What Does it Take to Have a Successful Orthotic Practice?

Technology, research, and the Internet now impact this crucial field.

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In the past decade, podiatric orthopedics and biomechanics have been revolutionized. Orthotic therapy has advanced in sophistication of assessment, diagnosis, prescription writing, and manufacturing techniques. New research unequivocally demonstrates that orthoses make a huge difference in outcomes.(1,2) Your patients are better educated and have easy access to information related to orthotic therapy through the Internet. Combine this with the changes in healthcare and the competitor down the street, and you will find that careless casting techniques, generic prescription writing, and using a "run-of-the-mill" orthotic lab will not meet the expectations in today's environment. Every podiatrist needs to update his or her education and knowledge level to approach the orthotic needs of our patients' specific pathologies.

Success in practice is not defined by how many devices you dispense. A successful practice and reputation is built on achieving the best possible clinical outcomes which support continued referrals. The key components for success are continuing your education in modern biomechanics, writing orthotic prescriptions based on each patient's specific pathology, skilled troubleshooting of the complications of orthotic therapy, and the use of quality orthotic devices. This article will discuss each component and provide specific recommendations that can drive your success and reputation to new levels.

Learn What's New in Biomechanics and Orthotic Therapy

Did you know that:

*** Subtalar joint pronation with calcaneal eversion produces a dramatic spike in pressure in the tarsal tunnel?**
*** Medial skive technique decelerates subtalar pronation at midstance?**
*** Midtarsal supination stretches the medial slip of the plantar fascia?**
*** Functional hallux limitus is proportionally related to collapse of the midtarsal joint and subsequent dorsiflexion of the first ray?**

If any of these recently-documented mechanisms that produce pathology are new to you, then it's time for an update. Learning more about the "new biomechanics" and pathology-specific orthoses isn't that difficult, and it's not necessary to understand the technology used in the research in order to understand the concept. Here are some information sources:

1. Seminars
2. Print media (books, journals, trade publications, newsletters)
3. Electronic media (websites, e-mail, newsgroups, etc)
4. Consultations with orthotic therapy experts

Seminars

Seminars and lectures in biomechanics or orthotic therapy are relatively scarce in podiatry. Lectures on fixation techniques, antifungals, and wound care have monopolized the podium at most national meetings. The International Conference on Foot Biomechanics and Orthotic Therapy is the only seminar that has a clinical and academic focus on orthotic therapy. This annual program is specifically designed for practitioners who want to improve the orthotic therapy aspect of their practices. The program is sponsored by the forty-five U.S. and Canadian member labs of the Prescription Foot Orthotic Laboratory Association (PFOLA).

This year's meeting is in Vancouver, BC on November 4-6, 2005, and will feature speakers from the Human Performance Labs at major universities, along with clinical experts. This seminar synthesizes the academic and research material into clinical applications during the workshops. The program includes a range of topics, from basic to advanced, making it appropriate for anyone interested in learning more about orthotic therapy. For more information about this program, go to www.pfola.org.

Texts

Print materials allow you to continue your education at your convenience. The best text we have found for orthotic therapy is Clinical Biomechanics of the Lower Extremities, by Ronald Valmassy, DPM published in 1996. The chapters on casting for orthoses and orthotic prescription writing are still the standard for clinical practice. The book can be ordered at www.amazon.com.

A less formal, yet clinical, book is Foot and Lower Extremity Biomechanics Volumes 1 and 2 by Kevin Kirby, DPM. Since 1987, Dr. Kirby has written a monthly clinical newsletter that has been condensed into a multi-chapter textbook. This is an ideal publication for the clinician. The volumes are well illustrated and very readable. It is a beautiful melding of science and clinical application.

A pediatric text with good information on orthotic therapy for the child is Introduction to Podopaediatrics by Russell Volpe, D.P.M. and Peter Thompson, DpodM. This book is also available at www.amazon.com

The Internet

The Internet is an easily accessible source of up-to-date information on orthotic therapy. Quality information can be found through both commercial and non-commercial sites. Sources include orthotic labs, educational institutes, online podiatric and biomechanics publications, etc. Biomechanics and orthotic therapy are rapidly growing internationally, with a much greater online presence in Canada, Australia, and the U.K.

