

EFFECTS OF TANGO DANCING ON SPATIOTEMPORAL AND KINEMATIC GAIT PARAMETERS IN PARKINSON'S DISEASE: A THREE-DIMENSIONAL MOTION ANALYSIS STUDY

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Objectives

The purpose of this study was to compare the effects of tango dancing and no intervention on clinical, spatiotemporal and kinematic gait parameters of patients with Parkinson's Disease (PD) by means of three-dimensional motion analysis (3D-MA) study.

Patients and Methods

20 PD patients, without dementia as defined by DSM-IV, were enrolled. All the patients underwent a neurological examination consisting of the motor section of the Unified Parkinson Disease Rating Scale (UPDRS-III) and Hoehn and Yahr. Gait parameters were collected using an 8-camera system (Qualysis®) at 120 Hz and the following were analyzed: speed, stride width, stride length, cycle time, step length, step time, double limb support time (DLS), cadence, stance time, swing time, double/single limb support time ratio (DLS/SLS). Moreover, we analyzed the range of motion on the sagittal plane of the thigh (T), knee (K), and ankle (A) joints, normalized for the 100% of the gait cycle calculating the Δs value as the difference between two consecutive peaks in the gait cycle. Participants were randomly assigned to tango or no intervention (control) groups. After basal evaluation the study group attended 2-h classes once a week, completing 13 lessons in 13 weeks. Neurological status and spatiotemporal-kinematic gait parameters of the two groups were evaluated at study entry (t₀) and at 13 weeks (t₁, end of dancing training).

Results

At t₀ (baseline evaluation) the two groups did not differ on clinical, demographic and motion parameters. At t₁ a significant improvement in both spatiotemporal and kinematic gait parameters and in UPDRS-III scores was observed in all treated patients as compared with both baseline and controls. Within the study group, post hoc comparison among t₀ and t₁ showed a significant increase for gait speed, cadence and stride length. A significant decrease was recorded for stance time, step time, step cadence, and for both DLS, DLS/SLS. As regard kinematic parameters, time factor significantly affected T Δ _{1,3,4}, K Δ ₄ and A Δ ₂ together with UPDRS-III scores. Within control group, no significant differences were found between t₀ and t₁ in all examined parameters.

Discussion

Our findings showed that significant improvements in mobility and gait parameters of PD patients can be obtained through Tango dancing, with a parallel improvement in clinical status. As a consequence Tango may target deficits associated with Parkinson's and benefit locomotion.

References

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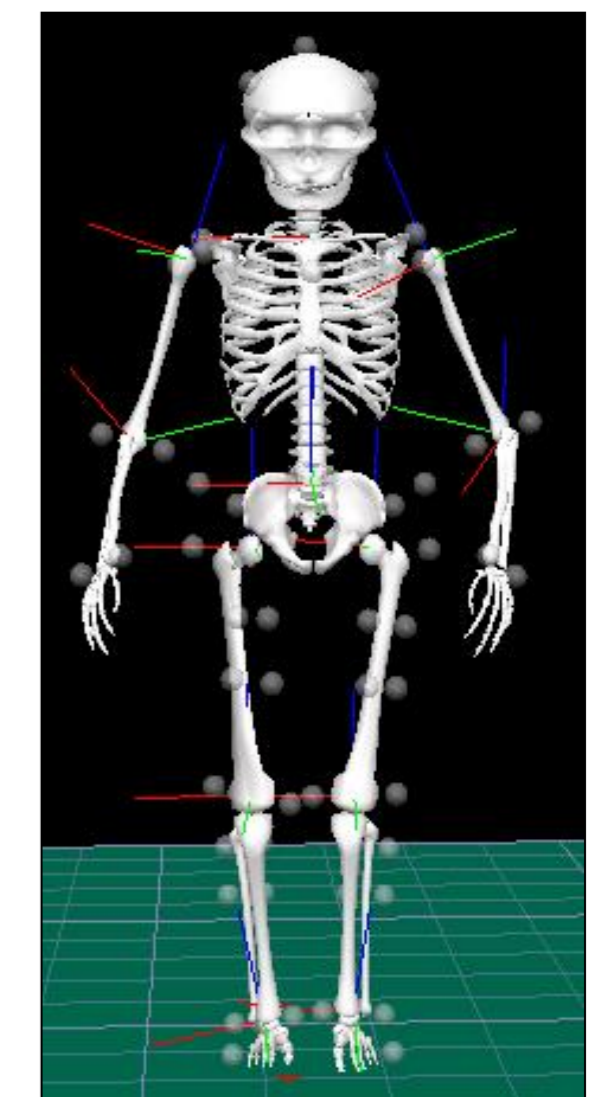


Fig.1 - The skeletal model with the markers set used to collect the data by means of 3D-MA

Table 1 - Clinical Features of Patients and Controls

	Tango Group	Controls	*t test/ χ^2 test/ χ^2	p
Age (ys)	67,3 ± 7,5	63,1 ± 4,2	*-1.545	0.140
Sex (M/F)	5/5	9/1	χ^2 2.143	0.143
Disease Duration/ys	8,0 ± 3,9	6 ± 0,81	*-1.560	0.136
UPDRS-III-t ^o	21,3 ± 7,6	20,3 ± 2,5	*-0.391	0.700
Total-LEDD/mg	684,2 ± 152	655 ± 121,2	*-0.475	0.641
H&Y-t ^o	2,1 ± 0,6	1,8 ± 0,6	χ^2 37.5	0.264

ys: years; UPDRS-III-t^o= Unified Parkinson's disease rating scale-III at baseline evaluation; H&Y= Hoehn & Yahr; Total LEDD= Total L-Dopa Equivalent Daily Dose.

