

Musculoskeletal disorders in podiatry and chiropody professionals

Reducing the risk

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Podiatry is a health profession which involves the assessment, treatment and management of patients with foot and lower limb disorders.

There has been an increasing awareness that podiatrists are exposed to musculoskeletal disorder (MSD) risk factors in their work and that this is leading to above average incidence of MSDs among this worker population. Recent studies have identified the high prevalence of MSDs amongst podiatrists and have identified that these are predominantly associated with poor postures assumed while working. Some suggestions of possible solutions have been made, to try to improve podiatrist's postures whilst they are performing treatments.

There is generally a low level of awareness among podiatrists regarding ways to reduce MSD risks through use of equipment that may assist the podiatrist's posture. During previous work (Lee and Jones [2004] and Birtles and Leah [2006]) observations of numerous podiatrists working in both domiciliary and clinical settings highlighted that with both NHS and privately employed practitioners the use of posture supporting equipment (such as stools, patient leg supports, ergonomic kit bags, etc) was uncommon and ill-informed. During the discussions of previous work it was suggested that podiatrists should attempt to make use of more posture assisting equipment while treating clients. In response to this latter work (Birtles and Leah [2006]), one particular NHS trust came forward and demonstrated a postural solution that they have put in place for their podiatrists. The solution comprised of a kneeling stool and mat for the podiatrist and an adjustable leg support for the client.

The aim of this project is to explore the efficacy of these possible solutions for improving podiatrists' working postures within the domiciliary working environment. It is intended to provide podiatrists with an opportunity to experience one possible set of solutions and give direct feedback, which will, through the publication of this report, be shared throughout the UK for the benefit of others.

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EXECUTIVE SUMMARY

Objectives

Previous research recognised risks of musculoskeletal ill health within working podiatrists, as an area where interventions may be effective in improving podiatrists' working postures by reducing their exposure to musculoskeletal risks. The main objective of this project was to introduce some portable equipment for podiatrists to use on domiciliary visits and highlight any improvements that the equipment has on the working postures when podiatrists are performing treatments.

Main Findings

During observations of the podiatrists using this equipment for client's treatments, opinions were noted and the podiatrists working postures were filmed for analysis. Common themes emerged from the discussions with the podiatrists, both positive and negative. However the posture analysis showed that the equipment significantly improved the podiatrists working postures during domiciliary visits.

Recommendations

Recommendations are made for improving the equipment. These are mainly related to the equipment's current limited range of adjustability. Recommendations were also made for the correct way of introducing this equipment into the podiatry sector, transporting the equipment and eliminating cross contamination between patients.

1 INTRODUCTION

Podiatry is a health profession which involves the assessment, treatment and management of patients with foot and lower limb disorders.

There has been an increasing awareness that podiatrists are exposed to musculoskeletal disorder (MSD) risk factors in their work and that this is leading to above average incidence of MSDs among this worker population. Recent studies have identified the high prevalence of MSDs amongst podiatrists and have identified that these are predominantly associated with poor postures assumed while working. Some suggestions of possible solutions have been made, to try to improve podiatrist's postures whilst they are performing treatments.

There is generally a low level of awareness among podiatrists regarding ways to reduce MSD risks through use of equipment that may assist the podiatrist's posture. During previous work (Lee and Jones. [2004] and Birtles and Leah. [2006]) observations of numerous podiatrists working in both domiciliary and clinical settings highlighted that with both NHS and privately employed practitioners the use of posture supporting equipment (such as stools, patient leg supports, ergonomic kit bags, etc.) was uncommon and ill-informed. During the discussions of previous work it was suggested that podiatrists should attempt to make use of more posture assisting equipment while treating clients. In response to this latter work (Birtles and Leah. [2006]), one particular NHS trust came forward and demonstrated a postural solution that they have put in place for their podiatrists. The solution comprised of a kneeling stool and mat for the podiatrist and an adjustable leg support for the client.

The aim of this project is to explore the efficacy of these possible solutions for improving podiatrists' working postures within the domiciliary working environment. It is intended to provide podiatrists with an opportunity to experience one possible set of solutions and give direct feedback, which will, through the publication of this report, be shared throughout the UK for the benefit of others.

