

REFLEX Embodiment Validation.

Supplementary Material.

Lora-Millan, Julio S.^{1,*}, Sanchez-Cuesta, Francisco José², Romero, Juan Pablo^{2,3}, Moreno, Juan C.⁴, and Rocon, Eduardo⁵.

¹Electronic Technology Area, Rey Juan Carlos University, Madrid, Spain

²Facultad de Ciencias Experimentales, Universidad Francisco de Vitoria, Pozuelo de Alarcón, Madrid, Spain

³Brain Damage Unit, Hospital Beata María Ana, Madrid, Spain

⁴Neural Rehabilitation Group, Cajal Institute, Spanish National Research Council (CSIC), Madrid, Spain

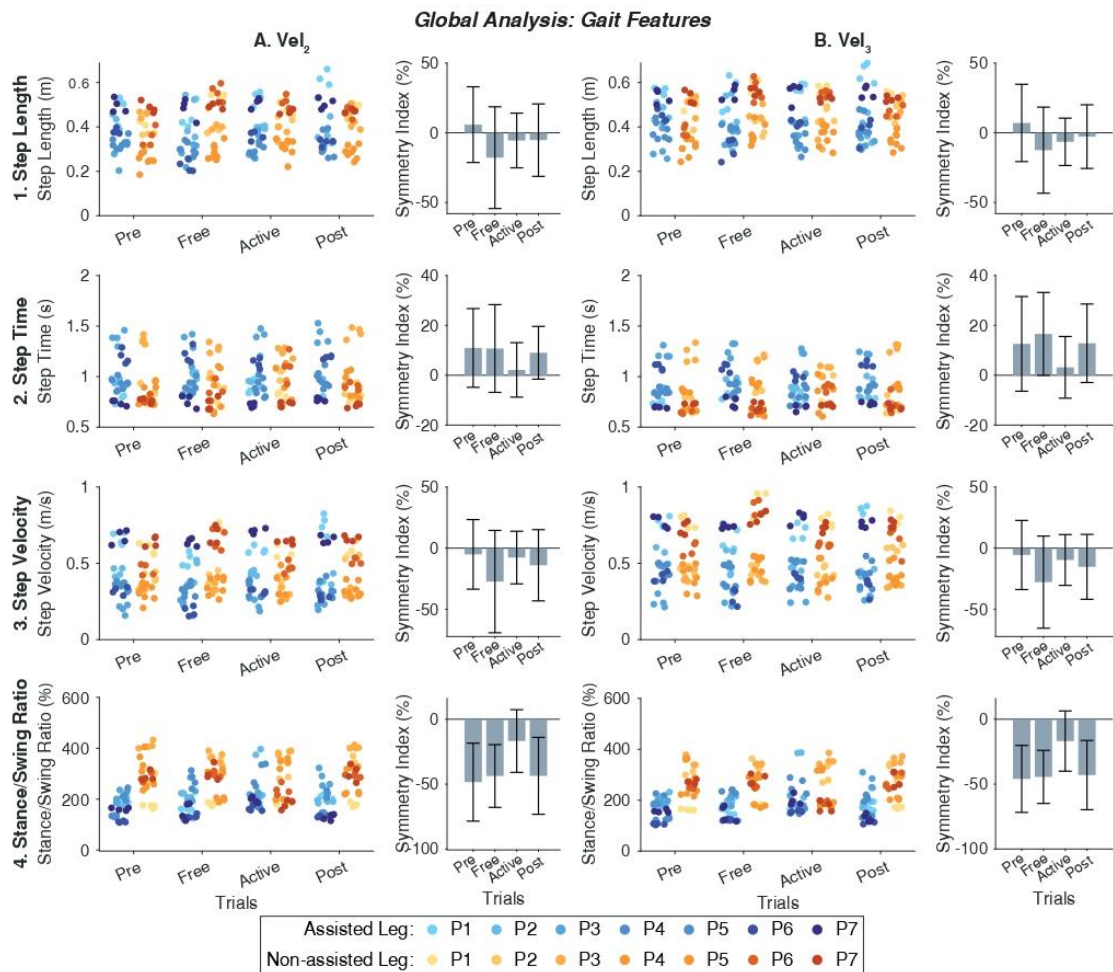
⁵Centro de Automática y Robótica, Spanish National Research Council (CSIC), Madrid, Spain

* Corresponding author: julio.lora@urjc.es

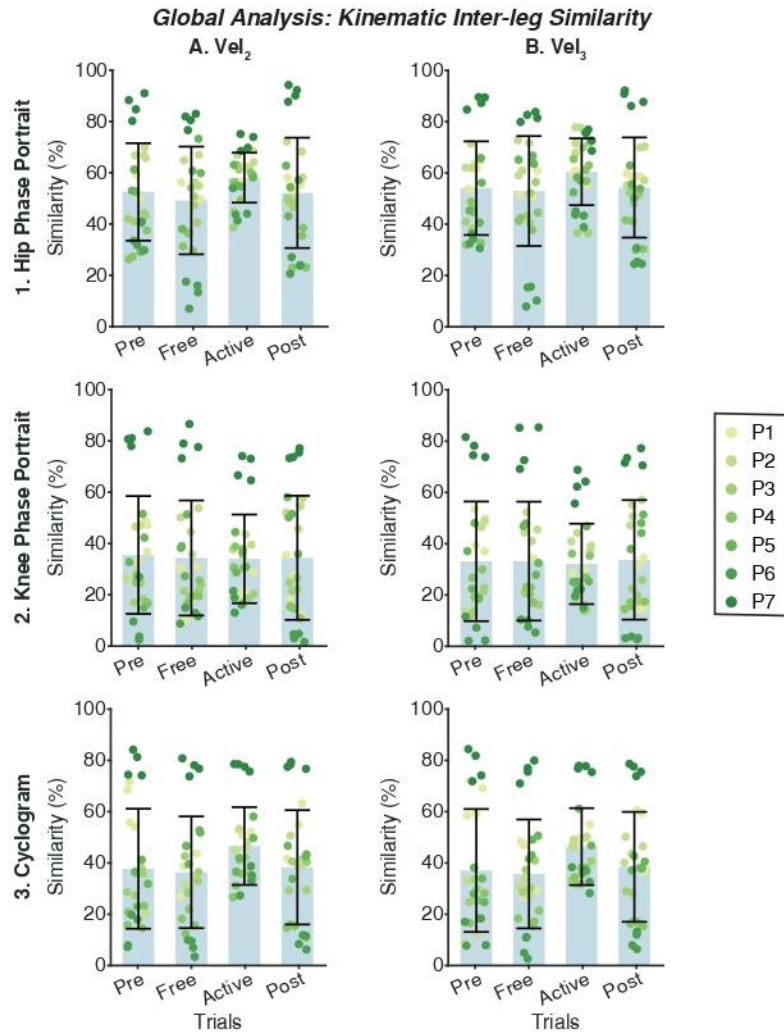
Supplementary Table 1. Stroke subject's demographic data

