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LEARNING IN CLINICAL CASES

Foot spa to enhance tissue perfusion on diabetic foot ulcers

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Abstract
Delayed wound healing is currently a concern in diabetic foot ulcer care. The problems occur due to ineffective blood flow to the wound, causing the leg muscles to feel stiff. Innovative approaches are needed to address this delay and accelerate healing. Therefore, this study aims to use a diabetic foot spa to increase tissue perfusion on the wound. The study uses a case study design involving one elderly patient living with a diabetic foot ulcer. Ethical clearance was obtained before the study began. A diabetic foot spa was implemented during the study. The research data uses descriptive research methods, interviews, and documentation. The findings show that diabetic foot spa improves tissue perfusion or blood flow to the feet within 5 days of use. The therapy also promoted blood flow to the wounds, relaxing and making the patient more comfortable. It is important to note that diabetic foot spacan be used in the community for patients living with diabetic foot ulcers.

Keywords: Diabetic foot ulcers; innovation in health; community health; treatment; prevention

Introduction

Diabetic foot ulcers (DFUs) are a severe complication of diabetes mellitus, primarily affecting individuals with poorly managed blood glucose levels (Wang, Yuan, Xu, & Yu, 2022). These ulcers typically develop on the pressure points of the feet, such as the soles, heels, and toes, and are precipitated by a combination of neuropathy, peripheral arterial disease, and minor trauma. Neuropathy, or nerve damage, leads to a loss of sensation in the feet, meaning patients may not notice minor injuries (Akkus & Sert, 2022). These injuries can progress to ulcers due to poor wound healing associated with diabetes. Peripheral arterial disease further exacerbates this condition by reducing blood flow to the extremities, impairing the body's ability to heal wounds effectively (Brownrigg, Apelqvist, Bakker, Schaper, & Hinchliffe, 2013). Hyperglycemia, or high blood sugar, creates an environment that fosters the growth of harmful bacteria, increasing the risk of infection (Casqueiro, Casqueiro, & Alves, 2012). The compromised immune response in diabetic patients means infections can quickly become severe, leading to complications such as cellulitis, osteomyelitis (bone infection), and even gangrene. The presence of neuropathy often means that these infections can progress unnoticed until they are quite advanced. Furthermore, repetitive stress on the feet from walking or standing can worsen the ulcers, making treatment and management more challenging (van Netten, Fijen, & Bus, 2022). Effective management of diabetic foot ulcers requires a comprehensive approach. The primary goals are to prevent infection, promote healing, and avoid recurrence. This involves meticulous wound care, including regular cleaning and debridement (removal of dead tissue), as well as the use of dressings that maintain a moist wound environment conducive to healing. Offloading, or reducing pressure on the affected area, is critical and can be achieved through specialized footwear, orthotics, or in severe cases, total contact casting (Everett & Mathioudakis, 2018). Additionally, controlling blood glucose levels is paramount in improving overall wound healing and preventing further complications.

Preventive strategies are crucial in managing diabetic foot ulcers and reducing their incidence. Regular foot examinations by healthcare professionals, along with patient education on proper foot care, are vital components of prevention (Pourkazemi et al., 2020). Patients are encouraged to inspect their feet daily for any signs of injury, maintain good hygiene, and avoid walking barefoot to minimize the risk of trauma. Smoking cessation, maintaining a healthy diet, and engaging in regular physical activity are also important in managing diabetes and its complications (Galaviz, Narayan, Lobelo, & Weber, 2015). Early intervention and a multidisciplinary approach involving

endocrinologists, podiatrists, vascular surgeons, and wound care specialists (Nurchis et al., 2022) can significantly improve outcomes for patients with diabetic foot ulcers, reducing the risk of severe complications and improving quality of life **(Figure 1)**. Integrating complementary approaches can also accelerate wound healing by enhancing tissue perfusion. For example, foot spa can be beneficial for the group of patients.

Figure 1. Illustration of quality of life (*Courtesy of vecteezy.com*).

