Improved Healing of Severe Open Long Bone Fractures Treated with Antibiotic-Formulated Bone Graft During the First Surgical Intervention Post-Injury

***Doron Norman, MD**; Moshe Salai, MD; Noam Emanuel, PhD*
Rambam Medical Center, Haifa, Sourasky Medical Center, Tel-Aviv, Rabin Medical Center, Petach-Tikva, Haifa, Tel Aviv, Beer Sheva, Israel

Purpose: Severe open fractures are associated with bacterial contamination that may lead to a high rate of bone infections and delayed unions. We hereby present the results of a randomized controlled study in a total of 47 patients with Gustilo III (A, B) and 4 patients with Gustilo I tibia fractures, treated with a doxycycline-eluting synthetic bone graft capable of constantly releasing the antibiotic over an extended period of 4 weeks (PLEX- DBG).

Methods: The trial included 24 patients treated with PLEX-DBG in addition to standard of care (the PLEX- DBG group) and 27 treated with standard of care (the SOC group). PLEX-DBG was inserted into the bone void during the first surgical procedure post-injury, with a 52-week follow-up period.

Results: Three cases of serious bacterial-related adverse events were recorded in the SOC group only, including 1 case of deep bone infection and 2 cases of nonunion that required additional surgery. Based on a blinded radiographic healing assessment, the percentage of patients presenting callus at 3 of 4 cortices during 24 weeks post-procedure was significantly higher in the PLEX-DBG group as compared to patients in the SOC group (88.2% vs 57.1%, respectively; $P < 0.04$). Time from surgery to bone healing, assessed by the presence of a callus in 2 out of 4 cortices during 36 and 52 weeks post-procedure, was significantly shorter in the PLEX-DBG group versus SOC (94.3 ± 11.2 vs 175.6 ± 26.2 days, $P < 0.006$ and 94.3 ± 11.2 vs 185.9 ± 26.5 days, $P < 0.003$, respectively). Time to callus formation at 3 of 4 cortices during 52 weeks post-procedure was 30% lower in the PLEX-DBG group as compared to the SOC group (123.1 ± 15.8 vs 182.5 ± 23.7 days, respectively; $P < 0.067$). Moreover, pain-free weight bearing was demonstrated in 41% of the patients in the PLEX-DBG group 12 weeks post-surgery, versus none of the patients (0%) receiving SOC alone ($P < 0.003$). The ratio between patients reporting pain-free weight bearing in PLEX-DBG versus SOC groups increased even further at 16 to 20 weeks post-surgery.

Conclusion: The implantation of PLEX-DBG in patients with severe open long bone fractures already during the first surgical intervention post-injury resulted in less bacterial-related complications, earlier bone union, and reduced pain on weight bearing. These benefits may increase the rate of return to active duty for PLEX-DBG- treated patients.