SHOCK WAVE
THERAPY
IN PRACTICE

SONOGRAPHY AND ESWT

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LEVEL10

CONTENTS

FUNDAMENTALS OF DIAGNOSTIC ULTRASOUND

TECHNICAL REQUIREMENTS

In order to integrate sonography with extracorporeal shock wave therapy, a modern ultrasound device suitable for musculoskeletal system applications in accordance with the Quality Assurance Agreement pursuant to Section 135, Sub-Section 2, Book V of the German Code of Social Law (SGB) should be available to the user, as should a focused shock wave therapy device. Although the high-end, all-in-one system made by Storz Medical AG, the Duolith® SD 1 ultra, is an ideal solution both technically and aesthetically, the examples of treatment described below can still be perfectly implemented when separate devices are used.

The examination and treatment room should provide sufficient space for patients and examiners as well as equipment. It should be ensured that the room is well-ventilated and can be darkened or the lighting dimmed in order to eliminate unwanted light sources.

For the ultrasound imaging of the musculoskeletal system, a 5.0 to 9 MHz linear transducer (scanning probe) and an optional curved-array transducer for visualizing the lumbar spinal canal should be available. For imaging structures close to the body surface – such as the acromioclavicular joint and the Achilles tendon – it may be advisable to use a commercially available stand-off if the existing ultrasound device does not have a program for tissue harmonic imaging, which allows harmonic-wave compensation for improved imaging of small parts.

The shock wave therapy system should be suitable for the application of focused shock waves and have an adjustable energy flux density (ED) of 0.02 to 0.8 millijoules (mJ) per mm^2. If the system is designed for the use of both focused and radial shock waves, this feature will expand the device's field of application, because many of the indications described below are associated with the development of active muscle trigger points (Travell J.G. 1992). Our experience shows that these can often be addressed more effectively with radial shock waves than with focused shock wave therapy. Another

COMPARISON BETWEEN VELOCITY MODE AND ANGIO MODE (AFTER SCHÄBERLE, 2010)
| *Table 3*

When visualizing blood circulation in tissues, examiners can choose between velocity mode (colour-coded Doppler sonography) and angio mode (power Doppler mode). For the visualization of inflammatory changes in the examined tissue, the use of PDI is recommended.

MODE:	ADVANTAGES:	DISADVANTAGES:
Velocity mode	Visualization of flow velocity and direction with high resolution	Angular dependence of flow visualization with possible aliasing effect
Power Doppler mode (angio mode)	Visualization of slow blood flows with low susceptibility to artefacts, irrespective of angle	No information about flow direction and velocity or haemodynamics

The higher the density of the blood cells in the investigated tissue, the brighter the colour visualization appears in PDI.

Whereas the colour box used in colour-coded Doppler sonography (CF) indicates the flow velocity of the blood cells and their direction (red towards the transducer and blue away from the transducer), in power Doppler imaging (PDI) the direction of flow is not identified and the intensity of the red or yellow colouring indicates the density of reflecting blood cells. The higher the density of the blood cells in the investigated tissue, the brighter the colour visualization appears (Schäberle W. 2010).
To carry out a power Doppler examination, the first step is to create a correct B image of the tissue formation being assessed. The power Doppler is then switched on and the sensitivity of the colour box is adjusted using either bone or a muscle tissue without any abnormalities. It must be ensured that no colour pixels are discernible above these tissues. If this is the case, the gain must be reduced. The size of the colour box is then adjusted to the structure under investigation and the region of interest (ROI) thus defined. This is highly important, as an excessively large colour box can lead to artefacts; this is because vessels passing above the colour box (i.e. superficial vessels) or below it (i.e. deep vessels) can be visualized as colour signals in the area to be examined (Gaulrapp H. 2011).

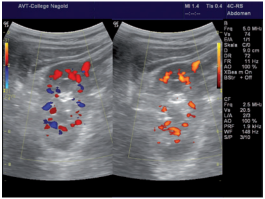


Fig. 3
Comparison between velocity mode and angio mode as used on the right kidney.

OPTIMIZING THE ULTRASOUND IMAGE

The ultrasound transducer is placed above the tissue to be examined, taking into account its alignment with the right and left edges of the monitor.

The quality of an ultrasound image depends partly on the technical quality of the ultrasound transducers used and the resolution of the image on the monitor, but also – and crucially – on the settings the examiner is able to perform for the ultrasound device.
First of all, the transducer is correctly positioned above the organ/tissue under investigation (i.e. taking into account the alignment of the visualization plane in relation to the right and left edges of the monitor and the desired cross-sectional plane).

SHOULDER JOINT – STANDARD PLANE I

Indications > Visualization of the subacromial bursa and rotator cuff. Differentiation of degenerative changes and ruptures and calcific tendinitis.

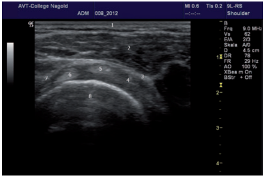
Patient positioning > The patient is seated on the examination table, with the arm in neutral position hanging freely by the side of the body.

Technique > The examiner palpates the coracoid process and the anterior margin of the acromion. The ultrasound transducer is placed above the connecting line of these bony distance points. The examination starts in neutral position and is then complemented by dynamic scans of the shoulder joint in external and internal rotation. During external rotation, the tendon of the subscapularis muscle is visualized. During internal rotation, the tendon of the supraspinatus muscle is displayed.

The ultrasound transducer is placed above the connecting line between the coracoid process and the anterior margin of the acromion.

RIGHT SHOULDER JOINT – STANDARD PLANE I (NEUTRAL POSITION) | *Fig. 11*

The rotator cuff displayed above the head of the humerus appears like a tyre on a wheel rim.



Landmarks in the ventral diagonal scan of the shoulder joint:

1. Skin and subcutaneous tissue
2. Deltoid muscle
3. Deltoid fascia and subacromial bursa
4. Tendon of subscapularis muscle
5. Coracohumeral ligament
6. Tendon of biceps brachii muscle, long head
7. Supraspinatus muscle