
Moderate-to-Vigorous-Intensity Physical Activity Observed in People with Diabetes-Related Foot Ulcers over a One-Week Period

Article by Lee M, van Netten JJ, Sheahan H, Lazzarini PA. J Diabetes Sci Technol. 2019 Sep;13(5):827-835.

Commentary by **Joseph Candela, DPM, PhD**

CONDENSATION

Purpose of Study: To observe and compare the levels of physical activity among patients with diabetes-related foot ulcers (DFUs) and diabetes-related peripheral neuropathy (DPN), without prior history of DFU and diabetes mellitus (DM) without DPN or DFU.

Approach: Data for this secondary analysis was collected from 65 type 2 DM patients who had participated in an original cross-sectional, case-controlled study investigating the activity of people with DFU, DPN or DM in their free-living environment over a period of seven days. Patients were divided into three groups: DPN with current DFU (DFU group, 27 participants), DPN and no DFU history (DPN group, 23 participants), and DM with no DPN or DFU history (DM group, 15 participants). The DFU group was further subdivided into: patients with a history of minor amputations (12 participants), patients without amputation (15 participants), patients wearing a non-removable offloading device (seven participants) and patients wearing another offloading device (20 participants).

All participants were instructed to wear the SenseWear armband (Bodymedia, Pittsburgh, Pennsylvania, USA) at all times on their mid-upper arm for one week. The average from at least five days (including at least one weekend day) of data, each of at least 22 hours, were determined to predict daily outcomes.

The number of episodes of moderate-to-vigorous intensity physical activity, its intensity and its duration in people with DFUs were calculated and compared with patients in the DPN and DM groups. Further, the accumulated time spent daily doing moderate-to-vigorous intensity physical activity and sedentary-intensity activity were collected and analyzed among the DFU subgroups.

What Investigators Accomplished:

- Most characteristics were similar between groups, except that those with DPN were older (DPN $68 \pm$ nine years, $p = .001$) and those with DFUs had more foot deformities (83%, $p < .001$).
- All groups recorded the same median numbers of daily episodes of moderate-to-vigorous intensity physical activity (DM .33, DPN .29, DFU .25 episodes), median durations per episode (DM 15, DPN 17, DFU 14 minutes) and median intensity per episode (DM 4.1, DPN 4.3, DFU 3.9 metabolic equivalents of task [METs]).
- While all patients achieved 30 minutes of physical activity, no group met the international guidelines as they did not perform bouts of ten consecutive minutes.

- Median accumulated time spent daily doing physical activity was similar between the groups (DM 40, DPN 37, DFU 36 minutes per day).
- The mean accumulated daily time spent doing sedentary-intensity activity and the intensity of these activities were significantly more in the DFU group than the DPN group (both $p < .05$).
- Patients with minor amputations had more episodes of moderate-to-vigorous-intensity physical activity, had higher-median intensity during episodes, recorded more median accumulated time doing moderate-to-vigorous intensity activity, and spent less mean accumulated time on sedentary-intensity activity when compared to patients without any amputation (all $p < .05$).
- Patients wearing non-removable knee-high devices or with other offloading devices did not show any significant differences in outcomes of interest.

Investigators' Observations: The investigators observed that patients with DFUs and minor amputations spent more time doing moderately-to-vigorously intense physical activity and less time doing sedentary-intensity activity. Thus, DFU patients with minor amputations were more physically active than DFU patients without minor amputations, indicating that minor amputations did not affect physical activity.

REFERENCES

- Colberg SR, Sigal RJ, Yardley JE, et al. Physical activity/exercise and diabetes: A position statement of the American Diabetes Association. *Diabetes Care*. 2016 Nov;39(11):2065-2079.
- Sheahan H, Canning K, Refausse N, et al. Differences in the daily activity of patients with diabetic foot ulcers compared to controls in their free-living environments. *Int Wound J*. 2017 Dec;14(6):1175-1182.
- Mackey DC, Manini TM, Schoeller DA, et al. Validation of an armband to measure daily energy expenditure in older adults. *J Gerontol A Bio Sci Med Sci*. 2011 Oct;66(10):1108-1113.

COMMENTARY

International guidelines suggest doing 30 minutes of exercise, five days a week, with active periods of exercise lasting at least ten consecutive minutes. All groups in this study *did* do at least 30 minutes of exercise per day, however none of the groups were required to perform bouts of exercise lasting for ten minutes. Patients with DFUs spent more time doing sedentary activity compared to the other groups, whereas patients with minor amputation had more episodes of moderate-to-vigorous physical activity. This is a pertinent article in the field of diabetes and diabetes-related complications, as regular exercise has been shown to delay diabetes-related complications as well as promote healing of DFUs.

Despite this, however, pressure to the wound site can delay wound healing and so clinicians will often place patients in cumbersome offloading devices, or even keep them non-weightbearing to the affected extremity with the use of a knee walker, thus limiting their ability to exercise. Regular exercise is important for these patients' overall well-being in addition to promoting faster wound healing. However, protecting the wound site and minimizing pressure to the area needs to be considered when discussing physical activity with these patients.

A multidisciplinary team approach involving podiatrists, wound care specialists, physical therapists and sports medicine would be beneficial to these patients in order to develop individualized daily exercise programs that match their needs. This would allow the treatment team to come up with a program that considers the patient's

physical limitation, their wounds, current offloading, and weightbearing restrictions in order to come up with a protocol the patient can follow. I feel that further research in this area would be beneficial to the wound care arena, to develop set protocols for optimizing physical activity in diabetic patients with foot ulcers while still maintaining their weightbearing or offloading restrictions.

REFERENCES

- Bolton L. Exercise and chronic wound healing. *Wounds*. 2019 Feb;31(2):65-67.
- Eraydin Ş, Avşar G. The effect of foot exercises on wound healing in type 2 diabetic patients with a foot ulcer: A randomized control study. *J Wound Ostomy Continence Nurs*. 2018 Mar-Apr;45(2):123-130.
- Lindberg K, Møller BS, Kirketerp-Møller K, Kristensen MT. An exercise program for people with severe peripheral neuropathy and diabetic foot ulcers: A case series on feasibility and safety. *Disabil Rehabil*. 2020 Jan;42(2):183-189.