

Biomechanics of Stair Climbing

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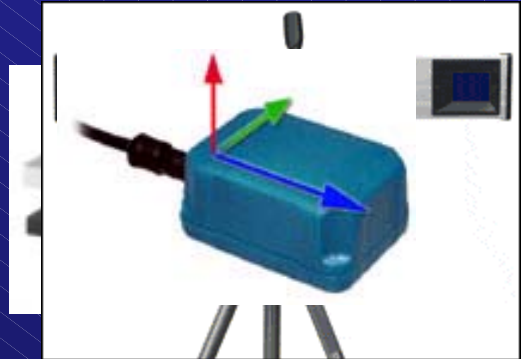
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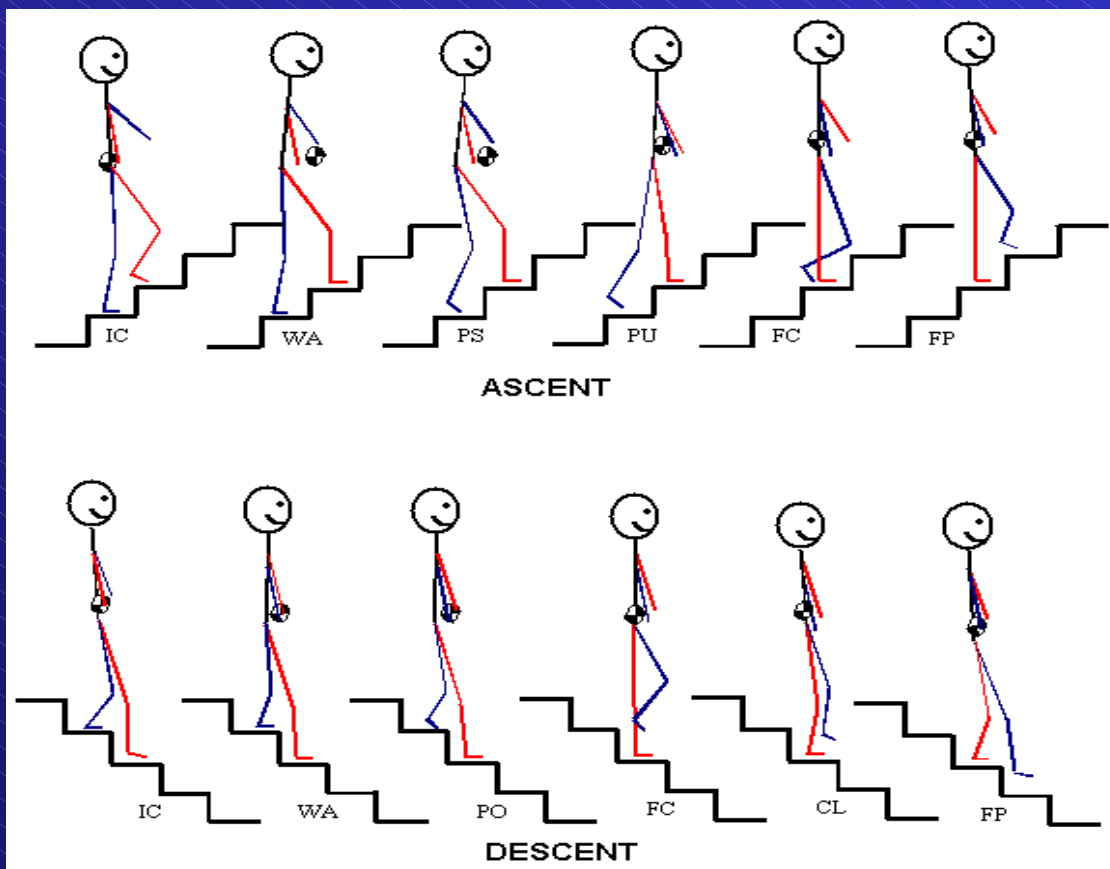
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Introduction

- Stair climbing \Rightarrow daily living
 - \Rightarrow force and co-ordination
 - \Rightarrow falls in elderly
- Assessment \Rightarrow camera systems
 - \Rightarrow force platforms
- Body worn sensor



