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Conservative Scoliosis Treatment: Integration of Biomechanics and Psychology

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Abstract

The patient is a 5-year-old, Risser 0 female diagnosed with thoracic scoliosis with a 46-degree magnitude, T8 apex, and psychiatric challenges. The scoliosis curve has been progressive and was approaching surgical magnitude, while statistically likely to continue to progress and require a surgical correction. She was treated by a multidisciplinary team that leveraged behavioral health principles to accomplish correction that outpaced expectations.

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Background

At the time of intake, the patient was a 5-year-old, Risser 0 female diagnosed with Juvenile Idiopathic Scoliosis. The scoliosis is best described as a right thoracic curvature spanning T5-T11 with an apex at T8, of a 46-degree Cobb angle magnitude and complicated by shoulder asymmetry. At the time of intake, her diagnostic history included Autism Spectrum Disorder, Separation Anxiety Disorder, and Tourette's syndrome. Following diagnostic workup, a definitive diagnosis of Obsessive-Compulsive Disorder was added, while Attention Deficit Hyperactivity Disorder, hyperactive subtype, and Generalized Anxiety Disorder remain as differential diagnoses under consideration. An unspecified phonological disorder was also under consideration and communication difficulties were seen with the patient preferring to communicate through her accompanying parent rather than directly engaging with the clinicians. Her family has relocated to our community after their insurer changed, forcing a change of the treatment team. She has been a TLSO wearer for approximately 1 month. The pt was described as "difficult to keep still" and has been having a difficult time with the immobilization offered by the orthosis, further complicating correct intervention donning and treatment compliance. At the onset of treatment, the orthosis was not worn correctly and simple tightening of the straps was shown to accomplish an increase of 10 degrees of correction. Her motor tics began at the age of 4 and included trunk shifts that are impeded by a TLSO.

Theoretical Orientation

The case was approached and modeled from the bi-opsychosocial theory perspective.

Figure 1: In- orthosis standing x-ray: Initial presentation.

Figure 2: First out-of-orthosis radiography

Figure 2.5: Normalization strategies employed in other cases.

Figure 3: Initial TLSO fitting

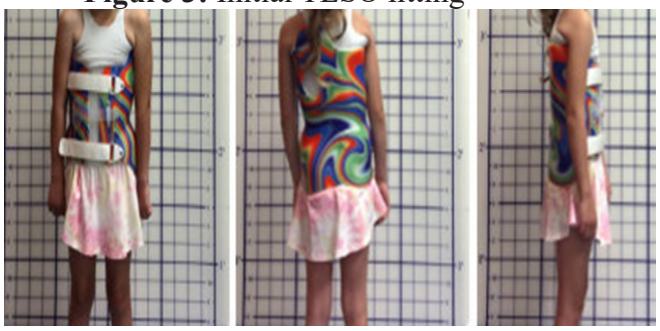
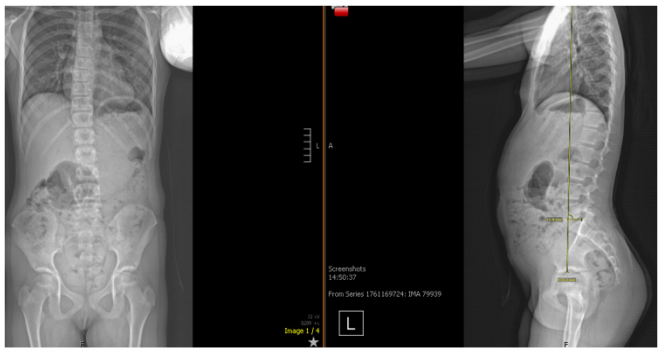


Figure 4: Initial in-orthosis correction (edit out the text in the radiographs here)

Figure 4.5: Intervention effectiveness at age 10. Out-of-intervention, unsupported radiograph (edit out the text please. I don't know what those notation mean)



Discussion

The prevalence of Juvenile Scoliosis is reported at 1.6% of the general population, approximately ¼ that of Adolescent Scoliosis [1]. This population is under-represented with all scoliosis- related cases representing approximately 10% of time utilization of Certified Orthotists [2], with infants, juveniles, adolescents, and adults included in that representative sample. Intervention compliance is a critical, and notoriously difficult, consideration influencing conservative treatment effectiveness [3]. Treatment compliance can become further complicated with the involvement of co-occurring psychiatric diagnoses. Tic suppression

can result in internal tension and discomfort, facilitating a rebound effect in which the tic becomes more intense [4]. Cognitive rigidity and habit orientation commonly seen in ASD [5] can complicate the initiation or modification of orthotic treatment: even replacing a gravely worn-out orthoses with a new one of an identical design and the same sizing can be difficult. Greater risks of scoliosis progression are seen during growth spurts and periods of axial growth [6], and in the context of a 5-year-old patient, the risk of progression is concerning and may lead to lifelong sequelae. The University of Iowa Children's Hospital predictive guideline indicated a 92% likelihood of curve progression to surgical magnitude with an 18-hour TLSO wear. It seems important to recognize that the youngest age for which the prognostic tool is validated is 9 years old and this patient's risk of progression was likely higher with more time for axial growth available.

