Reconstruction of many adult deformities requires the use of osteotomies and realignment arthrodeses. Interpositional lengthening of a bone or joint is often necessary to achieve the desired position. Examples include the acquired flatfoot deformity where lengthening of the lateral or plantarflexion of the medial column is needed in the moderate to severe forms. Traumatic deformities with loss of calcaneal height or failed ankle arthroplasty are also situations where large defects may necessitate structural grafts.

Autograft has been largely replaced by allograft for these structural defects, given the reduced morbidity and operative time, as well as fairly equivocal results (percent and time to union).2

Multiple types of metals have been used as a substitute for structural bone grafts and more recently these metal implants have been validated as a reasonable substitute in adult foot reconstruction.1 Their porosity is osteoconductive and allows for integration of bone. Ideal porosity is considered to be 50-400 µm (Bobyn, 1980), with orthopaedic applications in a range of 400-600 µm.

Cancellous titanium is one such metal, constructed of commercially pure titanium and which has a 60-70% fully porous construct with an average pore size of 530 microns. The compressive strength and modulus is similar to tantalum with a slightly higher coefficient of friction. It has a validated efficacy like tantalum with extensive animal and mechanical testing.

The metal has a compressive strength between that of cortical and cancellous bone, with a compressive modulus similar to cancellous bone. It's high friction coefficient and abrasive quality provides for inherent stability.

Porous titanium wedges (Biofoam, Wright Medical) have been reported successful in lateral column lengthening of the calcaneus (Evans procedure) and for cuneiform osteotomies (Cotton procedure). Prefabricated sterile wedges in commonly used sizes are commercially available, with trials and multiple sizes (footprints, widths). These “off-the-shelf” devices eliminate the need for harvesting autograft, intraoperative configuration and the concern for an immune response to allografts. In addition, cancellous bone graft and/or biologics (BMP, PRP, stem cells) can be added to the metal composite to potentially enhance ingrowth.

In a recent retrospective study (Garrels et al ‘11)³, 26 patients diagnosed with PTTD and stage 2 flatfoot deformities received a titanium metal wedge for lateral column lengthening of the calcaneus. 19/26 underwent a CT at a follow-up averaging 21.5 months (6-31mo). The average age was 56.6 years, with 9 males and 11 females. Additional bone graft was used in 5 patients (3 autograft, 2 allograft). Supplemental fixation was used in 5 patients. CT scans showed that all had some degree of bony ingrowth. The presence of partial versus solid ingrowth was not significant with respect to secondary measures. The cost incurred for the use of the metal wedge was found to be similar to allograft. In addition, total operative time was reduced for the pre-made metal wedges when compared to both allograft and autograft cases. There were two cases with loss of position and/or deformity correction, both requiring revision.

Porous titanium implants may be a good alternative to structural allograft or autograft for foot and ankle reconstruction. These prefabricated metal wedges allow for bony ingrowth and are able to provide lasting structural support. Further studies with larger numbers are needed for a direct comparison to autograft and allograft, based both on cost and outcome.
References:

