

Comfortable prosthesis made her mobile

Determined traveler set to vacation again in 2013

Zenobia Sneed of Trotwood – a traveler who’s flown to Jamaica, the East Coast, Hawaii and elsewhere – was convinced she’d be wheelchair-bound after her right leg was amputated in August following vascular complications.

“I am 74 years old!” she said. “I just didn’t think I’d walk again.”

But **Michael Shelburne**, a prosthetic resident at Dayton Artificial Limb Clinic, and others there thought differently. “We told her that anything you did before, we can help you do again,” he said.

For Sneed, using a prosthesis was difficult at first.

“The first time I put my leg on, I took it off again – I did not like it, and I did not want it,” she recounted. “It was two or three days before I put it back on.”

The hard part was learning to walk again. “But when I took my first steps, it felt wonderful!” she said, smiling.

Shelburne said Sneed grew determined: By the end of October, she was walking in her prosthesis with the same walker she’d used before her amputation. And when he saw her

in early December, she put on her prosthesis, stood up, walked across the room and then sat down and unlocked her manual-locking knee – all by herself.

“She had this huge, bright smile,” Shelburne said. “Then she told me, ‘I never expected to do this when I saw you the first time!’”

Clinic ensured a good fit

Sneed says the going got easier because she’s had so much help: from her family, including her three sons and daughter; Shelburne, who fit the prosthesis and made it comfortable for her to wear; and her physical therapists.

“We told her that anything you did before, we can help you do again.”

– **Michael Shelburne**

“In order for my leg to get stronger and the prosthesis to work, I have to move my whole body, and my therapists are helping me exercise,” Sneed said. “I am used to doing what I want to do, and by exercising, I am able to do it.”

What she wants to do next is take walks outside, cook “old-fashioned meals” and book a flight to Georgia and then Alabama to visit her family this spring. Her lifelong friend Wilma Westside will be her travel companion.

“I am going to plan it out and make it as easy as I can,” Sneed said. “It is always wonderful to get away.”



Zenobia Sneed, who thought she’d never walk again after her amputation in August, is now mobile and ready to travel again thanks to Dayton Artificial Limb Clinic and ongoing physical therapy.

‘Yoga for Amputees’ training, October 2012

Andrea Kinsinger: ‘It goes beyond traditional physical therapy’

People with limb loss are dealing with much more than a weak muscle or a stiff joint, says physical therapist Andrea Kinsinger of Dayton Physical Therapy, a sister company to Dayton Artificial Limb Clinic, who likes to approach her patients holistically. Kinsinger learned how to incorporate yoga into her therapy sessions during initial training in October from Marsha Danzig of Massachusetts, who offers Yoga for Amputees and other workshops worldwide.



Instructor Marsha Danzig demonstrates a yoga pose.

“As a physical therapist, it’s fantastic to have a lot of tools in your toolbox since not every patient responds to the same treatment,” Kinsinger explained. “I appreciate yoga because it goes beyond traditional physical therapy.”

Danzig said yoga heals the body, mind and spirit and can bring a sense of wholeness to people with limb loss. She should know since she lost her lower left leg to cancer at age 13.

“I want amputees to leave a yoga class feeling they have possibilities to live a full and healthy life, respecting and accepting who they are and what has happened to them,” Danzig said. “Accepting ‘what is’ frees us to do more

than we thought we could do. When I really accepted I was an amputee, I could do more advanced poses.”

Because of this self-acceptance, Danzig feels free to take her prosthesis off and put it back on during a yoga class. That’s because some poses work better without a prosthesis, while other advanced poses require two limbs.

“Amputees have found yoga very meaningful,” Danzig said. “It provides strength and empowerment. Everyone can just be themselves.”

Danzig – who’s relocating to Dayton in 2013 – plans to continue her worldwide workshops and teach Kinsinger, other physical therapists and people with limb loss here.

“People who have lost limbs are dealing with so many layers of things,” Danzig said. “That’s why I want to work with responsible professionals like Andrea who can make them feel safe.”

London Paralympics, September 2012

PDI built rowing seat for U.S. bronze medalist

Prosthetic Design, Inc. (PDI) of Clayton made the custom seat used by U.S. rower Oksana Masters, who won the bronze medal in the trunk and arms mixed double sculls at the Paralympic Games in September in London.

Masters, 23, from Louisville, Ky., and her rowing partner Rob Jones, 27, a military veteran from Orlando, Fla., shaved 5.33 seconds off their qualifying time to win bronze. Each has limb loss above both knees.

