



Use of BSN medical Fiberglass Casting Products in Hyperbaric Oxygen Therapy for Diabetic Foot Ulcer Treatment

Increasingly, the use of hyperbaric oxygen treatment is being indicated for management of hard to cure wounds, including diabetic ulcers. Many times this is coupled with synthetic casting immobilization of the affected extremity in order to offload weight from the affected foot in order to improve the potential for healing. The treatment of diabetic foot ulcers requires management of a number of systemic and local factors, including:

Precise diabetic control is, of course, vital, not only in achieving resolution of the current wound, but also in minimizing the risk of recurrence.

Management of contributing systemic factors, such as hypertension, hyperlipidemia, atherosclerotic heart disease, obesity, or renal insufficiency, is crucial.

Management of arterial insufficiency, treatment of infection with appropriate antibiotics, offloading the area of the ulcer, and wound care are also essential.

In the presence of an intractable wound and associated no correctible ischemic arterial disease, hyperbaric oxygen therapy may be beneficial (in selected cases). Löndahl et al found that 40 hyperbaric oxygen treatments (85 min daily, 5 d/wk for 8 wk) resulted in complete healing of chronic diabetic foot ulcers in 52% of patients in the treatment group. Among patients in the placebo group, 29% had complete healing at 1-year follow-up.

The off-loading of body weight using a total contact cast system is important in the treatment of a diabetic foot ulcer. Advanced casting products offered by BSN such as Delta Lite Plus employ a fiberglass substrate impregnated with a fast curing, low-tack, water activated polyurethane resin that cures to weight bearing strength in 20 minutes, flexural rigidity is specified at 30 minutes after application as 1.6 kgf/cm minimum, and the cast is considered for all practical purposes to be completely cured after approximately 1.5 hours.

While some practitioners recommend waiting 12 hours after cast application / reapplication before initiating hyperbaric oxygen therapy, BSN feels this is an excessive length of time to wait for full cast curing of BSN fiberglass casting products. Since curing levels reach high levels within 1.5 hours, hyperbaric oxygen therapy could commence immediately during the same treatment visit, thus increasing patient compliance and reducing the overall time needed for ulcer healing.

References

- 1) American Diabetes Association. Basic diabetes information: facts and figures. Available at: [http://www.diabetes.org/main/application/commercewf?origin=*.jsp&event=link\(B1\)](http://www.diabetes.org/main/application/commercewf?origin=*.jsp&event=link(B1)). Accessed June 5, 2002.
- 2) National Institute of Diabetes and Digestive and Kidney Diseases. National diabetes statistics. Available at: <http://www.niddk.nih.gov/health/diabetes/pubs/dmstats/dmstats.htm#7>. Accessed June 5, 2002.
- 3) Screening for diabetes. *Diabetes Care*. 2002;25(suppl 1):S21–S24.
- 4) Eastman RC. Neuropathy in diabetes. In: Harris MI, Cowie CC, Stern MP, et al, eds. *Diabetes in America*. 2nd ed. Washington, DC: US Government Printing Office; 1995:339–348. Publication NIH 95-1468.
- 5) Boulton AJ. The diabetic foot: a global view. *Diabetes Metab Res Rev*. 2000;16(suppl 1):S2–S5.
- 6) Ramsey SD, Newton K, Blough D, et al. Incidence, outcomes, and cost of foot ulcers in patients with diabetes. *Diabetes Care*. 1999;22:382–387.[Abstract]
- 7) Consensus Development Conference on Diabetic Foot Wound Care: 7–8 April 1999. Boston, Massachusetts. American Diabetes Association. *Diabetes Care*. 1999;22: 1354–1360.[Medline]
- 8) Reiber GE, Boyko EJ, Smith DG. Lower extremity foot ulcers and amputations in diabetes. In: Harris MI, Cowie CC, Stern MP, et al, eds. *Diabetes in America*. 2nd ed. Washington, DC: US Government Printing Office; 1995:409–428. Publication NIH 95-1468.
- 9) Pecoraro RE, Reiber GE, Burgess EM. Pathways to diabetic limb amputation: basis for prevention. *Diabetes Care*. 1990;13:513–521.[Abstract]
- 10) Cianci P. Consensus Development Conference on Diabetic Foot Wound Care: a randomized controlled trial does exist supporting use of adjunctive hyperbaric oxygen therapy. *Diabetes Care*. 2000;23:873–874.[Free Full Text]
- 11) Miller OF III. Management of diabetic foot ulcers. *J Cutan Med Surg*. 1998;3 (suppl 1):S1-13–S1-17.
- 12) Boyko EJ, Ahroni JH, Stensel V, Forsberg RC, Davignon DR, Smith DG. A prospective study of risk factors for diabetic foot ulcer: the Seattle Diabetic Foot Study. *Diabetes Care*. 1999;22:1036–1042.[Abstract/Free Full Text]
- 13) Armstrong DG, Lavery LA. Diabetic foot ulcers: prevention, diagnosis and classification. *Am Fam Physician*. 1998;57:1325–1332, 1337–1338.[Medline]
- 14) McNeely MJ, Boyko EJ, Ahroni JH, et al. The independent contributions of diabetic neuropathy and vasculopathy in foot ulceration: how great are the risks? *Diabetes Care*. 1995;18:216–219.[Abstract]
- 15) Abbott CA, Vileikyte L, Williamson S, Carrington AL, Boulton AJ. Multicenter study of the incidence of and predictive risk factors for diabetic neuropathic foot ulceration. *Diabetes Care*. 1998;21:1071–1075.[Abstract]
- 16) Stone JA, Cianci P. The adjunctive role of hyperbaric oxygen therapy in the treatment of lower extremity wounds in patients with diabetes. *Diabetes Spectrum*. 1997;10:118–123.
- 17) Hammarlund C. The physiologic effects of hyperbaric oxygenation. In: Kindwall EP, Whelan HT, eds. *Hyperbaric Medicine Practice*. Flagstaff, Ariz: Best Publishing Co; 1999:37–68.
- 18) Gimbel M, Hunt T. Wound healing and hyperbaric oxygenation. In: Kindwall EP, Whelan HT, eds. *Hyperbaric Medicine Practice*. Flagstaff, Ariz: Best Publishing Co; 1999:169–204.
- 19) Unger HD, Lucca M. The role of hyperbaric oxygen therapy in the treatment of diabetic foot ulcers and refractory osteomyelitis. *Clin Podiatr Med Surg*. 1990;7:483–492.[Medline]
- 20) Millington JT, Norris TW. Effective treatment strategies for diabetic foot wounds. *J Fam Pract*. 2000;49(11 suppl):S40–S48.[Medline]
- 21) Muha J. Local wound care in diabetic foot complications: aggressive risk management and ulcer treatment to avoid amputation. *Postgrad Med*. 1999;106:97–102
- 22) Undersea and Hyperbaric Medical Society. Indications for hyperbaric oxygen therapy. Available at: <http://www.uhms.org/Indications/indications.htm>. Accessed June 6, 2002.
- 23) Kindwall EP. The physics of diving and hyperbaric pressures. In: Kindwall EP, Whelan HT, eds. *Hyperbaric Medicine Practice*. Flagstaff, Ariz: Best Publishing Co; 1999:21–36.
- 24) Butler FK. Diving and hyperbaric ophthalmology. *Surv Ophthalmol*. 1995;39: 347–366.[Medline]
- 25) Grim PS. Hyperbaric oxygen therapy. *JAMA*. 1990;263:2216–2220.[Abstract/Free Full Text]
- 26) Sheffield PJ. Tissue oxygen measurements with respect to soft tissue wound healing with normobaric and hyperbaric oxygen. *Hyperb Oxyg Rev*. 1985;6:18–46.
- 27) Sheffield PJ, Workman WT. Non-invasive tissue oxygen measurements in patients administered normobaric and hyperbaric oxygen by mask. *Hyperb Oxyg Rev*. 1985; 6:47–62.

