# Editorial

# The Thumb Rule – an approach to optimise musculoskeletal ultrasound scanning in Rheumatology

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Ultrasound (US) is considered an operator-dependent imaging technique, due to the sonographer's ability to perform accurate examinations. This ability is influenced by both experience and proficiency in image acquisition and interpretation (1-5).

During real-time scanning, normal morpho-structural features and abnormalities of the tissues must be visualised and documented in at least two perpendicular planes. This procedure is essential for ensuring diagnostic accuracy and requires adequate training, proper probe handling, and correct image orientation. While it is without doubt that training is fundamental to ensure high-quality and reliable US examinations, most scientific research has focused on how to deliver effective training and define the core competences of the curriculum (6-8). In contrast, how to hold and orientate the probe, or identifying the best methods for doing so, has been a neglected topic for decades.

In fact, there are several ways to hold the probe. However, it is reasonable to believe that only one of them is the best for most of us. Those with limited experience, often hold the probe in a fist grip which does not allow minimal probe adjustments needed to optimise image quality. The optimal grip, however, is similar to a pencil grip – holding the probe between the thumb on one side and the second and third fingers on the other, thereby allowing the ulnar fingers (fourth and fifth fingers) to rest on the patients and support the probe. Like fine drawing, this method allows the sonographer to do small and precise movements, minimise probe pressure and, ultimately, to obtain more focused and detailed images.

Similarly, the orientation of the probe during US examinations varies and can influence the ability to accurately interpret US images and perform optimal US examinations and US-guided interventions.

The main aims of this technical note were:

- to describe the optimal way to hold the probe and to provide a rationale for using the Thumb Rule approach,
- to review the main recommendations provided by European scientific societies and to discuss the Thumb Rule in the light of the existing recommendations.

## The Thumb Rule: holding the probe

This rule refers to the proper technique for holding and orienting the US probe. The probe is held in a pencil-like grip with three fingers: the thumb on one short edge of the probe and the second and third fingers on the opposite edge (Fig. 1), allowing precise and subtle movements of the probe using only the fingers. The fourth and fifth fingers rest on the patient's skin and/or the examination table to stabilise the probe's position. Light probe pressure is essential for obtaining optimal information on structural abnormalities and perfusion, especially when the target is superficial. Of note, the short edge of the probe held by the thumb corresponds to the left side of the US field displayed on the screen.

This approach is independent of the patient's position, which should be determined by other factors such as the patient's comfort and the optimal access to the area of interest for US examination. Just as we do not adjust our grip on a pencil based on the position of the paper, the way the probe is held remains consistent regardless of the patient's position or the anatomical site under assessment.

**Fig. 1.** Probe holding according to the Thumb Rule.

## The Thumb Rule: orienting the probe

One of the fundamental principles of US in rheumatology is that the sonographer must verify the integrity of a structure or detect the presence of a pathological finding in at least two perpendicular scanning planes, by rotating the probe 90 degrees over the target area. This skill relies on precise movements of the fingers similar to those required to write with a pencil.

Moreover, holding the probe with the thumb placed on the short edge of the probe, which corresponds to the left side of the screen, helps maintain alignment between the image displayed on the screen and the actual anatomical area underneath the probe. Placing the thumb on the short edge that corresponds to the left side of the screen allows the probe to be moved while maintaining the spatial correspond-