<i>Id Subject</i>	<i>P1</i>	<i>P2</i>	<i>P3</i>	<i>P4</i>	<i>P5</i>	<i>P6</i>	<i>P7</i>	<i>Average^a</i>
<i>Age</i>	57	63	63	68	56	56	57	60±4.69
<i>Height (m)</i>	1.7	1.8	1.7	1.7	1.7	1.7	1.7	1.74±0.05
<i>Weight (kg)</i>	84	84	83	74	81	76	76	79.71±4.27
<i>Time after stroke (months)</i>	9	26	38	21	49	43	8	27.71±16.22
<i>MMSB Score</i>	29	27	13	26	26	25	29	25±5.51
<i>FIM Score</i>	117	104	79	118	90	107	126	105.86±16.61
<i>Time Up and Go (s)</i>	24.66	28.07	37.52	20.86	29.62	18.35	7.46	23.79±9.54
<i>Sex</i>	Male	Male	Male	Female	Male	Female	Male	
<i>Stroke</i>	Subcortical ischemic	Cortical ischemic	Cortical ischemic	Cortical hemorrhagic	Cortical hemorrhagic	Cortical hemorrhagic	Cortical hemorrhagic	
<i>Paretic side</i>	Right	Left	Right	Right	Left	Right	Left	

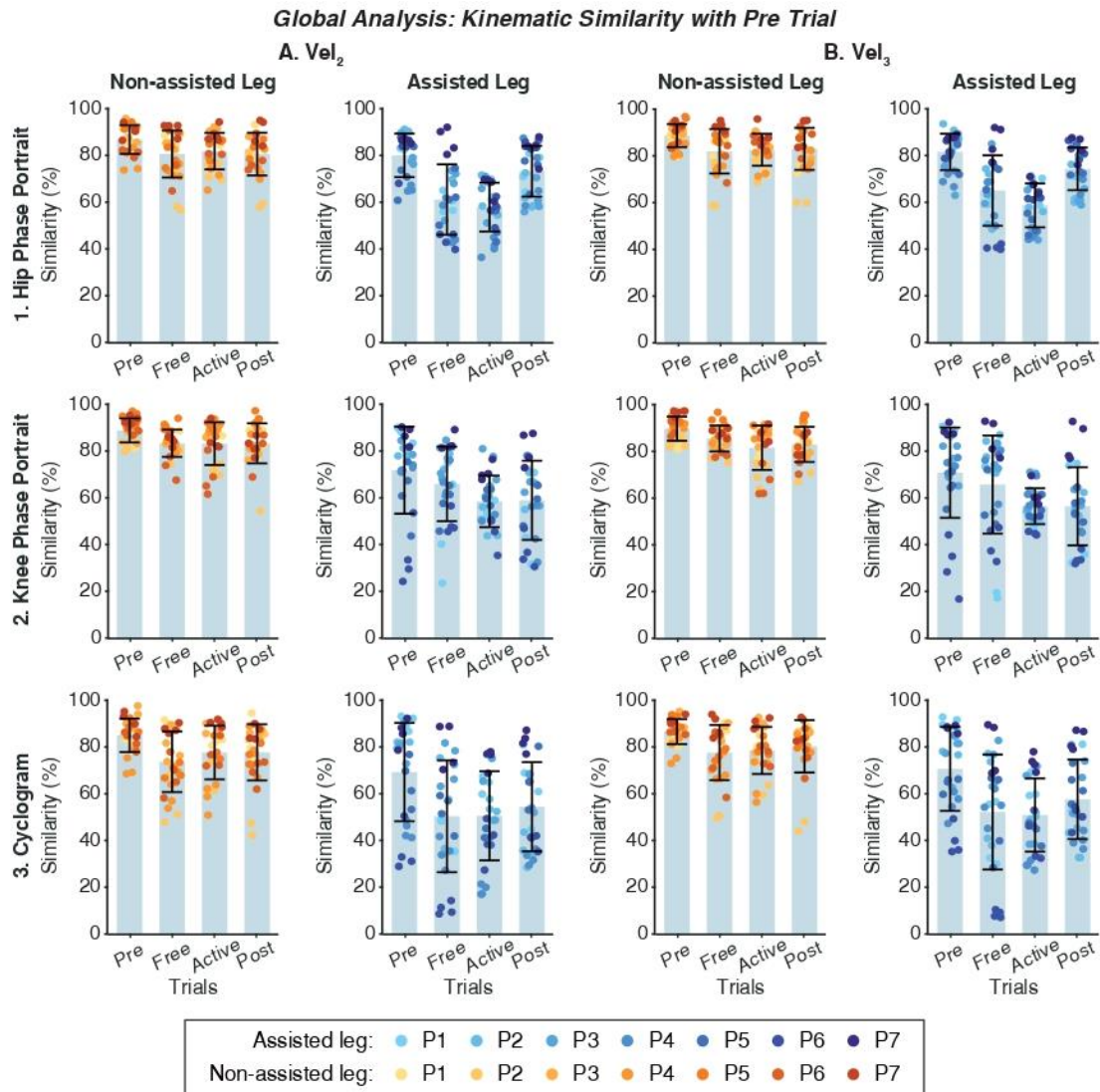
^a Mean ± STD



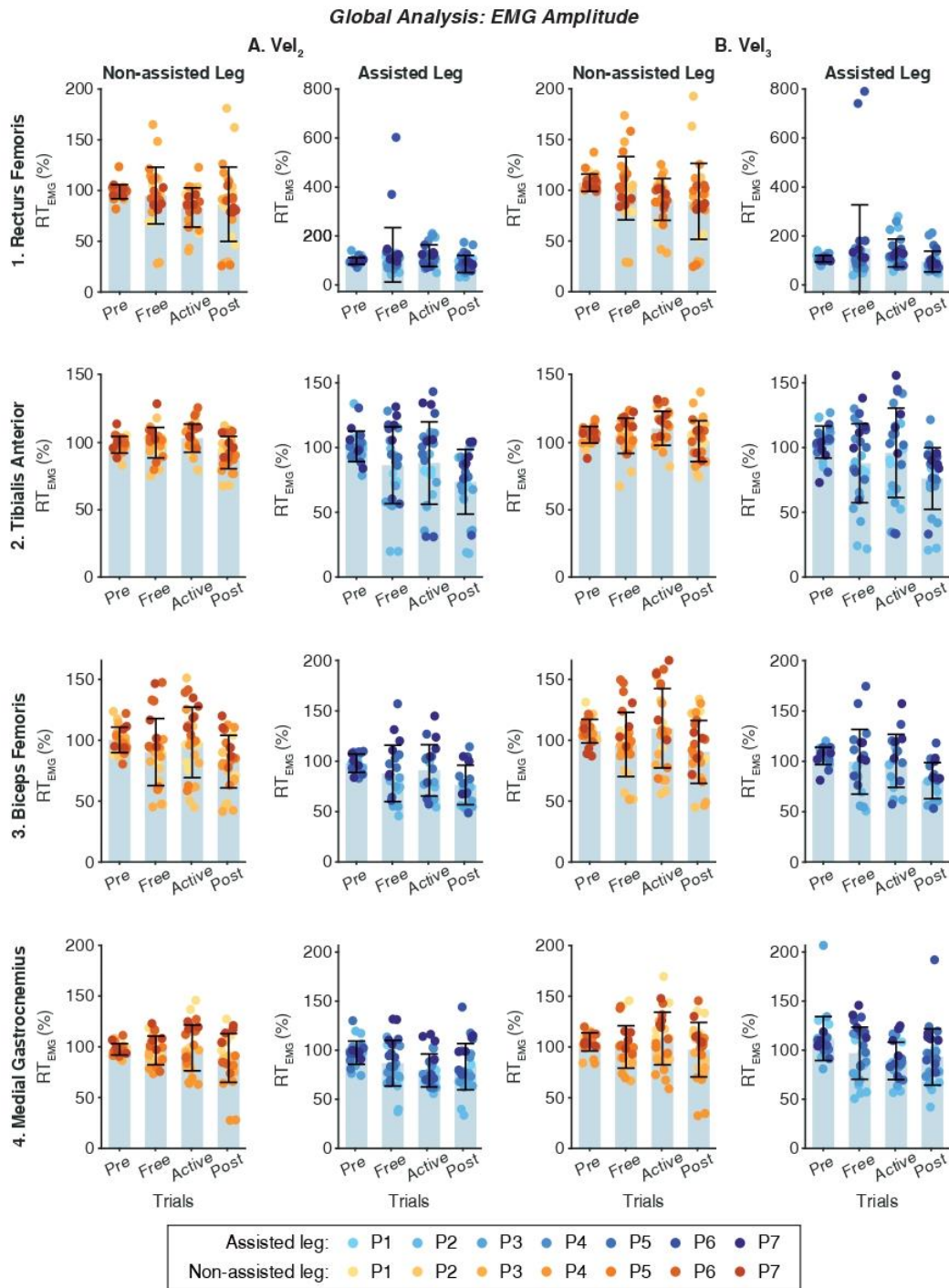
