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Inside This Issue

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Post-Thermoforming Strategies for Reducing Shrinkage and Material Fracture in Thermoplastics

Vacuum forming, or thermoforming, is commonly used in O&P to form custom molded orthoses and prostheses. A plastic sheet is first heated in the oven at a pre-specified time and temperature. Once the plastic is ready, it is formed over a positive model using vacuum suction. There are two general types of vacuum forming used in O&P: blister forming or bubble forming and drape forming, both of which have been clearly documented.[3] Therefore, this article focuses on the next stages in the fabrication process: 1) optimal timing to remove the model from the vacuum system to preserve dimensional accuracy; and 2) trimming the formed plastic from a positive model, emphasizing precision techniques to minimize potential material failure.

Key Terminology

Crystallinity – A material property which refers to the state of how molecules are arranged. Materials may be crystalline (highly ordered), amorphous (disordered), or semi-crystalline (both ordered and disordered).

Thermal expansion – How material changes volume in response to temperature changes.

Shrinkage – Refers to how a plastic material reduces volume when cooling from a molten to solid state and is expressed as a percentage.

Stress concentrations / ***Stress risers*** – a localized area of higher stress levels in a material due to a hole, notch, or sharp corner.

Notch sensitivity – refers to how a material's strength is reduced in the presence of stress concentrations It can often be related to a material's ductility, strength, toughness, and the geometry of the notch.

Table 1. Material Properties of Common Thermoplastics used in Prosthetics & Orthotics [3,4,6]

Material	Characteristics	Structure	Coefficient of Thermal Expansion (CTE) *(x 10-6 K-1)*	Shrinkage (%)	Cast & Set Temperature (°F)
Polypropylene (PP)	> Moderate stiffness – used for weightbearing > Blemishes easily – avoid touching surface when hot > Notch sensitive – cut circumferentially to relieve stress > May warp – leave vacuum on 2x melting time	Semi crystalline	100-180	1.5-2%	190
Low Density Polyethylene (LDPE)	> Extremely low stiffness (flexible) – used for non-weight bearing > Creep – cold flow with sustained pressure > Blemishes easily – avoid touching surface when hot > Not notch sensitive – still, smooth edges	Semi crystalline	100-200	1.5-3%	180
Copolymer (CP) a PP and PE blend	> Moderate stiffness > Creep – cold flow with sustained pressure > Blemishes easily – avoid touching surface when hot > Moderately notch sensitive polish edges to reduce crazing	Semi crystalline	83 - 104	1.5-2%	190
PETG (e.g., Vivak)	> Very stiff > Clear/transparent > Notch sensitive – avoid stress risers	Amorphous	20-80	<1%	165

All information and technical data are given as a guide only and vary by manufacturer and processing method.

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Strategies, cont'd

Reducing Shrinkage During the Cooling Phase of Thermoforming

Have you ever wondered why device trimlines come up short even though you have cut beyond your trimlines? Or why an AFO sometimes spreads after it is cut off the plaster model? This is due to a phenomenon called shrinkage. Thermoplastics undergo shrinkage because they expand upon heating and then shrink upon cooling. Shrinkage rates vary considering a given material's crystal structure, vacuum holding time, and cooling rate, among other factors (i.e., extrusion direction, residual stresses) and are expressed as a percentage[1]. It is important to note that though most shrinkage occurs within the first 24 hours after processing, shrinkage still occurs albeit in smaller increments months to years after manufacture[7].

Crystalline vs. Amorphous

Thermoplastic, used in O&P, exhibit specific crystallinity or crystal structure. They exist in three structural forms: crystalline, semi-crystalline, or amorphous. Shrinkage is especially important when working with semi-crystalline materials like polypropylene, polyethylene, and copolymers. These materials have a higher coefficient of thermal expansion (CTE) when compared to PETG (amorphous). When compared to PETG, they expand more when heated, thus inversely contract or shrink more upon cooling.

Vacuum Hold Time: When to turn off vacuum?

Many O&P professionals are familiar with AFO warpage, or spread, when plastic is cut off and removed from vacuum too soon. Spread is particularly relevant for open-shaped (non-circumferential) devices such as AFOs and TLSOs which are also typically fabricated from semi-crystalline materials more susceptible to shrinkage. There are several 'rules of thumb' used in practice. For example, Lunsford notes that it is not uncommon to maintain vacuum for up to one hour. However, a general rule is to leave the vacuum on for at least twice the time it took to heat or until all areas of the plastic are cool to touch.

