

DATA-DRIVEN DIRECTIONS FOR EFFECTIVE FOOTWEAR PROVISION IN DIABETIC PATIENTS WITH A HISTORY OF FOOT ULCERATION.

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INTRODUCTION

High plantar peak pressures play an important role in causing foot ulcers in patients with diabetes mellitus. In patients who are at risk for developing a plantar foot ulcer these high-pressure areas are offloaded with custom-made footwear. However, in earlier studies this footwear showed to be suboptimal in relieving plantar foot pressure (Arts et al, 2012)

The aim of this study was to evaluate the offloading effectiveness of modifying custom-made footwear and to use this data to provide directions for effective footwear provision for at-risk diabetic patients to prevent foot ulceration

METHODS

Eighty-five diabetic patients with loss of protective sensation due to peripheral neuropathy, and a recently healed plantar foot ulcer, who participated in a multi-center randomized trial on footwear effectiveness (Bus et al., 2013), were provided with new custom-made footwear.

This footwear, and any other pair of custom-made footwear the patient had or was prescribed with during follow-up, was evaluated with in-shoe pressure measurements during walking using Pedar-X at three-monthly intervals for 15 months or until a foot ulcer developed. The footwear was modified when peak pressure at plantar regions was ≥ 200 kPa.

The effect of single and combined footwear modifications on in-shoe peak pressure at these high-pressure target locations and at 8 anatomical foot regions was assessed and then summarized in an offloading-effect matrix. The shoe technician was free to choose type and number of footwear modifications.

RESULTS

A total of 1152 (combinations of) modifications were made over the course of the study in 304 shoes that showed a peak pressure >200 kPa. Modifications of the shoe insole involved replacement of the top cover, addition of

or repositioning of a metatarsal pad or bar, extra medical arch support, more cushioning or removal of insole material. Modification of the shoe involved adjustment of the pivot point of a rocker bar

The metatarsal heads were the target location for footwear modification in more than 50% of cases. All types of footwear modifications significantly reduced peak pressure at the target locations (range in peak pressure relief: -6.7% to -24.0%, $p < 0.05$). Repositioning a metatarsal pad or trans-metatarsal bar in the insole (-15.9% peak pressure relief), applying local cushioning to the insole (-15.0%), and replacing the top cover of the insole (-14.2%), were the most effective single modifications. Combining the replacement of the top cover of the insole with a trans-metatarsal bar (-24.0%) or with local cushioning (-22.0%) were the most effective combined modifications.

DISCUSSION AND CONCLUSIONS

In diabetic patients with a recently healed plantar foot ulcer, significant offloading can be achieved at high-risk foot regions by modifying the custom-made footwear of these patients based on in-shoe pressure analysis.

These results provide data-driven directions for effective offloading to be used in custom-made footwear design and evaluation for diabetic patients and that may likely lower the risk for developing a plantar foot ulcer.

REFERENCES

- Arts ML, et al. Diabetic Medicine 29: 1534-1541, 2012
 Bus SA et al. Diabetes Care 36: 4109-4116, 2013.