Editorial

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Musculoskeletal ultrasonography: Ninety-nine reasons for physiatrists

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This editorial is written for those having the quest to liberate musculoskeletal medicine; for "rabbits" and "turtles", even for "dinosaurs" [1]; but not for foxes [2] ...

In daily practice, musculoskeletal physicians are faced with a wide range of patients who suffer in numerous complaints. Naturally, after taking the patients' medical history, they always perform a substantial physical examination. In the past, they then tried their best to choose the most appropriate imaging technique. Fortunately, owing to developing technology, training opportunities and the wide applicability, musculoskeletal physicians now have another option, i.e. ultrasound (US) examination. [3]. Yet, for several reasons, US is not only an imaging modality but rather a comprehensive examination in the hands of an experienced musculoskeletal physician [4]. Indeed, it is being (and should be) used as an extension of the physical examination, similar to the clinician's 'stethoscope' or the 'sixth finger'. In other words, the utility of US can be compared to 'default settings' and should be a natural procedure in daily practice. This is actually why the combined term 'ultrasound imaging and guidance' is preferred, particularly for interventions [5]. Needless to say, US plays the paramount role, not only for precise guidance during those procedures but also for prompt clinical decision making in advance [6].

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To this end, the daily practice of musculoskeletal physicians have already evolved to another era and we are no longer using the same terminology as we did in the past [7]. For instance, nonspecific phrases such as 'shoulder impingement' or 'shoulder injection' have been replaced by diagnosis-, target- and content-specific explanations. New terms would perhaps be calcific tendinopathy or adhesive bursopathy (under sono-palpation and static imaging) which causes impingement of particular structures at a precise position [8] and which is thereafter intervened using a dual-target rotator cuff interval injection [9]. For sure, 'seeing' new things also has led to 'quantifying' them [10] and significantly enhanced the robustness of academic output [11].

With regard to the Physical and Rehabilitation Medicine (PRM) aspect, the aforementioned evolution has been adopted as much as possible [12,13]. It is worth noting that physiatrists (PRM specialists) are probably those physicians who deal with the broadest range of musculoskeletal patients and their diseases as well as their interventional treatments [4,5,14]. The spectrum includes (but not limited to) pathologies concerning sports/orthopedic injuries, peripheral nerve disorders, inflammatory diseases, rehabilitation patients, details of which could only partially be exemplified in Table I.

As an important side note, US strongly parallels a skyrocketing industry, where new and high frequency wireless probes/machines (working with different laptops or tablets) are no longer surprising. Instead, the current trend showcases how US examination can simultaneously be shared with others in distant centers or even be performed virtually. Likewise, the use of artificial intelligence is also another trend that has recently exploded. Of note, we have already incorporated machine learning

Table I. Exemplary pathologies/conditions for the use of ultrasonography in Physiatry

Pathologies/conditions	
Tissue	
Skin and subcutaneous fat	Pressure ulcer, lymphedema, cellulitis
Fascia	Changes in thickness and elasticity, Dupuytren's contracture
Salivary gland	Sjögren's syndrome, denervation
Pulley	Trigger finger, climber's finger
Tendon and ligament	Sprain, (calcific) tendinopathy, enthesopathy, snapping
Bursa	Inflammation, Baker's cyst
Vessel	Deep vein thrombosis, giant cell (temporal) arteritis, persistent artery/vein
Skeletal muscle	Strain, atrophy, sarcopenia, neuromuscular diseases, myositis ossificans
Joint (capsule)	Effusion/synovitis, adhesive capsulitis, loose body (osteochondritis dissecans)
Cartilage	Degeneration, meniscopathy, chondrocalcinosis, Bankart lesion, temporomandibular disc displacement
Peripheral nerve	Entrapment, tumors (e.g, neurofibroma, schwannoma, fibrolipomatous hamartoma), optic neuropathy
Periosteum	Periostitis, shin splint
Bony surface	Erosion/fracture, Osgood-Schlatter disease, femoroacetabular impingement
Intervention	
Head	Chronic migraine (suture), trigeminal nerve
Neck	Occipital nerves, trigger points, dystonia
Trunk	Fascial planes, cluneal nerves
Shoulder	Rotator cuff
Arm	Selective motor nerves
Elbow	Lateral epicondyle
Forearm	Posterior interosseous nerve
Wrist and hand	Carpal tunnel
Pelvis	Piriformis, pudendal nerve, sacroiliac joint
Hip	Anterior recess, snapping hip
Thigh	Muscle regeneration
Knee	Genicular nerves, joint recesses
Leg	Spasticity
Ankle and foot	Hydrodissection

for our routine scanning protocols in clinical practice and pathologies will potentially follow.

In conclusion, we would like to quote the saying of one of our radiologist colleagues who, in response to our former '19 reasons' paper [15], said 'you have perhaps 99 reasons to use US in clinical practice'. As can easily be foreseen, US will go on 'pushing' us off the scale and physicians need to cope with the 'extra spins' and remediate their 'US-lag', if any.

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Pathologies/conditions (continuation)
Rehabilitation setting
Amputees
Wheelchair users
Hemiplegic shoulder
Pressure ulcers
Heterotopic ossification
Dysphagia - dysphonia
Diaphragm imaging
Miscellaneous
Spine and radiculopathies
Regenerative medicine
Prolotherapy
Extracorporeal shock wave therapy
Radiofrequency ablation
Minor surgery

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