

History of Discoveries of Biomechanical Etiology of the So-Called Idiopathic Scoliosis (Adolescent Idiopathic Scoliosis [AIS]) In Dates And “Think Over”/ Meditations

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Introduction

Etiological factors of scoliosis and other groups of pathology of spine can be varied. [1-76]. There can be: congenital, paresis conditionals, in various pathological syndromes, functional and this group of scoliosis consist of 20 % of all cases. Other, bigger group

80 % of cases - are “the idiopathic scoliosis”- and its mean – the causes were secret, not founded [1-10, 45-73, 75-77]. My research about idiopathic scoliosis starts in the 1984, but describing of etiology, of classification and rules of new therapy is given in 1995 – 2007 (Figure 1).

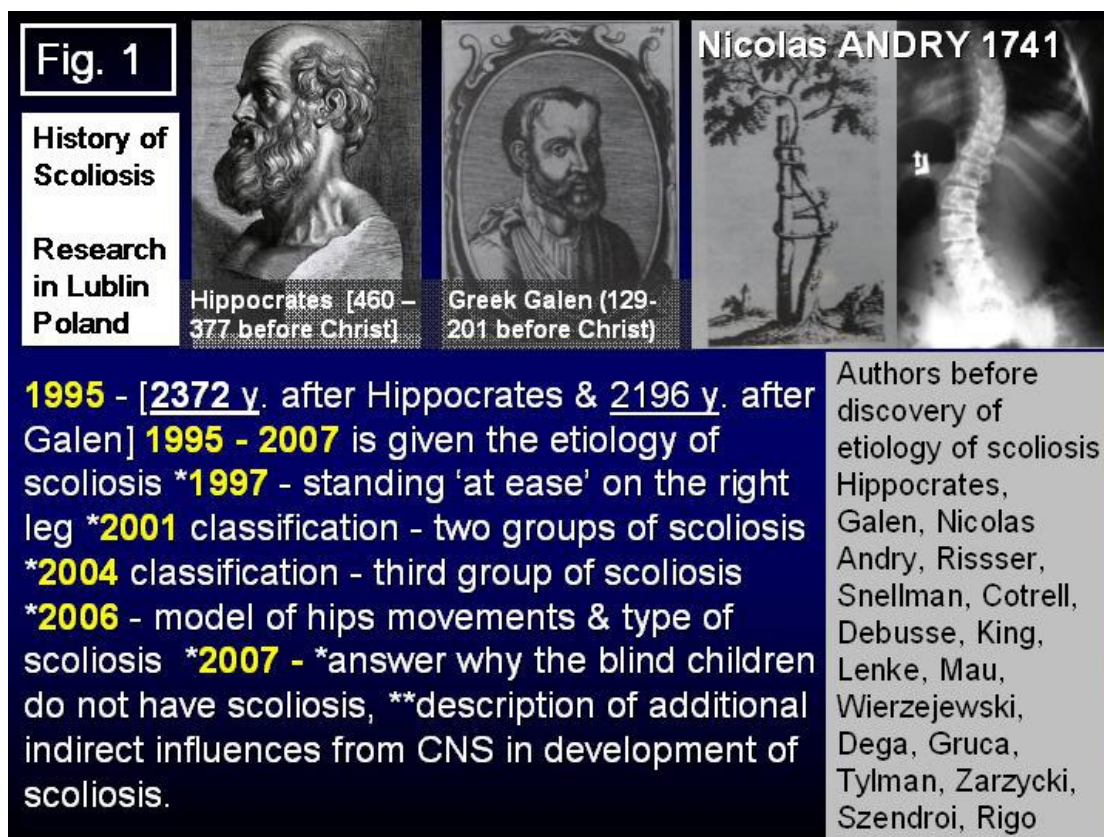


Figure 1: History in discoveries of the etiology of so-called idiopathic scoliosis. Dates.

As told above “idiopathic” mean – the etiology is “no founded”, but in the article there is presented – and “founded” biomechanical causes of this spine deformity [11 – 44, 68, 74]. In literature this kind of spine deformity is called often Adolescent Idiopathic Scoliosis (AIS) and this term I will also use in the article.

Material

In the years 1984 - 2022 I examined more than 4000 children and adults with scoliosis. In years 1984 – 2009 in this material there were children from Pediatric Orthopedic and Rehabilitation Department of Medical University in Lublin, Poland - in 1995 – 2009 I was a Head of this Department. Additionally, I had examined and treated children and adults in Out-Patients Clinic in my Praxis in years 1984 - 2022.

History of discoveries of the biomechanical etiology of the so-called idiopathic scoliosis (AIS) in determine following years

1984 – In years 1978 – 1984 - in every year I have been in Finland for orthopedic education. Mostly it was stay in Rheumatism Foundation Hospital in Heinola but also in Invalid Foundation Hospital in Helsinki. In 1984 my educative scientific stay in Invalid Foundation Hospital in Helsinki, Finland was with the “program of education about scoliosis”. In one month stay I had assisted to Dr Olai Snelman in his scoliosis operations. In this time “I decided to find” the etiology of the idiopathic scoliosis. I had examined many of children – but I did not find the etiology. After coming to Poland - in next years - 1984 – 1995 - I examined many of children with scoliosis. In period of eleven years, I stated that the children with scoliosis had the difference of adduction of hips in strait position of the joint, and in some cases also asymmetry of internal rotation of the hips. Namely in the right hip the adduction was limited,

also in many cases the range of internal rotation was smaller. In some children this limitation of adduction was to zero (0) degree or sometimes was even abduction contracture 5 - 10 degree. In other cases, the adduction in strait position of the right hip joint was only limited 20 – 30 degrees in comparisons to the left hip.

In this time my explanation of etiology was following during walking the absent adduction of right hips is made compensatory in lumbar part of spine during every step and make the left convex curve in lumbar spine first functional next fix scoliosis deformity. I thought if will be no present abduction contracture of right hips will be correction of scoliosis. In next year I come to conclusion the causes of scoliosis are not connected “direct from abduction contracture of right hip” but are connected with “function going from this contracture” and it is standing and walking. The full knowledge about etiology of scoliosis was given in the next years.

In the years 1995 – 2007 I found all biomechanical causes in the etiology. I could present the new classification of scoliosis and was possible to give proposal of the proper methods of therapy of scoliosis. In this time, I start to say not “idiopathic scoliosis” but “so-called idiopathic scoliosis”.

1995 – First lecture about biomechanical etiology of the so-called idiopathic scoliosis (AIS) in Szeged, Hungary. After 11 years of examination and new therapy of children with scoliosis - the knowledge about problem – was “so sufficient” that I prepared the first lecture about etiology of the so-called idiopathic scoliosis and had present this problem during the Orthopedic Congress in Hungary (Figure 2). The lecture was admitted with interest and very positive.

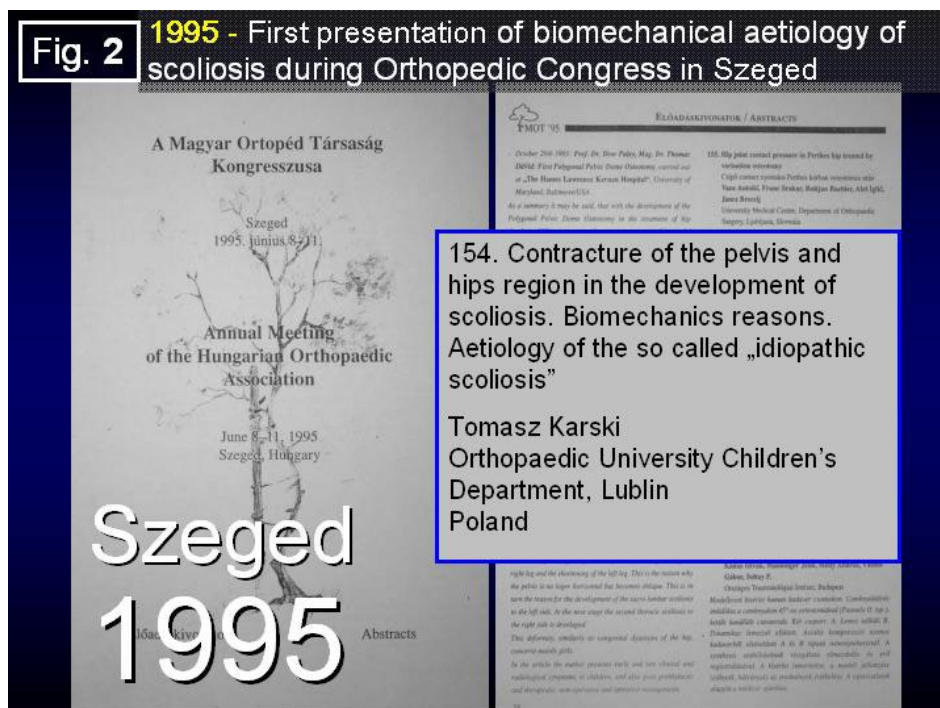


Figure 2: 1995 - First presentation of biomechanical aetiology of scoliosis during Orthopedic Congress in Szeged, Hungary.

1996 – First publication about etiology of the so-called idiopathic scoliosis (Figure 3). In 1996 I had published the first article about etiology of scoliosis in Orthopädische Praxis in Germany. In article was given full actually information about scoliosis (1996) - T. Karski: Kontrakturen und Wachstumsstörungen im Hüft- und Beckenbereich in der Ätiologie der sogenannten „idiopathischen Skoliosen“ – biomechanische Überlegungen, Orthopädische Praxis 32, 3 (1996) 155-160.