Cooling time: When to cut off plastic?

After the plastic is formed over the model, it cools at varying rates depending on the temperatures of the room and plaster model. A slower cooling rate reduces shrinkage, which is why many opt to heat their plaster model slightly to reduce the temperature difference between the heated plastic and the model. Semi-crystalline materials (e.g., PP, PE, and CP) become amorphous in their molten state and subsequently re-crystallize upon cooling. Rapidly cooling these plastics with compressed air (i.e., quenching) freezes molecules in a more amorphous state and creates internal stress and uneven crystallization patterns that can lead to weak points or areas prone to failure. Controlled cooling allows for more uniform crystallization and better material properties. Quenching would not have the same effect with amorphous materials such as PETG.

Lunsford stated one can reduce internal stress and warping by waiting to cut plastic off after it has cooled to its Cast and Set temperature. This temperature is defined as the Heat Distortion Temperature at 66 psi (ASTM D648), Table 1. He also advised that polypropylene should ideally be left on the model overnight to avoid warpage. In technical literature[2], 24 hours has been proposed as the appropriate time to leave thermoformed polypropylene on the plaster model before cutting. In contrast, Ojeda et al.[4] proposed that a 6-hour cooling period showed the least spread and was not statistically significant when compared to 12, 18 and 24 hours wait time. In summary, it is important to note that the Cast and Set temperature is a valuable guide to follow in practice when a cooling time of 6 or even 24 hours may not be feasible.

Reducing Material Failure During Plastic Removal

After the plastic has cooled and been removed from vacuum, now is the time to remove the plastic from the positive model. It is crucial to remove the plastic in a careful and methodical manner to avoid material failure. Material can fail especially at notches, seams, or wrinkles and can spread easily upon any impact. Reducing the chance of material failure can be achieved by careful evaluation of the thermoformed plastic and proper use of the cast saw, hammers, and chisels. Always ensure that appropriate personal protective equipment (PPE) is used.

Before making any cuts, visually inspect the plastic to identify stress risers: Look for cracks, cuts, notchs, sharp corners, folds in the plastic (creased during thermoforming) or sudden changes in geometry. If you find any stress risers, drill a hole (~1/8") at the end of the stress riser, which essentially changes the geometry from a sharp point (which creates extreme stress concentration) to a smooth, rounded feature. The hole creates a broader area to distribute stress rather than concentrated at a single point.

After evaluating the thermoformed plastic, it is time to cut trimlines with the cast saw. It is often helpful to remove the proximal excess plastic first by a circumferential cut. If the plastic is too broad to fit into the bench pipe vice, place the model on a secure surface and cut close to the top of the model to remove the excess plastic (Image 1).

Image 1

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Strategies, cont'd.

Removal of the proximal excess plastic makes it easier to stabilize the model in the vice before cutting to trimlines. For below knee sockets, it is often helpful to drill ¼" holes just proximal to the indentations at the hamstring tendons and at proximal to the lowest part of the PTB trimline. Adopting this procedure can help reduce notches in these areas from cast saw cuts (Image 2). PETG is more notch sensitive than other materials in O&P.