Supplementary Figure S1. Global inter-subject gait features analysis at vel_2 (column A) and vel_3 (column B). Each row (1-4) represents a different metric. Each cell is divided into two subpanels: the left subpanel represents all the metric measurements differentiating between trial, leg, and patient, while the right subpanel represents the symmetry index distributions across trials. The bar plot shows the average value $\pm$ the standard deviation; markers represent individual metric values. The same color represents the same patient across the figure (see the legend for details).



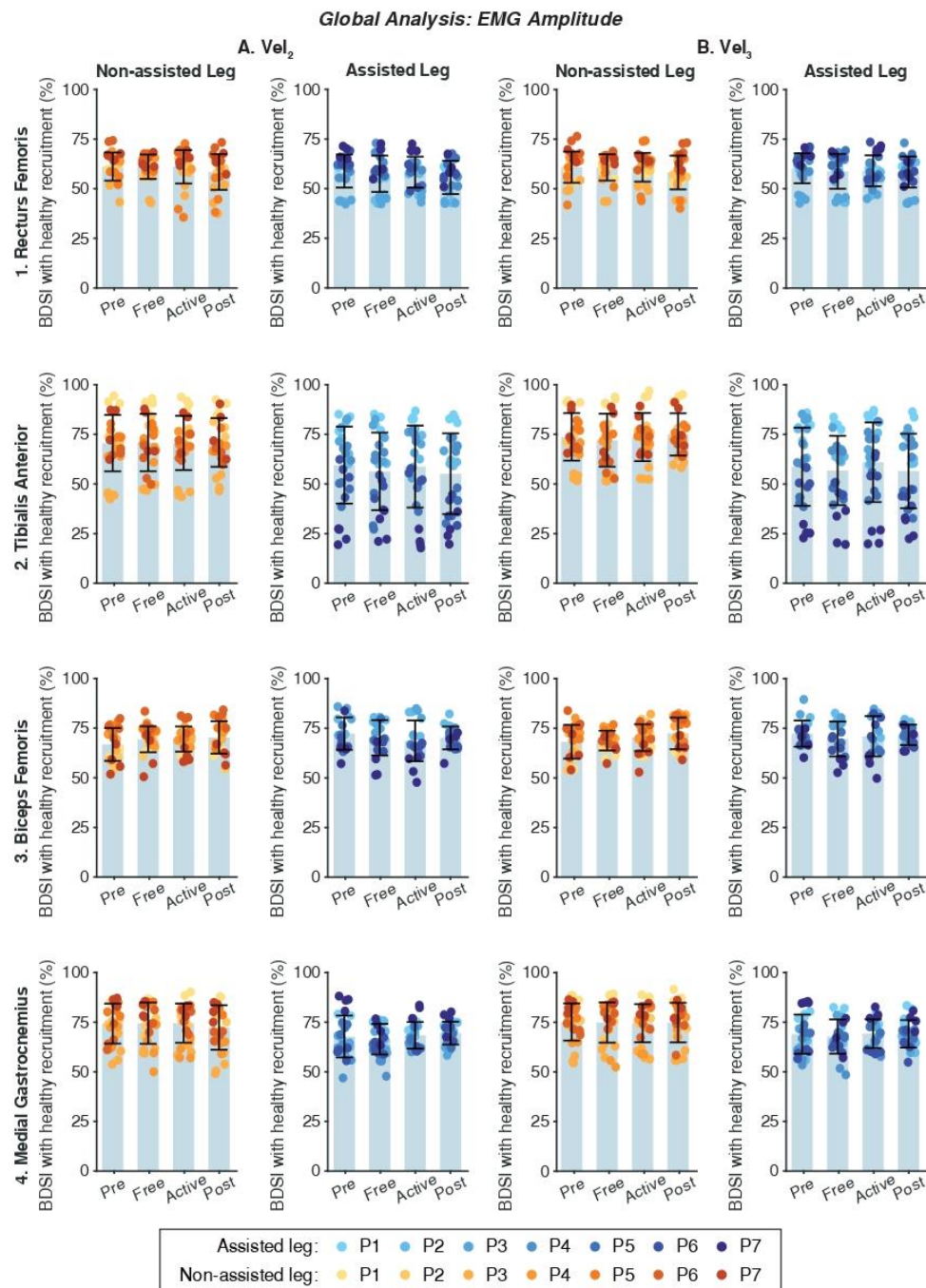
Supplementary Figure S2. Global inter-subject analysis of interleg kinematic similarity at vel_2 (column A) and vel_3 (column B). Each row (1-3) represents the interleg kinematic similarity across trials regarding the hip phase-portrait (1), the knee phase portrait (2), or the hip/knee cyclogram (3). The bar plot shows the average value $\pm$ the standard deviation; markers represent individual metric values. The same color represents the same patient across the figure (see the legend for details).



