Analysis of parameters influencing the assessment of gait and fall risk in elderly patients with and without a history of falls

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Introduction

During the aging process several modifications occur to the bio-psycho-social level, leading to loss of functional ability, quality of life and independence that increase the risk of accidents, highlight the increased risk of falls [(1).] Over 50% of falls occur during locomotion [(2)], being one of the main causes tripping among the elderly (53%) [(3)]. The specific point of the gait cycle that causes the most frequently stumble is the average swing phase because this is the stage where there is less distance between the foot and the ground - MFC (Minimum Foot Clearance). The occurrence of falls, variability of gait patterns, causing a decrease in speed and stride length with a consequent increase in length of footstep, in order to stabilize the gait pattern [(4)]. The decrease of muscle strength [(5)] and reduction of fast fiber shrinkage compared to the slow contracting fibers which leads to changing the rate of muscle activation is associated with an increased risk of falls [(6)]. The changing in balance occurs due to decreased ability to integrate sensory information and the ability to generate appropriate responses to control body movements due to decreased muscle strength and change the speed of nerve impulses [(7)]. Fear of fall may result from these changes leading to increased reduction of strength, agility and balance, thereby decreasing independence [(8)].

The aim of this study was to compare parameters that may influence gait, more specifically the strength, balance, fear of falling, Root Mean Square on the maximal voluntary contraction, Minimum Foot Clearance, stride length, speed and time and one-leg support check if there is a relationship between these parameters and the risk of falling.

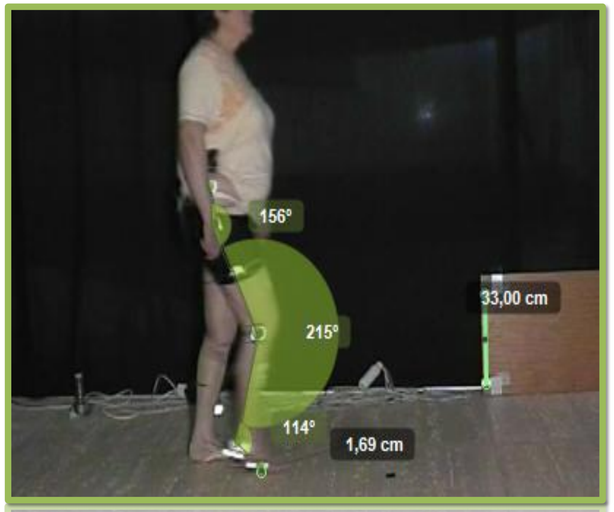
Results

		Without History of Falls n=15	With History of Falls n=15	*p*
Scales	**Berg Balance Scale Score**	52,47±2,50	47,87±2,75	*0,000*
	Scale Falls Efficacy Score	97,67±4,17	94,80±7,78	*0,281*
	TUG(s)	8,48±1,11	9,58±7,78	*0,056*
	Performance_Oriented Mobility Assessement Score	26,87±1,60	24,47±1,60	*0,001*
Kinematics	**MFC**	2,11± 0,4	1,92±0,41	*0,145*
	Right Time Suport (s)	74,74±21,99	78,93±9,12	*0,966*
	Left Time Support (s)	84,00±12,18	80,33±9,12	*0,645*
	Stride Length (cm)	110,35±12,42	102,59±14,39	*0,165*
	Speed (m/s)	0,87±0,16	0,96±0,51	*0,756*
	Hip Range (º)	21,93±10,08	18,53±8,67	*0,340*
	Knee Range (º)	26,67±8,63	22,67±4,47	*0,197*
	Ankle Range (º)	27,93±7,61	28,20±6,91	*0,901*
Electrom	**%RMS on maximal voluntary contraction of the Biceps Femoris**	20,43±13,78	22,73±11,43	*0,330*
	%RMS on maximal voluntary contraction of the Rectus Femoris	19,79±14,17	21,47±13,76	*0,494*
	%RMS on maximal voluntary contraction of the Soleus	43,12±11,26	46,76±14,49	*0,548*
	%RMS on maximal voluntary contraction of the Gastrocnemius	40,72±13,51	43,92±11,97	*0,443*
	%RMS on maximal voluntary contraction of the Gluteus Medius	30,65±13,23	37,13±17,10	*0,395*
	%RMS on maximal voluntary contraction of the Tibialis Anterior	38,02±12,74	38,10±14,92	*0,983*

The parameters collected by isokinetic dynamometer Biodex System 3, Peak Torque per unit mass (Nm/kg) and Reason FlexoresCon/ExtensoresCon (%) of the flexor and extensor muscles of the knee and tibio-tarsal, there were no differences between groups with a history of falls and no history of falls (p> 0.05). The peak torque values were always lower in the group with a history of falls only in the movement of Plantar Flexion of the dominant leg. Peak torque per unit mass (Nm/kg) slightly higher in the group with a history of falls.

Materials and Methods

The sample was composed of a total of 30 seniors, who met the criteria for inclusion and exclusion, and was divided in two groups: with no history of falls (n = 15) and with a history of falls (n = 15). All subjects were excluded if they needed support products to perform gait [(9)]; having any of the following conditions: dizziness, postural hypotension, visual disturbances, acute rheumatoid arthritis, Parkinson's disease, epilepsy, cognitive deficits, osteoporosis, some type of pain affecting gait and other musculo-skeletal or neurological conditions affecting the lower limbs and/or walking [(10)]. The strength evaluation was performed using the isokinetic dynamometer Biodex System at an angular velocity 60 /s, the balance using the Balance Scale Berg, fear of falling through the scale Falls Eficace Scale, the Root Mean Square on contraction with maximal voluntary use of surface electromyography, the Foot Minimum Clearance, and stride length, speed and time unipodal support were assessed using kinematic analysis. For assessing the risk of falling was applied Timed Up and Go Test, Performance Oriented Mobility Assessement and Berg Balance Scale.



Conclusion

Given the main objective of this study we found that there are few differences between individuals with and without history of falls. Significant differences were only obtained in scores on the Berg Balance Scale, the TUG and POMA. We conclude that for the group with a history of falls, strength, balance and Foot Minimum Clearance and support time at left side is smaller and the fear of falling, Root Mean Square on the maximal voluntary contraction, velocity and time to support law is superior compared to group with no history of falls. According to our study, application of scales appear to be an evaluation method less costly, more convenient and more significant results for predicting the risk of falls, when compared with other methods.

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