+ cases per year with an approximate split of 65% Claimant: 35% Defendant: 5% Joint. An orthotic clinical service is centred in the Hertfordshire region working with orthopaedic and neuro-rehabilitation consultants.

- [www.middletonmedicolegal.com](http://www.middletonmedicolegal.com)

##### **2008-Present, Pace Rehabilitation Ltd, Cheshire & Buckinghamshire**

###### Consultant Orthotist and Expert Witness

I was approached by Pace Rehabilitation, a leading UK Prosthetic rehabilitation service and Rehab Provider of the Year award winner 2010, and asked to provide a consultant Orthotic service centred on Expert Witness practice. With this organisation, I have worked alongside Paralympic athletes and the Walking With The Wounded charity preparing for their polar expeditions.

- [www.pacerehab.com](http://www.pacerehab.com)

##### **2003-2016, Royal National Orthopaedic Hospital, London**

###### Band 7 Specialist Orthotist

The Royal National Orthopaedic Hospital is an internationally recognised centre of excellence where I practised extensively in the fields of complex foot/ankle conditions, spinal deformity, spinal cord injury, brachial plexus injury and traumatic limb reconstruction. My further professional responsibilities included:

- Clinical lead in the orthotic management of neuro-muscular and idiopathic scoliosis
- Clinical and developmental lead in the field of Brachial Plexus injury
- Specialist in foot and ankle conditions
- Training of final year orthotic students and mentoring of junior staff

##### **2007-2013, HCA Healthcare: The Wellington Hospital and London Bridge Hospital, London**

###### Consultant Orthotist

The Wellington Hospital was a particular highlight due to the opportunity to deliver orthotic care within the largest private neuro-rehabilitation facility in the UK. Client groups were primarily stroke victims and traumatic brain injury who required extensive physiotherapy and gait re-education. This exemplary service also utilised cutting edge assistive technology equipment, including the Lokomat and Armeo systems.

### **2007-Present, North West London NHS Trust**

#### **Consultant Orthotist**

I provide a consultation service for the orthotic management of spinal cord injuries primarily in cases of Myeloma and TB. I am responsible for the guidelines and patient pathway for efficient application of custom-made spinal orthoses for the preservation of spinal cord integrity and facilitation of safe mobility.

### **August 2006, Hope Rehabilitation Society, Lahore, Pakistan**

I was approached by the leading organisation for orthotic and prosthetic provision in Pakistan to take on the task of improving the standard of orthotic treatment, especially scoliosis management. I provided education on a wide variety of modern orthotic techniques and also prepared detailed clinical and manufacture manuals. I implemented a range of multi-purpose AFOs and foot orthoses.

#### **Teaching, publications and presentations:**

- Orthotic tutor at the Basic Sciences in Orthopaedics Course for FRCS (T&O) exam preparation, British Orthopaedic Association and Royal National Orthopaedic Hospital, annually since 2012
- Orthotic tutor at the British Casting Certificate course, British Orthopaedic Association and Royal National Orthopaedic Hospital, annually since 2010
- Contributor to Brachial Plexus Rehabilitation chapter of "Surgical Disorders of the Peripheral Nerves" book by Professor R. Birch
- Article: "Cosmetic calf shaping for AFO case study", BAPO journal 2004
- Article: "Developments in Brachial Plexus management" BAPO journal 2004
- Article: "Pre-Preg KAFO design case study", BAPO journal 2005
- Article: "Composite materials, further development in Brachial Plexus management" BAPO journal 2013
- Article: "Development of dynamic elbow flexion orthosis," LinkedIn, direct to patient group and online distribution 2015
- Presentation: "Developments in Brachial Plexus Management", Australian Hand Therapy Association National Conference, Perth, Australia, 2004
- Presentation: "Orthotic Treatment Modalities", Pace Rehabilitation conference 2008
- Presentation: "Principles and applications of ankle foot orthoses", HCA Healthcare, Wellington Hospital, 2009
- Presentation: "Post-polio syndrome; gait and treatment", Royal National Orthopaedic Hospital, 2012
- Presentation: "Orthotic technology", Pace rehabilitation conference, 2015.

