CONFERENCE COVERAGE:

Ortho Technology Forum 2015

Technology experts, lower extremity clinicians, and orthotic lab owners and managers collected in Vancouver, Canada, in April to discuss and debate the technical and clinical implications of new developments in the design and manufacturing of footwear and foot orthoses.

The key difference between 3D laser scanning (left) and photogrammetry (right) is accuracy, experts say.

The future of footwear and orthoses is here. Now what?

By Jordana Bieze Foster

A shift in tone was apparent at this year's Ortho Technology Forum (OTF), and not just because the focus of the event has been expanded to include design and manufacturing technologies for footwear as well as foot orthoses. Speakers and attendees are no longer just speculating about how technology will change the footwear and foot orthosis industries—because those changes are already occurring in mainstream, high-profile ways.

The questions now focus on how foot care specialists' role will change in an industry in which start-up companies often champion technical bells and whistles at the expense of accuracy and clinical relevance, and how clinicians themselves can use technology to their advantage to stay competitive.

"The war has started," said Chris Lawrie, Healthcare Business Development Manager for Birmingham, UK-based Delcam Healthcare Solutions, which organized the April event held in Vancouver, Canada.

Lawrie was speaking specifically about how the growing accessibility of 3D printing technology has created a market for entrepreneurial footwear and orthoses manufacturers who are less concerned with clinical effectiveness than their bottom line. But the assessment could as easily be applied to other aspects of technology being used by entrepreneurs to battle clinicians for a share of those markets.

"There isn't a part of our industry that isn't being affected by technology right now," said Graham Archer, CPed(C), vice president of pedorthic services at Kintec Footlabs and president of Kiwi Software Solutions, both in Vancouver, in an OTF presentation.

The challenge for clinicians, and for other players in the footwear and orthotics markets for whom quality is a priority, will be to prove that new technologies aren't just for newcomers. OTF presenters detailed multiple ways in which new tools and processes can help even established labs and clinics become more efficient, more accurate, and more profitable.

"The key is how to get around the paradigm shift to take advantage of things like new materials and new design opportunities," Lawrie said.

3D printing

It's tempting to dismiss 3D printing, also known as additive manufacturing, as the province of start-up companies looking to make a quick buck off drugstore-grade insoles or creative types designing futuristic-looking shoes that nobody in the real world would ever wear. But 3D printing is also being employed by a number of companies in ways that could potentially have much more practical and even clinical applications.

Continued from page 29

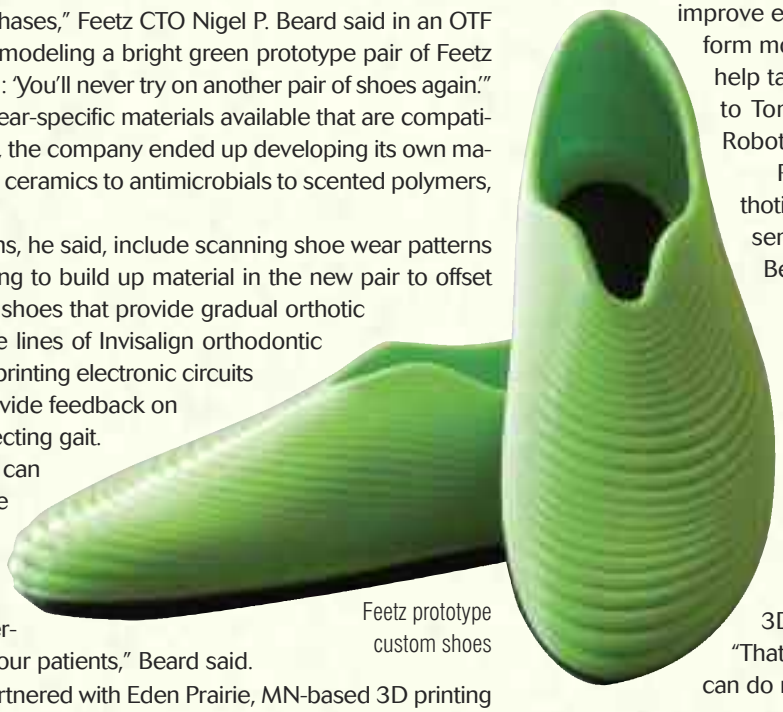
Chattanooga, TN-based Feetz is currently in the beta-testing phase of its personalized shoe business, which aims to 3D-print individual pairs of shoes based on either an in-store scan or on customers' digital photos of their feet taken with the company's app.

