

Embody, Disembody, Re-embody, Body

Working with Scoliosis and Embodiment

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ABSTRACT *The scoliotic client is met with a world that idealizes the spine being ‘straight’ and faced with diagnoses and treatment that often focus exclusively on angles, scales, and measures of the spine and rib cage. But what is the experience of the person living within the spine and rib cage? The author broadly reviews the domain of scoliosis, from etymology to diagnosis to psychobiological issues and conventional corrective measures. She explores the effect of a scoliosis diagnosis on embodiment and considers what it means to embody ‘curved’ and ‘rotated’ in a world that idealizes ‘straight’, taking us through elements of her work with a client diagnosed with scoliosis as a teenager some forty years ago.*

When I reflect on years in private practice and clients coming for help with scoliosis, I recognize that the majority came because they thought I could help them “be straighter.” Many had pursued their ‘straighter’ ideal with braces, surgeries, and a variety of exercise methods ever since their scoliosis was first diagnosed. All too often, ‘straight’ was something someone told them they were not, others were, and they desperately wanted to be. Not being ‘straight’ had shaped their self-concept and defined their capacity for expression.

As I imagine is true for many of my colleagues, my practice includes scoliotic clients of different ages with varying types and degrees of curvature. Some of these clients have received or participated in an assortment of treatment approaches, including anterior dual rods, spinal fusions, Cheneau braces, and stretching techniques, such as the Schroth Method. Many perceive their previous treatments to have been effective at varying degrees, others not so. Some have complications and compensations from treatments resulting in pain and movement restrictions.

Many were diagnosed during routine screenings as a child or adolescent. Others never knew that they had scoliosis until, as an adult, they visited an orthopedist, chiropractor, or physical therapist who, based on films, told them their pain was linked to a scoliotic spinal curvature. Many have continued to pursue various forms of treatment – the reason for their arrival in my office.

As Rolfing® Structural Integration (SI) and Rolf Movement® Integration practitioners, we are fortunate because, as we continue to grow and refine our education in myofascial, visceral, cranial, and movement concepts and techniques, we have many opportunities for meaningful interventions in scoliotic patterns. However, the focus of this article is not about specific theories and interventions, but on exploring scoliosis related to embodiment. Scoliosis diagnoses often focus exclusively on angles, scales, and measures of the spine and rib cage, but what about the person living with the spine and rib cage? What does it mean to embody ‘curved’ and ‘rotated’ in a world that idealizes ‘straight’?

PART I: BACKGROUND TO DISEMBOIMENT AND EMBODIMENT

The word 'embodiment' means different things to different people. Its definition seems to be in constant motion as diverse disciplines embrace embodiment as essential in understanding our personal, social, and cultural experience on Earth. Physiological, phenomenological, developmental, and behavioral aspects of embodiment are considered and weighed differently depending on the viewer's vantage point. As Rolf Movement and SI practitioners, we often speak of embodiment as a valued therapeutic process for our clients and ourselves. We believe our embodied presence is integral to our work. When our clients embody one of our principles or goals we are pleased. When they return and the evidence is still present and alive, we are thrilled. We may meet a new client and think, "Hmm, he lives in his head, disconnected from his body."

Guiding someone to reconnect with his/her body, to embody, involves coaching awareness of the steady stream of sensations arising from processes of interoception, proprioception, and exteroception. We help our clients learn to allow and recognize the flow of these sensory experiences as rich information to support their actions, their movement in the world; and in turn their movement creates sensations rich for their awareness. Additionally, we pay attention to language as a way to encourage embodying supportive patterns of coordination and perception instead of reinforcing unsupportive ones. Kevin Frank's (2012) article, "Differentiating Categories of Embodiment: An Educational Rationale for Rolf Movement Integration within Rolfing SI", describes seven categories of embodiment relevant to our work: orientation, interoceptive, proprioceptive, exteroceptive, agency body/coordination, levels of abstraction, and autonomic. As SI and Rolf Movement practitioners, we are trained to value, monitor, and coach a holistic process of embodiment and recognize that the long-term nature of our work depends on it.

The Invisible Brace

Coaching embodiment for scoliotic clients – or any client – is not coaching them into 'straightness', which is something

they may already try to do themselves. When Colette first started sessions with me, she would begin by enthusiastically demonstrating her latest evolution toward "standing straighter" by shifting sections of her rib cage and pelvis in various lateral directions, along with a variety of sagittal rotations. These adjustments seemed to come from her interpretation of suggestions made by a collection of past and present therapists, medical practitioners, and fitness instructors. Once she had all these in place, she would ask, "Okay, am I straighter?" Often, she would interrupt my response with, "Wait, let me try that again . . . no, wait, I need to start over . . . there . . . how about now – am I straighter?" It was as if she systematically put on an invisible brace and then tightened it in various directions before locking it in place. We will return to Colette as we journey through this article.

Diagnostic Criteria for Scoliosis

Before going further with the discussion of embodiment and our work with clients, let's look at how scoliosis is conceptualized, traditionally and with recent advances.

2D Versus 3D Conceptualization

SI and Rolf Movement practitioners generally accept that scoliosis is a whole-body phenomenon, not exclusively limited to the shape of the spine. We see manifestations of scoliosis from the arches all the way through to eye focus and cranium shape. However, from a more traditional viewpoint, scoliosis involves a three-dimensional torsional deviation in the shape and position of the spine involving the coronal, sagittal, and horizontal planes, and often includes the thorax, trunk, and pelvis. The Cobb angle, named after orthopedist John Robert Cobb, is the most widely used basic measurement to quantify the magnitude of spinal curvature and track progression. By anterior-posterior radiographs in an upright position, lines are drawn from the endplates of the most angulated superior and inferior vertebrae of the curve. Two more lines are drawn at an angle of 90° to these lines. Finally, the resulting angle is measured and expressed in degrees (O'Brien et al. 2008, 49-53). The Scoliosis Research Society (SRS) suggests a diagnosis of scoliosis when the Cobb angle is 10° or higher and axial rotation

is recognized. Cobb angles between 10°-24° are considered mild scoliosis; 25°-39°, moderate; and 40°-70°, severe (Baaj 2018). Since the Cobb angle measurement was invented in 1948, several curvature classification systems have been developed, mainly for refinement of surgical decisions. The Lenke system, created by orthopedist Lawrence Lenke in 2001, is still predominately in use. It measures lumbar and thoracic curves in the coronal plane with sagittal-plane modifiers, thus attempting to represent a more global overview of the spine. He first attempted to factor all three planes into his system, but the horizontal plane was excluded due to "inconsistent reliability of measurement assessment" (Lenke 2018).

