HP's FitStation and the 3D Tiger Scanner: Fine-Tuning Custom Orthotics

There are a host of both clinical and financial benefits offered by this innovative technology.

BY JEANETTE SMITH

Our world is constantly changing and podiatric practices along with it. But some things have stood the test of time. Or rather, they haven't evolved much over time. But a lack of change does not mean that something is fine the way it is. Perhaps we need to take a closer look to properly judge whether things are as they are just because they *should be* or because they simply always *have been.*

A bulky, stiff orthotic may not fit into many shoes, making compliance an impossibility, not a patient choice.

Pressure plate

A decade ago, the process for making orthotics was exactly the same as it is today. In fact, if you use plaster casting, you're using a method invented over half a century ago. While the rest of medicine is progressing, the process for crafting custom prescription orthotics has remained stagnant. But the future is just around the corner. Or, according to HP and Go 4-D, it's already here.

Industrial Revolution 4.0

Humankind is already onto its fourth Industrial Revolution, one that blurs the lines between biology and technology. It's about combining the best of modern advances with the knowledge of a seasoned physician to bring better healthcare to patients. As Paul Linton, CEO of Go 4-D, says, "We feel that the more data we can get and the more involved the practitioner is in the prescription process, the better they can help the patient get back to regular activity and lead a more normal life. Prescription orthotics work. They've been shown to benefit patients and we're just trying to fine tune them to work better than what has been done in the past."

HP, the world's largest printing and PC company, has teamed up with Go 4-D to bring this vision to life by redesigning the orthotic manufacturing process from the ground up. "We chose them because they have a strong desire for new technology and making better products using technology," says Sarah Clevinger, senior manager, FitStation by HP. "We don't just want to copy the problems [with

Continued on page 125

New Concepts and Studies

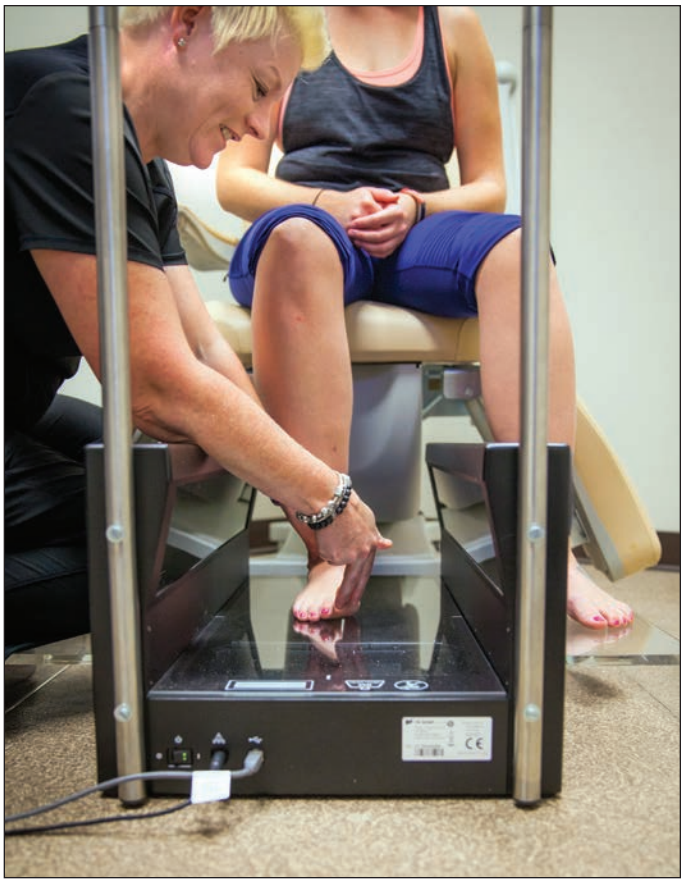
"New Concepts" is a forum for the presentation of (1) new technologies and products and (2) new studies involving existing products. Readers should be aware that Podiatry Management *does not specifically endorse any of the technologies, concepts, or products being discussed.*

the process], we want to correct the problems."

