

The efficacy of a removable vacuum cast replacement system in reducing plantar forefoot pressures in diabetic patients

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A new prefabricated cast replacement system incorporating an instantly moulded vacuum cushion has recently been developed for the treatment of diabetic plantar forefoot ulcers. The aim of this study was to determine the plantar forefoot off-loading efficacy and perceived walking comfort while wearing this vacuum cast replacement system (VCRS) in neuropathic diabetic patients. Fifteen high-risk neuropathic diabetic subjects (14 male, mean age 59 yrs.) underwent in-shoe dynamic plantar pressure assessment in a removable VCRS (VACO®diaped Plus, OPED, Germany), a Rattenhuber Talus forefoot offloading shoe (FOS) (1), and a Pulman control shoe. The VCRS involves a low rise above-the-ankle prefabricated lightweight lattice frame structure, an instantly mouldable (custom) vacuum cushion providing total contact with the foot and ankle, and a roller walking sole. For each of six foot regions, peak pressure, pressure-time integral (PTI), and force-time integral (FTI) were calculated. Load transfer diagrams based on interregional differences in FTI were developed to assess the mechanical action of the footwear tested. A visual analogue scale was used to assess perceived walking comfort. Forefoot peak pressures and PTIs were significantly lower (by 37-59%) in all offloading footwear conditions when compared with control ($P < 0.001$). The VCRS showed significantly higher metatarsal head (MTH) peak pressures ($P < 0.05$), similar MTH PTIs, and lower hallux pressures than the FOS; no significant pressure differences were found in other foot regions. A major transfer of load from the forefoot to the midfoot explained the off-loading efficacy of the VCRS. Perceived comfort of walking was significantly higher in the VCRS than in the FOS ($P < 0.001$). The results showed that the VCRS was effective in relieving pressure at the plantar forefoot of at-risk diabetic patients. Based on the combined peak pressure, PTI, and comfort results, the VCRS seems a useful alternative for the FOS for offloading the diabetic plantar forefoot and may prove effective in plantar forefoot ulcer healing in future studies.

1. Bus S.A., Wissink M, van Deursen RW, Kanade R, and Manning E. Offloading the diabetic foot using forefoot offloading shoes. DFSG Meeting 2005.