The California School of Podiatric Medicine at Samuel Merritt College in Oakland, California and LaTrope University in Australia both provide web pages that are an excellent

source of biomechanics and orthotic therapy information. In addition you get a sneak peek at what today's students are learning.

The Samuel Merritt College Department of Applied Biomechanics (www.smcdab.com) contains PowerPoint handouts from five biomechanics courses. Topics include basic terminology outlines, pathology specific orthoses, and pre-tibial stress syndrome in the athlete. The information is copyrighted and protected, so avoid lifting the presentations for your own use at the next hospital staff meeting. Each entry into the site is monitored. When you enter the website you will be asked for user ID (biomechanics) and a password (orthotic). These ID's are exclusively for Podiatry Management Magazine subscribers. LaTrope University Department of Podiatry also presents its biomechanics course online, with original and very descriptive illustrations (www.latrobe.edu.au/podiatry/learningcentre.html).

ProLab Orthotic/USA, (www.prolaborthotics.com), provides a synopsis of the pathomechanics of ten foot pathologies and recommendations for orthotic treatment on their website. ProLab clients can also request a more comprehensive Pathology Specific Orthoses guide.

Northwest Podiatric Lab's website offers a tutorial on lower extremity torsional abnormalities in children and adults, and recommended treatments. This topic is presented in a very logical format. You do not need to be a client to access the information at www.nwpodiatric.com.

The last webpage is the tried and proven source of all medical knowledge – pubmed medline query www.PubMed.gov. This National Library of Medicine search engine allows you to search by author, as well as by topic. For example, by entering "foot orthotics plantar fasciitis", you will get a listing of every article available on that topic. Free abstracts are available on each article, in addition to links to the actual articles.

Newsletters

E-mail and snail mail newsletters on foot orthotic therapy are available, and are a simple way to keep you updated on developments in orthotic therapy. They can be excellent sources of information, with practical applications of scientific and/or clinical concepts.

Precision Intricast Laboratory's monthly newsletter is written by Kevin Kirby, DPM, and sent via regular mail to clients of Precision (1-800-227-7805).

ProLab Orthotics/USA publishes the Orthotic Communiqué, a weekly publication with concise overviews of timely topics in orthotic therapy. It also lists upcoming educational events and seminars. The Orthotic Communiqué is distributed for free to practitioners and students by e-mail. You can subscribe to the Orthotic Communiqué at www.prolab-usa.com/education.htm.

Orthotic Therapy Consultations

Many orthotic laboratories offer their clients free consultation with some of the country's top orthotic therapy educators. These consultations can be an excellent educational experience, with every consult becoming a mini-tutorial on orthotic therapy. Look for labs that have experienced clinicians, rather than orthotic technicians. Some consultants will accept digital pictures and/or video of selected patients for an in-depth consultation.

Networking is important for skill development in any specialty area. Attend orthotic seminars and meet speakers who are experts in the area of orthotic therapy so you can build your network of resources. Educational institutes with programs for podiatric medicine

and/or human performance (gait) laboratories can also provide access to orthotic therapy and/or biomechanics "experts".

Orthotic Prescription Writing

Ten years ago, podiatric biomechanics still believed that structural abnormalities could predict function, and that abnormal function should direct our mechanical treatment. Orthotic prescription writing was based on the measurement of structural "deformities" and joint range of motion, as described by Root.(3)

To date, no studies have shown a correlation between these measurements and foot function; however, there are theories on orthotic function that may allow us to write orthotic prescriptions and provide our patients with better clinical outcomes.

Tissue Stress Model

In 1995, McPoil, et al.(4) proposed the tissue stress model as an approach to orthotic therapy for the foot. This model had been used extensively for orthotic therapy in other parts of the body, and provides a logical process for prescribing a clinically effective orthotic based on your patient's specific pathology. The basic concept is to design a foot orthosis that will act to decrease abnormal and deleterious forces on tissue to optimize function of the foot, and to decrease tissue stress that leads to injury.

There are three steps in applying tissue stress methodology to your orthotic prescriptions:

1. Identify the anatomical structures causing the patient's complaints.
2. Determine what might be causing excessive stress on those structures.
3. Prescribe an orthosis to decrease this stress.