"One in three consumers are seeking personalization in their shoe purchases, and one in five Americans have foot issues that affect their shoe purchases," Feetz CTO Nigel P. Beard said in an OTF presentation, while modeling a bright green prototype pair of Feetz shoes. "Our motto is: 'You'll never try on another pair of shoes again.'"

With few footwear-specific materials available that are compatible with 3D printing, the company ended up developing its own materials, ranging from ceramics to antimicrobials to scented polymers, Beard said.

Future directions, he said, include scanning shoe wear patterns and using 3D printing to build up material in the new pair to offset the expected wear, shoes that provide gradual orthotic correction along the lines of Invisalign orthodontic correction, and 3D-printing electronic circuits into footwear to provide feedback on how the shoe is affecting gait.

"I'm hoping we can not only change the face of regular footwear but also give you [OTF attendees] some different things to offer your patients," Beard said.



Feetz prototype custom shoes

Delcam has partnered with Eden Prairie, MN-based 3D printing company Stratasys to develop hybrid shoes with 3D-printed soles and heels and a leather upper, created using Delcam's footwear design software. Prototype shoes made using this process were exhibited at SIMAC, an international exhibition of machines and technologies for the footwear and leathergoods industries, held in February in Milan, Italy. A similar process can also be used to create a conventional shoe with a 3D-printed insole, Lawrie said.

This type of evolution in footwear design and manufacturing may ultimately lead to a "lastless shoe," he said.

"If we can create a digital last and three-D print the whole shoe, we'll never need an actual last. That's where the real savings are going to come from," Lawrie said.

Other OTF presenters encouraged attendees to think about the possibilities of integrating 3D printing with other technologies to improve the manufacturing process. Robotics, for example, can improve efficiency and free up staff members to perform more complex tasks, and has the potential to help take 3D printing to the next level, according to Tom Bentley, owner of Waukesha, WI-based Robotic Solutions.

Potential uses for robotic automation in orthotic manufacturing include milling, gluing, assembly, sanding, packaging, and shipping, Bentley said.

"When you add robots to the equation for a milling function, even if it's just to do that one function, you may be more cost effective. But what you want to do is look beyond the milling function at the four or five steps surrounding it. That's how the robot really makes a difference," he said.

Combining robotic technology and 3D printing is a logical next step, Bentley said.

"You could have a robot working with a 3D printer—loading it, for example," he said. "That's not a future thing. That's something you can do now."

Scanning

Just as entrepreneurial companies are jumping on the 3D printing bandwagon, they are also helping to popularize smartphone- and tablet-based scanning technologies for the design of what's often billed as "custom" footwear and orthotic devices.

Clinicians and orthotic lab managers have years of experience sifting through the range of foot scanning devices on the market and determining the extent to which resolution, accuracy, and the ability to scan the entire foot justify the additional expense of high-end scan-

The argument for library-based orthotic prescription

Much of the discussion at the 2015 Ortho Technology Forum (OTF) focused on various ways in which the future of the orthotic industry will require adapting to new technologies. But the event's final presenter challenged OTF attendees to consider the possibility that the future of the industry will also require reinventing the entire process of orthotic prescription.

Scott Marshall, co-owner of KLM Laboratories in Valencia, CA, noted that industry professionals who have been making custom foot orthoses have likely noticed, as he has, that a majority of the devices fall into recognizable and predictable shape categories. This phenomenon makes the industry particularly well-suited, he said, for a scientific library system in which most devices are made from premanufactured shells or positives or pre-engineered digital shape files.

