RECOVERY OF SHOULDER MOTION DURING GAIT AT 1-WEEK, 3-MONTHS AND 1-YEAR AFTER SPINAL FUSION SURGERY IN AIS

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Introduction

Adolescent Idiopathic Scoliosis (AIS) is a growth defect of the spine that primarily occurs in pre-pubertal children and is surgically treated when a curve exceeds 50° [1]. Presently, surgical outcomes are evaluated through 2D static radiographs, clinical examination and questionnaires. Although, the functional outcome (e.g. the gait performance) plays an important role in the patient's evaluation of treatment success, no accurate, evidence-based predictions regarding the recovery of this functional outcome can be provided by the surgeon. Indeed, postoperative gait analysis of AIS patients has thus far only been documented 1-2 year postoperative at the earliest [1, 2]. Consequently, no information on the preceding recovery of gait in AIS patients exist, which prevents the understanding of early recovery or compensation mechanisms, e.g. in terms of shoulder motion, as well as its possible implications for enhanced rehabilitation. Therefore, the present study aimed to investigate the early gait recovery in terms of shoulder motion after spinal fusion surgery in AIS patients. It was hypothesized that AIS patients walked with a reduced range of motion (RoM) of the shoulder angle at 1-week postoperative and that the RoM gradually recovers to preoperative levels from 3 months to 1 year postoperative.

Methods

Seventeen AIS patients (Age: 17.3 ± 4.0; Gender: 15 Female and 2 Male) scheduled for spinal fusion surgery underwent an instrumented gait analysis protocol using a validated spinal deformity-specific marker protocol [3], both preoperatively (Pre-op) and postoperatively (Post-1Week, Post-3Months and Post-1Year). At all timepoints, patients walked on an instrumented, split-belt treadmill (Motek, Amsterdam, NL) at 0.75m/s and 1.25m/s walking speeds (not possible at Post-1Week) recorded using a 10-camera motion capture system (VICON Motion systems, Oxford, UK). Based hereon, range of motion (RoM) of the shoulder in the frontal and transverse plane was determined. A one-way ANOVA, followed by Bonferroni post-hoc testing ($p<0.05$), was performed to identify differences between timepoints.

Results

When walking at 0.75m/s, the RoM of the shoulder angle decreased significantly ($p<0.05$) at Post-1W in the transverse plane compared to Pre-op and increased back to preoperative levels at Post-3M and Post-1Y, whereas no differences in the frontal plane were identified at this speed. In contrast, at 1.25m/s the significant reduction in shoulder angle RoM persisted at Post-3M and Post-1Y (Table 1).

	Pre-Op	**Post-1W**	**Post-3M**	**Post-1Y**
0.75 m/s				
RoM F [°]	**4.79** (± 1.49)	**4.74** (± 1.42)	**4.61** (± 1.34)	**4.93** (± 1.93)
RoM T [°] *	**13.60** [a] (± 3.80)	**10.06** (± 3.23)	**13.10** [a] (± 3.33)	**12.10** (± 3.58)
1.25 m/s				
RoM T [°] *	**5.95** [b] (± 2.42)		**4.62** (± 0.97)	**5.23** (± 1.80)
RoM F [°] *	**15.34** [b,c] (± 3.59)		**12.52** (± 2.93)	**11.91** (± 3.11)

Table 1. Overview of the range of motion (ROM) of the shoulder angle in the transverse (T) and frontal (F) plane when walking (at 0.75m/s and 1.25m/s) at the different timepoints.
** Statistically significant ($p<0.05$) Timepoint effect*
[a] Different ($p<0.05$) compared to Post-1Week
[b] Different ($p<0.05$) compared to Post-3Months
[c] Different ($p<0.05$) compared to Post-1Year

Discussion

The present study is the first study to investigate the early gait recovery in terms of shoulder motion after spinal fusion surgery in AIS patients. At 1 week postoperative, AIS patients walked with a reduced RoM of the shoulder, which increased back to preoperative levels at three months and one year after surgery. However, this recovery in shoulder angle was not present at three months and one year postoperatively when higher walking speeds were imposed which was assumed to be due to increased task demands. These findings suggest that early postoperative dynamic assessments could provide new insights in patient-specific and task-dependent recovery. This novel information could serve as a basis for patient-specific early rehabilitation protocols.

References

1. Mahaudens et al, Gait & Posture, 61:141-148, 2018.
2. Lenke et al, Spine, 26:330-337, 2001.
3. Severijns et al, Spine J, 20:934-946, 2020.