

## Pathological changes in locomotors system in children with Minimal Brain Dysfunction (MBD). Causes. Symptoms. Physiotherapy

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### Summary

In the paper we present observations of patients from the years 1995 – 2016. Material content of 955 children and youths in age of 2 to 18 years and small group of adults people. We give the clinical material of secondary deformities connected with Minimal Brain Dysfunction [MBD]: valgus deformity of the feet, hyperextension of the knees, anterior tilt of the pelvis, hyperlordosis of the lumbar spine.

In the treatment we propose physiotherapy methods rely / upon on stretching exercises. Proper and successful treatment all above mentioned deformations is the best prophylaxis of pain syndromes in people in adult age.

### Streszczenie

W opracowaniu przedstawiono materiał z lat 1995–2016. Obejmował on 955 dzieci w wieku od 2 do 18 lat a także małą grupę osób starszych. Praca przedstawia kliniczne i radiologiczne objawy w obrębie narządu ruchu powodowane przez dysfunkcje neuro – mięśniowe (ang. *Minimal Brain Dysfunction*). Były to: koślawość stop, przeprosty kolan, przodopochylenie miednicy i hiperlordoza lędźwiowa. Autorzy proponują w leczeniu sposoby fizjoterapeutyczne polegające na redresji przykurczonych tkanek. Poprawne leczenie tych deformacji może być traktowane jako najlepsza profilaktyka zespołów bólowych u dorosłych.

**Key words:** minimal brain dysfunction, secondary valgus deformity of feet, hiperextenson of the knees, anterior tilt of pelvis and hiperlordosis of lumbar spine.

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### Introduction

Almost 7 % of the population of children and youth in Poland in the last years of the XX century and in the XXI century present the children born with various changes in the central nerve system (CNS). During the pregnancy and delivery in many cases can happen various complications and because of this asphyxia can be the cause of MBD or even Cerebral Palsy (CP). The status of mild cases of asphyxia we described as Minimal Brain Dysfunction (MBD). Next, in these cases we observe secondary changes in the movement

apparatus. Clinically in 90 % of these children we see spasticity or sub – spasticity, but in 10% of these patients can be “flaccidity” (Prof. Harald Thom).

In this paper in chapter – “Discussion” - the authors speak about “so-called low tension of the muscles” – opinion of many Polish physiotherapist, and in therapy the necessity to strengthen the muscles, necessity to form “a special master of brain activity to influence the body function”. We think, it is miss idea and the proposed therapy never gives positive result of the treatment. The method of therapy is only proper, when the diagnoses and

pathogenesis of illness is correct define and status of deformity is properly described. Only, if we realize such conception - we can plan the proper therapy. According ours point of view only stretching exercises leading to symmetry of function, give symmetry of growths and development in children and relieve or fully treat pain in adults are proper.

### **General information about clinical forms of pathology in children with MBD**

The secondary deformity causes by MBD include the deformations of the legs, arms and spine in children. These changes in movement apparatus we can see very early, even in age of 3 – 5 years. Next they can persist to the older years of life of these group of patients. There are: valgus or plane valgus deformity of the feet, recurvation of the knees, anterior tilt of the pelvis with hiperlordosis of the lumbar spine. All these abnormalities should be fully treated in infants and throughout a child's period of life. If the children are not treated fully – there will be a serious problem in adult age – pain and even handicap connected with pathology in the feet, knees, pelvis and spine.

### **Examination of children with MBD**

To make a proper diagnosis we should firstly ask in anamnesis about the details of pregnancy and delivery period. Before planning any treatment we must give a precise diagnosis. Firstly we must answer the question – was or was not the asphyxia of the child in both periods - pregnancy and delivery. To find the proper diagnosis we should use the examination tests similarly in orthopedic and in neurology.

