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Choosing The Right Footwear to Prevent Diabetic Foot Ulcers

Diyabetik Ayak Ülserlerini Önlemek için Doğru Ayakkabı Seçimi

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Abstract

Diabetes Mellitus (DM) is a persistent metabolic condition marked by elevated blood sugar levels caused by deficiencies in either insulin secretion, insulin function, or both. Diabetes-related foot sores are an expensive consequence of diabetes that reduces quality of life and raises rates of illness and death. It is estimated that 2% of diabetic patients in Türkiye suffer from foot ulcers, with a prevalence ranging from 5-7%. Individuals with diabetes may face foot ulcer rates as high as 34% during their lives. Patients with ulcers have a mortality rate that is roughly twice as high as diabetic patients who do not have ulcers. Furthermore, foot ulcers precede 85% of diabetes-related lower extremity amputations. Diabetic foot ulcers commonly develop due to frequent pressure and cutting on the foot, worsened by diabetes-related issues like peripheral neuropathy and peripheral arterial disease. The healing process is often complicated by the development of infections. Therefore, it is advisable for individuals with diabetes to wear suitable footwear specially designed to minimize repetitive strains in order to prevent diabetic foot ulcers. It is crucial to create a method that helps multidisciplinary healthcare providers provide shoes to these patients.

Keywords: Diabetes mellitus, foot ulcers, shoe selection

Özet

Diabetes Mellitus (DM), insülin salgısındaki, insülin fonksiyonundaki veya her ikisindeki eksikliklerden kaynaklanan, yüksek kan şekeri seviyeleri ile karakterize kalıcı bir metabolik durumdur. Diyabetle ilişkili ayak yaraları, yaşam kalitesini düşüren, hastalık ve ölüm oranlarını artıran ve yüksek maliyetli sonuçlara neden olan bir komplikasyondur. Türkiye'de diyabet hastalarının %2'sinin ayak ülserleri olduğu ve bu oranın %5-7 arasında değiştiği tahmin edilmektedir. Diyabetli bireyler yaşamları boyunca %34'e varan oranlarda ayak ülserleriyle karşılaşabilir. Ülserli hastaların, ülseri olmayan diyabet hastalarına göre yaklaşık iki kat daha yüksek ölüm oranına sahip olduğu bilinmektedir. Ayrıca, diyabetle ilişkili alt ekstremite amputasyonlarının %85'inden önce ayak ülserleri görülmektedir. Diyabetik ayak ülserleri, genellikle ayakta tekrarlayan basınç ve yaralanmalar sonucunda ortaya çıkar ve bu durum, periferik nöropati ve periferik arter hastalığı gibi diyabetle ilişkili problemlerle daha da ağırlaşır. Enfeksiyon gelişimi, iyileşme sürecini genellikle karmaşık hale getirir. Bu nedenle, diyabetik ayak ülserlerini önlemek için diyabetli bireylerin tekrarlayan zorlanmaları en aza indirmek üzere özel olarak tasarlanmış uygun ayakkabılar giymeleri önerilmektedir. Bu hastalara ayakkabı sağlanmasına yardımcı olacak bir yöntemin oluşturulması, multidisipliner sağlık hizmeti sağlayıcıları için kritik öneme sahiptir.

Anahtar Kelimeler: Diabetes mellitus, ayak ülseri, ayakkabı seçimi

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1. Introduction

Diabetes Mellitus (DM) is a chronic metabolic condition characterized by high blood sugar levels due to issues with producing enough insulin, using insulin effectively, or a mix of both (Ulusal Diyabet Konsensus Grubu, 2023). The earliest documented evidence of diabetes mellitus symptoms can be traced back to the 15th century BC, discovered during archaeological digs in ancient Egypt and India. Aretaeus, who resided in Cappadocia in Anatolia, is credited with coining "diabetes mellitus" (Karamanou et al., 2016). Symptoms seen in diabetes mellitus typically stem from high blood sugar levels and glucose excretion, but patients can also experience symptoms from long-term complications in delayed diagnoses or acute diabetes complications (Güçlü et al., 2022). Diabetes is diagnosed in individuals who have a fasting plasma glucose level of 126 mg/dL (7.0 mmol/L) or higher, a random plasma glucose level of 200 mg/dL (11.1 mmol/L) or higher, a 2-hour plasma glucose level of 200 mg/dL (11.1 mmol/L) or higher during a 75 g oral glucose tolerance test (OGTT), or a Hemoglobin A1c level of 6.5% (47 mmol/mol) or higher (World Health Organization, 2006).

