management of MFS EOS is often further complicated by medical comorbidities.

Methods: Two large prospective registries of children treated for EOS were queried for MFS patients treated between 1996 and 2016. Forty-two patients underwent rib or spine based growing instrumentation and were assessed on preoperative, surgical and postoperative parameters.

Results: Mean (±SD) preoperative age was 5.5 (2.8) years. Mean scoliosis and kyphosis were 77° (19°) and 50° (24°), respectively. Twenty-eight patients were treated with spine-based traditional growing rods (65%) and four with traditional rib-based constructs (9%). Eight patients (19%) had magnetically expandable control rods (5 spine and 3 rib-based), two had Shilla constructs (5%).

Patients subsequently underwent an average of 7.1 surgical procedures, with a mean of 5.7 lengthening surgeries and 2.4 revision surgeries. At final follow-up of a mean 6.5 (±4.1) years, scoliosis was 42° (±18), kyphosis was 42° (±21°), and T1-T12 spine height was 23.8 (±4.2) cm. Patients experienced, on average, 2.6 complications, with implant failures representing 42%. Nine percent developed superficial infections, 5% deep infections, and 14% wound dehiscence.

There were no differences in patient demographics, number of procedures, or complications between the spine and rib based constructs. Patients with spine-based fixation had a greater reduction in scoliosis (40 ±22°) than rib-based patients (20 ±11°, p=0.004) and greater reduction in thoracic kyphosis (11°±27° versus 19°±25°, p=0.038).

Conclusion: Children with EOS and MFS benefit from growth-friendly spinal surgery, but complication rates are high. Spine-based constructs showed greater reduction in scoliosis, but similar complications and revisions compared to rib-based constructs.

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Paper #27

Controlled Dynamic Spine Distraction Increases Vertebral Body Growth, Disc Height and Volume, and Nucleus Pulposus Expansion; An in Vivo Study on Rodent Tail Model

Pooria Salari, Garrett Eason, Kaitlyn Broz, Simon Tang

Summary: Continuous distraction forces increase vertebral body growth and disc height in immature spine. Distraction showed to be successfully promoting growth in disc and vertebral body withno gross evidence of disc degeneration.

Hypothesis: Distraction causes significant changes in disc height, vertebral growth and disc viscoelastic behavior in immature spine when compared to control group.

Introduction: Growth friendly and growth modulation techniques are routinely used in treatment of scoliosis in immature spine. The effect of distraction on immature spine is unknown. The purpose of this study is to evaluate the effect of distraction on disc and vertebral body growth, bone quality and disc biomechanical characteristics in immature spine.

Methods: Forty-eight, 6 weeks old mice were randomly assigned to 3 distraction groups and a sham group. Instrumentation was applied to the tails spanning over two caudal disc segments. In distraction groups, a sustained tensile force approximately 2X of the animal's body weight was applied to the instrumented levels for 8, 10, or 14 weeks. Radiographs and MicroCT imaging were obtained weekly. Vertebral body length and disc height were measured on imaging. (Image-A) At the end of the distraction period, histology was done on all samples to evaluate end-plates and disc. The intervertebral disc mechanical behavior was quantified using dynamic mechanical testing; Contrast enhanced microCT was used to reveal and quantify the nucleus pulposus and annulus fibrosus structures. The vertebrae bone volume fraction and vertebral end-plate morphologies was assessed using microCT.

Results: There were no complications in any of the groups. Vertebral length and disc height/volume increased in distraction groups. (Image-b,c) The stiffness of the disc increased by 60% in the group that was distracted for 14 weeks. Glycosaminoglycan content of the discs decreased with distraction. (Image-d) End plates in the distraction groups showed decreased pore size and bone volume fraction. Histology revealed an expansion of the nucleus pulposus in the discs subjected to sustained distraction.

Conclusion: Distraction showed to be successfully promoting growth in both the lengthening of the vertebrae and the expansion of the disc space. There was no gross evidence of disc degeneration in distracted discs. This study provides new information on effect of distraction on spine and will have significant clinical impact on future work on growth modulation in immature spine.

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