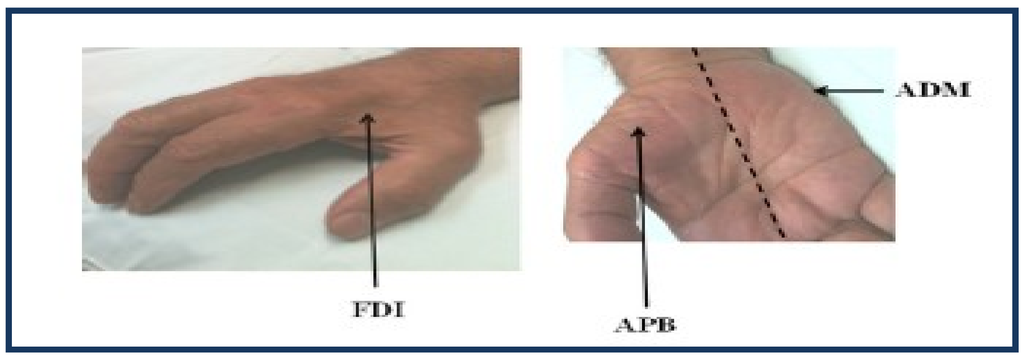
Studying the split hand in amyotrophic lateral sclerosis

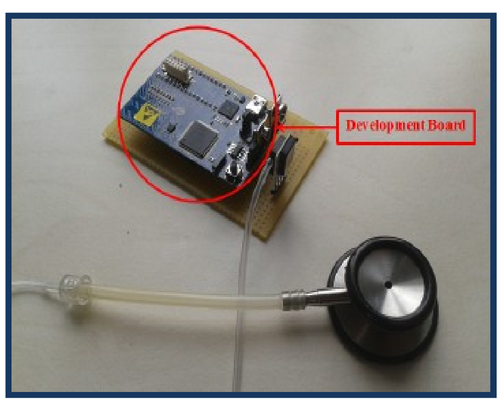
Diletta Cereda,[1] Lucio Tremolizzo,[1] Vittorio Mantero,[2] Andrea Rigamonti,[2] Eleonora Maestri,[3] Christian Lunetta,[3] Dario Bovio,[4] Caterina Salito,[4] Barbara Uva,[4] Alessandra Ferri,[5] Francesca Lanfranconi,[6] Ildebrando Appollonio,[1] Carlo Ferarrese[1]

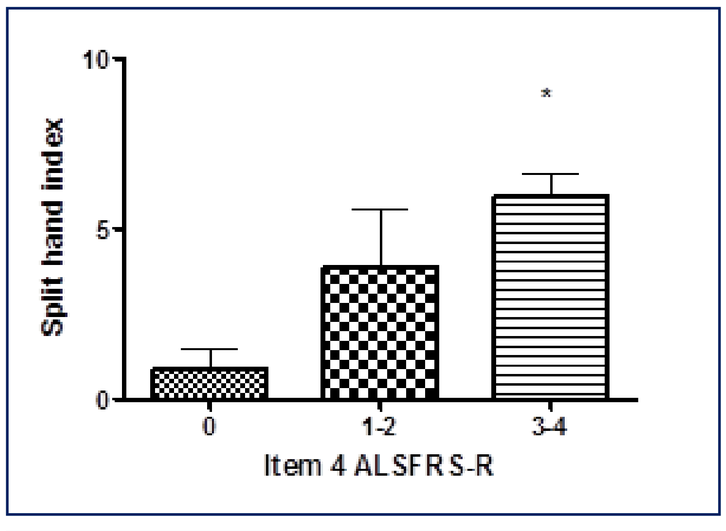
1 Neurology Unit, San Gerardo Hospital and University of Milano-Bicocca, Monza, Italy 2 Neurology Unit, Manzoni Hospital, Lecco, Italy 3 NEuroMuscular Omnicentre (NEMO), Fondazione Serena Onlus, Milano, Italy 4 Biocubica s.r.l., Milano, Italy
5 Institute of Sport, Exercise and Active Living, Victoria University, Melbourne, Australia
6 DISS, University of Milano-Bicocca, Monza, Italy