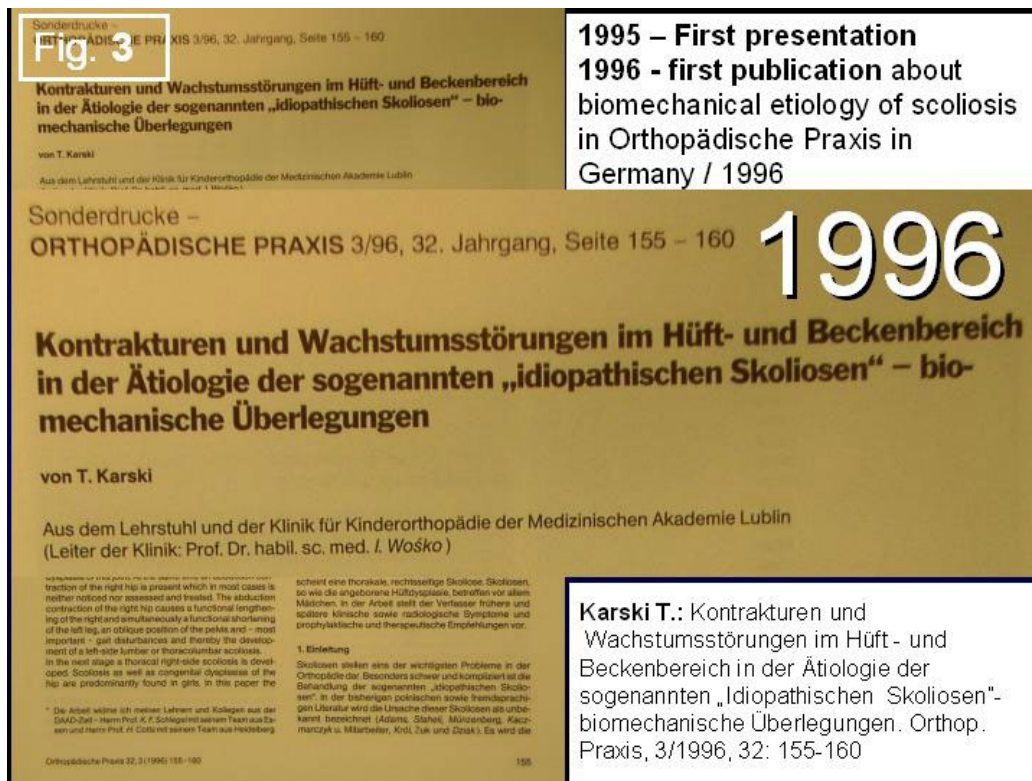


Figure 3: 1996 - First publication about biomechanical etiology of scoliosis in journal Orthopädische Praxis in Germany

The article was admitted - with congratulations words from Professor K. F. Schlegel – Chief Redactor of this Journal and simultaneous Head of Orthopedic Department in Essen, Germany. Here, I want to inform, that as Participant of DAAD Scholarship Study, I was some months in 1973 in the Orthopedic Department in Essen to learn orthopedics.

1997 – In this year was founded that all children with scoliosis have the habit to stand ‘at ease’ only on the right leg. It was crucial and very important discovery.

In all cases with scoliosis there was a difference of adduction of the right hip – but in 1997 by one girl in age of 13 years was also the difference of adduction - but she didn’t have scoliosis. After some hours of discussion with patient and her mother, I noticed that this girl never had the habit to stand ‘at ease’ on the right leg. She had habit to stand on both legs or on left leg. In next year’s here in Lublin, but also during my scientific excursions abroad I had examined children with scoliosis in Berlin, in Vienna, in Innsbruck, in Helsinki, in Copenhagen and I could confirm that all children with scoliosis had the habit to stand ‘at ease’ only on the right leg.

This observation was very important in etiology and in the new classification of scoliosis.

1998 - Presentation of etiology of the so-called idiopathic Scoliosis in Bratislava. In all years of XX century and also in XXI Century were organized by Slovak Orthopedic Association the Orthopedic Congresses under the name “Cervenansky Days”. In 1998 I had presented in Bratislava the problem of biomechanical etiology of scoliosis. From the audience of participants only Prof. Ivo Mařík from Prague was especially interested about the problem. We had long time discuss about etiology of the so-called idiopathic scoliosis.

From this year we are all time in scientific contact and cooperation. From this time the Lublin Orthopedics’ Team take part in organized “Prague – Sydney Symposia”. In next years the name of Symposium was changed into “Prague – Sydney – Lublin Symposia”. Professor Mařík - had presented the new “Lublin knowledge about so-called idiopathic scoliosis” in many departments and places in Czech Republic.

In this time, I could observe that also exist – additional causes in development of scoliosis (Figure 4, 5) There are some changes of body anatomy and function connected with Central Nerve System – in children with Minimal Brain Dysfunctions (MBD) (Figure 5) [59, 60, 70].

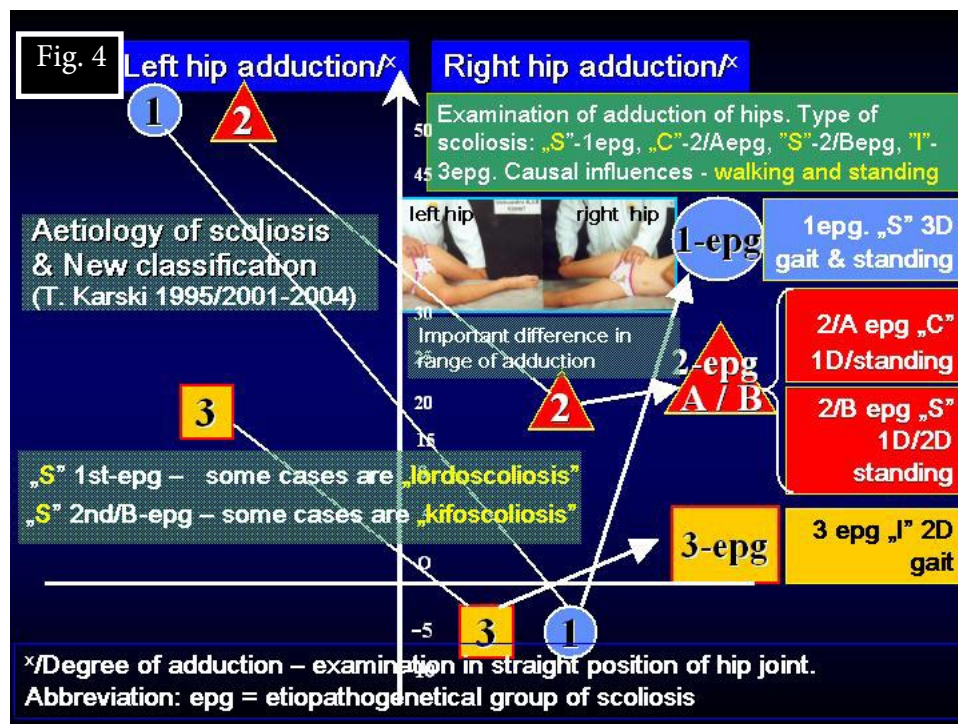


Figure 4: Three groups and four types of scoliosis. Types of scoliosis connected with „hips movement model”. There are: „S”-1epg, „C”-2/Aepg, „S”-2/Bepg, „I”-3epg scoliosis. Causal influences - walking and standing.

First group - the deformity is in form “S” with stiff spine – double curves – lumbar left convex, thoracic right convex, gibbous on the right side of thorax. In new classification it is the 1st etiopathological group (epg). This deformity is connected with walking and standing ‘at ease’ on the right leg. First symptoms of this type of scoliosis are stiffness of the spine Th 6 – Th 12. Some cases in this group are “lordoscoliosis”. Progression of this type of scoliosis is observed very frequently, but especially in acceleration period of growth.

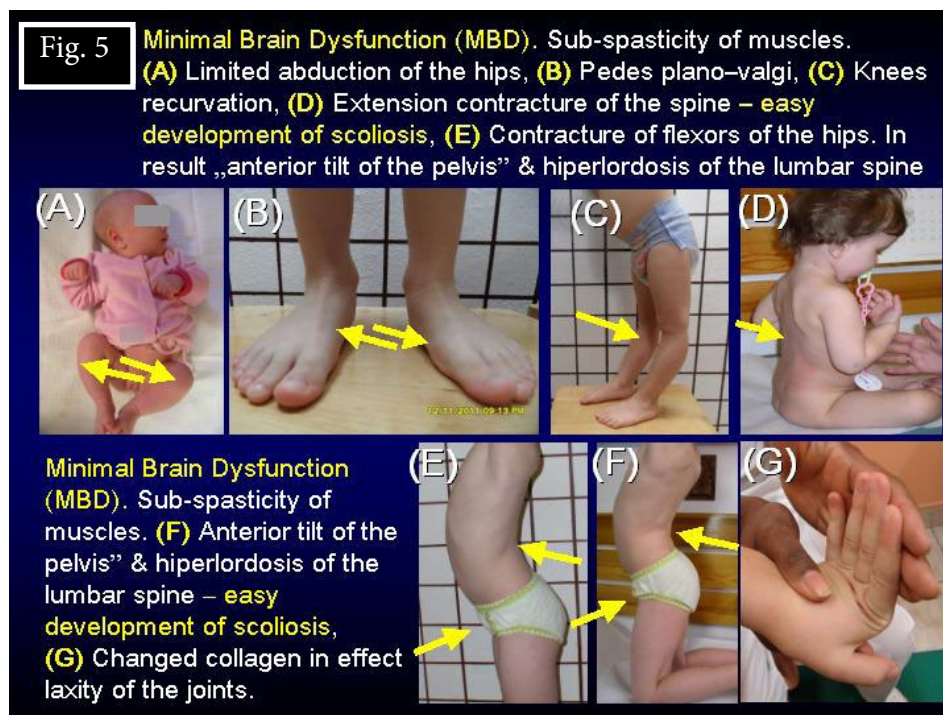


Figure 5: Additional causes in development of so-called idiopathic scoliosis in children with Minimal Brain Dysfunction (MBD) – stiffness of spine and anterior tilt of pelvis and hiperlordosis of lumbar spine

2001 – On many cases I could confirm that scoliosis deformity start to develop – when the child start to stand and walk – its mean - in age of 2 – 3 years. In 2001 I described two groups and three types of so-called idiopathic scoliosis (AIS).

