



Co-funded by the
Erasmus+ Programme
of the European Union

3D Scanning of the foot

Background

The foot geometry representations used to design FO have often been used to define the degree of customisation of FO

C. Smith, S. Marshall, PFOA Technical Standards Document: Foot Orthotic Classifications, Definitions, and Summary of Manufacturing Processes Document, (n.d.). <https://outlook.office.com/owa/?path=/attachmentlightbox>.

B. Jarrett, R. Marcus, R. Michel, M.A. Robinson, Prescription Custom Foot Orthoses Practice Guidelines, Am. Coll. Foot Ankle Orthop. Med. (2006).

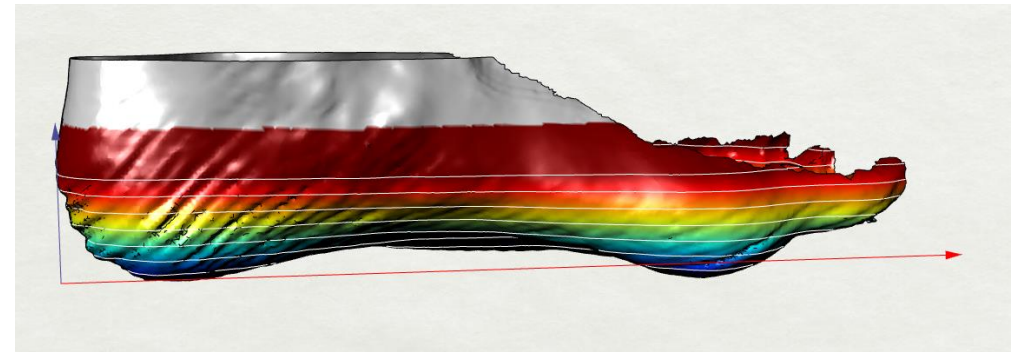
A lot of effort has been dedicated to the analysis of FO referred as “customised FO” which are defined as FO based on a patient-specific 3D foot model.

L.S. Chapman, A.C. Redmond, K.B. Landorf, K. Rome, A.M. Keenan, R. Waxman, B. Alcacer-Pitarch, H.J. Siddle, M.R. Backhouse, A survey of foot orthoses prescription habits amongst podiatrists in the UK, Australia and New Zealand, J. Foot Ankle Res. 11 (2018) 1–11. doi:10.1186/s13047-018-0304-z.



Physical VS Digital 3D foot model

Previously, foot models have exclusively been captured in a physical way typically via the use of foam box or plaster cast techniques. Nowadays, we are able to capture and generate foot models in a digital way via the use of technologies such as digital camera or 3D scanner.



C. Smith, S. Marshall, PFOLA Technical Standards Document: Foot Orthotic Classifications, Definitions, and Summary of Manufacturing Processes Document, (n.d.). <https://outlook.office.com/owa/?path=/attachmentlightbox>.

B. Jarrett, R. Marcus, R. Michel, M.A. Robinson, Prescription Custom Foot Orthoses Practice Guidelines, Am. Coll. Foot Ankle Orthop. Me



Co-funded by the
Erasmus+ Programme
of the European Union

Physical VS Digital 3D foot model

While the anthropometric measurements on the physical and digitized models are in general comparable, the use of the 3D scanning techniques have a time and cost advantage which can be maximized by making the acquisition directly on the patient's foot to avoid a casting procedure.

S. Telfer, J. Woodburn, The use of 3D surface scanning for the measurement and assessment of the human foot, *J. Foot Ankle Res.* 3 (2010) 1–9. doi:10.1186/1757-1146-3-19.

From an ecological point of view, avoiding the casting procedure can also be deemed advantageous since it automatically reduces the waste of material.

A. Gatt, C. Formosa, N. Chockalingam, The application of generic CAD/CAM systems for the design and manufacture of foot orthoses, *Faoj.* 9 (2016) 6. doi:10.3827/faoj.2016.0903.0006.



Physical 3D foot model - Definition

A physical 3D model captures foot anatomy through direct contact to duplicate plantar foot anatomy.

The most common examples are :

- Plaster of Paris casts
- Foam impressions

C. Smith, S. Marshall, PFOA Technical Standards Document: Foot Orthotic Classifications, Definitions, and Summary of Manufacturing Processes Document, (n.d.). <https://outlook.office.com/owa/?path=/attachmentlightbox>.



Co-funded by the
Erasmus+ Programme
of the European Union

Digital 3D foot model - Definition

A digital 3D foot model must use actual 3-dimensional data points taken directly or indirectly from the foot to duplicate plantar foot anatomy. The most common technologies used to acquire such a digital 3D foot model are :

- Laser 3D scanners
- Stereo-digital 3D imaging systems
- Pin array systems.

C. Smith, S. Marshall, PFOA Technical Standards Document: Foot Orthotic Classifications, Definitions, and Summary of Manufacturing Processes Document, (n.d.). <https://outlook.office.com/owa/?path=/attachmentlightbox>.

Modes of modeling the foot

Numerous techniques have been developed to capture the shape and contour of the foot for the purpose of prescription fabrication of custom foot orthoses. These techniques have an impact on the resultant plantar geometry of the foot that is captured for the individual patient and these fall into two general categories:

- Category 1 – scanning in a functional position: modeling the foot while the foot is placed by the therapist or the patient in a specific position imposed by the therapist (most often STJ neutral with the MTJ locked). An example of such scanning may involve the positioning of the STJ neutral position according to Root in order to create a so-called neutral foot model.
- Category 2 - scanning in an accommodative position: modeling the foot while the foot is in a natural relaxed position without any interaction of the patient or the therapist

These definitions were adapted from : B. Jarrett, R. Marcus, R. Michel, M.A. Robinson, Prescription Custom Foot Orthoses Practice Guidelines, Am. Coll. Foot Ankle Orthop. Med. (2006).