For example, a patient complains of medial ankle pain. Following a thorough examination, you find that pain is primarily in the posterior tibialis tendon.

The next step is to determine what is causing this tendinitis. Has the patient been running long distances in an unstable shoe? Is the calcaneus everted, leading to out-of-phase firing of the tibialis posterior to stabilize the foot? Has the patient developed a unilateral flatfoot indicative of posterior tibialis dysfunction (PTD)? For the purposes of this discussion, let's assume that the diagnosis is PTD.

Now it is time to write an orthotic prescription to decrease tension on the posterior tibialis. The patient with a PTD will usually have a medially deviated subtalar joint axis, so the orthosis must act to decrease pronatory torque by applying force medial to the axis.(5) If you are not familiar with this concept, Dr. Kirby's article will help advance your understanding of foot biomechanics.

An orthosis based on the tissue stress model for this patient might consist of the following:

*** Semi-rigid polypropylene to maintain a neutral foot position**
*** Deep heel cup to provide more orthotic surface area medial to the subtalar joint (STJ) axis and to create a greater supinatory torque. This prevents heel eversion and, in turn, reduces tension on the posterior tibialis.**
*** Medial flange puts more orthotic surface medial to the STJ axis to prevent excessive pronation.**

*** Minimum cast fill to better conform to the arch.**
*** Medial heel skive to increase the supinatory torque of the orthosis.**
*** Sweet Spot (Figure 1) a pocket formed into the orthotic plate, to decrease pressure on a prominence. The navicular is often prominent in the PTD foot, and the sweet spot will reduce pressure in this area to allow the patient to wear the device comfortably.**

Another example is a pathology-specific orthosis for metatarsalgia (Figure 2). This orthosis is designed to decrease tissue stress on the metatarsal heads by using:
*** Minimum cast fill to transfer force from the met heads to the medial arch.**
*** An unbevelled distal edge to transfer force from the metatarsal heads to the metatarsal shaft.**
*** A Poron® metatarsal bar to transfer force and pressure from the metatarsal heads to the neck and shafts of the metatarsals.**
*** A Poron® forefoot extension to provide additional cushion and to slow metatarsal head velocity during forefoot loading and heel lift.**

Pathology-Specific Orthoses

Orthotic prescription writing education at the California School of Podiatric Medicine has been based on a derivation of the tissue stress model since 2001. The model is known as pathology-specific orthoses, and teaches the students to write orthotic prescriptions based on the patient's primary pathology. The curriculum includes pathology specific prescriptions for over twelve diagnoses.

Using pathology-specific orthotic prescriptions will make the process of writing orthotic prescriptions more logical, and provide your patients with better clinical outcomes. If all of your patients' feet look different but all your patients' orthotics look the same, maybe you are not prescribing as specifically as you could. More information on pathology-specific orthoses and the tissue stress model is available through the educational links in this article and in the references.

Quality Devices For Quality Care

Clinical outcomes are directly related to the materials used in the orthoses, the construction techniques, and the ability of your laboratory to make your device exactly as prescribed. The techniques mentioned under prescription writing are only effective if properly executed at the orthotic laboratory. Several factors impact orthotic quality, including:

*** The negative cast or image.**
*** The cast work and cast balancing.**

The Negative Cast

For over 50 years, the gold standard for constructing a functional orthosis has been the negative suspension cast taken with the subtalar joint in neutral and the midtarsal joint at its end of range of motion. This standard has been used in the majority of outcome and investigational studies. The orthotic lab depends on the accuracy of the position of the foot during casting since they have to make the device without seeing the foot.

Foam box impressions of a semi-weight bearing foot have distinct disadvantages relative to the neutral suspension cast. A semi-weight bearing impression forces the midtarsal

joint into a supinated position and dorsiflexes the first ray. This almost guarantees that a functional orthosis will be ineffective at reducing symptoms, and often results in arch irritation and induced hallux limitus.

Foot Scanners

New technologies, such as foot scanners, are becoming more prevalent as an alternative to negative casting; however, few scanners can replicate the quality orthoses achieved from the gold standard negative cast. The Bergmann Scanning Device is currently the only commercial scanner that can capture a three-dimensional image of the foot in a neutral, non-weight-bearing position, and accurately replicates the position achieved with a negative suspension cast.

