

SUPPORTING INFORMATION

Title: Preserved thenar muscles in non-ambulant Duchenne muscular dystrophy patients

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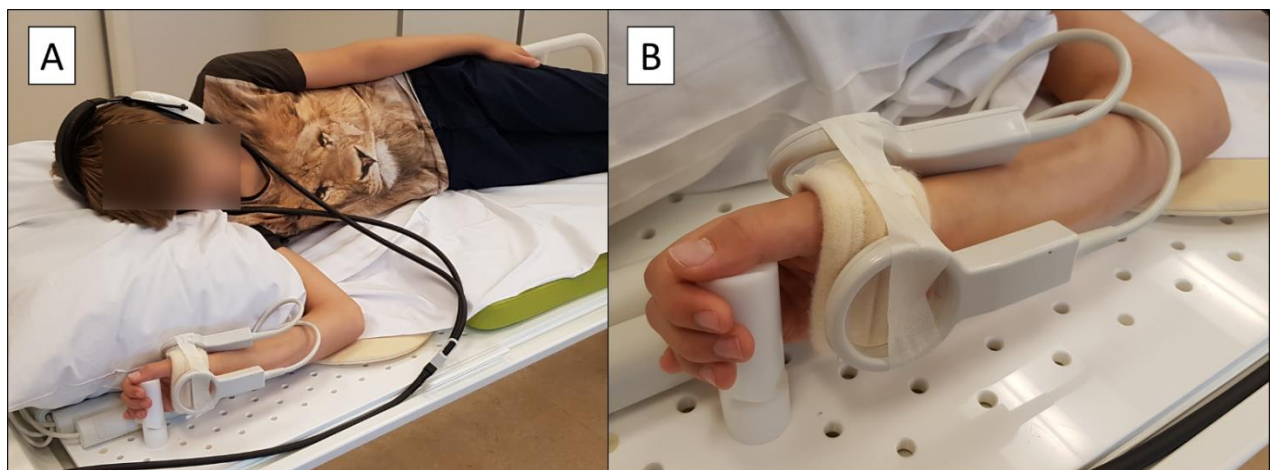


Figure S1 Example of a participant and forearm positioned in maximum pronation

In (A) the standard position is shown, where participants lay on the right side with the right shoulder in 90° flexion, with the right elbow in 90° flexion and the forearm in maximum pronation, which was supported by holding a handle. During the actual scanning procedure a sheet would be placed around the arm to prevent direct contact between the skin and the coils and cables. A detail of the 47 mm surface coils placed on the ventral and dorsal side of the thenar muscles is shown in (B).

Effect of different positioning

Healthy controls (HC) ≥ 18 years old without MRI contra-indications were included in a separate study to assess the effects of different positioning in the MRI scanner on thenar quantitative MRI (qMRI) results. Medical ethical approval for this protocol was waived, and written informed consents from participants were obtained.

Seven HCs were included. MRI scans of the right hand were acquired, while the participant was positioned on his right side with the right shoulder in 90° flexion, the elbow in 90° flexion, and the forearm in maximum pronation or halfway between pronation and supination. The Dixon scan was acquired in these two positions in all HCs, and the multi-echo spin-echo (MSE) scan was acquired in both positions in three of the HCs. Thenar fat fraction (FF), total volume (TV), contractile volume (CV) and T2 relaxation time of the muscle compartment ($T_{2_{\text{water}}}$) were determined as described previously. We assessed differences between qMRI results in the different positions using Wilcoxon signed-rank test.

Thenar FF and $T_{2_{\text{water}}}$ results were comparable in both positions (figure S2A and D). Both TV and CV differed significantly between the two positions, although the average difference was small with 0.55 cm^3 for TV and 0.63 cm^3 for CV (Supporting information figure S2B and C).