2 APPROACH

2.1 GENERAL APPROACH

Overview

Light portable equipment were introduced to podiatrists to use on domiciliary visits. Podiatrists' opinions on this equipment were given. Podiatrists were also asked to compare the new equipment with any equipment that they currently use. The equipment introduced included a simple foam kneeling mat, a lightweight, foldable kneeling stool and a height-adjustable, lightweight leg support for the patients. The researchers performed observations of, and interviews with the podiatrists during their normal processes of work. Where possible, the podiatrists' were filmed while they were treating their clients and a subsequent comparison was made on their working postures with and without the equipment provided. For this purpose the ergonomics tool Rapid Entire Body Assessment (REBA; Hignett and McAtamney, 2002) was used to attempt to identify any postural improvements when using the equipment.

Approach

An ergonomist accompanied 7 different podiatrists on domiciliary visits. Once initial contact had been made with the podiatrist and a meeting arranged, an ergonomist met the podiatrist before the beginning of the appointments with the clients. The nature of the study was explained to each client and there was then a demonstration of how to use the equipment.

Semi Structured Interviews

The approach to the data gathering from the podiatrists was two fold; informal observations and interviews with the podiatrists while they were providing clients with treatments and during periods between each treatment. A pre-developed series of questions were used to prompt the ergonomist, covering various aspects of the podiatrists' work and the use of the supplemental equipment. These included questions on:

- Transportation of the posture equipment, including:
 - Carrying the equipment
 - 'Fit' of the posture equipment with the presently used kit bags
 - The weight of the posture equipment
- Set-up of the posture equipment, including:
 - The adequacy of the range of adjustability
 - Match with the client's needs (weight bearing and adjustability)

- The fit of the stool, and ability to adjust the stool height adequately
- The use of the posture equipment during the treatment, including:
 - Mobility of the client's lower limb and the podiatrist's whole body posture during treatment
 - Podiatrist's comfort of lower limbs, lower back, upper back/neck/shoulders, upper limbs

These questions were used to inform and guide discussion with the podiatrists during their use of the posture equipment and between each treatment. Each podiatrist tended to focus on particular issues concerning the posture equipment and this report attempts to cover all of these issues even when mentioned only once or twice.

During each treatment the duration and overall activity were noted.

Photographic and video evidence

Podiatrists were asked to begin each treatment by following their normal working practices, using the furniture they would normally use to assume as comfortable a posture as possible. This is generally any stool or pouf on offer at the client's residence although one podiatrist did bring and use a collapsible footstool. After a period of time (depending on the treatment given) the podiatrists were provided with the posture equipment and asked to set this up and use this for the remainder of the treatment, giving comments throughout, where customer care allowed. Where possible, in 9 of the 28 treatments observed where the client and/or podiatrist had no objections to being filmed, photographs and video recordings were taken of the podiatrists' working postures when they were both using and not using the equipment. Attempts were made to capture the posture of the podiatrists when they were working for subsequent analysis and consideration.

Posture Equipment Tested

The equipment provided to the podiatrists for testing is presently used in one NHS trust by district nursing staff while providing clients with leg dressings. It comprises of three distinct pieces of apparatus:

- **Kneeling mat:** Examples of the lightweight foam mat, which is easy to clean.



Figure 1: Kneeling mat

- **Kneeling stool:** The kneeling stool is a lightweight (1.2kg), foldable, height adjustable, strong & robust stool. It is inclined forwards slightly ($8-10^{\circ}$) to assist the person kneeling to assume a more upright posture by following the approximate angle of the thigh when in a kneeling position.



Figure 2: Kneeling stool

The limited height adjustability of the stool, afforded by threaded feet on each leg allowing a range of heights of 219 – 240 mm to the centre of the seat from the floor. Allowing for discrepancies due to the leather bound, soft foam covering of the stool, the dimensions of the stool are 480mm wide by 160mm.