There are the following list of tests: 1/ quick stretch test (QST), 2/ Elly Duncan test (others names Staheli or Thom test), 3/ Holt test, 4/ Thomas test and 5/ test for laxity of joints (**Fig. 1a, 1b, 1c, 1d, 1e, 1f, 2a, 2b, 3a, 3b, 4a, 4b, 5a, 5b, 6a, 6b, 6c**). Especially important is the QST. We can

repeat - mostly shortening of tendons, capsules, muscles, fascias there are cause of malformations, but not “weak muscles”. After completing the tests we can properly diagnose the “mal position of the joints and parts of the body”, this means, properly describing the deformations of the feet, knees, pelvis and spine.

### **Deformity of the feet in children with MBD**

The causes of feet valgus deformities are various: it can be spastic shortening of pronator muscles – m. peroneus brevis and m. peroneus longus, anomalies of the bones and a laxity of the joints.

According to the authors observations - the main cause of feet valgus deformities is the shortening (contracture) of the m. triceps surae together with other flexors of the feet and Achilles tendon.

This influence is coming from the MBD and is going to both legs. When there is only a shortening of the Achilles tendon and m. triceps surae the child is walking on the equines position of the feet or one foot (**Fig. 7a**). Quite a difference is when a shortening of the flexors of the feet persist at the same time with exists laxity of the joints. Now, with every step while walking, in the phase when the leg is behind the body, will come to the prone position of the feet and with time will fix the valgus deformity (**Fig. 7b**). Mostly the are complex deformity - valgus and plane deformity of feet. The described deformity of feet is very common among polish children, even 7 % - 11%.

This deformity is connection with the function. Namely: 1/ during walking we need by every step dorsal flexion of feet 15 - 20 degrees, 2/ in a situation of the shortening of the Achilles tendon and m. triceps surae and accompanying the laxity of joints, the needed dorsal flexion is possible only in prone position of the feet, 3/ such repeated “dorsal flexion in prone position” since the first steps of a child walking, after some

years give the “full fixed valgus, or plane - valgus deformity” of the feet (**Fig. 8a, 8b**). When such children are not treated early enough, next they need a longer time for therapy, even many years and it is difficult to achieve good results. Deformity in mild form can be treated only with physiotherapy. When the deformity is fixed and the child older – it is necessary to make surgery. No treated valgus deformity of feet in child’s period of life, makes big problem in adults – pain, limping, difficulties in walking (**Fig. 9a, 9b, 9c, 9d**).

### **Secondary deformity of the knees in children with MBD**

Recurvation of the knees (**Fig. 10a, 10b**) is very often accompanied by a valgus deformity of the feet. Such deformity to the knees is also the effect of a shortening of the Achilles tendon and m. triceps surae and there is also a compensatory deformation. Explanation: 1/ a small limitation of the dorsal flexion of the feet during walking, what is typical for children with MBD, 2/ at the moment when the foot is in full contact with the floor, 3/ cause hyperextension of the knees, together with prone position of the feet. Such a knee deformity we see very often in children with MBD.

### **Hip dysplasia – types, forms. Pathological influences from MBD**

Hip dysplasia appears in two pathological conditions: 1/ in the situation of general laxity of the joints (10 % of all cases in Poland) and 2/ in Syndrome of Contractures and Deformities (H. Mau, T. Karski & J. Karski) - 90 % of all cases in Poland. This second group of deformity Prof. Klisic from Yugoslavia (60-years of XX century) called “Developmental Dysplasia of the Hip” (DDH). In this group dysplasia develops slowly, not because of primary undeveloped roof of acetabulum, but because of incorrect position of the femoral head in acetabulum. Namely deficit of abduction,

others words, permanent adduction position of the femoral head, leads to “secondary dysplasia of the roof of acetabulum” what Klisic called “development dysplasia of the hip”.

In the “laxity group of dysplasia of roof” can coexist sub – spastic or spastic contracture of adductors. In such a situation the dysplastic hip therapy is longer and more difficult. In order to achieve better therapeutic effect it is important inform the parents about this coexistent contractures.