The Way It's Always Been Done

The very first step in making custom orthotics poses the first problem with the overall process. Both foam impression boxes and plaster casting methods offer a single, static look at the foot. A foot in motion works differently than a foot at rest and can reveal additional considerations needed for prescribing modifications to an orthotic device.

These manual methods also leave room for human error. "There is a gap created when you try to take an inaccurate manner of analysis and create an accurate device," explains Linton. For a truly customized orthotic, the subtleties of the foot and gait must be captured and analyzed—something plaster casting and foam impressions cannot do.



3-D scanner

Note: All pictures were taken at the North Bay Foot & Ankle Clinic in Northern Ontario, Canada.

After the initial mold is taken, the cast or foam box must then be shipped to the lab, presenting more problems—the cost of postage, the perils of shipping, and the long wait from pickup to delivery. Not only is postage a direct expense to your business, but it has also been steadily increasing. In 2001, the average cost for a package sent through USPS was $0.34 per oz. Today, it's $0.88.[1]

There are also a staggering number of packages and letters lost in the mail—88 million in 2014; only 2.5 million of which were returned to their owners.[2] Not to mention the millions more that arrive damaged. And if you aren't paying a premium for 2-day shipping, then you can expect to wait between one and two weeks before your package reaches the lab.

After the package is received at the lab, there is a further waiting period while the technician makes a positive form from the foam box or plaster cast. After all the money, effort, and time to get it there, the cast or box is then tossed in the trash. But the waste doesn't stop there. The subtractive process of crafting a custom orthotic means that "you're taking an oversized piece of plastic or oversized material and then trimming and subtracting and taking away pieces, all of which are thrown in the bin," says Linton. "It's incredibly wasteful."

The subtractive process also poses a problem to the final design. Shaping an orthotic from a single piece of plastic leaves you with a solid device of relatively uniform thickness and strength. To add support, excess materials must be added, making the final orthotic bulky and difficult to use.

This leads to problems with patient compliance. While many physicians blame the patient for his/her lack of obedience, perhaps the real problem lies in the device itself. A bulky, stiff orthotic may not fit into many shoes, making compliance an impossibility, not a patient choice. "That's an issue a lot of people have," agrees Clevinger. "They go and get their orthotic and then they don't fit into their shoes right and they don't want to wear the orthotic, and then what's the point of all this?"

The HP pressure plate offers four sensors per square centimeter to capture more useful data.

A Mission for Change

When looked at in these terms, the process for crafting a custom prescription orthotic leaves something to be desired. But Go 4-D and HP have analyzed each of these problems and found solutions. "We saw the shortfalls that traditional manufacturing had," says Linton. "And technology, for the most part, hasn't been used for the product benefit to try and make a better mousetrap, or in this case a better orthotic." The new FitStation technology combines 21st century computing with a dynamic range of data to eliminate inaccuracies and inconveniences.

The Pressure Plate

The first problem to solve was the issue of static scanning. "The reason we call it Go '4-D' is that we wanted to