Other scanning technologies, such as weight-bearing scanners and pressure sensitive mats, capture a two-dimensional image of the foot in a compensated position. They then manage to change a two-dimensional image into a three-dimensional foot shape and establish the forefoot-to-rearfoot relationship. A three-dimensional shape cannot be accurately created from a two-dimensional picture. It is, at best, just a very rough guess. If the reader were provided with the square footage and weight of every building in downtown San Francisco, could he describe what the skyline of the city woulook like? Of course not! This is the equivalent of trying to build an orthosis from a 2-D image.

There are no clinical outcome studies demonstrating that the orthotics made from these 2-D images and extrapolated data match the clinical performance of those made from a quality 3-D negative cast.

Useful Resources

If you are taking shortcuts for negative casting because you lack training or experience, there are several resources that can help you. Northwest Podiatric Laboratory (www.nwpodiatric.com) offers a step-by-step guide of an alternative negative casting technique that captures the appropriate position of the rearfoot, midfoot and first ray. ProLab Orthotics (www.prolab-usa.com) offers a DVD to their clients with step-by-step casting and cast evaluation instructions for consistent outcomes. Root Functional Foot Orthotic Lab (rfol@jps.net) sponsors a negative casting workshop each year at the PFOLA meeting (www.pfola.org). If plaster mess and office time are the reason for using the short cut methods consider learning how to use the STS casting sock www.stssox.com which produces, with a little skill, a similar negative cast in less time and with no plaster mess.

The negative cast is the foundation of the custom functional orthosis, and is not a place to take shortcuts if you care about your patients' clinical outcomes and your reputation.

Cast Work and Cast Balancing

The basic concept of orthotic therapy was developed by Merton Root, DPM, who proposed that much of the foot pathology and symptoms originated with an anatomical variation between the forefoot and the rearfoot, or between the rearfoot and the leg. He proposed that if a negative cast could capture the anatomical variation, a positive cast and subsequent plastic insert could be fabricated to compensate for the variation. This concept requires an accurate negative cast and an accurate "balancing" of the positive cast.

Some orthotic labs do not correct the negative cast/image, but use it only to determine the length of the foot and height of the arch. They then select a predetermined orthotic shape

from a library of arch shapes of that particular foot size. This provides your patients with a customized pre-fabricated orthosis, but not a balanced functional custom orthosis. There is a place for off-the-shelf and customized prefabricated orthotics in our profession, but you need to be critical because some laboratories that deliver a customized pre-fab or off-the-shelf device that they claim as a custom orthosis.

Few practitioners ever investigate the skill or accuracy of the positive cast work performed by their lab, and only question the quality of work when the orthotics fail to relieve symptoms. Orthotic manufacturers have always understood the importance of this and have long known that standards needed to be developed. The Board for Accreditation of Prescription Foot Orthotic Laboratories (BAPFOL) is a certifying board which provides a test for quality standards for cast correction and manufacturing. Using a BAPFOL certified lab guarantees that the lab has the resources and talent to correct a positive and make a consistently good device. A listing of the BAPFOL certified labs and standards are available at www.pfola.org. Quality matters!

Troubleshooting

Even the experts in orthotic therapy who use a certified lab and have a compliant patient can have a problem with an orthosis. The device may be uncomfortable, cause new symptoms, or simply not relieve the patient's symptoms as expected. Your success in orthotic therapy will be determined by your ability to prevent problems proactively through proper diagnosis, pathology-specific prescription writing, accurate negative casting, meticulous positive cast correction, and quality manufacturing. If problems do arise, you must be able to determine the cause of orthotic problems and correct them. This article will provide an overview of troubleshooting problems.

Most orthotic problems can be traced to one of four areas:
1. Negative cast
2. Positive cast and orthotic production by the laboratory
3. Prescription
4. Shoe - orthotic relationship

Negative Cast

The ability to take a negative cast that captures the foot with the subtalar joint neutral, the midtarsal joint locked, and the first ray plantar-flexed is critical to achieving optimum clinical outcomes. (Figure 3) Inadequate plantar-flexion of the first ray while casting captures excessive varus in the forefoot-to-rearfoot relationship and the resulting orthosis will contain excessive varus. An orthosis with excessive varus prevents plantar-flexion of the first ray. Roukis, et al.,(6) showed that preventing first ray plantar-flexion decreases hallux dorsiflexion. By not plantar-flexing the first ray when you cast, the orthosis may hold the first ray up and cause functional hallux limitus. The first rule when troubleshooting orthotic problems is to critically evaluate your casting technique if the orthosis causes first metatarsophalangeal joint pain or medial arch pain.

