

BIOMECHANICALLY DESIGNED SCIENTIFICALLY APPROPRIATE DIABETIC FOOTWEAR

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INTRODUCTION

Mechanical factors play an important role in the etiology of a majority of foot ulcers. The stress and strain experienced by the diabetic foot is significantly different from that of the non-diabetic foot. This is because of the biomechanical abnormalities in the foot as a consequence of diabetic neuropathy. This paper looks at the factors responsible for the abnormal stresses and also examines the vital role of the footwear which is designed after the biomechanical analysis of the diabetic foot. Many foot complications due to external sources are prevented only by footwear and it is illustrated in this paper that prescription of footwear is a pre-requisite for the diabetic foot along with medical treatment.

The paper also highlights the use of biomechanical principles in designing the correct footwear and details criteria and materials for satisfying the requirements of a scientifically appropriate footwear for diabetics which is designed to provide for better shock absorption, reduced friction, better comfort and wear properties and most importantly helps in redistributing pressure uniformly on the plantar surface of the foot.

METHODS

- A careful selection of patients was made and an adjusted sandal was fabricated for them. The footwear were fabricated with specially derived Rocker bottomed soles[1], to relieve biomechanical stresses
- This was tested for its pressure reduction using an optical pedobarograph [2]
- Pressure reduction was analysed
- Wear trials was carried out and Wear pattern assessed

RESULTS AND DISCUSSION

From the pressure contours generated the significant changes in the pressure pattern as compared to the barefoot is evident. The pressure has been well distributed and reduced.

Sl. No	Bare foot Press. (KPa)	Inshoe Press. (KPa)	Sl. No	BFTP (KPa)	ISHP (KPa)	Sl. No	BFTP (KPa)	ISHP (KPa)
	BFTP	ISHP						
1.	960	52	6.	534	33	11.	665	21
2.	670	45	7.	491	33	12.	676	35
3.	717	38	8.	694	40	13.	546	32
4.	786	45	9.	680	38	14.	684	40
5.	486	26	10.	773	33	15.	645	37

Table 1: Plantar pressure readings - Barefoot Vs Specially designed footwear

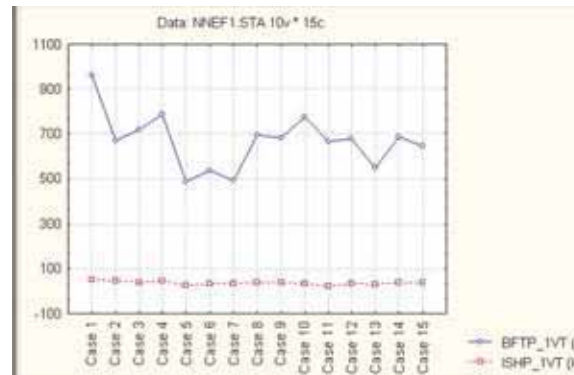


Figure 1 : Graphical representation of plantar pressures : Barefoot Vs Specially designed Footwear (BFTP = Barefoot Pressures; ISHP = Inshoe Pressure after wearing special footwear)

Table 1 and Figure 1 highlight the Barefoot pressures as well as the Inshoe pressures of subjects measured after wearing the specially designed footwear. As is amply demonstrated from the table, the underfoot pressures have reduced drastically on wearing the new footwear. On some of the patients, a follow-up study was done after three months and while there have been no drastic reduction in pressures in the follow up period as compared to the time when the initial pressures were measured on wearing the new footwear, in most of the cases the plantar pressures have either reduced or have remained unchanged.

The tabulated results clearly demonstrate that the design methodology adopted, selection of last and materials for the specially designed footwear have proven to be efficacious in minimizing underfoot pressures resulting in more comfort to the wearer.

The developed footwear targets specific high pressure areas particularly susceptible to neuropathic ulceration [3] and with the right combination of lasts, materials and design markedly reduces the pressures in these areas. The pedorthic therapeutic footwear, through use of specially designed rocker bottomed soles and custom moulded footbeds, relieves underfoot biomechanical pressures to a very large extent.

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