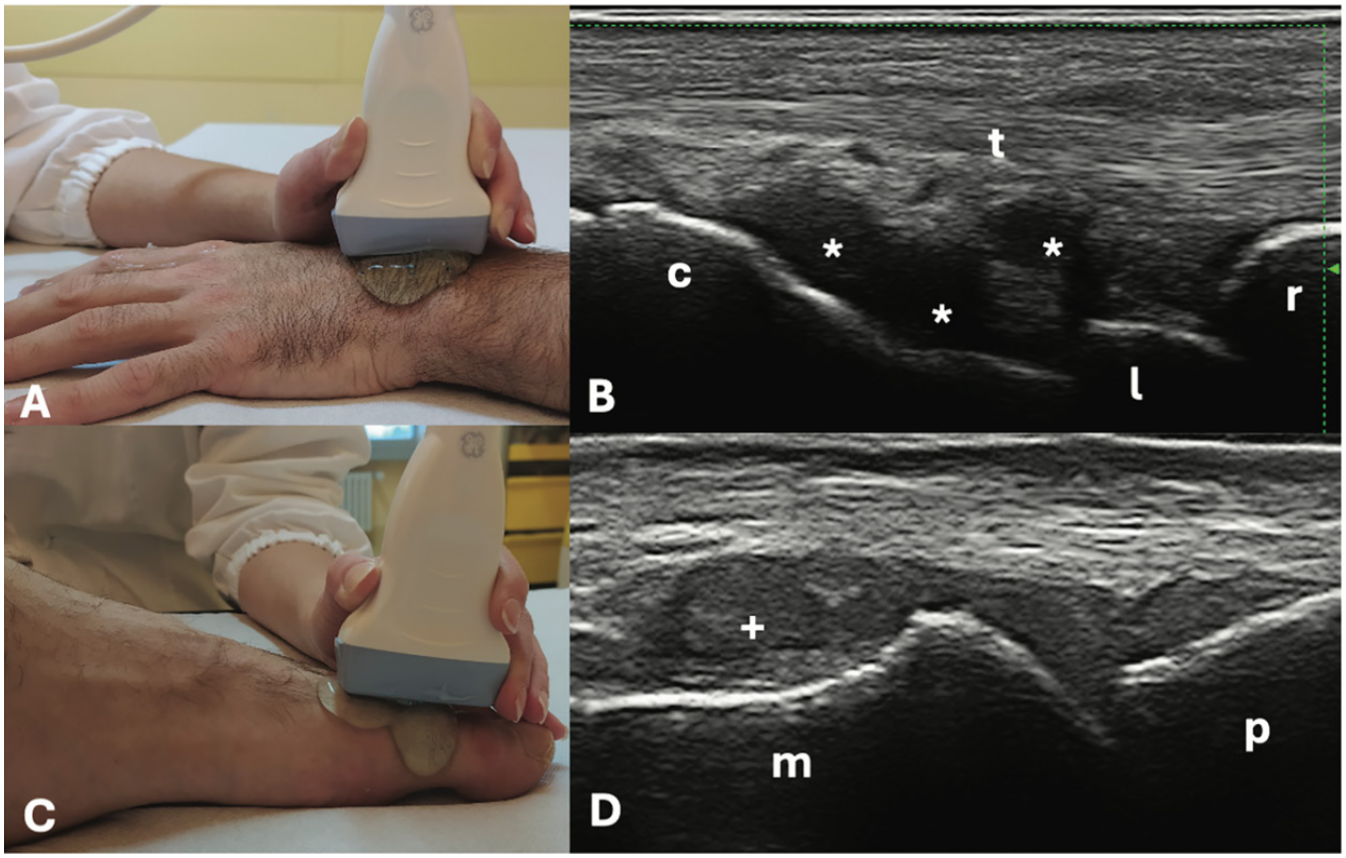


**Fig. 2.** Probe orientation according to the Thumb Rule.
**A**-**B**: probe orientation during an US assessment of the wrist and corresponding US image
**C**-**D**: probe orientation during an US assessment of the metatarsophalangeal joint of the hallux and corresponding US image.
In both cases, the position of the thumb corresponds to the left side of the screen.
**c**: capitate, **l**: lunate, **m**: metatarsal bone, **p**: proximal phalanx, **r**: radius, **t**: tendons of the 4th extensor compartment, *: abnormal distension of the joint capsule, **+**: intra-articular tophus.

ence. For example, in a transverse volar scan of the carpal tunnel of the wrist to locate the pisiform bone, the sonographer moves the probe toward the ulna regardless of whether the wrist is the right or the left one. This concordance is also essential for accurately guiding the needle during US-guided procedures.

