

CarePartners Orthotics and Prosthetics Device Reference

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Abstract:

The purpose of this project was to create a useful resource for physicians and clients that utilize the services at the CarePartners Orthotics and Prosthetics clinic. This resource is an informational book that provides definitions and examples of specific technologies and services provided by the clinic. It specifically aims to simplify the process of referring patients to practitioners at the clinic and allows those patients to understand what services will be available to them. Although time constraints did not allow me to complete the informational book, I organized its beginning stages and completed the first section. I took notes on the different elements surrounding prosthetics and orthotics and learned technical terms used in the field. I also documented the technology involved in assembling the assistive devices. The book includes pictures of such technology along with other necessary equipment for clients and descriptions of their functions. This allows clients to be better informed about orthotics and prosthetics and to be able to ask for specific services. Physicians are also able to use the information in this book to accurately refer patients to the clinic. In the following months when the reference book is completed it will provide pictures and information for all assistive devices provided by the clinic.

Keywords: Prosthetics, Orthotics, Vascular Disease, Disability, Assistive Devices

Origins of Project

According to the Center for Disease Control and Prevention (CDC), in the 2014 National Diabetes Statistical Report, approximately 29.1 million people in the United States have diabetes while 86 million people have prediabetes. In addition to these statistics, 1 out of 4 people with diabetes are unaware that they have diabetes and 9 out of 10 people with prediabetes do not know they have prediabetes (2014 National Diabetes Statistics Report). Peripheral arterial disease (PAD) obstructs blood flow in arteries and causes severe pain in the legs and feet. PAD is a symptom of atherosclerosis characterized by occlusive disease of lower extremities. Diabetes causes many vascular complications like poor blood circulation and nerve damage. Nerve damage can result in peripheral neuropathy, which causes weakness, numbness, and pain in the hands and feet (Peripheral Artery Disease-Legs: MedlinePlus Medical Encyclopedia). In the United States, vascular diseases including, but not limited to, diabetes and peripheral arterial disease are the most common causes of lower limb amputation.

Most major and minor lower limb amputations in the United Kingdom are caused by PAD and 40% of those amputations are performed on diabetics (Marshall et al. 2010). The correlation between vascular diseases and amputations is very serious as it affects millions of people in the United States and around the world. Applications of prosthetics and orthotics are used to combat the hardship of living with an amputation. A thorough health evaluation must be completed to determine the specific needs of the amputee. General health evaluation criteria include the assessment of cardiovascular function, muscular power, self-sufficiency when applying a prosthetic device, bearing capacity of the residual limb, and physiological preconditions for the use of the prosthesis (Rajčůková, 2014). A functional regimen characterized by individual limitations is determined for the amputee based on the evaluation criteria.

CarePartners is a private, nonprofit healthcare organization that provides a wide range of services to help patients live full and productive lives despite illness, injury, disability or issues related to aging. In 1939 CarePartners, known then as the Asheville Orthopedic Home, opened to treat children with disabilities. It expanded in size and extent of services as a result of the polio epidemic during the 1940's and continued to expand throughout the decades that followed. Areas of service were added and new opportunities for health care became available for all ages. Today the organization offers services in the areas of rehabilitation, home health, adult care, and hospice.

Included in the area of rehabilitation, the CarePartners Orthotics and Prosthetics clinic aims to improve the quality of life for people living with amputation or disability. The clinic is the region's leader in providing comprehensive care and assistive devices to its clients. Professional orthotists and prosthetists provide quality care to support the organizations' overall mission by helping clients achieve freedom of mobility. The clinic is certified by the National Commission on Orthotic and Prosthetic Education and is a member of the American Orthotic and Prosthetic

Association. The clinic offers state-of-the-art technology to develop custom orthotic and prosthetic devices to help clients regain their lives.