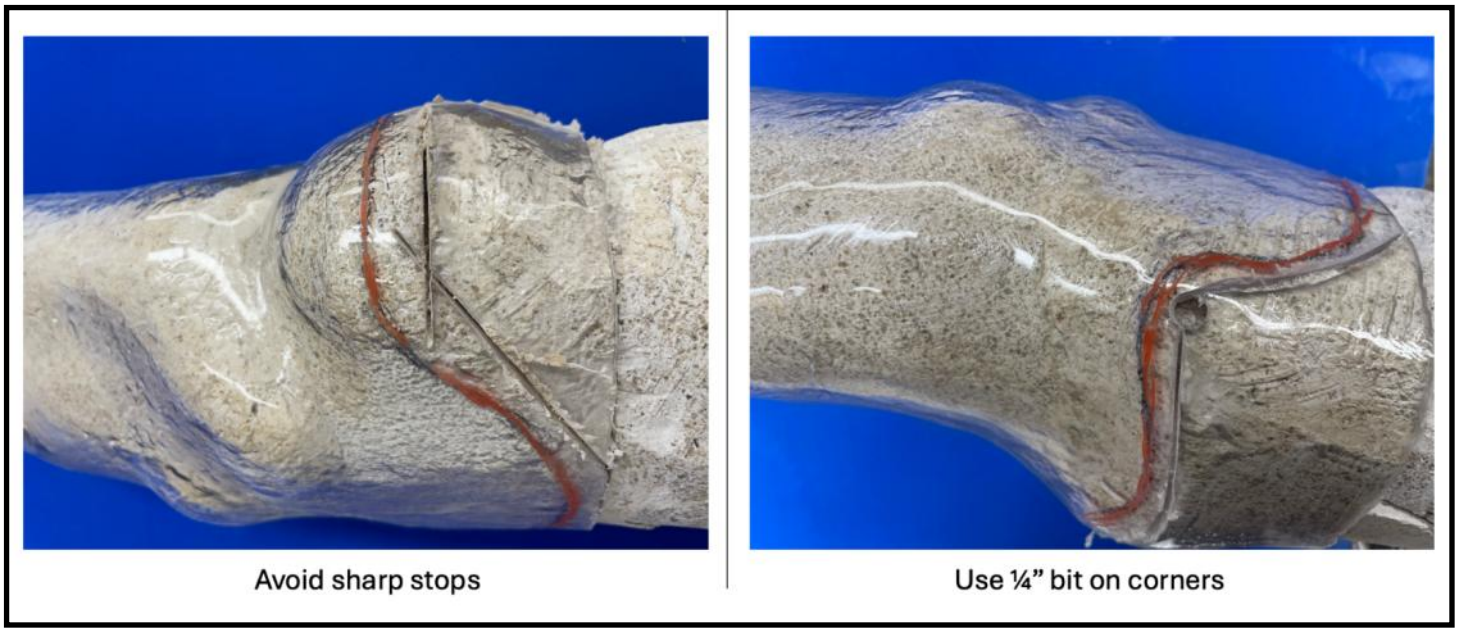

Image 2

The first cut on an AFO or KAFO should be made perpendicular to the long axis of the model (Image 3). Specifically, this means making a full circumferential cut around the proximal part of the model before cutting along the longitudinal axis. Thermoforming plastic over a model creates residual tensile stresses - stresses that remain in a solid material after the original cause of the stress has been removed.

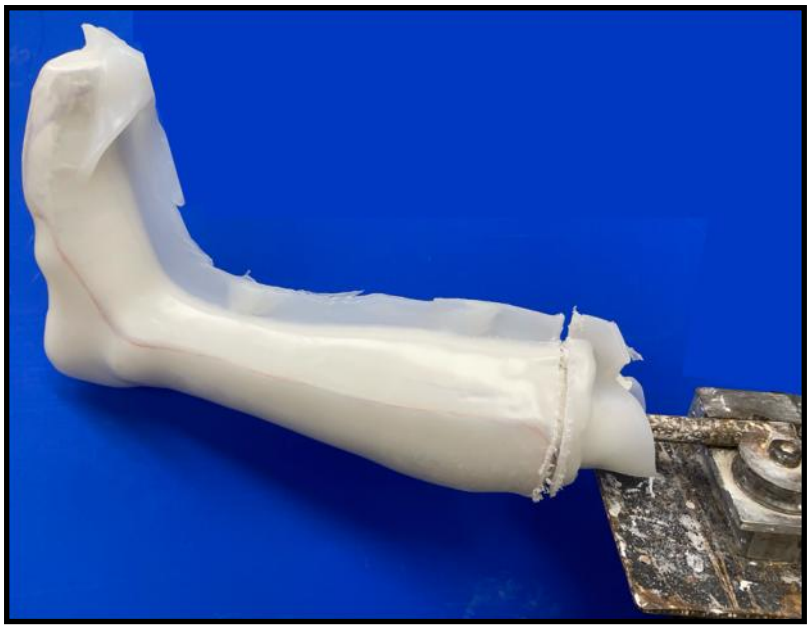

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Image 3

Strategies, cont'd.