### **Influence of the MBD to the spine - anterior tilt of the pelvis and hyperlordosis of the lumbar spine**

In children with minimal brain dysfunction independent of valgus deformity of the feet and recurvation of the knees very often we observe anterior tilt of the pelvis with hiperlordosis of lumbar spine (**Fig. 11a, 11b**). Spasticity or sub spasticity concerns not only m. triceps surae but very often also m. rectus, one of the parts of the m. quadriceps. M. rectus is the muscle which includes two joint – knee and hip joint. For the knee this muscle works as extensor, for the hip as flexor. When this muscle is spastic, its mean shortened – it causes an anterior tilt of the pelvis. This deformity is very frequent in children with MBD. We observe this deformity of the pelvis in 11% of people in Poland. When this deformity is not cured at childhood, or in the youth period of life, can be the cause of “back pain” in adults. These problems cause a very large scientific and clinical subject and need a new paper.

### **General laxity of joints and influence on sitting position**

In the children with MBD very often we observe the general laxity of joints. About such habit connected with specific property of the soft tissues we announce already in this paper. Now we

would like to come back to the valgus deformity of knees. This deformation of the knees can be caused by a shortening (contracture) of m. tensor fascia latae and next - of fascia lata, tracts ilio-tibialis and capsules of the knee joints.

More frequent the cause is connected with improper sitting position of many MBD children. We observe the valgus deformity of the knees as the result of incorrect sitting in “the TV position” (German: Najadesitz) (**Fig. 12a, 12b, 12c**).

The picture on **Fig. 13** shown the proper sitting position – “butterfly sitting position” called in language of karate what enable proper development of hips, proper position of spine – relax in flexion (!).

### **Psychological problems with MBD children**

In observations of many doctors - orthopedic surgeons, pediatric, neurological, psychologist, was state that the children with MBD are very often nervous, they cry without any cause and at the same time they very willingly look for close contact with mother, or farther, or grandparents. These children like also to jump off from various high objects such as chairs, sofas, window-stills, tree branches and other objects in their environment. The jumping repeated for many times causes Perthes disease, that is necrosis of femoral head. When the illness appears, it usually lasts 3 or 4 years. It makes long-lasting changes of the shape and structure of the femoral head, and in time, it triggers the development of coxarthrosis. Such data concern the etiology of Perthes disease and indicates the kind of causal prophylaxis to be recommended in due course of the illness. Parents should be informed that repeated jumping is dangerous for the hips especially for children aged between 4 – 11.

### **Physiotherapy in treatment of feet, knees, hips, pelvis and spine**

In the treatment of deformed feet, knee and pelvis as well hips the first role play stretching exercises to receive symmetry of anatomy of soft tissues, of length of tendons, fascias, muscles, capsules, symmetry of movement of joints as well the symmetry of function in every day activities in school, in home and in job. For correction of valgus deformity of feet it is important to makes stretching exercises for Achilles tendons and for m. triceps surae (**Fig. 14a, 14b, 14c**). Only such exercises are proper in therapy. Some rehabilitations doctors in Poland recommend the strengthening exercises for opposite group of muscles, what is in ours opinion “mistake of therapy”. Such incorrect therapy never give the good results. More about such harmful, iatrogenic therapy in chapter “Discussion”.

Special important is proper therapy of dysplastic hips, especially if on the same time in child exist the spasticity or sub – spasticity of the adductors muscles. In treatment of these children the good cooperation of doctor and parents is a special important. These children need permanent proper carrying on hands of parents, face to face, with maximal abduction and flexion of child’s legs and using the orthopedic devices. Recommended by “modern educated doctors and rehabilitants” the carrying of children with their “face to front”, to street, to shops is totally wrong and incorrect, is deny to old, but proper orthopedic rules.

Only abduction of hips through the 12 months prevent the dysplasia of hips and enable the good function of hips for the whole life of everybody. In the course of treatment of the MBD children should be included the orthopedic and rehabilitation special program like occupational therapy and positive psychological stimulation. The complete program should be made both for kindergarten, school and home.