- **Patient leg support:** The Locometer limb support, affords a height adjustability ranging from 165mm to 525mm. The limb support weighs 2.2kg and is weight tested to support loads up to 12kg. The patient foot cradle is a disposable cloth sling which can be removed after each client treatment and replaced with a new one to reduce the probability of cross infection across clients. Photographs of the limb support are provided in Figure 3.



Figure 3: Patients leg support

A total of twenty-eight treatments were observed with seven different podiatrists. During the visits the podiatrist conducted some treatments without using the equipment (thereby performing their usual routine) and the other treatments using the equipment described above. No attempt was made to influence the nature of the clients' treatments and these appeared to be random and representative of each podiatrists normal treatment regime. The client's permission was sought for the filming of the treatments.

After completing the observations, the ergonomists gathered the podiatrists' opinions and gained feedback about the equipment being used. Notes were made of pertinent issues/comments during these discussions.

2.2 POSTURAL ANALYSIS USING REBA

Rapid Entire Body Assessment (REBA) (Hignett & McAtamney 2000) was used as a tool to analyse event driven postures captured on the video and still photographs, which were taken when observing podiatrists. REBA analysis was performed on the podiatrists' postures whilst they were using and not using the posture equipment.

From the video recordings of the treatments, a screen shot of the podiatrists' postures was taken every 60 seconds for the duration of each treatment to give a sample of indicative postures during each treatment. Each of these pictures of the body posture of the podiatrists were then analysed using REBA. The resultant scores were then used for comparison of the postures with or without the use of the posture equipment.

3 FINDINGS

3.1 GENERAL POSTURAL OVERVIEW

3.1.1 Not using equipment

During domiciliary treatments podiatrists usually use seating available in patients' homes, and so adopt different postures depending on the environment and the variation of seating provided. It was common practice, as has been observed during previous work, that the client's foot was placed on the knee of the podiatrist when working. Due to podiatry being such a visually demanding task, podiatrists often have to adopt very awkward postures to allow them to gain the hand-eye coordination that is needed to perform their treatments. Figure 4 demonstrated two examples of such postures where the podiatrist are assuming a bent over posture with near maximal flexion in the neck to look at the top of the foot, while reaching forward with both hands to perform a treatment in a fixed posture for few minutes duration.



Figure 4: Examples of common postures adapted by podiatrists in domiciliary settings.

3.1.2 Using equipment

During treatments where the podiatrists used the provided posture equipment; a dramatic improvement was noted in the postures assumed while treating the patients. Figure 5 shows examples of these working postures. The torso was generally more upright, improving the podiatrist's spinal postures through the reduction of forward flexion, especially in the thoracic and cervical areas of the spine. This is likely due to the increased ability to place the clients' leg at any point within the height range of the leg support (clients' mobility allowing). This allows the podiatrist to set the working height so that hand reach is set at the most comfortable position, reducing elevation of the lower arms, possible flexion of the elbows, abduction of the upper arms or shrugging in the shoulders. Where tasks are more visually demanding the clients'

lower limbs may be set higher, closer to the podiatrist's eyes to facilitate a better view of the work area without stooping forwards and downwards.

The stool and kneeling mat reportedly offers a reduction of bodyweight loading on the lower limb joints and soft tissue combined with reducing loading on the patella-femoral joint and pre-patella bursae, via the provision of the padded kneeling stool. The patient's limb support helped in reducing the need for the podiatrist to lift and support the weight of the leg while treating with the free hand.



Figure 5: Examples of postures adapted when using the equipment.

3.2 POSTURAL ANALYSIS USING REBA

104 REBA analyses were performed on the video recorded treatments at a sample rate of once per minute resulting in a total of 59 scores for podiatrists when using the posture equipment and 47 scores for when the same podiatrists used the client's own furniture. The resulting scores demonstrate a significant variation in the different postures adopted between the two scenarios (Mann-Whitney U, 521.500, $p < 0.001$). The results of these analyses varied between the postures adopted when not using the equipment (mean REBA score 3.7) and when using the equipment (mean REBA score 2.5). The REBA scores indicated that 34% of postures adopted by the podiatrist were assessed as being low risk level when using the equipment. Compared to 88% of postures being a low risk level when using the equipment. This can be seen in Figure 6.

