

# Handheld Osteotomes Facilitate Arthroscopic Treatment of Elbow Valgus Extension Overload



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**Abstract:** Arthroscopic elbow surgery can be difficult due to the highly congruent nature of the joint and the surrounding neurovascular and ligamentous structures at risk. In a patient with valgus extension overload, posterior medial olecranon osteophytes must be removed safely to restore range of motion and alleviate pain. Arthroscopic burrs and shavers create significant debris, therefore limiting visualization, and their use has inherent risks to the surrounding structures that need to be preserved. Small, handheld osteotomes can facilitate the safe and efficient removal of these posterior medial osteophytes while preserving normal bone and articular cartilage.

Valgus extension overload is a common source of elbow pain in overhead athletes. A study of professional pitchers found that posterior medial olecranon osteophytes were present in 65% who underwent either open or arthroscopic surgery.<sup>1</sup> The throwing motion can expose the elbow to a valgus force of up to 65 Nm and cause the pathologic triad of medial tension, lateral compression, and posterior extension shear (Fig 1).<sup>2,3</sup> During the deceleration and follow-through phases of throwing, the elbow undergoes terminal extension and the olecranon may come into contact with the posterior medial trochlea. This repetitive stress and microtrauma causes osteophyte formation on the olecranon and clinically presents as posterior-medial impingement with loss of extension, decreased pitch velocity and accuracy, and pain.<sup>3</sup>

When nonoperative treatment is unsuccessful, surgical resection of osteophytes is indicated to relieve pain and restore motion. Over the last few decades,

arthroscopic techniques have become more popular and have high success rates and return to play in athletes.<sup>1,3,4</sup> Due to the highly congruent nature of the elbow joint and limited intra-articular volume, removal of the olecranon osteophytes can be challenging when using arthroscopic burrs and shavers.<sup>5</sup> Elbow arthroscopy poses inherent risks to surrounding neurovascular structures, with the ulnar nerve being the most vulnerable; however, the incidence is still quite rare.<sup>6</sup> Furthermore, over-resection may cause valgus instability and strain on the ulnar collateral ligament (UCL); however, the ideal amount of resection is still unknown.<sup>1</sup>

Small, handheld osteotomes have been used extensively by the senior author (L.D.F.), and a previous technique was described for their use in arthritic elbows. The osteotomes provide increase control and allow for safe and efficient removal of only pathologic osteophytes.<sup>5</sup> This paper describes the surgical technique for arthroscopic removal of olecranon osteophytes in valgus extension overload using handheld osteotomes.

## Surgical Technique

After induction of anesthesia, the patient is positioned prone on the operating table with the extremity draped over an arm holder to allow access to the elbow. A nonsterile tourniquet is applied to the upper arm and the arm is prepped and draped. The portal sites are identified by palpating bony landmarks and the ulnar nerve is marked throughout its course behind the medial epicondyle. The elbow is loaded with 30 mL of normal saline through the soft spot (Fig 2) and then anterolateral and anteromedial portal sites are

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The authors report the following potential conflict of interest or source of funding: L.D.F. reports consulting income from Smith & Nephew and research and educational support from Arthrex, Mitek, and Smith & Nephew. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