## Discussion

In discussions of many doctors, physiotherapist and other group of researches appears very often the term “low tension of muscles” by the children with MBD. After such incorrect diagnosis they recommend also “the incorrect strengthened exercises”. In our opinion there is not problem of muscles, not “the low tension of the muscles” but is the laxity of soft tissues because is because of chemical changes in collagen, what we underline in our paper many times.

In our observation – the tension of muscles is bigger, even appears spasticity or sub – spasticity and laxity belong to the soft tissue in capsules, tendons, fascias, mostly after asphyxia of the child during pregnancy or during delivery. Clinically the problem is the spastic shortening of soft tissue and as result incorrect position of joint – what is in orthopedic term is called - “contracture”. The treatment of contractures was presented in previous chapter.

The treatment of laxity of joints is difficult, but beneficial are active exercises in geothermal water (mineral warm water).

## Conclusions

- 1/ In end of XX and in XXI century we observe in Poland from 7 % till 10 % of children and youth with the symptoms of Minimal Brain Dysfunctions (MBD).
- 2/ In children with MBD we observe two kinds of pathology – general laxity of joints and on the same time spasticity or mini – spasticity of muscles with their shortening.
- 3/ In situation of two fold pathology – shortening and laxity - can develop valgus or valgus – planes deformity of feet, recurvation of knees, anterior tilt of the pelvis with hiperlordosis of the lumbar spine.
- 4/ Not treated deformity of feet, recurvation or valgus deformity of knees, anterior tilt of pelvis

with hiperlordosis of lumbar spine in child's and youth period of life, can be the cause of pain syndromes in adults age.

- 5/ Neurologist, peditrician and orthopedic surgeons should realized the early program of treatment of all above mentioned deformities in childhood, what will be the best prophylaxis for adults people.
- 6/ In the treatment the best method there are stretching exercises for flexors of feet, of knees and of hips. The therapy should be prolonged so long as the child growth up.

## Figures

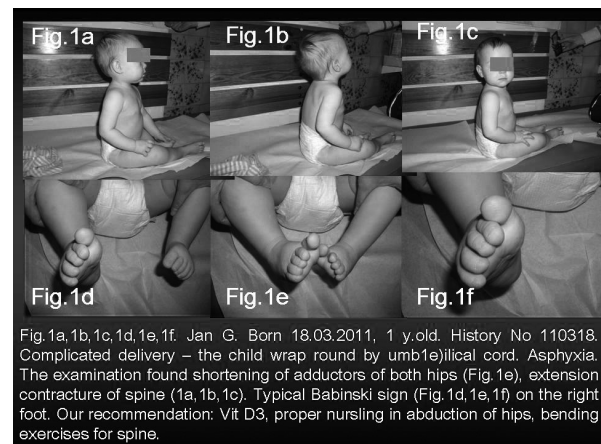


Fig. 1a, 1b, 1c, 1d, 1e, 1f. Jan G. Born 18.03.2011, 1 y. old. History No 110318. Complicated delivery – the child wrap round by umbilical cord. Asphyxia. The examination found shortening of adductors of both hips (Fig. 1e), extension contracture of spine (1a, 1b, 1c). Typical Babinski sign (Fig. 1d, 1e, 1f) on the right foot. Our recommendation: Vit D3, proper nursing in abduction of hips, bending exercises for spine.

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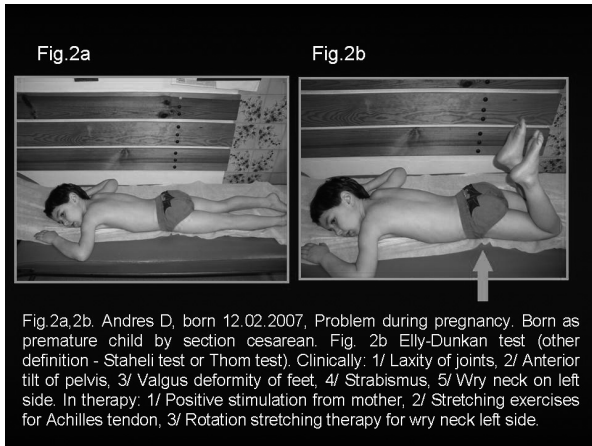