New clients to the Orthotics and Prosthetics clinic experience a multi-step process to allow practitioners and technicians to develop a custom device based on their specific needs. An evaluation of the client reviews medical history and any information that is relevant for considering the client's needs. During the evaluation, specific measurements and necessary impressions are taken of the area of concern to fit a custom brace or artificial limb. Based on the information from the initial evaluation, technicians at the clinic will fabricate the device. Once the device is made, practitioners will assist in testing the device on the client to make sure it is the ideal fit. At this point, clients will be informed of the proper uses and care for the device. Adjustments or repairs will be made to the device to obtain the correct fit for the client. Additional adjustments or repairs will be needed over time as the client experiences changes in physical condition or lifestyle.

The CarePartners Orthotics and Prosthetics clinic needed an intern to assist with projects that could not begin as a result of meeting daily demands. An intern would help practitioners and technicians to concentrate on patient care and focus on the quality of work. The creation of a device reference book was determined by the need to clarify and simplify the services provided by the clinic. The idea for the reference book was mentioned approximately 10 years ago, but practitioners had not yet had the opportunity to begin such a project. The vision for the reference book encompassed a list of specific devices and components of these devices to allow clients and referring physicians to better understand the services provided by the clinic. When the reference book is completed, clients will be able to refer to the book to decide which services they need, while physicians may use the book to more accurately refer patients to the clinic.

Methods and Work Undertaken

The Orthotics and Prosthetics Clinic offers a comprehensive array of services, but the focus of my individual project was on prosthetics of the lower extremity. My learning was not limited to prosthetics, but also included orthotics and bracing. I began my project by shadowing practitioners and technicians to set a foundation of knowledge for the practice. It was important for me to familiarize myself with the surrounding environment and operations of the clinic because I had no prior experience in a professional health setting. I observed technicians as they constructed custom made braces and prostheses from raw materials, such as carbon fiber fabric and plastic polymer laminates. Through my observations I learned about some of the equipment and methods used to make assistive devices as well as the different types of devices used by clients. I took notes on everything I learned in the technology lab, including the devices that were made and the terms associated with the identification of those devices. I engaged in one-on-one conversations with technicians, who explained technical terms and the functions of each device.

I also shadowed practitioners as they worked with clients. I was able to observe the entire process, which includes evaluation of the client's needs, fabrication of new devices, fitting and testing of devices, and making adjustments to equipment as needed. While being included in practitioner-client interactions, I learned about the physiological effects of amputations and the ailments that result in the need for amputation. I observed the way prostheses fit and must be adjusted over time to accommodate for limb volume fluctuation. The hands on experience of shadowing professionals in this field enhanced my knowledge of prosthetics enough to begin my project.

After shadowing and observing for the first two weeks, I began work on the specific project, which was to create a simple book to reference devices and their components. I made a rough outline of what I would include and how the information would be displayed. I then gathered the devices for transtibial amputations, which are amputations of the limb below the knee joint (BK). Amputations in this category include any amputation below the knee including partial foot amputations, and Syme's, Boyd, and Pirigoff amputations, which characterize ankle disarticulations. Once I had gathered the necessary devices for this section, I began to photograph them for the book.

To take photographs of the devices and their components I set up an appropriate photography shooting area. I was given one of the client assessment rooms to set up the equipment and store the devices. I borrowed large sheets of white foam from the lab to use as a background for the pictures and shot the pictures with my phone camera. I was worried the photos would not turn out well because I did not have a professional camera, but the phone camera took surprisingly detailed pictures. After taking the photographs I uploaded them on to my computer to be edited and added to a Microsoft Excel document, where they would be organized in the appropriate order.

I first photographed a standard toe filler for a partial foot amputation and the leg brace that could complement it to enhance support and mobility for the client. This represented the lowest level of prosthetic devices without overlapping with orthotic devices. I then took pictures of two separate prostheses for Syme's level amputations, one for a pediatric client and the other for an adult. I also photographed a carbon fiber socket with a custom design used to accommodate a residual limb with a mid-calf amputation. I then included a photo of a completed transtibial prosthesis that displayed all of the separate components of the device. The last photo I included in this section of the book was an Immediate Post Operative Prosthetic (IPOP), which is applied in the operating room immediately after an amputation to protect the residual limb, but is not to be used as a weight-bearing device. This device is used to decrease the initial shock of losing a limb and to provide a sense of security.

