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Reply to the comment of Misirlioglu et al. "Periscapular muscle ultrasound as a diagnostic aid in scapular winging secondary to long thoracic nerve lesion"

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We have read with pleasure the correspondence by Misirlioglu and al. about the usefulness of periscapular muscle ultrasound (US) in cases of long thoracic nerve impairment [1]. We have appreciated authors' considerations and the fascinating case, which underlined the efficacy of muscle US when nerve assessment is hardly performable. The authors correctly asserted US can reveal changes in echo-intensity or dimension, representing tissue alterations occurring in denervated muscles. The meaning of US alterations in a muscle may be significantly amplified by the comparison with the contralateral muscle. We fully agree with Misirlioglu and coworkers because they confirm the role of US as extension of clinical evaluation from diagnosis to rehabilitation [1,2].

Muscle US can easily quantify muscle thickness and, as shown by the authors, this parameter is very useful for initial diagnosis. Muscle echogenicity represents a significant additional aspect of tissue healthiness. Its precise quantifications is less direct, but some approaches based on post-processing image analysis, have been described [3,4]. In this way, an objective comparison of the echogenicity of two muscles is possible.

We would like to present our computer-based echotexture comparison (Co-ECo) of the right and left extensor digitorum communis muscles (ECD), in a case of axonal neuropathy. A 40-year-old woman presented severe deficit of the right ECD and electrophysiology revealed denervation signs in the same muscle and motor axonal potential reduction of the right radial nerve. Co-ECo consisted on analysis of US images, based on methodologies previously described in literature [3]. We performed US evaluation of the muscles through Toshiba Aplio^{TM} 400 machine (Toshiba Medical Systems Corporation, Otawara, Japan) with an 18 MHz linear probe. The structures were visualized in transverse scan putting the probe

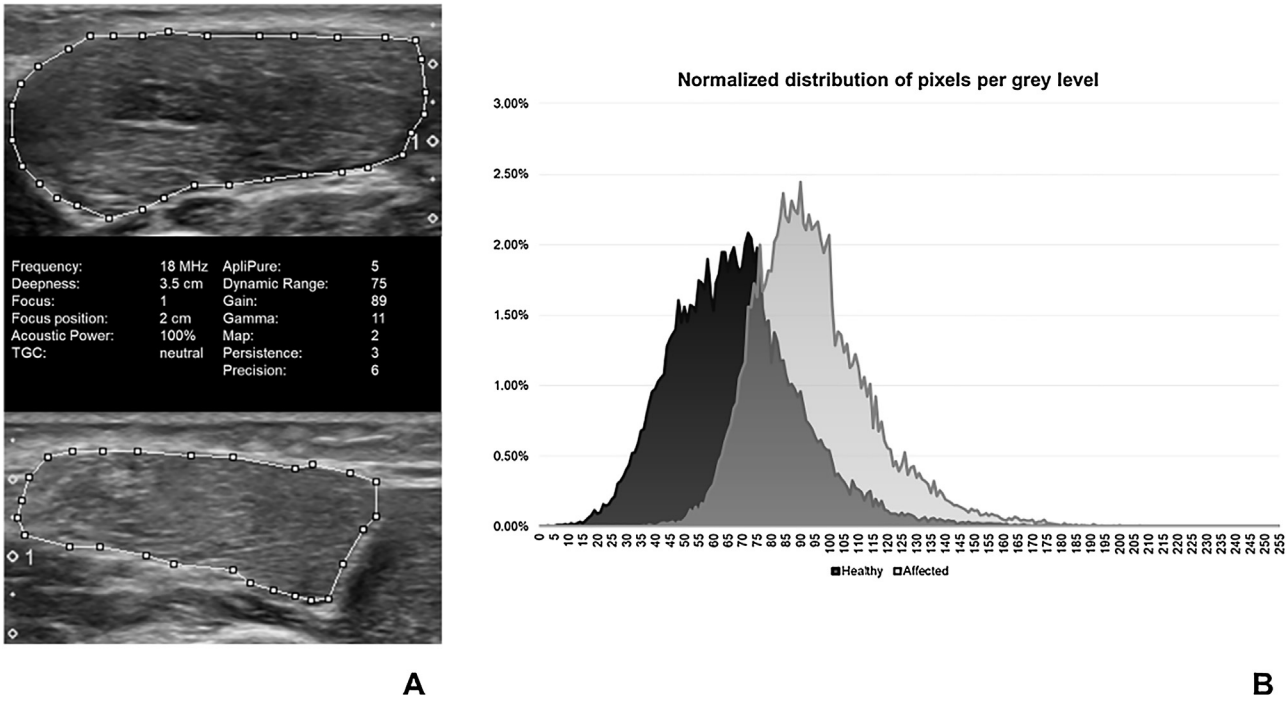

Fig. 1. Ultrasound images of the left (top) and the right (bottom) examined muscles. The black space between the two images shows the ultrasound parameters used for the examination. The lines for the selection of regions of interest are shown (A). Normalized distribution of pixels per grey level (B).

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Table 1
Quantitative data form the two muscles. In the 256-level grey Scale, 0 indicates black, 255 white.

	Area (pixels)	Most represented grey level [% of pixels]	Minimum grey level [% of pixels]	Maximum grey level [% of pixels]	95% of grey levels [interval]
Right muscle (affected)	31,033	90 [2.442%]	31 [0.003%]	217 [0.003%]	58–137 [80]
Left muscle (healthy)	49,556	72 [2.082%]	2 [0.002%]	200 [0.004%]	26–110 [85]

perpendicularly to the muscles to obtain the most defined visualization. The compression of the probe on the skin was limited by high amount of gel. Machine settings are summarized in Fig. 1A. US pictures were exported as JPG files and analyzed by ImageJ 1.8.0 software (National Institute of Health, USA) [5,6]. The pictures were converted in 8-bit black/white images. A region of interest (ROI) of each muscle was manually selected. For each ROI, area (total number of pixels) and pixel distribution (number of pixels for each 256 levels of greys), were obtained. These data were imported in digital worksheet and we divided the number of pixels for grey levels by the total number of pixels, obtaining a percentage of representation of each grey level for each ROI (Fig. 1B). The most represented grey level, the minimum and maximum grey levels and the 95% of the most represented grey levels were considered to compare the two muscles (Table 1). Co-ECo numerically showed the hyperechogenicity and lower echotexture variability of the affected ECD [7].

Some elements can limit this approach (US device, settings, selection of the scanned site and so on) and more studies are needed for a correct validation. However, quantification of US picture features may represent a new "qualitative leap" and a concrete area of development for US application in clinical practice.

Disclosure of interest

The authors declare that they have no competing interest.

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