

Monitorowanie wyników usprawniania skolioz za pomocą systemu DIERS

Monitoring the results of scoliosis improvement using the DIERS system

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Streszczenie

Celem pracy było przedstawienie nowoczesnej metody obrazowania postawy ciała człowieka jaką jest system DIERS formetric 4 d. Metoda ta wykorzystywana jest między innymi do bezinwazyjnej oceny efektów terapii pacjentów ze zdiagnozowaną skoliozą. Dzięki zastosowaniu aparatu DIERS formetric 4d, badanie postawy ciała może być wykonywane niemal w każdej chwili bez zastosowania reżimu czasowego pomiędzy poszczególnymi badaniami. Umożliwia to ocenę zarówno efektów terapii realizowanych w planie bliższym jak i tych realizowanych w założeniach planu dalszego terapii.

Zdaniem autorów pracy, zastosowanie metody DIERS formetric 4d w kontroli efektów leczenia skoliozy jest niezwykle istotne ze względu na możliwości częstego wykonywania tego badania, krótkiego czasu jego trwania oraz powtarzalności uzyskanych wyników. Są one dostępne bardzo szybko oraz istnieje możliwość ich porównania z wynikami badań poprzednich, co niezwykle ułatwi pracę fizjoterapeutom.

Słowa kluczowe:

skolioza, system Formetric 4D, DIERS, SOSORT

Abstract

The aim of the study was to present a modern method of imaging the posture of the human body, namely, the DIERS Formetric 4D system. This method is used, among others, for non-invasive evaluation of the effects of treatment of patients diagnosed with scoliosis. Using the DIERS Formetric 4D device, the test of body posture can be done almost any time without the use of a temporary regime between studies. This allows assessment of both the effects of the treatment carried out in the short term, as well as the assumptions of the plan for further treatment.

According to the authors, the use of the DIERS Formetric 4D method to control the effects of scoliosis treatment is extremely important because of the possibility of frequent performance this test, its short duration and repeatability of the achieved results. They are available very quickly and there is a possibility to compare them with the results of previous tests, thereby greatly facilitating the work of physiotherapists.

Key words:

scoliosis, the Formetric 4D system, DIERS, SOSORT

Broadly defined bad posture, including scoliosis, is becoming a huge problem in the modern computerized; both medical (diagnosis, treatment) and social (great costs associated with the treatment of spinal scoliosis). Currently, it is assumed that approximately 2-3% of the population in the developmental age suffers from idiopathic scoliosis [8]. Due to the lack of a clearly proven, effective therapies for idiopathic scoliosis, it seems extremely important to identify ways by which the progress of physiotherapy could be assessed. One of the basic methods of assessing the size of scoliosis is a metric X-ray

image. Unfortunately, due to the dose of X-ray radiation, it may only be carried out every six months. Therefore, other ways to determine and describe the posture and its abnormalities in a quantified manner are still sought for. The DIERS Formetric 4d method is precisely the needed method of assessing body posture (Fig.1.).

Idiopathic scoliosis belongs to a group of structural scoliosis.

