



## Diabetic foot ulcer care: case report with experience using Eva insoles

*Diabetic foot ulcers care: case report with Eva insole experience*

*Care of diabetic foot ulcers: case report with experience in Eva's plants*

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### SUMMARY

Diabetic foot ulcers are a common complication in diabetic patients and affect a significant number of patients globally. They are linked to impaired physical function, related mortality and morbidity, decreased quality of life, and increased use of healthcare services. Left untreated, they can progress to soft tissue infection, hemorrhage, and even limb loss. Relief of palmar tension is one treatment option. This article reports the case of a patient with a diabetic foot ulcer and discusses the use of an EVA insole adapted to the patient's footwear, which contributed to ulcer healing. This is a case report of a 64-year-old male patient diagnosed with a diabetic foot ulcer who underwent treatment with an EVA (ethylene-vinyl acetate) insole. The results were supported by existing literature, including publications published between 2015 and 2025. The case study demonstrated that nurses and physiotherapists from the Curitiba Municipal Health System have been involved in diabetic foot care initiatives for several years. Today, they play a key role in supporting the development of primary care teams' skills in assessing at-risk feet, guiding the management of identified neuropathies, and regulating care and materials related to diabetic feet. In the case reported here, the aforementioned professionals, involved in the patient's treatment with the development of an EVA insole, observed a significant reduction in plantar pressure in the affected area. The effectiveness of this insole was evaluated through patient follow-up, which demonstrated a significant reduction in the ulcer, which corroborates the limited existing literature and is used as a parameter. This material is recommended for the development of new insole models for the relief of plantar ulcers, along with new clinical studies with greater methodological precision.

**Keywords:** Diabetes Mellitus; Management; Diabetic foot; Plantar pressure; Treatment; Diabetic foot ulcer.

### ABSTRACT

Diabetic foot ulcers are a common complication in diabetic patients and affect a significant number of patients worldwide. They are associated with impaired physical function, related mortality and morbidity, decreased quality of life, and increased use of health services. If left untreated, they can progress to soft tissue infection, hemorrhage, and even limb loss. Relief of



palmar tension is one of the treatment possibilities. The objective of this article was to report the case of a patient with diabetic foot ulcers, discussing the use of an EVA (Ethylene-Vinyl Acetate). insole adapted to the patient's footwear, which contributed to the healing of the ulcer.

This is a case report of a 64-year-old male patient diagnosed with diabetic foot ulcers who underwent treatment with an EVA insole. The results were justified by the existing literature, considering publications between 2015 and 2025. It was demonstrated, from the analyzed case, that nurses and physiotherapists of the Municipal Health System - Curitiba have participated in actions related to the diabetic foot for some years, and today they are the professionals who play a fundamental role in supporting the development of skills of primary care teams for the evaluation of feet at risk, in the guidance of the management of identified neuropathies, in the regulation of care and materials related to diabetic feet. In the case reported here, the mentioned professionals, involved in the treatment of the patient based on the development of an EVA insole, found a significant reduction in plantar pressure in the affected area. The evaluation of the effectiveness of this insole was carried out by monitoring the patient in which a significant reduction in the ulcer was observed, which was in line with the scarce existing literature and exposed as a parameter. This material is recommended for the creation of new models of insoles for the relief of plantar ulcers, together with new clinical studies with greater methodological precision

**Keywords:** Diabetes Mellitus; Management; Diabetic foot; Plantar pressure; Treatment; Diabetic foot ulcer.

## SUMMARY

Diabetic foot ulcers are a common complication in diabetic patients and affect a significant number of patients around the world. It is associated with deterioration of physical function, related mortality and morbidity, decreased quality of life and greater use of health services. If it is not treated, soft tissue infection, hemorrhage and even loss of extremities can progress. Palmar tension relief is one of the treatment possibilities. The objective of this article was to report the case of a patient with diabetic foot ulcers, analyzing the use of an EVA (Ethylene-vinyl acetate) sheet adapted to his shoes, which contributed to the healing of the ulcer. The case of a 64-year-old male patient diagnosed with diabetic foot ulcers who underwent treatment with an EVA plant is presented. The results are based on existing literature, considering publications between 2015 and 2025. It was demonstrated, from the analyzed case, that nurses and physiotherapists of the Municipal Health System of Curitiba have participated in actions related to diabetic foot pain for several years, and today they are professionals who play a fundamental role in the development of skills of primary care equipment for the evaluation of at-risk pies, guidance in the management of identified neuropathies and the regulation of care and materials related to diabetic pie. In the case reported here, the professionals mentioned, involved in the treatment of the patient based on the development of an EVA plant, observed a significant reduction in plantar pressure in the affected area. The evaluation of the effectiveness of this plant was carried out through patient monitoring, in which a significant reduction of the ulcer was observed, which is in agreement with the scant existing literature and is exposed as a parameter. This material is recommended for the creation of new plant models for the relief of plantar ulcers, together with new clinical studies with greater methodological precision.