The issue with Cobb angle measurement and the Lenke classification system is that they consider a three-dimensional phenomenon from a two-dimensional image. In his keynote presentation at the 2017 conference of The International Scientific Society on Scoliosis Orthopaedic & Rehabilitative Treatment (SOSORT), orthopedist, J.F. Dubousset proposed axial vertebra rotation (AVR) to be key in determining the progression and appropriate treatment of scoliosis, more so than the Cobb angle (Karavidas 2017). During the 1980s, Dubousset worked with Dr. Yves Cortel to develop the Cortel-Dubousset Implant System for surgical correction of scoliosis – the first method to consider the three-dimensional nature of scoliosis (Drummond 2009). Dubousset pointed out the significance of the shape and degree of 'rib hump', or 'piling up of vertebrae', as an indicator that scoliosis is an "evidence symptom from trouble occurring on the horizontal plane" (Dubousset 2017). A 2015 article published in the *Journal of NeuroEngineering and Rehabilitation* suggests that current computer modeling technologies can more accurately represent the complex three-dimensional nature of scoliosis and that the time has come for clinical application (Donzelli 2015).

It's interesting to note that the latest technology provides a model that validates what SI and Rolf Movement practitioners perceive through our eyes and hands. During his keynote, Dr. Dubousset spoke in favor of computerized modeling, but also recommended experiencing the nature of scoliosis by direct feel of its shapes: bulging, hollowing, missing, protruding, or penetrating. Similar to Gracovetsky, he stressed the importance of torsional movement in the horizontal

plane. He stated, “During walking and any movement, it is the horizontal plane that gives a smooth adaptation of the skeleton regarding gravity” (Dubousset 2017). He went on to explain why scoliosis correction should be about harmonious congruence, not a perfect Cobb angle, stating, “harmony is the sister of economy,” and was passionate about dynamic balance taking precedence over static alignment. All music to the hearts of SI and Rolf Movement practitioners!

Known and Unknown Causes

Scoliosis results from known and unknown causes in patients of all ages. Exact figures for worldwide occurrence of scoliosis are unavailable. However current research suggests that 2%-3% of the world's population is affected, with 80% labeled idiopathic (unknown cause) in origin. The majority of idiopathic scoliosis (IS) is diagnosed in adolescence, between the ages of eleven and eighteen, and is therefore named adolescent idiopathic scoliosis (AIS). It is more likely to show up at the onset of puberty when there is a major growth spurt. Females are eight times more likely than males to have AIS and are at increased risk for progression. The main risk factors at diagnosis for progression are: female gender, large curve magnitude, skeletal immaturity measured by the Tanner scale, and sexual immaturity measured by the Risser scale. Of adolescents diagnosed with scoliosis, only 10% have curves that progress and require medical intervention (Negri et al. 2018, 3-5).

Other forms of IS are infantile, juvenile, and adult. Infantile scoliosis is diagnosed before three years of age, occurs equally in males and females, and accounts for 1% of IS. While the etiology is unknown, there are two theories. The intrauterine molding theory suggests that the spine is curved at birth and progresses with growth. The post-delivery theory suggests that placing infants on their backs will lead to flattening of their skulls and scoliosis. Juvenile scoliosis occurs between the ages of three and ten years. In the lower age range, it is found more often in males and the curve is left-sided. In the upper age range, it mirrors AIS with more females and right-sided curvatures. When the juvenile curve is greater than 20°, there is a high incidence of Arnold-Chiari malformation and syringomyelia, a cyst on the spinal cord. Adult idiopathic scoliosis is typically continuation of a

curvature that began in adolescence and continues or progresses into adulthood (Nelson and Sanders 2018).

Scoliosis cases with known causes are categorized as: congenital, neuromuscular, degenerative, functional, or syndromic. These account for the remaining 20% of diagnoses. Congenital scoliosis starts before birth and results from incomplete formation or separation of one or more vertebrae (Kawakami 2018). Neuromuscular scoliosis results from a medical condition affecting nerves and muscles, such as cerebral palsy (Newton 2018). Degenerative, or de novo, scoliosis is diagnosed in adulthood and results from degenerated discs and arthritic facets, often accompanied by a flattening of the lumbar lordosis (Crawford and Glassman 2018). Functional scoliosis is secondary to a primary cause, such as a leg-length difference (Baaj 2018). Syndromic scoliosis is attributable to any of a number of syndromic diseases, such as Marfans, Ehlers-Danlos, and osteochondrodystrophy (dwarfism) (Herzop et al., 2018).

Naming and Early Treatment

The word scoliosis is derived from the Greek *skoliosis*, meaning crookedness or bent. Recorded observance dates to the fifth century BC when Hippocrates described spinal deviations as *spina luxate*. He developed the Hippocratic Ladder to facilitate traction with the subject hanging head upwards alternating with head downwards. In the second century AD, the Greek physician Galen of Pergamum defined scoliosis as an abnormal lateral spinal curvature and added manual pressure, braces, distraction, and breathing techniques (including singing) to the work of Hippocrates (Kanter et al. 2009, 631). Leonardo da Vinci scrupulously illustrated the spine, indicating the significance of curvatures and articulations. The first supportive braces were developed by a sixteenth-century French army surgeon, Ambrose Paré, who described a method of using directed pressure and extension to reduce the deviated curvature (Serhan and Kuhn 2016, 1072). The treatment principles of Hippocrates, Galen, and Paré form the basis of traditional scoliosis treatment today: use of stretches, pressure, devices, rods, cages, or pins to directly move the laterally deviated spine, with ‘straightness’ being the goal.