It happened – after full and finished observations and was an important step of research. I could describe two groups of scoliosis (Figure 6-9).

Second group – it is “C” and “S” scoliosis deformity. In both types – “C” and in “S” the spine is flexible. These deformities are connected with standing ‘at ease’ on the right leg only. Additionally, in “S” type at all patients I could notice the laxity of joints. Some cases in this group are “kyfoscoliosis”. In these both types of scoliosis no exist progression or is very small [11 – 44, 68, 74].

2004 – Describing of the third group of the so-called idiopathic scoliosis Figure 4, Figure 10, Figure 11 During lectures and discussions with Prof. Keith Luk and Prof. Kenneth Cheung in Hong Kong (2004) I had presented the type of spine deformity – which has form “stiffness” only. So – this form of spine deformity is described by me - as “scoliosis without scoliosis”. This type of scoliosis is connected only with walking.

2006 – Precisely and definitively was described the model of movement of hips and type of scoliosis. In this year after – long years of observations (1984 – 2006) and research on many patients with scoliosis – I described three group of models of hips movement and three group and four types of scoliosis Figure 4-11 On many examples in all next years, I could confirm these three models of hips movement and four types of scoliosis.

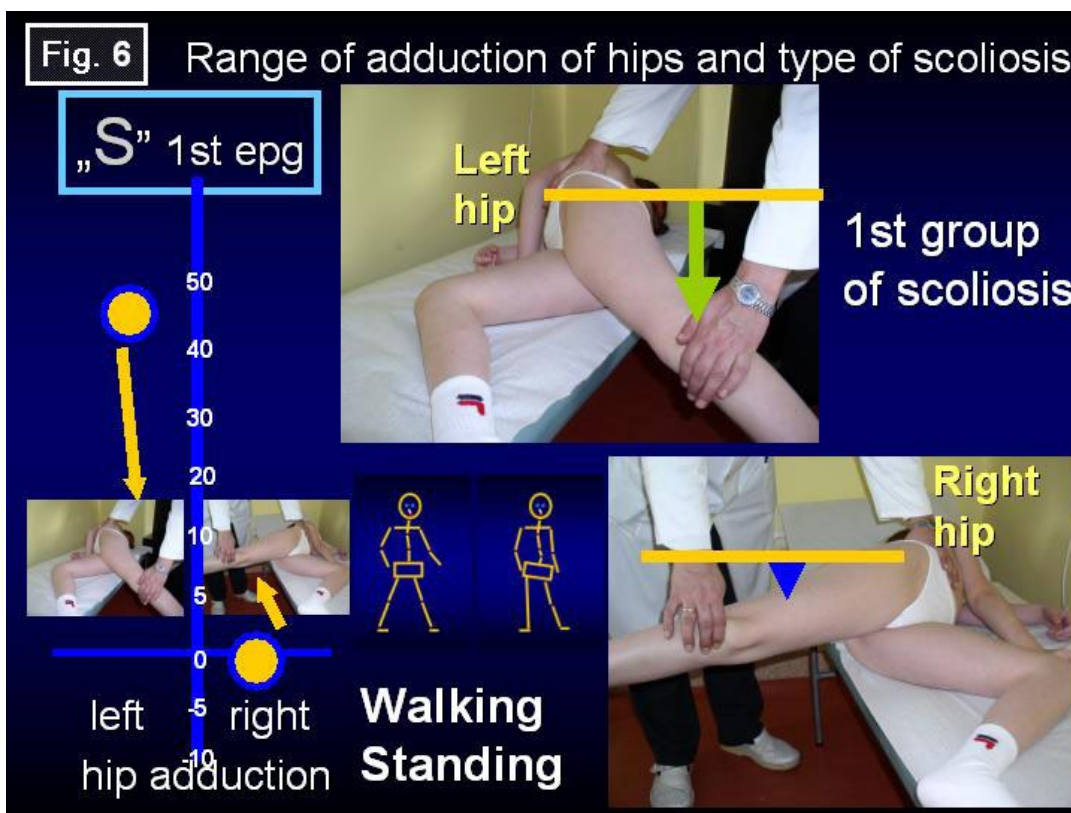


Figure 6: Range of adduction of hips in 1st group of scoliosis. „S” 1st epg deformity. Causative influence – walking & standing ‘at ease’ on the right leg.

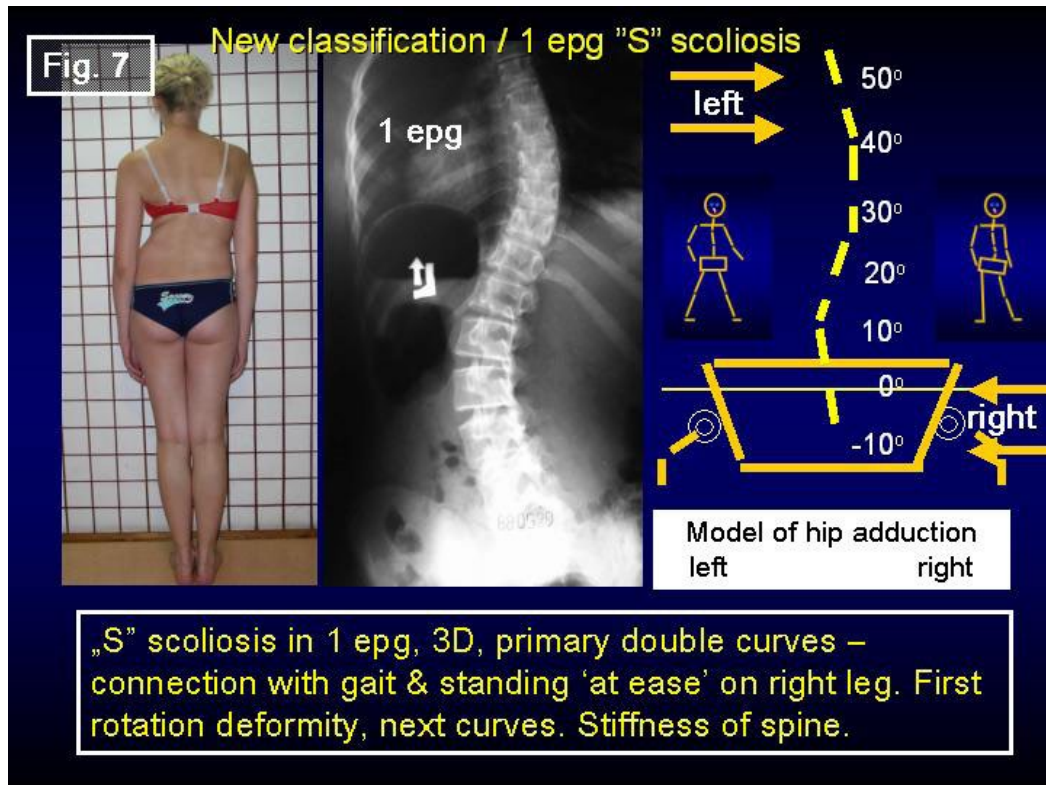


Figure 7: Example of „S” scoliosis in 1 epg, 3D, primary double curves – connection with gait & standing ‘at ease’ on right leg. First rotation deformity, next curves. Stiffness of spine. Progression.

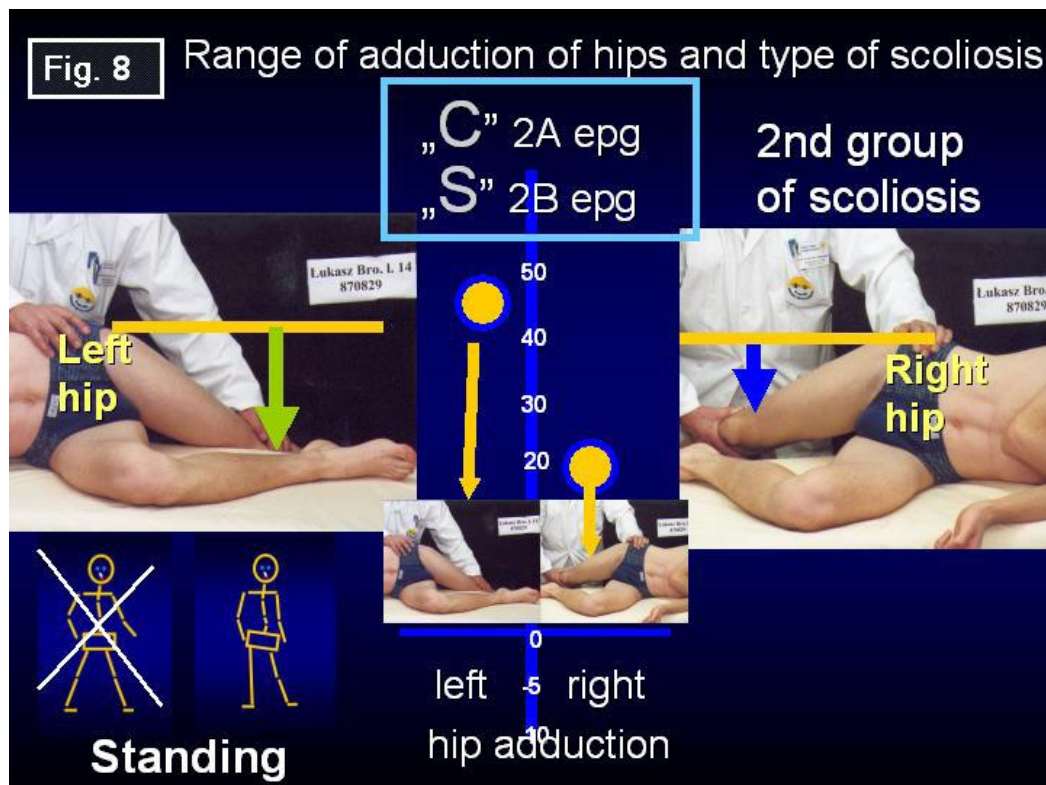


Figure 8: Range of adduction of hips in 2 group and 2 types of scoliosis “C” and „S” 2st epg deformity. Causative influence – standing ‘at ease’ on the right leg.

