

Supplementary Table 1 - Consistency of gait parameters and their coefficients of variation (CoV) across straight walking segments

Healthy elderly		3 straight walking segments (each 20 meters)		
	<i>ICC</i>	<i>p</i>	<i>Range of segment means (min - max)</i>	<i>SD of segment means</i>
HE Stride length	0.98	<0.0001	86.02 – 86.20	0.10
HE CoV Stride length	0.61	<0.0001	1.78 – 2.16	0.21
HE Stride time	0.94	<0.0001	1.02 - 1.03	0.01
HE CoV Stride time	0.28	<0.0001	1.48 – 1.90	0.16
Movement disorders		5 straight walking segments (each 10 meters)		
	<i>ICC</i>	<i>p</i>	<i>Range of segment means (min - max)</i>	<i>SD of segment means</i>
MD Stride length	0.97	<0.0001	76.76 – 77.37	0.46
MD CoV Stride length	0.69	<0.0001	2.86 - 3.37	0.75
MD Stride time	0.97	<0.0001	1.02 – 1.04	0.01
MD CoV Stride time	0.62	<0.0001	2.78 – 3.76	0.46
ATX Stride length	0.96	<0.0001	78.16 – 78.93	0.30
ATX CoV Stride length	0.73	<0.0001	4.33 - 6.01	0.75
ATX Stride time	0.98	<0.0001	1.10 – 1.14	0.02
ATX CoV Stride time	0.73	<0.0001	4.00 – 6.14	0.93
ET Stride length	0.98	<0.0001	75.64 – 76.69	0.43
ET CoV Stride length	0.20	0.028	2.15 – 2.63	0.18
ET Stride time	0.97	<0.0001	1.01 – 1.02	0.003
ET CoV Stride time	0.22	0.019	2.87 – 3.05	0.08
PD Stride length	0.97	<0.0001	76.76 – 77.37	0.25
PD CoV Stride length	0.69	<0.0001	2.86 – 3.37	0.21
PD Stride time	0.97	<0.0001	1.02 – 1.04	0.01
PD CoV Stride time	0.62	<0.0001	2.78 – 3.76	0.46

ATX – patients with ataxia, CoV – coefficient of variation; ET – patients with essential tremor; GC – gait cycle; HE – healthy elderly; ICC – intraclass coefficient; MD – neurological disorders with motor impairment; PD – patients with Parkinson’s disease; SD – standard deviation

Supplementary Table 2 - Consistency of gait parameters and their coefficients of variation (CoV) across straight walking segments per disease subgroups AFTER omission of one additional stride before and after turns

Healthy elderly		3 straight walking segments (each 20 meters)		
	<i>ICC</i>	<i>p</i>	<i>Range of segment means (min - max)</i>	<i>SD of segment means</i>
HE Stride length	0.98	<0.0001	86.15 – 86.33	0.09
HE CoV Stride length	0.43	<0.0001	1.53 – 1.82	0.13
HE Stride time	0.94	<0.0001	1.016 - 1.027	0.006
HE CoV Stride time	0.24	<0.0001	1.37 – 1.62	0.11
Movement disorders		5 straight walking segments (each 10 meters)		
	<i>ICC</i>	<i>p</i>	<i>Range of segment means (min - max)</i>	<i>SD of segment means</i>
MD Stride length	0.97	<0.0001	77.10 – 77.62	0.22
MD CoV Stride length	0.79	<0.0001	2.52 – 2.85	0.13
MD Stride time	0.97	<0.0001	1.020 – 1.033	0.006
MD CoV Stride time	0.70	<0.0001	2.14 – 2.86	0.33
ATX Stride length	0.95	<0.0001	76.26 – 77.11	0.33
ATX CoV Stride length	0.83	<0.0001	4.13 – 5.31	0.40
ATX Stride time	0.97	<0.0001	1.10 – 1.23	0.014
ATX CoV Stride time	0.75	<0.0001	3.02 – 5.79	0.88
ET Stride length	0.98	<0.0001	78.42 – 79.23	0.27
ET CoV Stride length	0.26	0.0067	1.85 – 2.14	0.12
ET Stride time	0.95	<0.0001	1.009-1.021	0.004
ET CoV Stride time	0.37	0.00053	1.70 – 2.30	0.20
PD Stride length	0.96	<0.0001	75.76 – 76.60	0.32
PD CoV Stride length	0.50	<0.0001	1.65 – 2.47	0.34
PD Stride time	0.93	<0.0001	0.98 – 0.99	0.004
PD CoV Stride time	0.17	0.051	1.49 – 2.40	0.33