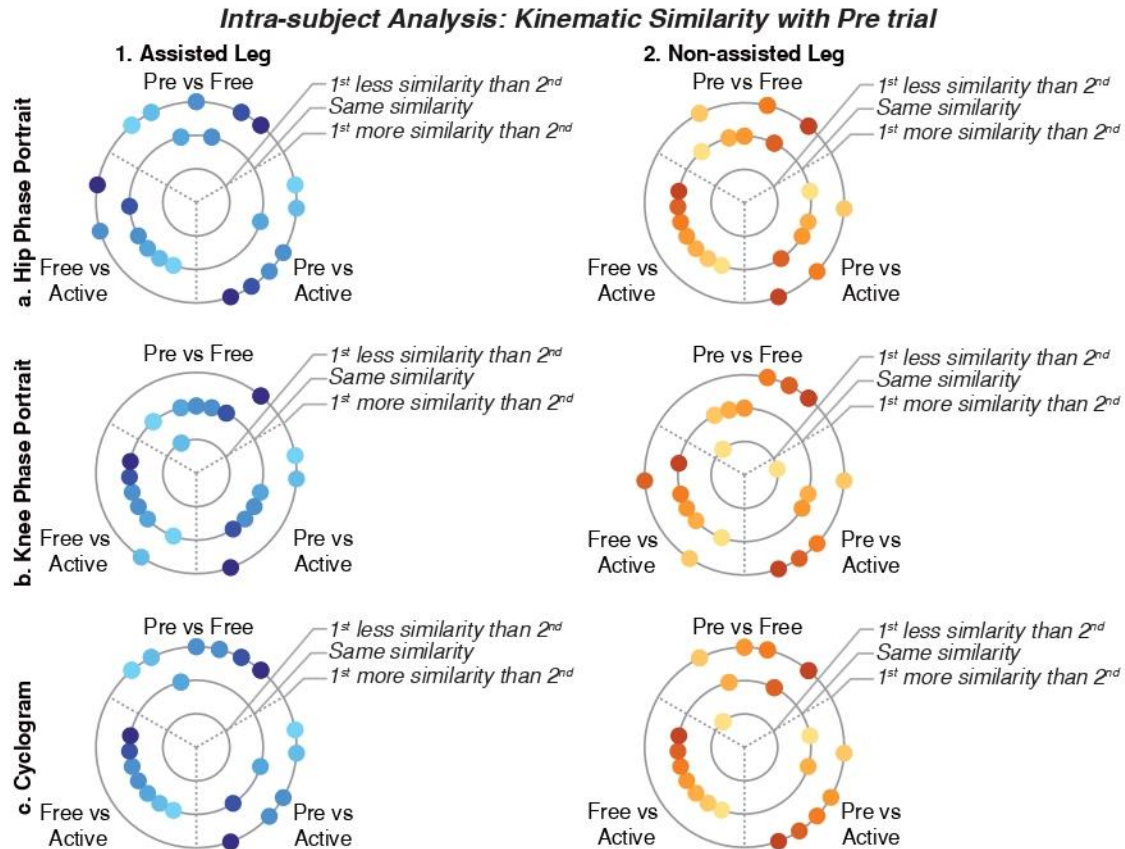
Supplementary Figure S3. Global inter-subject kinematic intra-leg similarity analysis at vel_2 (column A) and vel_3 (column B). Each graph compares the evolution of kinematic representations from \textit{Pre} across trials. Rows group the results of hip phase portraits (row 1), the knee phase portraits (row 2), and hip/knee cyclograms (row 3). The first columns represent the metric for the non-assisted leg, while the second columns represent the assisted leg. The bar plot shows the average value $\pm$ the standard deviation; markers represent individual metric values. The same color represents the same patient across the figure (see the legend for details).



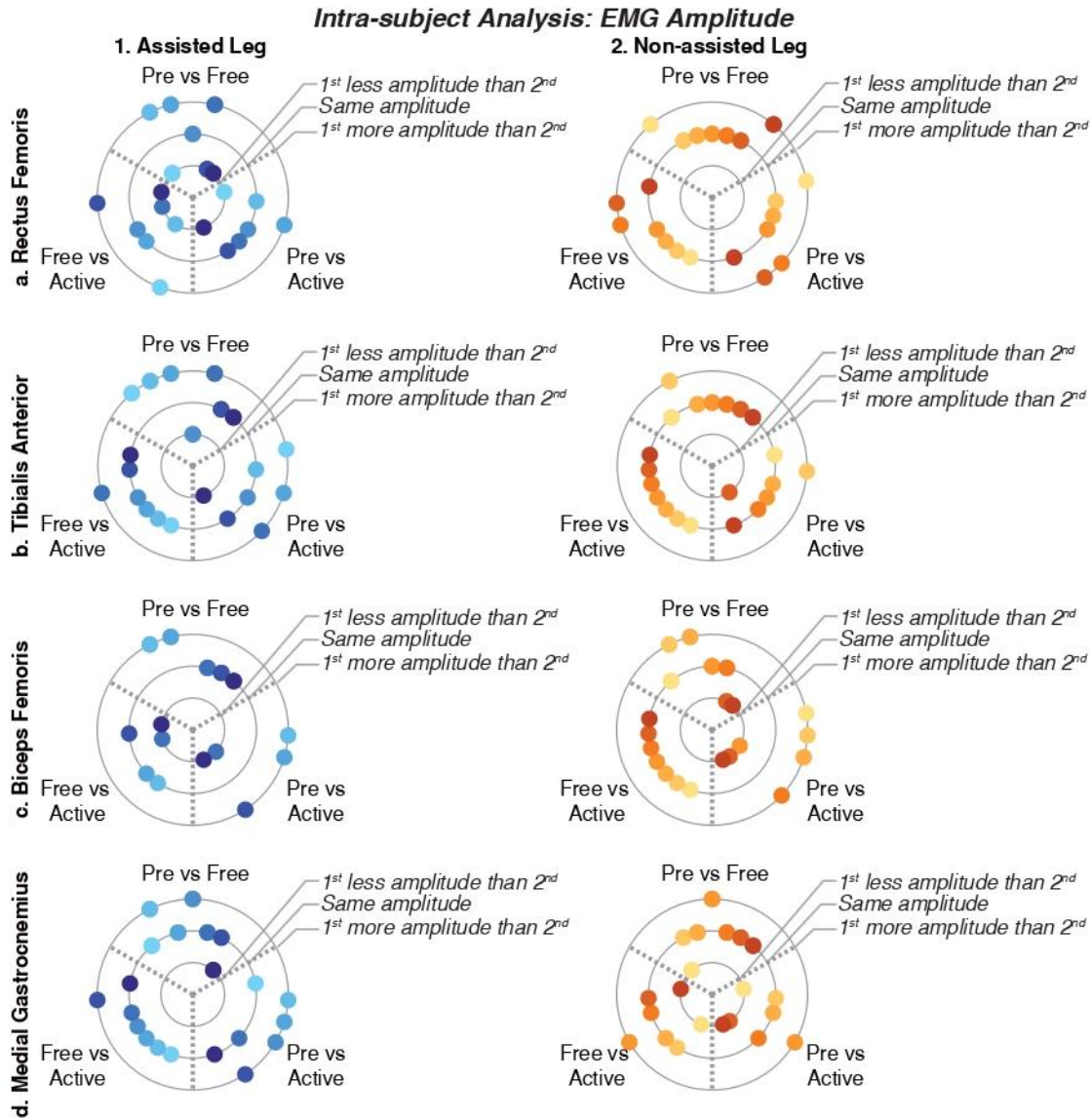
Supplementary Figure S4. Global inter-subject EMG amplitude analysis at vel_2 (column A) and vel_3 (column B). Each represents the EMG ratio across trials. Rows group the results for each muscle (Rectus Femoris, Tibialis Anterior, Biceps Femoris, and Medial Gastrocnemius for rows 1-4, respectively). The first columns represent the metric for the non-assisted leg, while the second columns represent the assisted leg. The bar plot shows the average value $\pm$ the standard deviation; markers represent individual metric values. The same color represents the same patient across the figure (see the legend for details).



