

## Extracorporeal Shock Wave Therapy for Diabetic Foot Ulcers: A Case Report Diyabetik Ayak Ülserinde Ekstrakorporeal Şok Dalga Tedavisi: Olgu Sunumu

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### Abstract

Diabetic foot ulcers are the most common chronic and serious complication of diabetes. Diabetic foot ulcers are associated with increased morbidity, impaired quality of life, substantial treatment costs and high rates of lower extremity amputations. Management of diabetic foot ulcers include conventional treatments such as patient education, preventive measures, treatment of concomitant infection, local surgical debridement as well as alternative treatments such as hyperbaric oxygen therapy and negative-pressure wound therapy. Here, we report a case of diabetic foot ulcer treated with extracorporeal shock wave therapy (ESWT). We applied ESWT every other day for a total of 9 sessions to a 65-year-old male patient with a history of diabetes mellitus for 15 years and insulin use for treatment of a 2.3 x 3.8 cm wound in the lateral side of his right foot which was present for six months. ESWT was applied with 100 shocks per session for each square centimeter of the wound with a frequency of 4 Hz at 2 bar pressure. No serious adverse reactions or complications occurred during the course of treatment. At the post-treatment follow-up visit at 3 months, a significant reduction in perceived pain and a decrease in the wound size (to 1.5 x 2.2 cm) and depth were observed. We believe that ESWT is an inexpensive, easy to administer and effective treatment modality for management of diabetic foot ulcers which are associated with high costs, treatment challenges, and require amputation in most patients.

**Key words:** Diabetes, foot ulcer, treatment

### Öz

Diyabetik ayak ülserleri diyabetin en sık görülen ve ciddi bir kronik komplikasyonudur. Diyabetik ayak ülserleri morbidite artışına, hayat kalitesinin bozulmasına, yüksek tedavi maliyetlerine ve yüksek oranda alt ekstremitte amputasyonlarına neden olmaktadır. Diyabetik ayak ülserlerinin tedavisinde hasta eğitimi, koruyucu önlemler, eşlik eden enfeksiyonun tedavisi, lokal cerrahi debridman yapılmaktadır. Diyabetik ayak ülserinin tedavisi amacıyla ekstrakorporeal şok dalga tedavisi (ESWT) uyguladığımız hastamızı sunmak istedik. 65 yaşında 15 yıldır diyabeti olan ve insülin kullanan erkek hastanın 6 aydır mevcut olan sağ ayak lateralindeki 2,3x3,8 cm boyutundaki yarasının tedavisi için gün aşırı toplam 9 seans ESWT tedavisi uyguladık. Tedavi her bir seansta yaranın her cm<sup>2</sup>'si için 100 atım, 4 Hz, 2 bar olacak şekilde uygulandı. Tedaviden sonra 3. ay kontrolünde ağrının belirgin azaldığı ve yara boyutunun 1,5 x 2,2cm'ye gerilediği ve derinliğinin azaldığı saptandı. Tedavisi zor, maliyeti yüksek olan ve çoğu hastada amputasyona gerek duyulan diyabetik ayak ülseri tedavisinde ESWT'nin ucuz, kolay uygulanabilir ve etkin bir tedavi olduğunu düşünüyoruz.

**Anahtar kelimeler:** Diyabet, ayak ülseri, tedavi

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### Introduction

Diabetes Mellitus is a common endocrine disease. The occurrence rates and significance of diabetic foot ulcers increase in correlation with the increasing prevalence of diabetes. Diabetic foot ulcers are the most common chronic and serious complication of diabetes.<sup>1-4</sup> Major consequences of diabetic foot problems include impaired blood circulation, non-healing wounds and amputations. Diabetic foot ulcers

lead to increased morbidity, impaired quality of life, substantial treatment costs and high rates of lower extremity amputations. More than 50% of non-traumatic lower extremity amputations are associated with diabetes.<sup>2,4,5</sup>

The management of diabetic foot requires local surgical treatments, using appropriate footwear and orthoses, treatment of concomitant infection as well as revascularization procedures in some cases, when necessary. Additionally, alternative therapeutic options including human dermal collagen, growth factors and hyperbaric oxygen therapy are employed for the treatment of diabetic foot ulcers.<sup>2,5</sup> Recent studies have shown the effectiveness of extracorporeal shock wave therapy (ESWT) in diabetic foot ulcers.

Here, we present a case of diabetic foot ulcer treated with ESWT application.

### Case-Report

A 65-year-old male patient was presented to our outpatient clinic with the complaint of pain in his right heel. At the physical examination, a wound in the lateral side of his right foot was observed which has been present for about six months. The patient had a history of diabetes for 15 years and insulin use for 12 years and reported pain in his right heel and a wound that has subsequently developed in the lateral side of his right foot. The wound has been present for about 6 months and caused pain, difficulties with walking and wearing shoes. He had not received any treatment previously other than antibiotic therapy. At the time of physical examination, a 2.3 x 3.8 cm wound with purulent discharge was observed that generated pain in the wound area on pressing. Peripheral pulses could be obtained and gangrenous appearance was absent (Figure 1).