Continued on page 126

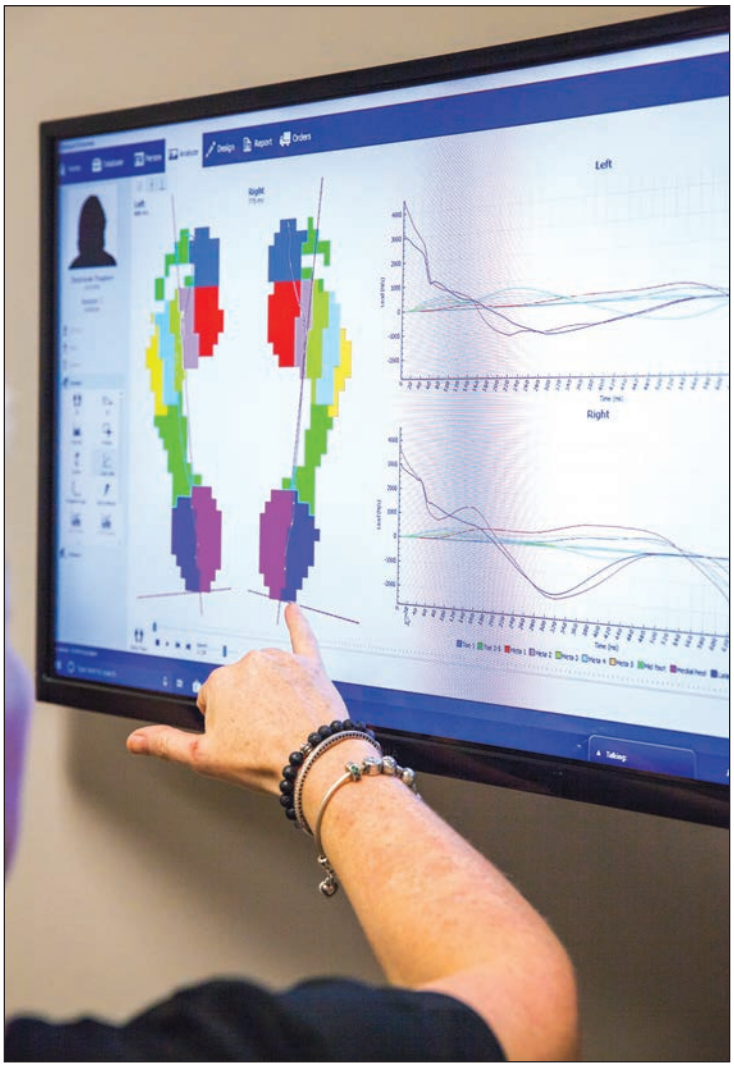
look at the foot in another dimension," explains Linton. "We're looking at timing and pressure and how these are important factors in prescribing orthotics." The HP pressure plate offers four sensors per square centimeter to capture more useful data.

Making recommendations for modifications to the orthotic device is easier than ever.

During the scan, the foot is broken down into 10 distinct areas.

The pressure plate measures when each area of the foot strikes the floor, how long it stays there, and how much pressure goes through one area compared to another. "That's useful information that we can build into the designing of the actual orthotic device," says Linton. "We get detailed information through the entire gait cycle and we can modify or change the prescription based on what we're seeing with the dynamic analysis, versus just the static analysis."

The pressure plate also measures pronation, supination, and asymmetry within the feet. This can give insights into balance and indicate risk factors for injuries based on the patient's gait, arch, existing deformities, etc. By capturing the dynamic motion of the foot, podiatrists will be able to better understand a patient's needs and order modifications to the prescription device as necessary.



Display of data from the FitStation.

The HP 3-D Tiger Scanner

The second step to building a better orthotic came in the form of the 3-D scanner. Each of the nine laser-powered cameras is completely accurate down to half a millimeter, building the most detailed 3-D profile of any technology. This 3-D scan allows the prescriber to see more details than other impression or casting methods and eliminates inaccuracies.

The Tiger Scanner doesn't just measure length and width, "but also the arch height, arch length, arch width, and other biometric data of your foot. So, if one foot is fatter or has more girth than the other, we are able to see all these differences in the 3-D scan," says Clevinger. The scanner can pick up on the subtle differences between feet that a visual inspection cannot, leaving you with more information to make an accurate diagnosis and orthotic recommendation.

Together, the 3-D Tiger Scanner and pressure plate eliminate several other problems. There is no need to buy materials for casting or foam boxes for impressions. There are no longer chances for inaccuracies or a need to adjust for human error in the casting/impression process.

Going digital with the FitStation also eliminates the need to purchase casting materials and foam boxes.

And making recommendations for modifications to the orthotic device is easier than ever. "It's plug and play," explains Clevinger. "We worked really hard in the beginning to make sure it's a smooth installation process. You can have the unit up and running, even in as little as a week after contacting us."

FitStation Software

To utilize the data gathered by the 3-D Tiger Scanner and pressure plate, HP created the FitStation platform.

