Foot and stair treads dynamics: a photographic study

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Introduction

The hazard of stairs, its socio-economic cost and the potential for stair tread slip resistance to reduce it is widely acknowledged. This study is part of the author’s investigation of foot–tread dynamics and slip resistance.

In a separate study, the loading profile of the landing foot on stair treads was investigated with respect to the motion of the foot on and between treads and the forces on the tread (Hunter, 2015). The purpose of this study was to inform that study: it sought to analyse the motion of feet throughout their approach to, vertical rotation on and departure from stair treads. The study is identical to the photographic studies of Muybridge (1955) except that his participants were in bare feet whereas in this study, participants were in footwear; nor did Muybridge analyse the motion of feet. Other studies have analysed foot motion but with a very small number of participants, such as the ten participants of Riener et al.

Of particular interest for this study was the trajectory of feet between treads, the angle of inclination of feet (plantarflexion) throughout their trajectory, the duration of the trajectory between treads, the rate of foot rotation (dorsiflexion) at foot contact and the placement of feet with respect to the width of the tread tread. The study did seek for social representativeness of its sample other than that there was no filtering of stairway users except for qualitative culling of unsuccessful captured motion sequences.

Method

A video camera with slow-motion functionality was mounted in alignment with and at the same level as a stair tread on each of two stairways. One stairway had timber treads of consistent width over its length; the other was ceramic-tiled and tapered in width from one end to the other.

Camera operation was manually activated upon observation of an approaching person on the stairway.

Results

Discussion

Conclusion

References