Introduction



Methods

- Xsens MT9
sf=100Hz

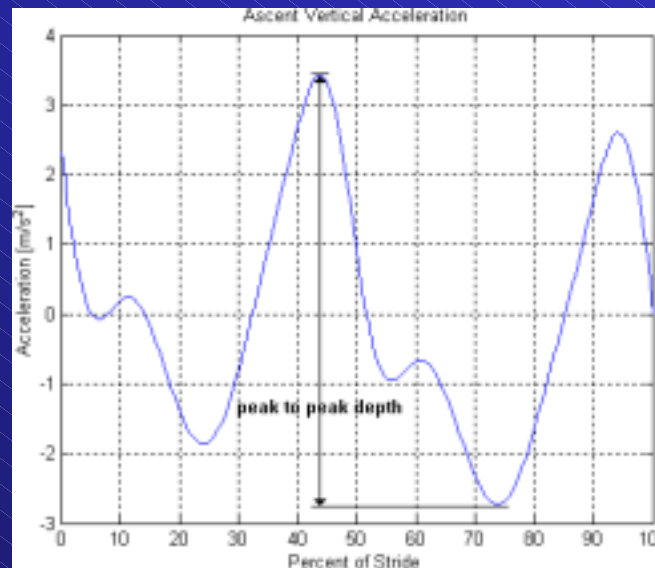


- Ten young healthy volunteers
- Ascending and descending 13 steps
- Gravity correction

Methods

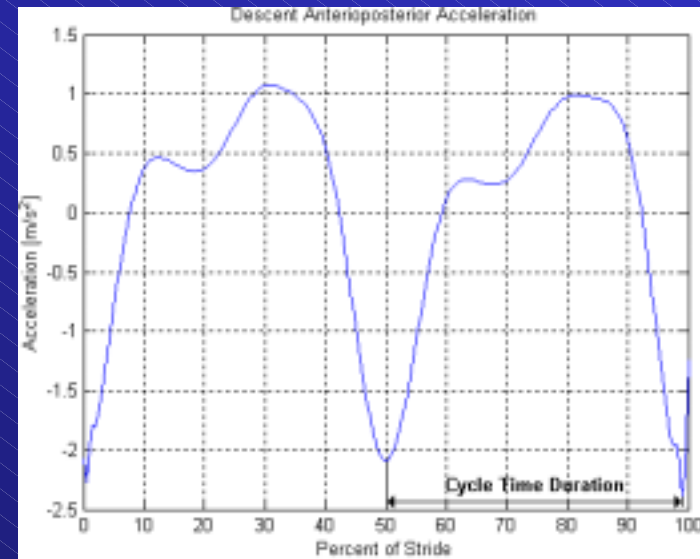
- Vertical acceleration \Rightarrow peak to peak amplitudes

- Joint loading



Methods

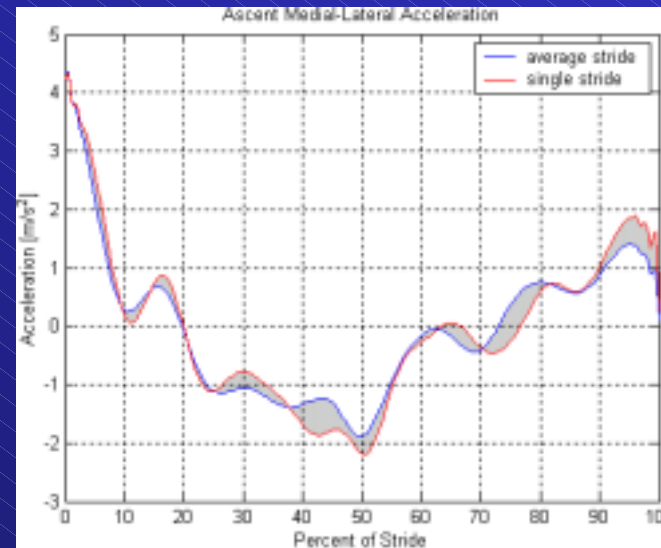
- Anterior-posterior acceleration
⇒ Stride cycle duration
- Joint Loading
- Differences between
right and left legs,
ascent and descent



