3D Scanning for Modern Clinical Practice

It's a matter of technique over technology.

BY DEAN HARTLEY

The Forum is PM's ongoing series of articles in which individual practitioners present their personal perspectives on clinical technologies, new products and services, practice-building, and/or the state of the profession.

3D Scanning vs. Plaster Casting: Evolving Techniques in Orthotic Capture

Since the 1990s, debate has persisted over which method—traditional plaster casting or modern 3D scanning—yields superior orthotic outcomes (Figure 1). Yet, one constant remains: the clinician's understanding of what they are capturing and how it influences the final result is paramount.

Regardless of the capture method, the orthotic lab's role is unchanged—to interpret and modify based on the clinician's recommendations and desired outcomes. However, the variables requiring interpretation have expanded significantly with the advent of modern techniques. Today's methods include plaster casting, foam boxes, flatbed laser scanning and more recently iPad and iPhones using either TrueDepth (front camera infrared sensor array), structured light (Structure attachment) and videogrammetry (rear video camera).

It is essential for orthotic labs to deepen their clinical understanding of each technique to ensure the best clinical outcomes.

Each 3D scanning approach offers varying degrees of load-bearing and biomechanical correction. Some clinicians employ fully corrected scans using flat, clear, glass/acrylic frames or weight-bearing flatbed scanning techniques to balance the forefoot to rearfoot alignment. Clinicians using the above-mentioned technology may often stray from traditional neutral position casting techniques.

Many techniques are evolving including deliberately over or under correcting rather than traditional

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Figure 1

	Pros	Cons
Traditional/Plaster Casting	Easy to balance and visualize Inexpensive initial outlay Physical cast for technicians to work off	Labor intensive Reproducibility Turnaround Times Inaccuracy of plaster mods Material warp Slow and messy casting Potential damage in post Cost and time per cast Foot often shorter/narrower (NWB)
3D Scanning	Turnaround times Reproducibility Accuracy 3D Scanning speed Scanning costs become cheaper over time	More expensive initial outlay New technique to learn No physical mold to examine

1. Is Scanning More Effective Than Casting for Custom Orthoses? Podiatry Today Vol 33—May 2020 by Bruce Williams, DPM and Jeff Root
2. Cost benefit comparison of plaster casts and optical scans of the foot for the manufacture of foot orthoses. 2007. Craig Payne.

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'neutral' position only. Other clinicians opt for non-weight-bearing scans with minimal correction, relying on the lab for modification. Semi weight bearing methods such as suspension or prone casting with plaster bandage or handheld scanners, introduce further variability, however, these are tried and tested methods that are still widely used.

Given this diversity, it is essential for orthotic labs to deepen their clinical understanding of each technique to ensure the best clinical outcomes. Accurate modification and design depend on recognizing and adapting to these nuanced variations.

As with any technological advancement, the shift to 3D scanning has introduced new challenges. Chief among them is the need for clinicians to master scanning techniques. This article explores the current hardware landscape, shares findings from a recent comparative study on scan accuracy and provides practical guidance for optimizing scanning protocols—especially for foot orthotics and above-the-ankle devices.

Figure 3

The Hardware Landscape: Options and Trade-Offs

The selection of appropriate scanning hardware is a critical decision for podiatrists, as it directly influences workflow efficiency, scan fidelity, and long-term costs. While some clinics may prioritize affordability, others may seek versatility or compatibility with specific orthotic applications. Understanding the nuances of each system allows clinicians to make informed choices that align with their practice needs and patient demographics (Figure 2).

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Clinicians now have access to a range of 3D scanning technologies, each with its own strengths, limitations, and cost structures. Figure 3 presents a breakdown of the most commonly used systems.

Accuracy: What the Research Tells Us

A recent study compared four scanning technologies. The study evaluated scan-derived CAD measurements and final design files across platforms (Figure 4).

The implications of this research are significant. It suggests that investment in expensive hardware may not yield better clinical outcomes unless accompanied by rigorous training in scanning technique. This democratizes access to high-quality orthotic fabrication, enabling smaller clinics to achieve comparable results using more affordable tools, provided they adhere to best practices in scan acquisition.