Cutting circumferentially around the top of the model relieves stress in the longitudinal direction, thus reducing much of the material stress. Residual stress may also play a role in thermoplastic warpage, or spread, after making the longitudinal cut.

Hold the cast saw near the blade, close enough to maintain control while still being able to operate the trigger lever (if present). This grip improves precision and stability and allows use of your thumb on the model for added support (Image 4).

Image 4

If sharp corners or precise cuts are necessary, consider changing to a smaller or notched blade (Image 5). Make short cuts - once through the material, lift the blade out before moving to the next cut. To avoid overheating the plastic, do not drag the blade continuously through the material because this action can cause the plastic to melt and adhere to the blade.

Image 5

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Strategies. cont'd.

Once trimlines are cut, it is time for "breaking out." This procedure tends to be where material fracture occurs most frequently. Listed below are various methods to break the plaster out of the model.

- Hammering along the length of the pipe sends impact force through the pipe and into the brittle plaster. Chisels are used to directly impact and break up the plaster. That impact force is also translated to the plastic. Any stress risers in the plastic will experience the impact at higher magnitudes and potentially expand.
- Pneumatic chisels can speed up the process and require extreme caution during use. They increase the debris that may cause damage to eyes and skin and create rapid impacts that can potentially fracture the plastic itself. Care must be taken to avoid placing the chisel too close to the wall of the socket.
- A rubber mallet can be used to strike the outside of the socket. Never hit the edges of the socket or areas that will create isolated areas of impact.
- If the model is cylindrical and has no undercuts, the plastic can be hit off with a hammer and wood or can be blown off with compressed air. The benefit of this method is that the positive model can be saved. However, this procedure must be performed with extreme caution as plastic can easily fracture, and built-up air pressure can be extremely dangerous. If using compressed air to force the socket off, avoid standing in front of the socket, as it suddenly pop off the positive model and may cause personal injury.

To summarize, though the thermoforming process has been well documented in orthotics and prosthetics, less has focused on post-thermoforming strategies to reduce shrinkage and material failure. This article has outlined commonly used materials and their properties in O&P, how material properties affect shrinkage and material failure, and offers practical guidance on this topic. Table 2 summarizes some helpful tips that were mentioned in this article.

Table 2. Fabrication DOs and DON'Ts

Best Practices	Practices to Avoid
♦ Always use appropriate PPE ♦ Be familiar with the properties of the materials with which you are working. ♦ Wait the appropriate amount of time before turning off vacuum (at least twice the amount of time needed for heating) and cutting off plastic (until it reaches the Cast and Set temperature) ♦ Consistently look for stress risers ♦ Cut circumferentially first to remove excess plastic proximally and to relieve residual stress ♦ Use a careful and methodical approach when breaking out ♦ Drill holes at corners where there will be potential stress concentrations ♦ Use compressed air and the pneumatic chisel with extreme caution	♦ Avoid plastic shrinkage by forming along extrusion direction and heating the model. ♦ Avoid turning off vacuum or cutting off plastic too soon. ♦ Avoid uneven cooling of semi-crystalline materials (PP, PE, CP) after thermoforming. ♦ Avoid sharp cuts when using the cast saw. ♦ Avoid hitting the plastic at or near stress concentrations (sharp cuts, seams, or wrinkles). ♦ Never stand in front of the model when using compressed air to blow socket off.

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AUTHORS

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Harnessing the Power of Industry Surveys: A Roadmap for O&P Clinicians

Turning Data into Action for Personal and Professional Growth

In today's rapidly evolving orthotics and prosthetics (O&P) profession, clinicians are constantly challenged to adapt to new technologies, shifting patient expectations, and the ever-present pressure to deliver better outcomes. Amid these changes, industry data becomes more than just numbers on a spreadsheet, it becomes a vital compass for navigating growth, improvement, and competitive advantage.

One of the most powerful sources of such data comes from industry-wide participation in the AOPA Operating Performance and Compensation and Benefits surveys; their impact is felt throughout the entire field. Decisions shaped by these survey results ripple outward, influencing practice policies, compensation structures, and the overall quality of care.

AOPA's Surveys: What Are They and Why Should You Care?

