Biomechanics

Introduction : History of Biomechanics

The human body has evolved as a dynamic structure which is in motion for a significant part of its life. At the earliest of times man relied entirely on his legs to travel and in the face of adversity to stand and fight or to run and flee to safety.

Over time man has used his ingenuity to invent aids to motion and to take some of the stress and time out of reaching a destination, namely, the dugout, the sail, the wheel, the hot-air balloon, the stream engine, the internal combustion engine and so on.

The study of mechanics is an ancient science and has not only been concerned with inanimate objects but the study of the human body as a mechanical structure has attracted the attention of scientists such as Aristotle, Archimedes and Leonardo da Vinci and Sir Isaac Newton to name only a few.

Modern history of Biomechanics

No one comprehensive approach or theory exists to explain the biomechanical movement of the foot and lower leg. The main theories are:
☐ Sagittal plane facilitation theory.
☐ Sub talar joint neutral theory.
☐ Tissue stress theory.

Each theory contributes a greater or lesser degree to the understanding of Biomechanical problems with different particular foot types and different problems experienced with the foot.

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Biomechanics at Emscote Therapy

To receive treatment based on podiatric biomechanics at Emscote Therapy, you may have been referred by a consultant, a GP or other professional, you may have self referred or you may have been referred by a physiotherapist.

The reason for you seeking treatment may be based on over-use injuries from running or other sports activity or a recognised injury or trauma or surgical intervention.

The aim of the Podiatrist is to establish if there is an underlying dysfunction in the movement of the foot and or lower limbs which might be producing the symptoms.

At Emscote Therapy the podiatrist assesses the foot both in stance position and in motion to reach a diagnosis; a treadmill may also be used as part of the assessment. Recently Emscote Therapy acquired F-Scan (by Tekscan) which is a computer diagnostic software tool used in conjunction with in-shoe transducers to measure pressure and forces during the process of several footsteps.

If it is clear that the patient can benefit from Orthotic therapy, the usual practice of Emscote Therapy is to issue a temporary orthotic to establish that it provides the necessary foot re alignment and in time some resolution of symptoms before a customised carbon fibre or poly propylene orthotic device is prescribed.

Having obtained the desired results with a temporary orthotic device the next stage is to carry out a detailed Biomechanical Evaluation (BME) to evolve a specific prescription. The evaluation involves full assessment of gait in stance, walking and faster motion and use of F Scan before taking a suspension plaster cast of both feet. The prescription and casts are then sent to RX Laboratories for custom made CE marked orthotic devices to be produced in the appropriate material, often TL2000 (a form of carbon fibre) or poly propylene.

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Team Approach to Biomechanical Treatment

Consider the example of the road runner who suffers from what is commonly called 'shin splints' (Tibial Fasciitis) and anterior knee pain. The podiatrist during his initial assessment of the runner establishes, using the postural foot index or Fscan that he over-pronates and notes he has poor posture whilst running and is unable to control his core when asked to stand on one leg bending the loaded leg.

The treatment plan would be that he/she would benefit from temporary orthotic devices to help control the movement of the foot, that he/she should be referred to the physiotherapist for some strengthening and stretching exercises to improve the balance in the muscles around the patellofemoral joint. He/she would benefit from a few sessions of rehabilitation to strengthen his/her core stability to improve posture and help the 'flow' over his/her foot during running.

Orthotic Therapy

Walking, running and standing are good every day activities but can subject our bodies to considerable stress and force. Forces of three to five times the weight of the body are generated at every foot strike and translated into forward and upward motion.

What is an Orthotic Device and how can it help?

It is a specialised insole manufactured to exact specification of the foot and lower limb for the purpose of -:

- Alleviating foot pain
- Controlling or correcting abnormal gait patterns.
- Improving the shock absorbing properties of a foot.
- Providing padding (cushioning) to rest sore areas on the foot such as corns and calluses.
- Helping the older foot with support.
- Reduce symptoms from lower back, hip, knee, ankle and foot that may be generated from foot abnormalities.
- Control of lower limb function in competitive athletes.

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Orthotic Devices Can:

- Help to reduce fatigue in the foot and lower limb.
- Support feet that have collapsed.
- Can help to control feet for a person with a Gait related problem.
- Can accommodate padding to take weight from calluses and corns.

Will I need orthotic devices?

If any of the above circumstances apply to you then Orthotic Devices could be useful to you in alleviating your symptoms. Only a Podiatrist experienced in this field of work can advise you fully. **Peter Robinson at Emscote Therapy** has been working in this field for many years.

Your initial consultation will be approximately a 45mins appointment, where a full medical history will be taken together with details of your leisure activities (in particular sporting activities) and your occupation. Peter Robinson will examine you walking, standing and sitting having regard to the information you have provided in the medical history.

This information aids the decisions process and conclusion as to the help that may be gained by Orthotic use for each individual. A treatment plan is evolved.

(Please bring shorts with you and footwear that is currently worn. Advice and discussion on footwear are part of each consultation.)

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What do I have to do to get an Orthotic?

Emscote Therapy does not expect any patient to commit to the costs of custom made orthotics until evidence has been obtained that such a device is likely to provide the desired help. The approach to providing long term orthotics devices is therefore sequential.

On your initial appointment, you will be seen walking, standing and sitting. A temporary orthotic may be made as a trial for you and to provide insight as to how well a prescription may target your symptoms. A review appointment is booked so that feed back is obtained. Please bring shorts with you and footwear that is currently worn.

At the review appointment the help that the temporary device has given will be assessed. A decision may be made to make a Biomechanical evaluation appointment (BME).

The BME is a 1 hour appointment during which time many tests are carried out to assess and evaluate the lower limb. Following the Clinic's acquisition of F Scan from Tekscan the evaluation will include computer aided pressure and force analysis that will allow the use of scanning images from the foot. A plaster cast may be taken of the feet at this session and together sent off with your prescription. Please bring shorts and footwear that the Orthotic devices are expected to fit into.

- Ten days later (approximately) you will be called for an issue appointment.
- Four weeks later (approximately) a review meeting to assess the effect of the orthotics and to decide if any minor modifications may be required.

How do I get used to the Orthotic Devices?

Peter Robinson will instruct you to wear the devices slowly increasing wear time each day. All Orthotic devices made are CE marked i.e. EEC Conformity Declaration for Medical products.

Peter will wish to see you four weeks from the issue date. However if any problems occur in the meantime you are encouraged to ring and discuss the problem and may be asked to make an appointment sooner.

It is advisable to remember that if you have had symptoms over a number of years it may take more than a few weeks to resolve.

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Will my Orthotic Devices wear out?

It is an impossible task to estimate how long orthotics devices will last. Most devices last ten to fifteen years; some a lifetime! Different devices have different life expectancy. This can be discussed with your Podiatrist, Peter Robinson.
Should there be a change in your symptoms and or a marked change in life style or sport then it will be advisable to make a review half hour appointment with Peter Robinson to make sure alterations are not required.

Regular visits are a good idea to see if your orthotic prescription is still relevant for you. Sometimes feet do change and a new device may have to be made.

With Care most devices will last a long time.

Are there any problems with wearing Orthotic devices?

Please keep them away from dogs as they love to chew them!

Please don't climb ladders in them or dig, both put undue pressure onto the devices and may crack them.

Please do not wear them in Wellington boots.

There are many substitutes sold for Orthotics, in good shops selling sports equipment or in Pharmacies. It is worth remembering that they are indeed substitutes. They are not functional prescriptive medical devices made for your unique foot by a specialist in their field, aiming to provide you with ultimate comfort and control.