Methods

The patient was engaged in Orthotics using a strength-based approach supplemented with Motivational Interviewing and NLP techniques: the patient was invited to try/experiment, to participate, instead of being directed to; her goals, attributions, and motivating factors were explored. Both the patient and her accompanying family members appeared to have a poor understanding of donning orientation/techniques or proper orthosis usage. The orthosis was worn too loosely to initial radiology and a first attempt indicated a 25 degree in-orthosis alignment, not meeting the 50% correction threshold of successful treatment [7]. Repositioning and re-tightening before re-imagery revealed an acceptable 15 degree in-orthosis curvature. Early encounters in Orthotics, with an intervention already in place, focused on the establishment of therapeutic rapport, patient education, patient empowerment, and the normalization of the experience. The patient responded admirably: participated in all but one of the scheduled appointments, wore the orthosis correctly, and promptly reported changes that influence treatment to the clinical team. Compliance remained a challenge with the pt reported the orthosis as uncomfortable.

Over the course of treatment, patients' height has increased, warranting a replacement of the TLSO. The patient was fit with a Cheneau variant TLSO that was custom molded to the pt and featured an anterior opening, lateral trochanteric extension, lumbar derotation pad, lateral thoracic /axillary extension, and a cosmetic finish of the patient's choice. For added normalization, patients' doll was also 'braced' with a device that mirrored the design elements and the cosmetic finish of her own TLSO. The pt was scheduled and maintained on a higher follow-up frequency for comfort-level adjustments, as well as a communication of acceptance and positive regard. Despite the time elapsed and growth accomplished, the initial in-orthosis correction of 13 degrees improved from 15 degrees as the best alignment achievable in the previous TLSO.

The impact of a belief system on physical/anatomical outcomes cannot be understated: placebo is used in all of biomedical research, and the belief that an intervention can make a positive difference has been shown to be able to address a condition [8] to a greater extent than no treatment at all, despite the control intervention being inert. Patient's treatment, therefore, invested energy and effort into accommodation, empowerment, engagement, care, concern, regard, and self-determination.

Results

The patient has been engaged with the current treatment team for approximately 5 years. She has grown and has used several orthoses in that time period. A compliance monitor was used, and confirmed patients' reported wear time. Despite some periods when the orthosis was not worn to the prescribed length of time, patients' engagement, openness, genuineness, and efforts toward compliance have been observed and factored into the treatment plan. The clinicians of different disciplines communicated and coordinated care in an effort to lower barriers, decrease frustrations, and empower the patient to make decisions that get her closer to her intrinsic goals. A total of 2 appointments have been missed over the 5 year length of treatment while the pt was admirable in scheduling additional appointments and check-ins, as needed. Despite having a high level, high magnitude curve that has been progressive and was statistically likely to continue to progress, despite psychiatric challenges, and 1 foot of axial growth achieved, an out-of-orthosis correction accomplished has reduced the curve to under 10 degrees and the definition of scoliosis is no longer met. Inter-rater reliability of small magnitude measurements is somewhat limited, and an argument can

be made that the true current curve magnitude is between 9 and 14 degrees. The halting of the curve progression would have been a successful treatment outcome [7], the curve reversal exceeded treatment expectations. The patient has transitioned to a nocturnal TLSO that permits unrestricted trunk motion throughout the day, her engagement and compliance has remained commendable. The use of a compliance monitor/sensor is believed to have improved treatment compliance, in line with Hawthorne effect [9], and it has been discontinued in the most recent orthosis after sustained observation of treatment compliance with the wear-and-tear of the padding and the Velcro supporting patients' reported wear time.

Summary

This case represents an individual that is underrepresented in a clinical setting with a curve magnitude that is approaching a surgical magnitude and was likely to progress and require a surgical correction. Patient care has been complicated by behavioral and communication challenges. These difficulties have been successfully overcome with integrated, humanistic, attentive and responsive, multidisciplinary care.

Advocacy for Future Research

The utilization of behavioral health principles in Allied Health interventions remains an understudied/underreported topic in the literature.

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