Each year, AOPA conducts comprehensive Operating Performance and Compensation and Benefits surveys. These surveys collect insights from practices and clinicians nationwide, compiling a robust dataset that reflects the realities of O&P business and clinical practice. Please note: AOPA's surveys are administered by an independent third party, ensuring that all individual responses remain strictly confidential and are never shared beyond that party.

But why should clinicians care about these surveys? The answer is simple: knowledge is power. The data collected provides the basis for informed decisions that affect compensation, benefits, workflow, and clinic culture. By participating in these surveys, clinicians help shape the industry benchmarks that their own careers and workplaces are measured against.

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- Clinics can use this data to set salaries, establish benefits, and refine operational procedures.
- The aggregated data supports advocacy work, helps the profession stay competitive, and ensures that evolving standards reflect real-world experiences.
- Broad industry participation improves data accuracy and ensures changes are widely relevant.

The Ripple Effect: How Survey Participation Fuels Industry Growth

Participation in industry surveys is powerful. Every clinic's response contributes to a more accurate and meaningful pool of information, which individual clinics can use to:

- Foster transparency around compensation, benefits, and performance metrics
- Promote healthy competition, encouraging each clinic to meet or exceed industry standards
- Support advocacy efforts with credible, real-world data
- Guide the development of educational programs and clinical best practices

The results influence practice policies and professional development opportunities, ultimately shaping the environment in which every clinician works.

Key Insights from the Latest Surveys

Let's look at some interesting data points from the recent Compensation & Benefits reports that illustrate this chain of influence:

- Vacation Time: Data showing that clinicians and staff receive three weeks of vacation after five years provides a benchmark managers use to update or maintain competitive benefits.
- Remote Work Trends: With 17% of administrative staff working remotely at least 20% of the time, clinics may consider offering similar flexibility, benefiting staff based on industry trends.
- Competitive Compensation: Survey results help set fair salaries for clinicians and specialty roles, using market insights to support transparent, equitable pay policies.

Why Every Clinician Should Engage with the Survey Process

It is easy to think of surveys as tools for managers or owners, but every clinician stands to benefit by engaging with this information. Here is how:

1. Participate to Shape the Industry
By responding to surveys, clinicians make their voices heard, providing data that steers the profession toward fairness and innovation. Their collective input shapes standards that define compensation, benefits, and clinical practices for everyone.

2. Stay Informed Through Communication
Ask your manager to share key takeaways from the latest surveys. Many clinics review industry summaries or use data to justify policy changes; being part of these conversations helps you understand how industry trends affect your role.

3. Advocate for Transparency
Encourage an environment where leadership communicates how decisions are made. Knowing that your compensation, benefits, and workplace policies are grounded in national data builds trust and engagement within your team.

4. Drive Practice Improvement
Use information from the surveys to propose changes or improvements. Demonstrating an understanding of industry benchmarks shows initiative and a commitment to excellence.

5. Support Talent Acquisition & Retention
Recruitment and retention strategies are often built on industry data. By participating in surveys, clinicians help ensure their clinic remains attractive to talented professionals.

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Turning Insights into Action: Practical Steps

- Participate in Surveys: Your input strengthens the quality of industry data.
- Request Summaries: Ask management to share highlights or summaries of key survey findings.
- Discuss Benchmarks: Use available information to advocate fair policies and workplace improvements.
- Pursue Professional Development: Align your career path with trends and opportunities identified by industry leaders.

Real-World Scenarios: The Impact of Survey Data

- Contract Negotiation: Clinics use survey data as a reference for salary discussions, ensuring offers are competitive and fair.
- Policy Updates: Trends like flexible work arrangements or enhanced benefits are implemented in response to industry data, improving workplace satisfaction.
- Retention Strategies: By knowing what benefits matter most, clinics can keep their teams engaged and supported, directly benefiting every clinician.

Conclusion: Elevating the Profession Together

Engaging with industry surveys is more than a bureaucratic task, it's a professional responsibility and an opportunity for collective growth. While individual clinicians may not always have direct access to the data, the decisions and policies crafted from it shape the landscape of O&P practice.

Contributing to these surveys ensures that the realities of front-line clinicians are reflected in industry standards. Staying informed allows clinicians to advocate for themselves and their teams, while trusting that national data guides the evolution of their workplace. By working together—owners, managers, and clinicians—the O&P field continues to advance, creating a dynamic and supportive environment for all.