PDI designs and manufactures artificial limb components for prosthetic clinics nationwide and sister company Dayton Artificial Limb Clinic.

"She needed something very strong but very lightweight so she could lighten the boat and go faster in the water," said **Ronda Miller**, PDI's carbon lab supervisor who developed the seat, which bolts into the frame of Masters' boat to keep her stable. The seat was 1/16th of an inch thick and just 1.07 pounds. Masters' former seat weighed more than 10 pounds.

'It could have turned into a big pancake!'

On a typical day, Miller makes carbon fiber offset plates and flexion contracture plates, which help align an artificial limb. Miller said she made Masters' seat by adapting the techniques she uses every day to make artificial limb components.

The seat – made in only four days from "prepreg" material, a carbon fiber reinforcement pre-impregnated with a resin – was created in six to eight compressed layers and processed in an autoclave for five hours. Miller also molded in "nutserts" so the seat could be bolted to the frame of Masters' boat.

Miller worried that high heat and pressure in the autoclave might destroy the only model available to make a custom seat for Masters in time for the Paralympics.

"It could have turned into a big pancake!" Miller said. "I went low and slow on temperature and timing in the autoclave and hoped for the best. Orville and Wilbur (Wright) didn't have any instructions either."



Paul Galloway, director of engineering at PDI, demolds the new lightweight seat for Paralympic rower Oksana Masters – a difficult task because of the seat's shape.

PDI donated the seat to Masters. "We created something that allowed a very fast world-class athlete to go even faster," said **Tracy Slemker**, PDI's president and founder. "Who doesn't want to do that?"

U.S. bronze medalist Oksana Masters rows in the black carbon fiber seat made by PDI. (Photo by Allison Frederick, USRowing)



Prosthetic clinic + device R&D + physical therapy make sense for patients Dayton Artificial Limb Clinic ahead on accountability

by Tracy Slemker

Dayton Artificial Limb Clinic – unlike other prosthetic clinics in our region – is fortunate to have direct access to everything driving prosthetics today: advanced materials, new technology and on-site physical therapy geared toward people with limb loss.

That's possible only because the clinic is affiliated with two sister companies locally: Prosthetic Design, Inc. (PDI) of Clayton and Dayton Physical Therapy.

It's a matchup that makes sense for prosthetic patients because they reap the benefits:

- precise prosthetic fittings with comfortable, lightweight, often computerized materials;
- custom-made components;
- a team approach to patient care; and
- specialized physical therapy sessions so patients can enjoy a higher quality of life.

PDI – besides designing and manufacturing artificial limb components for our clinic and others nationwide – conducts research and development to help prosthetic patients.

Every day we process materials ranging from carbon fiber and composites to silicones and urethanes. We're advancing 3D printing, other digital manufacturing technologies and precision tooling to make custom prosthetic devices faster. In partnership with the University of Dayton's Physical Therapy program, we're conducting a study to evaluate whether a new PDI component helps patients improve the way they walk. And we continue to explore new opportunities with other partners to expand funded research in prosthetics.

At **Dayton Physical Therapy**, we're sharing our expertise in rehabilitating people with limb loss by offering a free course, complete with 1.5 CEUs, to physical and occupational therapists in our region. Attendees are excited and driven, like we are, to provide better patient care.

Having a testbed of patients from **Dayton Artificial Limb Clinic** helps us validate how patients respond to new technologies and techniques so we can improve our devices and approaches. As patients wear new prosthetics and progress with their mobility, we have the objective, quantified data to prove it.

That will become even more important in the months and years ahead as healthcare organizations demand more accountability and documented results from providers.

At Dayton Artificial Limb Clinic, I am confident we are already there. Some of our work is already gaining attention from respected research organizations like the Rehabilitation Institute of Chicago. Last year researchers there asked us to join them in applying new patient evaluation techniques for a study, funded by the National Institute on Disability and Rehabilitation Research, that promises to help clinics nationwide improve patient services.

As the only clinic in our region invited to contribute, we are honored to have yet another opportunity to advance the quality of care for prosthetic patients everywhere.

Tracy Slemker is a Certified Orthotist/Prosthetist; Ohio-Licensed Orthotist-Prosthetist; Fellow of the American Academy of Orthotists and Prosthetists; and the president and founder of Dayton Artificial Limb Clinic, Prosthetic Design, Inc., Dayton Physical Therapy and Montgomery Motorsports.



