KEVIN ORTHOPEDIC

Client Services: 1-877-767-3338
Fax: 1-866-919-9268
Web: www.kevinorthopedic.com
Email: hello@kevinorthopedic.com

Making a Switch: From Casts to 3D Scanning

Are you thinking of switching to 3D scanning? Podiatric clinicians are constantly wondering which method to perfectly capture a patient's contour is the most accurate and practically preferred. This presentation will demonstrate a brief overview of the history, instructions for usage, pros/cons and costs of switching from a physical casting method to a 3D scanner.

Brief History of 3D Scanning Technology

According to Modena specialists, 3D scanning began in the late 1960's. At that time, it was created by using projectors, lights and cameras. The technology since then has been rapidly developed and perfected to make it as easy as possible for daily usage. Laser stripe and laser point imaging was developed with varying results until Immersion and FARO Technologies were introduced, creating low cost manually operated digitizers. 2D slices, polygon models and other techniques were the staple at the time (History of 3D Scanners). Currently, the podiatric environment of 3D scanning involves using point clouds, sets of data points in a given space. Podiatric scanners measure the number of points on the external surface of objects. Point clouds are extremely helpful when used for rendering, animation and mass customization applications.

Devices and Software Needed:

There are two main ways to capture scans and send them to Kevin Orthopedic:

1. Portably, through a software program installed on a compatible Apple iPad with 3D scanner attachment
2. Stationary, through a custom software program coupled with a 3D imaging device.

For convenience, some companies offer the portable scanning equipment as as a bundle. Kevin Orthopedic will release more news soon regarding its iPad application update in Spring 2019. Legacy scanning systems (Delcam, TechMed3D, Tom-Cat, etc.) will continue to be accepted.

Portable 3D Scanning

1. Compatible Apple iPad
2. Scanner attachment
    - Structure Sensor
3. Scanning Software Programs:
    - KevinRx by Kevin Orthopedic Spring 2019 App store release
    - TechMed3D
    - AOMS TOT by Sharp Shape
4. Bundle Options (iPad, Sensor Attachment, & Scanning Program):
    - KevinRx Bundle
    - Structure Sensor Bundle

Stationary 3D Imaging

Scanners and Programs:

- VeriScan Podiatric Scanner (VPS)
- Elinvision Scanner
- DelCam iQube (Elinvision rebranded discontinued, still functional)
- TOM-CAT Foot Scanner (discontinued, still functional)
- Sharp Shape 3D Laser Foot Scanner USB3D

Scanning a patient:

In general, scanning a patient's feet with a portable iPad Scanner is best done when approximately 1 meter away from the object and having an unimpeded 360° path around it. When the patient is placed in a stable position, the scans capture the image well. Next, the scanning software program will convert the files and you will be able to submit them to Kevin Orthopedic. Each program may differ, so please refer to the programs' "How to" section on the software developers' page for more details.

In general, scanning a patient's feet with a stationary 3D imaging device requires placing the foot in/on the designated area of the device. When the patient is placed in a stable position, red line-lasers can process and complete an image in a matter of a seconds. Submission to Kevin Orthopedic takes another few seconds. Each program can differ because of the customization options for the clinician's office, so please refer to the programs' "How-to" section on the software developers' page for more details.

How 3D scans become orthotics

Kevin Orthopedic offers a variety of methods to create orthotic and AFO frames from 3D scans. Preferably, measurements of the arch height and size of the foot are converted to creating a CAD CAM positive model for vacuum forming, but additive manufacturing (3D Printing) and subtractive manufacturing (Direct Mill Frame) are available too. For more information on the processes listed above, please visit here or review Section 3 of the Kevin Orthopedic Order Form Guide.

Pros

Most 3D scanners available are capable of capturing high quality detail in high resolutions, i.e. 0.5mm for Structure Sensor, and only show a 1% variation in congruence. The process of capturing a scan is incredibly simple for a clinician and staff. The costs related to plaster, STS socks, impression foam and other supplies commonly used for creating a cast or impression are significantly reduced, while also maintaining a clean practice. Sending a digital scan through the internet to the orthotic laboratory eliminates any shipping costs and reduces some manufacturing time. At the end of the process, an excellent orthotic or AFO product is produced. For more information on 3D scanning, please visit here or review Section 3 of the Kevin Orthopedic Order Form Guide.

Cons

Although 3D scanners are incredibly accurate, the actual manufacturing process does produce a higher variation of congruency when compared to plaster slipper casts or foam impressions. Kevin Orthopedic offers a general frame congruency chart that can be reviewed on pg. 11 in the Kevin Orthopedic Order Form Guide. The reason for this variation is due to the CAD software program's rendering. CAD technicians are also economically very limited in time to create perfect congruence, and thus shortcuts are used to shorten production time. If more time were given for the process to perfect frame congruence, it would significantly increase costs of production. Dependent on the manufacturing process selected by the clinician, some limitations on materials can be applicable. For more information on 3D scanning, please visit here or review Section 3 of the Order Form Guide.

DPM Opinions on 3D Scanning

Dr. Dianne Mitchell has stated that she enjoys using the scanners, but valuable lessons need to be addressed. A few examples of the lessons (view all examples here) mentioned are obtaining a scanner will not make-up for poor casting capabilities or patient's being able to sit still for the digital imaging (Mitchell

2008). Dr. Huppin has written a more detailed article about scanning techniques, i.e.1st ray plantarflexion techniques, which can be viewed here (Huppin 2009).

Estimated 3D Scanning Costs:

Portable 3D Scanner

- iPad: $329+ (new device)
- Structure Sensor: $379+
- Scanning Software Programs: $350+/year (complimentary for qualified clients)
- Complete Bundles: $1,100-$1,600+

Stationary 3D Scanner

- 3D Imaging: $3,000 (complimentary for qualified clients)
- Foot Plates: $3,500

Comparing the costs to maintain plaster, impression foam or STS socks with the costs of 3D scanning is the next step for a clinician interested in making a change. According to DPM's Lawrence Z. Huppin and Paul R. Scherer, the cost per patient for plaster was $19.96 to $35.43 (converted from AUD in 2/2019). In the same paper, they estimated that digital scanning cost $2.36 to $7.14 (converted from AUD in 2/2019) per patient (Huppin & Sherer 2017).

Final Thoughts

Kevin Orthopedic believes this informative presentation provides a good sample of the starting off point when making a switch from a physical casts to digital ones. It is recommended to review and compare the costs for each option as prices may have fluctuated or changed since the creation of this presentation. Please contact Kevin Orthopedic for any additional questions.

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Kevin B. Rosenbloom, C.Ped, Sports Biomechanist

Kevin B. Rosenbloom, founder and president of Kevin Orthopedic, is a renowned certified pedorthist and sports biomechanist practicing in Santa Monica, CA. With his continuing research on the historical development of foot and ankle pathologies, comparative evolution of lower extremities and the modern environmental impacts on ambulation, he provides advanced biomechanical solutions for his patients and clients.