**Keywords:** Diabetes Mellitus; Management; Diabetic pie; Plantar pressure; Treatment; Diabetic foot ulcer.

## INTRODUCTION

The prevalence of diabetes mellitus (DM) is spreading rapidly at a rate alarming worldwide<sup>1</sup>. DM is known to damage multiple organs, including the heart, kidneys, eyes and nerves, leading to complications such as heart attack, stroke cerebral palsy, blindness, kidney failure, and lower limb amputation. Foot ulcers diabetic (UPD) is a frequent complication that occurs in approximately 6.3% of patients with DM globally<sup>2,3</sup>.

Diabetic foot ulcers affect approximately 18.6 million people worldwide. all, are associated with impaired physical function, associated mortality and morbidity, reduction in quality of life and increased use of health services; if they are not Left untreated, foot ulcers can progress to soft tissue infection, gangrene, and loss of members<sup>3-5</sup>.

Early in the course of DM, patients experience severe symptoms of sensitivity in the feet, such as pain and tingling, while the more advanced stages of the disease course are characterized by negative symptoms, such as numbness and weakness of the toes<sup>5,6</sup>. With the progression of the disease, patients often present with mixed sensitivity to pain and dullness, along with decreased limb sensitivity and motor function, which leads to imbalance and instability and increases the likelihood of falls<sup>6,7</sup>. In addition, due to increasing morbidity, UPD is a leading cause of non-traumatic amputation and is associated with an increased risk of death<sup>8</sup>.

The pathophysiology of UPD is based on the triad of neuropathy, peripheral arterial disease and concomitant secondary bacterial infection. Recent studies indicate some risk factors for its development, they are: diabetes for more than 10 years, male sex, patients older, presence of comorbidities, including nephropathy, neuropathy and vascular disease peripheral, and history of foot ulceration<sup>4-6</sup>.

The practical guidelines formulated by the International Working Group on the Foot Diabetic (IWGDF) defined UPD as a set of symptoms secondary to diabetes current or previous, including skin cracks, ulceration, infection, or destruction of foot tissue, which reflects, in part, the nebulous and imprecise nature of this concept<sup>9</sup>.



In the Western world, more than 60% of non-traumatic amputations involve DFU, which leads to an increased rate of hospitalization and mortality <sup>10</sup>. Furthermore, treatments amputation-based treatments impose a heavy burden on the economic and health resources of patients with diabetes <sup>1</sup>.

Once an ulcer has formed, the factors that affect healing may be more complex, and different factors may predominate at different stages over time. Thus, these related factors play different roles depending on the severity of the disease and the duration of recovery, requiring different diagnoses and treatments for apparently identical symptoms and causing differences in the healing effect <sup>10,11</sup>.

Existing management systems for UPD have gradually expanded based on the three principles established by Treves <sup>1</sup>, namely: debridement, glycemic control, activity physical, education and unloading (relief of high pressure in the foot), this last process involves unloading the affected area of the foot, redistributing the extra pressure to other regions <sup>12</sup>. Most of the interventions with unloading devices available is divided into four categories: plaster, orthosis, footwear and walking aids <sup>12,13</sup>.