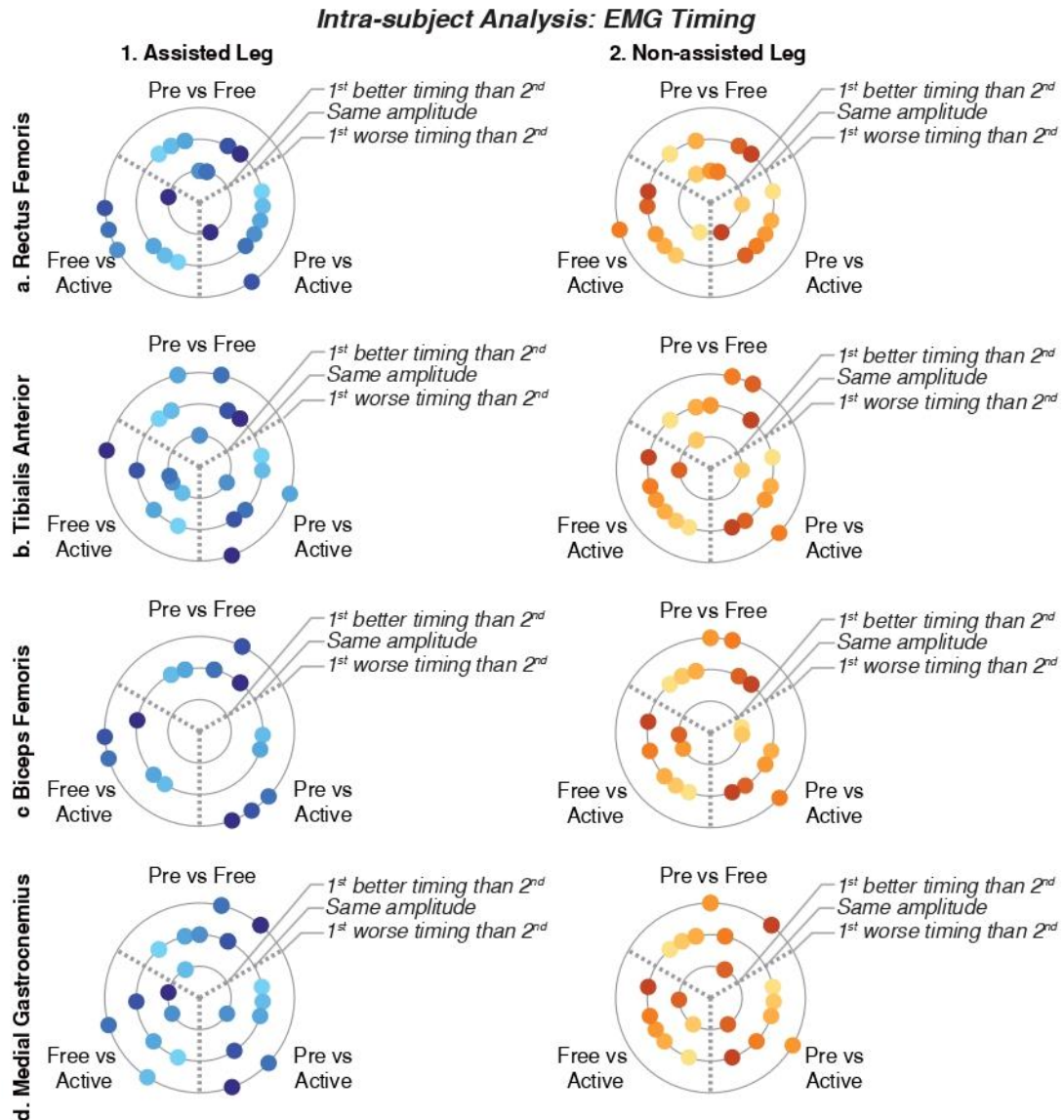
Supplementary Figure S5. Global inter-subject EMG timing analysis at vel_2 (column A) and vel_3 (column B). Each represents the BDSI with the normal healthy muscular recruitment across trials. Rows group the results for each muscle (Rectus Femoris, Tibialis Anterior, Biceps Femoris, and Medial Gastrocnemius for rows 1-4, respectively). The first columns represent the metric for the non-assisted leg, while the second columns represent the assisted leg. The bar plot shows the average value $\pm$ the standard deviation; markers represent individual metric values. The same color represents the same patient across the figure (see the legend for details).