**Figure 1.** Patient's foot ulcer before treatment.

Laboratory workup of the patient revealed the following results: WBC: 9700, Hb: 15.7gr/dl, HbA1c: 9.8, ESR 25mm/h and CRP: 7.5 mg/dl. A course of antibiotic therapy was recently completed for the patient and no growth was detected in the wound site culture. Foot radiographs did not show any pathologic findings in the bone tissue. ESWT treatment was administered to the patient three times a week (every other day) for a total of 9 sessions. A Vibrolith Ortho ESWT device was used for ESWT application. ESWT was applied with 100 shocks per session for each square centimeter of the wound with a frequency of 4 Hz at 2 bar pressure. The wound was closed with stretch film and then ESWT was applied using a 15-mm head by passing the probe around the wound area. Local anesthetics were not administered during the procedure and use of a topical antibiotic cream was recommended to the patient. The patient perceived slightly increased pain during treatment sessions and nonsteroidal anti-inflammatory drugs were used for pain relief. He was followed for 3 months after the treatment. At the post-treatment visit at first month, reduced pain on pressing the wound area and less purulent discharge from the wound were observed along with the increased blood supply to the wound. At the 3-month follow-up visit, pain and purulent discharge were considerably diminished and the patient was now able to wear his shoes without any difficulty. The wound was reduced in size (to 1.5 x 2.2cm) and depth (Figure 2).



**Figure 2.** Patient's foot ulcer 3 months after treatment.

## Discussion

Patients with diabetes have a 12-15% lifetime risk for developing a foot ulcer. Patients with long-standing diabetes for 10 years or more with poor metabolic control, peripheral neuropathy, peripheral vascular disease and foot deformities are strong candidates for the development of diabetic foot.<sup>5</sup> Our patient had a history of ongoing diabetes for 15 years, concomitant diabetic retinopathy and inadequate glycemic control. It is generally accepted that diabetic foot ulcers result from a combination of peripheral neuropathy, peripheral vascular disease and an infection. In diabetic patients, disruption of microcirculation and reduced oxygenation of tissues due to microangiopathy cause formation of an ulcer and the condition prevents wound healing.<sup>2,4,5</sup> Diabetic foot ulcers require prolonged treatment and cause therapeutic challenges and high treatment costs. More than 50% of non-traumatic lower extremity amputations are associated with diabetes.<sup>2,4,5</sup> Management of diabetic foot ulcers include conventional treatments such as patient education, preventive measures (control of blood glucose, using appropriate footwear), treatment of concomitant infections, local surgical debridement as well as alternative treatments such as hyperbaric oxygen therapy and negative-pressure wound therapy.<sup>5</sup> As a supplementary treatment, hyperbaric oxygen therapy was demonstrated to reduce the risk of lower limb amputations.<sup>2</sup> ESWT has been used for many years in various musculoskeletal disorders including plantar fasciitis, lateral epicondylitis and shoulder tendinitis. In cells, ESWT promotes neovascularization by increasing the release of nitric oxide and angiogenic growth factors such as vascular endothelial growth factor and bone morphogenic protein. Several new fields for the application of ESWT have appeared recently including spasticity, chronic skin ulcers, burn scars, avascular necrosis and myocardial ischemia owing to its mechanism of action.<sup>6,7</sup> There are numerous data showing that ESWT is effective in wound healing and promotes cell division, increases the release of immune defense cells and nitric oxide production, and accelerates vascularization.<sup>1,6,7</sup>

The study of Wang et al demonstrated that ESWT was superior to hyperbaric oxygen therapy in the treatment of diabetic foot wounds.<sup>8</sup> In a randomized, controlled study, Omar et al. found a marked improvement in wound healing and faster recovery in the ESWT group at the end of 20-week follow-up.<sup>9</sup> In another study examining the long-term effectiveness of ESWT in diabetic and non-diabetic foot ulcers, treatment was found to be effective in both groups but the therapeutic effectiveness gradually declined after 1 year.<sup>10</sup>

In the light of literature data, we decided to use ESWT in our patient to treat diabetic foot ulcer. To our best knowledge, there are no studies or case reports from our country using ESWT for the treatment of diabetic foot. We did not observe any serious complications or adverse experiences associated with ESWT in our patient. Considerable reduction in the wound size and depth and reduced pain intensity were observed after the completion of treatment. Compared to the duration of follow-up reported in the literature, our follow-up period was shorter for this patient and we believe that more favorable treatment outcomes may be observed over a longer follow-up period.



We believe that ESWT is an inexpensive, easy to administer and effective treatment modality for the management of diabetic foot ulcers which are associated with high costs, treatment challenges, and require amputation in most patients.

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