Building on this democratization of access, economic analyses further reinforce the practicality of 3D scanning. Comparative evaluations have shown that 3D scanning can reduce procedural costs by up to

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Figure 2

Hardware	Laser Bed Scanner	Hand-Held (Structured Light)	iPad Structured Light Scanner	TrueDepth Scanning (iPad Pro or iPhone)
Best for	Custom Foot Orthoses (CFO)	Above the ankle orthotics (AFOs, Custom Braces)	CFO, UCBL, SMO and AFOs	CFO and AFO
Not Suitable for	Ankle-Foot Orthoses (AFO)	—	—	—
Hardware Cost	~$2,000	>$2,000 One-off capital purchase	~$1,500 (Structure Scanner + iPad)	$500-$1500 (iPad Pro—3rd Gen+ or iPhone X and up)
Pros	Reliable for foot-level capture	Reliable for foot-level capture	High-quality scans; versatile	Most clinicians already own compatible devices; minimal setup
Cons	Limited depth capture; not viable for above-the-ankle devices	Limited depth capture; not viable for above-the-ankle devices	Higher initial outlay; requires calibration and setup	Dependent on scanning technique; file quality varies

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80% and time requirements by nearly 85% compared to traditional plaster casting. These insights emphasize the efficiency and cost-effectiveness of 3D scanning technologies in clinical settings.[2]

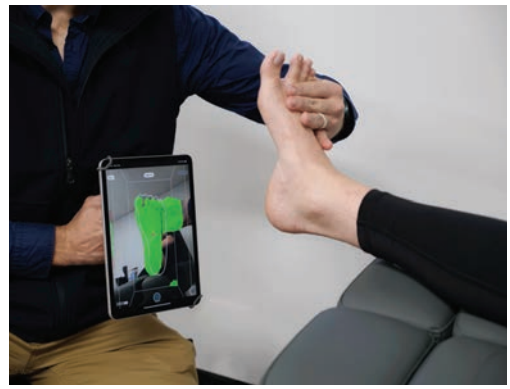

Figure 5

Figure 6

Key Findings:

- No significant differences were found between the hardware platforms in terms of scan accuracy and final design output.
- Clinician technique was the most critical variable influencing the quality and usability of the final design file.
- The amount of load placed through the scan was the main cause of differences in design output.

This underscores a vital point: while hardware matters, technique matters more.

Technique Matters: A Closer Look at Scanning Protocols

Technique is not merely a procedural step—it is the cornerstone of successful digital orthotic design—no different to a plaster cast or foam impression. A well-executed scan captures the anatomical subtleties of the foot and lower limb in the desired corrected position, ensuring that the final device conforms precisely to the patient's morphology if required. Conversely, poor technique can introduce distortions that compromise fit, function, and patient comfort.

TrueDepth scanning—using the front-facing camera of an iPad Pro or iPhone—in addition to iPads with a structure sensor pro attachment, is rapidly becoming the industry standard for foot orthotic and above-the-ankle capture.