When done with caution and under the guidance of healthcare professionals, foot spas can offer significant benefits for individuals with diabetes, particularly those at risk of or dealing with diabetic foot ulcers. Any foot care regimen for individuals with diabetes should be individualized and performed with care (da Silva et al., 2015). One of the primary benefits of a foot spa is the promotion of blood circulation through the use of warm water. Improved circulation is crucial for individuals with diabetes as it helps deliver oxygen and nutrients to tissues, aiding in the healing process. Furthermore, foot spa sessions can provide much-needed relaxation and stress reduction (Chatchawan et al., 2015). Since stress can elevate blood sugar levels, relaxation techniques like a foot spa can positively impact overall well-being. Proper foot hygiene is essential for individuals with diabetes to prevent infections. Gentle soaking in warm water during a foot spa can aid in cleaning the feet thoroughly. Following the foot spa, moisturizing the feet can help prevent dryness and cracking, thereby reducing the risk of skin breakdown. Additionally, regular foot care that includes gentle massage during a foot spa can enhance sensory awareness. Many individuals with diabetes experience reduced sensation in their feet, making it vital to be attentive to any changes in sensation. Regular foot spa sessions also allow individuals and caregivers to closely examine the feet for any signs of redness, swelling, or injury (Fan et al., 2018). Early detection of such issues facilitates prompt intervention, reducing the risk of complications, including diabetic foot ulcers. Moreover, gentle exercises and movements performed in warm water during a foot spa can promote foot flexibility, which is beneficial for individuals with diabetes who may experience stiffness in their feet. The combination of warmth, massage, and gentle movement can help maintain joint mobility and reduce the discomfort associated with stiffness. Overall, while foot spas can be a valuable component of a comprehensive foot care regimen for individuals with diabetes, it

is essential to approach them with caution and always under the guidance of healthcare professionals to ensure safety and effectiveness.

However, there are limitations to using foot spas among patients with diabetes in Indonesia. One significant limitation is the lack of widespread access to healthcare facilities that offer specialized diabetic foot care. In many rural and underserved areas, there are limited resources and trained professionals to guide patients in the safe use of foot spas. Without proper guidance, individuals may inadvertently cause harm, such as burns from excessively hot water or injuries from inappropriate handling of their feet. Additionally, there may be a lack of awareness and education among patients and healthcare providers regarding the benefits foot spas for diabetic foot care, leading to underutilization or misuse of this potentially beneficial therapy. Another limitation is the cultural and socioeconomic barriers that affect the adoption of foot spa treatments. In Indonesia, traditional medicine and home remedies are often preferred over modern medical interventions. While these traditional practices are valuable, they may not always include foot care methods that are safe for individuals with diabetes. Furthermore, the cost of accessing a professional foot spa or purchasing the necessary equipment for home use can be prohibitive for many individuals. Therefore, while foot spas can offer benefits for diabetic foot care, they must be used with caution, ensuring that strict hygiene protocols are followed and that the specific environmental risks are managed. Comprehensive education and support from healthcare professionals are essential to maximize the benefits and minimize the risks of using foot spas among diabetic patients in Indonesia. Therefore, the study aimed to evaluate the use of foot spa among patient with diabetic foot ulcers. It is hoped that the finding of the study can help accelerate the wound healing and quality of life.

Method

The study employs a descriptive research method (case study), which aims to describe existing phenomena, including activities, characteristics, changes, relationships, similarities, and differences between one phenomenon and another. Case studies offer several benefits, particularly in the context of research and learning. They provide in-depth insights into complex issues by examining real-life examples, allowing researchers and practitioners to explore the nuances and contextual factors that influence outcomes (Alpi & Evans, 2019). This method facilitates a comprehensive understanding of specific phenomena, generating rich qualitative data that can reveal patterns, causes, and effects not easily captured through other research methods. Case studies also support the development of practical solutions and strategies by illustrating how theories and concepts apply in actual situations. Additionally, they can enhance critical thinking and analytical skills by encouraging detailed examination and interpretation of data (Budgell, 2008). According to another perspective, descriptive research is research that describes and interprets existing conditions or relationships, opinions currently developing in the world, ongoing processes, effects that have already occurred, or current trends. In this study, the researcher used one respondent with diabetes mellitus (DM) with a case study design. The researcher intends to describe a case study on the innovation of a diabetic foot spa to improve peripheral tissue perfusion in DM wounds, conducted for five consecutive days.

