A revolution in bone grafting

Bone replacement techniques have been confronted with an unlimited amount of challenges, but the use of revolutionary bioactive products has been shown to prevent future concerns.

Company Profile

Vivoxid Ltd develops, manufactures and markets new-generation biomaterial products and production services within the medical device sector. Vivoxid markets its MetAlive soft tissue attachment technology for implant surfaces, BonAlive bioactive glass bone filler for orthopaedic and cranio-maxillofacial surgery and FiberLive biodegradable fibreglass composites for load-bearing biodegradeable implants. The Vivoxid quality system is certified by Danish Medical Devices Certification (DGM) to meet the requirements of ISO 9001:2000 and ISO 13485:2003. Vivoxid also follows FDA QSR (21 CFR Part 820).

Further Information

Website: www.vivoxid.com

The practice of bone grafting is well over 100 years old, the first successful graft having been performed in the 1870s. Today, bone is one of the most frequently transplanted tissues, with hundreds of thousands of surgical cases each year in the US alone. The most common method is autogenous bone grafting – using the patient's own bone – but this is not without drawbacks.

Now, however, advances in materials sciences mean that alloplastic techniques are increasingly common, where bioactive glass products, such as those produced by Finnish medical technology company Vivoxid, are used for grafting.

Bioactive benefits

Nina C Lindfors, MD, PhD, MSc, is an orthopaedic surgeon and teacher in orthopaedic and hand surgery at Helsinki University and Helsinki Central University Hospital. With a degree in chemical engineering, a doctoral thesis on bioactive glass and extensive clinical experience, Lindfors is well placed to attest to the benefits of the use of bioactive products such as Vivoxid's BonAlive™ – a synthetic bioactive resorbable bone graft substitute.

Lindfors has first-hand experience of BonAlive, having used the product in research (animal and in vitro) since 1995, and clinically in cavitary bone defects in the hand since 2006.

She explains the mechanism by which it works. 'When [BonAlive] is implanted in bone, a rapid reaction starts at the surface of the glass, eventually forming an Si-rich layer, on top of which a hydroxyapatite (HA) layer is then formed. This HA layer will chemically bind to bone,' she explains. 'Bone grows around the glass granules – the glass is osteoconductive, with osteopromoting properties. Eventually, over a number of years, depending on the amount of glass implanted and the size of the glass granules used, the granules will dissolve and the filled region will be replaced by new bone.'

Grafting issues

While the use of autograft bone has been the golden standard in reconstruction surgery if bone substitutes are needed, it is not without problems.

'To obtain autograft bone, which is usually taken from the iliac crest, a second operation is needed,' says Lindfors. 'The second operation causes significant postoperative pain, sometimes for years. Furthermore, haematomas, peripheral nerve injury, infections and pelvic instability have been reported. Also, the second operation prolongs the total operation time, which is associated with a higher risk for postoperative infection.

'In children the use of autograft bone can be limited because of the amount of bone available, and the second operation may also disturb the growth of the iliac crest.'

Equally, the use of allografts, bone tissue not from the patient but usually from donors via a bone bank, is also fraught with challenges. Allografts are associated with issues such as a marked immune response, poor or no union between graft and recipient bone, fractures and infection.

Why choose bone substitutes?

Many complications, those associated with autograft and allografts, can be avoided using bone substitutes. There are other surgical advantages, too, says Lindfors, who notes BonAlive's usefulness in a number of areas, including in children and adults for treating benign bone tumours, especially aneurysmal bone cysts; and in all kinds of orthopaedic bone defects where the glass will not be in a high load-bearing location or inside a joint.

'In children, a bone defect in the hand can be remodelled to normal size during growth, even though it is filled with BonAlive,' adds Lindfors. 'Very promising clinical results have been seen in using BonAlive to treat osteomyelitis. The documented bacterial growth inhibiting properties of BonAlive in combination with these results clearly differentiates BonAlive and gives an extraordinary benefit compared to other bone substitutes.'

It seems that after 130 years, during which bone grafting has become a commonplace practice, bioactive materials such as Vivoxid's BonAlive herald a new revolution in grafting techniques; to the benefit of the hundreds of thousands of patients yearly needing this kind of treatment. ●