Fig. 2a, 2b. Andres D, born 12.02.2007, Problem during pregnancy. Born as premature child by section cesarean. Fig. 2b Elly-Duncan test (other definition - Staheli test or Thom test). Clinically: 1/ Laxity of joints, 2/ Anterior tilt of pelvis, 3/ Valgus deformity of feet, 4/ Strabismus, 5/ Wry neck on left side. In therapy: 1/ Positive stimulation from mother, 2/ Stretching exercises for Achilles tendon, 3/ Rotation stretching therapy for wry neck left side.

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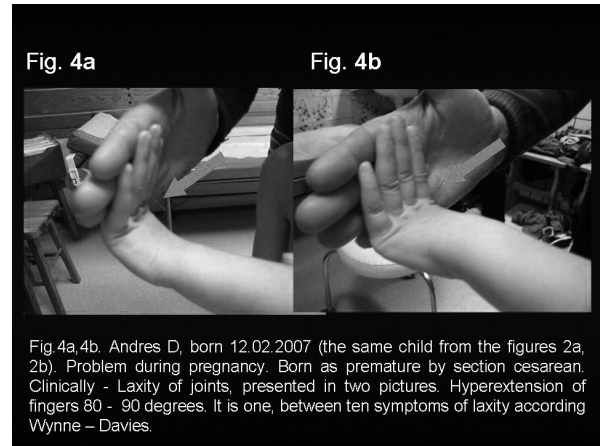


Fig. 4a, 4b. Andres D, born 12.02.2007 (the same child from the figures 2a, 2b). Problem during pregnancy. Born as premature by section cesarean. Clinically - Laxity of joints, presented in two pictures. Hyperextension of fingers 80 - 90 degrees. It is one, between ten symptoms of laxity according Wynne - Davies.

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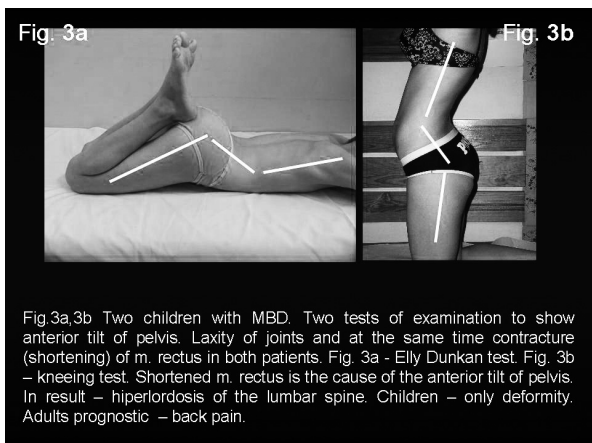


Fig. 3a, 3b Two children with MBD. Two tests of examination to show anterior tilt of pelvis. Laxity of joints and at the same time contracture (shortening) of m. rectus in both patients. Fig. 3a - Elly Duncan test. Fig. 3b - kneeling test. Shortened m. rectus is the cause of the anterior tilt of pelvis. In result - hiperlordosis of the lumbar spine. Children - only deformity. Adults prognostic - back pain.