The Thumb Rule enhances the sonographer's systematic control of the US image. Moving the thumb changes the left side of the US image, whereas a movement of the second and third fingers alters the right side of the image. Therefore, if the left side of the image needs adjustment the sonographer can move the thumb to improve the quality of the US image in that specific area.

## Recommendations of European scientific societies on how to hold and orientate the probe

Various European scientific societies have issued their own recommendations for how to hold and orientate the US probe. We conducted a non-systematic literature review to identify published guidelines for performing musculoskeletal US examinations.

- *The European Alliance of Associations for Rheumatology (EULAR) recommendations*

In 2001, the EULAR Working Group for Musculoskeletal Ultrasound published a review entitled "Guidelines for musculoskeletal ultrasound in rheumatology" (9). This review was the first attempt to standardise musculoskeletal US examinations in rheumatology. Several recommendations were provided including guidance on transducer orientation. However, these recommendations primarily focused on standardising how to present the examined anatomical structures in longitudinal and transverse scans, with probe orientation advised accordingly (Table I).

In 2017, a dedicated EULAR-endorsed task force was created to update the standardised scanning procedures for US imaging in rheumatology (10). This update extended beyond the musculoskeletal system to include other rheumatologically relevant structures such as salivary glands and arteries.

**Table I.** Transducer orientation in standardised ultrasound musculoskeletal examination.

| | Longitudinal scan | Transverse scan |
|---|---|---|
| Left side of the screen | Proximal, cranial, upper | Medial, ulnar, tibial |
| Right side of the screen | Distal, caudal, lower | Lateral, radial, fibular |

Adapted from *Ann Rheum Dis* 2001; 60: 641-49.

Regarding probe orientation in long-axis views, the 2017 updated recommendations confirmed the "proximal end of the structure/left side of the screen" rule but they also provided more flexibility for longitudinal views, allowing for alternative scanning approaches as long as the movement of the image on the screen is kept parallel to the direction of the probe on the patient (10). On the other hand, the authors recommended aligning the structure of interest on the screen as if the observer is looking at the patient (10). However, no mention on how to hold the probe was provided either in 2001 or in 2017.

- *The European Society of Musculoskeletal Radiology (ESSR technical guidelines for ultrasound*

In 2004, a subcommittee of the ESSR for US in musculoskeletal radiology was established. One of its main aims was to standardise musculoskeletal US scanning technique across Europe as reported in the official website (https://www.essr.org/subcommittees/ultrasound/). In 2010, the ESSR published a document outlining musculoskeletal US technical guidelines, organised by eight major anatomical sites: shoulder, elbow, wrist, hand, hip, knee, ankle, and foot (11).

These guidelines did not specifically address how to hold the probe. However, based on the US images and the few photos of the sonographers' hands, it seems that the Thumb Rule approach is in use.

- *The European Federation for Ultrasound in Medicine and Biology (EFSUMB) Guidelines and Recommendations for Musculoskeletal Ultrasound*

The EFSUMB issued various guidelines for musculoskeletal US addressing competency assessments for rheumatologists in 2013 (12) and the use of US for assessing extra-articular structures, joint pathologies, paediatric applications, and US-guided procedures in 2022 (13). However, none of these guidelines describe how to hold or orientate the probe. Similarly, a recent EFSUMB position paper on professional standards across different medical professions offers no guidance on probe orientation or handling, though it does address image acquisition and structured examination protocols (14).

- *The European Musculoskeletal Ultrasound Study Group (EURO-MUSCULUS)/Ultrasound Study Group in Physical and Rehabilitation Medicine (USPRM)*

Since 2010, the EURO-MUSCULUS group has focused on increasing awareness of US use in physical and rehabilitation medicine. The EURO-MUSCULUS/USPRM group has published many articles outlining structured scanning protocols for all major anatomical sites (15). However, none of these publications provide specific details about probe handling and orientation.