Why Scan Quality Matters

Labs rely solely on the scan and prescription. A poor-quality scan can

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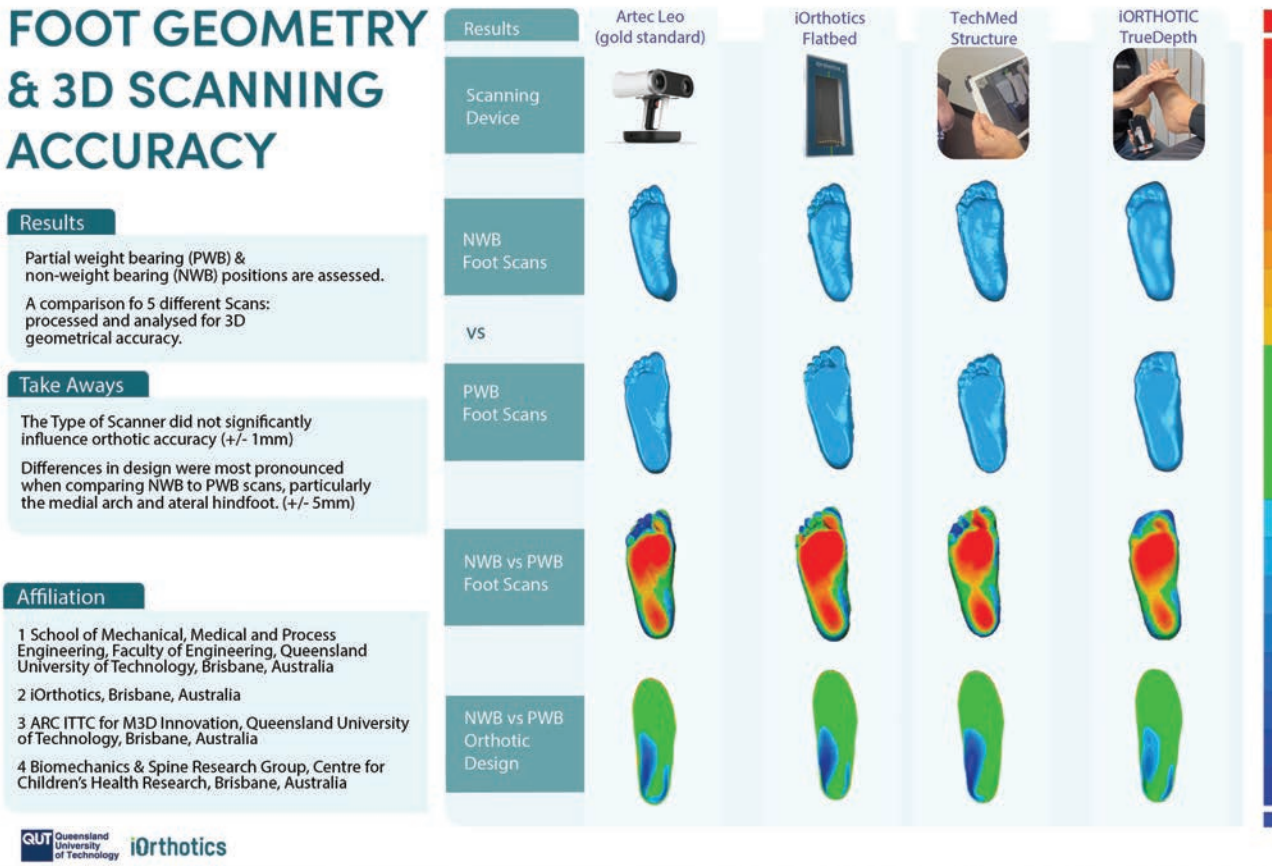

Figure 4: Komal Chhikara 1 2 3, Sinduja Suresh 1 2 3 4, et al.

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compromise the final device, leading to delays, remakes, or suboptimal outcomes. Although digital cast correction is easily done, it is not ideal, and best practice is providing a well-balanced and aligned scan to your orthotic lab.

Tips for Effective 3D Scanning

These principles serve as a checklist for clinicians aiming to produce clinically viable scans.

- Choose the foot position required for 3D capture based on the assessment and diagnosis of your patient.
- Position can vary from STJ neutral to maximally everted/inverted depending on the patient's needs.
- 3 Point Contact with flatbed scanner/frame is ideal—1st and 5th Metatarsal and heel.
- To reduce discretion from your Orthotic Lab attempt to capture the most accurate foot morphology and balance the forefoot to rearfoot relationship within the scan when possible.
- Consistency within each method of scanning is a key ingredient. Semi-Weight bearing appears to be a common trend as it helps negate certain casting errors including forefoot supinates (flexible varus) and plantarflexed forefoot, whilst capturing soft tissue expansion.
- Due to varied techniques with modern scan methods, Labs need to know if scans are Full Weight Bearing (FWB), Non-Weight Bearing (NWB) and Semi Weight Bearing (SWB). Minimal Lab interpretation is ideal, and this is the case for both 3D scanning and traditional plaster casting.
- There is no perfect technique. Personal experience and desired patient outcomes influence technique used.