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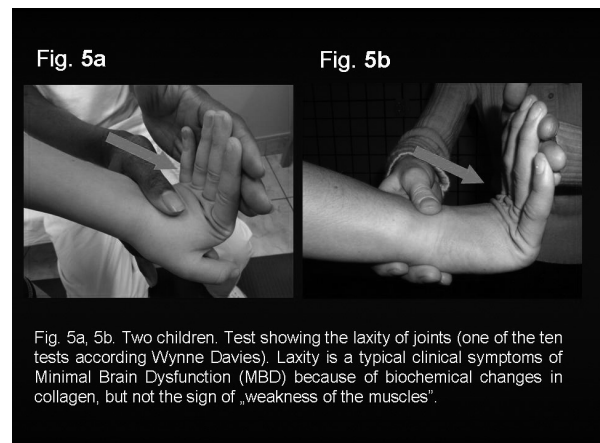
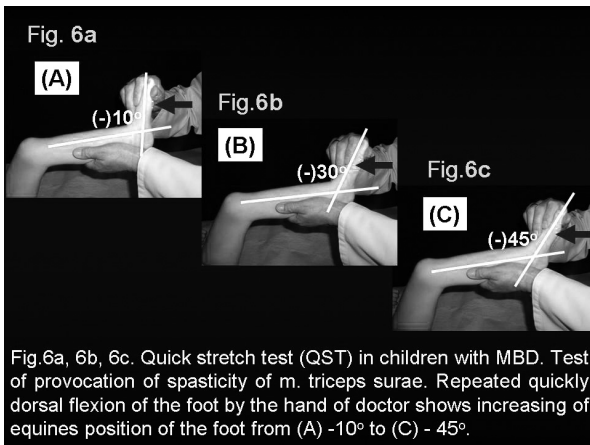
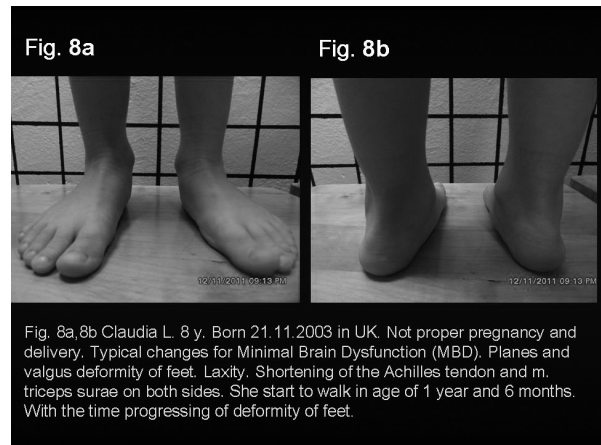


Fig. 5a, 5b. Two children. Test showing the laxity of joints (one of the ten tests according Wynne Davies). Laxity is a typical clinical symptoms of Minimal Brain Dysfunction (MBD) because of biochemical changes in collagen, but not the sign of „weakness of the muscles“.

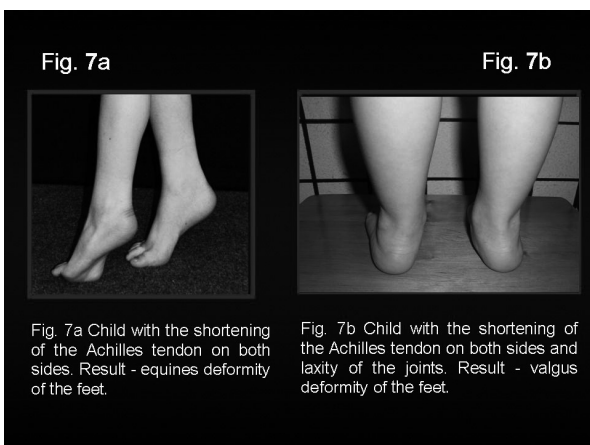
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**Fig. 6a, 6b, 6c.** Quick stretch test (QST) in children with MBD. Test of provocation of spasticity of m. triceps surae. Repeated quickly dorsal flexion of the foot by the hand of doctor shows increasing of equines position of the foot from (A) -10° to (C) - 45°.

