among early onset scoliosis patients, and the impact this has on pulmonary function.

Methods: Using a multicenter database, 63 early onset scoliosis (EOS) patients were identified with C-EOS and spirometry data available. Age, gender and radiographic parameters (major Cobb angle and kyphosis) were tabulated prior to surgical treatment. Cross-sectional evaluation of C-EOS and spirometry variables, FVC (Forced Vital Capacity) actual and predicted, FEV1 (Forced Expiratory Ventilation in 1 second) actual and predicted, and FEV1/FVC ratio, were performed. Correlates between C-EOS, spirometry and age were evaluated.

Results: FVC predicted was not different among patients with congenital, idiopathic, neuromuscular, and syndromic etiologies (68.7%, 60.3%, 62.03%, and 62.9% respectively; p=0.539). FEV1 normalized to FVC was normal in all groups, with no difference observed among groups (range .82-.90) (p= 0.506). For patients with neuromuscular, syndromic and congenital scoliosis, there was no relationship between predicted FVC or FEV1 and age, while in patients with idiopathic scoliosis predicted pulmonary function decreased with age (p=0.0026). There was an observed correlation between Cobb angle and FVC predicted regardless of etiology (p=0.062).

Conclusion: Predicted FVC is greatest in patients with congenital scoliosis. Children with idiopathic type EOS demonstrate significant declines in predicted FVC and FEV1 with age while other etiologies do not. While FVC appears to be dependent on Cobb angle, larger cohorts will be necessary for further granularity within C-EOS etiology categories.

Author disclosures: Klane White: Biomarin Pharmceuticals; UpToDate; Biomarin; Genzyme; Medicrea. Bompadre Viviana: none. Norman Ramirez: none. Shing Varakitsomboon: none. Sumeet Garg: Pediatric Orthopaedic Society of North America; US News & World Report Best Children's Hospitals Orthopedics Working Group; Medtronic; Decision Support Medicine. Gregory Redding: none. Walter Krengel: none.

Paper #3

Can TGR change the natural history of pulmonary functions in EOS? Is Radiological Straightness Correlated with Normal Lung Development?

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Summary: Even though traditional growing rod (TGR) patients score lower in exercise tolerance and spirometry compared to age-matched controls, their pulmonary functions are similar to those of instrumented adolescent idiopathic scoliosis (AIS) patients.

Hypothesis: TGR supports normal lung development in early-onset scoliosis (EOS) patients.

Design: Cross-sectional comparative study.

Introduction: Despite a long and involved process, TGRs are able to radiologically control EOS deformities. There are no studies evaluating otherwise healthy TGR graduates utilizing sophisticated pulmonary function tests and comparing them with normal adolescents and surgically treated adolescent idiopathic scoliosis. In this study, we aimed to compare exercise tolerance and oxygen consumption capacity of otherwise healthy TGR graduates with those of age-matched controls and post-surgical AIS patients.

Methods: Group 1 consisted of 8 EOS patients without neurologic or systemic comorbidities, group 2 of 8 similarly aged thoracic AIS patients at least 1 year out from instrumentation, and group 3 of 10 individuals without musculoskeletal disorders. Other than radiological studies, subjects underwent cardiopulmonary exercise testing (CPET) and spirometry (Cosmed Pulmonary Function Equipment Ergoselect).

Results: There were no statistically significant differences regarding height, weight and residual deformity between TGR and AIS patients. Pulmonary data is summarized in Table. None of the studied parameters were different between AIS and GR patients; however, both groups' results were significantly different from healthy controls.

Conclusion: Despite a long and tedious process often wrought with complications, the TGR can help EOS patients, who would otherwise be doomed to serious pulmonary insufficiency, achieve pulmonary capacities compatible with a healthy life. Despite significant decreases in TGR graduates in oxygen consumption capacity and pulmonary tests compared to healthy controls, results were not statistically different than AIS patients of similar age and radiographic characteristics. TGR is effective and successful in achieving good results in pulmonary functions as well as radiological parameters.

Author disclosures: Ebru Celebioglu: none. Alper Yataganbaba: none. Oncel Asli: none. Ceren Degirmenci: none. þÿ Osmail Aykut Kocyigit: none. Fatih Tekin, H. Gokhan Demirkiran: none. Elmas Ebru Yalcin: none. Ahmet Ugur Demir: none. Muharrem Yazici: none.

Paper #4

Referral Patterns and Prevalence of Sleep Abnormalities in Children with EOS

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Summary: Polysomnograms (PSGs) are not used in most spine centers for children with EOS. There are no standards for PSG referrals, and the yield from PSGs is unknown. We describe referrals for PSGs in 96 children > 5 years old with EOS, their lung functions, types of EOS, and frequency of abnormal PSGs.

Hypothesis: Most children with EOS have abnormal breathing during sleep and abnormal sleep quality.

Design: Retrospective chart review.

Introduction: Eleven children with EOS were previously reported with sleep-related breathing disorders. Criteria for PSG referral do not exist; diagnostic yield is unclear, and frequency of treatment for sleep-related breathing disorders is unreported.

Methods: Charts were reviewed on 160 children with EOS (2003-2016). 96 who were >5 years old with pulmonary function tests (PFTs) and/or a PSG were analyzed. Variables included Vital Capacity (VC) and Cobb angle within a year of the PSG and type of EOS. PSG indices included: Apnea-Hypopnea Index (AHI), lowest SaO2, and Arousal Index (AI).

Results: The average age was 10.5 years at PSG and 9.7 years at VC testing. 57% had only PFTs, 15% had only PSGs, and 28% had both tests. 64% had >1 spinal surgery before the PSG. Types of EOS were: idiopathic (12), congenital (23), neuromuscular (22), syndromic (31), and thoracogenic (8). The %s with PSGs per group were: idiopathic 0%, congenital 22%, neuromuscular 50%, syndromic 61%, thoracogenic 75%. Cobb angles were 54+/-49Ëš for those with PSGs. The VC % for those that had PSGs was lower than those with no PSG. (mean VC=42+/-17 % vs 70/-29%, P<.001). 95% (39/41) of the children with PSGs had abnormal

Group	#	Weight	Height	Cobb angle	FEV1(lt)	FVC(lt)	VO2Kg (ml/kg/min)	Ve (lt/min)	HR (bpm)	FEF25-75 (lt/s)
1 (TGR)	8	49.12	153,12	43,73	1.90	2.09	22.23	33.25	162	2.57
2 (AIS)	9	49	155,11	24,88	2.23	2,56	23,70	38,26	164,44	2,92
3(Control)	10	63.1	173,60	NA	3,76	4,22	30,91	58,73	156,90	4,25
p										
1 vs.2		1.000	1.000	0.603	0.799	0.667	1.000	1.000	1.000	1.000
2 vs.3		0.005	0.000	0.000	0.000	0.000	0.033	0.000	0.001	0.005
2 vs.3		0.003	0.002	0.008	0.008	0.008	0.055	0.008	0.004	0.011