

Role of High Resolution Diagnostic Ultrasound in Musculoskeletal Physiotherapy

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High resolution ultrasound has been widely used as a screening imaging tool with its usage increasing for decades (Chiang et al., 2007). This modality is non-invasive and not associated with any harmful radiations and so considered the safest of all imaging techniques with no reported side effects. It has been the first choice to diagnose various abnormalities of the soft organs of the abdomen area including heart, prostate, breast, gynecological problems and monitoring the fetal development during pregnancy.

During the past decade, the ultrasound has been increasingly used in the diagnosis of musculoskeletal conditions (Backhaus et al., 2001). Due to the technical advancements and high frequency transducers, the ultrasound has become the most commonly used modality for detections of soft tissue diseases, fluid collections and visualizing structures such as cartilage and bone surfaces (Grassi et al., 1999, Backhaus et al., 2001). The ultrasound is able to detect very minute changes on the bone surface even before detected by radiographs and MRI due to its better axial and lateral resolution (Backhaus et al., 1999). Additionally, this modality has also the advantage of being the portable and easy to use modality and also can be used on very sick and fragile patients due to no exclusionary criteria for its use.

Traditionally radiographs have been considered to be the gold standard in the assessment of various musculoskeletal conditions. This modality is used to demonstrate bony abnormalities, but they have the limitations of not being able to visualize and detect any changes in the articular cartilage (Tarhan et al., 2003; Naredo et al., 2005).

MRI has considered to be the most accurate and valid imaging modality for the detection of both the hard (bone) as well as the soft tissues of the musculoskeletal

system. But despite this, this modality has not been used as a primary imaging tool due to its vast exclusionary criteria and cost reasons (Roemer et al., 2014).

Physiotherapy has evolved as a major remedy for various musculoskeletal conditions. In the recent times, the curriculum of physiotherapy is such planned and designed that the person becomes capable enough for diagnosis and preparing an effective treatment plan for its management. The main emphasis of the physiotherapy management is on accurate diagnosis of the various soft tissue conditions and assessing the extent of injury involved. For the proper assessment, the physiotherapists make use of various specialized physical assessment tests designed for particular conditions of the joints. Along with, various imaging technique, like MRI, CT-scan, high-resolution ultrasound and radiographs, are also being used to confirm the diagnosis.

Nowadays, as discussed, the ultrasound has been increasingly used in the diagnosis of various musculoskeletal conditions, the physiotherapists are availing more and more services of the sonologists for diagnosing various conditions, and that too without putting the patient at any risk of harmful radiations.

Role of Ultrasound in various Musculoskeletal Conditions

- The diagnosis of role of ultrasound in the musculoskeletal conditions was first reported and published in the year 1972 when it was used to differentiate Baker cyst from thrombophlebitis (McDonald and Leopold, 1972). Just a few years later Ultrasound was used to demonstrate synovitis and to evaluate result of the treatment in rheumatoid arthritis (RA) patients (Cooperberg et al., 1978). The applications of ultrasound to MSK conditions have continued to expand and it has become the primary modality of imaging for most of MSK conditions. The diagnosis of various musculoskeletal conditions using ultrasound is equally supported by various research studies in the past.

S.No	Name of the condition	Supporting studies
1	Lateral Epicondylitis	Dones et al,2014; Obradov & Anderson 2012; Toprak et al, 2012

2	Rheumatoid Arthritis	Reizai et al, 2014; Jain & Samuels, 2011
3	Osteoarthritis	Braun & Gold, 2011; Keen et al,2009
4	Carpal Tunnel Syndrome	Wong et al, 2004; Gaffar et al,2012
5	Psoriatic Arthritis	De Simone et al, 2011; Gladman et al,1987
6	Crystal Arthritis	Grassi et al, 2006
7	Sports Medicine	Jennings et al, 2008
8	Pediatric Rheumatology	Wakefield et al, 2004

Ultrasound characteristics of various Musculoskeletal condition

There are number of musculoskeletal conditions that can be diagnosed with accuracy using ultrasound. Various conditions that can be diagnosed includes rheumatoid arthritis, psoriatic arthritis, osteoarthritis, carpal tunnel syndrome, muscle tear, ligament tear, bursitis, loose body in the tissue, cysts, fat pads, joint and bony erosions and many more. Few conditions have been discussed in detail below.

1. **Rheumatoid Arthritis:** This condition is characterized by Synovitis, erosions and tenosynovitis. Ultrasound has been considered to be very sensitive tool to diagnose synovitis (Grassi, 2003; Kane et al, 2003). There have been incidences when patients have been judged in remission phase of disease has been found in active inflammatory phase with the help of ultrasound. (Brown et al, 2008). Compared to X-rays, USD is more sensitive in identifying the presence of erosions during initial phase of the disease (Bajaj et al,2007) almost 7 times more accurate detection than X-rays (Wakefield et al, 2000), which itself is an indicator of the active and aggressive disease course (Heijde et al, 1992). USD has been proposed as gold standard in assessing tendon involvement in RA (Grassi et al., 2000).

