Reference

Schmalz, T, Blumentritt, S, Drewitz, H, Freslier, M. (2006)

Department of Research, Otto Bock Health Care, Duderstadt, Germany.

The influence of sole wedges on frontal plane knee kinetics, in isolation and in combination with representative rigid and semi-rigid ankle-foot-orthoses

Clinical Biomechanics (Bristol, Avon) 21 (6): 631–639
doi:10.1016/j.clinbiomech.2006.02.004.

Products

Agilium Freestep (Prototype), MalleoSprint, shoe wedges (medial, lateral)

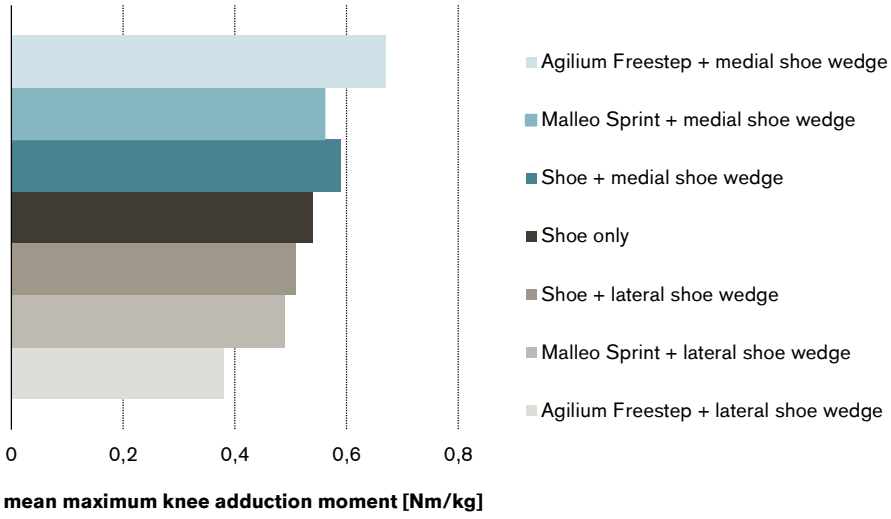
Major Findings

With Agilium FreeStep or Malleo Sprint in combination with shoe wedges compared to no intervention (shoe only condition):

→ **Static: the vertical component of the ground reaction force (GRF) shifts significantly to the medial site with AFO + medial wedge and significantly to the lateral site with AFO + lateral wedge**

→ **Dynamic: the frontal knee loading could be reduced significantly**

Maximum knee adduction moment during walking

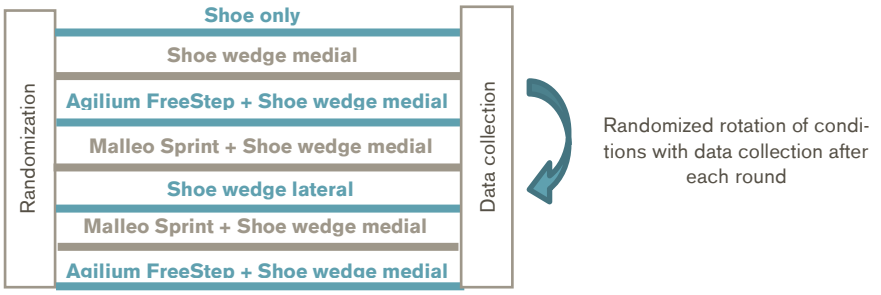


Population

Subjects:	10 healthy adults (6 men, 4 women)
Mean age:	34 ± 9 years
Mean height:	178 ± 4 years
Mean body mass:	73 ± 9 kg

Study Design

Observational, comparative:



The effect on frontal knee loading was measured during standing and walking with medially and laterally placed wedges under the sole of the shoe. The wedges were also combined with two types of orthotic devices – an Ankle–Foot-Orthosis (AFO) that was rigid in the frontal plane but allowed unrestricted sagittal plane motion (Agilium Freestep) and an ankle support that was semi-rigid in the frontal plane (MalleoSprint).

Results

Functions and Activities						Participation
Biomechanics – Static measures	**Biomechanics – Gait analysis**	**X-Ray**	**EMG**	**Functional tests**	**Clinical effects**	**Satisfaction**

Category	**Outcomes**	**Results***		
Biomechanics – Static measure	Knee lever arm in the frontal plane	**Agilium Freestep + 10mm shoe wedge**	Malleo Sprint + 10 mm shoe wedge	Only 10 mm shoe wedge
	Shoe wedge medial	++	0	0
	Shoe wedge lateral	++	0	+
	(knee lever arm = distance between knee joint center to the vector of the ground reaction force (GRF))	With medial elevation of the foot, the vertical component of ground reaction force shifts in a medial direction, while lateral elevation causes lateral shifting.		
Biomechanics – Gait analysis	Knee adduction moment	**Agilium Freestep + 10 mm shoe wedge**	Malleo Sprint + 10 mm shoe wedge	Only 10 mm shoe wedge
	Shoe wedge medial	++	0	+
	Shoe wedge lateral	++	++	0
		A tendency towards an increased adduction moment with medial elevation can be observed. With lateral elevation of the foot, the adduction moment is reduced.		

* no difference (0), significant with $p \leq 0.05$ (+),significant with $p \leq 0.01$ (++)

Author's Conclusion

„For the treatment of osteoarthritis at early stage, the results of this study support enhancement of the effect produced by shoe wedges by application of an AFO that blocks potential compensating coronal plane movements in foot and/or ankle joint." (Schmalz et al. 2006)

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