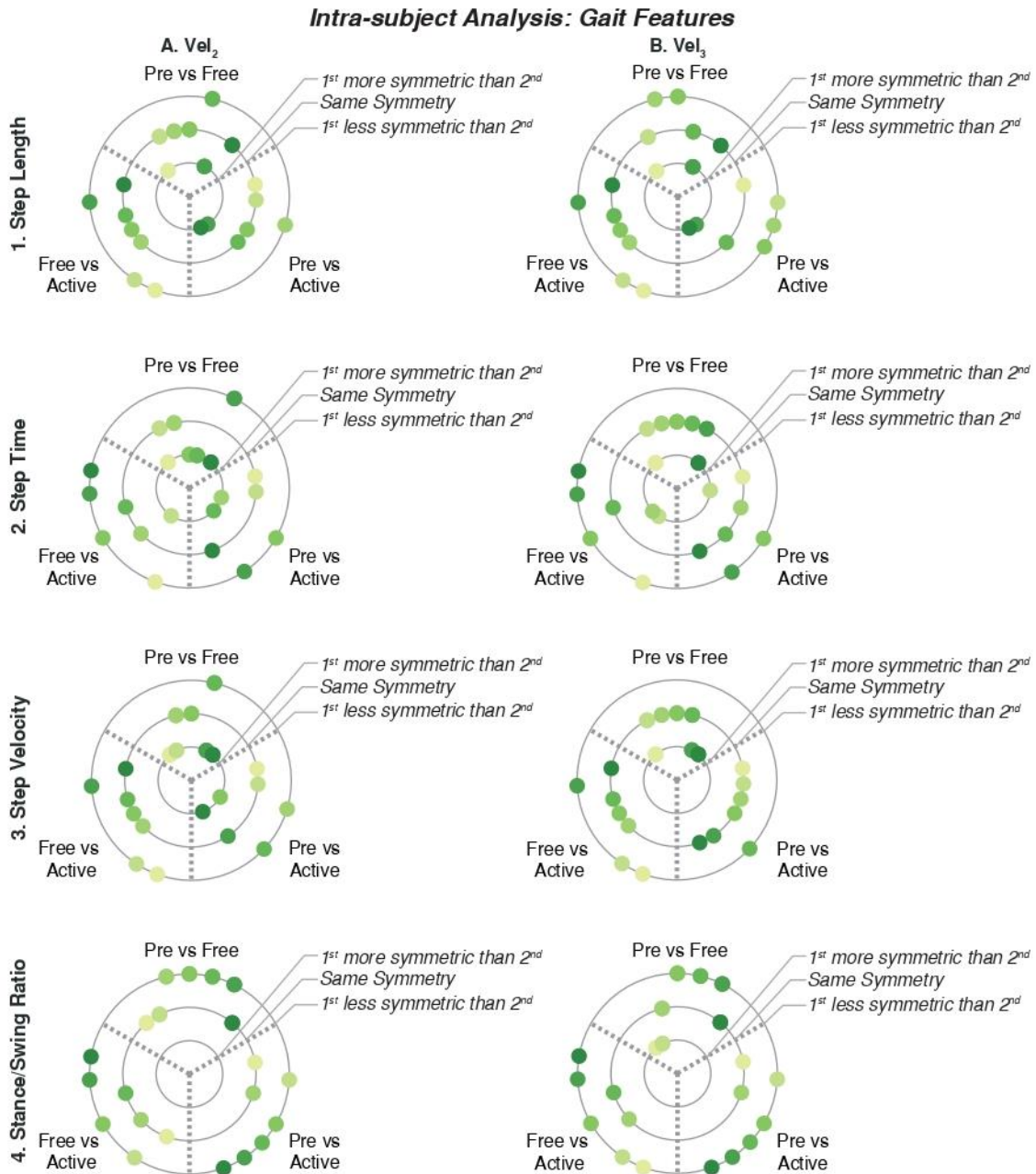
Supplementary Figure S6. Summary of the intra-subject kinematic intra-leg similarity analysis at vel_1 . Each panel represents the evolution of kinematic representations from Pre , they also compare this evolution in *Pre*, *Free* and *Active* trials. Columns group the results for the same leg (assisted leg in the column 1, and non-assisted leg in column 2). Rows group results for the same kinematic representations (hip phase portrait, knee phase portrait and cyclogram for rows a-c). Each subject is represented with a different color, the same brightness gradation represents the same patient across panels.



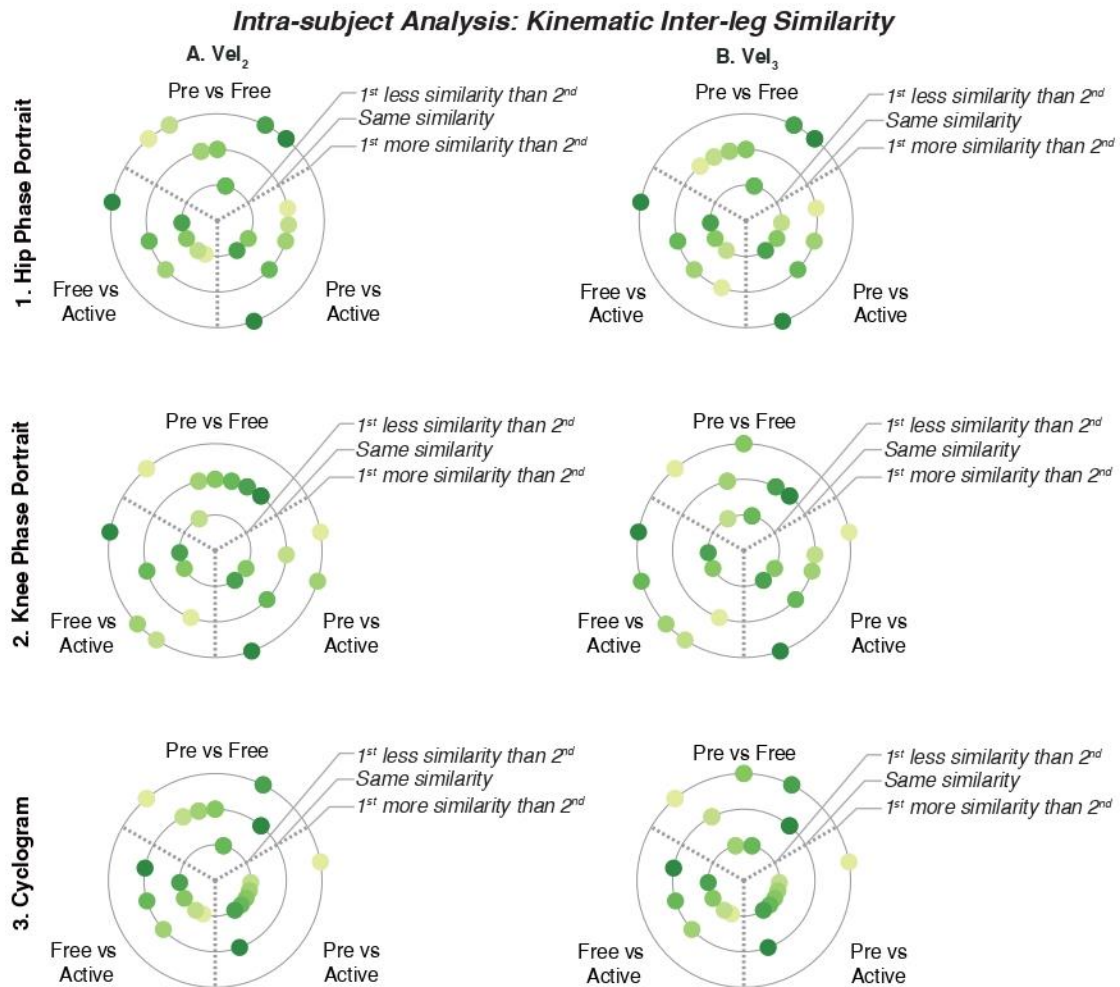
Supplementary Figure S7. Summary of the intra-subject EMG amplitude analysis at vel_1 . Each panel compares the EMG amplitude for different muscles between *Pre*, *Free* and *Active* trials. Columns group the results for the same leg (assisted leg in the column 1, and non-assisted leg in column 2). Rows group results for the same muscles (Rectus Femoris, Tibialis Anterior, Biceps Femoris and Medial Gastrocnemius for rows a-d). Each subject is represented with a different color, the same brightness gradation represents the same patient across panels.