Diabetic foot ulcers represent a significant and costly complication of diabetes, adversely affecting quality of life while increasing morbidity and mortality rates (Boulton et al., 2005; Jupiter et al., 2016; Kerr et al., 2014; Nabuurs-Franssen et al., 2005). In Turkey, the estimated incidence and prevalence of foot ulcers among diabetic patients are approximately 2% and 5-7%, respectively. Throughout a diabetic patient's lifetime, the likelihood of developing foot ulcers may reach as high as 34% (Ulusal Diyabet Konsensus Grubu, 2023). The mortality rate for individuals with foot ulcers is approximately twice that of diabetic patients without such ulcers. Additionally, studies indicate that 85% of lower extremity amputations in diabetic patients are preceded by the development of foot ulcers. Diabetic foot ulcers generally arise from continuous stress (such as pressure and shearing) on the feet, particularly in the presence of diabetes-related issues like peripheral neuropathy or peripheral arterial disease. The healing process is often further complicated by infections (Crawford et al., 2015; Jia et al., 2017; Monteiro-Soares et al., 2012; Schaper et al., 2016; Waaijman et al., 2014). Wearing ill-fitting shoes or walking without shoes amplifies the local mechanical stress on the feet, contributing to diabetic foot ulcers (Crawford et al., 2015; Monteiro-Soares et al., 2012; Schaper et al., 2016; Waaijman et al., 2014). As a result, it is advised that individuals with diabetes wear properly fitted shoes at all times to minimize repeated stresses and help prevent the occurrence of foot ulcers (Bus et al., 2016'a; Bus et al., 2016b).

1.1. Classification of Diabetic Ulcers

Common findings from all new systematic reviews regarding shoe selection were reviewed and recorded. A table was created to define standard terms related to footwear for individuals with diabetes. This study aims to protect the health of diabetic feet and reduce risks related to shoe selection.

The definitions for the diabetic foot risk status were determined as outlined in the TÜRKDİAB Diabetes Diagnosis and Treatment Guide 2023 (Ulusal Diyabet Konsensus Grubu, 2023). These are as follows:

•Low risk: No risk factors, no sensory loss, and no pulse loss.

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•Medium risk: Presence of one risk factor (such as sensory loss, absence of pulse, callus, or deformity).

•High risk: Previous amputation or ulceration, or the presence of two or more risk factors (such as sensory loss, absence of pulse, peripheral arterial disease, callused foot deformity, pre-ulcerative lesion, end-stage renal failure).

•Active diabetic foot: Foot with an active ulcer (Ulusal Diyabet Konsensus Grubu, 2023; van Netten et al., 2018).

1.2. Examination

The main reason for the development of diabetic foot in diabetic patients is diabetes-related damage to motor, sensory, and autonomic nerve functions. In addition to this damage, risk factors arising from uncontrolled blood glucose levels and lack of foot care and knowledge of patients may cause the development of diabetic foot in patients. Common risk factors for diabetic foot are peripheral neuropathy, peripheral artery disease, infection, foot deformities and wearing inappropriate shoes, poor foot care of patients, Charcot foot, previous foot ulcer, previous lower extremity minor amputation, and trauma. In addition, having diabetes for a long time, uncontrolled blood sugar levels, heart failure, and kidney failure increase the risk of diabetic foot. The first and most important preventive approach to diabetic foot ulcers is the identification of high-risk patients. Education is essential after identifying risky patients. The patient or a relative should check the feet, including between the toes, daily for any redness, swelling, cuts, or calluses. A mirror should be used to observe every area of the sole. Relatives of patients with vision impairments should assist with foot examinations (van Netten et al., 2018). Patients with low risk should undergo foot screening at least once a year, while those with medium or high risk should be screened every three to six months (Ulusal Diyabet Konsensus Grubu, 2023).

Wagner's classification system for foot ulcers ranges from Category 0 to Category 3, assessing factors such as loss of protective sensation, foot deformities, and prior history of ulcers or ischemia. Grade 0 indicates no issues; patients in this group should focus on primary foot care education and use conventional footwear. Grade 1 is characterized solely by loss of protective sensation, for which the recommendation includes in-depth shoes or sneakers, non-molded soft insoles, and total contact orthoses. Grade 2 involves both loss of protective sensation and foot deformity, necessitating in-depth shoes or sneakers, custom-molded orthotics, and potential shoe modifications. Grade 3 encompasses all three factors: loss of protective sensation, foot deformity, and a history of ulcers or ischemia. This category requires custom-fabricated, pressure-relieving orthoses, along with specific recommendations for inlay depth, soft leather materials, adjustable lacing systems, and possible external modifications (Wagner, 1987). Grade 4 involves gangrene affecting part of the toes or forefoot, while Grade 5 indicates that the entire foot is gangrenous (Sun et al., 2012).

