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An exercise intervention seems to improve motor and gait function in adolescents and young adults with tumor megaendoprosthesis of the lower extremity

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Background

Limb preservation with megaendoprosthesis in adolescents and young adults (AYA) with bone tumors → functional limitations and gait abnormalities → proGAIT pilot RCT

Hypothesis

A personalized exercise program improves gait function, quality of life, functional scales (MSTS, TESS), functional mobility, and fatigue in adolescents and young adults with tumor megaendoprosthesis around the knee.

Methods

Participants

- 15-39 years old, tumor megaendoprosthesis of the knee joint, >1 year post surgery
- RCT, Individualized **online exercise program** vs. no intervention for 8 weeks

Intervention and Assessments

- IG: personalized 8-week exercise program including strength, coordination, balance and mobility
- CG: booklet, no exercise intervention

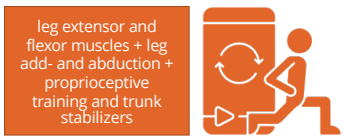

Table 1: Patient characteristics at baseline

	IG			CG		
Characteristic	**Mean**	**SD**	**Range**	**Mean**	**SD**	**Range**
Number of patients	6	-	-	5	-	-
Male/female	3/3	-	-	3/2	-	-
Tumor location (Proximal tibia/distal femur)	3/3	-	-	1/4	-	-
Age at gait analysis (years)	26.3	8.0	15–34	27.0	9.8	17–41
Age at surgery (years)	19.8	7.5	12–31	24.0	11.2	10–39
Follow-up (years)	6.5	6.1	1–16	3.0	2.3	1–7
Weight (kg)	69	12.4	52.0–82.0	76.1	25.9	60.0–122.0
Height (cm)	172.2	7.7	163–182	179.0	4.7	172.0–185.0
BMI (kg/m²)	23.4	4.7	18.0–29.1	23.4	6.8	20.0–35.6
Leg Length Discrepancy (mm)	23.7	30.5	1.6–83.2	13.6	13.3	3.9–36.9

Conclusion

- Survivors of osteosarcoma show functional gait impairments (Tab. 1)
- 8-week exercise intervention → promising positive effects (small to medium effects sizes) on gait function, functional mobility, and subjective functional scores (Fig. 2)
- No statistical significance → powered clinical trials with larger samples sizes are needed to confirm these preliminary results
- in addition to confirmatory studies, there is a particular need for the development of implementation approaches

The long-term goal is to implement effective exercise concepts as standard care for AYA survivors with a tumor endoprosthesis and survivors with other consequences of cancer treatment.

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Results

Gait at baseline of every participant deviated from a healthy reference group:

- Deviations affected leg > deviations unaffected leg (Figure 1)
- Largest deviations in pelvis up/down, hip adduction/abduction, hip internal/external rotation, knee flexion/extension

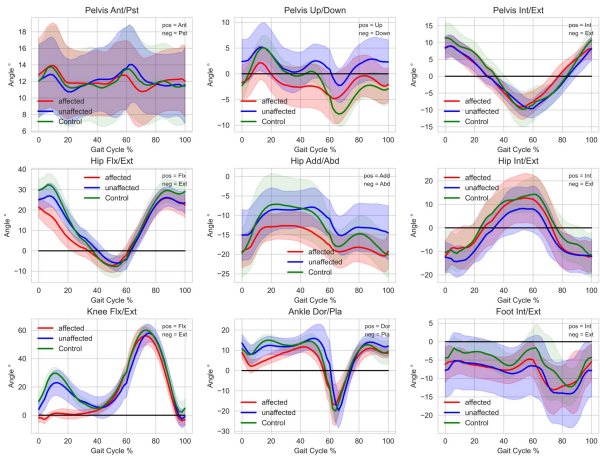

Figure 1. Averaged segment and joint angles throughout the entire gait cycle of all participants at baseline. Unaffected (blue) and affected (red) side of participants with endoprosthesis and a healthy reference group (green, n = 13,, 22–39 years without tumor megaendoprosthesis) showing the mean and SD (light color area).

The exercise intervention had small to medium positive effects on

- **gait score GDI** |d|=0.50 (unaffected leg), |d|=0.24 (affected leg)
- **subjective functional scores** TESS |d| = 0.74 and MSTS |d| = 0.49
- **functional tests** TUG and TUDS |d| = 0.61 and |d| = 0.52 (Fig. 2)

No effect on Quality of Life
Non significant increase of fatigue in the CG
No adverse events occured

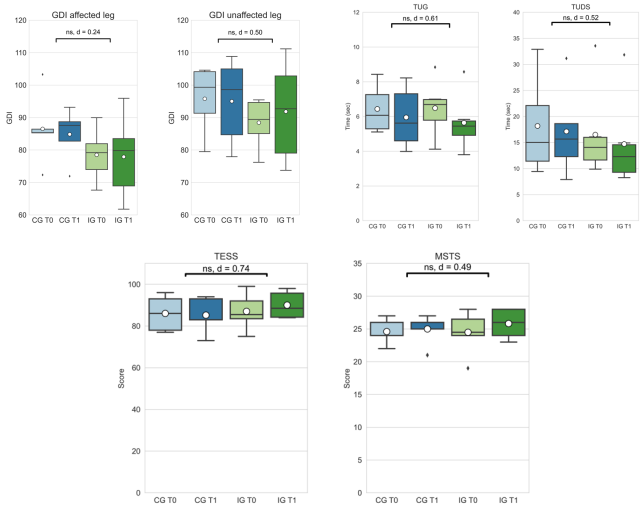

Figure 2. The Gait Deviation Index (GDI), Timed up an Go (TUG), Timed up and downstairs (TUDS), Musculoskeletal Tumor Society Score (MSTS) and Toronto Extremity Salvage Score (TESS) of the control group (CG) and intervention group (IG). Box-whisker plot shows quartiles, mean (•), and outliers (♦); statistical annotations show significance (ns = not significant) and effect size (absolute Cohen's d); comparison of delta changes via independent *t*-test, α = 0.05.