2. **Psoriatic Arthritis:** In about 50% of patients with psoriatic arthritis (PsA), the disease will progress leading to functional impairment (Gladman et al. 1987). MSK Ultrasound is useful in determining both intra- and extra-articular manifestations of PsA. Routine screening of psoriasis patients for the MSK involvement with Ultrasound helps in detecting early PsA changes (De Simone et al. 2011).
3. **Osteoarthritis:** Osteoarthritis is a condition associated with degeneration of articular cartilage characterized by cartilage clarity, cartilage interface and cartilage thinning. The ultrasound has proved to be a reliable tool for assessing changes in the articular cartilage (Keen and Conaghan, 2009). The ultrasound also gives an impression of age related tear of medial meniscus associated with this condition.

Conclusion

It is imperative from the above communication that the high resolution ultrasound is an effective imaging tool that can be used for diagnosis of various musculoskeletal conditions of the body. The physiotherapists can inculcate the ultrasound imaging for reaching out at diagnosis of various musculoskeletal conditions.

References

- Aurell Y, Johansson A, Hansson G, Jonsson K. Ultrasound anatomy in the neonatal clubfoot. *Eur Radiol* 2002; 12: 2509-2517.
- Backhaus M, Kamradt T, Sandrock D, Loreck D, Fritz J, Wolf KJ, *et al.* Arthritis of the finger joints: a comprehensive approach comparing conventional radiography, scintigraphy, ultrasound, and contrast-enhanced magnetic resonance imaging. *Arthritis Rheum* 1999; 42: 1232–45.
- Backhaus, M., Burmester, G.R., Gerber, T., Grassi, W., Machold, K.P., Swen, W.A., Wakefield, R.J. and Manger, B. (2001) Guidelines for musculoskeletal ultrasound in rheumatology. *Annals of Rheumatic Disease*, 60: 641-649.

- Bureau NJ, Beauchamp M, Cardinal E, Brassad P. Dynamic Sonography evaluation of shoulder impingement syndrome. *AJR* 2006; 187: 216-220.
- Carrillon Y, Noel E, Fantino O, Perrin-Fayolle O, Tran-Minh VA. Magnetic resonance imaging findings in idiopathic adhesive capsulitis of the shoulder. *Rev Rhum Engl Ed* 1999; 66: 201–206.
- Chiang, Y.P., Wang, T.G. and Lew, H.L. (2007) Application of high resolution ultrasound for examination of the knee joint. *Journal of Medical Ultrasound*, 15 (4): 203-212.
- Farin PU, Jaroma H, Harju A, Soimakallio S. Shoulder impingement syndrome: sonographic evaluation. *Radiology* 1990;176: 845-849.
- Farin PU, Jaroma H, Harju A. Soimakallio S. Medial displacement of the biceps brachii tendon: evaluation with dynamic Sonography during maximal external shoulder rotation. *Radiology* 1995; 195: 845-848.
- Graf R. The diagnosis of congenital hip- joint dislocation by the ultrasonic compound treatment. *Arch Orthop Trauma Surg* 1980;97(2); 117-33.
- Grassi W, Lamanna G, Farina A, Cervini C. Sonographic imaging of normal and osteoarthritic cartilage. *Semin Arthritis Rheum* 1999;28:398–403.
- LB, Wilson DJ, Nag D, Benson MK. Ultrasound and congenital dislocation of hip. The importance of dynamic assessment. *J Bone Joint Surg Br* 1990; 72: 1997-2001.
- Naredo, E., Cabero, F., Palop, M.J., Collado, P., Cruz, A. and Crespo, M. (2005) Ultrasonographic findings in knee osteoarthritis: a comparative study with clinical and radiographic assessment. *Osteoarthritis and Cartilage*, 13 (7): 568- 574.
- Patil P & Dasgupta B (2012): Role of diagnostic ultrasound in the assessment of musculoskeletal diseases. *Ther Adv Musculoskelet Dis*; 4(5): 341–355.
- Radiologyinfo.org

- Roemer, F.W., Eckstein, F, Hayashi, D. and Guermazi, A., (2014) The role of imaging in osteoarthritis. *Best Practice and Research Clinical Rheumatology*, 28:31-60.
- Ryu KN, Lee SW, Rhee YG, Lim JH. Adhesive capsulitis of the shoulder joint: usefulness of dynamic sonography. *J Ultrasound Med* 1993; 12:445– 449.
- Tandon A, Bhatt S and Bhargava SK (2013): Dynamic Musculoskeletal Sonography. *JIMSA*; 26(1): 21-24.
- Tarhan, S., Unlu, Z. and Goktan, C. (2003) Magnetic resonance imaging and ultrasonographic evaluation of the patients with knee osteoarthritis: a comparative study. *Clinical Rheumatology*, 22: 181-188.
- Van Holsbeeck M, Introcaso JH. Musculoskeletal ultrasound. St. Louis Mosby-Year book; 2001.
- Van Holsbeeck M, Vanderschueren J, Wohlend J. Shoulder sonography in adhesive capsulitis. In: 83rd Annual Meeting of the Radiological Society of North America. Chicago,USA; 1997.