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Three-dimensional virtual bone bank system for selecting massive bone allograft in orthopaedic oncology

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Background: Although structural bone allografts have been used for years to treat large defects caused by tumour or trauma, selecting the most appropriate allograft is still challenging. **Purposes:** The purposes of this study were to: (1) describe the establishment of a visual bone bank system and workflow of allograft selection, and (2) show mid-term follow-up results of patients after allograft implantation. **Methods:** Allografts were scanned and stored in Digital Imaging and Communications in Medicine (DICOM) files. Then, image segmentation was conducted and 3D model reconstructed to establish a visual bone bank system. Based on the volume registration method, allografts were selected after a careful matching process. From November 2010 to June 2013, with the help of the Computer-assisted Orthopaedic Surgery (CAOS) navigation system, the allografts were implanted in 14 patients to fill defects after tumour resection. **Results:** By combining the virtual bone bank and CAOS, selection time was reduced and matching accuracy was increased. After 27.5 months of follow-up, the mean Musculoskeletal Tumor Society (MSTS) 93 functional score was 25.7 ± 1.1 points. Except for two patients with pulmonary metastases, 12 patients were alive without evidence of disease at the time this report was written. **Conclusions:** The virtual bone bank system was helpful for allograft selection, tumour excision and bone reconstruction, thereby improving the safety and effectiveness of limb-salvage surgery.