ATX – patients with ataxia, CoV – coefficient of variation; ET – patients with essential tremor; GC – gait cycle; HE – healthy elderly; ICC – intraclass coefficient; MD – neurological disorders with motor impairment; PD – patients with Parkinson’s disease; SD – standard deviation

Supplementary Table 3 – Characteristics of strides before and after turns. Average refers to the means of all 40 gait cycles.

	Mean	StD	p (vs. average)	% of stride values smaller than 97.5% of individual mean	Within 97.5%-102.5%	% of stride values greater than 102.5% of individual mean
HE SL BEFORE [%stature]	84.98	5.825	< 0.0001	21.25	74.06	4.66
HE SL AVERAGE [%stature]	86.13	4.83	n.a.	n.a.	n.a.	n.a.
HE SL AFTER [%stature]	85.26	5.223	< 0.0001	24.07	69.14	6.79
HE ST BEFORE [seconds]	1.035	0.06897	< 0.0001	4.01	68.21	27.78
HE ST AVERAGE [seconds]	1.021	0.06276	n.a.	n.a.	n.a.	n.a.
HE ST AFTER [seconds]	1.037	0.07288	< 0.0001	5.56	61.42	33.02
MD SL BEFORE [%stature]	76.29	7.66	0.0182	22.31	69.42	9.02
MD SL AVERAGE [%stature]	76.99	7.04	n.a.	n.a.	n.a.	n.a.
MD SL AFTER [%stature]	74.85	7.81	<0.0001	47.58	45.53	7.26
MD ST BEFORE [seconds]	1.045	0.110	0.2829	6.45	68.55	25.0
MD ST AVERAGE [seconds]	1.035	0.116	n.a.	n.a.	n.a.	n.a.
MD ST AFTER [seconds]	1.068	0.130	0.0027	7.26	53.23	39.51

HE – healthy elderly; MD – neurological disorders with motor impairment; StD – standard deviation; *n.a.* – not applicable, as comparisons of strides BEFORE and AFTER turns were made against averages of all strides.

Supplementary Table 4 – Characteristics of strides before and after turns per disease groups. Average refers to the means of all 40 gait cycles.

	Mean	StD	p (vs. average)	% of stride values smaller than 97.5% of individual mean	Within 97.5%-102.5%	% of stride values greater than 102.5% of individual mean
ATX SL BEFORE [%stature]	74.01	9.19	0.1667	42.31	42.31	14.81
ATX SL AVERAGE [%stature]	76.06	7.56	n.a.	n.a.	n.a.	n.a.
ATX SL AFTER [%stature]	73.93	8.69	0.0514	50.00	37.04	14.29
ATX ST BEFORE [seconds]	1.12	0.19	0.5439	25.00	53.57	21.43
ATX ST AVERAGE [seconds]	1.12	0.20	n.a.	n.a.	n.a.	n.a.
ATX ST AFTER [seconds]	1.15	0.22	0.1697	17.86	50.00	32.14
ET SL BEFORE [%stature]	76.10	7.05	0.0021	21.43	75.00	3.57
ET SL AVERAGE [%stature]	78.50	6.66	n.a.	n.a.	n.a.	n.a.
ET SL AFTER [%stature]	78.27	7.02	0.4689	50.00	39.29	10.71
ET ST BEFORE [seconds]	1.07	0.11	0.0061	0	78.57	21.43
ET ST AVERAGE [seconds]	1.02	0.07	n.a.	n.a.	n.a.	n.a.
ET ST AFTER [seconds]	1.04	0.07	0.0001	0	35.71	64.29
PD SL BEFORE [%stature]	74.08	8.23	0.001	21.43	67.86	10.71
PD SL AVERAGE [%stature]	76.02	7.45	n.a.	n.a.	n.a.	n.a.
PD SL AFTER [%stature]	75.69	7.83	0.2364	42.86	50.00	7.14
PD ST BEFORE [seconds]	1.02	0.04	0.0224	0.00	64.29	35.71
PD ST AVERAGE [seconds]	0.99	0.05	n.a.	n.a.	n.a.	n.a.
PD ST AFTER [seconds]	1.01	0.05	0.0005	7.14	64.29	28.57