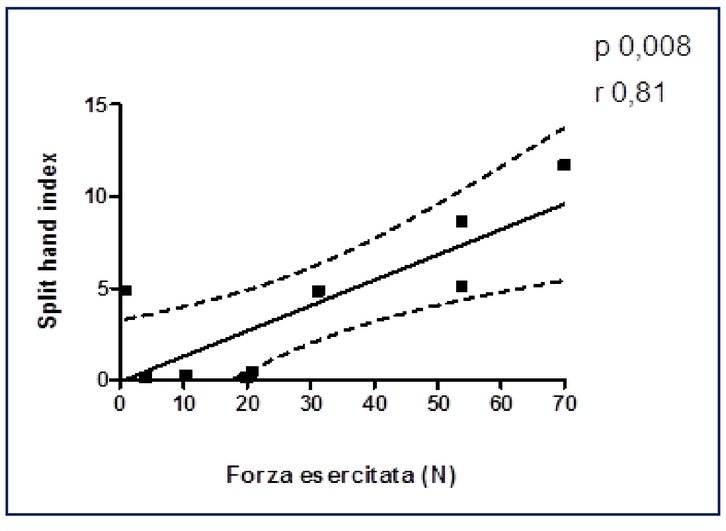
Background: Wasting of the abductor pollicis brevis (APB) and of the first dorsal interosseus (FDI) muscles with relative sparing of abductor digiti minimi muscle (ADM) is complexively known as “split hand”, rarely seen in disorders other than amyotrophic lateral sclerosis (ALS). For this reason a neurophysiological index (split hand index, SPI) has already been proposed for the early diagnosis of ALS. Albeit not invasive, SPI determination may be quite bothersome for some patients and methodological issues might limit its accuracy. Therefore, developing novel tools able to capture the split hand phenomenon might be desirable in order to improve ALS diagnosis. Mechanomyography (MMG) consists in recording the sound that is produced by the dimensional variations of muscle fibres and by their progressive recruitment during contraction. MMG allows the study of muscle contraction over time, possibly providing a putative link between diagnostic usefulness and functional implications, guiding rehabilitation.

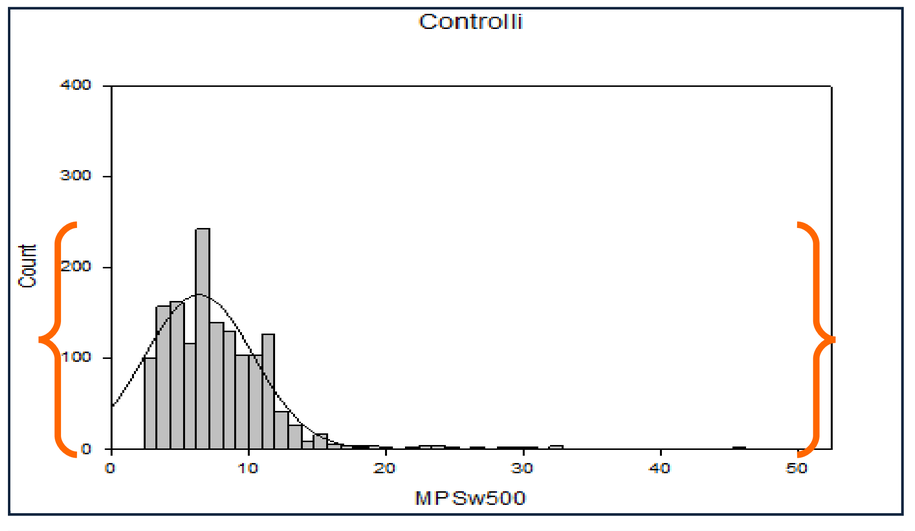
Our study: Here we decided to not-invasively approach the “split hand” problem aiming at: (a) diagnostic repercussions, especially when hand muscle wasting is not already clinically discernible in ALS patients, and (b) functional repercussions, since this amyotrophic pattern might imply relevant consequences on everyday disability. **50 probable or definite ALS patients** were been enrolled and clinical data obtained, including hand intrinsic muscle atrophy and strength and finger tapping. **SPI was calculated** in these patients on both hands. A novel approach to **MMG interface creation** and subsequent recording was set up and applied to the dominant hand of 10 selected ALS patients. In these patients the maximal pinch strength was calculated as well by a dynamometer.