The sampling technique used in this study involved the selection of a specific respondent, namely a late adult aged 56 years who is suffering from a diabetic ulcer. The data for this research were collected using several instruments, including the NANDA 13-domain assessment format, observation formats, and direct physical examinations conducted in person. Additionally, patient interventions were performed, with data collection guided by standard operating procedures (SOPs). The assessment of the wound was carried out using the Bates-Jensen Wound Assessment Tool, which provided a structured and comprehensive evaluation of the wound's condition. Data collection occurred over five sessions, integrating both wound care and health education. This combination aimed to not only treat the wound but also to enhance the patient’s understanding of diabetes management and wound care practices, thereby promoting overall health and preventing further complications. The study was conducted at the patient’s home, allowing for a realistic and practical assessment of the patient’s living conditions, adherence to treatment protocols, and the effectiveness of the interventions in a naturalistic setting. This home-based approach ensured that the interventions were feasible and sustainable in the patient’s daily environment, thereby providing valuable insights into the practical application of the treatment regimen.

The findings are expected to highlight the effectiveness of using foot spa in improving patient outcomes. This approach not only addresses the immediate clinical needs but also empowers patients with the knowledge and skills necessary for long-term self-care. The detailed documentation and rigorous assessment standards used in

this study ensure that the results are reliable and can be utilized to inform future research and clinical practices in diabetic wound management **(Figure 2)**.

