

# Composite Grafting: What I do and Why?

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Autologous bone graft (ABG) remains the gold standard of graft materials containing the 3 important desirable properties for bone regeneration being osteoinductivity, osteoconductivity, and osteogeneity. The most common site for harvesting ABG is the iliac crest. Lately using the RIA device ABG can also be harvested from the femoral and tibial intramedullary cavity.

The limited volume availability of ABG and the depletion with aging of cancellous bone reservoir from the harvesting sites (such as the pelvis), created a gap and a clinical need for development of other graft materials possessing similar properties. Currently, substitutes of ABG includes synthetics ( $\beta$ -TCP (tricalcium phosphate) granules), allograft and xenograft.

Nonetheless, due to the fact that none of the existing bone substitutes possess similar properties to the autologous bone graft, clinicians have used the concept of 'composite grafting' to address this limitation.

Composite grafting is defined as the process where different graft materials are combined to produce a bone graft material with optimum biological based properties and adequate volume to promote an efficient, timely bone repair response.

The concept of 'composite grafting' can be used on the basis of 3 principles:

- a) Enhancement of the biological properties of the graft material
- b) Expansion of the volume of the material used
- c) Both expansion of volume and biological enhancement.

The two materials that can be used as the foundation of composite grafting include autologous graft and allograft. Other materials that can be combined with either of these two include: xenograft, synthetics, bone marrow aspirate, growth factors (bone morphogenetic properties (BMP's), platelet rich plasma (PRP) and demineralised bone matrix (DBM). There is also the option to combine autograft with allograft in cases of large bone defects.

Examples of composite grafting include the combination of allograft with bone marrow aspirate where a material with conductive properties (allograft) is enhanced with osteoprogenitor cells to improve its biological property (addition of osteogeneity to the existing conductive property), (option a).

Another example of composite grating includes the mixing of an amount of autologous graft (harvested from the pelvis or the femoral canal using the RIA

device) with a bone morphogenetic protein (BMP), allograft and/or xenograft and bone marrow aspirate to produce the necessary graft volume that is required to fill a large bone defect area. In this case the autologous bone graft volume has been increase with expanders (allograft and or xenograft, an inductive molecule (BMP) and a cellular therapy. In this scenario this 'composite graft' material (option c) has been provided with all the essential requirements for bone repair and as such it can be characterised as having an optimum biological potency for regeneration.

The ideal ratio between autograft (RIA graft) with any of the above options continues to be a matter of debate. In our experience the ratio we usually aim is at least 70% autograft and 30% the volume expander. <sup>1</sup>This ratio has been reported to be associated with successful results. <sup>2</sup>

Overall a number of studies that have utilized the above composite graft principles have reported good outcomes.<sup>3-6</sup>This strategy of composite grafting is also believed to be the main contributing factor to the high rates of graft consolidation seen in the series published by Giannoudis et al applying the masquelet technique. <sup>2</sup>

## References

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