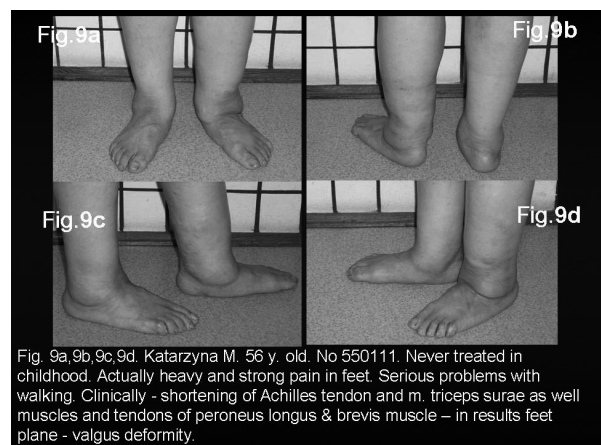


**Fig. 8a, 8b** Claudia L. 8 y. Born 21.11.2003 in UK. Not proper pregnancy and delivery. Typical changes for Minimal Brain Dysfunction (MBD). Planes and valgus deformity of feet. Laxity. Shortening of the Achilles tendon and m. triceps surae on both sides. She start to walk in age of 1 year and 6 months. With the time progressing of deformity of feet.

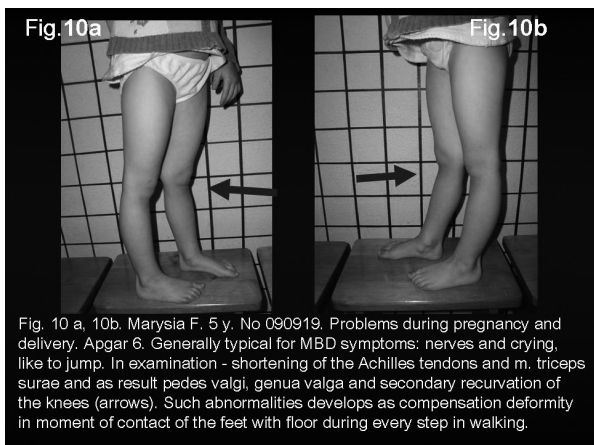


**Fig. 7a** Child with the shortening of the Achilles tendon on both sides. Result - equines deformity of the feet.

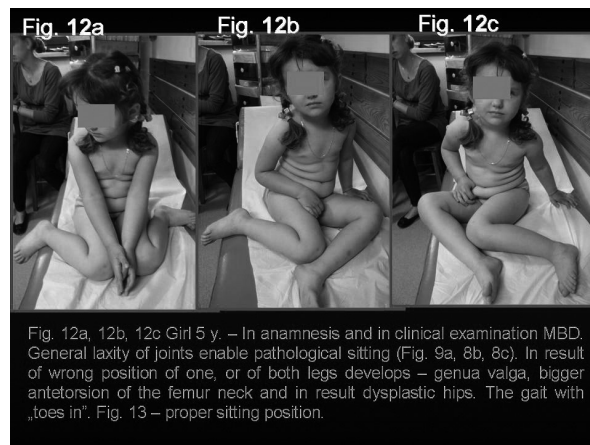
**Fig. 7b** Child with the shortening of the Achilles tendon on both sides and laxity of the joints. Result - valgus deformity of the feet.



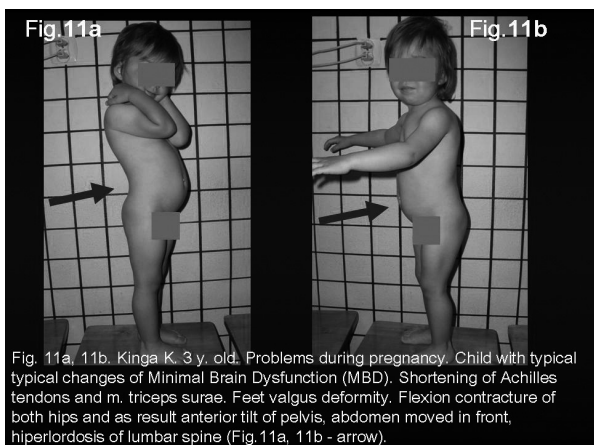
**Fig. 9a, 9b, 9c, 9d.** Katarzyna M. 56 y. old. No 550111. Never treated in childhood. Actually heavy and strong pain in feet. Serious problems with walking. Clinically - shortening of Achilles tendon and m. triceps surae as well muscles and tendons of peroneus longus & brevis muscle - in results feet plane - valgus deformity.