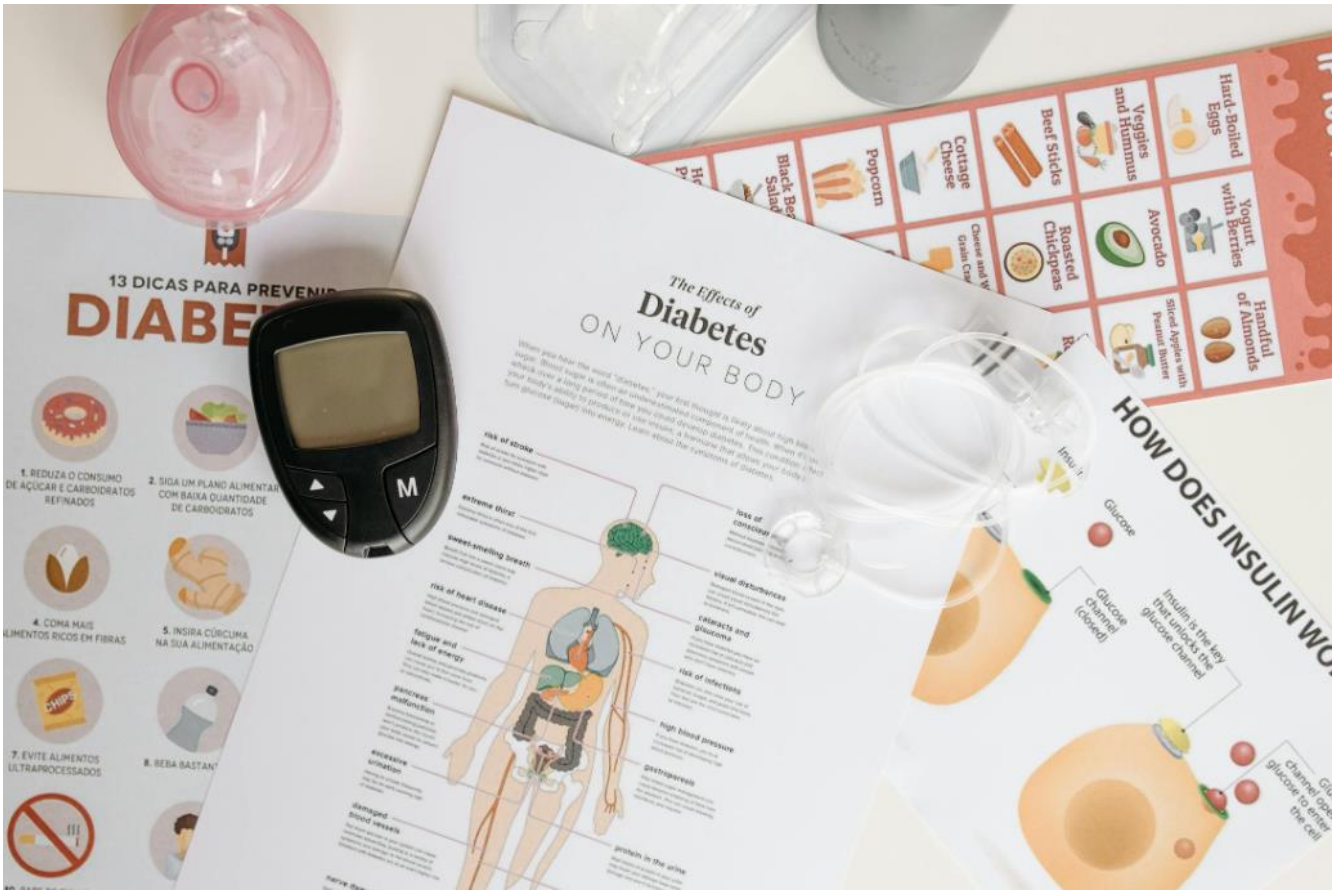

Figure 2. Illustration of diabetes care (*Courtesy of pexels.com*).

Results

Data collection was conducted from June 15 to June 20, 2021. The nursing care provided included assessment, data analysis, nursing diagnosis, nursing care planning, nursing implementation, and evaluation. The author collected data from a client named Mr. J, who is 56 years old and works as an entrepreneur, and who has Diabetes Mellitus. The assessment used the NANDA 13 Domain Assessment, and the subjective data revealed that the client had a wound on his right foot, felt weak due to a long period without exercise, experienced stiffness and difficulty moving his foot because of the wound and edema, and had a history of diabetes mellitus since 2019. The client was initially diagnosed with diabetes mellitus when a wound on his right foot failed to heal and was later confirmed with a blood glucose level of 525 mg/dl at a community health center. The diabetic wound occurred when the client injured his foot while playing volleyball but ignored the wound, assuming it would heal on its own. However, when the wound did not heal and instead worsened, he sought treatment at the nearest community health center. The objective data indicated that the client had a malodorous wound on the right foot, measuring 6 x 3 cm with a depth of stage 4. The wound had no tunnels, necrotic tissue, or significant exudate, with a small amount of purulent, bloody discharge. The surrounding skin was pale or hypopigmented with non-pitting edema of less than 4 mm around the wound. There was hardening of the tissue edges in a small area of less than 2 cm around the wound, with bright granulation tissue covering approximately 100% of the wound bed and epithelialization at less than 25%. The wound score was 35, and a random blood glucose test showed 190 mg/dl.

The nursing diagnosis established was impaired skin integrity related to diabetes mellitus. Impaired skin integrity refers to damage that occurs in the epidermis and dermis layers of the skin. Interventions included monitoring vital signs, educating the client and family about wound care and diabetes mellitus, teaching muscle and

joint strengthening exercises to reduce stiffness, providing foot spa treatments for one week with five continuous sessions, trimming nails, observing the wound condition, performing wound care, and educating the client about the signs and symptoms of diabetic infections such as pain, heat, swelling, redness, and loss of function. The client reported feeling more comfortable after wound care interventions. Evaluation showed that the client felt more comfortable and found the wound dressing more aesthetically pleasing after it was changed. The muscle soreness in the legs decreased, and the client reported that the stiffness in the foot had lessened, and blood flow in the foot felt more fluid. The wound condition was noted to have reduced odor and exudate, with the wound size measuring 5.5 x 3 cm and now at stage 3 in depth. The wound edges were clearly defined and integrated with the wound bed, with no tunnels or necrotic tissue. The amount of exudate was minimal and bloody in nature, the skin around the wound was red when pressed, and there was non-pitting edema of less than 4 mm around the wound. The tissue hardening was limited to a small area of less than 2 cm around the wound, with bright granulation tissue covering approximately 100% of the wound bed and epithelialization at less than 25%. The issue of impaired skin integrity related to diabetes mellitus was partially resolved. The intervention plan is to continue observing the wound condition and providing wound care with the innovative diabetic foot spa treatment.