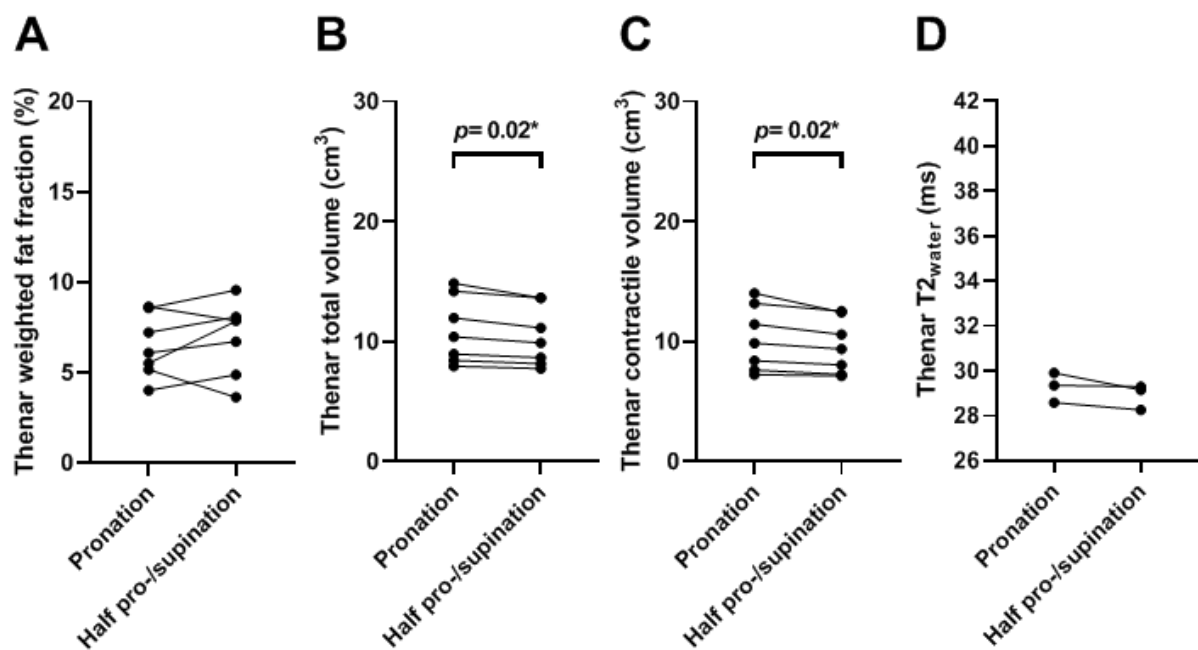
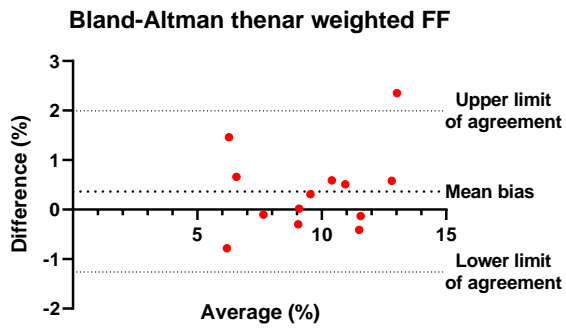
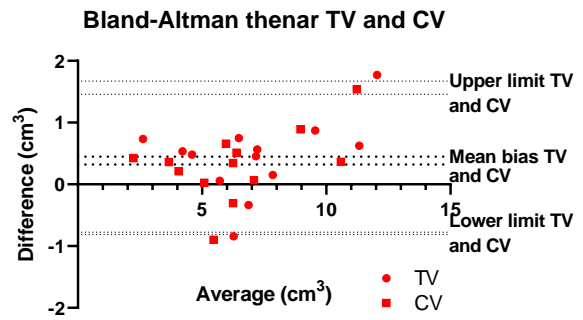
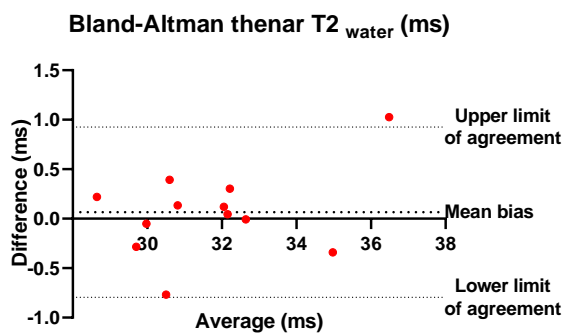