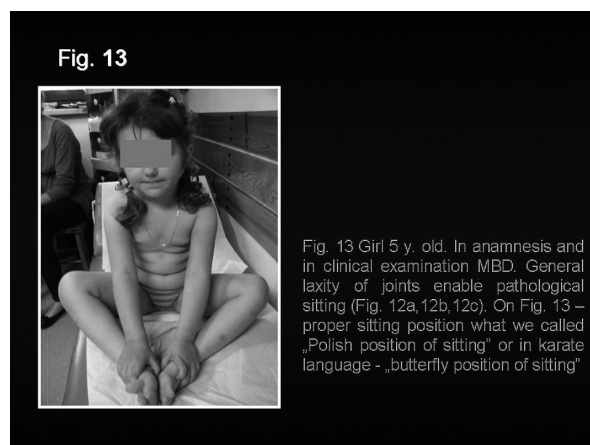
**Fig. 10a, 10b.** Marysia F. 5 y. No 090919. Problems during pregnancy and delivery. Apgar 6. Generally typical for MBD symptoms: nerves and crying, like to jump. In examination - shortening of the Achilles tendons and m. triceps surae and as result pedes valgus, genua valga and secondary recurvation of the knees (arrows). Such abnormalities develops as compensation deformity in moment of contact of the feet with floor during every step in walking.



**Fig. 12a, 12b, 12c.** Girl 5 y. - In anamnesis and in clinical examination MBD. General laxity of joints enable pathological sitting (Fig. 9a, 8b, 8c). In result of wrong position of one, or of both legs develops - genua valga, bigger antetorsion of the femur neck and in result dysplastic hips. The gait with „toes in”. Fig. 12d - proper sitting position.



**Fig. 11a, 11b.** Kinga K. 3 y. old. Problems during pregnancy. Child with typical changes of Minimal Brain Dysfunction (MBD). Shortening of Achilles tendons and m. triceps surae. Feet valgus deformity. Flexion contracture of both hips and as result anterior tilt of pelvis, abdomen moved in front, hiperlordosis of lumbar spine (Fig. 11a, 11b - arrow).



**Fig. 13** Girl 5 y. old. In anamnesis and in clinical examination MBD. General laxity of joints enable pathological sitting (Fig. 12a, 12b, 12c). On Fig. 13 - proper sitting position what we called „Polish position of sitting” or in karate language - „butterfly position of sitting”



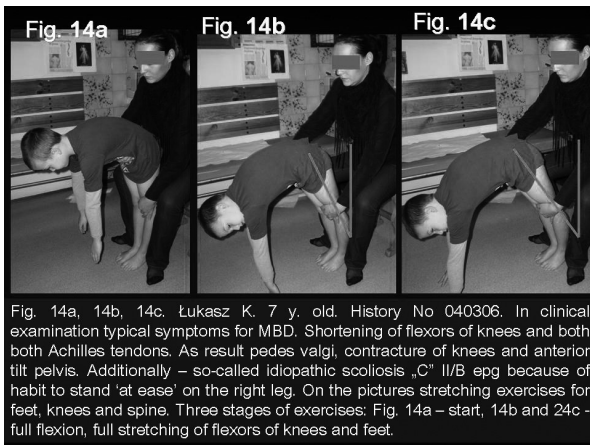


Fig. 14a, 14b, 14c. Łukasz K. 7 y. old. History No 040306. In clinical examination typical symptoms for MBD. Shortening of flexors of knees and both Achilles tendons. As result pedes valgi, contracture of knees and anterior tilt pelvis. Additionally – so-called idiopathic scoliosis „C” II/B epg because of habit to stand ‘at ease’ on the right leg. On the pictures stretching exercises for feet, knees and spine. Three stages of exercises: Fig. 14a – start, 14b and 24c - full flexion, full stretching of flexors of knees and feet.

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