Table 2 - Clinical and Spatiotemporal Gait Parameters of Study Group (mean±SD)

Gait Parameters	Pre-test t ₀	Post-test t ₁	Time effect		Group effect		Interaction Time x Group	
			F	p	F	p	F	p
Temporal gait parameters								
Gait Speed (m/s)	0,832 ± 0,136	0,966 ± 0,149*	23,693	0,001	4,486	0,048	22,343	0,001
Cycle time (s)	1,177 ± 0,059	1,113 ± 0,093	4,293	0,053	2,171	0,158	4,564	0,054
Stance time (s)	0,696 ± 0,053	0,657 ± 0,077*	5,879	0,026	9,498	0,006	5,229	0,021
Step time (s)	0,588 ± 0,029	0,570 ± 0,039*	4,883	0,040	1,136	0,301	4,123	0,041
Step cadence (s)	102,567 ± 5,012	105,916 ± 6,961*	5,534	0,030	1,122	0,303	5,113	0,029
Stride cadence (s)	51,174 ± 2,514	52,905 ± 3,517*	5,921	0,026	1,203	0,287	5,333	0,029
DLS (s)	0,215 ± 0,045	0,139 ± 0,098*	5,828	0,027	33,287	0,001	5,225	0,029
DLS/SLS (s)	0,306 ± 0,043	0,257 ± 0,073*	8,847	0,008	41,940	0,001	8,859	0,008
Spatial gait parameters								
Step Length (m)	0,487 ± 0,070	0,544 ± 0,073*	22,115	0,001	0,107	0,748	21,545	0,001
Stride Length (m)	0,975 ± 0,140	1,068 ± 0,149*	10,767	0,004	0,191	0,667	10,250	0,004
Clinical parameter								
UPDRS III	21,30 ± 7,66	18,50 ± 6,78*	9,470	0,006	0,085	0,774	9,666	0,007

Pre-test t₀: baseline evaluation; Post-test t₁: end of treatment at 13 weeks; *: statistical significant as compared to baseline evaluation (pre-test); SD: Standard deviation; s: seconds; m: meter; DLS: Double Limb Support; SLS: Single Limb Support Significant parameters are in red type; UPDRS: Unified Parkinson's Disease Rating Scale.

Table 3 - Kinematic data of the thigh (T), knee (K), and ankle (A) joints on the sagittal plane in the study group (mean ± SD)

Degree (°)	t ₀	t ₁	Time effect		Group effect		Interaction Time x Group	
			F	p	F	p	F	p
T Δ ₁	1,052±0,670	1,449±0,377	6,028	0,024	18,640	<0,001	4,751	0,043
T Δ ₂	33,206±5,273	34,981±7,387	2,662	0,120	0,116	0,737	4,306	0,053
T Δ ₃	35,224±4,870	38,017±7,018	11,193	0,004	5,864	0,026	13,294	0,002
T Δ ₄	1,442±0,719	2,458±1,128	16,433	0,001	7,138	0,016	21,525	<0,001
K Δ ₁	5,895±2,302	5,925±2,664	0,038	0,848	24,108	<0,001	0,083	0,777
K Δ ₂	9,045±3,759	8,925±4,234	0,706	0,412	0,508	0,485	0,103	0,752
K Δ ₃	44,155±6,343	46,234±8,204	4,178	0,056	0,097	0,759	5,674	0,028
K Δ ₄	43,638±5,596	47,021±6,803	42,770	<0,001	4,153	0,057	65,078	<0,001
A Δ ₁	0,621±0,513	0,893±0,864	0,033	0,857	22,916	<0,001	3,069	0,097
A Δ ₂	15,721±3,384	13,732±3,758	21,830	<0,001	9,451	0,007	4,414	0,050
A Δ ₃	23,164±4,856	24,734±4,095	0,199	0,660	4,789	0,042	11,980	0,003
A Δ ₄	13,565±5,318	16,576±5,689	3,675	0,071	12,339	0,002	10,949	0,004
Clinical evaluation								
UPDRS III	21,30 ± 7,66	18,50 ± 6,78	9,470	0,006	0,085	0,774	22,617	<0,001

Significant parameters and values are in red type. Pre-test t₀ baseline evaluation. Post-test t₁ end of treatment at 13 weeks. SD standard deviation. UPDRS-III Unified Parkinson's Disease Rating Scale. The Δs value represents the difference between two consecutive peaks in the gait cycle.