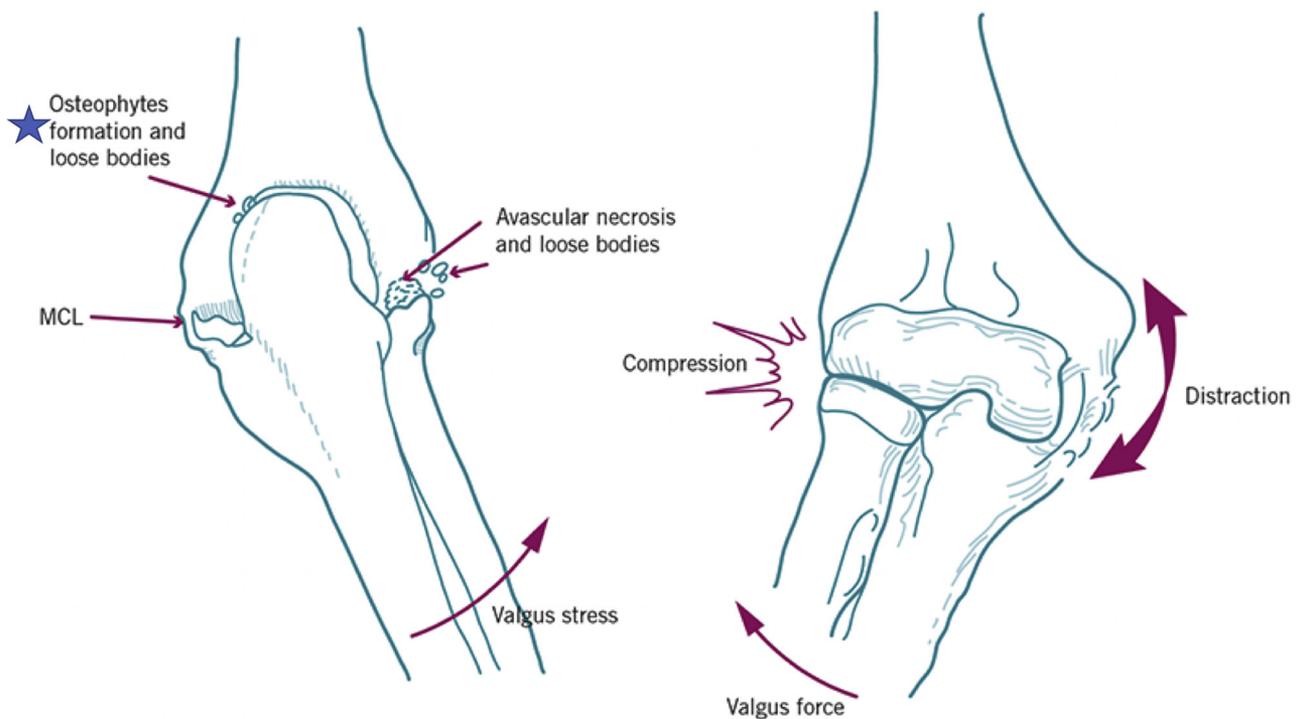
Received September 9, 2019; accepted November 17, 2019.

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2212-6287/191118

<https://doi.org/10.1016/j.eats.2019.11.004>



**Fig 1.** During the throwing motion, significant forces are seen throughout the elbow that include medial-sided tension, lateral-sided compression, and posterior olecranon fossa shearing. Valgus extension overload syndrome occurs secondary to this repetitive microtrauma in the posterior compartment and leads to posteromedial olecranon osteophyte (bone spur) formation as seen on the left side of the figure labeled with the star. These osteophytes then limit terminal extension and cause pain with range of motion.

established. We prefer to use slightly more proximal portals to avoid iatrogenic nerve injury. The anterolateral portal site is approximately 2 cm proximal and 1 cm anterior to the lateral epicondyle. The anteromedial portal is established anterior to the intermuscular septum approximately 2 cm proximal from the medial epicondyle (Fig 3). When possible, inside-out portal placement for the proximal anteromedial portal is used, as shown in Figure 4. Diagnostic arthroscopy is performed and then the posterior compartment is entered.

A standard posterior lateral portal is established approximately 2 to 3 cm proximal to the olecranon and just lateral to the triceps, and the camera is inserted into the olecranon fossa. An 18-gauge spinal needle is used to create a direct posterior portal 3 cm proximal to the olecranon tip in the central aspect of the tendon using a triceps splitting approach. After evaluation of the posterior compartment and the extent of the osteophytes, sequential removal is employed using small, handheld osteotomes (Symmetry Surgical, Antioch, TN; and Zimmer Biomet, Warsaw, IN) (Fig 5) inserted through the direct posterior working portal with or without the use of a cannula (Fig 6A). The osteotomes facilitate

removal of only pathologic osteophytes (Fig 6B) until normal anatomy is restored (Fig 7). This technique is shown in Video 1. A preoperative computed tomography scan can be very useful to help determine the amount of resection needed, as over-resection can lead to late valgus instability (Fig 8). The fragments are then removed from the joint using any standard arthroscopic grasper device. Depending on the size of the fragment, the portal site may need to be elongated to facilitate removal. After removal of osteophytes, the elbow can then be taken through a range of motion and an arthroscopic valgus instability test can be performed to evaluate the competency of the UCL.