After uploading, editing and organizing the transtibial device pictures, I moved on to photograph the components of prosthetic devices. These items included a locking liner, a cushion liner, a sealing liner, cover, skin, and suspension sleeves. For certain photographs of completed prostheses I added lines pointing to and labeling features of the device to make it easy to

comprehend. This section of my work would go at the beginning of the book to organize the components that are used in all prosthetic devices. I followed the same procedures for the next section of the book on transfemoral amputations, which are amputations above the knee joint (AK). I photographed a transfemoral prosthesis with a suction socket, a knee disarticulation prosthesis with a vacuum pump, and a hip disarticulation prosthesis. I edited and organized the pictures as I had done in previous sections. Finally, I made the last formatting changes to the document by reordering pictures and editing device descriptions.

Ties to Academia

As a Health and Wellness Promotion major, I have been able to connect my work and experiences at the CarePartners Orthotics and Prosthetics clinic with my academic competences. In my experiences with anatomy and physiology courses I have learned much about the structure and functions of the human body. This knowledge has helped me in understanding the anatomical terms used by the practitioners in the clinic when referring to the characteristics and needs of clients. Having prior knowledge of this sort has allowed me to quickly learn about lower extremity amputations and comprehend the physiological affects that are associated with them. I am able to converse with practitioners and technicians about specific topics related to the diseases that result in amputation and the functions of prosthetic devices. I am also able to comprehend the effects that a prosthetic or orthotic device has on an individual's mobility and physical health. I can also identify physiological reasons for complications a client may have with their device. For example, as the volume of the residual limb fluctuates, the device may not fit correctly and cause pressure or irritation to certain areas of the skin. The device will then need to be altered to for a better fit.

From a health promotion perspective, it is important to consider all aspects of health using a multidimensional approach to fully understand the situation of an individual or the needs of a population. When considering the needs of an amputee, there are many issues that have varied affects on each individual. No two amputees are alike and one must accommodate for very individualized situations. Considering the physical health of an amputee is very important because the main goal is to improve mobility. Many people suffer from an amputation as a result of a type of vascular disease such as diabetes or peripheral artery disease. These diseases reduce blood flow to the feet, which is an important consideration when applying a prosthetic device to a lower extremity amputee. In my experience at the clinic, I have found that it is common for people in this situation to develop ulcers on the functional limb as a result of disease or overcompensation for the residual limb.

Maintaining a state of positive physical health is important for everyone, but it can be difficult for those living with an amputation. However, there are ways that these people can be as active and as healthy as possible. For example, I conducted research for a research methods class in the spring of 2014 on proprioceptive neuromuscular facilitation (PNF), which has been found to improve joint and muscle range of motion. During my experience at the Orthotics and Prosthetics clinic I came across a small study that showed the effects of PNF techniques on

prosthetic training, which proved to be more beneficial than traditional prosthetic training. It was insightful to make a connection between my past research and the knowledge I have gained at the clinic because I had not considered PNF techniques for amputees.

It is also important to consider a state of mental health as an aspect of the multidimensional approach to understanding the health of an amputee. From my studies and experiences in the field of health promotion I have learned that mental health affects all other aspects of health. An individual goes through a drastic change with the loss of a limb and is forced to make many physical and mental adjustments for daily life. Many new amputees suffer from depression and other debilitating mental illnesses as a result of their disability. Hindered mobility makes it difficult for an individual to live life the way they used to. Dealing with the shock of amputation can be extremely hard on certain people as they adjust to a new way of life. In my health promotion curriculum I have learned that promoting mental health can be difficult as it is a highly varied subject. Characteristics of mental health are individualized so it takes one on one communication with a client to identify the stressors and emotions that are affecting the individual's mentality.