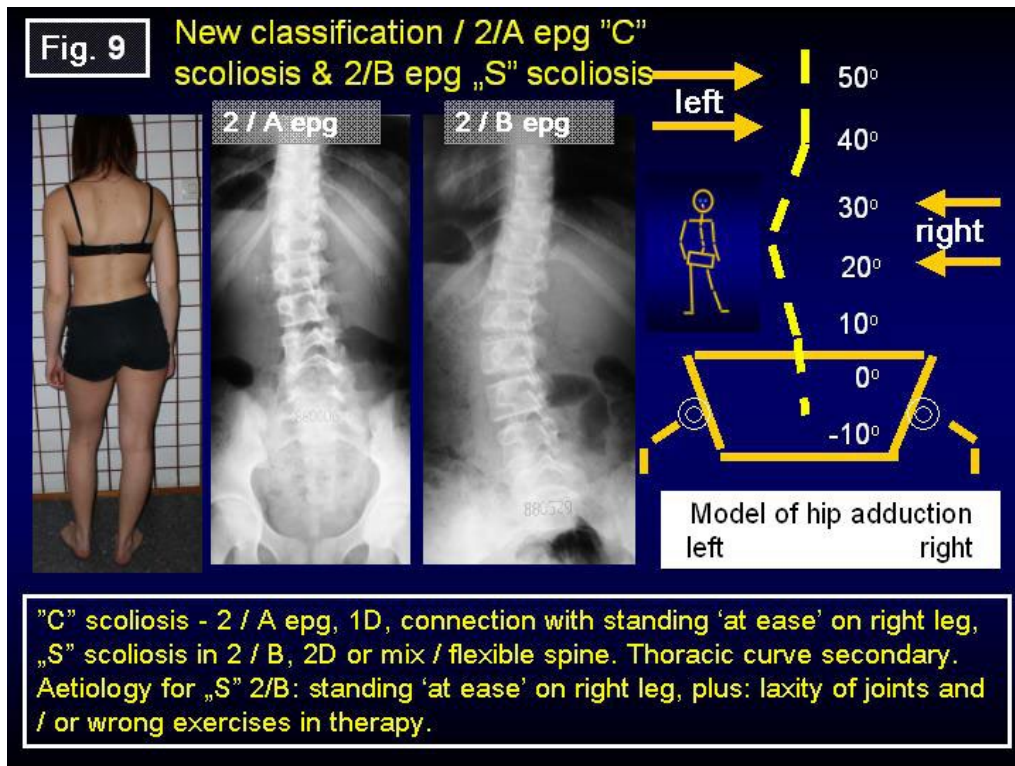


Figure 9: Example of “C” scoliosis - 2 / A epg, 1D, connection with standing ‘at ease’ on right leg and „S” scoliosis in 2 / B, 2D or mix / flexible spine. Thoracic curve secondary. Etiology for „S” 2/B: is standing ‘at ease’ on right leg, plus: laxity of joints and / or wrong exercises in therapy. No stiffness of spine. No progression or slight.

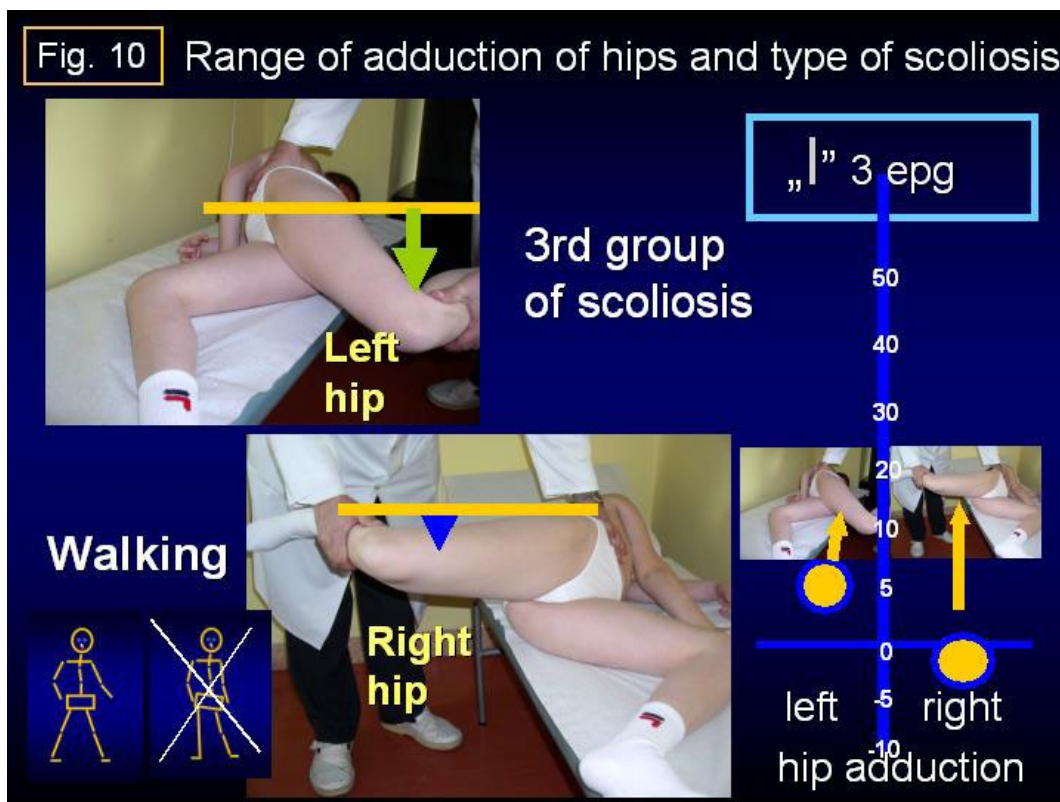


Figure 10: Range of adduction of hips in 3rd group of scoliosis. „I” 3rd epg deformity. Causative influence – walking.

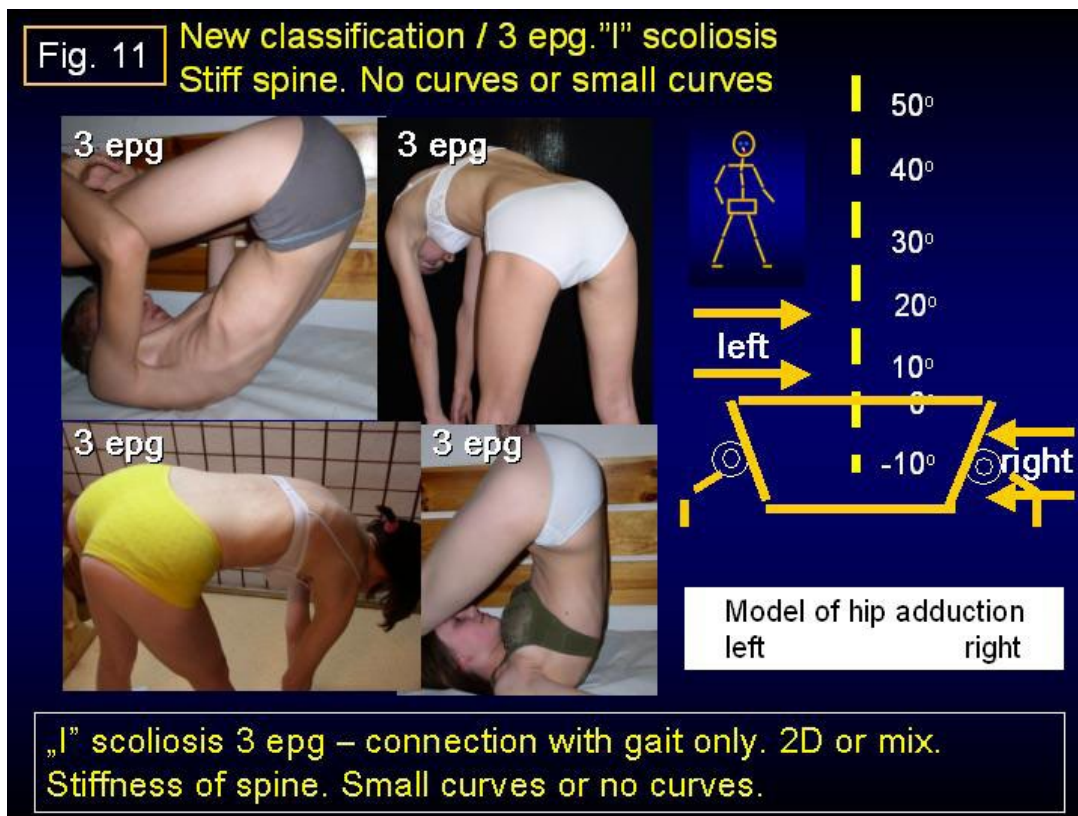


Figure 11: Example of „I” scoliosis in 3 epg. Connection with gait only. 2D or mix. Stiffness of spine. Small curves or no curves.

2007 – A/ Answer to the question – why the blind children do not have scoliosis. B/ Describing of the indirect influences from CNS on development of scoliosis (AIS).

A. During Congresses – I was asked many times – why the blind children – do not have scoliosis. Only in 2007. I could answer this question. The blind children gait is different it is without lifting of legs and without enlarge movement of pelvis and spine during every step – so it is no any influence to spine during walking going from pelvis. Also standing of blind children is safe and mostly symmetrically on both legs confirmed by observation of ophthalmologists.

