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Short Communication

Ever-Present Factors in Healthy Children that Can Deform their Spines. Opposition to Dickson's Paradigm on Lordosis

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Abstract

Revision of older knowledge on spinal deformities shows causing factors in all day life and the source of rotational forces in men in respiration. The role of lordosis as a causative factor can change towards a correcting force, supported by different studies. The thoracolumbar spine is the originating area of many deforming processes.

INTRODUCTION

Science on spinal deformities in Orthopedics is apparently on a crossroad [1-3]. Degenerative deformities will soon be the greatest consumers of time and investments in this field. Prevention should have taken place in childhood as Orthopedics literally means. Because growth is based on forces, spinal deformations must be seen as a deviation of the natural arrangement of these forces during the development of a child. In the light of knowledge on evolutionary changes environmental factors are very influential in deviations. Man creates its own environmental factors. Its structural body has to follow in fenotypical alterations. Basically the patho-anatomical knowledge should depict the morphogenetic influence of the skeletal muscles as the main "builder" of the posture of vertebrates. As scoliosis is typical for men, as is hyperkyphosis both starting in childhood, these postural deviations a genuine orthopedic etiological factor has to be found in otherwise healthy children.

GOAL

We go back to the era before Dickson by whom the presence of lordosis in the thoracic spine got his firm place as causative factor and became a factor to be addressed in scoliosis. Most biomechanical models supporting present bracing got here a scientific background [4] was older knowledge forgotten [5]? Morphogenesis is more dependent on the way the CNS arranges and controls the musculoskeletal system during growth, than that genetic patterns do. Basically in living structures, all processes like regulation of equilibrium in posture and movement go along Newton's and Hooke extended laws on conservation of energy, momentum and angular momentum during growth [6]. Form follows function (phylogenetic and ontogenetic), also in the spine. The musculature acts as primary engine in balance and locomotion in vertebrates. The major change in form and function in bipedal is that the coupling mechanism at the thoracolumbar joint now couples a pendulum with a reversed pendulum. Still by the use of torsional forces, men are amblers, not gallopers [7]. Where quadrupeds like dogs and horses use the alternating torsions for locomotion, men has to use this torsion in an upright position to optimalize balance. Because they are the only species with the conus-cauda at a much higher level with neuromechanical advantages it allows the counter wise torques to start preferably at the thoracolumbar joint.

METHOD

A focused literature search shows a clear gap in the evolution in science on deformities by social disturbances in the period 1914-1945. The orthopedic world had to focus on Traumatology and posttraumatic deformities by two World Wars. A complete separation of the Anglo-Saxon and the German speaking scientific world take place, with cruel events for science and scientists at the latter side. We therefore went back first to the literature before 1914.

REVISITED HISTORIC KNOWLEDGE ON SPINAL DEFORMITIES

Andry described guidance and correction of growing spines using the moulding capability of muscular forces with exercises and extending corsets (for "weak" girls) [5]. He gave a clear view in those early days of Enlightening of the meaning of good posture as a result. Extension and avoidance of wrong sitting became a mainstay in Orthopedics (later even in schools) [8].

In 1792 Van Gesscher postulated out of clinical observations and cadaveric studies two concepts in "Observations on Deformations of the Spine" (Dutch): The optimalization of the

balancing forces in men needs a certain optimal curvature to keep the weight of the head and the shoulders above the hips. The second concept was on the role of sitting in relation with postmortem changes around the discs at the thoracolumbar spine. Girls with "a weak constitution" knitting or reading while sitting develop scoliosis more easily. He found the early deformations at the side of the apophyses with the worst alterations in the "dorsolumbar" spine [9]. His extending (by lordosis) corrective corset was used for more than 150 years in parts of Europe before plaster became popular and was even mentioned by Sayre from the USA [10]. An immense amount of studies on deformations of the spine was published in Middle European countries during the nineteenth century.

In 1907 L. Wüllstein described animal experiments in young dogs to show how forced flexion produces all characteristics of kyphotic deformities at the midportion of their spines [8]. In 1912 Murk Jansen brought in: "The Physiologic Scoliosis and its causes" (in Dutch) a review of all available knowledge out of the two worlds and with own research he found the origin of rotational forces in men [11]. Postmortem studies (with Sir Robert Jones) revealed anatomic asymmetry in the left and right crurae diafragmaticae responsible for asymmetric rotational forces in ventilation as clue for the predominant lateral curves. In vivo tests show increased thoracolumbar kyphosis if siblings are put too much and too soon in sitting positions. He was able to show, that inspiration in suspended children goes along with a constant torsional movement of the trunk in which the lower spine is torque in a left side direction with a right sided counter torque at the thoracic spine. The stiffening in kyphosis creates in his concepts a fulcrum to cantilever the opposing rotational forces into lateral curvatures. In experiments in hares a constant lower intra thoracic pressure was shown in the right pleural cavity. He plead common alertness by parents and teachers on preventing early and prolonged sitting and compensation by playing prone or gymnastics was underwritten. Some of the skills out of that early era of Orthopedics to create better postures still survive in Europe and is researched for its evidence [12,13]. In progressed scoliosis Sayre's method of corrective plastering in suspension and Calot's corrections in prone position under anesthesia and plaster shelves with lordosis in bed became popular, which diminished the attention on the functional properties of the musculature in general [8]. In the "Volkmann Hueter principle" a start in knowledge was made why the resilience of the deformable structures in the spine, e.g. the discs, the apophyses and the cartilage in joints help deforming the spine (to be attached to the Conservation Laws). Early genetic science ascribed these basic properties of this mechanical resilience to the individual cells and by their organization also to the complete structures that are build of them [6]. Bone formation is regulated under Wolff's law, in which traction do has a equal role as compression as they are both delivered by muscular contractions, although gravity always will facilitate the latter.

