Cotton and Evans Allograft Wedges

Optimized Strength and Texturing for Deformity Correction

A study demonstrating the benefits of engineered contiguous etched lines on **SymALIGN** Evans and Cotton osteotomy wedges.

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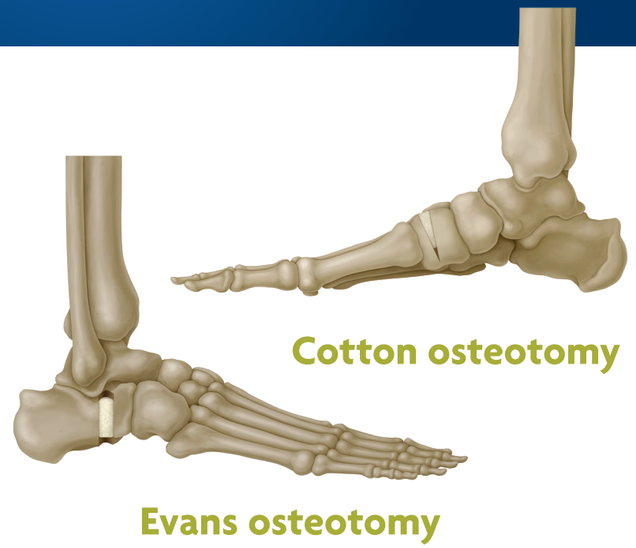
Investigating the potential to reduce Cotton and Evans graft displacement.

Pes Planus (Flatfoot) is a common deformity of the foot. To correct, the following procedures are used:

- An Evans calcaneal osteotomy is a lateral column-lengthening procedure aimed at preserving the calcaneocuboid joint. This occurs by using a laterally based opening wedge osteotomy to provide multi-planar correction
- A Cotton osteotomy is a medial cuneiform dorsal opening wedge osteotomy used to correct the forefoot varus deformity associated with pes planovalgus foot deformity. This procedure increases medial arch height while preserving the medial column joints

Subsidence and graft displacement is a particular concern due to the potential difficulty in repairing a displaced graft[1-3]



Preparation

This study compared the forces needed to displace Evans osteotomy wedges with four different surface textures from a cancellous bone substitute test site. The surface textures consisted of a no-textured control, a three-groove pattern, a Z-pattern, a contiguous groove pattern. Non-textured Evans wedges served as control samples, while experimental grafts were created with computer numeric control programs for the geometry and surface texture noted in each of the four groups (Figure 1).

- The graft size tested was chosen because it has the highest degree of slope, which represents the minimum condition for static friction among the product line
- All samples were processed using LifeNet Health's patented Allowash XG® sterilization and Preservon® preservation technologies

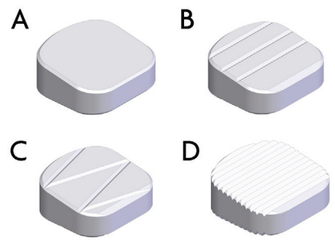


Figure 1. Surface Texture Types.
A) Type 1 = blank cancellous control;
B) Type 2 = 3 parallel etched lines;
C) Type 3 = Zigzag etched lines; and
D) Type 4 = Contiguous etched lines.

Test Methods

- Instron mechanical tester with a 5000 Newton load cell
- A calibrated air pressure regulator applied a preload of 27N to achieve sensitivity to the frictional forces. A load was applied tangential to the specimen/jaw interface by the mechanical tester at a rate of 0.4 mm per second (Figure 2). The test terminated after the specimen had been displaced 3 mm. Peak force was recorded for each test

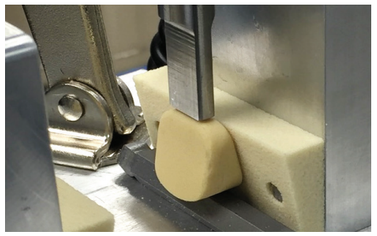


Figure 2. Instron mechanical tester setup with Sawbones and DPS-Evans-1812 Evans Osteotomy Wedge.
This image depicts the Instron with the jaws apart to show the graft in place. The hex wrench is removed once the jaws are closed.

Results

Resists Migration

Almost 135N more force was needed to move the wedge with contiguous lines (Type 4) compared to the non-textured control wedge (Type 1).[4]

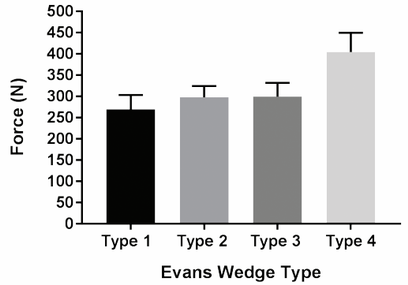


Figure 3. The average force to displace each wedge type.
Type 4 outperformed all other designs.