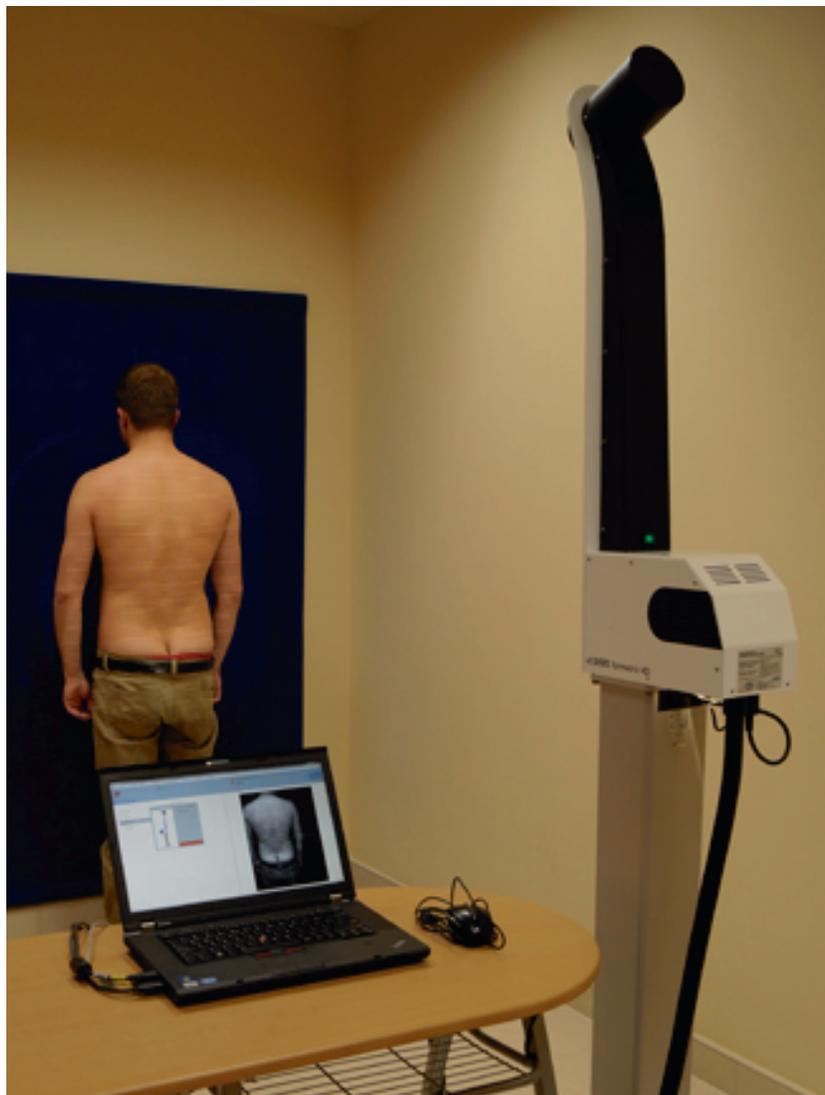


Fig.1 Patient during the examination with the DIERS Formetric 4D device (private collection)

Among the entire group, it represents 80% of all cases. The definition of idiopathic scoliosis says that it is the type of a spine scoliosis, whose causes are not possible to determine [1, 2, and 3]. Idiopathic scoliosis is characterized by several basic determinants:

1. A three dimensional deformation [2, 4].
2. The value of the scoliosis is measured on the basis of an X-ray image - Cobb angle is above 10° [1]
3. Always develops in childhood, and tends to progress [1, 2, 5]

Additionally occurring elements that deform the figure are:

- Rib hump,
- Asymmetry of the coastal arches,
- Body of lumbar vertebra,

- Asymmetry of waist angles,
- Asymmetry of brachiocephalic joints.

Treatment of idiopathic scoliosis, due to its unknown origin, is only the treatment of symptoms rather than the causes. Generally, the treatment is divided into:

- Surgical treatment - the major indication for surgical treatment is the scoliosis angle greater than 50° and ailments of the cardiovascular system;
- Conservative treatment - conservative treatment is a part of widely understood physical therapy [1, 2, and 6].

Due to the ambiguous definition of standards and procedures in case of idiopathic scoliosis, three basic scientific societies for the evaluation of information on the treatment of scoliosis and issuing recommendations regarding the same treatment were established.

SOSORT (Society on Scoliosis Orthopedic and Rehabilitation Treatment) deals with issuing recommendations for the treatment of idiopathic scoliosis in line with the latest state of knowledge about the disease.

IRSSD (International Research Society of Spinal Deformities) - deals mainly with the scientific basis of the formation of spinal deformity.

SRS (Scoliosis Research Society) - focuses mainly on the surgical treatment of idiopathic scoliosis [1, 6].

SOSORT developed, based on current research, guidelines for physical therapists regarding treatment of idiopathic scoliosis. The following objectives are included the treatment:

1. improving the aesthetics,
2. improving the quality of life,
3. reducing disability,
4. prevention and treatment of back pain,
5. improving and maintaining mental health,
6. prevention of progression to adulthood,
7. improvement / maintenance of respiratory function,
8. stabilization of the size of scoliosis (Cobb angle),
9. reducing the need for treatment in adulthood [1, 7].

The first two important points are related to the improvement of the visual image of the patients.

To assess the progress of treatment, which is unquestionably associated with the improved of the aesthetics of the body, several diagnostic methods can be used:

- X-ray metric images,
- Angle of rotation of the trunk measured using the Bunnell scoliometer.
- DIERS Formetric 4D.

An X-ray image, due to the amount of the emitted X-rays may be carried out in 6-month intervals. Unfortunately, the measurement using the Bunnell scoliometer can provide little information on other values, assessing the size of the scoliosis outside of the intermediate evaluation of the angle of rotation.

The method of three-dimensional studies of the spine, and thus broadly defined "posture", used in the DIERS device, is based on the projection of light patterns, which are a great alternative to tests for which X-rays are used.