Language and Imagination

Scoliosis is often described in literature as a ‘spinal and trunk deformity’. Deformity is defined as being ‘misshapen’. Relevant to a discussion about abstract language and embodiment is that scoliosis is named with a visual description and references an ideal aesthetic about how a posterior view of our upright spine and torso should look. At a deep level, there is primal symbolism in the language and concept of an upright spine that can trigger strong emotions. An upright spine is associated with our capacity for survival without dependence on others for our basic needs. On a social level, phrases such as ‘an upright citizen,’ ‘having a backbone,’ ‘being spineless,’ or ‘crooked to the core’ symbolically describe conditions of morality, ethics, strength, and desirable behavior.

Somatic pioneers alluded to the condition of the spine as being symbolic of character. Peggy Hackney (1998, 85), student of Irmgard Bartenieff, wrote: “A spine which supports and easily achieves verticality while also having the potential for fluid grace with flexibility seems to convey an important message: ‘This person is proud to be the human being s/he is and is comfortable attending to the world’.” She suggests that our culture places value on the individual and asserts that a sense of ‘individual’ resides at the spinal level of development. According to Hackney, “The culture is quite deprecating of a person who has not achieved a sense of self, whose internal support does not allow them to reside easily in a fluid upright relation to gravity.” Ida Rolf (1977, 182) wrote, “. . . The individual's attitude toward his environment does mirror the sturdiness and adequacy of his spinal structure.”

Historically, authors have employed spinal deformity to symbolize undesirable behavioral characteristics or situations. In his novel *The Quaker City; or, The Monks of Monk Hall* (1845), George Lippard's most villainous characters share an overtly visible distortion of their spines (Hall, 2010). In John Steinbeck's novel *Of Mice and Men*, Crooks, a lonely disempowered character, is named for his crooked spine. Victor Hugo titled *The Hunchback of Notre Dame* to describe the main character, Quasimodo, who is socially ostracized because of his physical characteristics. Even though society has advanced toward acceptance of physical differences and public figures

are more open to sharing their stories as encouragement to others, it's not difficult to image the fear created by a radiographic image of a meandering spine if it is yours, and especially if you are an adolescent girl.

Back to Colette: her scoliosis was diagnosed when she was fourteen, with a Cobb angle of 25°. She has never forgotten staring at the x-ray in disbelief as her doctor traced vectors to arrive at his diagnosis; Colette's conclusion for herself was "crooked spine." She was placed on a four-year, every six-month observation schedule. Her doctor suggested she might have to wear a full-torso brace for twenty hours per day or else he would need to surgically insert a rod to straighten her spine. He advised her to attend ballet classes and work on her posture. Colette was terrified, but determined. She said that she excelled in all the stretching aspects of ballet, and was able to perform splits in every direction, but she was terrible at *petite allegro* (quick footwork) and *adagio* (slow balance).

Thirty-five years later, she came to my office with multiple shoulder dislocations, collapsed arches, and chronic sacroiliac instability. Every few months, Colette incurred an injury, in spite of her years of physical therapy and therapeutic-exercise programs. She stood with hyperextended knees, tailbone tucked, weight on heels. Colette was terrified to move, so no wonder she organized, re-organized, and held herself together with the image of a straight spine. She relied on others to tell her where she was in space and how she should use her body. For Colette, "Am I straighter?" also meant, "Am I secure?"

Stability – Mobility

Orthopedic doctors Julius and Robert Hass casually linked joint laxity with scoliosis in 1958. In 1967, British physician J. A. Kirk coined the name joint hypermobility syndrome (JHS) to describe "generalized joint laxity occurring as an isolated finding in otherwise normal subjects" (Kirk et al. 1967). Forty-four years later, physiotherapists and researchers from Poland published a comprehensive award-winning study on JHS in adolescents in the journal *Scoliosis*, finding that adolescents diagnosed with scoliosis are 30% more likely to have coexisting JHS (Czaprowski, et al. 2011). Additional research conducted

by Czaprowski (2014) found that JHS was more prevalent in girls with AIS, but there was no relationship between curve pattern, size, or number of vertebrae involved in the curvature. So JHS is more likely to coexist regardless of whether the curve is mild or severe. Czaprowski (2011) warned that the treatments often prescribed for IS patients involving flexibility training, passive stretches, and balance-dependent exercises may cause injury or deterioration if refinements are not made to take coexisting JHS into account.

In 2017, an international consortium of experts in treating the condition changed the name of JHS to hypermobility spectrum disorder (HSD) and expanded the criteria beyond hypermobile joints to include both musculoskeletal and systemic manifestations. One of these manifestations is "disturbed proprioception," defined as "not understanding where our joints are and how much muscle strength it takes to use them" (Castori et al. 2017). In clients with HSD, I have often noticed hyperextension of the joints as a means to enhance postural stability; or perhaps due to disturbed proprioception, the joint overshoots home. In those with coexisting scoliosis, the natural bracing knee is often the one that enhances their scoliotic curve.

Each person and each curve is unique with stories, experiences, and emotions behind them. However, a worrisome commonality I have often found is that scoliotic clients diagnosed as adolescents attach their success on being 'straighter', regardless of improved capacity for breath, greater ease of movement, or even freedom from pain. Even more troublesome, this ideal body image often seems to define them and may impede a more differentiated body awareness – a fluid sense of embodiment based on the body as a sensory organism, not an objectified ideal. This may lead to less coordinative adaptability and stability in response to internal and external stimuli.

Colette was once sitting on a wide flat seat, chatting with a fellow passenger, on a slow-moving shuttle bus. Suddenly, the driver swerved to avoid an oncoming car. Colette slid across the entire width of the shuttle bus, unable to catch or right herself before crashing her head, shoulder, and hip into the opposite side. She sustained a concussion and several painful soft-tissue injuries.

Body Schema, Peripersonal Space

Embodiment doesn't end with our skin. We navigate movement through space by continually monitoring our position and motion in relation to gravity, body parts, and nearby objects, including other people. The effectiveness of this piloting to avoid, connect, or manipulate objects in pursuit of our behavioral goals requires an integrated neural representation of our body (body schema) with the space around us (peripersonal space). Researcher Lorimer Moseley, author of the *Explain Pain* books, proposes the name, 'body matrix' for this dynamic interrelated system: "This body matrix is a network of multisensory and homeostatic brain areas. That is, it is a dynamic neural representation that not only extends beyond the body surface to integrate both somatotopic and peripersonal sensory data, but also integrates body-centered spatial sensory data and then integrates the whole lot with homeostatic and motor functions" (Moseley 2011). In this way, we organize our movement based on our perceived potential for action in the world – our agency (Holmes and Spence 2004). Perception is shaped by multiple experiences, including emotions, beliefs, memory, and culture. If our perception is that we are deficient because our spine is not ideally shaped, and therefore we must hold ourselves as close to that ideal as possible, then our movement capacity corresponds to that belief. We lose adaptability and connectedness related to movement, task, and environment.