ATX – patients with ataxia; ET – patients with essential tremor; HE – healthy elderly; MD – neurological disorders with motor impairment; PD – patients with Parkinson’s disease; SL – stride length; ST – stride time; StD – standard deviation; *n.a.* – *not applicable, as comparisons of strides BEFORE and AFTER turns were made against averages of all strides.*

Supplementary Table 5 –Number of gait cycles needed to reach a correlation coefficient of $R>0.8$ compared to 32 gait cycles in subjects with movement disorders (MD) and healthy elderly (HE) per disease subgroups AFTER omission of one additional stride before and after turns.

	N to reach R>0.8	Average at nth GC (\pm SD)	Number (%) of subjects with increased CoV ($>2.6\%$) at n	Average parameter after 32 GC (\pm SD)	Number (%) of subjects with increased CoV ($>2.6\%$) at 32 GC
HE Stride length [%stature]	3	86.48 \pm 4.99	n.a.	86.25 \pm 4.81	n.a.
HE CoV Stride length	25	1.69% \pm 0.60	9/162 (5%)	1.80 % \pm 0.67	17/162 (10%)
HE Stride time [seconds]	3	1.029 \pm 0.07	n.a.	1.019 \pm 0.062	n.a.
HE CoV Stride time	17	1.70% \pm 0.66	13/162 (8%)	1.91 % \pm 0.70	22/162 (14%)
MD Stride length [%stature]	3	77.17 \pm 6.77	n.a.	77.32 \pm 6.84	n.a.
MD CoV Stride length	5	2.70% \pm 2.04	10/31 (32%)	3.01 % \pm 2.05	12/31 (39%)
MD Stride time [seconds]	3	1.02 \pm 0.10	n.a.	1.026 \pm 0.11	n.a.
MD CoV Stride time	6	2.56% \pm 2.0	12/31 (38%)	2.87 % \pm 2.06	10/31 (32%)
ATA Stride length[%stature]	3	76.18 \pm 7.46	n.a.	76.60 \pm 6.82	n.a.
ATA CoV Stride length	5	4.45% \pm 3.39	5/7 (71%)	5.07 % \pm 3.00	5/7 (71%)
ATA Stride time [seconds]	3	1.09 \pm 0.14	n.a.	1.11 \pm 0.18	n.a.
ATA CoV Stride time	5	4.44% \pm 2.27	4/7 (57%)	5.08 % \pm 3.27	4/7 (57%)
ET Stride length [%stature]	3	78.22 \pm 6.58	n.a.	78.79 \pm 6.37	n.a.
ET CoV Stride length	16	2.28% \pm 0.64	4/12 (33%)	2.28 % \pm 0.87	4/12 (33%)
ET Stride time [seconds]	3	1.019 \pm 0.076	n.a.	1.01 \pm 0.07	n.a.
ET CoV Stride time	5	2.24% \pm 1.12	6/12 (50%)	2.37 % \pm 0.66	3/12 (25%)
PD Stride length [%stature]	3	76.69 \pm 6.38	n.a.	76.28 \pm 7.03	n.a.
PD CoV Stride length	6	2.01% \pm 1.04	2/12 (17%)	2.54 % \pm 1.35	3/12 (25%)
PD Stride time [seconds]	3	0.98 \pm 0.05	n.a.	0.99 \pm 0.05	n.a.
PD CoV Stride time	9	1.92% \pm 0.77	2/12 (17%)	2.07 % \pm 0.71	3/12 (25%)

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