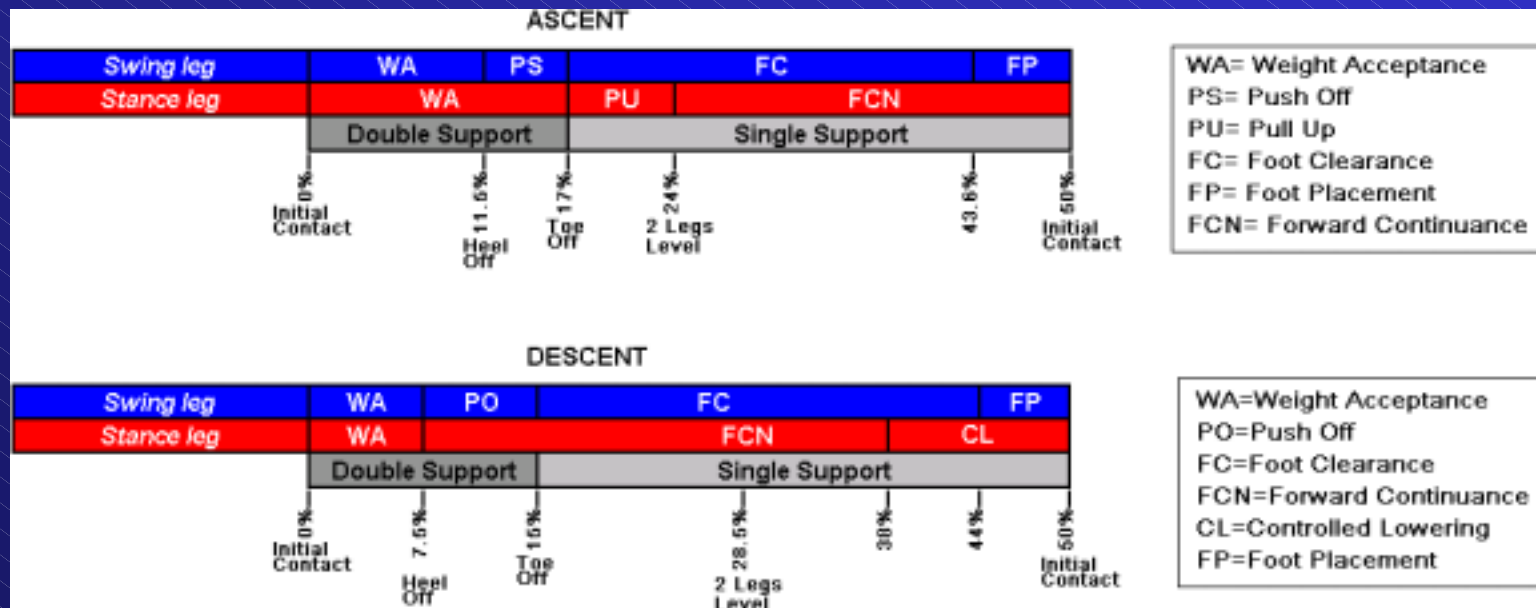
Methods

- Medio-lateral acceleration
⇒ Area under the curve

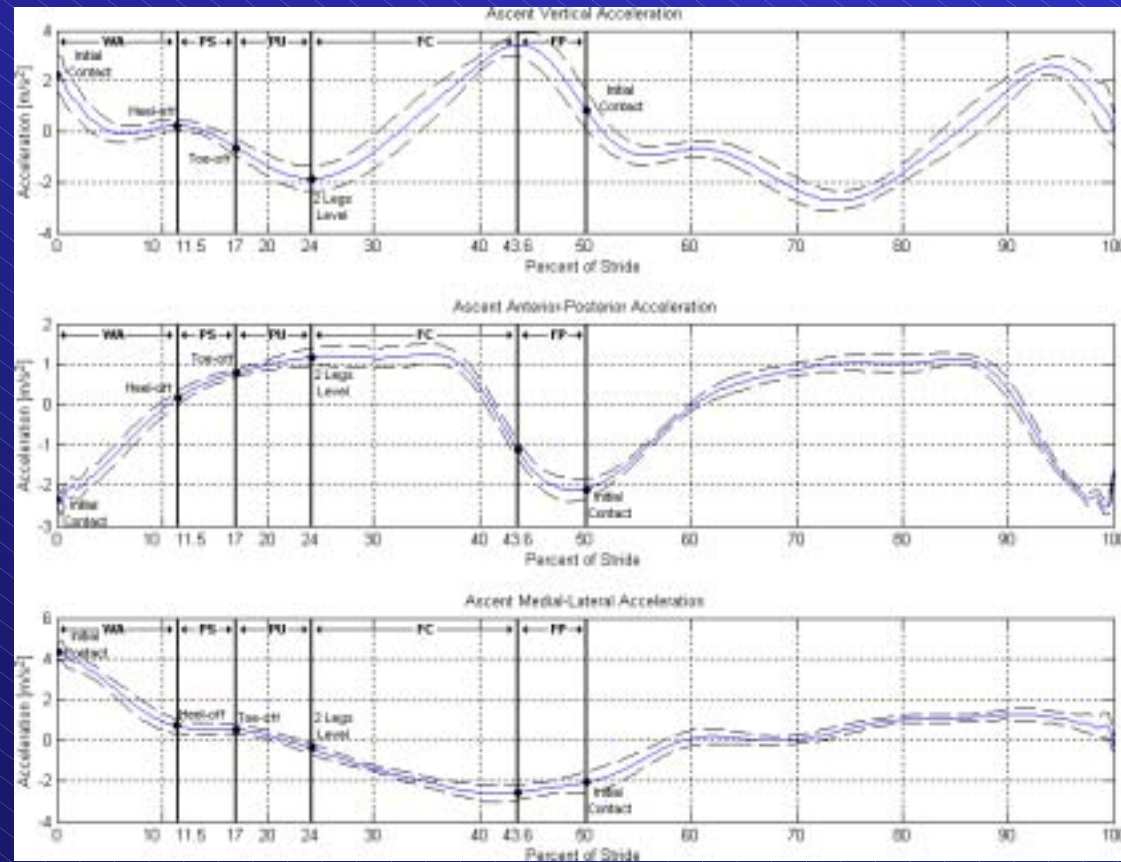
- Balancing effort



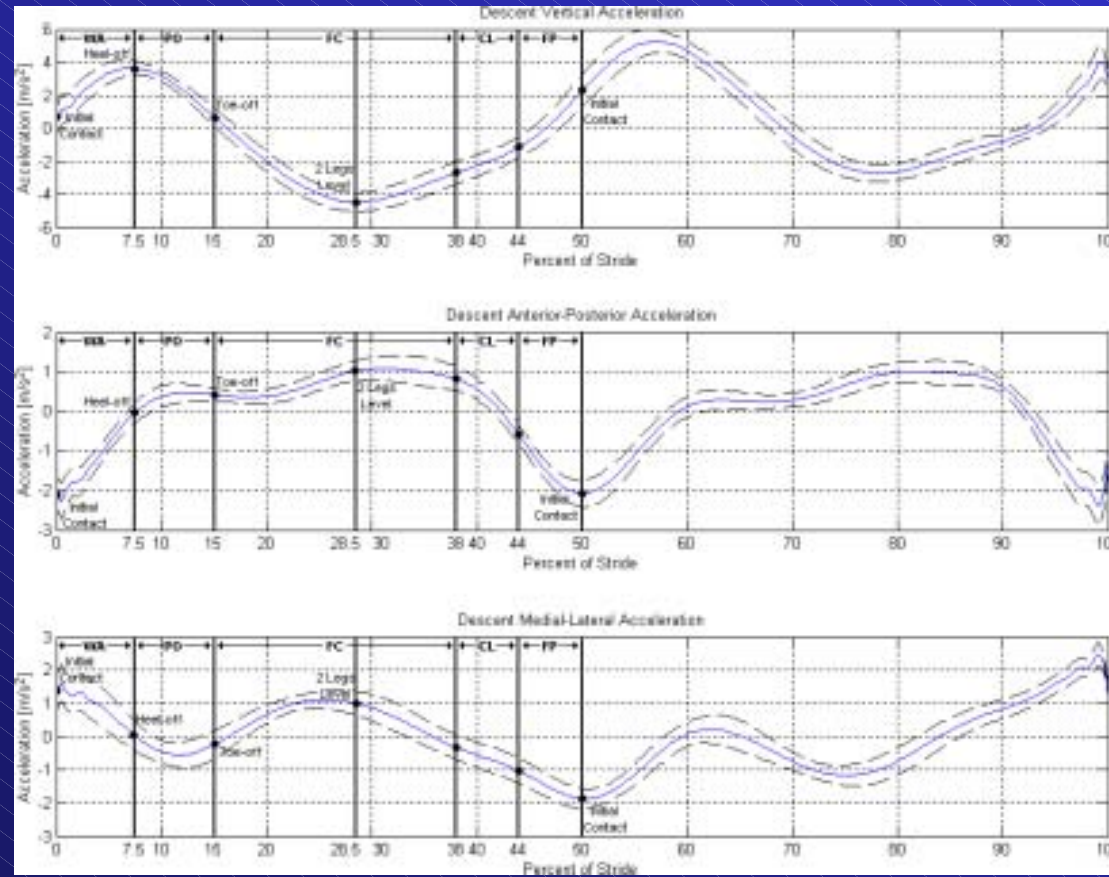
Results



Results



Results



Results

	Stride cycle duration [s]	Balance effort [(m/s²)cycle]	Vertical loading [m/s²]
Ascent (mean)	1.15 ± 0.06	6.40 ± 0.94	6.51 ± 0.98
Descent (mean)	1.02 ± 0.09	9.17 ± 1.84	9.94 ± 1.84
p-value	0.002	0.000	0.000

	Left Leg	Right Leg
Ascent	(0.57 ± 0.04) s	(0.57 ± 0.04) s
Descent	(0.51 ± 0.06) s	(0.51 ± 0.05) s

Discussion

- Area under the curve \Rightarrow Balancing effort (elderly people)
- Stride cycle duration + Peak vertical acceleration \Rightarrow Balance control (arthritis)
- Asymmetry in cadence \Rightarrow After stroke

Discussion

- System \Rightarrow portable, easy to use, low cost, results easy to interpret
- Assessment in any environment



Acknowledgements



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