Figure S2 Thenar qMRI results in different forearm positions

Dixon and multi-echo spin-echo whole muscle thenar results are shown for seven HC. Participants are positioned with a 90° elbow angle, and the forearm in maximum pronation or halfway between pronation and supination. Both positions are shown in (A) for FF, (B) for TV, (C) for CV and (D) for $T_{2_{\text{water}}}$. Thenar FF and $T_{2_{\text{water}}}$ results are comparable in both positions. Total volume and contractile volume differ significantly between both positions, but the resulting difference is small.

A**B****C****Figure S3** Interrater variability for thenar qMRI results

The thenar ROIs of DMD patients were drawn by two raters: K.J.N. and A.J.P. The Bland-Altman plots for the interrater variability in DMD patients is shown for FF in (A), TV and CV in (B) and T2_{water} in (C). The mean bias and 95% limits of agreement for FF were 0.4% (-1.3 to 2.0%), for TV 0.4 cm³ (-0.8 to 1.7 cm³), for CV 0.3 cm³ (-0.8 to 1.5 cm³), and for T2_{water} 0.1 ms (-0.8 to 0.9 ms).

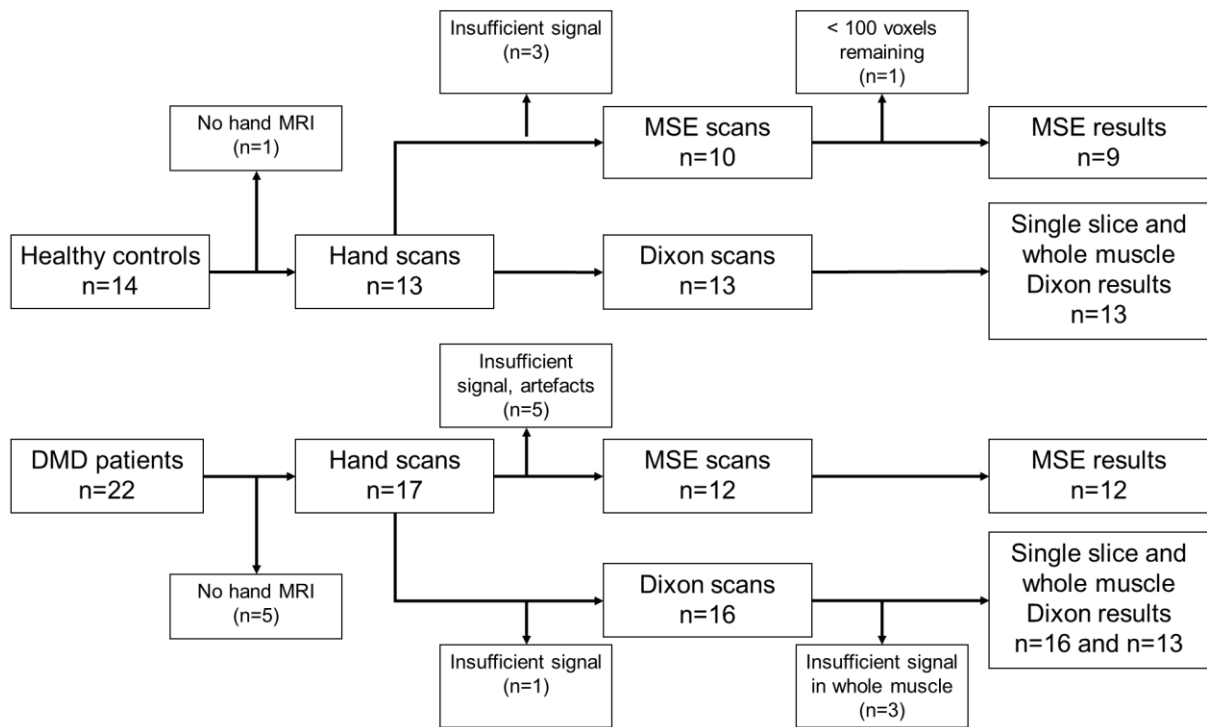


Figure S4 Flowchart of MRI data inclusion

Twenty-two DMD patients and 14 HC participated in the study. Five DMD patients could not undergo the MRI scans of the hand muscles: two patients decided not to undergo the MRI at the baseline visit, two patients were unable to complete the scans due to discomfort, and a technical failure of the MRI led to absence of the scans for the last patient. In one HC no MRI scans were acquired due to the relative contra-indication of dental braces. Four Dixon scans and five MSE scans of DMD patients were excluded