What a scientific orthotic library might look like.

"What if certain shapes are used over and over again? This is what optometrists do; that's why you can get glasses in about an hour," Marshall said.

What makes the proposed library system scientific is that the shape categories would be defined by specific measurements calculated from years of data on devices that were created using more traditional means of orthotic design and manufacturing.

Some technologies in which a tablet-based scanning device is moved around the foot, such as those utilizing the 3D Occipital Structure Sensor (sample image at right), approach the accuracy of more conventional laser scanners.

ners. But now they're faced with the prospect of competing with businesses that in some cases are creating footwear devices from 2D "scans" taken by the consumers themselves.

"As footcare professionals, we look at this and wonder how they're going to make a true orthotic using this methodology. But this is out there, and these companies are going straight to the consumer and claiming they're providing custom orthotics," Archer said. "We need to be on top of this as an industry, and be able to answer questions from our patients and from insurance companies."

The most critical issue, OTF presenters agreed, is accuracy.

"Don't underestimate the role accuracy plays in what you're doing when it comes to scanning technology," Lawrie said.

Some of the technologies in which a mobile scanning device is moved around the foot, such as those utilizing the 3D Occipital Structure Sensor, approach the accuracy of more conventional laser scanners that require placing the foot against a flat scanner surface. But photogrammetry-based mobile scanning systems, in which a software algorithm translates 2D photographs of the foot into a 3D image, are unlikely to produce an accurate representation of foot structure, Archer said.

"There's error throughout the entire process," he said.

And at least one of the new foot-focused start-ups has made scanning accuracy a priority. At the Westfield North County Mall in

Escondido, CA, customers can visit the Yooshu retail kiosk to have custom flip-flops made while they do the rest of their shopping. Each pair is designed based on a 3D laser scan (Littleton, CO-based Yooshu has been partnering with Delcam for the last year) and milled by a robot, CEO Scott Goldie said in an OTF presentation.

The result is a flip-flop with a customized sole, which can be further personalized with artwork. The products sell for $29 to $41 per pair, depending on materials; artwork is another $5. At the time of the OTF event, the first Yooshu location had been open for business for three weeks, and was already seeing repeat customers and referrals, Goldie said.

The company invested in laser scanning technology specifically to get an accurate scan of each patient's toes, he said, but there are plans to also use the scan data to position dorsal straps and to save customer scans to facilitate easy ordering of duplicate pairs.

"The scanner has more capability than we're using right now," Goldie said. "The robot is expensive, but it's getting cheaper and cheaper. Our real investment has been in software and training."

Another future direction includes offering a more sophisticated product for customers who wear foot orthoses.

"Of the customers who decline to purchase after the pitch, fifteen to twenty-five percent are looking for orthotic features we don't offer yet," Goldie said. "We're not interested in going 'full medical,' but it's not far for us to go from our flip-flop to a truly orthotic flip-flop." ler

KLM's ongoing analysis of its database of 367,755 plaster casts and digital foot scans has revealed four key measurements that dictate device shape:

1. Length from the bisection of the first metatarsal head to the most proximal aspect of the heel;

2. Apex of medial arch height along the bisection of the first metatarsal shaft when the cast is placed in the balanced or prescribed position;

3. Apex of lateral arch height when the cast is placed in the balanced or prescribed position; and

4. Heel width across the middle of the heel, at the widest part.

After identifying the range for each measurement that accounted for the majority of devices in the database, Marshall and colleagues estimate that a library system of 4680 reproducible foot shapes would accommodate most patients' needs. The library models could also easily be adjusted, mathematically and objectively, by increasing or decreasing one of the four key measurements.

This type of system could allow most patients to get high-quality orthotic devices at a single visit, and at a lower cost than with current processes, Marshall said. It could also provide a scientific means of tracking and studying the performance of different orthotic configurations on the same patient or on patients with particular deformities.

"The time has come to revisit how we prescribe orthotic devices, and to redefine what a custom orthotic is," Marshall said. ler

–Jordana Bieze Foster