Increases Friction

Results show that despite the grafts being the same size, increasing the surface area from 260 mm^2 on the non-textured control to 564 mm^2 on Type 4 increased the force needed for displacement by nearly 50 percent (Figure 4).[4]

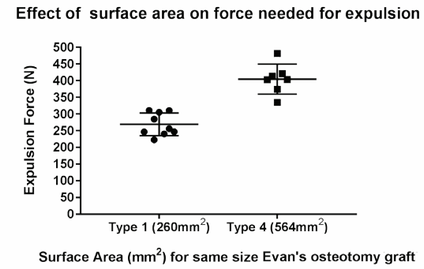


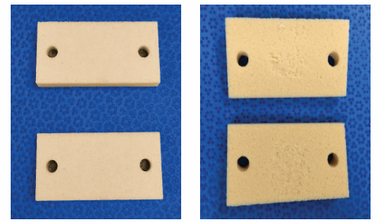
Figure 4. The effect of surface area on expulsion force for Types 1 and 4.

Biomechanical Strength

Tissue is sourced from the femoral head and condyles, talus and calcaneus – areas where trabecular structure matches those of cancellous implant sites. Results show that SymAlign wedges have the biomechanical strength necessary to support Evans and Cotton osteotomies with average yield loads of 1726N and 1964N.[4]

Increases Surface Area

Although these grafts are the same size, the increase in surface area created by the grooves on Type 4 increase friction between the graft and the Sawbones cancellous bone substitute, which increases the force required to displace the graft.[4]



Type 1, 260 mm^2 **Type 4, 564 mm^2**

Study Conclusions

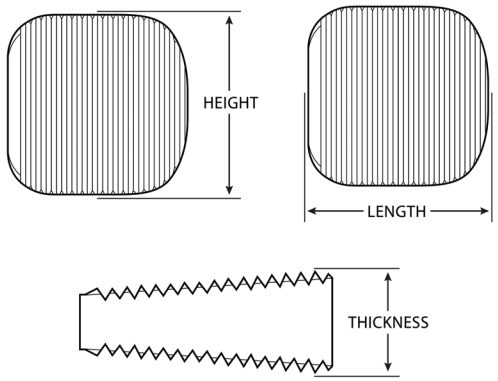
The biomechanical properties, engineered design, and convenient ready-to-use features make LifeNet Health's Evans and Cotton osteotomy wedges an excellent option for treating Pes Planus deformities.

SymALIGN™ Allograft Wedge System

Implant Size Offerings

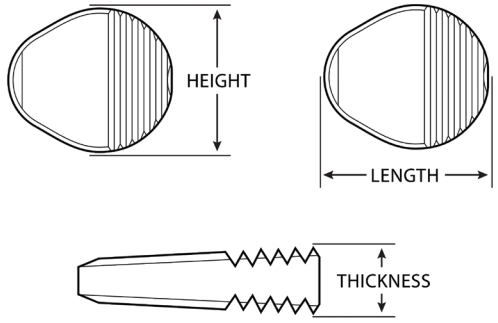
Product Code	Height (mm)	Thickness (mm)	Length (mm)
FA-EVN-1808	18	8	18
FA-EVN-1810	18	10	18
FA-EVN-1812	18	12	18
FA-EVN-2008	20	8	20
FA-EVN-2010	20	10	20
FA-EVN-2012	20	12	20
FA-EVN-2208	22	8	22
FA-EVN-2210	22	10	22
FA-EVN-2212	22	12	22

Evans



Product Code	Height (mm)	Thickness (mm)	Length (mm)
FA-CTN-1604	14	4.5	16
FA-CTN-1605	14	5.5	16
FA-CTN-1606	14	6.5	16
FA-CTN-2004	14	4.5	20
FA-CTN-2005	14	5.5	20
FA-CTN-2006	14	6.5	20

Cotton



References

1. Haeseker, G.A., M.A. Mureau, and F.W. Faber, Lateral column lengthening for acquired adult flatfoot deformity caused by posterior tibial tendon dysfunction stage II: a retrospective comparison of calcaneus osteotomy with calcaneocuboid distraction arthrodesis. J Foot Ankle Surg, 2010. 49(4): p. 380-4.
2. Prissel, M.A. and T.S. Roukis, Incidence of nonunion of the unfixated, isolated evans calcaneal osteotomy: a systematic review. J Foot Ankle Surg, 2012. 51(3): p. 323-5.
3. Zwipp, H. and S. Rammelt, [Modified Evans osteotomy for the operative treatment of acquired pes planovalgus]. Oper Orthop Traumatol, 2006. 18(2): p. 182-97.
4. Data on file LifeNet Health, 68-20-198
5. Data on file LifeNet Health, ES-18-031

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