due to insufficient signal or movement artefacts, and four MSE scans of HCs were excluded due to insufficient signal or because less than 100 thenar voxels with a sufficient B1 remained. In total 13 Dixon scans from HCs and 13 from DMD patients were included in the analysis of the whole thenar muscles. Similarly, MSE scans from nine HCs and 12 DMD patients were included in the analysis.

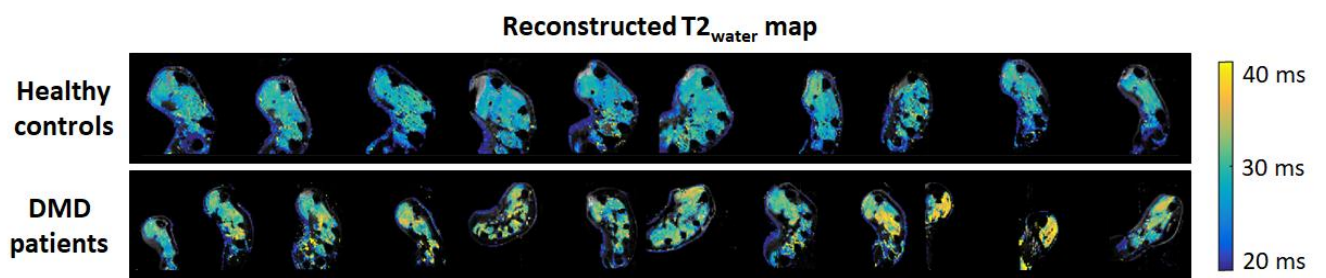


Figure S5 $T_{2_{\text{water}}}$ of all hand muscles for HCs and DMD patients

The reconstructed $T_{2_{\text{water}}}$ map for one slice per HC and DMD patient is shown in all participants to illustrate the higher $T_{2_{\text{water}}}$ values in hand muscles in DMD patients versus HCs.

Single slice versus whole muscle results

If patient positioning would influence thenar qMRI results, this effect is expected to be larger if results would be determined on one slice instead of the whole muscle. In addition, to reduce scan time in the future, we assessed if qMRI results could be determined only on a single slice. To study this in all DMD patients and HCs, we also assessed all Dixon results for the slice with the largest cross-sectional area (CSA). This yielded a single slice thenar FF, CSA, contractile CSA (cCSA), and specific strength (pinch strength/cCSA). Spearman correlation coefficient was used to assess the correlation of the single slice and whole muscle Dixon results for HCs and DMD patients separately.

All correlations between single slice and whole muscle Dixon results were strong, except for FF in DMD patients and specific strength in HCs, which were moderate (figure S5A until D).

