# Modified Masquelet Technique in the Treatment of Large Bone Defects

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## Statement of Purpose

Large bone defects (LBD) present a challenge to the limb preservation surgeon regardless of its etiology. Several techniques have been published in the literature that help guide the management of these defects. Three commonly reported techniques include free bone transfer, Illizarov bone transfer method, and Masquelet's membrance induced technique. This case series highlights our modified Masquelet Technique, in reconstruction of large bone defects regardless of the etiology. The following case series includes modifications to the traditional Masquelet technique for bone defects.

## Literature Review

The Masquelet technique is a staged reconstruction of large bone defects. It was developed by Alain C. Masquelet in the early 2000's, and has been recorded as used in defects up to 15cm.[1-3] The two-stage procedure begins with an initial stage of debridement of non-viable bone, and placement of a polymethylmethacrylate(PMMA) spacer impregnated with antibiotics. The PMMA spacer is stabilized by various fixation options including; external fixation, intramedullary rod, or plates. The second stage is performed six to twelve weeks later, where the PMMA spacer is removed from an infection-free site and a bone graft is loosely packed to bridge the deficit.[3-6] A biomembrane forms around the PMMA spacers, which is then used as a pocket in which autologous, cancellous bone grafts can be placed.

A review of the literature shows the Induced Membrane technique has been used for a variety of cases, including gout of the 1st MPJ, acute tibial bone loss, osteomyelitis of the hand and posttraumatic bone loss of the forearm.[7-10] Huang et al. achieved good results in the use of the Masquelet technique in treating metatarsal defects from 3-6cm in the treatment of gout of the 1st MPJ.[7] The following case series includes modifications to the traditional Masquelet technique for bone defects

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The authors declared no potential conflicts of interest with respect to the research and/or authorship of this poster

## Case Series

| Deformity | Bone Defect Size | Time to Healing |
|---|---|---|
| Patient A: 56 y/o diabetic male with LLD and ulceration following talectomy, TC fusion for ankle Charcot and ankle varus (JP) | 3.2 cm | 28 weeks |
| Patient B: 69 year old femaleLLD following talectomy, TC fusion after osteomyelitis s/p calcaneal fx, LLD (AM) | 2.89cm | 25 weeks |
| Patient C: 67 y/o female w/ hx of Talar avn sequelae after failed tibiotalar arthrodesis | 1.71cm | 32 weeks |

- **Stage One:** Tibial osteotomy or corticotomy; debridement of bone; percutaneous application of bone graft and spacer; application of multiplanar, computerized external fixator.
  - Patient #3 underwent additional Talectomy with Tibial lengthening.
- **Stage Two**(6-8 weeks)**:** Preservation of bio-membrane; application of bone marrow aspirate (BMA) and cancellous allograft; transition to dynamization rods.
- **Stage Three**(12-14 weeks)**:** Final application of BMA and PRP. Removal of external fixator.

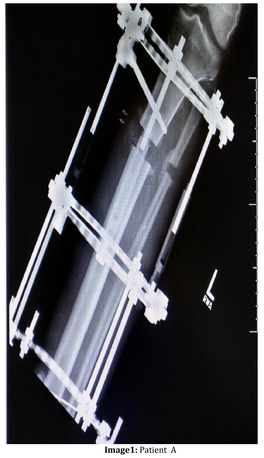

**Image1:** Patient A

**Image2:** Patient A Final X-ray

**Image 3:** Patient B

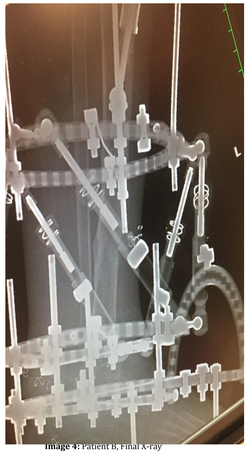

**Image 4:** Patient B, Final X-ray

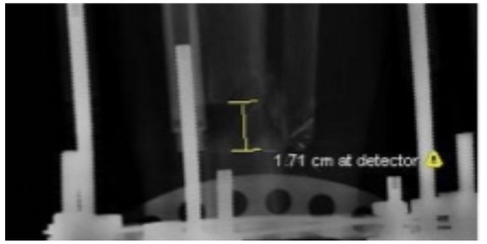


**Image 5: Patient C**

**Image 6:** Patient C Final X-ray

## Analysis & Discussion

Reconstruction of bone defects can be both challenging and complex to the limb salvage surgeon. This is especially true in patients with co-morbidities as well as soft tissue compromise. Our modified technique has a few obvious benefits. The minimal incision negates the need for a large polymethacrylate spacer, and allows for percutaneous application of BMA and bone graft. It should be noted, that bone graft substitutes can be used in place of autologous bone grafts to eliminate the risk of donor site morbidity. Traditionally, autologous cancellous bone was used over allografts due to the lack of growth factors and stem cells in allografts.[11] However, due to new techniques growth factors and osteoinductive factors can now be added. The use of cancellous allograft with bone marrow aspirate application instead of cancellous autografts decreases donor site morbidity. The percutaneous application of bone marrow aspirate with PRP to the bone matrix provides osteogenic stimulus that the allograft lacks. Although bone marrow aspirate does contain red blood cells that can interfere with bone healing, the application of PRP with the BMA provides concentrated growth factor such as BMP-2, TGF-B, b-FGF, VEGF, and PDGF that aid in cell proliferation and differentiation.[12,13] The classic Ilizarov corticotomies, application of DBM and BMA is especially crucial in the traumatized limb.

Secondly, the use of multiplanar external fixation allows for stabilization with protected weightbearing until healing is noted. Internal fixation can be added once healing is noted to create a "superconstruct".[14] In our three cases internal fixation was used in one case as the soft tissue quality was poor in the other two. The method highlighted above gives clinicians further tools in their armamentarium for managing

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