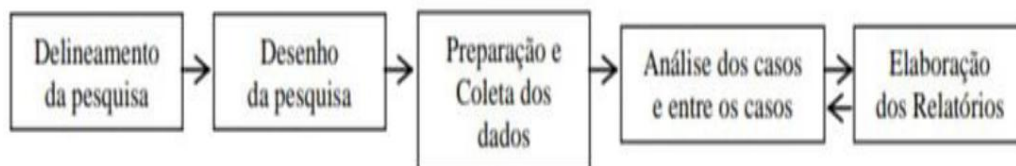
Patients are often resistant to cast applications or the extra costs. associated with other interventions. Physicians are therefore compelled to use methods alternatives, such as shoe modifications, which are less expensive and reimbursable. In addition, Furthermore, patients are generally more tolerant of small modifications made to shoes with which they are familiar <sup>1,14</sup>.

Therefore, given the introductory approach, the objective of this article is to report the case of a patient with a diabetic foot ulcer, discussing an adapted EVA insole to the patient's shoes, which contributed to the healing of the ulcer.

## METHODOLOGY

This is a case report of an elderly diabetic patient with a diabetic foot ulcer, for this, five steps were required, namely: research design; research; preparation and collection of data; analysis of cases and between cases; and preparation of the report (figure 1) <sup>15</sup>.

**Figure 1** – Clinical case description steps <sup>15</sup>



The research design was then defined, with emphasis on its validity in context. real, considering the external (clinical) and internal (professional performance) perspective, as well as the topics to be addressed to support the area of physiotherapy. Subsequently, the preparation and data collection, in which the clinical case to be analyzed was defined. Subsequently, the case analysis was carried out, based on an evaluation of treatment and monitoring records of the patient; finally, the final report was prepared, the results of which were obtained with the research were compared with existing literature, supporting them 15.

The literature used as a parameter to support and substantiate the case studied was identified in the PubMed/Medline, Elsevier and Scielo databases, for this purpose, considering the following descriptors found in DeCS (Health Descriptors): physiotherapy, diabetes mellitus, diabetic foot, diabetic foot ulcers, treatment, management, offloading devices pressure, plantar pressure, offloading, discharge. Another criterion that was considered is the materials published between 2015 and 2025, in Portuguese, English and Spanish.

## CASE REPORT

64-year-old patient, married, self-employed, businessman, two children, with his own residence, non-smoker, non-alcoholic beverage user, mother and brother with type 1 diabetes mellitus 2 (DM2) insulin-dependent. Attends a physiotherapy consultation at the Basic Health Unit Health – Santa Felicidade (UBS - SF) on 10/23/2023, and brings the request for the Surgery service Vascular from the accredited external network (SUS) for the correction of acquired foot deformity left after amputation in diabetic foot.

Patient with DM since age 56, non-insulin dependent, undergoing treatment oral medication, with routine medical consultations at the UBS - SF. It is included in the Program National Diabetic Registry since 2023, has moderate risk stratification and control exams quarterly, with control of stabilized glycated hemoglobin (below 7.0%), assessment of the foot



diabetic at the UBS and with the daily evaluation carried out by his wife after the amputation, guided by the appropriate nutritional diet.

Reports the history of having suffered amputation of the 2nd and 3rd toes of the left foot in February 2023, held at Hospital Evangélico Mackenzie - Vascular Surgery Service, after a long walk in sneakers and socks, in January 2023, causing an injury to the 2nd toe, which due to friction caused a wound, with edema, redness, pain and local hyperkeratosis, with little serous secretion and no signs of necrosis, progressing to signs of edema, redness, followed of infection, extremity cyanosis, and tissue necrosis. The patient sought medical attention doctor at the UBS, and after evaluation, he was referred to the Campo Emergency Care Unit Long (UPA CC).

The UPA CC provided emergency care to the user and then recommended that the continuity of medical treatment took place at the UBS SF. This is what happened. However, as the patient did not evolve as expected, the UBS SF again referred the user to the UPA CC. During the reassessment, it was found that it was necessary to request service assistance. Vascular Surgery Department of the Evangelical Makenzie University Hospital (HUEM), hospital of reference from UPA CC. In the meantime, the user reports that there was decompensation of blood glucose, leading to the emergency use of insulin and antibiotic therapy, without a satisfactory response, requiring amputation due to the presence of necrosis (figure 1).

Figure 1 – Amputation of the extremity of the 2nd and 3rd toes





Source: the authors

The search for physiotherapy consultation at the UBS came from a medical request from the hospital to obtain an orthosis to fill the interdigital space between the hallux and the 4th left toe. In the physiotherapeutic evaluation it was observed that in addition to the importance of treat the new shape of the foot for better plantar distribution of body weight and balance during walking, the presence of calluses with characteristics of a lesion with a pre-existing signal was observed. stage 1 pressure ulcer in the metatarsal arch region of the 4th left metatarsal (figure 2).

Figure 2 - presence of callus with characteristics of a lesion with a pre-ulcerative pressure sign, stage 1



Source: the authors

Therefore, the physiotherapist requested an evaluation from the Nurse, who prescribed it, and in sequence, performed the asepsis and debridement of the installed callus, in which it was used scalpel blade no. 11. Therefore, the treatment plan was established according to the instruction received at SMS Training / Curitiba (Paraná) in the 1st Professional Training of Health in Diabetic Neuropathy and Foot Complications, in 2023, when the debridement of calluses arising from the pressure point of the shoe and correction of the tread with insole for relief at the site of the injury and to promote the healing process.

The patient was previously informed of the need for pre-existing sign treatment. ulcerative found, as well as, it was also clarified as to the intervention conduct indicated therapy, such as debridement of the callus region, and concomitant preparation insole for the foot, with the aim of promoting better efficiency in the biomechanics of gait and consequently the resolution of the plantar tissue injury.

Debridement was performed by the nursing service, and after the necessary preparation, the mold for the insole was made. It was made with EVA material (figure 3) with customized mold through the measurement of the foot/width and length, and demarcation of the





pressure point to be neutralized. The hollow mold is made at the site of the callus, along with the choice (among the shoes provided by the patient), appropriate for the use of a special insole. The process involved preparing the foot with plastic film, marking and delimitation of the lesion with a felt-tip pen. Afterwards, the foot was pressed on the EVA, for transferring the marking of the callus area to be treated. The mold had the area of the hollow callus with the cut of iris scissors and thinned on its edge with a scalpel blade No. 11 for effective decompression of the injured area.

Figure 3 – EVA used in the manufacture of the insole



Source: the authors

The insole mold was made by the Physiotherapy and Nursing service, references of the Health Training in Neuropathy and Foot Complications at the UBS. The material used was partly made available by UBS, acquired by the professionals involved, and also by user himself, following the guidance of the training received. The recommended footwear must have rigid sole, maximum two centimeters in the rearfoot, or heel (figure 4), suitable for feet rigid, with altered sensitivity, deformities or amputations. Its use should occur throughout the treatment period.

Figure 4 – Footwear recommended by the patient



Source: the authors

Once the insole was completed, it was inserted into the pre-selected footwear.  
(figure 5).

Figure 5 – Insole inserted into the selected footwear



Source: the authors

The user was monitored weekly during the first month, to observe the resolution of the pre-ulcerative sign and control to prevent the emergence of new pressure points. Afterwards, in biweekly monitoring for callus removal and assessment of insole. From February/24 the user, with excellent progress, began to be monitored monthly, by nursing, together with the medical team, and the physiotherapy service. Due to the probable adaptation of the step during the healing process, a change in gait was noted. thus causing the need to fill the empty interdigital space in the amputation, then the use of an interdigital orthosis made of silicone material was suggested, improving thus distributing the footprint, relieving pressure on other points in the plantar region, taking care to avoid recurrence (figure 6).

Figure 6 – Silicone orthosis



Source: the authors

## DISCUSSION

In the treatment of diabetic foot ulcers, pressure modulation, commonly called of "offloading" is most successful when pressure is mitigated in an area of high vertical or shear stress 1, 14. Common methods include bed rest, wheelchair, crutch-assisted walking, total contact casts, felted foam, mid-height shoes, therapeutic shoes, and walkers with removable casts 16. Although it is well known that pressure mitigation through unloading devices is crucial for the healing of plantar ulcers of the diabetic foot.

Ground pressure, excessive plantar shear stress, and compressive stress of adjacent shoes or toes collectively impact the development of diabetic foot. Designing specialized insoles for diabetic foot patients becomes imperative due to these complexities 17.

Pain relief devices, including insoles, shoes, and other orthotics, are some of the of the most commonly used interventions to treat or prevent diabetic foot ulcers.



Customized pain relief devices are increasingly used to compensate for development of foot ulcers, a systematic review demonstrated that relief devices Customized pressure devices are more effective than standard devices in preventing diabetic foot ulcers, and their use has been recommended when feasible 17.