Often, Colette was injured by seemingly random pedestrian actions. She took a cast-iron pot off the stove and strained her elbow; sprained her ankle stepping off a curb; and pulled back muscles while organizing a closet. The frequency of these occurrences created exasperation about the lack of an explanation and a sense of distrust in her body. They also increased her resolve that "straighter" would provide the remedy.

Considerable research – and money – has been devoted to identifying the etiology of AIS. By identifying the origin, researchers hope predictions regarding progression and appropriate treatment will improve. To date, the two leading professional scoliosis research societies, SOSORT and SRS, agree that the etiology of scoliosis is multifactorial, and because it tends to run in families, there

is a genetic basis, yet the full etiological mystery remains unsolved. A 2011 review of the literature reports previous and ongoing etiological hypotheses related to abnormalities of genetics, spinal growth, postural control, intervertebral discs, connective tissues, hormones, melatonin, in utero visceral rotation, the autonomic nervous system, muscle tonus, minerals, and neuraxis growth (Séze and Cugy 2011). Various disciplines conduct research and investigate hypotheses; however, until recently many studies have suffered from small sample populations, inconsistent reporting, discipline bias, and lack of established guidelines. SOSORT and SRS are working together to improve these practices. Even with these research difficulties, many topics have implications for Rolfers in working with clients, scoliotic or not.

Proprioception, Postural Control, Postural Sway

Since the late 1970s, there have been studies investigating the role that certain aspects of body schema, especially faulty proprioceptive postural control, may play in AIS. In 1984, Herman et al (1983) published an article in the journal of the SRS, *Spine*, that postulated a relationship between IS and a proprioceptive recalibration of the internal representation of the body in space, so that a “non-erect vertebral alignment may be erroneously perceived as straight.” Robert Schleip (2000) describes a study in his article “Scoliosis and Proprioception,” that links proprioceptive dysfunction in the upper extremities to the presence of scoliosis (Keessen 1992). The researchers found no correlation between the degree of curvature and the degree of inaccuracy; so, the presence of proprioceptive dysfunction was suggested as a causal factor in scoliosis.

Since these earlier studies there have been many others investigating faulty proprioceptive postural control and the development, progression, and treatment of scoliosis. ‘Postural control’ is a term used by researchers to describe the role of proprioception for the dual purposes of stability and orientation. Postural control – or as we might say, ‘orientation embodiment’ – allows us to balance, calibrating our center of mass over our base of support, and orient appropriately within our environment. Hubert Godard offers a more comprehensive and dynamic

vision of this phenomenon in his theory of tonic function. [If you are unfamiliar with Godard’s tonic function theory, see Newton (1995) and Frank (1995).] Postural sway describes the small oscillating movements that humans make while standing, in response to breathing and orienting with a relatively high center of mass.

Recently, Swedish researchers (Dufvenberg et al. 2018) published findings from a review of eighteen case-controlled studies (of 917 filtered for inclusion and exclusion criteria) linking proprioceptive postural instability with the occurrence of AIS. Nine of these studies qualified for meta-analysis. The research team explained the background reason for this review as: “postural stability deficits have been proposed to influence the onset and progression of AIS.” The chosen studies, conducted from 1978 through 2013, utilized a force plate to measure ground reaction forces that represent the sum of pressure distribution under the foot in quiet standing balance. The studies included adolescents aged ten to eighteen years with IS without surgical or brace interventions. The review found increases in range of oscillation and amplitude of sway in AIS patients compared to the control group. According to Dufvenberg et al., these increases correlated with a center-of-pressure positional shift posteriorly in the sagittal plane in persons with AIS. This may be significant for the progression of AIS because biomechanical studies suggest that the human spine becomes more rotationally unstable with increased dorsal shear loads on the thoracolumbar spine. The review also cited a sensory-integration hypothesis that indicates a presence of impaired dynamic regulation of sensorimotor signals due to inaccurate weighting of sensory inputs in AIS. Our body schema relies on ‘weighting’ or filtering sensory inputs to activate the most efficient and effective postural motor adjustments. Impairment in proprioceptive signaling may create uneven tension in muscular and ligamentous structures, which may also exacerbate curvatures (Dufvenberg et al. 2018, 15-16).

Gerda Alexander, the creator of Eutony, named her work based on healthy tonus, describing it as “harmonious, well-balanced tension” (Alexander 1985) and discusses tonus regulation underlying adaptability in postural reflexes and equilibrium (Bersin 1983). Alexander describes tonus as the system by which humans feel and react; it provides the

capacity to adapt to the reality of the moment, interfacing our inner state with the movement dynamics required by a given situation. In scoliotic clients, we may see uneven tonus regulation, not exclusively in the muscles along the spine, but also throughout the body, including diaphragms, tendons, ligaments, and membranes, resulting from the scoliosis or from compensatory strategies.

As far as compensatory strategies, such as those I observed with Colette, Dufvenberg et al. (2018, 15-16) recognized that “what clinicians see in their evaluation of postural control is the net result of the disease process and the person’s compensatory strategies in terms of behavioral components and adaptive plasticity in the nervous system.” They pointed out the need to identify the compensatory strategies because they may not be optimal or effective. The findings of this review support investigating postural stability and sensory integration in early stage AIS with the prospect of identifying cause and effect of the curvature, as well as the effectiveness of postural control in scoliosis progression.