Supplementary Figure S9. Summary of the intra-subject EMG timing analysis at *vel*₁. Each panel compare the BDSI calculated respect to healthy activation for different muscles between *Pre*, *Free* and *Active* trials Columns group the results for the same leg (assisted leg in column 1 and non-assisted leg in column 2). Rows group results for the same muscles (Rectus Femoris, Tibialis Anterior, Biceps Femoris, and Medial Gastrocnemius for rows a-d). Each subject is represented with a different color, the same brightness gradation the same patient across panels

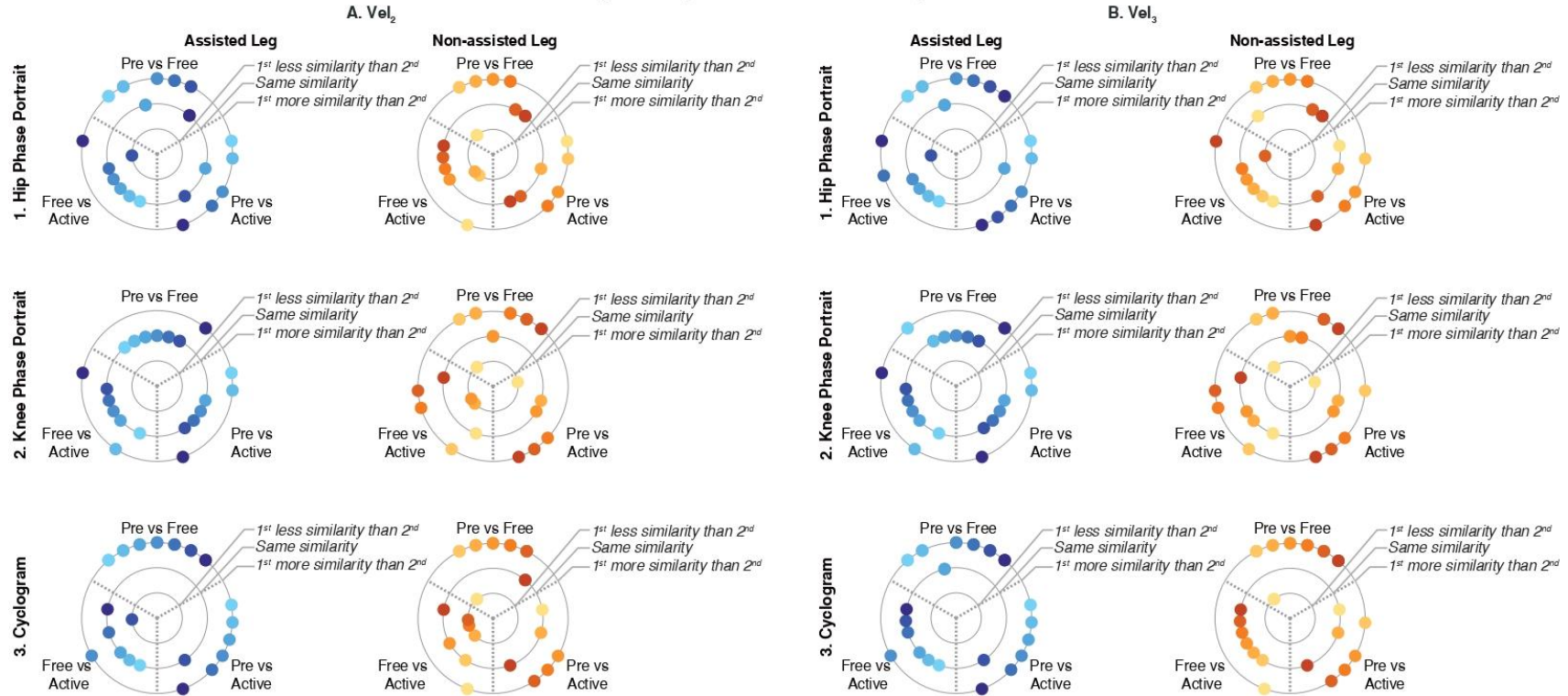


Supplementary Figure S10. Summary of the intra-subject gait feature analysis at vel_2 (column A) and vel_3 (column B). Each row (1-4) represents the results when comparing the symmetry of a gait feature between *Pre*, *Free* and *Active* trials. Each subject is represented with a different color and the same color represents the same patient across panels.



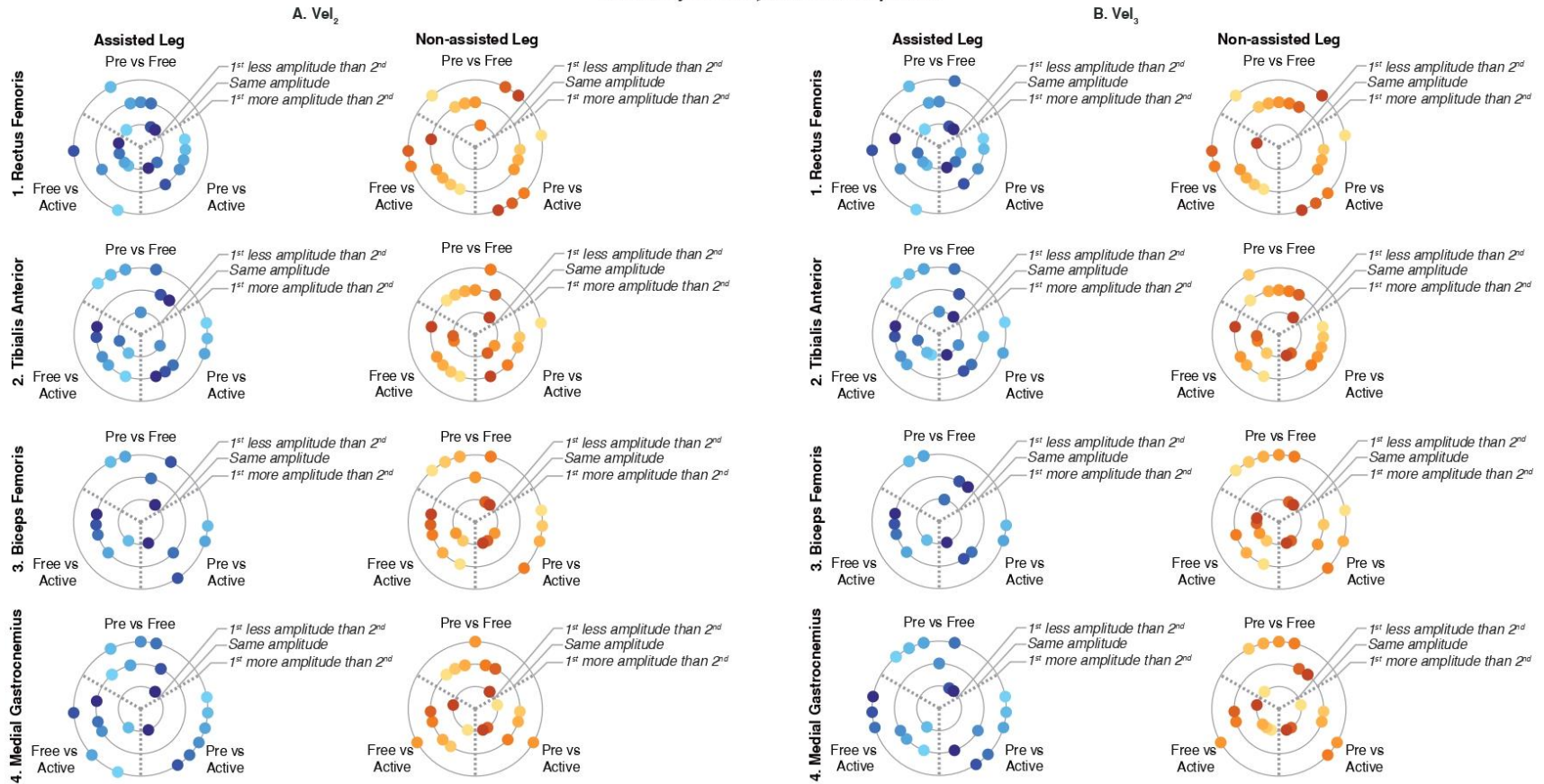
Supplementary Figure S11. Summary of the intra-subject kinematic inter-leg similarity analysis at vel_2 (column A) and vel_3 (column B). Each row (1-3) represents the results when comparing the similarity between limbs of different kinematic representations between *Pre*, *Free* and *Active* trials. Each subject is represented with a different color and the same color represents the same patient across panels.