Local injuries aggravate foot ulcers when certain parts of the sole are pressed excessively 18, therefore, reducing plantar pressure or optimizing pressure distribution effectively prevents and treats diabetic foot 19. Improving pressure reduction performance involves optimizing the shape, material and structure of the insole 20. In addition, The comfort levels of insoles with different shapes, materials and structures vary. Considering that diabetic patients may need to use insoles for long periods, the discomfort significantly affects its regular use, potentially compromising effectiveness prevention or treatment 19-21.

When designing the insole, determining the shape of the insole is crucial. Due to the differences individual feet, custom molded shapes are essential to reduce peak plantar pressure in insoles for diabetic feet 21.

Considering the case analyzed, the option for the insole is based on the assumptions mentioned, i.e. reduction of plantar pressure and optimization of pressure distribution <sup>19</sup>, aiming, therefore, to avoid the potentialization of the identified lesion, consequently a new amputation, it was in this context that the creation of an EVA insole was considered. There is no, to the best of our knowledge, significant reports in the literature that describe the characteristics and considerations associated with the use of pressure mitigation devices using insoles in EVA.

Differences in mechanical properties between materials affect relief performance of the pressure of customized insoles 20. Telfer et al. <sup>22</sup> identified the elasticity of the material of footwear as the most influential factor in pressure relief. Studies comparing the performance pressure relief between different insole materials <sup>23, 24, 25, 26</sup> provide information practices for clinical prevention, guiding the design of more suitable insoles for diabetic patients.

Soft insole materials such as PORON Medical 4.708 and Nora Lunalastik EVA, outperformed rigid materials such as Nora Lunalight A fresh and Pe-Lite in relieving plantar pressure in elderly diabetics 27. Furthermore, the uniform softening of a homogeneous insole





led to a 30% reduction in maximum plantar pressure 28. Nouman et al.<sup>29</sup> found that a combination of soft materials, such as EVA, and hard materials provided a more uniform distribution of contact pressure. Tang et al.<sup>30</sup>, low-density ethylene-vinyl acetate (or i.e., EVA) is generally soft and provides good cushioning and shock absorption during walking 30.

It is important to mention that EVA (Ethylene-Vinyl Acetate) provides several advantages in the production of insoles for diabetic foot ulcers, such as their ability to absorb impacts, flexibility, lightness and moldability. EVA has the ability to be molded to the shape of the foot, reducing pressure on sensitive areas. Furthermore, It is a robust and durable material, suitable for use in plants that need to withstand the pressure of continuous use 31.

It was with this perspective in mind that we decided to choose EVA for making the insole for the patient analyzed, given this advantage, throughout the follow-up, a significant improvement in the patient's injury was observed, and adaptation of the step during the healing process, as changes in gait were observed which led to the need for interdigital space. However, in relation to ulcer control, the process adopted for making EVA insoles, although in a handmade process, contributed to the treatment of the patient's diabetic foot injury, in line with the literature existing, although scarce, confirming the contribution of designing insoles with materials available.

## CONCLUSION

Nurses and Physiotherapists from the Municipal Health System - Curitiba have participated in actions related to diabetic foot a few years ago, and today it is the professionals who play a fundamental role in supporting the skills development of the teams primary care for the assessment of feet at risk, in guiding the management of neuropathies identified, in the regulation of care and materials related to diabetic feet. Thus, It is necessary to praise the investment of SMS Curitiba in the training of professionals in primary care to inform, evaluate and treat patients with DM in their own care primary, and when necessary, request support from medical specialties, secondary services and tertiary care, with the aim of preserving the patient's overall health. The training





multidisciplinary team updates, awakens attention and creativity to improve functional life of patients with DM, enabling differentiated care for better health indices and therefore, preserving the patient's mobility.

In the case reported here, the diligence of nursing professionals was evident and physiotherapy involved, specifically in the treatment of the patient from the development of an EVA insole, which provided a significant reduction in plantar pressure in the affected area. The effectiveness of this insole was evaluated by monitoring the patient in which a significant reduction in the ulcer was observed, which was in line with the scarce existing literature and presented as a parameter. This material is recommended for the creation of new models of insoles for the relief of plantar ulcers, together with new studies clinical with greater methodological precision.

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