

Inion OTPS™ Mesh for Reconstruction of the Iliac Crest

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Introduction

Bone grafts are used in a variety of orthopaedic procedures; they provide support to the skeleton and stimulate healing of the surrounding bone. Perhaps the most frequent application is spinal fusion therapy, however, bone grafts can also be used:

- To fill a bone defect in a poorly healed fracture
- To replace bone lost to tumour surgery
- In dental surgery
- In plastic surgery

Two types of bone graft are commonly used, allografts and autografts. Allografts require the donation of bone, which usually comes from bone banks that harvest from cadavers. This technique is not ideal as, despite disinfection, there is concern regarding disease transmission, as well as a lower histocompatibility and the possibility that the donor bone is weaker than the recipient's own.

Bone autografts are the preferred method of grafting (Hsu et al. 1995), where bone is harvested from the recipient's own body. This type of graft is the safest technique, due to low risk of infection, whereas a study undertaken by Lord et al. (1988) showed that of 283 patients who received allograft bone donation, 11.7% of them developed an infection. Autografts are therefore a viable alternative to avoid the risk of infection (Samartzis et al. 2005). They are also favoured as they confer the lowest possibility of rejection of the new tissue and have been shown to fuse better (Bishop et al. 1996) and faster (Kao et al. 2005) than allografts. Unfortunately the autograft procedure means the patient will have to undergo additional surgery to harvest the bone, which can cause increased pain and discomfort for the patient. Problems can occur at the bone harvest site (frequently the iliac crest) including chronic pain, hernia and cosmetic deformity (North American Spine Society, 2002).

Due to the problems arising from the removal of bone from the iliac crest, suggestions have been made that alternative graft sites should be used when possible e.g. where less bone is needed at the graft site. These alternative sites include:

- Rib
- Cranium
- Fibula

- Tibia
- Mandible
- Scapula
- Radial forearm

(Disa and Cordeiro 2000, Hsu et al. 1995, Schwartz-Arad and Dori 2002, Canady et al. 1993)

However, in many cases, the use of iliac crest bone is preferred and so every effort must be made to ensure the best results from the procedure and that patients undergoing this procedure should experience as little discomfort as possible. Complications arising at the iliac crest harvest site can be avoided or reduced by the use of form-retaining mesh (Taylor et al. 2001, Wang et al. 2002).

The Iliac Crest

The iliac crest is the most frequently used bone graft reserve as it has a large quantity of cortical and cancellous bone; and is easy to harvest. It allows the formation of various shapes and sizes and is an ideal graft for anterior interbody fusion of the cervical, thoracic or lumbosacral spine (Hsu et al. 1995).

Despite the iliac crest being an ideal site for bone graft harvest it is not without disadvantages. Complications can arise at bone graft donor sites and Younger and Chapman (1989) found that of 239 cases, major complications arose in 8.6% and minor complications occurred in 20.6% of patients.

Complications can include:

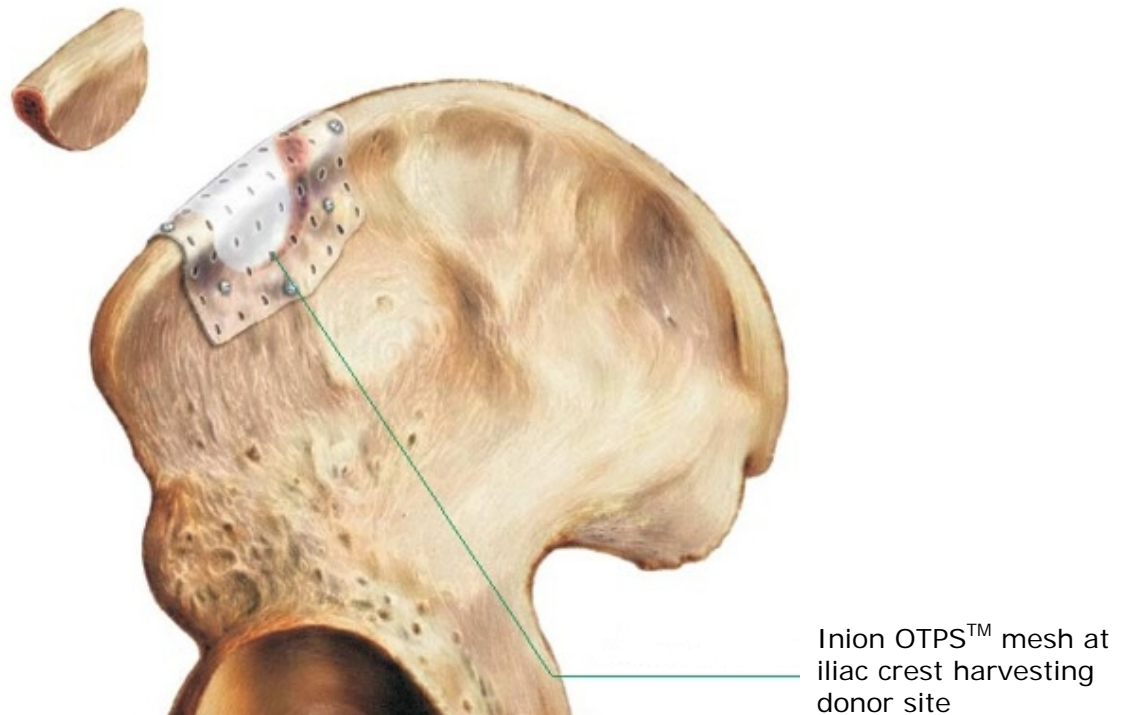
- Weakened bone – instability of pelvis
- Hernia
- Haematoma
- Post operative morbidity
- Severe pain and discomfort
- Cosmetic deformity
- Fracture
- Heterotopic bone formation
- Infection
- Ambulation difficulty
- Nerve injury
- Paralysis

