ACTIVITY ASSESSMENT AND CLINICAL GAIT ANALYSIS AFTER MALIGNANT BONE TUMORS TREATMENT WITH RECONSTRUCTION OF FEMORAL AND TIBIAL DEFECTS

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INTRODUCTION

Tumors that affect the distal femur and/or the proximal tibia require a resection of the knee joint, which may be reconstructed with modular prostheses. It is reported that current treatment achieves long-term, disease-free survival rates around 60% [1, 2]. Until now, patient activity after tumor prostheses was assessed with questionnaires which do not provide objective and quantitative information about patients' activity in daily living. Thus, the present study assessed the activity patterns of patients with portable measurement devices. Furthermore, the relationship between clinical gait parameters and activities of daily living is unclear.

METHODS

From a larger sample of patients with successful prosthetic treatment, a subgroup of 22 subjects (14 male, 8 female) volunteered. Their mean age was 35±18 years, the follow-up ranged from 2 to 17 years (mean 6±4 yrs.). The tumor was located in the distal femur (n=18) or the proximal tibia (n=4). Clinical outcome was assessed with MSTS and TESS score.
Two measurement devices were applied: The Dynaport® ADL monitor (McRoberts, Den Haag, NL) uses three uniaxial accelerometric sensors and is able to distinguish between different modes of activity, i.e. lying, sitting, standing, walking and cycling. The system is worn around the waist, the third sensor in a strap around the left thigh. The second system is the SAM® Step Activity Monitor (Cyma Inc., Seattle, OR), a 2-dimensional accelerometer that counts and stores steps for several weeks in daily profiles.
The patients were instructed how to handle the devices before taking them home, older patients were visited at home. On the first measurement day, both devices were worn simultaneously from getting up until going to bed. The following six days, the SAM was worn alone.
Data of a clinical gait analysis was available for 14 subjects. In these cases, relations between the number of steps (SAM), activity categories (ADL-Monitor) and main gait parameters (e.g. gait speed, maximum knee flexion) were analyzed.

RESULTS AND DISCUSSION

Three ADL-Monitor measurements had to be excluded due to a handling error. The predominant activity "sitting" accounted for 53.7 ± 15.4% of the total time, followed by standing (27.4 ± 15.6%), locomotion (9.7 ± 5.4%) and lying (8.2 ± 6.3). Only 0.2% of the data could not be classified.
The SAM counted an average of 4786 ± 1770 (Min: 2045, Max: 8135) gait cycles per day which extrapolates to 1.75 million gait cycles per year. These numbers of gait cycles were similar to hip and knee patients assessed in a different study using identical methods, but were slightly lower compared to a group of patients with well functioning hip arthroplasty [3].
Regarding the distribution of daily activities, the activity level of the selected patients was similar to patients with limb salvage surgery and superior to an amputation group reported from the Netherlands [4].
No correlation was found between the number of gait cycles and the clinical scores, age or follow-up of the subjects, whereas the clinical scores (MSTS: 24.7 ± 3.8 out of 30, TESS: 83.6 ± 15.3 out of 100) were nearly identical to tumor patients assessed by Brown in 2002 [2].
If the right knee was affected, the number of steps correlated inversely to the right step length (r=-0.78, p=0.7). This trend was not seen if the left knee was affected and related to the step length of the left leg.

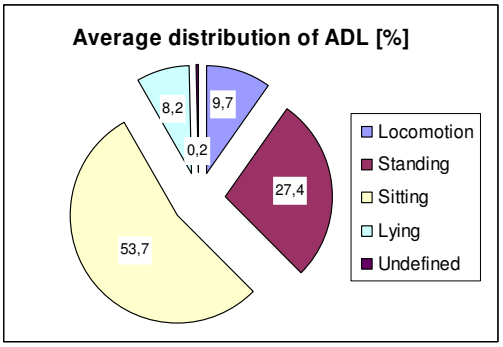

Fig. 1: Average distribution of activities of daily living (ADL-Monitor, n=19)

CONCLUSIONS

Overall, the patients showed a fairly good activity level, whereas strong inter-individual differences were detected, given that the most active subject performed the fourfold number of gait cycles compared to the least active subject. The weak correlations between the clinical gait parameters and the activity level suggest that an estimation of patients´ activity from clinical gait parameters is not solid. Instead, objective devices should be used for a reliable assessment of patients´ activities of daily living.

REFERENCES

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