So, remember: your participation makes a difference. Every response helps build a stronger profession for you and your colleagues.

AUTHOR

Coleson Chase has 20+ years of leadership experience across healthcare, non-profit, and Fortune 500 companies. Eight years ago, he joined SPS and currently serves as Vice President and General Manager. In this role, he focuses on leading business operations, implementing strategic initiatives, and partnering with O&P, Podiatry, and Government customers, as well as Vendors, to drive mutual success and positive patient outcomes. Coleson holds a BBA in Management from the University of Georgia and a master's in marketing from Georgia State University. He lives in Canton, Georgia with his wife and three children.

Coleson Chase, Vice President and General Manager, SPS

The Importance of Fabrication Skills for Clinicians

The certified orthotist/prosthetist ultimately acquires a balanced combination of skills – a blending of clinical training in addition to technical skills acquired over the course of their career. This combination is one of the unique characteristics of this field permitting the clinician to customize each O and P device for the unique patient presentations. The acquired skills enhance the patient outcomes sought by the clinician and boost the resourcefulness of the clinician when working with patients in the diverse patient care environments encountered.

Students graduate with baseline technical skills and spend a sizable number of hours during their residency gaining proficiency. And yet, even with evidence of the crucial role of technical skills noted above, there is a lack of heightened focus in this area. What is limiting O&P residents from gaining and enhancing technical skills while in clinical settings?

An inherent challenge for acquisition of technical skills is the business model of the orthotic/prosthetic field. The clinician's role is viewed as patient intake/evaluation plus development of the treatment plan. Revenue generation is a primary aspect of the clinician's role, but the associated consequence of this approach is the reduction of acquired technical skills. Additionally, technicians, once a source of assistance and instruction for clinicians, are moved out of satellite offices and into a consolidated central fabrication location. A central fabrication lab permits consolidation of inventory, reduction of equipment duplication, consistency of fabrication standards and more oversite for lab safety and OSHA. The outcome to this approach is the clinician's loss of access to technical expertise and the associated learning that could take place.

The commonly heard complaint among experienced clinicians and company owners is that recent graduates lack technical skills. However, this lack of technical skills may not be solely the graduate's lack of abilities, but rather the significant time constraints required to cover all mandated areas in the field. The master's programs are focused on clinical presentations and specific patient-focused decision making. A wide variety of fabrication projects are completed within classes, but schools are businesses which still deliver a prescriptive O&P design for these projects. This model helps control costs, standardize inventory, limit variables, and establish only baseline skills for the educator clinicians to build upon. Additionally, because of limited interactions scheduled with patient models, there are fewer opportunities to follow-up on the treatment plans created in classes. This deficiency causes a knowledge gap in the implementation of treatment plans, making it more difficult for residents and new clinicians early in their career. Thus, with limited fabrication skills learned in the lab, the solutions that these clinicians are aware of and can execute appropriately are constrained.

The impact of entry level technical skills becomes more evident at clinical sites. For a new clinician, the time spent on each task is longer than the time used by clinicians with more experience. Likewise, the initial quality of modifications may prove to be subpar. Remakes, reorders, or non-adoption of the device(s) add significant costs without an increase in reimbursement. Poor device outcomes and patient concerns may be noted by the clinical site manager and may require intervention. Hence, the patients' trust in the clinician can be negatively influenced and lengthy delivery times become frustrating for referral sources, patients, and families, and once again hinder revenue.

The need for improvement is evident. The question is "what are the realistic solutions?" Below are listed a series of potential solutions. Our hope is that individual O&P practice sites can internalize some of these suggestions to remedy this challenge, helping both patients and clinical staff members.

- Provide in-house opportunities for the new clinicians to modify sample orthoses and prostheses with standard modification techniques - without the concerns of negative patient risk or ruining a patient's device.
- Partner the clinician with an in-house technician for a set amount of time per week for several months. This action will permit the technician and clinician to establish a communication model and share differing skill backgrounds. The established time frame may be dedicated to specific modifications based on the focus of the practice (orthotics, prosthetics, pediatrics) or driven by the new clinician's identified weaknesses.
- Create mentoring in clinical sites with senior clinicians advising and supporting the newer clinicians.
- Dedicate time and arrange for the new clinician initially to work 2-4 weeks in thecentral fabrication facility used by the practice. Arrange and implement rotations in that time frame to include intake with cast assessments, perusal of submitted orthometry forms, shadow follow up calls to clinicians, fill casts, perform modifications, vacuum-form plastic that include joints, prosthetic lamination overlays, access to a variety of materials (metals, plastics, foams). Make this flexible so the clinician can gain competent skill sets to build upon.