Cobb's warning not to forget the clinical aspects of scoliosis happened in many directions of research and treatment at the time scoliosis was renamed as idiopathic [14]. The opening of the "black box" in which the neuromechical regulation of growth got its place by Prof. Milan Roth had to wait for another few decades. He attached the old knowledge in a comprehensive explanation how growth is organized and regulated by the oldest organ of animal life, both phylogenetic as ontogenetic, the central nervous system in vertebrates, in his concept of the "Nervous Skeleton" and it's very intriguing way of growth [15]. Milan Roth developed between 1960 and 1985 his concepts on neurovertebral and neuro-osseous growth relations and the tension driven incongruence of growth in a vast amount of research and publications. Roth provided new biological knowledge on how dyscongruencies can affect the skeleton as well as the CNS itself (Syringomyelie; Arnold Chiari). In animal experiments, mechanical modeling and radiological studies in scoliosis he stressed the role growth by stretching of "the nervous skeleton" has in the (ab-) normal formation of the spine. A "short cord" can indeed cause scoliosis [16-19]. Recent studies with MRI in idiopathic scoliosis support this [20].

DICKSON'S PARADIGM ON THE CAUSE OF SCOLIOSIS

By the finding of a more lordotic or hypokyphotic configuration on the sagittal X-rays (true lateral) in adolescent scoliosis by Dickson and the chosen starting point that the thoracic spine should be kyphotic along its complete reach, the way of conservative treatment altered onto a forced kyphosis in the thoracic spine in bracing. Dickson himself stated, that conservative treatment of scoliosis seemed impossible, whilst in hyperkyphosis the extension towards lordosis was proven effectual, but must be counterproductive in scoliosis [4].

PERSONAL OBSERVATIONS

In 2008 own study in 40 children demonstrates that forceful restoration of thoracolumbar lordosis can correct double major scoliotic curves [21]. A consequent ever present thoracolumbar kyphotic curve was found, recently reproduced with stronger conclusions [22]. With the TLI (Thoracolumbar Lordotic Intervention) brace technique we brought promising results. It rest on the older techniques, and proves that the focus mainly on the apical zones by Dickson can be widened [23]. It is the total of the loco motor system, which gives the clues (Figure 1).

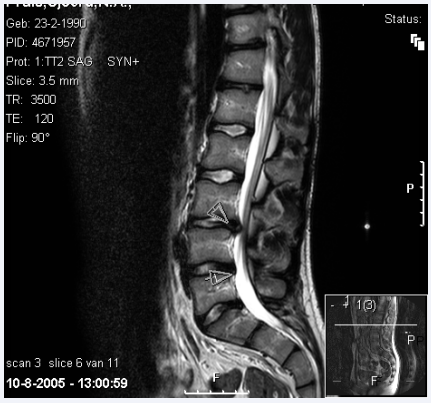

Figure 1 MRI of a 15 year old healthy boy with postural and pain problems. The kyphotic events on the TL joint are clear. The posterior parts in the lumbosacral area show signs of overload. The posterior placement of the cauda resembles all of Roth's statements on tension on the CNS.

By continuous extending the spine with stimulus of the erecting musculature to take over in time the fear for detoriations of the lateral curves can disappear. Out of personal observations the variable presence of neuromuscular tightness or tension in the lower extending musculature like the hamstrings, as much present in progressive scoliosis as in kyphosis was found a representant of deforming and protective forces. They can be assessed in simple straight leg raising by any physician, therapist or even teacher in sports or gymnastics [24,25].

CONCLUSIONS

Combining older knowledge depicts spinal growth as result of a combination of neuro-osseous growth regulation in a very complex but understandable loco motor system. Internal and external factors like growth spurts and (early) sitting causes muscular reactions in order to obey all Mechanical Laws to keep balance while creating adaptations and mechanical solutions. Knowledge on the functional role of the thoracolumbar spine needs extensive attention in further research. Lifestyle factors especially extensive sitting were known of great influence in deformations and should get renewed attention by physicians. Restoration of natural postural balance in true lordotic extension of the spine in physical therapy or braces can be used at any moment in the development of spinal deformities.

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