Temporal and spatial gait characteristics of transfemoral amputees fitted with osseointegrated fixation: preliminary data

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Background
The conventional method of attachment of prosthesis involves on a socket. A new method relying on osseointegrated fixation is emerging. It has significant prosthetic benefits. Only a few studies demonstrated the biomechanical benefits.

Purpose
The ultimate aim of this study was to characterise the functional outcome of transfemoral amputees fitted with osseointegrated fixation, which can be assess through temporal and spatial gait characteristics. The specific objective of this preliminary study was to present the key temporal and spatial gait characteristics.

Methods
Four male transfemoral amputees fitted with a fixation were asked to performe 3 trials of straight level walking. The speed of walking, cadence, duration of gait cycle, support and swing phases, length of stride and step, and walking base were extracted from displacements of foot markers using a 3D motion analysis system recording at 200 Hz.

Results
The speed of walking and the cadence were 0.81±0.16 m/s and 46.03±4.70 steps/min, respectively. The duration of the gait cycles, support and swing phases were 1.31±0.13 s, 0.76±0.07 s and 0.55±0.07 s, respectively. The stride and step length, and walking base were 1.29±0.09 m, 0.10 ± 0.65 m and -0.09 ± 0.138 m for the prosthetic leg, and 1.31±0.07 m, 1.00±0.64 m and 0.11 ± 0.12 m for the sound leg, respectively.

Conclusion
The results demonstrate that the amputees fitted with an osseointegrated fixation showed a highly functional walk compared to normative data presented in previous studies focusing on amputees fitted with a socket and able-bodied.

References

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INTRODUCTION

•The conventional method of attachment of prosthesis of transfemoral amputees involves on a socket.

•An alternative method relying on osseointegrated fixation is emerging and have significant prosthetic benefits.

•The purpose of this study is to ccharacterise the functional outcome of transfemoral amputees fitted with osseointegrated fixation using gait spatial and temporal characteristics.

METHODS

•**Equipment:** Gait spatial and temporal characteristics were extracted from displacements of foot markers using a 3D motion analysis system recording at 200 Hz.

•**Subjects:** Four male transfemoral amputees fitted with a fixation were asked to perform three trials of straight level walking (N=12)

•**Protocol:** The person have to walk about 15m without aids. If the subject need it, a rest could be taken to avoid tiredness.

•**Variables:** Gait spatial and temporal characteristics included the speed of walking, cadence, duration of gait cycle, support and swing phases, length of stride and step, and walking base.

Figure 1-2: Participant during the data collection with the markers

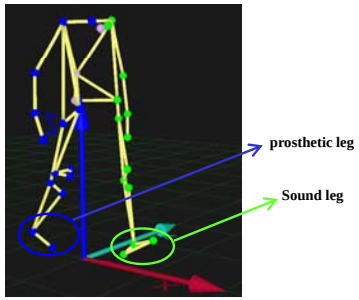

Figure 3: Stick figure of the participant during double support phasis obtained with the reconstruction software "Qualysis"

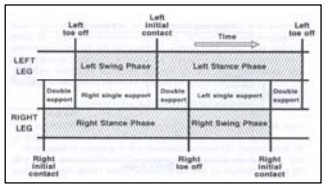

Figure 4. Temporal gait characteristics

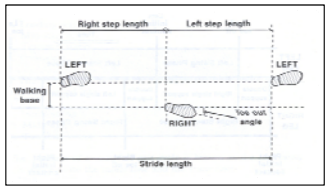

Figure 5. Spatial gait characteristics

RESULTS

Tableau 1. Mean and standard deviation of the speed of walking, cadence, duration of gait cycle, support and swing phases, length of stride and step, and walking base for four male transfemoral amputees (three trials).

Characteristics	Transfemoral amputees osseointegrated	Transfemoral amputees Socket	Able-bodies
Spatio-temporal characteristics			
Speed (m/s)	0.82±0.15	1.01±0.18	1.51±0.20
Cadence (steps/min)	45.99±4.63	44.04±2.67	57.7 ±2.89
Temporal characteristics			
Gait cycles (sec)	1.33±0.13	1.37±0.08	1.09 ±0.12s
Support (sec)	0.77±0.08	0.83±0.07	0.66 ±0.08s
Support (%)	58.07±2,02	±61.38	±60
Swing (sec)	0.55±0.07	0.55±0.05	0.43 ±0.05s
Swing (%)	41.93±2.02	±40.75	±40
Spatial characteristics			
Stride length (m)	PRO 1.29±0.10 m SND 1.31±0.09 m	1.33±16	1.47±0.06
Step length (m)	PRO 0.70 ± 0.65 SND 0.85±0.51	0.61±0.84 0.63±0.58	0.74±0.04
Walking base (m)	PRO 0.16± 0.06 SND 0.15 ± 0.07	PRO 0.21±4.4 SND 0.21±4.4	

PRO:Prosthetic side SND: Sound side %: pourcentage of the gait cycle

DISCUSSION

Limitations:

• The spatial and temporal characteristics were determined from external markers.

• There were variations of prostheses in terms of components, particularly the knees, and alignments

Take away results:

• Like most studies focusing on functional outcomes of transfemoral amputees ossoeintegrated, the results were either comparable or better than transfemoral amputees with socket mostly for the gait cycle and the support phase.

•Overall, the participants were less functional than able bodied.

•However, the most functional transfemoral amputees oessointegrated and the least functional able bodied were similar.

•This study provided key information to clinicians facing the challenge to restore the locomotion of lower limb amputees but in the framework of an evidence-based biomechanics practice.

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CONCLUSIONS

•The results demonstrate that amputees fitted with an osseointegrated fixation showed a highly functional walk compared to normative data presented in previous studies focusing on amputees fitted with a socket and able-bodied.

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SPEAKER INFORMATION

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