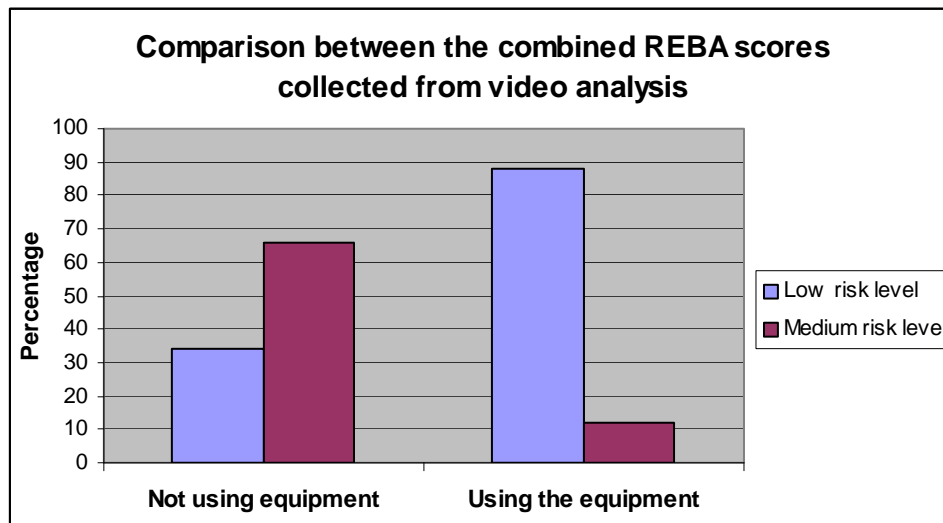


Figure 6: Comparing average REBA results gained overall from the treatments when not using the equipment compared to using the equipment.

3.3 FEEDBACK ON EQUIPMENT

During the observations semi-structured interviews were performed with both the NHS and privately employed podiatrists. This gave further insight into the opinions of the podiatrists and allowed comments to be recorded concerning various aspects of the use and carriage of the equipment. Common themes emerged from these discussions, including a general reluctance to carry (manually handle) extra kit from the podiatrists' car to the home of the client. This said, some NHS podiatrists did mention that the amount of equipment they would be carrying to each client in the future would be reduced significantly with the introduction of new working methods which involve bringing only one set of 'tools' to each client, while leaving the remaining tools in the boot of their car. This will reduce the amount and weight of the equipment carried and could possibly pave the way for the carriage of posture correcting equipment such as that on trial.

One further recurrent point raised by the podiatrists involved the negative impact on their mobility during the treatment while 'seated' on the stool. Due to the kneeling position of the podiatrists while they are working 'seated' on the stool, lateral movement to the sides of the clients' feet for example is impaired. This is mainly due to the kneeling position with the feet and lower legs being 'enclosed' within structures of the kneeling stool and so it being awkward to shift the kneeling position. This led to podiatrists leaning sideways to access the sides of the client's lower limbs or to reach to retrieve equipment from the floor/bag. This results in sideways bending and asymmetrical loading of the spine, which may lead to postural discomfort and possible injury if prolonged and repeated.

The feedback gained from these discussions with the podiatrists are presented in the following table as bullet points.

