

Evaluating insocks for rubber work boots

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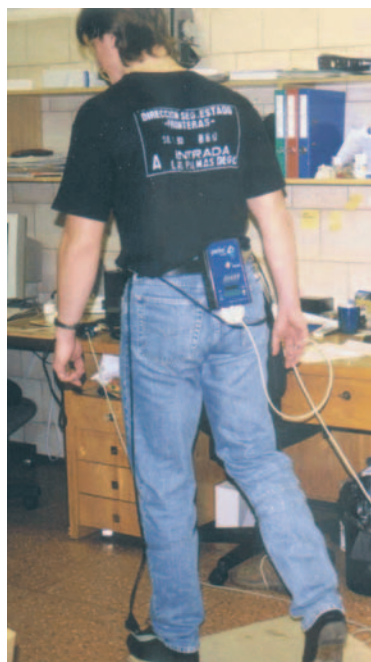
The foot is considered to be the oldest part of the human body from the point of view of its development. It has not changed its function, and hence its structure, for over three million years. On the other hand, the last 100 years have seen considerable changes in the types of surfaces we walk on, with many of them becoming harder. This has a significant influence on the foot's mechanism for dampening impact forces.

Soft surfaces, such as grass, ploughed land and sand substantially dampen the impact that occurs during walking, jumping or jogging. However, hardened surfaces, such as asphalt, concrete and paving, do not do this. The lack of impact absorption in these hard surfaces must therefore be compensated by the dampening ability of the soles and insocks used in modern footwear.

Extensive studies have been carried out to find an optimum type of insock and many researchers have focused on sports shoes or footwear for diabetics. Other fields of research have been children's feet and military boots. Some research has also been done with regard to the material properties of insoles, with some scientists trying to establish new fields. However, all papers refer to the fact that the use of suitable insocks can lead to positive results in the areas of correct body posture, impact absorption, vibration during walking, and improving foot comfort.

An important area for this type of analysis, which is not given sufficient attention, is protecting workers' feet when they have to walk on hard surfaces or have to alternate between standing for long periods of time and moving. In general, people spend a quarter to a third of their day in their working activities, which is why greater attention should be paid to the choice of suitable work boots in terms of comfort.

In tests carried out at the Tomas Bata University, in the Czech Republic, the focus was on workers who use all-rubber boots, where the dampening ability of the soles is limited. Such footwear is loose-fitting resulting in reduced stability in hard ground conditions. The purpose of the current paper is to help such people reduce foot pain and discomfort, and most importantly, to seek ways to decrease the risk of accidents or foot deformities.



Pedar mobil equipment

Methods

The performance of various types of insock was tested with two key aspects in mind: environmental hygiene and physical demand with regard to the musculature of the foot and its entire kinetic system. The respective measurements were made under laboratory conditions with the test subjects walking on flat PVC flooring. The aim of the experiment was to analyse the occurrence of maximum foot pressures on selected types of shoe lining insoles to assess their suitability. For this reason, moulded size 42 all-rubber boots were used, which were fitted with the following types of insock:

1. Original boot insole of nonwoven bonded fabric only
2. Single layer insock made of latex foam
3. Two-layer insock – natural moss top and soft latex lower
4. Two-layer insock – sheep's wool top and foam latex lower
5. Two-layer insock – sheep's wool top and aluminium lower
6. Moulded orthopaedic insock designed for diabetics
7. Gel insock
8. Silicone insock

The boots were tested by 30 subjects, aged from 17 to 29 and weighing 60-90kg. The only criterion in selecting the subjects was their foot size, which had to comply with the size of the boots supplied. To measure the tread forces, a Pedar mobil (Novel Munich) was used, which consists of a recording unit and a set of sensor insoles which record pressures at a frequency of 10,000 impulses per second.

Measurements were carried out under laboratory conditions, with the subjects walking on a 10m flat PVC floor. The walk was repeated three times for each boot and insole combination, and then recorded. Data of the pressures recorded was evaluated using the firm's Pedar Winn software which enables the surface of the insock to be divided into three parts or 'masks', the

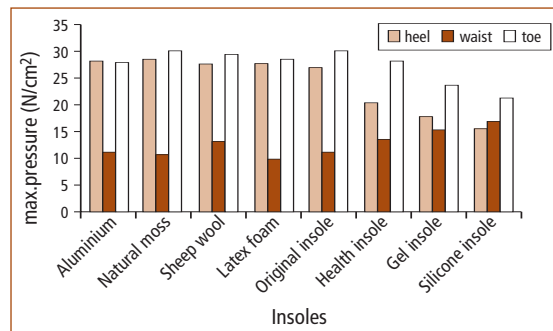
heel (M1), waist (M2) and toe (M3). Maximum pressure values from the given graphs were then calculated separately for each 'mask'.

Results and conclusions

The graph gives an overview of maximum localised pressure in individual masks throughout the walking gait. As can be seen, the impact and the shock are dampened on the whole and the pressures whilst walking are significantly reduced when using an orthopaedic insock. This is particularly apparent in the heel zone because the insoles are anatomically-shaped in this area.

In the tests, impact and shock were dampened the most and pressures when walking were reduced to a greater extent when using gel insoles or silicone insoles. Furthermore, some dampening properties were found for insoles covered with aluminium and those made of thin latex foam. Other insoles proved to have similar, or in some cases slightly worse, properties than the original insoles.

Even if there are no exact rules for choosing the perfect shoes, understanding the mechanics of the foot can help people find the best possible match. Wearing shoe insoles that support the arch and stabilise the heel should help to relieve pain and to



STUDENT GENERATION

keep the person moving in comfort. Of the samples tested, the best results—in terms of ability to eliminate shocks when walking and the subsequent pressures—were shown to be health promoting, anatomically-shaped gel or silicone insoles.

The research showed that for people who do not wish to undergo surgery when it is not necessary, insoles can help to reduce foot pain without invasive procedures and can prevent foot deformities. The results indicate that it is feasible to recommend that rubber work boots should be fitted with insoles that promote the right conditions for the body, help to avoid accidents, and promote better foot health.

This was a limited study, restricted to a single field, and has only addressed the question of localised pressures on the feet for different types of insoles. We are not yet in a position to offer an explanation of any other possible effects on the feet beyond pressure. Further research in this area might lead to the development of better materials to help people with foot problems.

Footnote: This article is based on the author's thesis work for her PhD

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