B. In many children with scoliosis, I could definitely confirm the earlier observed “anterior tilt of pelvis”, laxity of joints and even in small children “extension contracture of spine” (Figure 5). This all symptoms are connected with Minimal Brain Dysfunction (MBD). So – there exist – indirect influence from CNS in development of scoliosis. Connection with improper position of pelvis and scoliosis had to see also Prof. Donat Tylman and Prof. Kazimierz Rapała from Warsaw [59, 60, 70]. In the years 2009 - 2022 I published many articles about these indirect influences to spine. Articles are published mostly in USA, Canada, UK [11 – 44].

New classification. Practical information about all three groups of scoliosis and about causes (Figure 4-11).

1. **First group** – “S” double scoliosis. 3D. Specific model of hips movement. Left hip – adduction in straight position - full range - 40 – 45 – 50 degrees. Right hip - adduction in straight position

– movement maximally limited - range – 0 degree or abduction contracture 5 - 10 degree. First symptoms in age of 5 – 7 years. Symptoms - stiffness of spine, next curves. Heavy progression of spine deformity, especially in “in acceleration period of growth”. This type of scoliosis is described in Internet. It is written about big danger of function of heart and lungs and is given indication of “necessary operations”. My explanation is following: 1/ the spine deformity develops from 2 year of life, 2/ is full adaptation of bones – nerves – blood circulation to “deformed spine”, 3/ is no danger of “big cripplehood and malfunctioning” of the child’s and next adults’ people, 4/ it is not necessary to make surgery.

2. **Second group** – two types. In this group is “C” – left lumbar convex scoliosis and “S” scoliosis – two curves – lumbar left convex and thoracic right convex. Both types are connected with standing ‘at ease’ on the right leg. In “S” scoliosis additionally is laxity of joints. Specific model of hips movement - left hip – adduction in straight position - full range - 40 – 45 – 50 degree - right hip - adduction in straight position little smaller – only 20 – 30 degrees. First symptoms are in age of 10 - 12 years. In both types the spine is flexible. Progression of spine deformity is moderate. In Internet the “C” type scoliosis is very often described as “paralysis / neurogenic scoliosis”.

3. **Third group.** In this form of deformity, we see only stiffness of spine. Specific model of hips movement. Left hip – adduction in straight position – very small – only 5 – 10 – 20 degrees. Right hip - adduction in straight position – movement maximally limited - range – 0 degree or abduction contracture 5 - 10 degree. Both hips are similarly stable in standing – so – the causes of deformity

is only walking.

Influence going from “walking” is following:

- A. Maximally limited movement in right hip,
- B. During waking – the “absent movement” of right hip is “compensatory performed” in pelvis and spine,
- C. This “rotation movement of spine” is bigger than normally and has the character of “distortion movement”,
- D. Make stiffness of the spine.

This group of spine deformity was in earlier classification no included to the “scoliosis group”. Children with stiff spine has problem during school exercises / during gymnastic. Adults has pain problems. First symptoms are in age of 5 – 7 years. This stiffness is persisting over all years of life. In this group – the curves are rare and mostly very small. Adults people, but sometimes also youth persons, has pain syndromes.

Therapy of the so-called idiopathic scoliosis (AIS) – old and new methods. In former old methods of therapy – never was possible to receive good results of the treatment. Why? It was connected with following “steps of thinking”:

- A. Appear spine deformity in form of scoliosis,
- B. The deformity is because of weak muscles – it was common and general thinking (of cause mistake of thinking and mistake of conclusions!?) -. Such point of view I could observe during discussions on Congresses and is also presented in the orthopedic literature.
- C. In therapy – was recommended - to make strengthening exercises.
- D. After such therapy the curves were bigger, spine more stiff, gibbous more expressed, the results were poor, fully deceptive, fully insufficient (Figure 12).
- E. My opinion – presented since 27 years - such incorrect therapy should be stopped in all countries, for new generation of doctors should be only to see as “history of scoliosis therapy”.

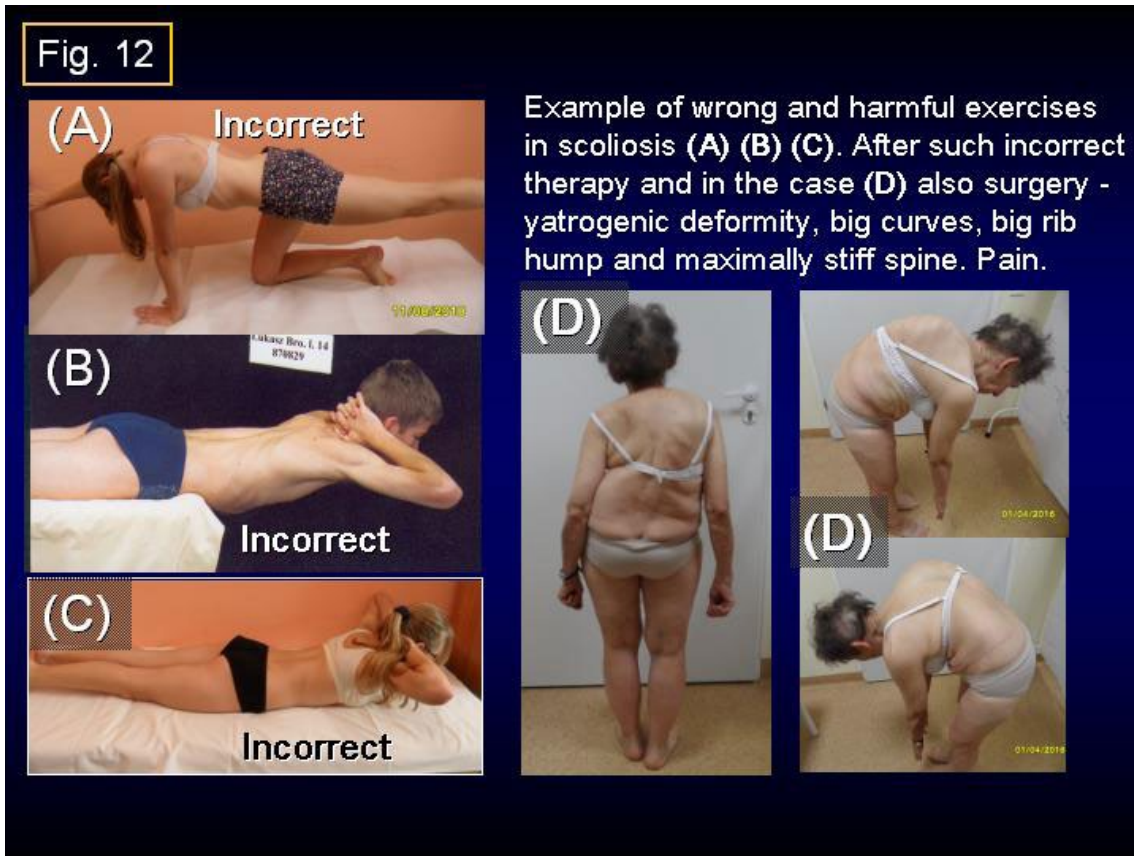


Figure 12: Example of wrong and harmful exercises in scoliosis (A) (B) (C). After such incorrect therapy and in the case (D) also surgery - yatrogenic deformity, big curves, big rib hump and maximally stiff spine. Pain.

If we take in consideration the “biomechanical etiology of so-called idiopathic scoliosis” only exercises leading to full movement of right hip, proper position of pelvis and full movement of spine - is the correct and proper therapy.

We known – the scoliosis is connected with asymmetry of movement of hips – and it make asymmetry of loading during gait and

asymmetry of spine growth. Spine curves develop because of permanent standing “at ease” on the right leg. Such – “one side standing” makes asymmetry of loading – more right side, it make overstress on concave side of spine and restrain the growth.

So, only stretching exercises – to receive full movement of the right hip, proper position of pelvis, full movement of spine – flex-

ion, deviation to the right and to the left side, rotation to the right and to the left side - give proper - conditions of growth and development of spine.

First in Poland and maybe on the world - who recommend the flexion exercises for scoliosis was Prof. Stefan Malawski from Warsaw [48, 49].

In the therapy it is important never to stand 'at ease' on the right leg. So - such easy and simply "standing 'at ease' on the left leg" - is very important method of therapy. Also - exercises - like karate, taekwondo, aikido, yoga - are proper for scoliosis therapy - because in these sport arts the area stretching exercises (Figure 13).

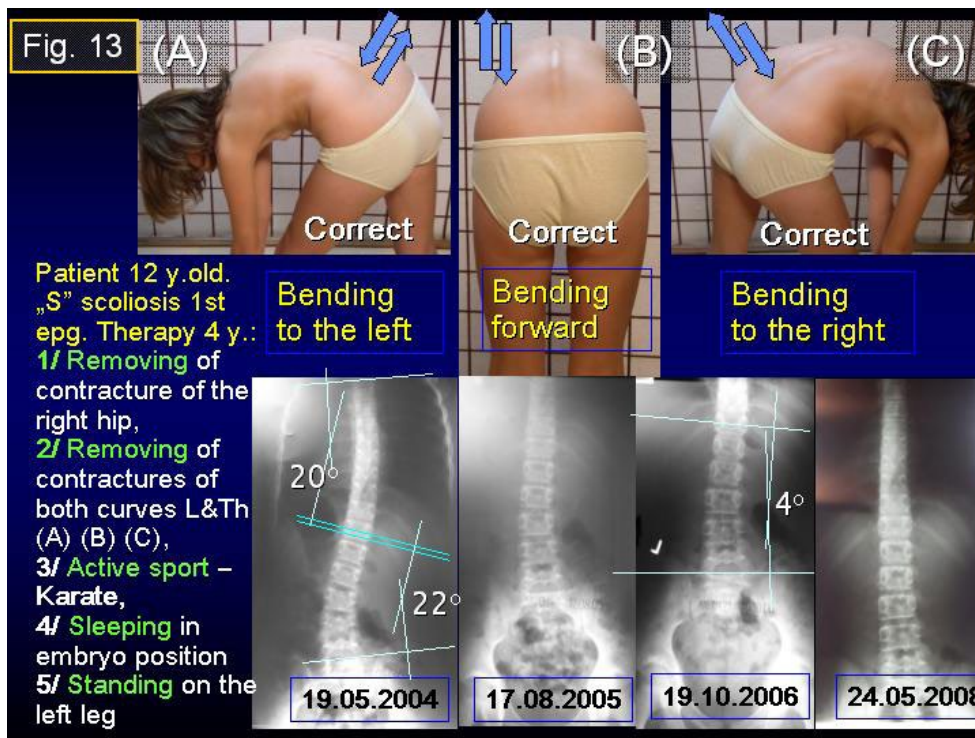


Figure 13: Patient 12 y. old. „S” scoliosis 1st epg. Therapy 4 y.: 1/ Removing of contracture of the right hip by stretching exercises, 2/ Removing of contractures of both curves (L&Th), 3/ Active sport – Karate, 4/ Sleeping in embryo position, 5/ Standing on the left leg.