PART II: CLINICAL CONSIDERATIONS

Research and Inspiration for Our Work

The art of our work lies in the inspiration we gain from scientific research studies in application to our clients. My inspiration from the Dufvenberg et al. study is the importance of engaging scoliotic clients in active sensorimotor activities as a way to rehabilitate proprioceptive signaling. I am reminded of the tuning boards created by Darrel Sanchez, the cranial beanbags of Esther Gokale, the Franklin Textured Ball™ of Eric Franklin, and the use of tools – sticks, balls, and bands. In order to be effective, these activities must be coached for their rich sensorimotor content, as opposed to a performance-oriented approach. For example, clients being guided toward experiencing the weight of the beanbag, and away from the challenge of balancing it; trying this, the beanbag may drop, and in the dropping there is valuable sensate information. Similarly, the tuning board is about experiencing shifts in weight and feeling how the whole body responds, rather

than the task of maintaining balance. I described a sensation-based Franklin Textured Ball exercise in an earlier article (Carli Mills 2018). The Dufvenberg et al. study also illustrates the need to cultivate structural and coordinative ease both within the thorax and in relation to pelvis and shoulder girdle. No matter the degree of thoracic scoliosis or hardware installed, it's possible to work with interventions that create fluidity in these relationships such as multidirectional micromovements, bidirectional senses, and spatial perception to foster ease in breathing and adaptability in postural strategies. I am further reminded of the importance of the segmental congruence of the vertebrae that transition between lumbar lordosis, thoracic kyphosis, and cervical lordosis. Godard (2009) emphasizes the function of the transitional vertebrae as key to full movement capacity. In scoliosis, there may be multiple variations of transitional vertebrae following the rotational torsion patterns. It's important to consider the spine as a three-dimensional congruent whole in order to develop the capacity for movement initiated in one direction to cascade responsively through the entire spine. If necessary, the movement can be small or even coached energetically. It is critical that the apices of the curvatures do not become the default habitual hinges for initiation of lateral and anterior-posterior spinal movement.

Lastly, I am reminded of the image that humans live on a sensation-rich continuum between earth and sky; this embodiment is a key resource for our movement potential.

Ideal and Imperfection

Another piece of work that is necessary with scoliosis is a process of re-embodiment, or reclaiming the body from the pathologizing scoliosis diagnosis and the disembodied template of 'straightness' it often imposes on posture and movement. Often IS begins to show up at the beginning of puberty, a powerful developmental time bringing uneven growth spurts and shifting hormones that produce dramatic physical and emotional changes. At the same time, social pressures are most intense. Being accepted and included within one's peer group is perceived to be of primary importance. Often we go to a different school, involving a sorting of new social structures along with intense pressure to conform. Our world and our body are dramatically changing. Streams of new

sensations, thoughts, and feelings merge with changing demands and expectations from our family, friends, and environment. In case you have forgotten, Bo Burnham's movie, *Eighth Grade* will take you right back there.

In many communities, there are still routine school screenings for scoliosis, a practice that brings the topic into social conversation, with potential for speculation, comparison, anxiety, and humiliation if one receives a flag for possible scoliosis. Adolescents are at a critical stage regarding the development of self-concept, and those with scoliosis have a constant reminder that their own may not be as 'perfect' as those of their friends. One young blogger said that she felt like a "monster," with her "rib hump." An older blogger said she had never danced nor worn a bathing suit in public.

Colette was initially flagged in 1975 by a school screening exam using the Adams Forward Bend Test. This test involves a health professional observing the patient bending forward at the waist 90° with arms stretched towards the floor and knees straight. The practitioner observes for signs of asymmetry such as: one shoulder, scapula, hip, or side of the rib cage appearing higher than the other – or an uneven waist or body tilting (D'Alessandro 2017). This was at the height of two alarmist poster pro-screening campaigns in the U.S.: "The Dangerous Curve" and "Straight as an Arrow?" (Linker 2012). U.S. school posture and scoliosis screenings began as an early twentieth century practice to identify skeletal deformity linked to poliomyelitis and tuberculosis. Once these diseases were eradicated, the practice of school screening continued to be promoted, even though the exact nature of the health risk was unclear. These campaigns often relied on alarmist messaging linking scoliosis with bad appearance and ill health.

Orthopedic surgeon John H. Moe, an early adopter of the Harrington rod, founded the SRS in 1966. According to medical historian Beth Linker (2012), Moe and colleagues "simply adopted disease-related treatments and applied them to a non-disease related spinal deformity, with few questions asked about the medical and scientific validity of such a transference." Moe advocated a "do not delay" campaign for universal screening, promoting the belief that undiagnosed and untreated curves, no matter the

degree, could lead to children having to endure radical surgery. According to Linker (2012), "Instead of emphasizing the limits of surgical intervention (or even the necessity of it) for AIS, Moe and his colleagues shifted the blame to recalcitrant parents, uneducated physicians, and obstinate adolescents, making anyone but themselves responsible for bad outcomes."

During this era of medically imposed fear and guilt, along with confusion about the difference between transient or mild spinal curvatures and those that progress to morbidity and disfigurement, Colette was diagnosed with scoliosis. Colette's radiology report likely read something like this: *Standing AP and lateral views of the entire spine demonstrate an arcuate thoracolumbar scoliosis with a leftward convexity. No associated vertebral abnormalities are noted. Using the Cobb technique, and measuring from the top of the T9 and the bottom of the L3 vertebral bodies, this angle measures 24°. The apex of the curve is at the T12 vertebral body and demonstrates grade 2 out of 4 right rotation. The iliac apophyses are complete along the iliac crests, but have not yet fused with the ilium, indicating that the patient has not yet reached skeletal maturity* (Richardson 2018). Colette told me that her mother interpreted her scoliosis to mean that she was "imperfect." When I met her, Colette had been "fighting her curvature" for forty-five years; she said it was exhausting, but she would continue to fight. The symbolic power of fighting for a 'perfectly straight' spine as counter to a deadly and disfiguring disease makes Colette's collection of postural corrections and desire for validation of their effectiveness understandable.

As we know, the influence of our history, culture, and beliefs is experienced and seen in our postural and movement patterns. When a fixed aesthetic ideal governs one's process of embodiment, especially when it involves posture, there is disharmony between the postural ideal, ease in movement, and responsive tonic function. When we are in harmony with gravity, and responsive to the immediate context, we may say that our movement is in a dynamic state of 'flow'. We coordinate muscular activation appropriate to successfully meet the demands of the context without excessive effort. Our body is secure in its sense of shifting weight and spatial location because we are actively engaged with the environment. However,

when an overlay of an ideal image (flat stomach, military posture, tucked chin, wrapped ribs, straight spine) is valued and reinforced enough to become habitual and patterned, our dynamic state of flow will be inhibited. We may disrupt our sensorimotor response to orientation by imposing one based on an ideal, a thought. Godard (1993) describes controlling the masses or blocks of the body as “the beginning of the end of movement.” We could also describe it as a movement from embodiment to disembodiment.