Physical health and mental health are two major components that affect an individual's quality of life. Quality of life is an individual's general wellbeing characterized by a standard of health in areas such as physical, mental, spiritual, and social health, among others. From a health promotion perspective, improving quality of life is the ultimate goal because it positively affects multiple areas of health. By observing practitioner-client relationships in the orthotics and prosthetics clinic, it is clear that improving the quality of life of clients is a major objective of the clinic. Every individual is different and requires specific needs to combat their disability. Everything I have learned at university about quality of life is present in the clinic and is demonstrated by how practitioners treat each client as an individual and make custom assistive devices to fit specific needs. The goal is to make a client comfortable in their device and allow as much mobility as possible to instill a sense of independence and freedom, which affects multiple areas of health to improve overall wellbeing.

Through my academics I have worked with older adults and conducted research on the physiology of aging. I have worked with older adults in the HAPI (Healthy Aging Program Initiative) Lab at UNCA and experienced first hand the limitations of mobility and physical capacity that arise as a result of age. Many of the clients at the orthotics and prosthetics clinic are older and experience more complications with their devices and general mobility. I have prior knowledge of the physical affects of aging, which has helped me comprehend the affects of amputation in an older population. It is harder for an older adult to recover from an amputation and adapt to the lifestyle changes associated with such a drastic procedure.

In my courses at UNCA I have learned that it is beneficial to be as active as possible to maintain physiological capacities like bone density and muscular strength. An individual is more likely to experience debilitating effects on lifestyle if they are inactive. This concept is important to consider when working with older amputees because they already experience limitations with

mobility and activity. Practitioners at the orthotics and prosthetics clinic act as health promoters as they encourage older adults to be as active as possible to maintain or improve mobility. Through my experiences at the clinic I have observed that inactivity will negatively affect physiological capabilities such as joint range of motion, gait control, and stability, all of which are important factors for maintaining independence and physical health.

A major focus in the health and wellness promotion curriculum is the prevention of disease to create a healthier society. The majority of amputations in the United States are a result of vascular disease such as diabetes and peripheral artery disease, which in several cases can be prevented with a proper diet and physical activity. By working with clients at the clinic I have experienced the dramatic affects that vascular diseases can have on the body. It is common for people coping with an amputation to develop ulcers on the functional limb as a result of a preexisting condition or compensating for the residual limb. Maintaining healthy foot hygiene and controlling the condition can prevent situations like this. A role of being a prosthetist or orthotist is to educate clients about ways to take care of their bodies. Health education is a characteristic of health promotion, which is a concept that has been thoroughly covered in my studies at UNCA. When promoting health education it is important to create understandable and clear informational materials for the target population. My project can be related to health education material because it is concise, which allows clients to understand how orthotics and prosthetics devices are used. The reference book can positively contribute to patient's overall understanding of this topic, which can lead to further knowledge of their individual health.

As a health and wellness promotion major I have learned much about public health, which is a broad topic that relates all aspects of health to the overall health of a population. From my knowledge of public health and experience in the orthotics and prosthetics clinic I have been able to identify several factors that connect the workings of the clinic to public health. Any health care organization is connected to public health, but the CarePartners Orthotics and Prosthetics clinic deals with a specific population of people with amputations or other disabilities related to mobility. Health education focused on maintaining mobility and foot hygiene is a component of the public health for the specific population at the clinic. Practitioners teach clients about specific types of disability and how to maintain a healthy lifestyle. Practitioners also exercise public health by providing individualized care to clients, which increases the chance that those clients will learn important health information and incorporate it into a healthy lifestyle. Finally, the orthotics and prosthetics clinic uses a public health approach by promoting the prevention of further disease or other ailments and prolonging life.

Challenges Faced and Responses to Those Challenges

As with every new experience, this internship presented several challenges throughout its duration. I found it difficult to obtain the required number of internship hours because of weather constraints and personal illness. The snow and ice at the beginning of the semester caused the clinic to close or hindered me from traveling into town. I calculated the number of hours I would need to obtain by the end of the semester and distributed them among the remaining weeks. I

altered my schedule at my current job and decided to work at the clinic twice a week for at least five hours each visit. The environment of the clinic, with its extensive technology, posed a challenge for me because of my lack of knowledge about prosthetics and orthotics equipment. I was out of my element, but I was also very intrigued by everything that was going on. To increase my technical knowledge about assistive devices I shadowed technicians who explained the process to me. This was very helpful because I learned about specific devices and the methods of constructing them.

