



**Karolinska  
Institutet**

**From the DEPARTMENT OF MOLECULAR MEDICINE AND SURGERY**

# Early onset spine deformity. Outcome of surgical treatment and 3D movement analysis of sitting.

**AKADEMISK AVHANDLING**

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## **Abstract**

**Early onset, non-idiopathic spine deformities are progressive and associated with increased respiratory and cardiovascular morbidity and mortality as well as neurological and functional deteriorations. If untreated, the deformity progression can continue throughout the adult life and conclude with early mortality mostly due to cardio-pulmonary reason. Wheelchair dependent children with early onset neuropathic and neuromuscular diseases present spine deformities in up to 90%. Abnormal motor control can lead to difficulties in sitting due to postural balance disturbances, spinal deformity, pelvic obliquity and hip disorders.**

**The aim of this thesis was to analyse a group of patients with early onset non-idiopathic spine deformity from two different perspectives. From clinical perspective: outcome of surgical treatment on multidisciplinary risk patients, the impact of additional neurosurgical intervention in the same surgery session, and the impact of treatment unit when standardizing for pre-operative parameters, surgical technique and surgeon. From functional perspective: the sitting quality was analysed using three-dimensional movement analysis techniques in stationary and dynamic conditions.**

**Clinical studies. Data from local deformity registry and medical records of consecutive series of patients treated at two departments : one with paediatric multidisciplinary team, and the other with focus on adult spine were included. Variables at base line: age,gender, diagnosis, curve size, type of surgical procedure. The result variables for the group comparisons were as follows: clinical and radiographic outcome, surgery time, length of intensive care and hospital stay, relative blood loss, and occurrence of complications or adverse events.**

**There was no peri- nor postoperative mortality, no spinal cord damage, no neurological or ambulatory function deterioration. The rate of complications indicating any intervention was 15%. An additional neurosurgical procedure combined with fusion surgery did not increase the complication rate or use of resources compared with fusion surgery alone, except in the length of surgery time. There were statistically significant between-department differences regarding treatment outcome in favour of more specialized department.**

**3D movement analysis of sitting was performed using two force plates for kinetics and self-reflective markers on anatomical points for kinematics. The analysis was performed during unsupported sitting quiet and when performing circular movements with upper body. Four patients were retested after spine surgery.**

**The results in both domains showed clear differences between patients with spine deformity when comparing with controls as well as in pre- and postoperative comparisons. During quiet sitting patients were able to compensate deformity and postural control related disequilibrium and keep thorax position similar to controls. During dynamic sitting functional limits of stability were significantly larger in the control group. After the surgery, sitting parameters improved.**

**Conclusions. Major spine surgery in high risk patients can be performed with safety and good outcome. Impact of organization and work place culture on the outcome might be important and worth further studies. One-stage major spine surgery, even when neurosurgery is included, is safe and does not increase the risk of complications.**

**The 3D method of movement analysis of quiet sitting and self-initiated sitting movements provides new perspectives to analyse sitting pathology regarding postural balance and symmetry as well as stability in patients with neuropathic and congenital spine deformities. The method enables quantitative intra- and inter-individual comparisons over time and gives a possibility to analyse treatment intervention dependent changes.**

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