Discussion

A diabetic foot spa offers several benefits for improving tissue perfusion, particularly for individuals suffering from diabetes mellitus. One of the primary advantages is enhanced blood circulation. Warm water immersion during a foot spa session causes blood vessels to dilate, which promotes increased blood flow to the extremities (An, Lee, & Yi, 2019). This vasodilation ensures that oxygen and essential nutrients are delivered more efficiently to the tissues in the feet, aiding in the healing process of any existing wounds and potentially preventing new ones from forming (Bharara, Viswanathan, & Cobb, 2008). Enhanced circulation is crucial for diabetic patients who often suffer from peripheral arterial disease, which can significantly impair blood flow to the lower extremities. Another benefit of a diabetic foot spa is the reduction of edema, or swelling, in the feet and ankles (Eversden, Maggs, Nightingale, & Jobanputra, 2007). The warm water and gentle massage involved in a foot spa can help mobilize fluid that has accumulated in the tissues, facilitating its return to the central circulation. This reduction in swelling can alleviate discomfort and improve mobility, making it easier for individuals to engage in physical activity, which further promotes overall cardiovascular health and tissue perfusion (Bleakley et al., 2012). Managing edema is particularly important for diabetic patients, as chronic swelling can lead to skin breakdown and increase the risk of infections and ulcers (Wu et al., 2017).

Foot spa also plays a crucial role in maintaining skin integrity. The hydration provided by soaking the feet in warm water helps to keep the skin soft and supple, preventing dryness and cracking that can lead to open wounds (Junker, Kamel, Caterson, & Eriksson, 2013). The improved moisture levels in the skin enhance its barrier function, protecting against external pathogens. Additionally, incorporating emollients and moisturizers during the foot spa can further nourish the skin, promoting overall skin health. Healthy skin is better able to withstand minor traumas and recover more quickly, reducing the risk of ulceration and infection (Takeo, Lee, & Ito, 2015; Tottoli et al., 2020). Moreover, the relaxation and stress reduction achieved through a foot spa have indirect benefits for tissue perfusion. Stress is known to have a detrimental effect on blood sugar levels, and managing stress can help in maintaining better glycemic control (Vedantam et al., 2022). When stress levels are reduced, the body can better regulate blood flow and maintain optimal tissue perfusion (Sharma, Akre, Chakole, & Wanjari, 2022). The calming effect of a foot spa can also lead to lower blood pressure, which further supports cardiovascular health and ensures that blood is effectively circulated to all parts of the body, including the feet (Arslan, Ceyhan, & Mollaoğlu, 2021). Regular use of a diabetic foot spa can improve sensory perception in the feet. Diabetic neuropathy often leads to a loss of sensation, making it difficult for individuals to detect injuries or changes in their foot health. The tactile stimulation from the warm water and massage during a foot spa can enhance nerve function and awareness in the feet. Individuals are better able to monitor their foot health and take prompt action if any issues arise, such as cuts, blisters, or changes in skin color by improving sensory perception. Early detection and intervention are key to preventing serious complications, making the diabetic foot spa a valuable tool in comprehensive diabetes care (Rismayanti et al., 2022; McMorrow, Nube, & Manski-Nankervis, 2022).

Nurses play a pivotal role in the administration and effectiveness of diabetic foot spa treatments, ensuring that they are both therapeutic and safe for patients (Aalaa, Malazy, Sanjari, Peimani, & Mohajeri-Tehrani, 2012). First and foremost, nurses are responsible for conducting comprehensive assessments of the patient's foot health

before initiating any foot spa treatment (da Silva et al., 2015). This includes evaluating the condition of the skin, identifying any existing wounds or infections, and understanding the patient's overall health status, including blood sugar levels and circulation issues. Nurses can tailor the foot spa treatment to meet the specific needs of each patient, addressing potential risks and maximizing therapeutic benefits. In addition to assessment, nurses provide essential education and guidance to patients regarding foot spa treatments (Singh, Jajoo, Shukla, & Acharya, 2020). They instruct patients on proper foot care techniques, emphasizing the importance of maintaining hygiene, monitoring for signs of infection, and the correct use of moisturizers and other topical treatments. Nurses also educate patients on the benefits of regular foot spa sessions and how they can improve circulation, reduce swelling, and enhance overall foot health. Nurses help them take an active role in their self-care (Awang Ahmad, Sallehuddin, Teo, & Abdul Rahman, 2020), thereby promoting better long-term management of their diabetes and associated foot conditions by empowering patients with knowledge and skills **(Figure 3)**.

Figure 3. Illustration of foot spa (*Courtesy of pexels.com*).

