CHARACTERISTIC GAIT PATTERNS IN AGED POPULATIONS COMPARED TO A YOUNG ADULT POPULATION

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INTRODUCTION

Exercise choices for the aged population necessarily decrease due to age related problems such as osteoporosis. Exercise walking has become very popular due to its cardiovascular benefits in conjunction with its low impact profile. Therefore, the recommended exercise mode of choice by physicians and researchers for aged populations is exercise walking. Several researchers (Andriacchi et al., 1977; Bates et al., 1978; Cavanagh and Lafortune, 1980; Cavanagh et al., 1981) have shown that the vertical component of the ground reaction force of running can be three times the vertical component of the ground reaction force of walking. The current research regarding walking and running revolves around a young adult population and their characteristics. There are some very early works regarding gait characteristics of aged populations. The more recent work deals primarily with gait disorders or senile gait (Gabell et al., 1984; Koller et al., 1985). The purpose of this investigation to initiate a data base for the kinematics of aged gait that reflect changes in gait as a function of the aging process.

METHODOLOGY

Kinematic data were collected and analyzed on four healthy young adult men and four healthy elderly men utilizing the PEAK Performance 2D Technologies, Inc., Motion Measurement System. In addition, a 6'x5' silver-fronted mirror was positioned at a 45 degree angle to the line of action of the subjects. This system utilized the Quasar VM705 VHS camcorder to record the subjects walking at a self-selected pace for a 20 minute duration. The camera was leveled at a height of 1.14 m and was positioned so that the optical axis of the camera was perpendicular to the direction of movement. This camera position captured both rear and sagittal views on each frame of film. Eight markers constructed from 3M reflective tape were used to locate anatomical landmarks in the sagittal view. These markers enabled the researcher to generate the sagittal variables of stride length (SL), stride width (SW), angular velocity of the upper arm (VUA) and angular velocity of the upper leg (VUL). Four markers constructed from 3M reflective tape were utilized on the lower leg and heel counter (Clarke et al., 1983). These markers enabled the researcher to generate the rearfoot variables of touchdown angle (TD), maximum pronation (MP) and time to maximum pronation (TMP).

Five right footfalls were manually digitized using the PEAK Performance 2D video analysis system. The data elicited from the videotape records included the X and Y coordinates for an eight segmented sagittal model, and a two segmented rear view model of the walking gait pattern. The sagittal data were subsequently filtered using a Butterworth digital filter and then processed to calculate stride length, stride width, angular velocity of the upper arm, angular velocity of the upper leg. While the rear view data were also filtered using the Butterworth filter and then further processed to calculate touchdown angle, maximum pronation angle and time to maximum pronation of the subtalar joint. Stick figures were then generated to visually distinguish similarities and differences between young and aged walking gait patterns.

RESULTS AND DISCUSSION

Table 1 presents a summary of the means and standard deviations for the statistically significant variable of stride length as a function of self-selected walking pace and age.

Table 1. Means (sd) of stride length as a function of self-selected walking pace (m/s) and age.

Age Group	Stride Length (m)	Walking Speed (m/s)
Young Adults	1.21[b]	1.63[a]
	(0.11)	(0.13)
Old Adults	1.01[b]	1.16[a]
	(0.09)	(0.05)

[a]Independent t = 4.9270; $p \leq 0.05$; [b]Independent t = 2.8691; $p \leq 0.05$

It is evident that a person's self-selected walking pace decreases with age. It can also be seen that stride length significantly decreases with age. This finding contradicted the Larish et al. (1987) finding that there were no significant differences between age groups for stride length when the subjects walked on a treadmill. One possible explanation may be that all the subjects in the current study participated in a physiology study requiring considerable experience walking on a treadmill, and perhaps this previous experience enabled their treadmill walking gait patterns to more closely resemble normal overground walking patterns.

The stride width data show that the stride width for the aged subjects were approximately 72% of that of the young adult subjects. Examining both tables together it makes sense that there is a concurrent decrease in stride length as a person's stride width increases. There were no other significant differences between the two age groups regarding the other dependent variables.

Table 2. Means (sd) for stride width as a function of self-selected walking speed and age.

Age Group	Stride Width (m)
Older Adult	0.378a (0.032)
Young Adult	0.271a (0.009)

a Independent t-test: $t = -6.46$; $p < 0.05$

CONCLUSIONS

Based on the analysis of these data, the following conclusions are warranted:

1. It would appear that a comparison of data between two groups of four subjects per group is insufficient for drawing conclusions.
2. Therefore, in concert with the overall purpose of this project it is recommended that biomechanical data be incorporated into a data base for the aged populations, to be further analyzed in the future.
3. It was difficult to make comparisons because subjects did not walk under the same walking speed conditions.
4. It was determined, however, from the data that a concurrent decrease in stride width

naturally accompanied a decrease in stride length.

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