Positive Cast

As noted in the quality devices section, your orthotic laboratory's positive cast corrections are critical to providing your patients with the best clinical outcomes. The most

common error made by orthotic labs is to overfill the medial arch. This results in an orthosis with a lower arch and, subsequently, less control of the medial column of the foot. Why is this error common? It creates a more "forgiving" orthosis that is likely to feel more comfortable, even in the event of a poor negative cast or a substandard prescription. Excessive medial arch fill creates an orthosis that does not adequately support the medial arch and is less likely to provide optimum clinical outcomes. (Figure 4) Avoid this problem by selecting the appropriate arch fill, and using a laboratory that follows your instructions. If you prescribed a minimum fill, then the arch of the orthosis should closely match the arch of the foot in stance.

Prescription

If you are confident that you took an appropriate negative cast and that the laboratory provided high-quality positive cast work, then the next item to evaluate is your prescription. If a patient complains that the arch of the orthosis is causing irritation, the first plan of action by many podiatrists is to lower the arch of the orthosis. Often the problem is not that the arch is too high, but that the orthosis does not adequately control heel eversion. If the orthosis prescription did not include a deep heel cup, wide orthosis, and a medial heel skive, then an everted heel may continue to drive the arch of the foot into the medial arch of the orthosis. Before rushing to lower the arch, try using moleskin to create a medial heel skive. (Figures 5A & 5B) You will likely find that controlling this excessive heel eversion decreases arch irritation.

To learn more on troubleshooting orthotics, attend the workshop on orthotic troubleshooting at PFOLA's International Conference on Biomechanics and Orthotic Therapy (www.pfola.org).

Shoes

Shoes can be the culprit of multiple orthotic problems, including continued symptoms, arch irritation, and edge irritation. When evaluating orthotic problems, check the position of the orthosis in the shoe. Shoes should be stable and have plenty of room to allow the orthosis to sit flat in the shoe and completely back in the heel counter. An unstable shoe allows the entire foot to pronate excessively regardless of the orthotic, and produce arch irritation or functional hallux limitus. A shoe that is too narrow for the orthosis can cause posterior heel irritation because the heel doesn't slide completely back into the shoe. Front edge irritation can occur when the front edge of the orthosis does not sit flat in the shoe. Arch pain can occur when the orthosis rides on the medial wall of the shoe. Remember, orthoses are made to fit the patient's foot – make sure the patient has a quality shoe that fits his/her foot and orthosis.

You can help ensure that your patients are wearing correct shoes by giving them one of several shoe lists that are available on the Internet. These are lists of shoes that are stable and work well with orthotic devices. You can find a list prepared by the Podiatric Medicine Clinic at Virginia Mason Sports Medicine in Seattle at http://www.vmmc.org/pdfdocs/sportsmedicine/VM_Shoes.pdf. ProLab Orthotics has a list that is updated twice a year and is available at www.prolab-usa.com. The American Academy of Podiatric Sports Medicine has a list on their website at www.acpsm.org.

Conclusion

The many changes occurring in podiatric biomechanics are providing an opportunity for practitioners to take the orthotic therapy portion of the practice to new levels of success. Not since the advent of recreational running in the early 1970's has there been a potential for growth in orthotic therapy as there is at present. Podiatric practitioners have the opportunity to be leaders in the field of orthotic therapy by continuing their education on the advances in this field. Build your foundation in biomechanics and orthotic therapy, prescription writing skills, and casting techniques so you can "build" quality orthoses for your patients and improve their clinical outcomes and your reputation for success with this treatment modality. Also, avoid shortcuts that provide flash but little substance, and use high quality orthotic laboratories. By taking these steps, you can provide superior clinical outcomes from orthotic therapy for your patients, enhance your professional reputation, and expand your practice.

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