#### **Further training:**

- KT2 Advanced Kinesio Taping qualification
- British Weight Lifting Association: Level 1 Instructor qualification
- NCTEPO: AFO management in children with Cerebral Palsy
- NCTEPO: Stance control KAFO
- NCTEPO: Adult Foot Problems
- NCTEPO: Orthotic Management of the Diabetic Foot
- Body Type Nutrition Seminar
- Flaccid Foot Gait Seminar

## Appendix C

### Glossary of technical terms

**Abduction:** The movement of a limb away from the midline or axis of the body.

**Adduction:** The movement of a limb toward the midline or axis of the body.

**Ankle-foot orthosis (abbreviated: AFO)** is a brace, usually plastic or carbon fibre, worn on the lower leg and foot to support the ankle, hold the foot and ankle in the correct alignment.

**Antalgic gait:** An antalgic gait is a gait that develops as a way to avoid pain while walking. It is a form of gait abnormality where the stance phase of gait is abnormally shortened relative to the swing phase. It can be a good indication of pain with weight-bearing.

**Anterior:** The front aspect of the body.

**Clonus:** muscular spasm involving repeated often rhythmic, contractions.

**Distal:** The part of the body segment furthest from the centre of the body.

**Dorsiflexion:** The turning of the foot or the toes upward.

**Dorsum [of the foot]:** The upper surface.

**Equinus:** a condition in which the upward bending motion of the ankle joint is limited. Someone with equinus lacks the flexibility to bring the top of the foot toward the front of the leg.

**EVA:** Ethylene vinyl acetate is the copolymer of ethylene and vinyl acetate. This is a dense foam type material which is available in varying densities.

**Eversion:** The movement of being turned outward.

**External shoe raise:** The raise is built into the sole of the shoe by splitting the sole in half and inserting the required amount of material. This method ensures that the shoe fitting is not compromised but cosmetically there is a compromise as the raise is not hidden.

**Hallux:** The 1<sup>st</sup>/big toe.

**Hurbscher Manoeuvre:** Also known as the "Jack test," can determine function of the windlass mechanism, which will be severely compromised by ligament disruption in the adult-acquired flatfoot. The examiner passively dorsiflexes the hallux and looks for movement transfer of supination of the hindfoot as well as external rotation of the tibia. In comparison to Stage I flatfoot, a Stage II deformity will lack tension in the plantar aponeurosis and connecting ligaments of the first ray, and no movement transfer will occur.

**Internal heel raise:** A simple and discrete piece of dense material which is placed inside the shoe under the heel. Typically 1cm is the maximum height that can be contained within securely fastening footwear (lace or Velcro) without compromising shoe fit and ankle stability.

**Inversion:** The movement of being turned inwards.

**Lateral:** Structures distant from the midline of the body

**Laxity [of ligaments]:** Ligamentous laxity, or ligament laxity, is a term given to describe loose ligaments.

**Medial:** Structures near the midline of the body.

**Plantarflexion:** A toe-down motion of the foot at the ankle. It is measured in degrees from the 0-degree position of the foot at rest.

**Pronation:** The lowering or descending of the inner edge of the foot by turning the entire foot outwards.

**Single heel raise test:** The patient is asked to stand on her affected leg only and then plantar flex the ankle such that she will rise up onto her toes. A normal result would be to observe full plantarflexion with inversion of the heel.

**Shoe pitch:** The difference in sole depth between the heel and the forefoot of the shoe.

**Subluxation:** A partial dislocation of the joint.

**Supination:** Inversion of the foot associated with internal rotation and increased arch height.

**Supination resistance test:** The test is performed by placing two fingers plantar to the talonavicular joint and applying a force in an upward direction. The amount of force needed to supinate the foot is estimated.

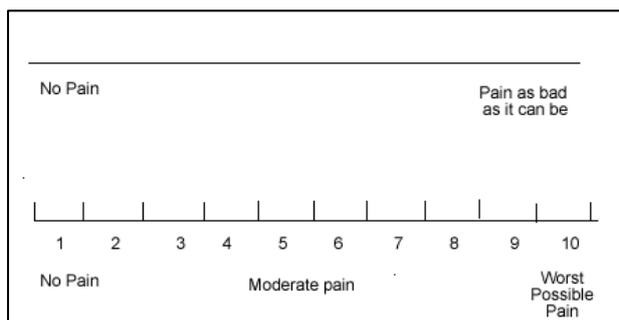


Diagram 1: Visual Analog pain scale

Grade	Definition
5	Normal strength
5-	Barely detectable weakness
4+	Same as grade 4, but muscle holds the joint against moderate to maximal resistance
4	Muscle holds the joint against a combination of gravity and moderate resistance
4-	Same as grade 4, but muscle holds the joint only against minimal resistance
3+	Muscle moves the joint fully against gravity and is capable of transient resistance, but collapses abruptly
3	Muscle cannot hold the joint against resistance, but moves the joint fully against gravity
3-	Muscle moves the joint against gravity, but not through full mechanical range of motion
2	Muscle moves the joint when gravity is eliminated
1	A flicker of movement is seen or felt in the muscle
0	No movement