Continued on page 127

"HP was the first to integrate the 2-D plantar pressure measurements with the 3-D scan inside of one cloud-based software," explains Linton. When taken together, the data gathered gives the most comprehensive overview of foot health ever compiled.

Not only does this allow for a more accurate diagnosis and prescription device, but it also gives the patient and physician better control over this important data. Since foam boxes and plaster casts are thrown away, there can be no comparison with future impressions and moldings. With the FitStation, "all that data is analyzed and stored in the database," Clevinger explains. "Practitioners can always access the customer's scan data and monitor their change over time, and also compare their movement with and without the orthotic devices."

Like other advances in the medical field, this one will impact the podiatric profession deeply in the years to come. It's imperative that every practitioner explore this process and decide whether it is suited to their practice.

Going digital with the FitStation also eliminates the need to purchase casting materials and foam boxes. There are also no more excessive shipping costs, the data cannot be damaged in transit like a cast or foam impression, and the time from when you hit send on your computer to the lab receiving the order is virtually instantaneous, shortening the wait time for your custom devices by days or even weeks.

Although the main goal is to automate as much of the process as possible, the FitStation software is never intended to take the place of a physician in prescribing custom orthotics. "Our goal is to take all the information about a patient we can gather—the 3-D scan, the plantar plate measurements, and the dynamic details—and partner it with a practitioner who has years of experience in diagnosing and treating those problems," says Linton. Like digital x-rays, this technology is simply another diagnostic tool aimed to make your job easier and result in additional benefits for the patient.

Multi Jet Fusion Printer

The last hurdle to overcome in creating a better orthotic was to find a superior manufacturing process. That's where the Multi Jet Fusion comes in. A literal 180 from the subtractive process used for orthotics today, 3-D printing is an additive process, building the orthotic from nothing with only the exact amount of material needed. "Any excess powder is scooped up and used in the next printing job, so it is much more environmentally friendly," explains Linton. Not only does this significantly reduce waste, but it also allows for a new level of customization.

The lattice design in particular is what sets 3-D printed orthotics apart. "When we build something from the ground up, we can change the design, we can change the structure," explains Linton. "The plastic they use in traditional manufacturing has the same properties throughout the entire shell. Whereas we are able to design the lattice to be more flexible or rigid in certain areas. We can also design the lines at a certain angle, adding an intrinsic motion control to the device that could never have been done before."

3-D printing also eliminates the time needed to make the positive foot mold from the foam box or plaster cast and eliminates the long, labor-intensive process of cutting down materials by hand. Product timing at factories and labs is impacted by demand and the number of available workers, which can change during the year due to holidays, vacations, etc.

Traditional timing to turn around a pair of orthotics can vary widely, and it can be weeks or even months before your patients receive their completed devices. 3-D printers do not take vacations and will cut down on the time needed to make each orthotic. In the future, it could be feasible to have a 72 window between the initial scan and when the orthotics arrive on your patient's doorstep.

Impact

Like other advances in the medical field, this one will impact the podiatric profession deeply in the years to come. It's imperative that every practitioner explore this process and decide whether it is suited to their practice. "Really, with HP, our goals are centered around this idea of using 3-D technology to change the way these industries are moving forward," says Clevinger. "The idea of FitStation is to reshape the footwear industry, whether it's creating custom orthotics, offering shoe recommendations, or making shoes fully customized for that individual's feet."

The writing is on the wall, and the traditional process for molding and crafting prescription orthotics is evolving for the better. *If you want to explore this technology further and see what it can do for your practice, go to www.go4-d.com, email Paul@go4-d.com, or call 1-888-353-4643.* **PM**

Sources for Statistical References

[1] https://en.wikipedia.org/wiki/History_of_United_States_postage_rates

[2] https://www.uspsoig.gov/blog/lost-and-found

Jeanette Smith is a freelance writer based in Dallas, Texas. She offers articles, web content, and copy editing for businesses and individuals. You can learn more at www.JeanetteTheWriter.com