Body Image and Body Schema

The work of re-embodiment – reclaiming the actual body from these attempts to impose an ideal – involves work with body image, body schema, and peripersonal space. Within the fields of neuroscience and psychology, the terms ‘body schema’ and ‘body image’ have often been used interchangeably, while at other times they have been meticulously differentiated. The term ‘body image’ was coined in 1935 by Paul Schilder MD, and the first line of his definition is often quoted by psychologists: “The image of the human body means the picture of our own body which we form in our mind, that is to say, the way it appears to ourselves” (Schilder 1950, 11). However, his definition went on to include aspects that are commonly attributed to body schema: “There are sensations which are given to us. We see part of the body-surface. We have tactile, thermal, pain impressions. There are sensations which come from the muscles and their sheaths – sensations coming from the innervation of the muscles – and sensations from the viscera . . .” (Schilder 1950, 11) Shaun Gallagher and Jonathon Cole (1995) made a conceptual distinction between body image and body schema in describing the rehabilitation of a deafferented patient, who, in short, lost properties of her body schema, yet her body image was able to compensate. They said, “*Body schema* involves a system of motor capacities, abilities, and habits that enable movement and the maintenance of posture,” and concluded that this takes place largely in the unconscious. In contrast, they defined body image as “a complex set of intentional states – perceptions, mental representations, beliefs and attitudes – in which the intentional object of such states is one’s own body. Thus the body image

involves a reflective intentionality.” French neuroscientist Jacques Paillard (2005) supported a cooperative relationship between body schema and image; he suggested that body image derives knowledge from the appropriate action of the body schema “interfacing the cognitive brain with its external world.” He proposes a mental self, grounded with motivations and emotions, aware of his presence as a “self-owner” of his body space, and “accountable of his own purposeful action in the world.”

Body image is a prevalent topic in scoliosis research and treatment. The medical usage of the term ‘body image’ has a slightly different connotation than the neurophysiology body image/schema discussion; it implies valance – a positive or negative attitude to how we perceive our bodies. In this context, the term, ‘self-image’ is frequently substituted for body image. This usage of body image is shared by other psychologically oriented fields such as the study of eating disorders and gender studies.

assumptions, beliefs, comparisons, and attitudes about one’s appearance. Most relevant research studies have documented a higher proportion of self-criticism, negative body image, low self-esteem, anxiety, depression, and personality disorders among those diagnosed with scoliosis.

I am struck by the similarity of Dubousset’s naming of scoliosis shapes (bulging, hollowing, protruding, missing, penetrating) to those described by psychiatrist and Laban Movement Analyst Judith Kestenberg to depict body-contour changes (bulging, hollowing, narrowing, widening, shortening, lengthening) expressing affective relations of self with others and environment. Rudolf von Laban described breathing in terms of bodily shape flow alternations between growing and shrinking (Bartenieff 1980). Kestenberg went further to develop a system of movement analysis, the Kestenberg Movement Profile (KMP), linking observable movement patterns with psychological needs, affect,

Godard describes controlling the masses or blocks of the body as “the beginning of the end of movement.” We could also describe it as a movement from embodiment to disembodiment.

Adolescents often place great emphasis on how they believe others see them, and shape their body image in response. While mirror image is classically developed as a toddler, the typical adolescent seems to cycle through a more intense version of this phase, especially because the social stakes are higher. Philippe Rochet and Dan Zahavi (2011) describe the mirror phase as “the realization that I am exposed and visible to others . . . I am seeing myself as others see me. I am confronted with the appearance I present to others.” At this time of life, as their world expands, adolescents are prone to influence by the cultural body image, with ideals cultivated by various social and aesthetic standards, often driven by mass marketing and social media. Body image incorporates experiences, memories,

temperament, learning styles, defense mechanisms, and relationship dynamics. Her observations included primordial needs, feelings of comfort/discomfort, and attraction/withdrawal to correlate meaning with movement (Kestenberg 1967, 356-357). The KMP describes tension flow rhythms as alterations between free and bound flow that are also expressive of needs. Bound flow is a restraining movement pattern that occurs when agonist and antagonist muscles contract simultaneously. Free flow is a releasing or joining movement whereby there is no counteraction of the antagonist while the agonist is contracting. Tension flow is linked to self-regulation with bound and free flow associated with feelings of caution/danger/displeasure and trust/safety/pleasure respectively (Koch 2014).

Adolescence is characteristically a dramatic time of trial and error with uneven hormonal surges coupled with social tensions and new situations. Often there is inner confusion, distress, and recalibration. Kestenberg describes adolescence as a prolonged period of development – a stage of reorganization of the past and preparation for the future, when earlier developmental phases are revived, but with a more complex ego, advanced intellect, and a less restricted social situation (1967, 426). One might have an inner drive to bulge, widen, and move forward to join, but retreat, narrow, and hollow if met by rejection. Or one might feel conflicted by competing inner drives and external demands, resulting in conflicting shape and tension flow changes. Dubousset describes structure – human architecture that he feels with his hands. Kestenberg describes function – the dynamics of human movement. In the context of Rolfing SI, we often cite the time-space relationship between form and function. It is understandable that as a human is in a process of growing upwards, while navigating unfamiliar sensations and circumstances, the symbolic home of the Self – the spine – might take a few twists and turns along the way. For most, this is a minor or temporary detour, but for a few, it becomes a long-term condition that shapes the relationship they have with their body.

Paris Opera Ballet prima ballerina Marie-Agnès Gillot was diagnosed with double scoliosis at age twelve and retired from professional performance at age forty-two. Throughout her acclaimed career, she danced with broken bones, battled double scoliosis, and continued to rehearse *en pointe* while seven months pregnant. Gillot is quoted as saying, “Discipline is the cornerstone of freedom” (Wilkens 2009). College student Rebecca Dann chronicled her severe scoliosis and surgery with a series of stunning photographs titled *I’m Fine* to “explore beauty and the media and dating with a disability” (Dann 2016). She received a photography award presented by Stephen Hawking. A web search including scoliosis+tatoos reveals realistic and abstract artistic tattoos to highlight or cover scoliosis curves and scars, some transformed into butterflies, elephants, or flowering vines, many with the expression *bent, but not broken*.