At the beginning of the project I was not familiar with the technology and equipment that I was asked to include in the resource book. To solve this issue I spent a lot of time asking questions and doing further research to increase my knowledge of the topic and gain the necessary information for the equipment descriptions. I was frequently intimidated about asking questions because I did not want to interrupt the work of a practitioner or technician. I forced myself out of my comfort zone and started asking short and specific questions to get answers while not taking up much time. This benefitted my communication skills and increased the efficiency of the note taking portion of my project. A major challenge I experienced came with formatting the Excel document to include pictures and text. My computer skills are adequate enough to ultimately produce a quality product but not without complications along the way. The work had a slow start, as I was not familiar with Excel software. I spent a good deal of time figuring out the software and researching how to carry out certain functions on the computer to achieve a proper structure and the level of professionalism I envisioned. Although there were quite a few challenges, I learned much about the ways of a professional health setting, specifically a prosthetics and orthotics clinic.

Results

In collaboration with my site supervisor I decided to develop a product model based project in the form of a device reference book for the clinic. The book contains general information on the descriptions and functions of specific devices provided by the CarePartners Orthotics and Prosthetics clinic. The first section of the book covers the components that comprise prosthetic devices. This includes various liners and socks that are used to cushion the residual limb as well as sockets and endoskeletal features that make up the structure of the device. The second section of the book focuses on devices for transtibial amputations, which are amputations below the knee joint. It covers the assistive devices used for a partial foot amputation, prostheses for Syme's level amputations, which are amputations at the ankle joint, and other transtibial prostheses. The third section of the reference book provides information on devices for transfemoral amputations, which are amputations above the knee joint and include knee and hip disarticulations. Each device and component has a simplified description to make it easy for clients and referring physicians to use when seeking information about the CarePartners Orthotics and Prosthetics services.

Sustainability

The work I have done at the CarePartners Orthotics and Prosthetics clinic has a high level of sustainability. Although I completed a small portion of the book, I began a project that was intended to start over a decade ago. Over the next several months my completed project is scheduled to continue and will be sent to the CarePartners headquarters for editing, processing, and publishing to create the final product. After budgeting and approval, it will be distributed to healthcare partners for the use of referring physicians to accurately refer patients to the clinic. Clients will also have access to the book to have a better idea of what services they need from the clinic. The completed book will provide basic but adequate information about all assistive devices provided by the clinic to simplify the process of practitioner-client appointments and referring physician-client interactions.

Conclusion

The creation of a device reference book for the CarePartners Orthotics and Prosthetics clinic was based on the need for a simple, informational resource for physicians and patients associated with the clinic. In collaboration with my community advisor, the director of the CarePartners Orthotics and Prosthetics clinic, this project was designed for an intended audience of people who are not entirely familiar with the services of an orthotics and prosthetics clinic. My work on this project was beneficial to the clinic because it set the foundation for the book to expand and achieve the overall goal of informing clients and physicians. When this resource becomes available, it has the potential to improve business at the clinic because physicians will have more information to appropriately refer patients there. The resource will make it easier for clients to understand the services available to them and decide which ones they need, which will increase the efficiency of the clinic.

As a health and wellness promotion major, it is important to experience many different types of health practices. I have made significant connections with my academic experiences and working at the Orthotics and Prosthetics clinic. Until the initiation of this internship, I had never given any thought to involving myself in this type of setting. Gaining a new perspective of individual and public health through this experience has influenced me greatly. It has increased my knowledge of health across multiple dimensions including mental and physical wellbeing. The process of implementing the project has improved my communication and computer skills as well as general knowledge about amputations, disability, and assistive devices. I have also gained insight into a new field of healthcare that I would potentially be interested in pursuing. The process and completion of my project has instilled a sense of self-assurance in my decision to work in a field of health.

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