	Kneeling Mat	Kneeling Stool	Limb Support
Transport	<ul style="list-style-type: none"> • Easy to carry & has a handle. 	<ul style="list-style-type: none"> • Stool's carbon fibre structure makes in light for carrying. • Stool was nice & compact when folded up. • Stool had no handle for carrying, but was small & could be held anywhere. 	<ul style="list-style-type: none"> • Lightweight, but not compact in comparison to other equipment. • Awkward to carry when carrying the other equipment, (would it loose stability if it was more foldable).
Set –up	<ul style="list-style-type: none"> • Easy to place down into position, at correct distance from the patients foot. • Mat is suitable size for podiatrists knees – although for hygiene reasons a larger mat would be beneficial. 	<ul style="list-style-type: none"> • Stool easy to unfold & set up. • Adjustability was only 2cm in height. This was found inadequate by people who had large or long legs. • Seat was adequate width & comfortably fitted all the podiatrists. • Slight discomfort was experienced in the foot of a couple of podiatrists when using the stool. (Extra height adjustability may help, as this discomfort reduced when stool was on its highest setting). 	<ul style="list-style-type: none"> • Easy to set up & liked changeable slings for each patient. • Reduced the amount of lifting & handling of the patient's foot. • Offered great adjustability & worked well with both patients sofas/arm chairs and the kneeling stool. • Possible infection control issue when stand positioned close to client's other foot. • Awkward to raise foot stand once patient's foot is supported.
Use	<ul style="list-style-type: none"> • Mat was comfortable. • Mat offered adequate level of support to podiatrist's knees. 	<ul style="list-style-type: none"> • Stool was comfortable & worked well with other equipment. • The stool limited podiatrist's mobility during treatments. (Stool meant podiatrists pelvis and legs were in a fixed position for duration of treatment). • Once podiatrist was sat on stool, they were stuck in that position, so they need to make sure they position their equipment close by. • Podiatrists felt like they were sat more upright and not leaning forward as much as they normally do during treatments. • Noted that stool tilted the pelvis to a very comfortable angle. • Higher sitting position (from floor) results in greater flexion to retrieve items from floor. 	<ul style="list-style-type: none"> • Offered a very stable & solid platform for the podiatrists to work from. • It allowed podiatrist to see all around patient's foot when it was resting on the sling. • Patients found it comfortable to rest their foot on. • One patient could not lift their leg enough to lift it onto sling at correct height to allow podiatrist to sit on stool – Podiatrist had to sit on the floor, but still used sling to support foot at a lower height. • Does not have anything to collect cutting off the foot. • Difficult to grip the foot when using scalpel. Often use the thighs as a clamp when supporting the foot 'manually'.

	Kneeling Mat	Kneeling Stool	Limb Support
Design	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Stool slips on wooden floor – needs rubber on feet. 	<ul style="list-style-type: none"> • Structures are sharp (square corners) which could knock patient's limbs. Will be problematic especially when patient has reduced tactile feeling in their feet (e.g. patients with diabetes or MS). • Patient harness needs to be deeper. • Would appreciate wipe down padded cushion for patient's foot support. • Needs to be more stable.
General comments	<ul style="list-style-type: none"> • Mat was comfortable, lightweight, portable and very useful. 	<ul style="list-style-type: none"> • Stool interacted well with the other equipment. 	<ul style="list-style-type: none"> • Offers very stable base for podiatrists work.

4 CONCLUSION

It would appear from the observations made and comments provided that there are significant benefits to using the posture equipment described above, in terms of postural correction and comfort for the podiatrists. However, there was individual variation and some subjects (a significant minority) felt less comfortable using the equipment, even when they demonstrated improved, more upright postures. This may be related to an adverse reaction to changing working habits and may also be due to the limited ranges of adjustability provided by the equipment, especially the kneeling stool.

Similarly, some individuals expressed a desire to use the equipment for only portions of the working day, a decision influenced by numerous environmental factors and individual preference.

While there are discernable benefits to the use of the equipment, the introduction of this into working practices would be best done carefully by allowing individual podiatrists to self select when and where they choose to use the equipment based on an assessment of each individual environment, patients condition and treatment. With this in mind, while the use of the equipment is generally recommended for most cases, it should possibly be introduced for use initially on a trial basis so that podiatrists have an opportunity to incorporate it into their working practices as they prefer.

It would be of great benefit if, as podiatrists gain experience of this or alternative posture equipment (stools, alternative leg supports, etc.), feedback is collated with a central organisation so that each NHS trust or private practitioner can benefit from other's experience. It is suggested that HSL could be that central organisation, which people can contact to enquire about the equipment or feedback on their opinions of the equipment once they are using it.

5 RECOMMENDATIONS

5.1 EQUIPMENT DESIGN

Overall there was a very positive response for all or some of the equipment and overall it was found to be a benefit to the podiatrists' postures. Podiatrists were enthusiastic about developing the equipment and they generally found it stable, comfortable and easy to use.

