

High-Resolution Wireless Ultrasound

Arthrex Synergy MSK Ultrasound by Clarius
 (<http://www.synergy-ultrasound.com/>)



Alan M. Hirahara, MD, FRCS(C) (pictured),
 and Wyatt J. Andersen, ATC,
 Sacramento Orthopaedic Center, Sacramento, CA.

Arthrex Synergy MSK Ultrasound by Clarius is a new wireless ultrasound scanner that can connect to any iOS or Android device through a secure WiFi Direct connection. The scanner sets up the connection to an app on the device. Ultrasound and wireless technology have been around for decades, but combinations thereof have produced poor results. The main challenge has been to create and wirelessly transmit high-quality images without latency to a display while maintaining a reasonably sized transducer. Handheld ultrasound transducers scan effectively and process the scanned information in compact form. Recent advances in image processing and proprietary imaging algorithms now allow creation of high-resolution images comparable to those produced by most midrange or high-range machines costing \$30,000 to \$50,000. This new unit costs about \$12,000. Ultrasound use has increased over the past decade.

Numerous studies have found improved accuracy, efficacy, and outcomes of injections, and reduced pain, with ultrasound-guided injections over blind injections, and cost savings over magnetic resonance imaging.¹⁻¹²

Three scanners are capable of targeting different tissue types and depths. We prefer the Synergy MSK Linear Ultrasound by Clarius, a linear transducer that can evaluate tissue to depths of 7 cm and use frequencies from 4 MHz to 13 MHz. Its battery holds a standby charge for 7 days and can be actively used for 45 minutes. The unit has a magnesium shell; with the battery removed, the unit can be completely immersed in liquid without being damaged, which allows for easy cleaning and, potentially, sterilization with a soak solution. Color Doppler (for blood-flow assessment) and proprietary advanced needle visualization technology will be available in June.

The app is simply controlled with typical smart-device gestures. Depth control requires a finger swipe, and zoom



Figure 1. Representation of versatility of wireless unit in operating room.

takes a pinch. Other controls, such as optimal gain and frequency settings, are automated. Images and videos can be stored on the device and uploaded either to the Clarius Cloud or to a PACS (picture archiving and communication system) device. New features will allow the device to use a Synergy arthroscopy tower (Arthrex) as its display for surgeons and anesthesiologists in the surgical suite.

This technology finally allows ultrasound to be used in the operating room without the hassles of cumbersome machines and the potential contamination by the sleeves covering the cord that connects the transducer and the base unit (**Figure 1**). In addition, image viewing is easier with wireless technology, which works with all displays, including the same large 4K monitors used for arthroscopy. The current ultrasound systems' fixed small screens, most less than 10 inches in size, need no longer be used.

Recent studies have demonstrated new ultrasound-guided surgical techniques for biceps tenodesis,⁴



Figure 2. Portrayal of portability of wireless ultrasound technology.

anterolateral ligament reconstruction,¹³ medial patellofemoral ligament repair or reconstruction,¹⁴ and medial collateral ligament internal bracing.⁴

This small device can also be easily used on sports fields, as it can be carried in a pocket with a smart phone or tablet. With its 10- to 15-second start-up, it is readi-

References

1. Eustace JA, Brophy DP, Gibney RP, Bresnihan B, FitzGerald O. Comparison of the accuracy of steroid placement with clinical outcome in patients with shoulder symptoms. *Ann Rheum Dis.* 1997;56(1):59-63.
2. Finnoff JT, Hall MM, Adams E, et al. American Medical Society for Sports Medicine (AMSSM) position statement: interventional musculoskeletal ultrasound in sports medicine. *Br J Sports Med.* 2015;49(3):145-150.
3. Henkus HE, Cobben LP, Coerkamp EG, Nelissen RG, van Arkel ER. The accuracy of subacromial injections: a prospective randomized magnetic resonance imaging study. *Arthroscopy.* 2006;22(3):277-282.
4. Hirahara AM, Panero AJ. A guide to ultrasound of the shoulder, part 3: interventional and procedural uses. *Am J Orthop.* 2016;45(7):440-445.
5. Kang MN, Rizio L, Prybicien M, Middlemas DA, Blacksins MF. The accuracy of subacromial corticosteroid injections: a comparison of multiple methods. *J Shoulder Elbow Surg.* 2008;17(1 suppl):61S-66S.
6. Naredo E, Cabero F, Beneyto P, et al. A randomized comparative study of short term response to blind injection versus sonographic-guided injection of local corticosteroids in patients with painful shoulder. *J Rheumatol.* 2004;31(2):308-314.
7. Panero AJ, Hirahara AM. A guide to ultrasound of the shoulder, part 2: the diagnostic evaluation. *Am J Orthop.* 2016;45(4):233-238.
8. Partington PF, Broome GH. Diagnostic injection around the shoulder: hit and miss? A cadaveric study of injection accuracy. *J Shoulder Elbow Surg.* 1998;7(2):147-150.
9. Rutten MJ, Maresch BJ, Jager GJ, de Waal Malefijt MC. Injection of the subacromial-subdeltoid bursa: blind or ultrasound-guided? *Acta Orthop.* 2007;78(2):254-257.
10. Sethi PM, El Attrache N. Accuracy of intra-articular injection of the glenohumeral joint: a cadaveric study. *Orthopedics.* 2006;29(2):149-152.
11. Sivan M, Brown J, Brennan S, Bhakta B. A one-stop approach to the management of soft tissue and degenerative musculoskeletal conditions using clinic-based ultrasonography. *Musculoskeletal Care.* 2011;9(2):63-68.
12. Yamakado K. The targeting accuracy of subacromial injection to the shoulder: an arthrographic evaluation. *Arthroscopy.* 2002;18(8):887-891.
13. Hirahara AM, Andersen WJ. Ultrasound-guided percutaneous reconstruction of the anterolateral ligament: surgical technique and case report. *Am J Orthop.* 2016;45(7):418-422, 460.
14. Hirahara AM, Andersen WJ. Ultrasound-guided percutaneous repair of the medial patellofemoral ligament: surgical technique and outcomes. *Am J Orthop.* In press.

ly available and allows for immediate evaluation of a player. No longer does a player need to be taken off the field for a radiograph. The same advantage of portability means the unit is appropriate for emergency department physicians and staff. The simplicity of the device allows personnel to quickly assess patients and obtain central or peripheral intravenous access and nerve blocks without having to locate an ultrasound machine in a large, busy facility (**Figure 2**).

Surgical pearl: Overall, ultrasound is an imaging technology that has improved the accuracy and efficacy of injections. Wireless capability, portability, and versatility with high-resolution images improve this modality further and extend our reach into surgical, office, hospital, and sports settings. The ease, convenience, and reasonable price of high-resolution wireless ultrasound make it an attractive tool for

physicians, nursing staff, athletic trainers, and physical therapists.

Authors' Disclosure Statement: Dr. Hirahara reports that he receives consultant, royalty, and research support from Arthrex and is a medical advisor to Clarius Mobile Health. Mr. Andersen reports no actual or potential conflict of interest in relation to this article.