Discussion

It is just more than two thousand years – after the first description and therapy of scoliosis (Hippocrates) and after the using the term “scoliosis” (Claudius Galenus). Till end of XX century the etiology was no founded, but described in years 1995 - 2007 – and it is “biomechanical”.

This biomechanical influences are: permanent standing ‘at ease’ on the right leg and walking - in “S” double curves scoliosis in 1st group. The deformity “C” and “S” in 2nd group is connected only with standing ‘at ease’ on the right leg. Such standing on the right leg – is because it is better stability of right hips during standing. Better – because the adduction in extension position of right hip is smaller. Smaller - because the tracts ilio – tibiale and fascia lata is shorter. It is connected with Syndrome of Contractures and Deformities [SofCD] according to Professors Hans Mau (German “Siebenersyndrom”) and Lublin observations [11 – 44, 68, 74]. In 2006 to SofCD was added varus deformity of shanks in newborn and babies, and this observation is presented in many my publications [74].

Smaller adduction or even abduction contracture of right hip in straight position of the joint is the cause of this “functional influences” - through standing and in some cases also through walking.

Limited movement of right hips is because in 90% – 97% cases the position of fetus is on the left side of mother’s uterus and in some circumstances during “gravity period” can lead to SofCD [11 - 13, 15-44, 74].

The abnormalities of CNS – by children with MBD – make additionally influences in development of scoliosis. Anterior tilt of pelvis diminishes the stability of pelvis and spine, make easy development of scoliosis and about these influences had spoken in Poland many years ago Prof. Donat Tylman [70].

The described biomechanical etiology of the so-called idiopathic scoliosis gives the possibility of proper therapy and causal prophylaxis – of patients in the whole world.

Unfortunately the explanation of the causes, new therapy and possibilities of causal prophylaxis of the so-called idiopathic scoliosis

are till now not admitted in Poland. It is not only misunderstanding of my explanation but sometimes were hard negation of my “research of scoliosis”. As example of such situations, I present the letter of Professor Stephan Eisenstein from UK who observed - the Discussion of Polish Colleagues after my lecture during Orthopedic Congress in Szczecin in 2004 (Figure 14).

Totally different situation was during my presentation of problem of scoliosis in SICOT Congress in Prague, Czech Republic in 2011 (Figure 15).

I hope – the publication of this article will open the way leading to “new looking and thinking about so-called idiopathic scoliosis” in the world

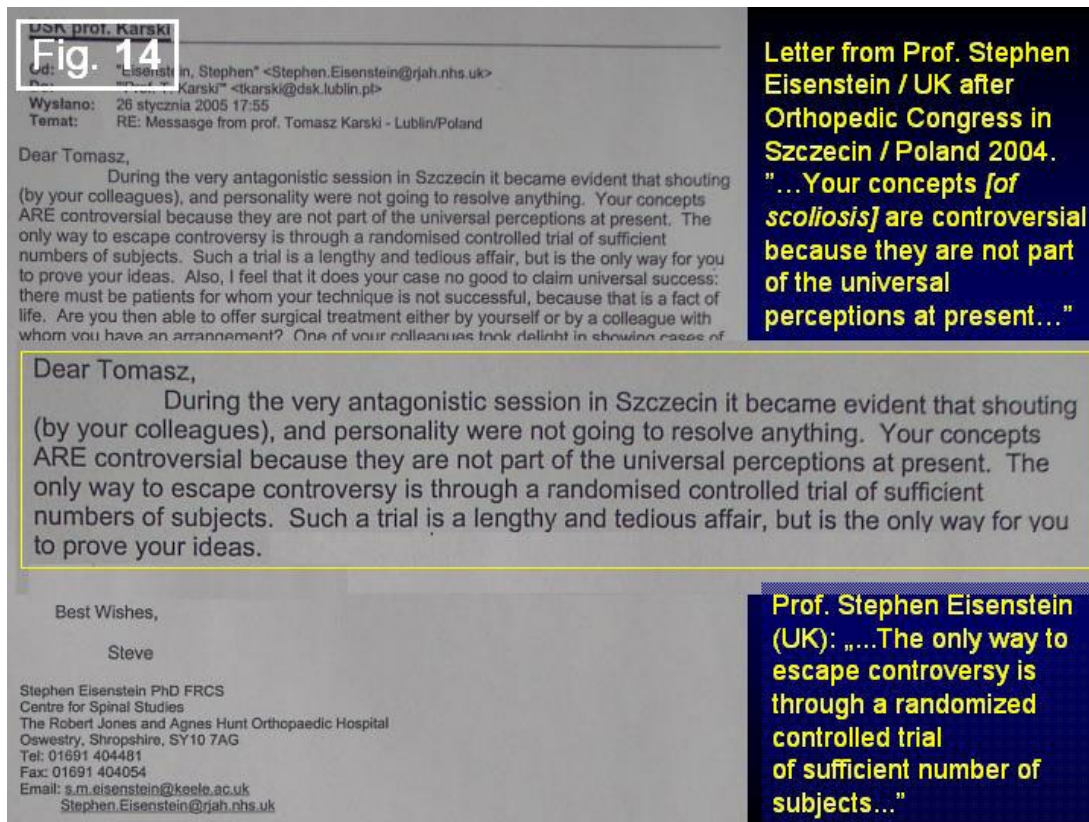


Figure 14: Opinion – confirmation letter from Prof. Stephen Eisenstein, UK after Orthopedic Congress in Szczecin, Poland 2004. "... Your concepts [of scoliosis] are controversial because they are not part of the universal perceptions at present...", "...shouting (against me) by your colleagues ... were not going to resolve anything..."

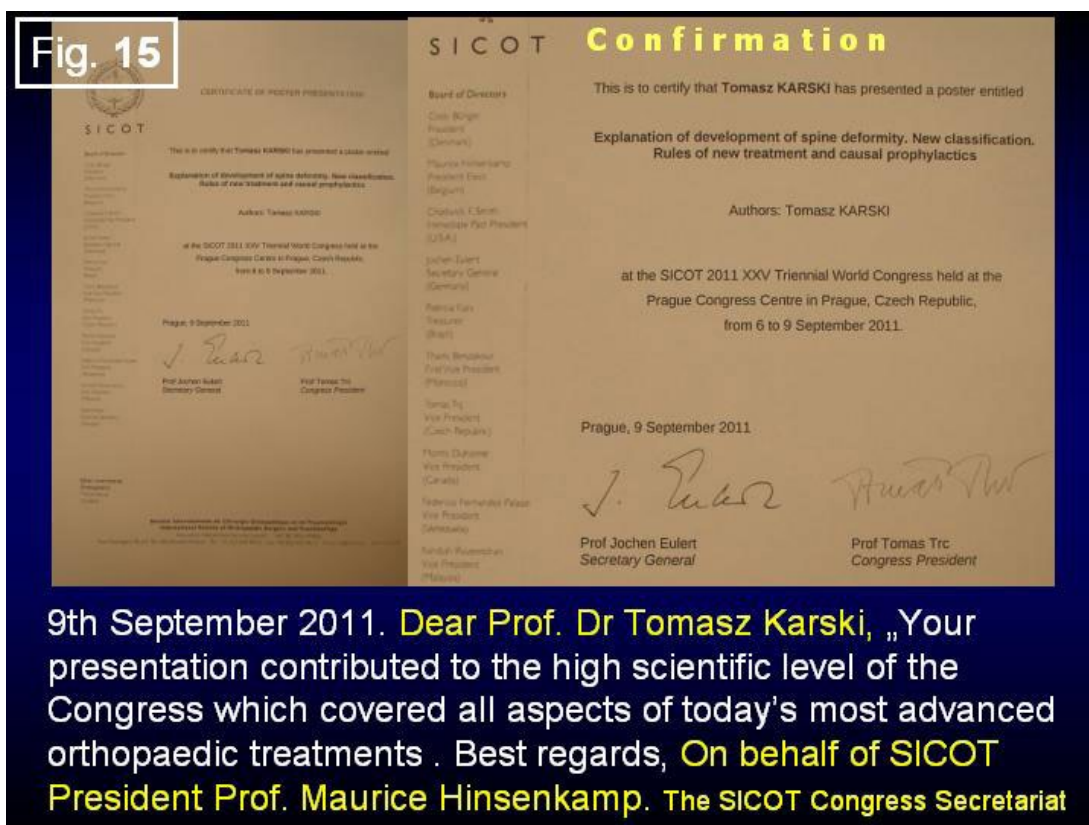


Figure 15: Letter – from 9th September 2011. „Dear Prof. Dr Tomasz Karski, „ ... Your presentation contributed to the high scientific level of the Congress (SICOT - Prague, Czech Republic) which covered all aspects of today’s most advanced orthopaedic treatments ...”. Best regards, On behalf of SICOT President Prof. Maurice Hinsenkamp. The SICOT Congress Secretariat.

