The Percutaneous Clamshell Osteotomy: A Novel Minimally Invasive Technique to Correct Complex Diaphyseal Malunions

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Purpose: The traditional clamshell osteotomy is contraindicated in patients with a poor soft-tissue envelope that precludes an open, extensile exposure of the malunited diaphyseal segment. We have developed a percutaneous technique for the clamshell osteotomy that preserves the soft-tissue envelope by using minimally invasive incisions to perform the transverse and longitudinal osteotomies.

Methods: Six patients with complex diaphyseal malunions (2 femurs, 4 tibias) underwent a percutaneous clamshell osteotomy. A drill bit was used to create a path of bicortical holes along the long axis of the malunited segment through percutaneous incisions. A mini-open approach was made over either the proximal or distal extent of the malunion and a Gigli saw was used to complete the first transverse osteotomy. An intramedullary bone saw was then introduced through the open osteotomy site and advanced to perform the second transverse osteotomy. An osteotome was used through the mini-open approach to complete and wedge open the longitudinal osteotomy. The proximal and distal segments were then aligned using an intramedullary nail.

Results: Five patients had at least 6-week follow-up (mean 150 days; range, 17-396 days). Angular correction was achieved in each case, ranging from 0° to 50° in the coronal plane and 5° to 24° in the sagittal plane. Three patients had at least 60-day follow-up and all went on to achieve radiographic healing of the osteotomy sites, although 1 patient had delayed healing. There were no wound complications.

Conclusion: The percutaneous clamshell osteotomy provides a minimally invasive way to correct complex diaphyseal malunions, even in patients with a poor soft-tissue envelope that may not be amenable to a traditional open osteotomy.