Benefits of dynamic joint orthoses for regression of joint contractures in children and adolescents

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Introduction
Contractures are a common complication in neurological conditions such as cerebral palsy, resulting in a limited range of motion (ROM). Stretching plays an important role in treatment of the affected joints. Controlled dynamic stretching (CDS) orthotic joints represent promising new devices to enhance existing therapy, but there are no data on this therapeutic option in children and adolescents.

Objectives
To analyze whether CDS orthotics reduce or prevent contractures of various joints in children and adolescents with the primary endpoint of clinically relevant improvement of passive ROM (PROM).

Patients and methods
In this single-center, observational, intraindividually-controlled study, children and adolescents were recruited in 2018-2019 at the Charité Center for Chronically Sick Children. Patients received CDS orthotics in addition to their regular multidisciplinary treatment. CDS orthotics were used for knee flexion (KF) and extension (KE), elbow extension (EE), wrist dorsal extension (W) and ankle dorsal extension (DE). PROM and clinically relevant changes were assessed with neutral/zero-method and goal attainment scale (GAS) at baseline, after 6 (FU1) and 12 weeks (FU2), and 6 (FU3) and 12 months (FU4). Undesired events were monitored continuously.
Results
We treated 39 affected joints with CDS orthotics (13 KE, 10 W, 7 EE, 4 KF, 5 DE) in a total of 18 children (8 male, median age 9 years (range 5-15) with cerebral palsy, spina bifida or other genetic syndromes. In addition to contractures, most patients had increased muscular tone. Children received 1 to 4 (mean 2) orthotics. At FU2, PROM improved in 5/6 KE by 8 ± 3° (p<0.05) and in 7/7 EE by 7 ± 6° (p<0.05). We detected a trend towards PROM improvement in 4/6 W by 18 ± 12° (p=0.05). Parents and therapists noted alleviation in care, positioning, transfers and increased activity in therapy. CDS were globally well tolerated, and no worsening of contractures was found. Until FU2, outcomes have improved, but not yet reached their pre-specified long-term goals (GAS). Whereas PROM was improved in 97% (p<0.05) of tested joints, active usage of improved ROM as long-term goal still needs to be evaluated at FU4.

Conclusion
This is the first study showing improvements in PROM attributed to CDS orthotics in the majority of joints after a short treatment period with consecutive clinical improvements of individually set goals in children and adolescents with chronic neurological conditions.