



# Spatial distribution of surface EMG signals in upper trapezius with myofascial trigger point

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## BACKGROUND AND AIM

An active myofascial trigger point (MTrP) in a muscle is characterized by a motor dysfunction, which induces a constant discrete hardness (i.e. taut band), and by localized sensory abnormality characterized by pain. The mechanism underlying the development of the MTrP is not fully understood. The current thinking is that the development of the taut band and subsequent pain is related to a local muscle overload. The aim of this study is to investigate the spatial relationship between motor units activation and MTrP in the upper trapezius muscle.

## MATERIALS AND METHODS

Twelve subjects with a MTrP in the right upper trapezius and 14 control subjects without MTrP were enrolled. All subjects performed an isometric force ramp during shoulder elevation. Surface EMG signals were detected using a matrix of 64 electrodes placed vertically. To describe the spatial recruitment of motor units, signals were divided in epochs of 1s and maps of EMG amplitude were computed for each epoch. The peak amplitude was identified for each epoch and its location with respect to matrix channels was analysed during the force ramp (Fig. 1a). MTrPs were detected by palpation and their location established according to matrix channels. The distance between map peaks and MTrPs were computed. Additionally the mean positions of the map peaks were computed for all subjects.

## RESULTS

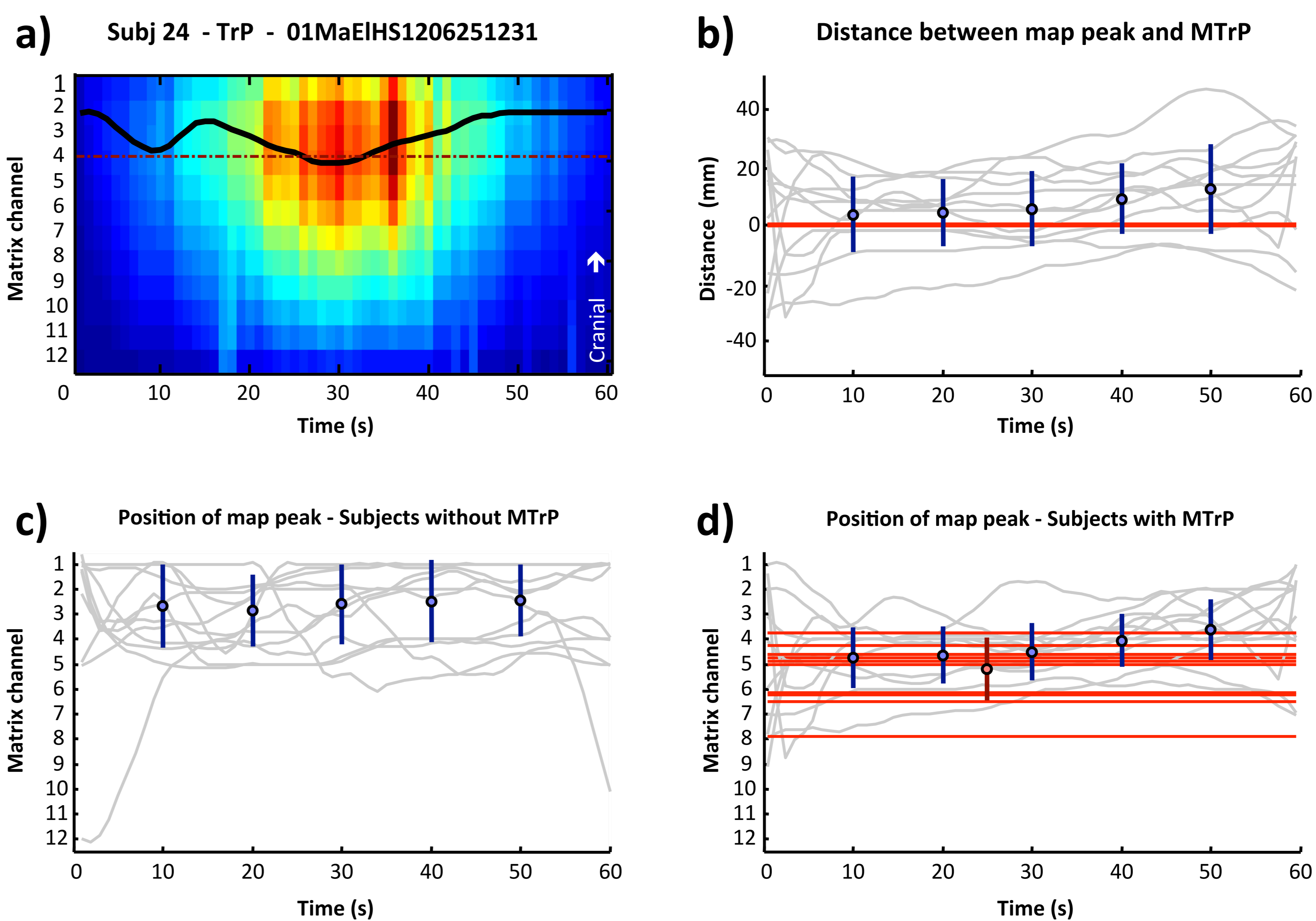
The mean distance between map peak and MTrP was  $5.2 \pm 1.2$  mm (Fig. 1b). The mean position of the map peak, with respect to the matrix, was  $2.6 \pm 0.1$  (matrix channel) for subjects without MTrP and  $4.3 \pm 0.4$  (matrix channel) for subjects with MTrP (Fig. 1c and 1d). The map peak position during the ramp in subjects with and without MTrP was statistically different ( $P < 0.05$ ).

## DISCUSSION

Our findings indicate that MTrPs are located nearby the peak amplitude of surface EMG map. Additionally subjects with MTrP showed a significant shift of the EMG amplitude distribution towards a caudal region.

## CONCLUSIONS

MTrPs in upper trapezius are located in a region with greater motor units discharge. This study shows for the first time that MTrPs can induce a change in the spatial activation of motor units.



**Figure 1** Graphical representation of data. a) An example of EMG signal amplitude map during the ramp (0% to 60% MVC from 0 to 30s and 60% to 0% MVC from 30 to 60s), the black line indicates the position of the map peak during the ramp while the dotted line indicates the MTrP position with respect to matrix channels. b) Mean distance between map peak and MTrP during the force ramp. c) Mean position of the map peak with respect to the matrix in subjects without MTrP. d) Mean position of the map peak with respect to the matrix in subjects with MTrP. Red lines indicate the MTrP position with respect to matrix channels.

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