Furthermore, nurses are integral in the implementation and monitoring of foot spa treatments. They meticulously oversee each session, ensuring that the water temperature is appropriate and that the duration and techniques used are suitable for the patient's condition. Nurses also monitor the patient's response to the treatment, looking for any adverse reactions or improvements in foot health. They document the progress and any changes observed, using this information to adjust care plans as needed. Through their expertise and attentive care, nurses ensure that foot spa treatments are not only relaxing but also contribute effectively to the healing process and prevention of complications, ultimately enhancing the quality of life for patients with diabetes. A diabetic foot spa offers numerous benefits for tissue perfusion, including enhanced blood circulation, reduced edema, improved skin integrity, stress reduction, and better sensory perception (An, Lee, & Yi, 2019; Bharara, Viswanathan, & Cobb, 2008). These advantages contribute to overall foot health and can play a significant role in preventing and managing complications associated with diabetes mellitus. Regular, careful use of foot spas, under the guidance of

healthcare professionals, can be a beneficial addition to the self-care routines of individuals with diabetes (Al Mahrouqi, Mallinson, Oh, & Weinstein, 2022).

While foot spas can offer therapeutic benefits for individuals with diabetes, there are several limitations and considerations that must be carefully addressed. One significant limitation is the risk of burns or skin damage due to improper water temperature management (Herrero-Fernandez et al., 2022). Diabetic neuropathy often reduces sensation in the feet, making it difficult for individuals to perceive when water is too hot. Prolonged exposure to high temperatures can lead to burns, blisters, or skin trauma, which can exacerbate existing foot conditions and increase the risk of infections. Therefore, meticulous monitoring of water temperature and patient education on safe water temperatures are essential to mitigate these risks. Another limitation is the potential for infection (Stec et al., 2022). Diabetic patients are more susceptible to infections due to compromised immune systems and poor circulation in the extremities. Foot spas, especially in communal settings or without proper sanitation protocols, can harbor bacteria and fungi that may enter through any cuts, blisters, or open wounds on the feet. This risk is heightened in environments where hygiene practices are not strictly enforced or where foot spa equipment is not adequately cleaned between uses. To minimize the risk of infection, stringent hygiene practices, including regular cleaning and disinfection of foot spa equipment, as well as the use of antiseptic agents in the water, are essential (Perkins, Reddy, Fagan, Arduino, & Perz, 2019). Moreover, the effectiveness of foot spas in improving circulation may vary among individuals with diabetes. Peripheral arterial disease, common in diabetic patients, limits blood flow to the feet, reducing the potential benefits of increased circulation from foot spa treatments. In such cases, alternative therapies or adjunctive treatments may be necessary to optimize circulation and promote wound healing effectively. Additionally, financial constraints and access to foot spa facilities may limit the regular use of this therapy for some diabetic patients, particularly those from low-income backgrounds or in rural areas where specialized diabetic foot care services are limited. While foot spas can provide relaxation and potential benefits for diabetic foot care, careful consideration of temperature management, infection control, individual health conditions, and access to facilities is crucial (Fang et al., 2018). Healthcare providers must assess each patient's suitability for foot spa therapy, educate them on safe practices, and monitor closely for any adverse effects to ensure that foot spa treatments are both safe and beneficial in managing diabetes-related foot complications.

Conclusion

Nurses play a crucial role in the holistic care of patients undergoing diabetic foot spa treatments. Through comprehensive assessment, education, and diligent monitoring, nurses ensure that foot spa sessions are safe, effective, and tailored to the individual needs of each patient. Nurses contribute significantly to the overall management of diabetes and the prevention of diabetic foot complications by promoting foot health, managing complications, and empowering patients with knowledge. Their dedication and expertise in diabetic foot care underscore their vital role in enhancing patient outcomes and improving quality of life for individuals living with diabetes mellitus. Additional research is necessary to further investigate the advantages of foot spas in managing diabetic foot ulcers and other associated complications.

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Author's perspective

Key points

- Diabetic foot spa improves tissue perfusion or blood flow to the feet
- Nurses play a crucial role in the holistic care of patients undergoing diabetic foot spa treatments
- Healthcare providers must assess each patient's suitability for foot spa therapy

Potential areas of interest

- What is the procedure for implementing a foot spa among patients with diabetes?
- How do nurses manage complications related to foot spa therapy?
- When should healthcare technology be involved in this therapy?

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