Conclusions

1. The etiology of the so-called idiopathic scoliosis is fully bio-mechanical – connected with permanent standing ‘at ease’ on the right leg and walking.
2. The abnormalities of CNS – by children with MBD - give only additionally influences in development of scoliosis.
3. There are three groups and four types of scoliosis – three “etio – pathological – groups” (epg) – connected with three models of hips movements:
 “S” scoliosis - 1 st etiopathological group (epg)
 “C” scoliosis 2 nd / A epg
 “S” scoliosis 2 nd / B epg
 “I” scoliosis 3 rd epg.
4. Details about new classification:
 A. Scoliosis “S”, 1st epg - double curves deformity, 3D, stiff spine, gibbous on the right side, cause - standing and gait, progression, some cases “lordoscoliosis”,
 B. Scoliosis “C” 2nd / A epg, scoliosis and “S” 2nd / B epg, 2D or 3D, one or two curves, some cases “kifoscoliosis”, flexible spine, no progression or slight, cause - standing only,
 C. Scoliosis “I” 3 rd epg – deformity in form of stiffness, no curves or small. Cause - walking.
5. In new therapy and in prophylaxis important are: standing ‘at ease’ only on the left leg, stretching exercises to receive full movement of right hip, proper position of pelvis, full movement of spine in all directions.

6. In new therapy – it is important to avoid standing ‘at ease’ on the right leg and do permanent sport - karate, taekwondo, aikido, kung fu, yoga – just in kindergartens and in primary school.

References

1. Burwell G, Dangerfield PH, Lowe T, Margulies J. (2000). Spine. Etiology of Adolescent Idiopathic Scoliosis: Current Trends and Relevance to New Treatment Approaches, Hanley&Belfus, Inc, May 2000., Philadelphia, str, 14(2), 324.
2. Dangerfield, P. H., Dorgan, J. C., Scutt, D., Gikas, G., & Taylor, J. F. (1995). Stature in Adolescent Idiopathic Scoliosis (AIS). 14 Meeting EPOS. Brussels, Papers and Abstracts, 210.
3. Gardner A, Karski T. (2000). Skoliozy tzw. idiopatyczne – przyczyny, rozwój i utrwalanie się wady. Profilaktyka i zasady nowej rehabilitacji. The etiology of the so-called idiopathic scoliosis. Progress and fixation of the spine disorders. The prophylaxis and principles of the new rehabilitation treatment, KGM, Lublin, 2000, 1-143
4. Green NE, Griffin PP. (1982). Hip dysplasia associated with abduction contracture of the contralateral hip. J.B.J.S, 268(63-A), 1273-1281.
5. Gruca A, Tylman D. (1995). Patomechanika bocznych skrzywień kręgosłupa, Wydawnictwo Severus, Warszawa, 1995, Seiten 167.
6. Hawes Martha. (2002). personal information and letters
7. Heikkilä E. (1984). Congenital dislocation of the hip in Fin-

- land. An epidemiologic analysis of 1035 cases, *Acta Orthop. Scandinavica* 1984, B.55, 125-129.
8. Hensinger RN. (1979). Congenital dislocation of the hip. *Clinical Symp.* 1979, 31 270
 9. Howorth B. (1977). The etiology of the congenital dislocation of the hip, *Clin. Orthop.*, 29 (271), 164-179.
 10. James W. Ogilvie, John Brown, VeeAnn Argyle, Lesa Nelson, Mary Meade, Kenneth Ward. (2006). The search for Idiopathic Scoliosis Genes, *Spine* 31, 679 -681.
 11. T. Karski. (1996). Kontraktoren und Wachstumstörungen im Hüft- und Beckenbereich in der Ätiologie der sogenannten „idiopathischen Skoliosen“ – biomechanische Überlegungen, *Orthopädische Praxis*, 32(3), 155-160
 12. Karski T. (1997). Biomechanical influence onto the development of the so-called “idiopathic scoliosis” - clinical and radiological symptoms of the disorder. *Acta Orthopaedica Yugoslavica*, 28(1), 9-15
 13. Karski T. (1998). Hip abductor contracture as a biomechanical factor in the development of the so-called „idiopathic scoliosis”. Explanation of the etiology, *Magyar Traumatologia, Ortopedia, Kezsebeszet, Plasztikai Sebeszet*, 1999(3), 239 - 246
 14. Karski T. (2002). in Grivas TB. *Studies in Technology and Informatics, Research into Spinal Deformities*, IOS Press 2002, Amsterdam, Berlin, Oxford, Tokyo, Washington DC, 4(91), 37-46.
 15. Karski T. (2005). Biomechanical Explanation of Etiology of the So-Called Idiopathic Scoliosis. Two etiopathological Groups - Important for Treatment and Neo-Prophylaxis *Pan Arab Journal*, 9(1), 123-135.
 16. Karski T, Burwell Dangerfield. (2000). *Spine. Etiology of Adolescent Idiopathic Scoliosis: Current Trends and Relevance to New Treatment Approaches*, Volume 14/Number 2, Hanley & Belfus, Inc, 2000, 324.
 17. Karski T, Makai F, Rehak L, Karski J, Madej J, Kalakucki J. (2001). The new Rehabilitation treatment of so-called idiopathic scoliosis. The dependence of results on the age of children and the stage of deformity. *Locomotor System*, 8(2), 66-71.
 18. Karski T, (2002), Etiology of the so-called “idiopathic scoliosis”. Biomechanical explanation of spine deformity. Two 272 groups of development of scoliosis. New rehabilitation treatment. Possibility of prophylactics, *Studies in 273 Technology and Informatics, Research into Spinal Deformities*, IOS Press 2002, Amsterdam, Berlin, 274 Oxford, Tokyo, Washington DC, 91(4), 37-46.
 19. Karski T, Kalakucki J, Karski J. (2006). “Syndrome of contractures” (according to Mau) with the abduction contracture of the right hip as causative factor for development of the so-called idiopathic scoliosis. *Stud Health Technol Inform*, 2006(123), 34-39
 20. Karski T. (2010). Explanation of biomechanical etiology of the so-called idiopathic scoliosis (1995-2007). New 276 clinical and radiological classification” in”*Pohybove Ustroji*” [*Locomotor System*], 17(3), 26-42.
 21. Karski T. (2011). Biomechanical Etiology of The So-Called Idiopathic Scoliosis (1995 – 2007) – Connection with 279 “Syndrome of Contractures” – Fundamental Information for Paediatricians in Program of Early Prophylactics / 280 *Journal of US-China Medical Science, USA*, 8(78), 281.
 22. Karski Tomasz. (2010). Factores biomechanicos en la etiologia de las escoliosis dinominadas idiopaticas. Nueva 282 clasificacion. Nuevos test clinicos y nueavo tratamiento conservador y profilaxis”, *Cuestiones de Fisioterapia*, Mayo- 283 Agosto 2010, *Cuest. Fisioter* 39(2), 144-152.
 23. Karski Tomasz. (2010). Biomechanical Etiology of the So-called Idiopathic Scoliosis (1995-2007). New Classification: 285 Three Groups, Four Sub-types. Connection with „Syndrome of Contractures”, *Pan Arab J. Orth. Trauma*, 286(14), 287.
 24. Karski Tomasz. (2013). Biomechanical Etiology of the So-called Idiopathic Scoliosis (1995 - 2007). Three Groups and 288 Four Types in the New Classification, *Journal of Novel Physiotherapies*, OMICS Publishing Group, USA, 289(6), 290.
 25. Karski Jacek, Tomasz Karski. (2013). So-Called Idiopathic Scoliosis. Diagnosis. Tests Examples of Children Incorrect 291 Treated. New Therapy by Stretching Exercises and Results, *Journal of Novel Physiotherapies*, OMICS Publishing 292 Group, USA, 3(9), 293.
 26. Karski Tomasz. (2014). Biomechanical Aetiology of the So-Called Idiopathic Scoliosis. New Classification (1995-2007) in Connection with “Model of Hips Movements”. Pages 12. *Global Journal of Medical Research H: Orthopedic and Musculoskeletal System*, 14(3), 2014.
 27. Karski Tomasz. (2014). Biomechanical Etiology of the So-called Idiopathic Scoliosis (1995 – 2007) - Connection with „Syndrome of Contractures” – Fundamental Information for Pediatricians in Program of Early Prophylactics. *Surgical Science* 5 (2014), 33-38.
 28. Karski Tomasz, Karski Jacek. (2015). Syndrome of Contractures and Deformities” according to Prof. Hans Mau as Primary Cause of Hip, Neck, Shank and Spine Deformities in Babies, Youth and Adults *American Research Journal of Medicine and Surgery*, 1(2), 2015.
 29. Karski Tomasz, Jacek Karski. (2015). Biomechanical etiology of the so-called Idiopathic Scoliosis (1995 – 2007). Causative role of „gait” and „permanent standing ‘at ease’ pn the right leg”. New classification. Principles of new therapy and causal prophylaxis. *Canadian Open Medical Science & Medicine Journal*, 1(1), 1-16
 30. Karski Jacek MD PhD, Prof. Tomasz Karski MD PhD, Jaroslaw Pyrc MD PhD, Dr Małgorzata Kulka. (2016). Deformations of the feet, knees, hips, pelvis in children and adults with minimal brain dysfunction. causes. treatment. Prophylaxis. *LOCOMOTOR SYSTEM*, 23(2), 2016.
 31. Karski Tomasz, (2017), *Physiotherapy– Correct, or Incorrect, Based on ‘Wrong Principles of Treatment’*. Example for Spine, Hip, Knee, Shank and Feet, *Crimson Publishers, USA*.
 32. Karski Tomasz, Jacek Karski, Klaudia Karska, Katarzyna Karska and Honorata Menet. (2018). *Pediatric Prophylaxis Program of Motor System Deformations and Illnesses in Children. Problems of Spine, Hips, Knees and Feet*, *EC PAE-*