5.1.1 Kneeling mat

One possible improvement to the existing Gelert foam Kneeling mat would be to make it larger. Currently the kneeling mat has the dimensions of 37.5 cm in width, 28 cm in height and a depth of 1 cm. However on domiciliary visits flooring is often dirty therefore a kneeling mat which covered the surface area of the podiatrists legs and feet would stop the podiatrist coming into direct contact with dirty floors. A foldable kneeling mat approximately double the surface area would be the ideal solution. This may mean that the kneeling stool would have to rest on the kneeling mat so that the mat would need to offer a stable surface to rest the stool on.

Further consideration may also be given to the development of a purpose built kneeling mat made of thicker material. Increasing the height of the knee may result in a more "neutral" posture of the ankle, which may enhance the users comfort.

5.1.2 Kneeling stool

The kneeling stool was found to be very comfortable. The sloping angle of the seat had highly positive feedback and felt comfortable to sit on, whilst allowing the podiatrist to have a natural curvature of the spine. However it was noted that on some occasions the podiatrist's shoes came into contact with the seat (when podiatrists shoes were large and bulky). If the height adjustability of the stool was increased e.g. an additional 5 cm, then it would allow more space for podiatrist's shoes. Obviously if the stool became higher in height adjustability the leg support may also need to be given more height to allow the two pieces of equipment to interact correctly.

5.1.3 Limb support

Patient's limb support offers great benefits to the podiatrist, as it reduces the amount of lifting of the patients' leg required. Patients generally said that the leg support provided a very comfortable footrest and it felt stable. A desirable improvement would be the addition of a detachable tray just below the disposable leg sling, this tray would act as a collection point for any waste products that the podiatrist had cut from the foot assisting with the cleaning and disposal of after treatment. More rounded surfaces to the limb support would also be beneficial to minimise any effects of patient lower limb contact with this equipment.

5.1.4 Transporting the equipment

The development of a bag to carry all of this equipment would be of great benefit to the podiatrist as they already have lots of equipment and tools to carry on domiciliary visits. A rucksack arrangement would leave the podiatrists hands free to open doors and carry anything else they needed to.

Ideally any bag provided with the equipment would need to contain the kneeling mat, kneeling stool, patients limb support stand and extra disposable slings for leg support. Also podiatrists would benefit if the bag could also contain space for: podiatrist's diary, patients notes and podiatrist's tools (including a drill).

If this bag could clip onto a trolley, then that would benefit some podiatrists by reducing the amount of equipment they needed to carry in situations where a trolley could be used.

It would assist the podiatrists significantly if the limb support was collapsible, to a semi-flat arrangement. This would not only assist in carrying and storing the support, but would also improve the storage of the support in the podiatrists' cars, which are often already relatively full of equipment.

5.1.5 Factors to consider.

5.1.5.1 *Weight of kit*

Podiatrists already have a large amount of equipment to carry with them on home visits. Therefore any additional equipment would have to be easy to carry and light weight. Consideration of lighter materials for the production of the limb support would be useful.

5.1.5.2 *Lighting*

Lighting is a factor, which is often noted as an issue on domiciliary visits. Patients treatments are generally performed in the living room area of their house, however lighting is occasionally limited. It is not uncommon for windows to be quite small and electric lights dim. This means that podiatrists can't always see the patients foot clearly when performing treatments, resulting in a requirement to bend closer to the patients' limb, reducing the neutrality of the podiatrists posture. Possibly a small clip on lamp could be carried on visits to assist podiatrists in rooms that are poorly lit.

5.1.5.3 *Space limitations*

The floor space available within patient's houses is often limited, due to furniture and small room sizes. This is an issue which affects podiatrists as they may have a limited area around the patient. This occasionally results in the adoption of compromised postures during treatments.

5.1.5.4 *Hygiene/cross contamination*

The equipment, especially the limb support needs to be easily cleaned and sterilised with a wipe down between each patient in order to eliminate any issues of cross contamination between patients.

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