- 28) Baroni G, Porro T, Faglia E, et al. Hyperbaric oxygen in diabetic gangrene treatment. *Diabetes Care*. 1987;10:81–86.[Abstract]
- 29) Cianci P, Petrone G, Drager S, et al. Salvage of the problem wound and potential amputation with wound care and adjunctive hyperbaric oxygen therapy: an economic analysis. *J Hyperb Med*. 1988;3:127–141.
- 30) Oriani G, Meazza D, Favales F, et al. Hyperbaric oxygen therapy in diabetic gangrene. *J Hyperb Med*. 1990;5:171–175.
- 31) Wattel FE, Matthiu DM, Fossati P, et al. Hyperbaric oxygen in the treatment of diabetic foot lesions: search for healing predictive factors. *J Hyperb Med*. 1991; 6:263–267.
- 32) Doctor N, Pandya S, Supe A. Hyperbaric oxygen therapy in diabetic foot. *J Postgrad Med*. 1992;38:112–114.[Medline]
- 33) Oriani G, Michael M, Meazza D, et al. Diabetic foot and hyperbaric oxygen therapy: a ten-year experience. *J Hyperb Med*. 1992;7:213–221.
- 34) Faglia E, Favales F, Aldeghi A, et al. Adjunctive systemic hyperbaric oxygen therapy in treatment of severe prevalently ischemic diabetic foot ulcer. *Diabetes Care*. 1996;19:1338–1343.[Abstract]
- 35) Zamboni WA, Wong HP, Stephenson LL, Pfeifer MA. Evaluation of hyperbaric oxygen for diabetic wounds: a prospective study. *Undersea Hyperb Med*. 1997;24:175–179.[Medline]
- 36) Kalani M, Jorneskog G, Naderi N, Lind F, Brismar K. Hyperbaric oxygen (HBO) therapy in treatment of diabetic foot ulcers: long-term follow-up. *J Diabetes Complications*. 2002;16:153–158.[Medline]
- 37) Kindwall E. Contraindications and side effects to hyperbaric oxygen treatment. In: Kindwall EP, Whelan HT, eds. *Hyperbaric Medicine Practice*. Flagstaff, Ariz: Best Publishing Co; 1999:83–97.
- 38) Leach RM, Rees PJ, Wilmshurst P. Hyperbaric oxygen therapy. *BMJ*. 1998;317:1140–1143.[Free Full Text]
- 39) Armstrong DG. Is diabetic foot care efficacious or cost effective? *Ostomy Wound Manage*. April 2001;47:28–32.
- 40) Tennvall GR, Apelqvist J, Eneroth M. Costs of deep foot infections in patients with diabetes mellitus. *Pharmacoeconomics*. 2000;18:225–238.[Medline]
- 41) Mackey WC, McCullough JL, Conlon TP, et al. The costs of surgery for limb- threatening ischemia. *Surgery*. 1986;99: 26–35.[Medline]
- 42) Cianci P. Adjunctive hyperbaric oxygen therapy in the treatment of the diabetic foot. *J Am Podiatr Med Assoc*. 1994;84:448–455.[Abstract]
- 43) Harrington C, Zagari MJ, Corea J, Klitenic J. A cost analysis of diabetic lower-extremity ulcers. *Diabetes Care*. 2000;23: 1333–1338.[Abstract/Free Full Text]
- 44) Löndahl M, Katzman P, Nilsson A, Hammarlund C : Hyperbaric oxygen therapy facilitates healing of chronic foot ulcers in patients with diabetes. *Diabetes Care* 2010; 33: 998– 1003