Neuropathy is a frequent issue among diabetic individuals and heightens the likelihood of foot injuries. As a result of nerve damage, people with diabetes might struggle to properly sense sensations like pressure, temperature, or touch on their feet. This scenario creates conditions for the formation of

diabetic foot ulcers, mainly as minor injuries go unnoticed. The Semmes-Weinstein monofilament test is among the most utilized assessments to measure the loss of protective sensation in patients with diabetic feet. During the examination, a 10-gram monofilament is pressed lightly against specific areas of the foot surface. The patient's inability to perceive this pressure indicates the presence of neuropathy and loss of protective sensation (Ertur et al., 2020).

The Semmes-Weinstein monofilament test is a practical and non-invasive method, so it can be easily applied in diabetic foot screenings and preventive care processes. Early diagnosis with this test plays a critical role in maintaining the foot health of diabetic patients and enables interventions to prevent ulcer development (Görgülü et al., 2022).

1.3. Shoe Selection

Shoes are among the most important items of clothing that protect individuals from external factors. In Turkiye, the average is 2.7 pairs of shoes per person (Akçakale, 2016). Educating diabetic patients is crucial in preventing complications such as "diabetic foot." This education should cover how to perform foot care, and which types of socks and shoes are appropriate (Bus et al., 2016a).

All patients at risk for foot ulcers should wear shoes that fit properly, provide protection, and accommodate the shape of their feet. Diabetic individuals should consistently wear socks with their footwear to prevent skin irritation and minimize friction. Educating diabetic individuals, their families, and caregivers about the significance of wearing appropriate footwear is crucial (van Netten et al., 2018). The goal should be to reduce pressure by at least 30% or below 200 kPa, particularly in areas of the sole that experience the highest pressure (Ahmed et al., 2020).

Diabetic individuals with medium or high foot ulcer risk (Figure 1) should buy shoes that fit, protect, and accommodate their feet. These patients should always wear shoes indoors and outdoors (van Netten et al., 2018).

Figure 1: *High foot ulcer risk, Previous amputation.*

Genuine leather footwear is favored over synthetic leather, nylon, and rubber alternatives. Footwear featuring narrow toe boxes and high heels should be avoided. Instead, shoes that provide a wide and deep toe box, adequate heel support, and insoles, if necessary, are considered appropriate. In general, using rigid materials is not advisable for patients with diabetes, neuropathy, or a history of foot ulcers (Chang et al., 2022).

Each part of the shoe should be according to the patient's needs and compatible with other parts. Otherwise, it may be harmful for diabetic feet. Patients should not wear shoes barefoot and should wear comfortable socks with minimal seams. Shoes such as flip-flops or sandals that go between the toes should not be preferred (Alkanat, 2015).

When buying new shoes, it is advisable to measure feet in the evening as feet tend to swell during the day. Old shoes should not be discarded immediately and should be worn alternately with the new ones. New shoes should initially be worn for no more than two hours a day, gradually increasing this duration to full-time use within a week (Durakbaşa, 2013).

Diabetic individuals should check their shoes for foreign objects or penetration of foreign objects into the insoles before each wear. Both the patient and their relative should learn to perform this check. When shoes are removed; the feet should be checked for signs of trauma or ulceration due to inappropriate pressure increases (van Netten et al., 2018).

Patients with foot deformities, pre-ulcerative lesions, or healed plantar foot ulcers should consider medical-grade shoes that may include custom-made orthotics or insoles. Patients should review their existing shoes every three months to ensure they fit well, protect, and support their feet (Kadanali et al., 2024).

Preventing diabetic foot ulcers requires using proactive medical practices, involving patients and their families in a collaborative effort, and providing continuous patient education. If ulcers develop, interdisciplinary collaboration is essential for managing moderate to severe infections, ensuring prompt treatment, and preventing further complications (Batın et al., 2020).

2. Conclusion

Diabetic foot syndrome, a prevalent condition among individuals with diabetes, frequently leads to ulceration and amputation of the lower extremities if not addressed with prompt and thorough evaluation. Minimizing the impact of foot ulcers is arguably the most critical intervention, bolstered by substantial evidence, for promoting the healing of diabetic foot ulcers and alleviating the global burden of diabetic foot disease. Ensuring the appropriate selection of footwear is essential in this endeavor. This includes educating individuals with diabetes and their families about diabetic foot care and enhancing their understanding of suitable footwear options.

Authors Contributions

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Conflict of Interest

The authors declared no conflict of interest.

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