The Impact of Questionnaires on Treatment

There has been increasing use of patient-reported questionnaires designed to measure subjective body perceptions, emotions, and health-related quality of life in AIS patients. Recent trends indicate their application for surgeons in recommending treatment and determining the success of their outcomes. Conservative scoliosis practitioners use them to recommend the type of brace and implications of bracing, especially compliance (Carrasco and Ruiz 2014). Examples of body-perception questions are: Do you feel attractive with your current back condition? Do you feel self-conscious about your body? How do you look in clothes? Do you wish to change certain aspects of your body? Most questions are multiple-choice and ask patients the one best answer from a bipolar range. Several questionnaires ask patients and their parents to choose from a range of drawings of the trunk, spine, or rib hump appearance that corresponds with their experience. Several studies on these questionnaires indicate that AIS patients perceive the magnitude of their deformity, especially rib hump, to be worse than measurements. Notably, Goldberg et al. (2001) stated, “It is the rib hump that the patient is unhappy with, not the value of the Cobb angle.”

One study designed and implemented by Rebecca Jacobson, a high-school student enrolled in an AP Capstone Research Program, caught my interest. It was published in the *Journal of Spine & Neurosurgery* in 2018. She used the causal-comparative method with a sample size of thirty-four high-school girls, twelve with AIS. She found that most girls, with or without AIS, had a negative view of their bodies. If given the choice, they wanted to change something. Most hid their torso with clothes. Interestingly, most – scoliotic or not – were more concerned about the appearance of their stomach, rather than their torso (Jacobson 2018).

The SRS-30 Questionnaire is most widely used to compare body perception postoperatively. A review of the AIS research literature from 2007-2013 showed that appearance is the domain most improved following surgery, and this strongly correlates with rib-hump correction. Researchers Carrasco and Ruiz (2014) stated, “Surgeons regard aesthetic appearance as grounds for surgical intervention and rib resection is increasingly being used for this purpose.”

The authors noted that the surgeon’s assessment of the cosmetic outcome often does not coincide with that of the patient and stressed the need to inform patients and relatives of objectives and expectations and that these must coincide with the patient’s needs. A recent study published in the *European Spine Journal* cited a rapid increase in the incidence of scoliosis surgery, especially in AIS cases, during the past fourteen years (Heideken et al. 2017). This correlates with the increased role of patient questionnaires in treatment decision-making. Because adolescents go through rapid changes in their physicality, and are also going through a pivotal, and sometimes turbulent, time in the development of their self-image, this life stage may not be the best time for long-term decisions. For example, one scoliosis blogger wrote that wearing a back brace was tantamount to a death sentence. Daily exercises can be a burdensome time commitment, and surgery in contrast may seem to offer the option of a quick improvement in appearance. Comprehensive long-term studies have not been completed, but the few that are available show a correlation between self-perception and spinal fusion surgery to be higher in the appearance domain and lower in the domains of activity and self-esteem. This seems to correlate self-esteem and our ability to move freely through our world. And no surprise to SI and Rolf Movement practitioners, studies show evidence of disc degeneration in the unfused areas.

Braces and Exercises

The research society SOSORT is dedicated to conservative management of scoliosis, including braces and physiotherapeutic scoliosis-specific exercises (PSSE). A 2013 clinical trial, Bracing in Adolescent Idiopathic Scoliosis Trial (BrAIST), demonstrated strong evidence that bracing significantly reduced the progression of high-risk curves with increased duration of wear (Weinstein et al. 2013). Shortly thereafter, SRS, which had previously leaned toward surgical options, updated their position on conservative management to include a stronger advocacy for bracing, PSSE, and other non-fusion techniques for mild to moderate scoliosis.

It’s no surprise that braces and rehabilitation exercises are rarely considered sexy or glamorous, especially by young people, so some may have difficulty complying. (The

standard prescription is to wear a brace twenty hours per day.) Helping brace-wearing adolescents feel more personal agency can make a difference in their compliance. Some may engage with the engineering and technological aspects, others may respond by creating brace art, or participating in web groups such as: Curvy Girls (www.curveygirlsscoliosis.com) or Scoliosis Stories (www.scoliosisstories.webs.com). The website *Embrace Your Brace* offers clothing advice (www.embraceyourbrace.com).

In sessions with brace-wearing adolescents, I find it useful to spend some time working with the brace on. Sitting work is a good time to encourage a sense of whole-body connectivity: as they connect with the ground, bench, and space around them, what happens if they sense themselves touching the brace, instead of only the brace defining them? What movement is available within their torso with the brace? Where does the movement of breath travel? How is breathing when they are connected to the ground through their feet? We may have conversations about what the brace is telling them and what they are telling their brace – some name it or develop images. If the brace is accepted and integrated into their body schema, compliance is less difficult. I have seen the brace become a reassuring friend, instead of a dreadful obligation.

In 2016, the journal *Scoliosis and Spine* published a comprehensive review of seven major methods for scoliosis-specific exercises: the Lyon approach from France, the Katharina Schroth Asklepios Center approach from Germany, the Scientific Exercise Approach to Scoliosis (SEAS) from Italy, the Barcelona Scoliosis Physical Therapy School approach (BSPTS) from Spain, the Dobomed approach from Poland, the Side Shift approach from the United Kingdom, and the Functional Individual Therapy of Scoliosis approach (FITS) from Poland (Berdishvsky et al. 2016). The shared characteristics of these methods are:

- They teach three-dimensional self-correction exercises.
- They include training for active daily activities.
- They show evidence of stabilizing the corrected posture.

The methods are a combination of exercises, breathing techniques, manual therapy, and bracing practices. (I have

only witnessed training in the Schroth method and have read about some of the others.) Even though they are challenging and time consuming, they offer patients a proactive option to address their spinal curvature. Often, doing something feels better than passive watchful waiting. Whenever exercises are performed for any reason, especially with the specificity, repetition, and duration of these, it is essential to engage in sensory awareness and foster haptic connections with the environment in order to stay alive in the movement. Coaching an enlivened connection to ground and space in anticipatory postural activity (APA), also known as pre-movement, is key, along with generating renewed curiosity about sensation throughout the action.