Figure 7

Weight-Bearing vs. Non-Weight-Bearing Scans

Weight-bearing load during scanning significantly affects the morphology captured. Semi-weight-bearing scans reflect the functional alignment of the foot during gait, leading to devices that better accommodate dynamic loading (Figure 6). Non-weight-bearing scans, while easier to perform, often result in narrower devices that require post-processing adjustments, increasing fabrication time and cost (Figure 5).

The study also compared semi-weight-bearing (SWB) and non-weight-bearing (NWB) scans. The results were clear:

- SWB scans produced more accurate and clinically viable design files.
- NWB scans can result in devices that were too narrow, requiring lab modifications.
- FWB scans may still be widely used for accommodative diabetic devices and rigid deformities within the foot and ankle. These results will be most closely replicated by foam box techniques.

In clinical practice, the use of scanning aids can significantly enhance the quality and consistency of digital captures.

Practical Setup Tips for Clinicians

Preparation is key to successful scanning. Clinicians should rehearse the scanning process to build confidence and ensure smooth execution during patient appointments. The physical setup—including chair height, patient posture, and room layout—should be optimized to facilitate unobstructed scanning and minimize patient discomfort.

Before You Scan:

- Practice with a colleague before scanning patients.
- Ensure correct setup to avoid fumbling during live appointments.

During Scanning:

- Follow the 90/90 Rule: Position the subtalar and talocrural joints at 90 degrees.
- Elevate the foot to capture the posterior heel.
- Use an adjustable chair: Align the patient's knee and hip for comfort and accuracy.
- Allow ample space around the patient for device movement.

Tools and Aids to Enhance Scanning

In clinical practice, the use of scanning aids can significantly enhance the quality and consistency of digital captures. (Figure 7).

Scan plates are indispensable for semi-weight-bearing (SWB) scanning. These devices help stabilize the foot and ensure proper alignment between the forefoot and rearfoot, which is critical for accurate modeling. We recommend their use for all custom foot orthoses and above-the-ankle scans, as they provide a reliable platform that supports reproducible positioning and minimizes distortion (Figure 6).

Scan mirrors are especially helpful when using TrueDepth scanning technology. These mirrors enable the clinician to maintain an upright position of the scanning device, improving visibility and control during the capture process. This is particularly useful when scanning complex ana-

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tomical regions or when working in confined clinical spaces.

Hand straps offer ergonomic benefits by improving the mobility and handling of the scanning device. They allow for smoother transitions around the limb and reduce clinician fatigue during longer scanning sessions. Together, these aids contribute to a more efficient and precise scanning workflow, ultimately enhancing patient outcomes through better-fitting and more functional orthotic and footwear solutions (Figure 7).

Conclusion: Technique Is the New Gold Standard

As 3D scanning becomes the norm in podiatric practice, the focus must shift from hardware to technique. The research suggests; regardless of the device used, the clinician's scanning method determines the accuracy of the final orthotic (Figure 4).

By mastering scanning protocols, using the right tools, and understanding the nuances of weight-bearing capture, podiatrists can ensure optimal outcomes for their patients—every time.

Get more scanning tips—just scan the the QR code.

Supporting Research

[1] Chhikara, K., Suresh, S., Morrison, S., Hartley, D., Evans, K., Wille, M. L., Teixeira, M. B. F., Hughes, B., Haskell, N., Beatson, A., Chamorro-Koc, M., & Little, J. P. (2025). Does scanner choice matter for the design of foot orthosis? Sensors (Basel), 25(3), 869. https://doi.org/10.3390/s25030869 [PMID: 39943509; PMCID: PMC11820986]

[2] Payne, C. B. (2007). Cost benefit comparison of plaster casts and optical scans of the foot for the manufacture of foot orthoses. Australasian Journal of Podiatric Medicine, 41(2), 29–31. https://www.podscan.com.au/images/downloads/Plaster_Cast_Vs_Scaning_Cost_Benefit.pdf

[3] Is scanning more effective than casting for custom orthoses? (2020). Podiatry Today. Retrieved from https://www.hmpgloballearningnetwork.com/site/podiatry/scanning-more-effective-casting-custom-orthoses

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