As a part of monitoring the progress of the treatment the current state can be easily visually compared with the earlier

states. Fig. 2-4 Shown an example of comparing the results of improvement for patient K. S. Suffering from double contour scoliosis. The first test was done in January 2016, the second in April 2016 and the third in June 2016.

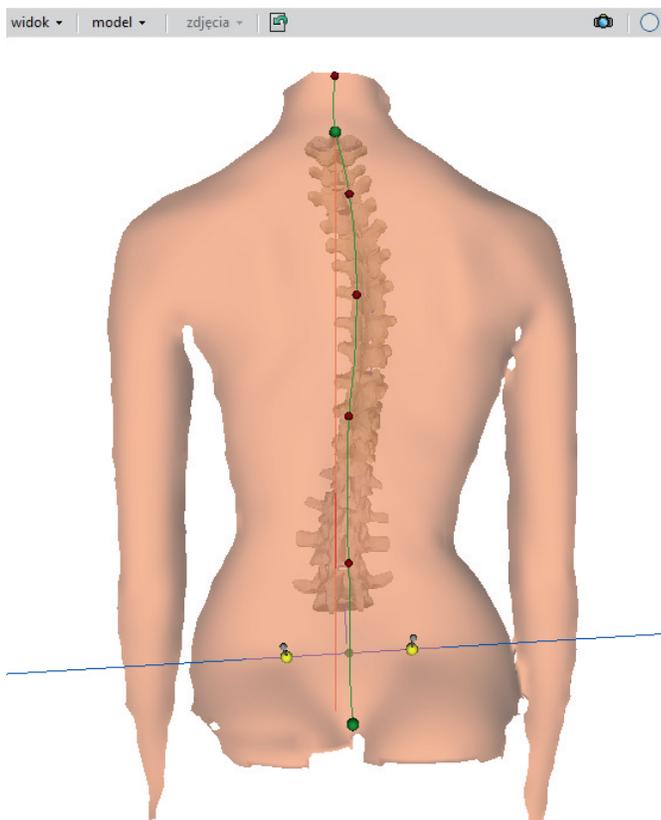


Fig. 2. Model of patient K.S. spine, test date: January 2016

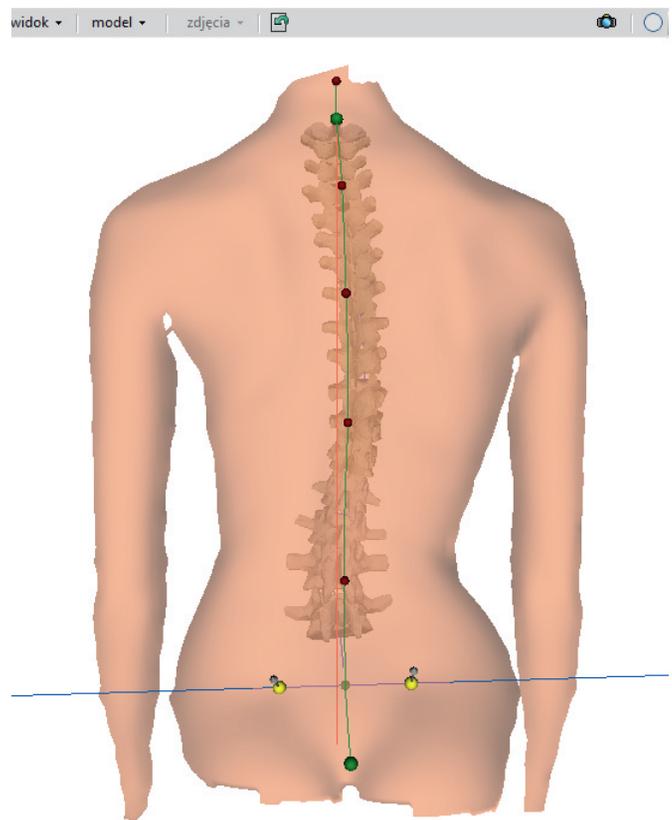


Fig. 3 Model of the patient's K.S. spine: test date April 2016

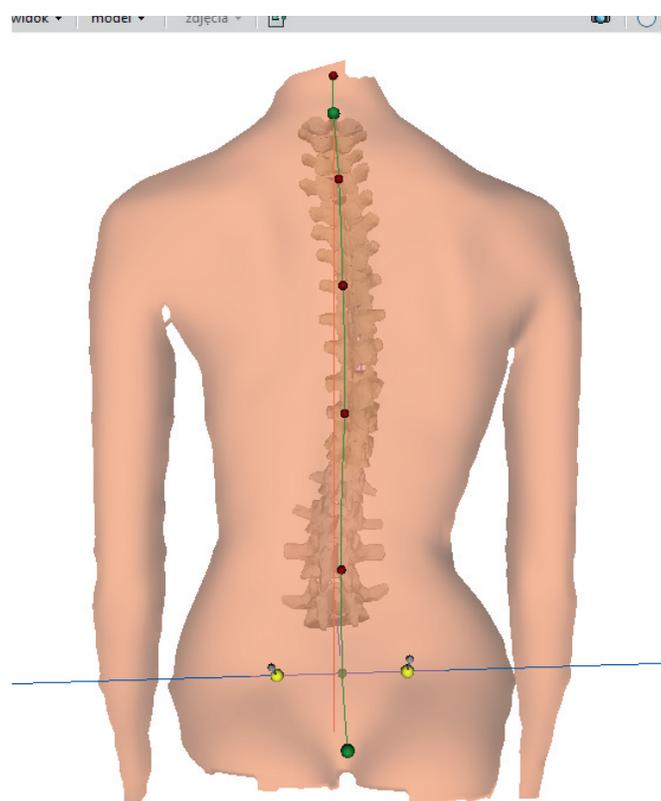


Fig.4 Model of the patient's K.S. spine, test date: June 2016

Often structural assessment of the value of the scoliosis does not translate clearly into the functional and visual evaluation of a patient with scoliosis. How can we keep assessing the parameters of the posture of a child affected by scoliosis a reliable, repeatable and accurate manner? Latest currently available on the market method is the DIERS Formetric 4D test system.