## Discussion

As far as it concerns the purposes of this report, standardisation refers to the development of a clear and detailed description of an operative procedure – such as how to hold the probe during US examinations – developed by a panel of experts who reach consensus following a specific methodology.

After reviewing the recommendations from the main European scientific societies committed to developing musculoskeletal US, educating new sonographers and standardising the technique (9-15), we found a lack of clear indications regarding probe handling as well as a rationale for probe orientation.

The Thumb Rule approach offers insights to address this gap and does not

conflict with existing European recommendations on musculoskeletal US.

Proper probe handling is a fundamental aspect of musculoskeletal US and should not be left to individual interpretation. A standardised approach, developed through international multidisciplinary expert consensus and established methodology, is essential. We propose that the best way for holding the probe in musculoskeletal US is the one we described in the present technical note: the Thumb Rule. It involves gripping the probe by the short edges with the thumb positioned on the short edge corresponding to the left side of the screen and the second and third fingers on the opposite short edge, while the fourth and fifth fingers stabilise the probe against the anatomical site being examined.

Regarding the probe orientation, the following considerations can be drawn. During our participation as tutors in national and international musculoskeletal US courses, we noticed that many rheumatologists, who are learning US, express confusion about the indications and the rationale for probe orientation during longitudinal scans (*i.e.* proximal should be always visualised on the left part of the screen as per EULAR guidance) and request clearer indications for probe orientation during transverse scans.

The EULAR rule of visualising proximal structures on the left side of the screen stems from previous efforts to standardise US imaging presentation (9, 10) and relies on assuming that the patient is lying supine on the examination bed. In the ideal situation of conducting musculoskeletal US examinations with patients consistently positioned supine on the examination bed, it is straightforward to visualise proximal structures on the left side of the screen. This alignment occurs because, when the sonographer looks towards the patient, the left side corresponds to the proximal structures being examined. However, challenges arise when the patient is in a different position. Let us consider for example a standard US examination of hands and wrists and follow the EULAR recommendations (9, 10) for probe orientation during longitudinal scans when the patient is sitting on the other side of the examination table with their forearm resting on the table. In this case, visualising proximal structures on the left side of the screen becomes difficult, as the distal parts of the fingers are now oriented leftward, reversing the correspondence between image display and anatomy.

Following these recommendations (9, 10) may require to sonographers additional scanning abilities which, in turn, can discourage trainees from learning musculoskeletal US.

For transverse scans, the update EULAR recommendations (10) have amended the previous indication for probe orientation (9) that suggested to visualise the medial part of structure on the left side of the screen, allowing flexibility based on the sonographer's preference. This new statement does not contribute to standardise US probe orientation nor provide a clear guidance for beginner sonographers.

However, we have to acknowledge some limitations. First, this specific probe handling may not apply to all US probes such as hockey stick and volumetric probes. Nevertheless, we believe that this rule can be still useful as a general framework for beginner sonographers to guide them in holding the probe and to help them to understand the correspondence between the probe position and the images displayed on the screen. Furthermore, most musculoskeletal US examinations are carried out with linear probes and not with volumetric or hockey stick probes.

Second, the advent of new technologies such as artificial intelligence may change the way in which we perform US examinations.

Artificial intelligence may guide the sonographer in the correct acquisition of US images, regardless of the way the probe is held (16, 17). However, artificial intelligence-guided US machines are not available yet.

## Conclusion

This technical note provides for the first time a detailed description for probe handling and orientation during musculoskeletal US examinations together with a rationale for this approach.


## Competing interests

E. Cipolletta has received research grant from FOREUM and EULAR, speaking fees from IBSA and Novartis, outside the submitted work.

E. Filippucci has received speaker's fees from AbbVie, IBSA, Janssen-Cilag, Lilly, Novartis, Pfizer and UCB Pharma, outside the submitted work.

S.T. Torp-Pedersen has received speaker's fees from Eli Lilly, Janssen, Novartis, Pfizer, and consulting fees from Janssen and UCB, outside the submitted work.

L. Terslev has received speaker's fees from Johnson & Johnson, Novartis and UCB.


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