Use of single-donor platelet glue and fibrin glue in human cranioplasty.

Authors: Burnouf T., Chen T.M., Tsai J.-C.

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Abstract:

Background: Reconstruction of post-traumatic, full-thickness calvarial bone defects is needed to provide brain protection, to restore aesthetic contours, and to correct intracranial ventricular collapse. The two most widely used materials, autogenous bone graft and methyl methacrylate, are not ideal. Much effort has been directed to the development of osteoconductive materials composed of various calcium phosphate compounds. However, as an osteoinductive agent is needed to favor bone regeneration, there is interest in the use of growth factors (GF) - rich platelet materials in this indication. Aim: Evaluate a bone graft substitute obtained by combining hydroxy-apatite/s-tricalcium phosphate (HA/s-TCP) with human platelet glue rich in growth factors. Methods: The safety and efficacy of (HA/s-TCP)-platelet glue to reconstruct post-traumatic, full-thickness, calvarial bone defects was evaluated in 6 consecutive patients (5 males and 1 female; 26-66 years). Interval between injury and reconstruction ranged from 6 months to 4 years. Equal volumes of single-donor platelet-rich-plasma and cryoprecipitate were mixed with HA/s-TCP. Twice the volume of human single-donor thrombin was then added and the mixture was gently stirred for a few seconds, quickly consolidating into a firm moldable paste. The paste was applied to the bone defect and shaped using simple finger pressure. The HA/s-TCP granules were carefully compacted to prevent the formation of dead spaces. Once the desired bone contour had been achieved, a closed suction drain was placed through a separate stab incision well behind the reconstructed site. Single-donor fibrin glue was sprayed to facilitate hemostasis, the wound was closed and a pressure dressing applied. Patients were followed for 28-48 months subsequent to surgery (mean period: 30 months).

Post-operative evaluation included serial photography, repeated physical examinations, and three-dimensional computed tomography (CT) scan performed 2 years subsequent to surgery. Results: High fibrin concentration of the platelet glue allowed easy molding and sculpting of the scaffold, providing mechanical stability and avoiding spillage of the granules into the operating field. The HA/s-TCP-human platelet glue paste demonstrated good tissue biocompatibility in all 6 patients. No infection of the surgical site or extrusion of HA/s-TCP was observed. The contour of the reconstructed calvarium was esthetically acceptable during the follow-up period. No secondary depression resulting from resorption of the HA/s-TCP was noted. There was no visible thinning of the overlying skin or sharp edges at the HA/s-TCP host bone interface. Three dimensional CT scans taken 2 years subsequent to reconstruction revealed good reconstruction of the bone defect in all six patients. Visual inspection of the reconstructed calvarium 2 years after surgery in one patient evidenced conversion of the scaffold into solid new bone. Section of the biopsy demonstrated new bone formation at the expense of the scaffold. Conclusion: Combining an osteoconductive scaffold with single-donor growth factor-rich platelet glue offers an interesting alternative to autogenous bone graft or methyl methacrylate for post-traumatic calvarium bone defect reconstruction.