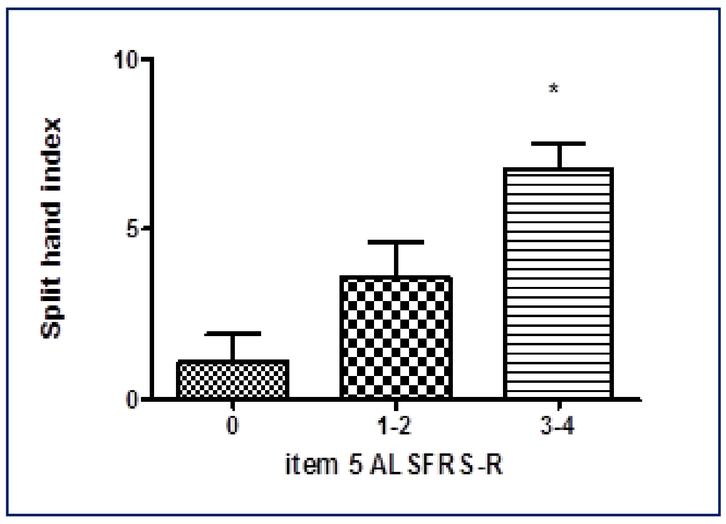


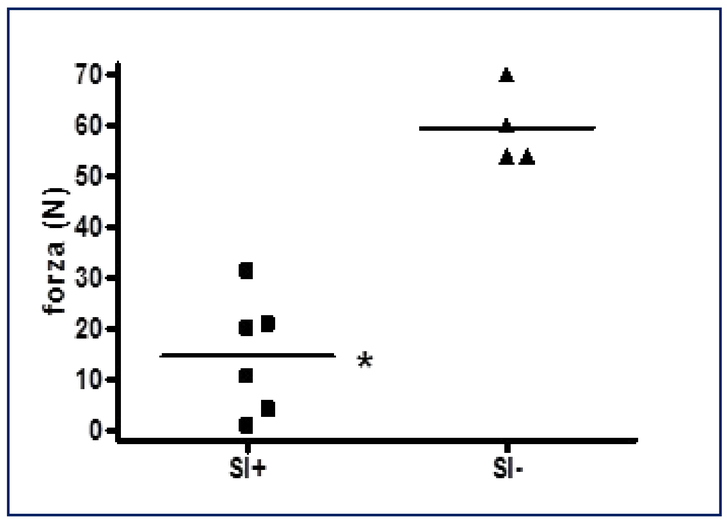


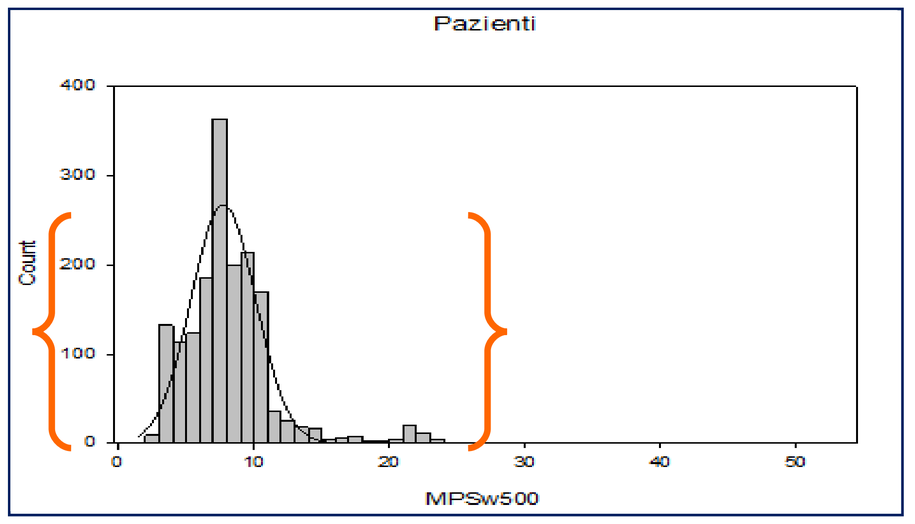












Discussion and Conclusions: SPI usefulness might extend beyond diagnostic applications, offering an estimation of pinch strength and, indirectly, of hand functional disability in ALS. On the other hand, our prototype of MMG technology is both pioneering and portable, offering an innovative and low-cost approach to the assessment of muscle function in neuromuscular disorders over time and applicable to specific training programs.