

Intractable Diabetic Foot Ulcers Require Aggressive Treatment

Investigators used two experimental methods of diabetic foot ulcer therapy to treat wounds with either exposed or unexposed bone.

REVIEWED BY SATOSHI ITAMI, MD

Patient response to a novel therapy for intractable diabetic foot ulcerations with exposed bone – initial debridement followed by partial excision – was better than response to standard therapy.

As the most common precursor for lower extremity amputation among diabetic patients, foot ulceration with exposed bone should be treated early and aggressively in the attempt to avoid amputation, investigators reporting in the *British Journal of Dermatology* wrote.

Initial debridement followed by partial excision treated intractable diabetic foot ulcers better than standard therapy.

Satoshi Itami, MD, and his colleagues from Osaka University Medical Hospital in Japan evaluated the effectiveness of two experimental therapies for wounds with and without exposed bone versus standard therapy. The nonrandomized, controlled study was comprised of 38 patients with chronic wounds caused by diabetes.

All patients were Asian and were treated for intractable diabetic foot ulcers at the Osaka University Medical Hospital between December 17, 1998 and March 17, 2002. Wounds were classified according to a simplified categorization of Wagner grades, which are based on wound depth after sharp en bloc debridement, investigators wrote. Patients chose their own therapy method; neuropathy was present in all patients, however none had a previous amputation (Table 1).

Bone was exposed in 20 patients with diabetic foot

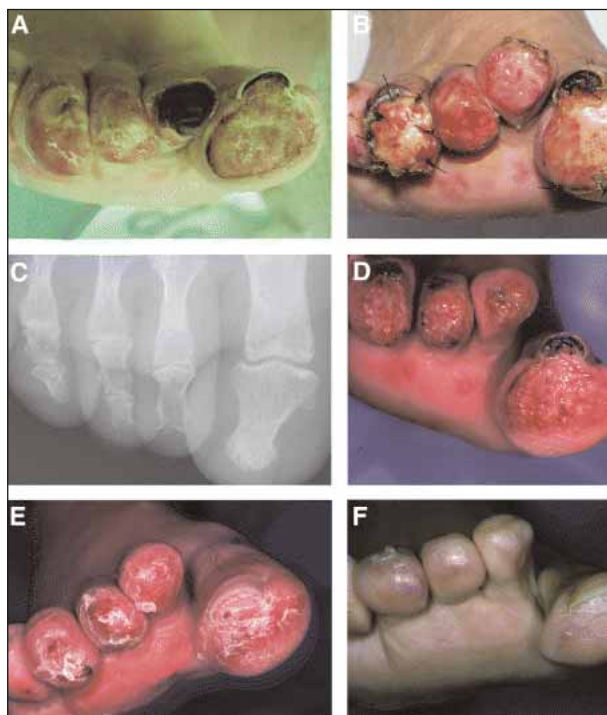


Figure 1. Diabetic foot ulcers on the right foot of a 53-year-old woman were treated by the experimental therapy. The clinical view of the wound before treatment (A) shows the result of 4 months of pain from osteomyelitis. Two weeks after en bloc debridement with a scalpel, (B) bone marrow was exposed with a bone scraper and an occlusive dressing was applied. X-rays showing the partially removed distal phalanx bones (C) and images from 1 week after (D), 6 weeks after (E) and 1 year after (F) epidermal grafting are seen above. All photos courtesy of the *British Journal of Dermatology*.

ulcers. At least one of three infrapopliteal arteries – the anterior tibial, posterior tibial or peroneal – had mild to severe stenosis or occlusion. All 20 patients, regardless of therapy type, had arterial hemoglobin oxygen saturation >80%.

PREVENTED AMPUTATION

Investigators used the experimental therapy, which healed all of the ulcers and prevented osteomyelitis and amputation, in 11 patients. Lesions were covered with an occlusive dressing for 3 to 8 days after investigators cleaned and exposed the bone, debrided the wound with a scalpel, and triggered fresh bleeding from the bone marrow by meticulous excision. Epidermal grafts were then applied to the wound bed. The spread of infection was avoided by delaying the coverage of autologous tissue, investigators wrote.

Remaining patients with exposed bone were treated by a standard therapy method; the wound was either covered with muscle and/or skin grafts or left as is.

A reduction in total toe amputation was noted by



Figure 2. The right foot of a 62-year-old man was treated by the experimental therapy for his diabetic ulcer. The clinical examination (A) showed bone exposure on the fourth toe. (B) An x-ray showed bone degeneration, and the histopathology of debrided bony tissue (C) shows the infiltration of inflammatory cells into the bony tissue. Bone marrow exposure was seen (D) after en bloc debridement with a scalpel plus shaving of the necrotic bone with a bone scraper. (E) shows the ulcer 3 weeks after bone marrow exposure and 1 week after epidermal grafting, and (F) is 11 months postgrafting. The investigators noted that no recurrence of erosion/ulceration or osteomyelitis were observed.