(Hsu et al. 1995, Canady et al. 1993, Silber et al. 2003)

Of these complaints, many may be resolved by reconstruction of the iliac crest graft site (Taylor et al. 2001, Wang et al. 2002).

Inion OTPS™ Mesh System

The Inion OTPS™ Mesh System is designed as a protective barrier for regeneration of a bone graft harvest site. The system comprises biodegradable meshes and fixation screws indicated, not only for repair of the iliac crest, but also as a containment system for grafts, for cement restriction in joint reconstruction and for the treatment of comminuted fractures in combination with rigid fixation.



The biodegradable meshes and screws are made from a blend of specially designed polymers from the Inion OPTIMA™ library, specifically L lactide, D lactide and Tri-Methylene Carbonate (TMC). The polymers are degraded *in vivo* by hydrolysis and are metabolised by the body into carbon dioxide and water. The Inion OTPS™ Mesh gradually loses its strength from 18-36 weeks and biodegrades thereafter within 2 to 4 years.

The blend of polymers in Inion OTPS™ Mesh produces a material high in malleability and toughness. The mesh can be cut to the desired shape and moulded and remoulded easily. After activation in the Inion Thermo+™ water bath it becomes completely malleable enabling it to conform to virtually any contours, ideal for use on the iliac crest. The mesh can be reactivated for further adaptation if required.

Benefits of Inion OTPS™ Mesh System

Many of the complications associated with iliac crest graft harvest could be avoided by using the Inion OTPS™ Mesh System. For example, chronic donor site pain was reported in 25% of 290 bone graft patients by Summers and Eisenstein (1989) and protection of the donor site may help relieve some of this pain. Taylor et al. (2001) states that reconstruction of the iliac crest causes the patient to experience pain for an average of 18 days, compared with 64 days for the non-reconstructed patients.

Other problems directly associated with the donor site, which may benefit from the reconstruction of the area and subsequent regeneration of bone at the harvest site include herniation, cosmetic deformities and pelvic instability.

Cornwall et al. (2002) describe how the use of a biodegradable sheet in iliac crest reconstruction results in 25.9% of the harvest site filled with new bone, compared with only 10.7% without the mesh system, after six months, decreasing weakness of the pelvis and risk of subsequent fracture.

The reconstruction of the harvest site also increases satisfaction with post-operative appearance. The use of mesh to repair the iliac crest completely eliminates the appearance of depression in the hip, which can be especially prominent in thin patients (Wang et al. 2002).

Herniation is a fairly rare complication of bone removal from the iliac crest, occurring in up to 5% of cases (Seiler et al. 2000). However, the reconstruction of the iliac wall prevents the occurrence of hernias (Wang et al. 2002).

The production of a custom-made titanium plate to prevent herniation at the iliac crest has been described (Halsnad et al. 2004). However the use of a metal mesh has disadvantages over the use of biodegradable implants:

- Hard to contour and cut
- Sharp edges risk injury to surgeon and soft tissues
- Difficult to remove if additional bone graft harvesting required
- Imaging interference, e.g. X-ray, CT, MRI

Conclusion

The Inion OTPS[™] Mesh System is a very easy and effective method for protecting and reconstructing the iliac crest after bone harvesting. In the past, complications have resulted from harvesting bone from this area. However, these can be avoided by the application of biodegradable mesh.

Use of biodegradable mesh results in the patient experiencing far less discomfort than they would without the reconstructive procedure. Biodegradable mesh has been seen to greatly reduce chronic pain and weakness of the pelvis and can eliminate the appearance of hernias and cosmetic deformities completely.

Inion OTPS[™] Mesh has been designed for ease-of-use by surgeons and it is this particular feature that confers a large advantage over the use of metal for this procedure. The material from which the Inion OTPS[™] Mesh is made ensures the implant has appropriate strength whilst retaining high malleability. Therefore, the mesh is quickly and easily moulded to fit the contours of the iliac crest.

Summary of benefits:

- Easily moulded and cut to shape
- No sharp edges; reducing risk of damage to tissues or injury to surgeon
- Biodegrades; beneficial if additional bone harvesting required
- Reduced post operative complications, such as pain and cosmetic deformity
- No imaging interference
- No removal operation
- Reduced potential for cross-infection as the mesh is supplied sterile

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