The test is based on the technology of rasterstereography (optical measurement of the surface) enabling the analysis of the back form, to reconstruct the geometry of the skeleton and support the orthopedic interpretation. Test carried out using the DIERS device gives results in line with the corresponding X-rays and at the same time it is possible to perform it even several times a day without exposing the patient to the risk associated with exposure to X-ray radiation. Reliability of the results of the back analysis when using the DIERS Formetric 4D system was confirmed by comparison with about 500 digital X-ray images. Sample comparison of the results of the X-ray testing and the DIERS tests of a female patient W. B., 16 years old, shown in Fig.5. and Fig. 6.

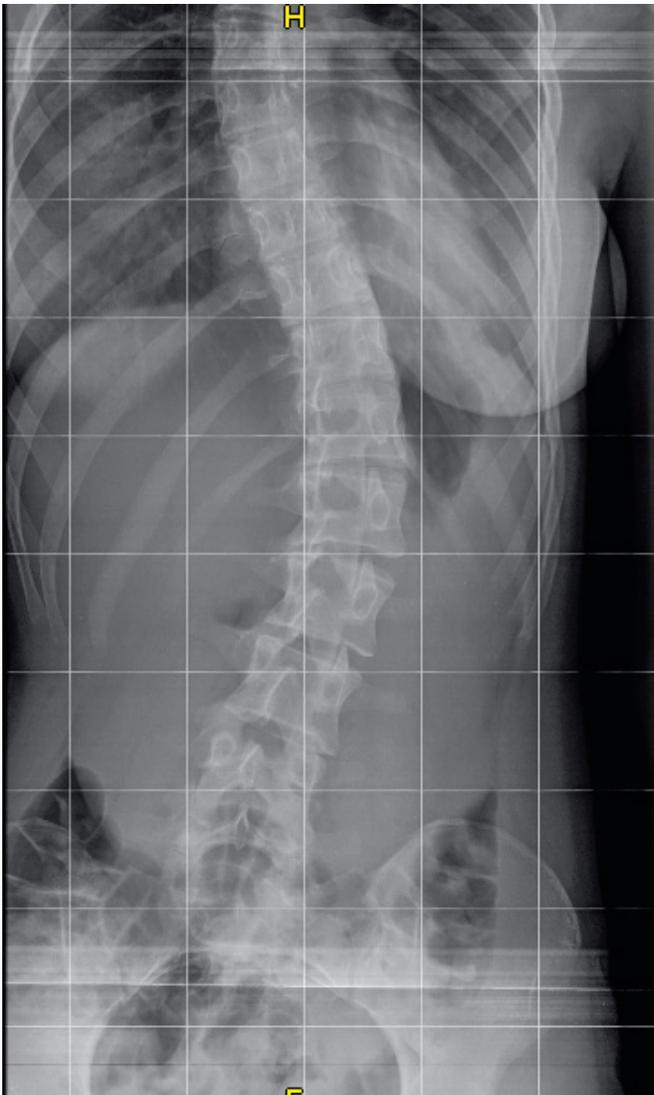


Fig.5 X-ray, patient W. B. 16 years old (private collection)