Epidermal sheets, made from suction blisters from the abdomen or inner thigh, were grafted to the wounds.

Itami and colleagues in patients who underwent experimental therapy ($P<.0001$) versus patients in the standard therapy group. Eighty-nine percent of standard therapy patients required amputation after 3 months; there were no amputations in the experimental therapy group. Wound healing time between the two therapies was similar ($P=.860$), the investigators wrote.

SIMILAR EXPERIMENTAL THERAPY

A similar, experimental therapy was used for intractable wounds without exposed bone. This treatment – scalpel debridement followed by occlusive dressing application of up to 2 weeks and epidermal sheet grafting – resulted in a 63% reduction in wound

healing time versus wounds treated with standard therapy, the investigators wrote.

Eighteen patients were treated for intractable diabetic foot ulcers without bone exposure. Investigators used the standard method of treatment on eight patients, and the remaining were treated with the experimental therapy.

After achieving healthy granulation through occlusive dressing, investigators harvested suction blisters from the abdomen or inner thigh and grafted these epidermal sheets to the wound. Because the graft's diameter was between 1 cm and 5 cm, several sheets were applied to the surface area of the wound. This group had an accelerated healing time ($P=.042$) versus standard therapy. Importantly, Dr. Itami said, stable plantar-type characteristics in grafts derived from the trunk epidermis can be induced by site-specific differentiation through mesenchymal-epithelial interactions.

Investigators recommend their

TABLE 1. COMPARISON OF STANDARD AND EXPERIMENTAL THERAPY

Wounds without exposed bone:			
	Standard therapy	Experimental therapy	P-value
Age (years; mean \pm SEM)	58.9 \pm 5.0	60.3 \pm 4.4	.750*
Sex (M/F)	5/3	5/5	.480 [†]
Wound size (cm ² ; mean \pm SEM)	6.5 \pm 2.7	4.7 \pm 1.1	.376*
Wound duration (months; mean \pm SEM)	4.6 \pm 1.4	2.8 \pm 0.3	.124*
Wound infection (%)	7/8 (88)	8/10 (80)	.527 [†]
Bone exposure, osteomyelitis	0/8	0/10	
Amputation (%)	1/8 (13)	0/10 (0)	.264 [†]
Healing period (weeks; mean \pm SEM)	11.6 \pm 3.4	4.3 \pm 0.6	.042*
Wounds with exposed bone:			
	Standard therapy	Experimental therapy	P-value
Age (years; mean \pm SEM)	64.8 \pm 3.8	58.1 \pm 4.9	.271*
Sex (M/F)	7/2	8/3	.606 [†]
Wound size (cm ² ; mean \pm SEM)	3.4 \pm 0.9	5.6 \pm 2.1	.342*
Wound duration (months; mean \pm SEM)	6.6 \pm 1.2	12.3 \pm 7.6	.450*
Wound infection (%)	7/9 (78)	8/11 (72)	.606 [†]
Bone exposure, osteomyelitis	9/9	11/11	
Amputation (%)	8/9 (89)	0/11 (0)	.0001 [†]
Healing period (weeks; mean \pm SEM)	6.2 \pm 2.5	5.1 \pm 0.7	.860*

* Values for age, wound size, wound duration and healing period were recorded as mean \pm SEM and compared by t-test.
[†] Each group of categorical data, including sex, wound infection and amputation avoidance, was compared by using the χ^2 test.

experimental therapy be used on intractable wounds with exposed bone.

Amputation rates were reduced with use of the procedure, and treatment time was shortened, they wrote. This therapy may also benefit patients who require amputation because it allows for the preservation of living tissue surrounding the wound.

Because this study was nonrandomized, investigators noted a possible bias in the selection process. The investigators are planning to perform randomized trials at a later date. ■

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Yamaguchi Y, Yoshida S, Sumikawa Y, Kubo T, et al. Rapid healing of intractable diabetic foot ulcers with exposed bones following a novel therapy of exposing bone marrow cells and then grafting epidermal sheets. *Br J Dermatol.* 2004;151:1019-1028.



Figure 3. This diabetic foot ulcer and arteriosclerosis obliterans before experimental treatment (A) was found on the foot of a 73-year-old woman. Eight months after postgrafting (B), the investigators did not find any recurrence of osteomyelitis and erosion/ulceration.