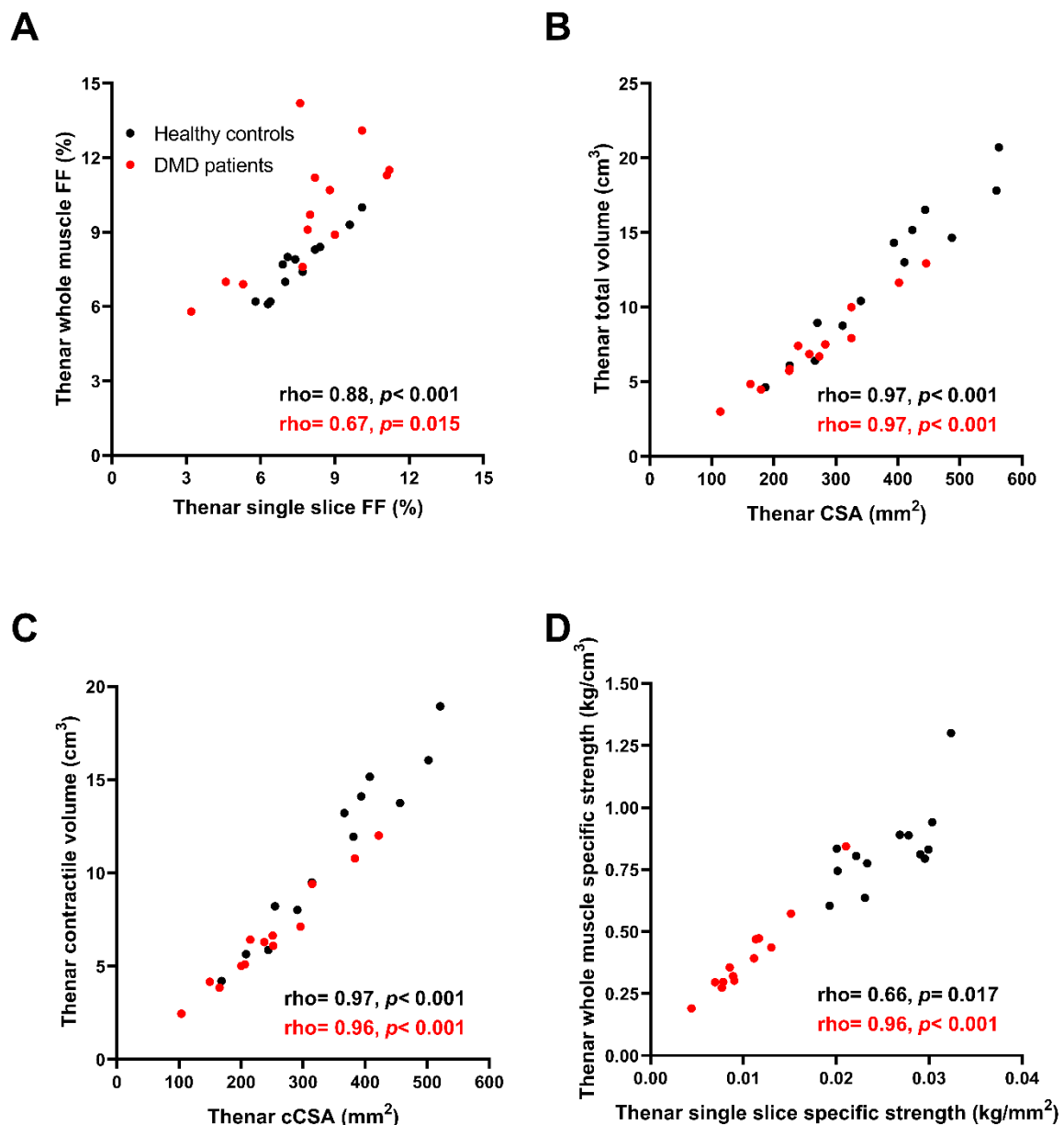


Figure S6 Single slice versus whole muscle Dixon thenar results

Dixon thenar whole muscle results are plotted versus the single slice results, for HCs (black; n=13) and DMD patients (red; n=13). The comparison is presented for FF in (A), CSA and TV in (B), cCSA and CV in (C), and

specific strength in (D). All correlations between single slice and whole muscle values were strong, except FF in DMD patients and specific strength in HCs, which were moderate.