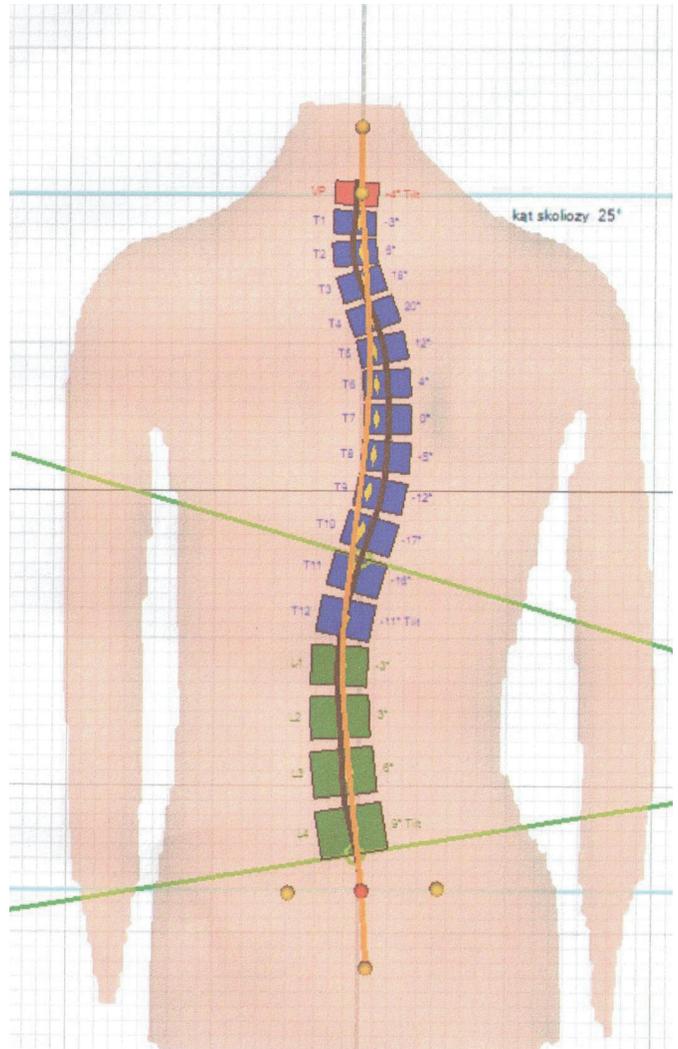


Fig.6. DIERS test, patient W. B., 16 years old.

Using the projector light sections in the form of parallel lines are projected on the back; they are at the same time recorded with a video camera. Exposure time in a standard test is the 6 seconds; 12 images are taken during that time to document the sequence of movements.

This image is loaded into the computer and by using the methods of photogrammetry and image processing a three-dimensional reconstruction of the surface of the back is performed. The location of the line of symmetry of the back is specified; a lot of information about scoliosis can be obtained from this point. This line is closely connected with the line of the spinous processes and follows it with high accuracy in the case of tests subjects with scoliosis. This allows specifying the rotation of the surface and the spatial course of the spine in all three surfaces.

The patient is examined in its habitual posture and as little as possible should be done to rectify it. Only physiotherapy aims at eliminating abnormally shaped patterns of static posture.

Another advantage of the system is that at the same time we can compare one test to the specific values of the parameters of interest to us but the assessment and comparison can be given to four test results in a graphical form. This provides the possibility to quickly assess the effects of the therapy and at the same time, greatly facilitates communication with the patients undergoing therapy, their parents and legal guardians. The test can be performed several times a day, so it is used to evaluate the different therapeutic actions and their impact on the posture of the patient in a short-term treatment. At the same time, it gives the opportunity to review the plan for further therapy and its modifications.

The patient must remain only in their underpants for the test and during the measurement a buttock and the gluteal gap must be uncovered as well. Hair must be tied above the neck in order to see the whole neck. The patient should not wear jewelry that could reflect light lines.