Like a Corvette, only better

After 3 decades on crutches, he's finally on 2 legs

Bill Lane, who lost a limb at age 14 because of a rare bone cancer, last wore a prosthesis on his wedding day in 1984. He'd worn it for aesthetics since 1977 after his left leg was removed from the hip, leaving only his pelvis on that side. But Lane said the device was clunky and uncomfortable.

"Shelly and I went on our honeymoon and left it behind," he said. "We never looked back."

Until 2012, that is, when Lane turned 50. By then he'd spent more than 10,000 days on crutches, which had taken a heavy toll: three hand surgeries and one shoulder surgery. He was ready to try 21st century technology.

"I knew if I waited much past 50, it would be too hard," said Lane, who co-owns the Gallery Home Furnishings store in Englewood. He and his wife have two sons and two daughters and live in Tipp City.

Fitting patients like Lane who have a hip disarticulation is challenging, said **Luci Busch**, vice president of operations and senior director of clinical services at Dayton Artificial Limb Clinic. "It's a custom device," she explained. "The hip joint placement is difficult because you have to get the correct angles."



Soon after Bill Lane received a new prosthesis from Dayton Artificial Limb Clinic – his first in 28 years – he asked physical therapist Katie Jenkins to help him improve the way he walks.

Michael Shelburne, a prosthetic resident at the clinic, was assigned to Lane's case. After explaining the fitting process and physical therapy ahead, Shelburne played YouTube videos of other hip disarticulation patients using today's devices. Lane was hooked.

"It looked almost effortless!" he said. "I was excited and ready to try."

'It was an emotional day for all of us'

Physical therapist Katie Jenkins gave Lane pre-prosthetic therapy so he'd be ready to wear a prosthesis again.

Shelburne, before making Lane's final socket, which joins his pelvis to the artificial limb, produced three test sockets and made modifications. Lane's prosthesis – a laminated, black, carbon fiber socket attached to an artificial limb with a microprocessor-controlled knee and sensors for walking smoothly and safely – was delivered before Christmas.

"He wore it immediately for almost two hours. He just kept walking," Shelburne said. "He was that happy to have it on. It was an emotional day for all of us."

Although his prosthesis is far from a shiny Corvette, Lane is still thrilled with "my cool, black, midlife-crisis purchase!" as he says. "The comfort is the biggest improvement because the fit is so much nicer. It has given my hands a break and will improve my overall health."

Physical therapy is helping Lane perfect the way he walks. That's important to him for at least one reason.

"One day I will walk my daughters down the aisle, and I'd rather do that on two legs than on crutches," he said. "That'll be sweet." 🌈

Free course helped physical therapists in the region provide better patient care in 2012

Rehabilitating people with limb loss requires specialized training for PTs

Dayton Physical Therapy, a sister company to Dayton Artificial Limb Clinic, took its free Amputee Rehabilitation Course on the road five times in 2012, training physical therapists in the region on everything from rehabilitation the day after surgery through high-level walking skills. Last year the course was taught by Andrea Kinsinger and other physical therapists specializing in this treatment.

Kinsinger said Steve Axiotes, a retired physical therapist in Dayton who helped rehabilitate people with limb loss, mentored her years ago. Now Kinsinger is paying it forward by teaching other physical therapists today who don't see people with limb loss routinely.

"Steve was so helpful, and I was so thankful to have that resource," Kinsinger recalled. "It's a joy to partner with other professionals so we can all provide the best patient care we can. Education is key to that."

In 2013, Kinsinger will continue to teach the 90-minute course, approved for 1.5 CEUs, to physical and occupational therapists working

with patients at hospitals, nursing homes, retirement communities, skilled nursing and rehabilitation centers, home health care organizations, physical therapy and sports medicine clinics, and other healthcare organizations throughout the Miami Valley.

"This is a very practical course that teaches specific training techniques, interventions and functional outcome tests to therapists so their patients can progress more quickly and become more independent," she said. "Even after the course, we will continue to be a resource in our region for therapists treating people with limb loss." 🌈



Physical therapist Andrea Kinsinger works with Tim Routson on balance and weight shifting, a technique she teaches in the Amputee Rehabilitation Course for physical therapists.

Liners, sockets and parts advance in 2012

PDI makes devices stronger, lighter, more comfortable

Prosthetic Design, Inc. (PDI) of Clayton significantly advanced three of its research and development programs in 2012 to help patients at its sister company, Dayton Artificial Limb Clinic, and patients nationwide.

Custom liners work better, feel better

Engineers at PDI are now designing custom liners for prosthetic patients who do not get an accurate fit wearing an off-the-shelf liner over their residual limb. "We continue to fit more patients with custom liners," said **Bob Carpenter**, customer service at PDI.