## Discussion

Valgus extension overload is a common source of elbow pain in the overhead athlete and frequently requires surgery. The use of handheld osteotomes can facilitate the safe and efficient removal of posterior medial olecranon osteophytes. Removal of these osteophytes can allow pitchers and other overhead athletes to return to play. Andrews and Timmerman<sup>1</sup> examined 72 professional baseball players, and 65% of these patients had evidence of posterior medial

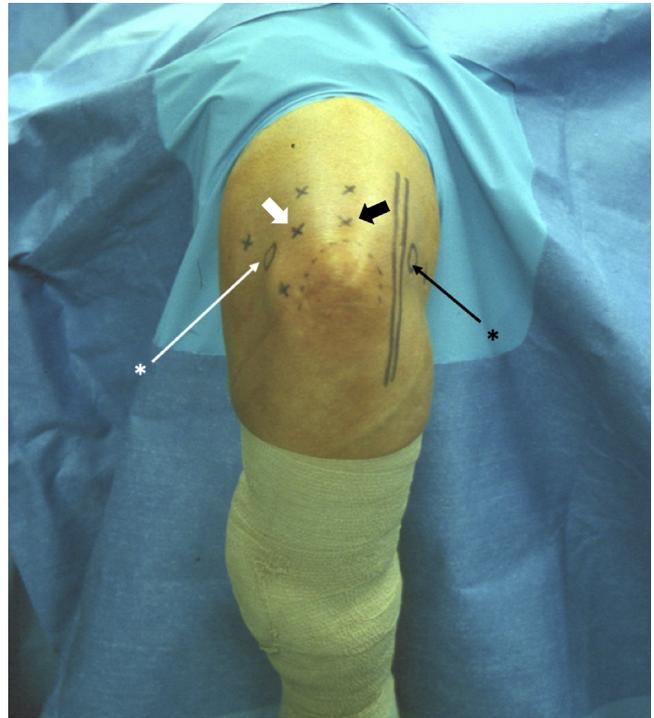


**Fig 2.** Our typical operating room setup with the patient in the prone position with the left arm draped over an arm holder. The head is to the left of the image and the feet are to the right. Prior to establishing portals for the elbow arthroscopy, a 30-cc syringe is used to insufflate the joint through the soft spot located at the center of the triangle that connects the radial head, the capitellum, and the olecranon tip. This allows for joint distention and for safer portal placement.

osteophytes. Surgery allowed for an 80% return to play; however, this number was greater in those undergoing ulnar collateral ligament reconstruction than those undergoing osteophyte removal. Similarly, there was a reoperation rate of 41% of patients after undergoing isolated posterior medial osteophyte removal and a 25% rate of valgus instability requiring later UCL reconstruction. The authors concluded that UCL insufficiency can be underestimated and must be addressed before performing isolated osteophyte resection.<sup>1</sup>

Although the ideal amount of osteophyte resection is unknown, there is biomechanical data that over-resection can lead to valgus instability and increased strain on the UCL.<sup>1,3,4</sup> In a study by Kamineni et al.,<sup>2</sup> 12 cadaveric elbows were tested in valgus stress after 3-mm increments in posterior medial resection from 0 to 9 mm. There were significant increases in valgus angulation with all levels of resection and the conclusion was to limit resection to osteophytes.<sup>2</sup>

The use handheld osteotomes can allow for more precise delineation of normal and pathologic anatomy due to minimal debris generation. Normal



**Fig 3.** A left arm is seen prepped and draped for elbow arthroscopy with the patient in the prone position. The head of the patient is to the left and the feet to the right. The potential portal sites are marked out as well as the path of the ulnar nerve. The anterolateral portal (white arrow and \*) is marked approximately 2 cm proximal and 1 cm anterior to the lateral epicondyle. The anteromedial portal (black arrow and \*) is established anterior to the intermuscular septum approximately 2cm proximal from the medial epicondyle. The posterior lateral portal (thick white arrow) is established approximately 2-3 cm proximal to the olecranon and just lateral to the triceps. The direct posterior portal (thick black arrow) is marked 3 cm proximal to the olecranon tip.

