

Background: Inlay cranioplasty in children is difficult because autologous bone is limited. Cranial particulate bone graft (PBG) effectively closes defects when placed over normal dura. The purpose of this study was to determine if PBG will ossify when used for secondary cranioplasty over scarred dura.

Methods: A 17mm x 17mm critical-sized defect was made in the parietal bone of 16 rabbits. Four animals received no implant (Group I). Twelve animals had the defect recreated 16 weeks postoperatively which was managed in two ways: Group II (no implant) (n=6) and Group IV (PBG) (n=6). PBG was obtained using a brace and bit from the frontal bone. Computed tomography was performed 32 weeks following the craniectomy to determine the area of ossification and thickness of the healed graft. Eight animals previously managed with PBG over normal dura were used as an additional control (Group III).

Results: Critical-sized defects treated with PBG over scarred dura exhibited superior healing of the area (83.8%; range, 73.0-90.6%) compared to control defects over normal dura (Group I: 62.9%; range, 56.5-73.4%) or scarred dura (Group II: 56.9%; range, 40.0-68.3%) ($p=0.0004$). PBG on scarred dura had less ossification area ($p=0.002$), and thinner bone (0.95 mm, range, 0.71-1.32), compared to when it was placed over normal dura (area 99.2%; range, 96.8%-100%; thickness 1.9 mm, range, 1.1 to 3.1) ($p=0.04$).

Conclusions: PBG ossifies inlay cranial defects over scarred dura, although its efficacy is inferior compared to placement over normal dura. Clinically, PBG may be used for secondary inlay cranioplasty.

Figure legend: Histological evaluation of particulate bone grafted cranial defects. (Left) Graft ossified over normal dura shows trabecular bone osseointegrated with the adjacent lamellar cranium. (Right) Graft healed over scarred dura shows rudimentary trabeculation and osseointegration. Grafted scarred and unscarred dura both show islands of lamellar particulate graft surrounded by areas of new woven bone (hematoxylin and eosin; original magnification, x400X).

