

FIFTY YEARS AFTER ZAMOSKY'S ARTICLE "SHOE MODIFICATIONS IN LOWER-EXTREMITY ORTHOTICS"

JAAP J. VAN NETTEN, PHD; KLAAS POSTEMA, MD, PHD

The art and science of correcting foot deformities is still a mixture of tradition, artisan skill, clinical experience, and the prescribing doctor's professional convictions [1]. Zamosky's 1964 article on various shoe modifications in lower-extremity orthotics starts with this observation [1]. Reflecting on 50 years of development in this field, we ask ourselves, Have the ingredients of this mixture changed?

Computer-aided design and computer aided manufacturing [2] have changed the elements of the ingredient "artisan skill." However, creating a last from which shoe modifications are fabricated remains an artisan skill, as reflected by the ongoing debate over the relatively low intra- and intercaster reliability [3–4]. The implicit knowledge of the artisan skill still seems to be too complicated to translate into an explicit computer-aided skill. Other technological advancements involve new objective measurement systems. In-shoe pressure measurement systems show promise for analyzing the effect of shoe modifications on plantar pressure distribution [5]. Advanced gait analysis systems provide the option to analyze gait performance before and after shoe modifications [6]. "Objective measurement" is a new ingredient in the mixture.

"Patient perspective" is another ingredient that can be added to Zamosky's mixture. Even when a shoe is "perfectly" modified, it is only effective if worn. As such, patients have an increased role in their own care compared with 50 years ago. This is reflected in studies with patient-reported outcomes as a primary outcome measure [7–8], together with a shift in clinical practice from a product-oriented toward a patient-

oriented method of prescribing and providing shoes.

The remaining ingredients—"tradition," "clinical experience," and "prescribing doctor's professional convictions"—are preferably balanced by reference to evidence-based guidelines. Although national protocols [9] or disorder-specific algorithms [10] can be found, an international guideline for prescribing and providing shoe modifications is an important gap in the literature. To progress from tradition and clinical experience, evidence-based guidelines need to be developed.

Fifty years after Zamosky's article, the ingredients of his mixture for prescribing and providing shoe modifications have changed in-line with advancing technology and changes in patients' role in their own care. The evidence base in this field will continue to profit from the addition of objective measurements and patient-reported outcomes, yet the lack of international guidelines is a reason for concern.

REFERENCES

1. Zamosky I. Shoe modifications in lower-extremity orthotics. *Bull Pros Res.* 1964;10:54–95.
2. Smith DG, Burgess EM. The use of CAD/CAM technology in prosthetics and orthotics—Current clinical models and a view to the future. *J Rehabil Res Dev.* 2001;38(3):327–34. [PMID: 11440264]
3. Carroll M, Annabell ME, Rome K. Reliability of capturing foot parameters using digital scanning and the neutral suspension casting technique. *J Foot Ankle Res.* 2011;4(1):9. [PMID: 21375757]
4. Telfer S, Gibson KS, Hennessy K, Steultjens MP, Woodburn J. Computer-aided design of customized foot orthoses: reproduc-

ibility and effect of method used to obtain foot shape. *Arch Phys Med Rehabil.*

2012;93(5):863–70. [PMID: 22541310]

5. Bus SA, Haspels R, Busch-Westbroek TE. Evaluation and optimization of therapeutic footwear for neuropathic diabetic foot patients using in-shoe plantar pressure analysis. *Diabetes Care.* 2011;34(7):1595–1600. [PMID: 21610125]
6. Keenan GS, Franz JR, Dicharry J, Della Croce U, Kerrigan DC. Lower limb joint kinetics in walking: the role of industry recommended footwear. *Gait Posture.* 2011;33(3):350–55. [PMID: 21251835]
7. van Netten JJ, Jannink MJ, Hijmans JM, Geertzen JH, Postema K. Use and usability of custom-made orthopedic shoes. *J Rehabil Res Dev.* 2010;47(1):73–81. [PMID: 20437329]
8. Williams AE, Nester CJ, Ravey MI. Rheumatoid arthritis patients' experiences of wearing therapeutic footwear—a qualitative investigation. *BMC Musculoskelet Disord.* 2007;8:104. [PMID: 17976235]
9. Heerkens YF, Beers CB, Jansen R, Verwaard R, Eiferink FH, Bougie T, Postema K. Development of protocols for foot/shoe provisions for orthopedic shoe companies and orthopedic shoe technicians for clients that have been referred. [Internet]. Soest, Utrecht (the Netherlands): NVOS-Orthobanda; [updated 2010 Jun; cited 2013 Feb 26]. Available from http://www.nvos-orthobanda.nl/modules/document/click.cfm?content_id=113309
10. Dahmen R, Haspels R, Koomen B, Hoeksma AF. Therapeutic footwear for the neuropathic foot: an algorithm. *Diabetes Care.* 2001;24(4):705–9. [PMID: 11315835]