arthroscopic burrs and shavers can cause significant debris within the joint and impair visualization, thus leading to poor resection planes. The osteotomes can allow more efficient debridement, as the pathologic spurs are easily dislodged with sometimes only a single blow. Although arthroscopic burrs are acceptable, there is an inherent risk to the native cartilage and surrounding neurovascular structures during their use. However, a disadvantage to the osteotomes is that sometimes the portal incision must be lengthened to remove large osteophytes using the arthroscopic grasper. The pearls and pitfalls of using handheld osteotomes are outlined in [Table 1](#). The authors recommend the use of small osteotomes to aid in the removal of osteophytes from the posterior medial compartment of the elbow in a safe and efficient fashion.



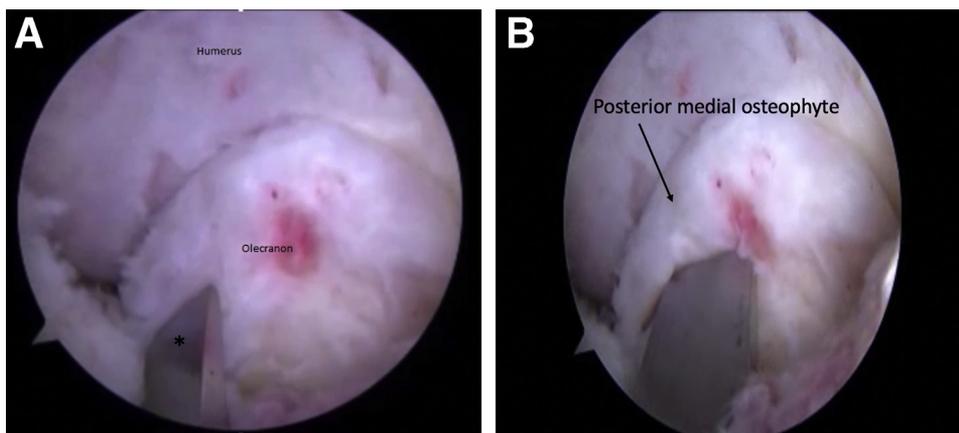
**Fig 4.** A left arm is seen prepped and draped for elbow arthroscopy with the patient in the prone position. The head of the patient is to the left and the feet to the right. The anterolateral portal has been established and a trochar (white arrow has been placed into the joint). After confirmation that this portal is intra-articular, the scope can be removed, and a switching stick can be passed through the portal and out the lateral anteromedial joint capsule until it tents the skin. A small incision is made over the switching stick and then it can be advanced out the skin and a cannula slid over it to establish the anteromedial portal in an “inside-out” technique.



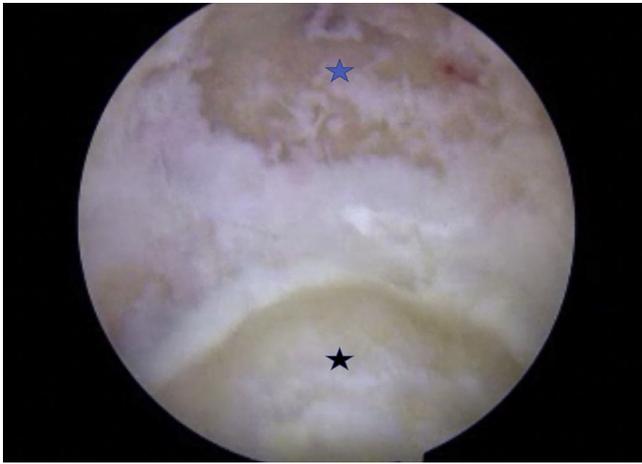
**Fig 5.** Various osteotome sizes and shapes that are used during the procedure to remove osteophytes from the elbow efficiently and safely. Listed from top to bottom: Symmetry 1/8” curved 28-4,953, Symmetry 1/4” curved 28-4,956, Symmetry 1/8” straight 28-4,903, and Zimmer 1/4” straight 852-00-04.