Diagram 2: Muscle Power Modified Medical Research Council Scale

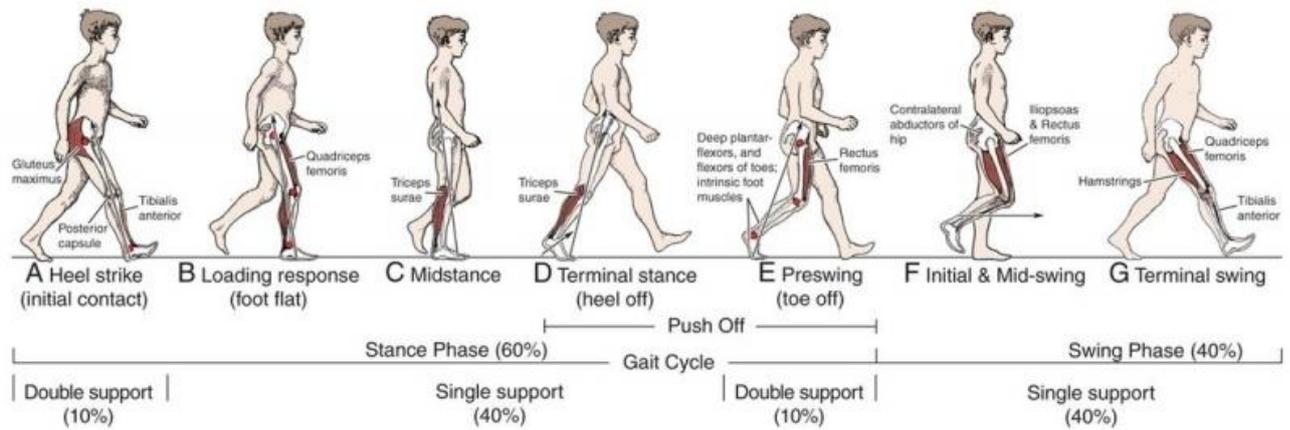


Diagram 3: Gait cycle

JOINT	MOVEMENT	RANGE
Hip	Flexion	0-120
	Extension (hyper)	0-30
	Abduction	0-45
	Adduction	0-30
	Lateral rotation	0-45
	Medial rotation	0-45
Knee	Flexion	0-135
Ankle	Dorsiflexion	0-20
	Plantarflexion	0-50
Ankle/Foot	Inversion	0-35
	Eversion	0-15

Diagram 4: Average Ranges of Motion. Source: American Academy of Orthopaedic Surgeons.

## Appendix D

### Lower Extremity Functional Scale

#### Instructions

We are interested in knowing whether you are having any difficulty at all with the activities listed below **because of your lower limb problem** for which you are currently seeking attention. Please provide an answer for **each** activity.

Today, **do you or would you** have any difficulty at all with:

Activities	Extreme difficulty or unable to perform activity	Quite a bit of difficulty	Moderate difficulty	A little bit of difficulty	No difficulty
1. Any of your usual work, housework or school activities.	0	1	2	3	4
2. Your usual hobbies, recreational or sporting activities.	0	1	2	3	4
3. Getting into or out of the bath.	0	1	2	3	4
4. Walking between rooms.	0	1	2	3	4
5. Putting on your shoes or socks.	0	1	2	3	4
6. Squatting.	0	1	2	3	4
7. Lifting an object, like a bag of groceries from the floor.	0	1	2	3	4
8. Performing light activities around your home.	0	1	2	3	4
9. Performing heavy activities around your home.	0	1	2	3	4
10. Getting into or out of a car.	0	1	2	3	4
11. Walking 2 blocks.	0	1	2	3	4
12. Walking a mile.	0	1	2	3	4
13. Going up or down 10 stairs (about 1 flight of stairs).	0	1	2	3	4
14. Standing for 1 hour.	0	1	2	3	4
15. Sitting for 1 hour.	0	1	2	3	4
16. Running on even ground.	0	1	2	3	4
17. Running on uneven ground.	0	1	2	3	4
18. Making sharp turns while running fast.	0	1	2	3	4
19. Hopping.	0	1	2	3	4
20. Rolling over in bed.	0	1	2	3	4