Back to Colette and 'Straighter'

So was Colette 'straighter' through the adjustments she demonstrated for me? Sure, her spine appeared to be straighter, as long as she was standing still, but this visual ideal was very expensive to her capacity for ease and efficiency in standing. There was evidence of holding in her feet as they worked to manage the shifts in weight distribution from above. She took small nips of air in and out, as if anything more natural would disturb her posture. There was tension in her neck and face reflective of the effort below. Difficult to describe, yet profound to see, were the effects of her lack of authentic connection to the ground and space around her. It felt as if Colette's presence began and ended within the confines of her embodied image. I felt stilted in my ability to relate to Colette, as if her image formed a barrier that communicated, "Either tell me that my spine is straighter or say nothing at all."

Of course, the effort and awkwardness intensified when she walked. With fixed focus, she seemed to wear blinders. Instead of relating to the ground, she pulled the ground. Her arm swing was a separate action unrelated to the rest of her, and her lumbar and cervical lordoses were more fixed than mobile. When asked about what she was sensing as she moved through space, she seemed to lack tolerance of the question and wanted to engage in, "Am I straighter now?" At this point, her image was in charge, limiting the primacy of the sensory information necessary for building proprioception.

Each of us might handle this situation differently with a client in our practice. For me, it was a matter of unlocking the hold this 'straight' image had on Colette without negating her experience and years of investment in trying to find solutions for her musculoskeletal issues.

Compare and Contrast

Reflecting back, I explained the primacy of movement over position, balance over symmetry, and dimensionality as a way to find ease in verticality. We worked with experiences of each of these concepts for comparison with her old patterns and to help her build different experiences of embodiment. I guided Colette toward awareness of her internal sensations with and without her 'invisible brace'. We worked with movement to facilitate new coordinative pathways that didn't evolve from the 'straighter' position, but rather from a sensory relationship with the ground and space. My hope was that as Colette expanded her movement vocabulary to find resources in experiences other than being 'straighter', she would also describe herself in terms other than being scoliotic or straight.

Sensation as Support

A breakthrough happened after I returned from studies with Hubert Godard and was inspired by the work he did with me and with a colleague. (Note: I am not attempting to describe his work, nor indicate a specific technique or protocol, nor suggest that my work as discussed here is representative of his work.) The process with Colette, described below, lasted over the course of several months; a given step may have taken several sessions. During some sessions, we would stay with the process more, others less, and then go to table work.

I began by asking Colette to allow herself to "have her scoliosis" – to allow her body to go where it wanted to go without interference – a kind of meeting. Instead of fighting or fixing, I asked her to allow herself to be with her scoliosis through direct experiencing or matching – being inside the shapes, twists, bends – allowing them. Of course, at first she looked puzzled, was resistant, and told me reasons why she should not. However, slowly and steadily, with reassurance that she would not be left there forever, she reluctantly agreed to try. We began in supported sitting, and with hands and

words, I asked her to gently release the holding in her rhomboids that was pulling her tightly upright. I asked her to allow herself to follow that release . . . and waited. Then I told her it was okay to let go of the area around her solar plexus.

Understandably, her first attempts were fairly superficial and she would pop right out again, asking me what we should do next. The going was quite difficult, so I suggested small rocking types of micromovements to explore releasing into gravity, first her rhomboids, then her solar plexus. We continued, and after some time her neck released slightly and her head eased forward. As we explored this gently, she began to soften and release gradually into her scoliotic shape – superficially, at first, then gradually more deeply . . . sensing her weight, her breath, and her presence; what was moving. Each time, we focused on building the sensation of her feet listening and opening to the ground and the shifting weight of her pelvis on the chair as the basis for her return to uprightness. We built the ground as the sensate basis for her support instead of the learned holdings in her middle.

Some days we moved more quickly to table work than others, but gradually Colette was able to stay with the process longer. Each session we began by returning, deepening the experience, slowing it down, and describing sensation. As Colette was more able to sense her relationship to the ground as a resource for security, we also worked with her awareness of the space and objects around her as she moved toward uprightness.

This process was the beginning of Colette experiencing herself moving, liberated from an ideal image. But first, she needed to experience the sensation of her shape, as lived through her body, instead of fixing or fighting it – parts against other parts. How can you release a whole pattern when you don't recognize the wholeness in the first place? Often our work is so powerful in its ability to create change that we can easily forget an important first step: allow the client to recognize where s/he is. We all have versions of Colette's 'straighter' body image that drive our standing and movement; holdings or inhibitions that interrupt our ability for harmonious tonus. Bringing awareness to the sensations involved in our body just being, without all the extra effort, may provide a pathway for finding responsive connection with self, other, and environment. In this

way our body schema may provide the therapy our body image needs.

None of this was quick or easy. It was a process based on trust, not a technique or protocol. It provided a collaborative frame for our work together, allowing me to fine tune fascial, visceral, or osseous manual techniques performed on the table relevant to Colette's ongoing process of remapping her orientation embodiment. On a good day, Colette described feeling free and connected. Often her image would catch her mid-passage and so we would back up or start again. Gradually she began building strength, resilience, and continuity in connection. She could sustain a little uncertainty without locking her 'brace'. After having a minimum of one injury every several months, she hasn't had one in six. Colette enjoys traveling and recently danced at a wedding. She is committed to a daily practice that reminds her to connect with the sensation of her self – now – embodied.

Thank goodness this story doesn't have a 'perfect ending'. I'm sure you have guessed: following a session, Colette will occasionally turn to show me her back and say, "Come on Rebecca, just tell me, am I straighter?"

Writing this article has been exciting and a little humbling. It was compelling to explore different perspectives on scoliosis, from spinal surgery, to public health, to support blogs. My goal was to enter domains with an open mind, and I found each to be uniquely compelling. Also, it was eye-opening to recognize that the central tenet of our work – how human beings embody our relationship with gravity – is often marginalized or missing from mainstream scoliosis theories and treatments. However, this also reveals the potential of our work – provided we communicate our message appropriately and make meaningful alliances with other professions. The 14th International SOSORT meeting is April 25-27, 2019 in San Francisco (<https://bit.ly/2yXhqFI>). I encourage those of us with interest or expertise to attend.

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