

Will Stem Cell Treatment Improve Wound Healing in Diabetic Patients?

Ashley Villa; Delia Benitez
Kelle Huong Phan, DNP, RN, NNP-BC

PICOT Question

In diabetic patients with foot ulcers, would stem cell treatment improve wound healing compared to wound debridement following two weeks after treatment?

Background

Diabetic neuropathy is a factor in the development of foot ulcers in patients due to the loss of sensation and increased pressure on the lower extremities. The development of diabetic foot ulcers is a severe complication related to diabetes that can eventually lead to amputation. The current management of diabetic foot ulcers consists of wound debridement in combination with offloading the affected area, pharmacological pain control, negative pressure wound therapy and wound dressings to protect the affected site (Lim et al., 2017).

Stem cells have a unique ability to develop into different types of cells in the body. Many studies have found that stem cell therapy can aid in faster wound healing, as it repairs damaged cells in the body by reducing inflammation (Cona et al., 2021). In addition, stem cells are able to regenerate damaged tissue and are self-replicating which can be very beneficial to the body as it creates the required cells for healing (Cona et al., 2021).

Literature Search

Keywords:

- Diabetes Mellitus
- Glycemic control
- Wound healing
- Debridement
- Foot ulcer
- Stem Cell therapy
- Infection control

Databases:

- Google scholar
- PubMed
- EBSCOhost
- CINAHL

- Peer reviewed journals, systemic reviews, published in the last 5 years (2016-2021).

Synthesis of Findings

- MSCs have superior wound-healing capabilities when compared to diabetic fibroblasts. There is stimulation of tissue repair by increased formation of fibroblast growth factor, blood capillaries, vascular endothelial growth factor, and collagen synthesis for the improvement of wound healing compared to diabetic fibroblasts.^{3, 5, 8, 9}
- Ulcers in lower extremities have shown to be more prevalent among populations that have been diagnosed with diabetes mellitus and they have been known to be at higher risk for amputation.^{3, 6}
- 73% wound closure in patient who were treated with stem cell hydrogel sheets compared to only 47% in patient who were treated with polyurethane film after week 8.^{3, 9}
- Stem cell therapy has improved vascular density, repaired wound and sensory functions, increased wound healing speed, and reduced size of foot ulcers.^{1, 5, 8}
- Individuals that have undergone debridement have shown to have increased wound healing times which has resulted in amputation caused by limb ischemia, while stem cell transplantation has significantly reduced amputation rate among patients with limb ischemia.^{7, 1}

Decision to Change Practice

- Wound care nurses will be trained in a stem cell therapy facility and provided with protocols in order to perform wound care in clinics.
- The current standards for managing diabetic foot ulcers have been stated to be insufficient due to only a small percentage of DFUs healing and developing a multi-drug resistant infection.⁶
- Implement the use of Wagner grade scale as an assessment tool to properly evaluate changes in diabetic foot ulcers and assess healing.^{9, 10}
- Use combination therapy of Metformin and Stem cell therapy to treat diabetic foot ulcers and improve wound healing.⁸
- Use allogeneic adipose derived stem cell hydrogel sheets as a dressing for diabetic foot ulcers.⁹
- Collaborate with case management and social workers to provide transportation services for patients who are unable to attend wound evaluation visits.¹²



Evaluation

In a 3-6 month period we want to evaluate for:

- An increase in wound healing through the use of stem cell therapy in comparison to wound debridement. The Wagner Grade Scale will be used to evaluate and assess wound healing of DFU on the day of treatment and on day 7, 14, 21 and every week after until completing the treatment.
- Effectiveness of wound healing by interviewing patients on their experience.
- Increase in wound care nurses who are certified to use stem cell therapy for wound care.

References

- 1Sun, X., Ying, J., Wang, Y., Li, W., Wu, Y., Yao, B., Liu, Y., Gao, H., & Zhang, X. (2015, June 15). Meta-analysis on autologous stem cell transplantation in the treatment of limb ischemic. *International journal of clinical and experimental medicine*. Retrieved November 6, 2021, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4538153/>.
- 2Blakely, M. (2016). The use of best practice in the treatment of a complex diabetic foot ulcer: A case report. *Healthcare*, 4(1), 18. <https://doi.org/10.3390/healthcare4010018>
- 3Jiang, X., Zhang, H., & Teng, M. (2016). Effectiveness of autologous stem cell therapy for the treatment of lower extremity ulcers. *Medicine*, 95(11). <https://doi.org/10.1097/md.00000000000002716>
- 4Cao, Y., Gang, X., Sun, C., & Wang, G. (2017). Mesenchymal stem cells improve healing of diabetic foot ulcer. *Journal of Diabetes Research*, 2017, 1–10. <https://doi.org/10.1155/2017/9328347>
- 5Jung, J.-A., Yoon, Y.-D., Lee, H.-W., Kang, S.-R., & Han, S.-K. (2017). Comparison of human umbilical cord blood-derived mesenchymal stem cells with healthy fibroblasts on wound-healing activity of diabetic fibroblasts. *International Wound Journal*, 15(1), 133–139. <https://doi.org/10.1111/ijw.12849>
- 6Hajimohammadi, K., Makhdooni, K., Zabihi, R. E., & Parizad, N. (2019). NPWT: A gate of hope for patients with diabetic foot ulcers. *British Journal of Nursing*, 28(12). <https://doi.org/10.12968/bjon.2019.28.12.s6>
- 7Baumfeld, D., Baumfeld, T., Macedo, B., Zambelli, R., Lopes, F., & Nery, C. (2018). Factors related to amputation level and wound healing in diabetic patients. *Acta Ortopédica Brasileira*. <https://doi.org/10.1590/1413-785220182605173445>
- 8Shawky, L. M., El Bana, E. A., & Morsi, A. A. (2019). Stem cells and metformin synergistically promote healing in experimentally induced cutaneous wound injury in diabetic rats. *Folia Histochemica Et Cytobiologica*. <https://doi.org/10.5603/fhc.a2019.0014>
- 9Moon, K.-C., Suh, H.-S., Kim, K.-B., Han, S.-K., Young, K.-W., & Lee, J.-W. (2019). Potential of allogeneic adipose-derived stem cell – hydrogel complex for treating diabetic foot ulcers. *Diabetes*. <https://doi.org/10.2337/db18-0699>
- 10Kudlová, P., & Kočvarová, I. (2020). Quality of life in patients with diabetic foot ulcers. *Central European Journal of Nursing and Midwifery*, 11(1), 34–42. <https://doi.org/10.15452/cejnm.2020.11.0006>
- 11Jiang, L.-L., & Liu, L. (2020). Effect of metformin on stem cells: Molecular mechanism and clinical prospect. *World Journal of Stem Cells*, 12(12), 1455–1473. <https://doi.org/10.4252/wjsc.v12.i12.1455>
- 12Nube, V. L., Alison, J. A., & Twigg, S. M. (2021). Frequency of sharp wound debridement in the management of diabetes-related foot ulcers: Exploring current practice. *Journal of Foot and Ankle Research*, 14(1). <https://doi.org/10.1186/s13047-021-00489-1>

Acknowledgements

We would like to cordially thank the Gessner family for providing academic scholarships through our nursing journey. They have made being a part of this program possible for us. We would also like to thank Dean Kathryn Tart EdD, MSN, RN and Dr. Kelle Huong Phan, DNP, RN, NNP-BC for always going an extra mile to provide each student with the best opportunities for success.

