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### Biomechanical optimization of orthopaedic footwear for diabetic patients using in-shoe plantar pressure measurement

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The purpose of this study was to assess the feasibility of using in-shoe plantar pressure measurement to optimize the pressure reducing effect of orthopaedic footwear in patients with diabetes. In-shoe plantar pressure was measured during walking at a self-selected speed in 10 diabetic neuropathic patients who were previously prescribed with orthopaedic footwear. Based on the peak pressure (PP) diagrams, regions of interest (ROI, i.e. highest measured pressure or previous plantar ulceration) were selected for optimization. Footwear modifications (shoe and/or insole) were made and their effect on PP at the ROI measured. A maximum 3 rounds of modifications and pressure measurement were applied. Criteria for successful optimization were a PP reduction  $>25\%$  or PP below 200 kPa. In 13 defined ROIs PP was reduced on average from 344 (SD 99) to 229 (SD 73) kPa after optimization. In 12/13 ROIs more than 25% PP reduction was achieved (mean 33%, range 22% to 50%, Figure 1). At the remaining ROI, PP was reduced below 200 kPa. These results show that the footwear evaluated could be successfully optimized. These findings suggest that using in-shoe plantar pressure assessment to evaluate custom-made footwear can be an effective method to achieve significant pressure reduction at high-risk areas. This method provides the clinical team with a more objective approach to footwear prescription and evaluation.

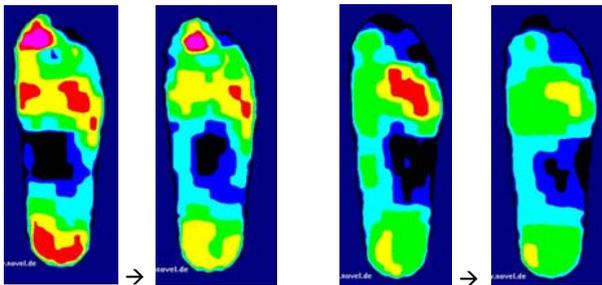


Figure 1. Peak pressure diagrams showing the result of footwear modifications made in two cases: a PP reduction from 469 to 319 kPa ( $=32\%$ ) at the hallux in one patient (left two planes) and from 239 to 172 kPa ( $=28\%$ ) at the lateral forefoot in another patient (right two planes)