- DIATRICES, Review Article, 7(7), 2018.
33. Karski Tomasz, Jacek Karski, Katarzyna Karska, Klaudia Karska and Honorata Menet, (2018), Prophylactic Rules for Newborns, Babies, Children and Adults in problems of Hip, Knee, Shank, Feet and Spine, Online Journal CRIMSON PUBLISHERS, USA.
34. Karski Tomasz, Jacek Karski, (2016), Bóle krzyża – problem neurologiczno - ortopedyczny. Objawy. Przyczyny. Leczenie. Back pain – neurology-orthopedic problems. Clinic, causes, therapy and prophylaxis. Postępy Neurologii Praktycznej, Wydawnictwo Czelej, 4, 9-16.
35. Jacek, K., & Tomasz, K. (2016). Imperfect hips as a problem at an older age. Early and Late Prophylactic Management before Arthrosis. *Jacobs Journal of Physiotherapy and Exercises*, 2(1), 7.
36. Karski, T. (2018). Biomechanical Aetiology of the So-called Adolescent Idiopathic Scoliosis (AIS). Lublin Classification (1995-2007). Causative Influences Connected with “Gait” and “Standing ‘at ease’ on the Right Leg”. *J Orthop Bone Res*, 1, 10.
37. Karski, T. (2019). Biomechanical etiology of the so-called Idiopathic Scoliosis-New classification; Rules of therapy and causal prophylaxis. *Int J Spine Res*, 1(1), 012-016.
38. Karski, T. (2019). Opinions and Controversies in Problem of The So-Called Idiopathic Scoliosis. Information About Etiology, New Classification and New Therapy. *Biomedical Journal*, 1, 5.
39. Karski, T. (2019). Biomechanical etiology of the so-called Idiopathic Scoliosis-New classification; Rules of therapy and causal prophylaxis. *Int J Spine Res*, 1(1), 012-016.
40. Karski Tomasz. (2019). Biomechanical Etiology of the So-Called Idiopathic Scoliosis, Connection with “Syndrome of Contractures and Deformities”, Role of Gait and Standing ‘At Ease’ On the Right Leg in the Development of Spine Deformity, New Treatment, Causal Prophylactics, *Int J Ortho Res*, 2(1), 1-5
41. Karski Tomasz. (2020). Biomechanical Factors in Etiology of the So-Called Idiopathic Scoliosis (Adolescent Idiopathic Scoliosis [AIS]. Dates of Discoveries. Classification, Rules of the Therapy and Prophylaxis, *International Journal of Orthopaedics Research, USA, Kansas, Int J Ortho Res*, 2020, 3(2), 1-6.
42. Karski Tomasz. (2020). So-Called Idiopathic Scoliosis. Historical Dates of Discoveries. Fate and Fortune of New Knowledge, *International Journal of Orthopaedics Research, USA, Kansas, Int J Ortho Res*, 3(3), 131.
43. [Karski, T. (2021). Minimal Brain Dysfunction. Children and adults. Clinical and Psychological Symptoms. Examples of pathology. Rules of Therapy. *Int J Ortho Res*, 4 (3): 127, 133, 1995-2021.
44. Karski Tomasz. (2020). Rules of Prophylaxis for Hips and Spine - Children and Adults – in Points and Figures, Educational Article, Canada, CPQ Orthopaedics, 2020, 5:1
45. Karski, T. (2002). Etiology of the so-called “idiopathic scoliosis”. Biomechanical explanation of spine deformity. Two groups of development of scoliosis. New rehabilitation treatment; possibility of prophylactics. In *Research into Spinal Deformities 4* (pp. 37-46). IOS Press.
46. Lowe, T., Lawellin, D., Smith, D., Price, C., Hafer, T., Mero-la, A., & O’Brien, M. (2002). Platelet calmodulin levels in adolescent idiopathic scoliosis: do the levels correlate with curve progression and severity?. *Spine*, 27(7), 768-775.
47. Normelli, H. (1985). Asymmetric rib growth as an aetiological factor in idiopathic scoliosis in adolescent girls.
48. Maławski, S. (1994). Własne zasady leczenia skolioz niskostopniowych w świetle współczesnych poglądów na etiologię i patogenezę powstawania skolioz. *Chirurgia Narządów Ruchu i Ortopedia Polska*, 59(3), 189-197
49. Mau H. (1979). Zur Ätiopathogenese von Skoliose, Hüftdysplasie und Schiefhals im Säuglingsalter. *Zeitschrift f. Orthop*, 1979(5), 601-605.
50. Mau, H. (1982). Die Ätiopathogenese der skoliose, bücherei des orthopäden. enke verlag stuttgart, 1, 1-110.
51. Mau Hans. (2004). personal information and letter.
52. Tomaschewski, R., & Popp, B. (1992). Die funktionelle Behandlung der beginnenden idiopathischen Skoliose. *Barth*.
53. Normelli, H. (1985). Asymmetric rib growth as an aetiological factor in idiopathic scoliosis in adolescent girls.
54. Oleszczuk, J., Chazan, B., & Kamiński, K. (1999). i wsp. Poród patologiczny. W: Szymański W.(red.). *Rudolfa Klimka położnictwo*. Kraków: Dream Publ. Comp.
55. Oleszczuk J., Szymański W., Wilczyński. (1999). “Patologia ciąży” in “Położnictwo” Klimek Rudolf, Dream Publ. Comp. Inc., Kraków, (1999), 395-499.
56. Palacios-Carvajal J, Karski T. (2003). Skoliozy tzw. idiopatyczne – etiologia, rozpoznawanie zagrożeń, nowe leczenie rehabilitacyjne, profilaktyka. The etiology of the so-called idiopathic scoliosis. The new rehabilitation treatment. Prophylaxis, *FOLIUM, Lublin*, 2003(1), 1-233.
57. Perdiolle J. in Tomaschewski R, Popp B. [1992] Die Funktionelle Behandlung der beginnenden idiopathischen Skoliose. *Jahann Ambrosius Barth, Leipzig Heidelberg 1992*, 1-96.
58. Rapała K, Tylman D. (1995). *Patomechanika bocznych skrzywień kręgosłupa*, Wydawnictwo Severus, Warszawa, 1995, 167.
59. Rapała K. in Karski T. (2003). Skoliozy tzw. idiopatyczne – etiologia, rozpoznawanie zagrożeń, nowe leczenie rehabilitacyjne, profilaktyka. The etiology of the so-called idiopathic scoliosis. The new rehabilitation treatment. Prophylaxis, *FOLIUM, Lublin*, (2003), 1-233.
60. Tomaschewski, R., & Popp, B. (1992). Die funktionelle Behandlung der beginnenden idiopathischen Skoliose. *Barth*.
61. Saji, M. J., Upadhyay, S. S., & Leong, J. C. (1995). Increased femoral neck-shaft angles in adolescent idiopathic scoliosis. *Spine*, 20(3), 303-311.
62. Sevastik, J. A., & Diab, K. M. (Eds.). (1997). *Research Into Spinal Deformities 1* (Vol. 37). IOS Press.
63. Sevastik John [2006 – 2008] – personal information.
64. Skogland, L. B., & Miller, J. A. (1980). Growth related hormones in idiopathic scoliosis: an endocrine basis for accelerated growth. *Acta Orthopaedica Scandinavica*, 51(1-6), 779-789.

-
65. Stokes, I. A. (Ed.). (1999). Research into spinal deformities 2 (Vol. 2). IOS press.
 66. Stokes Jan [2006] - personal information and letters
 67. Tarczyńska, M., Karski, T., & Frelek-Karska, M. (2000). Prenatal conditions for the development of the hip dysplasia in the material of 223 pregnant women, followed-up study of the newborn children. EPOS, 5-8.
 68. Tomaschewski, R., & Popp, B. (1992). Die funktionelle Behandlung der beginnenden idiopathischen Skoliose. Barth.
 69. Tylman D. (1995). Patomechanika bocznych skrzywień kręgosłupa, Wydawnictwo Severus, Warszawa, 1995, 167.
 70. Tibor, V., & Karski, T. (2000). Skoliozy tzw. idiopatyczne-przyczyny, rozwój i utrwalanie się wady. Profilaktyka i zasady nowej rehabilitacji [The Etiology of the So-Called Idiopathic Scoliosis. Progress and Fixation of the Spine Disorders. The Prophylaxis and Principles of the New Rehabilitation Treatment]. KGM, Lublin, 1-143.
 71. Normelli, H. (1985). Asymmetric rib growth as an aetiological factor in idiopathic scoliosis in adolescent girls.
 72. Normelly H. (1985). Asymmetric rib growth as an aetiological factor in idiopathic scoliosis in adolescent girls, Stockholm, 1985, 1-103.
 73. www.ortopedia.karski.lublin.pl.
 74. Vlach O, Rouchal T, Neubauer M. in Karski T. (2003). Skoliozy tzw. idiopatyczne – etiologia, rozpoznawanie zagrożeń, nowe leczenie rehabilitacyjne, profilaktyka. The etiology of the so-called idiopathic scoliosis. The new rehabilitation treatment. Prophylaxis, FOLIUM, Lublin, 2003, 1-233.
 75. Zarzycki, D., Zarzycka, M., Tylman, D., & Pucher, A. (1992). Naturalna historia bocznych skrzywień kręgosłupa. Chir Narz Ruchu, 57(1), 9-15.
 76. Żuk T, Dziak A. (1993). Ortopedia z traumatologią narządów ruchu, PZWL, Warszawa, 1993, 161-173.

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