A custom liner ensures a better fit with the socket, which joins the residual limb to the artificial limb. Since a custom liner is created from a mold and a digitized model of the patient's residual limb, it's more comfortable.

"That means patients can wear their prosthesis longer throughout the day," he said.

About 90 percent of the custom liners produced by PDI are used for elevated vacuum prostheses, which provide patients with better wound healing and more mobility, control and comfort. PDI and Dayton Artificial Limb Clinic are known nationwide for advancing Elevated Vacuum Locking System (EVLS®) technology, which adds a lock as a sealing and safety measure to elevated vacuum.

Ultimately, PDI expects to further improve its digital tooling, manufacturing and 3D printing technologies to make custom liners in 24 to 48 hours instead of two to four weeks, Carpenter says.



Co-op student Catie Van Fleet begins making a carbon fiber socket using new materials and a tooling and lamination kit she helped develop (see inset).

Carbon fiber sockets now airtight

By combining two new materials and inventing tooling, PDI developed a fast, repeatable, in-house process for making carbon fiber sockets, said **Rob Hoskins**, a prosthetic engineer and clinical consultant at PDI. These sockets are often used for elevated vacuum and EVLS prostheses.

Previous carbon fiber materials were not airtight, which is essential for elevated vacuum. The new sockets are also strong, lightweight and pressure-adjustable.

Carpenter said, "We were surprised at how well and how quickly it worked. Now we know we'll get a seal, and our carbon won't breathe. Everyone here is reenergized about carbon fiber sockets."

PDI is creating the sockets by combining a specially formulated epoxy resin with SpectraCarb™ Stockinette, a strong, flexible

material. Crucial to the process is the tooling and lamination kit developed in part by Catie Van Fleet, a co-op student at PDI in fall 2012. Van Fleet is majoring in biomedical engineering at the University of Cincinnati.

Some patients prefer carbon fiber sockets over thermoplastic sockets, Hoskins said. "The materials and tooling, along with carbon fiber ring technology, really moved this project along. Our results are now consistently good," he said.

Carbon fiber parts let patients move easier

By upgrading its manufacturing processes, PDI is now making more carbon fiber parts for prosthetic devices faster and in-house.

PDI's aerospace-quality, carbon fiber parts – which typically weigh 40 percent less than aluminum or stainless steel parts made by other companies – are better for patients, Carpenter said.

"It's like losing weight," he said. "Since the parts are lighter, patients use less energy to move their limb. If the parts are heavy, the patient feels it."

Because carbon fiber parts are slimmer, clinicians can align and fit artificial limbs more precisely. And since the parts are stronger and break less often, they can be used on heavier patients, Carpenter said.

"We have consistently continued to convert a lot of our metallic parts to carbon fiber," said **Tracy Slemker**, PDI's president and founder.

PDI has even created some carbon fiber parts with additional "layers" of material so they're more durable for patients who are very active, Carpenter added.



PDI made this custom silicone liner, which required a three-part mold, especially for Bryan Davidson, a patient at Dayton Artificial Limb Clinic. Without it, Davidson's EVLS prosthesis would not fit well, which could lead to instability while walking and skin irritations.

Co-op program helps keep projects moving

The co-op program celebrated three years in 2012, with 77 students from local universities advancing technology and patient care at Prosthetic Design, Inc. (PDI) and Dayton Artificial Limb Clinic since 2010, said Jennifer Larew, human resources specialist.

Paul Galloway is director of engineering at PDI. "The co-ops have moved many projects farther down the road than we could have with our workload," he said. Here are three program highlights:

- A line of reusable, slip-on, cosmetic protective covers for microprocessor knees was invented by Cathy Rawers Kuck, a University of Cincinnati biomedical engineering major who graduated in 2012. PDI began selling the Cosm-Easy® covers in 2012.

- Three co-op students researched the process, materials and mold-making techniques for designing custom liners (see story this page). Contributors included two University of Dayton mechanical engineering majors – Martin Piszkiwicz, who will graduate in 2013, and Sarah Meyer, who graduated in 2012 – and Tyler Fosnight, a University of Cincinnati biomedical engineering major who graduated in 2012.
- Refining PDI's benchtop "squirt shape" machine and software for rapid socket manufacture were three mechanical engineering students at the University of Dayton: Martin Piszkiwicz; Erin Sutton, who graduated in 2012; and Krista Korneffel, who will graduate in 2013. A socket joins a residual limb to an artificial limb.

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