Intra-subject Analysis: Kinematic Similarity with Pre trial

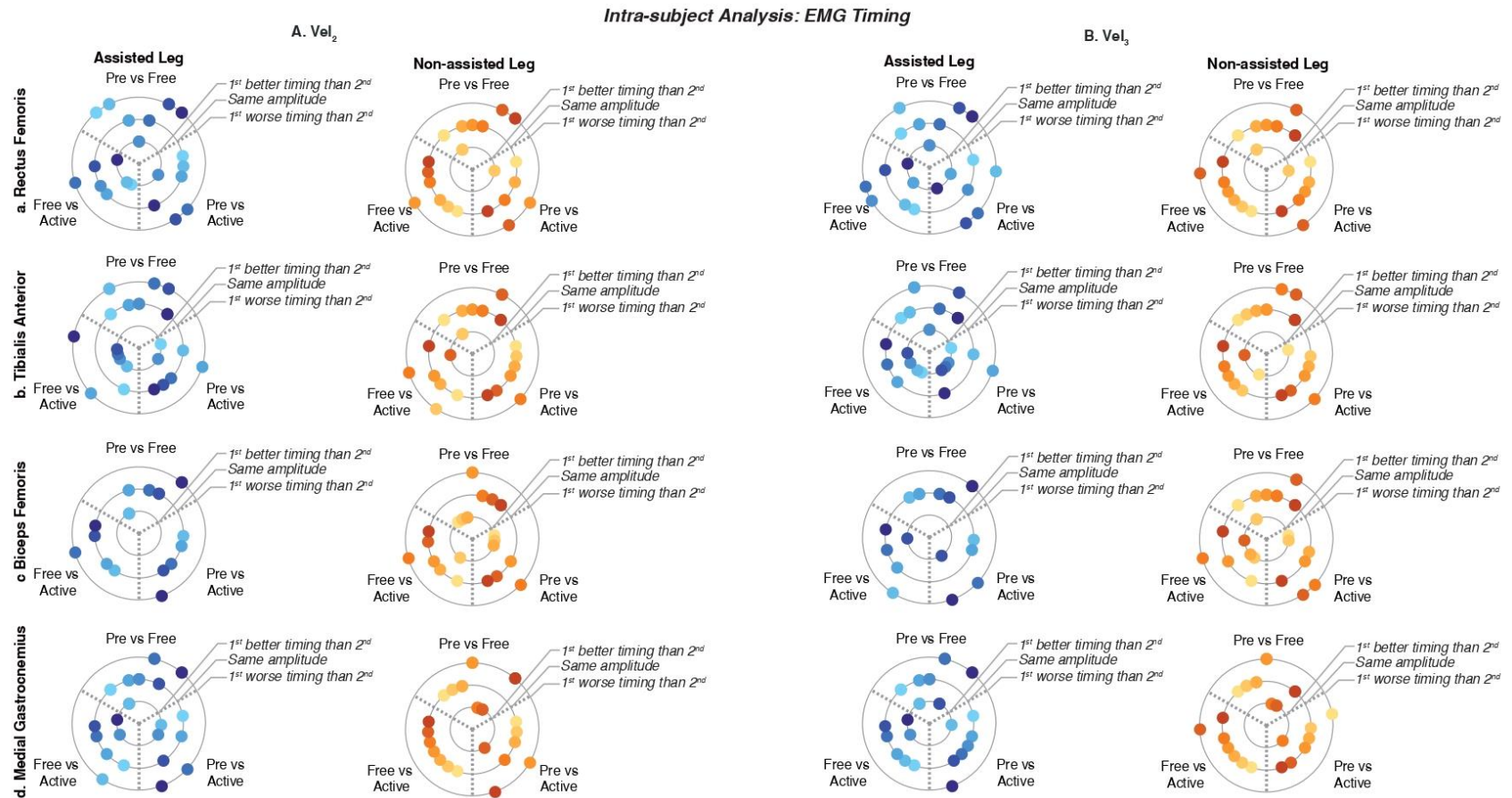


Supplementary Figure S12. Summary of the intra-subject kinematic intra-leg similarity analysis at vel_2 (column A) and vel_3 (column B). Each row (1-3) represents the results when comparing the similarity between limbs of different kinematic representations *Pre*, *Free* and *Active* trials. Each subject is represented with a different color, the same brightness gradation represents the same patient across panels.

Intra-subject Analysis: EMG Amplitude



Supplementary Figure S13. Summary of the intra-subject EMG amplitude analysis at vel_2 (column A) and vel_3 (column B). Each graph compares the EMG amplitude for different muscles between *Pre*, *Free* and *Active* trials. Columns group the results for the same leg (assisted leg in the first column, and non-assisted leg in the second column of each panel). Rows group results for the same muscles (Rectus Femoris, Tibialis Anterior, Biceps Femoris and Medial Gastrocnemius for rows 1-4). Each subject is represented with a different color, the same brightness gradation represent the same patient across panels.



Supplementary Figure S14. Summary of the intra-subject EMG timing analysis at vel_2 (column A) and vel_3 (column B). Each panel compare the BDSI calculated respect to healthy activation for different muscles between *Pre*, *Free* and *Active* trials. Columns group the results for the same leg (assisted leg in the first column, and non-assisted leg in the second column of each panel). Rows group results for the same muscles (Rectus Femoris, Tibialis Anterior, Biceps Femoris and Medial Gastrocnemius for rows 1-4). Each subject is represented with a different color, the same brightness gradation represents the same patient across panels.