The creation of a successful clinician with both clinical and technical skills is not solely the responsibility of the master's programs. Satisfactory results are a combination of the schools establishing entry level skills and the employers developing an environment where these skills can be expanded with mentoring, dedicated time for skills acquisition, with or without technician support, opportunities for model access, exposure to materials, and identifying solutions that are personalized and supported by the employer.

AUTHORS

Julie Czech is currently a resident at Bionic P&O in Owensboro, Kentucky. She graduated from Northwestern University's Masters in Prosthetics and Orthotics program in March 2025. A Michigan native, she previously graduated in April 2023 from Oakland University with a Bachelors in Exercise Science with a specialization in Orthotic and Prosthetic Assistant Studies. During her time at Oakland University, Julie worked as an Orthotic Technician at Becker Orthopedic.

Julie has been pursuing an interest in O&P since 2017 when her cousin was diagnosed with osteosarcoma and received a right transfemoral amputation. Seeing her cousin experience the highs of accomplishing new tasks while surmounting the struggles that also existed inspired Julie's personal goal to make a difference in patients' lives. Her goal is to be a knowledgeable and trusted partner with every patient, supporting their achievements as well as the challenges they experience.

Julie is passionate in giving her time, skills, and effort to those in need. She has volunteered with the Range of Motion Project (ROMP) in Quito Ecuador, helping fabricate and provide prostheses to patients who would not have received care if not for ROMP. She has also served on multiple mission trips in the states and internationally, where she served communities, teaching, providing religious support, and giving resources such as clean drinking water.

In her free time, Julie enjoys biking, reading, completing puzzles, competing in recreational sports, participating in Bible studies, keeping her puppy entertained, and learning to ride a unicycle.

Tamara Treanore, CO is a certified orthotist, graduating from Northwestern University Prosthetics-Orthotics Center in 1992. For many years, she practiced as a general clinician with a strong focus on TBI, the post-polio patient population and stroke patients. Her work with these patient populations prompted a greater interest in the challenges these patients faced with orthoses applications and initiated Tamara's interest in the technical side of the orthotics/prosthetics industry.

Tamara worked at Baker College Orthotist Prosthetist Technician Program for seven years, updating curriculum while increasing the students understanding of patient needs and orthoses design. When Baker College Orthotist Prosthetist Technician Program closed in 2018, she accepted a position at Oakland University in Rochester, Michigan to develop the Orthotist Prosthetist Assistant program curriculum and labs. Tamara is the acting program director and advocates extensively for the role of assistants in O & P as well as all other care extenders aligned with patient care outcomes and clinician support.

Tamara volunteers on the NCOPE Academic Accreditation Services Committee for the updating and revision of the Technician Standards, Clinician Standards, and Assistant Standards. She is also a reviewer on the Self Study Review Committee. Tamara has presented at MOPA on the roles of care extenders in O & P as well as on clinician burnout/ solutions. She also acts as an ambassador promoting a career in orthotics and prosthetics at local high schools, career fairs, STEM, and similar gatherings.

In her spare time, Tamara does lapidary, woodworking, rock hunting, Tang Soo Do karate and whatever else appeals to her creativity.

Forging a Path in Animal Orthotics and Prosthetics

With over 27 years in the orthotics and prosthetics (O&P) field, my journey has been anything but linear. I have worn many hats over the years—clinician, technician, manufacturing manager, and engineer with each role giving me a unique perspective on the challenges and possibilities within this specialized profession. I have had the privilege of training and working internationally, experiences that exposed a variety of practices and pushed me to constantly continue to refine my skills. But it was not until 2012, when I made my very first prosthetic device for a dog, that I truly found a new sense of purpose in my career.

