

Autogenous Bone is Still the Gold Standard of Graft Materials in 2022

I read with interest the recent editorial entitled “Is Autogenous Bone Grafting Still the “Gold Standard” in Oral Bone Grafting?”.¹ As the authors pointed out, I wrote a similar editorial in 2010 and concluded that indeed autogenous bone was the gold standard of graft materials.² However, the authors have challenged my conclusion. To support their opinion, they referenced two publications on sinus bone grafting evaluating histomorphometric results and implant survival.^{3,4} They claimed these studies found that “bone substitutes either performed in a like manner or superior to autogenous bone alone”. However, the histomorphometric analysis showed autogenous bone resulted in the highest amount of new bone formation compared to bone substitutes, but bone substitutes seem to be a good alternative.³ The systematic review on sinus bone grafting concluded implant survival rates using bone substitutes were as effective as autogenous bone when used alone or in combination with autogenous bone.⁴ Although the implant survival was lower with 100% autogenous bone (87.7%) compared to autograft with bone substitutes (94.9%) or bone substitutes alone (96%), the data clearly shows that the majority of machined implants were placed in sinuses grafted with autogenous bone. The review found rough surface implants had superior survival rates compared to machined implants (96% vs. 85.6%), so this explains the lower implant survival rate in autogenous grafts. Pjetursson et al⁵ performed a systematic review evaluated the grafting of pneumatized sinuses that had 6.0 mm or less residual bone height. Focusing on outcomes using only rough surface implants they found high implant survival rates for all types of grafts (> 96%). However, rough implants placed in particulate autogenous bone had a significantly higher estimated three-year survival (99.8%). There are limitations in using a secondary outcome measure, such as implant survival, to evaluate graft success. The assumption is that if the implant survived the graft was successful. The influence of the amount of native bone supporting the implant is unknown in some studies unless the residual bone limit was defined, such as in the Pjetursson et al study.

Another important distinction is the relationship of the augmentation to the osseous defect. Bone defects inside the bony contour, such as sockets and the maxillary sinus floor, are much easier and predictable to reconstruct than horizontal and vertical augmentation outside the bone contour. Intrabony defects have a greater number of bone walls with a higher regenerative capacity. There is also greater ease in achieving soft tissue coverage, space maintenance, graft stability and protection. As such bone substitutes perform well in treating

these types of contained defects. However, horizontal and vertical bone augmentation outside the bone contour is more biologically challenging. The greater the distance from the native bone, the more difficult it may become for vascular ingrowth, cell migration and bone formation at the outer limits of the graft. As such a graft material with greater regenerative capacity may be needed to obtain the required bone gains. Autogenous bone has superior biologic qualities compared to osteoconductive bone substitutes. It is the only bone graft material that fulfills all three aspects of the tissue engineering triad - osteogenesis, osteoinduction and osteoconduction. Autogenous bone contains osteocompetent cells and osteoconductive growth factors that can positively influence bone formation. Although cancellous bone contains a higher amount of osteoblasts and mesenchymal stem cells, cortical bone grafts contain cells that have the ability to proliferate and differentiate into the osteogenic lineage, suggesting that these cells can also contribute to bone regeneration following transplantation.⁶ Research has found cortical bone chips contain over 40 different growth factors that can modulate the cellular aspects of bone regeneration.⁷ The healing time of autogenous bone grafts also is shorter than bone substitutes.⁸

Rather than focus on implant survival, it would be more clinically relevant to evaluate horizontal and vertical bone gains produced by different graft materials. When reviewing studies measuring bone gains it becomes evident that autogenous bone is needed for larger bone augmentations and vertical gains.^{9,10,11,12} While I agree with my colleagues that bone substitutes may be used effectively in many clinical situations, I still maintain that autogenous bone is the gold standard of graft materials. This does not mean it is the first choice option, but it does offer biologic advantages unmatched by bone substitutes. The use of a local donor site and bone scrapers can decrease the morbidity of bone harvest. In addition, some donor sites for block grafting, such as the mandibular ramus, have a lower incidence of postoperative complications.¹³ Surgeons should weigh the advantages and disadvantages of each material and select an approach that has the highest likelihood of clinical success.¹⁴

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