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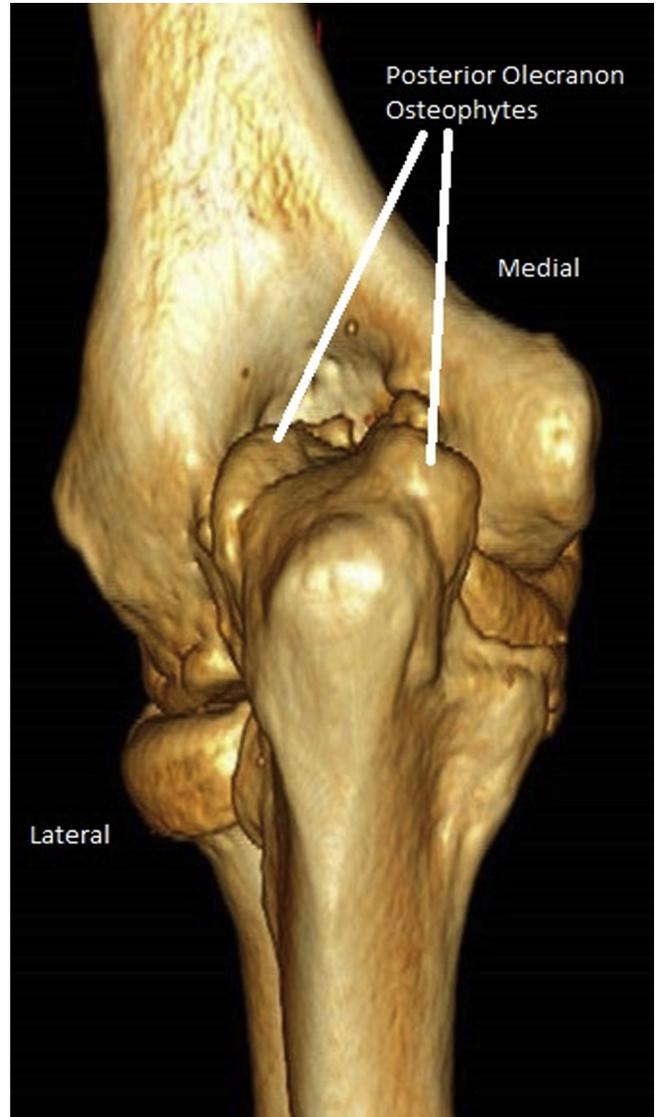
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**Fig 6.** Arthroscopic view of a right elbow in the prone position with the camera in the posterolateral portal. (A) The osteotome seen (\*) was inserted through the direct posterior portal and is directed at the posteromedial osteophyte. (B) The osteotome being used to disrupt the posteromedial osteophyte (arrow).



**Fig 7.** Arthroscopic view of a right elbow in the prone position with the camera in the posterolateral portal. The osteophytes have been excised from both the olecranon fossa (blue star) and the olecranon (black star) to restore normal anatomy and range of motion to the elbow.



**Fig 8.** Three-dimensional reconstructions of a left elbow computed tomography scan can help outline and define posterior olecranon osteophytes that are typically seen in valgus extension overload syndrome. In this 3-dimensional image viewed from posteriorly, you can clearly see the “Micky Mouse” type osteophytes around the olecranon pointed out by the white lines. This information can then guide the surgeon on the amount of resection needed in order to restore the native anatomy of the elbow.

**Table 1.** Pearls and Pitfalls of Using Osteotomes for Posteromedial Osteophyte Removal

Pearls	Pitfalls
Small osteotomes less than 4 mm fit through a small metal cannula.	May need to special order small osteotomes and curved osteotomes do not readily fit through cannulas.
Larger or curved osteotomes may be inserted directly through portal incisions.	Portal size may need to be expanded for osteotome.
Osteotomes allow for precise delineation of normal and pathologic bone and removal of bone without causing debris obscuring visualization.	Portal incision may need to be expanded to remove osteophyte or osteophyte will need to be removed in piecemeal fashion.