That particular case unlocked something within me. The challenge was different and exciting. The anatomy, behavior, and biomechanics of animals created a fascinating puzzle. The emotional impact was powerful, helping not just the animals, but the humans who love them. I quickly realized that while human O&P is a well-established field with structured standards, these applications and standards did not exist for animals. The provision of animal orthotics and prosthetics was wide open. There was—and still is—so much opportunity for growth, innovation, and compassion.

Over the years, I have watched this field evolve dramatically. What started as a niche corner of veterinary medicine is now becoming a legitimate specialty, with growing demand and expanding expectations. I have had the honor of working with a wide variety of animals—dogs and cats, of course, but also more unusual cases like a llama, a donkey, and even a giraffe. Each of my patients has required creative thinking resulting in customized solutions. This blend of engineering and empathy is what keeps me inspired.

As the field began to grow, I decided to go all in. I signed a licensing agreement with one of the largest providers of animal orthotic and prosthetic care and opened an office in the Austin, Texas metro area. It was a bold move into full-time animal practice, and it allowed me to work with more patients, refine clinical protocols, and be part of a broader effort to bring legitimacy and visibility to this emerging discipline.

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But after two years, I found myself wanting more control—more freedom to innovate, to explore new approaches, and respond to the unique needs of both animals and their caregivers. So, I made the decision to break away and launch my own independent practice. That choice was driven by a deep belief that animal orthotics and prosthetics deserve the same level of focus, investment, and creativity as its human counterpart.

Since then, I have been able to learn and incorporate a wide range of technologies and materials into my work, from 3D printing and carbon composites to traditional thermoplastics. Each tool brings new possibilities, whether it is improving the weight and strength of a device or customizing a design to fit the specific lifestyle of the animal. But technology is only part of the equation. Understanding the behavior, healing patterns, and needs of each species is critical, and every case continues to be a learning experience.

One of the greatest challenges and opportunities I envision in this specialized field is quantified education and the development of standards and practices for orthotic and prosthetic care of animals. Presently, there is no unified standard of care for animal orthotics and prosthetics. Too often, pet owners and veterinarians are unaware of the clinical possibilities for the care of the animal. We need more clinicians, engineers, and innovators to step into this space with curiosity and commitment. We need to invest in education, research, training, and product development that is specifically tailored to animals, rather than repurposing human solutions.

We are just scratching the surface of what is possible in this specialized field. The more we learn, the more we can do—not only to extend the lives of animals but to enhance their quality of life. It is my hope that by sharing my professional journey, I can inspire others to take a closer look at this field, to contribute and expand their talents, and to help shape the future of orthotic and prosthetic animal care. Because the animals—and the people who love them—deserve nothing less.

AUTHOR

Chris Pujol, C. Ped, CTO is a seasoned professional with over 24 years of experience in the prosthetics and orthotics industry, both in the human and animal sectors. Having worked across the globe in diverse markets, he has honed his expertise as a technician, practitioner, process engineer, and business owner.

Chris's international career includes notable stints in the United States, Germany, Austria, and Canada, where he has contributed to advancing the field through innovative solutions and hands-on work. His deep understanding of both human and animal needs has shaped his approach to creating tailored, functional, and life-changing prosthetic and orthotic devices for all.

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- **Industry-Defining Innovation:** Thrive in our brand-new, state-of-the-art Integrated Care Center (ICC)—the first of its kind—where you'll help shape new standards in prosthetic fabrication, education, and clinical performance
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The Orthotic and Prosthetic Unit of the Department of Orthopedic Surgery at the University of California O & P Department provides orthotic and prosthetic services in both the inpatient and outpatient environment.

UCSF is seeking a candidate who can:

- Fabricate primary orthotics and occasional prosthetics.
- Collaborate with clinicians on repairs and modifications to devices.
- Work with both adult and pediatric populations.
- Maintain and comply high safety and quality standards of lab and equipment.

Expectations:

- Team-oriented mindset while working with multiple practitioners on projects.
- Strong verbal communicator; positively accepts feedback.
- Excellent time management skills in a deadline driven environment.
- Ability to reprioritize work projects based on patient and clinician schedules.

Schedule: Monday-Friday 8:00 am to 5:00 pm

Salary: $28 per hour

Benefits: UC pension/401(k), Health, Dental and Vision, Vacation, and Sick PTO

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