The test results are available after properly made measurements and analysis carried out by the computer. The authors use some basic parameters for assessment of patients with scoliosis:

- The slope of the trunk VP-DM,
- Deviation from the vertical VP-DM,
- Lateral deviation VP-DM (max)
- Pelvic obliquity DL-DR,
- Twisting the pelvis DL-DR
- The angle of kyphosis,
- The angle of lordosis,
- Rotation of the surface,
- The angle of the spine scoliosis.

Thanks to the above values given on the basis of parameters of the SI system, it becomes possible to describe the habitual posture, evaluate it and determine if there is possibly a bad posture occurring.

In the Markmed center in Ostrowiec, the patients undergo assessment with the use of the DIERS Formetric 4D device in different stages of physiotherapy:

- Preliminary assessment

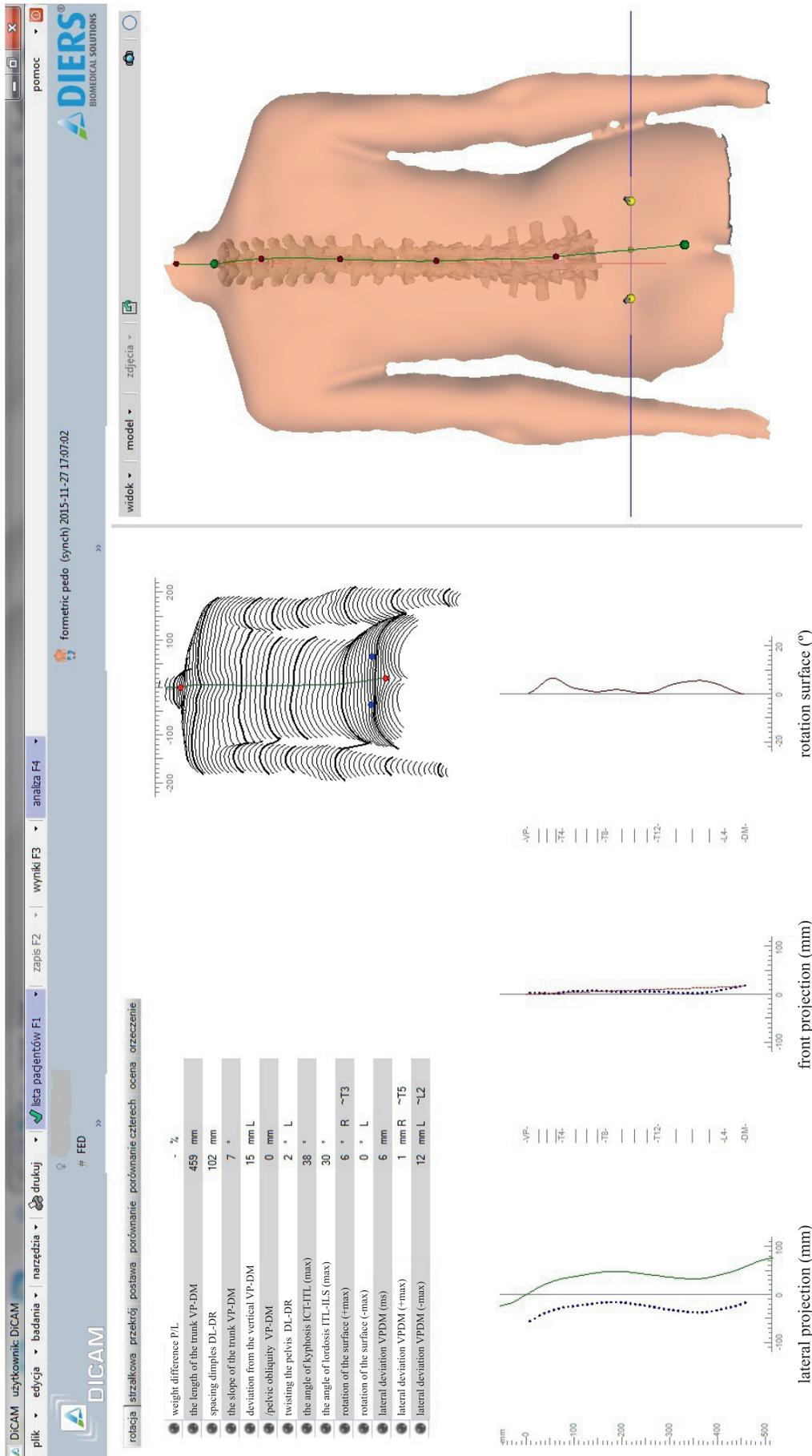


Fig. 7. Initial assessment of the patient using the DIERS test patient K. L., age 14

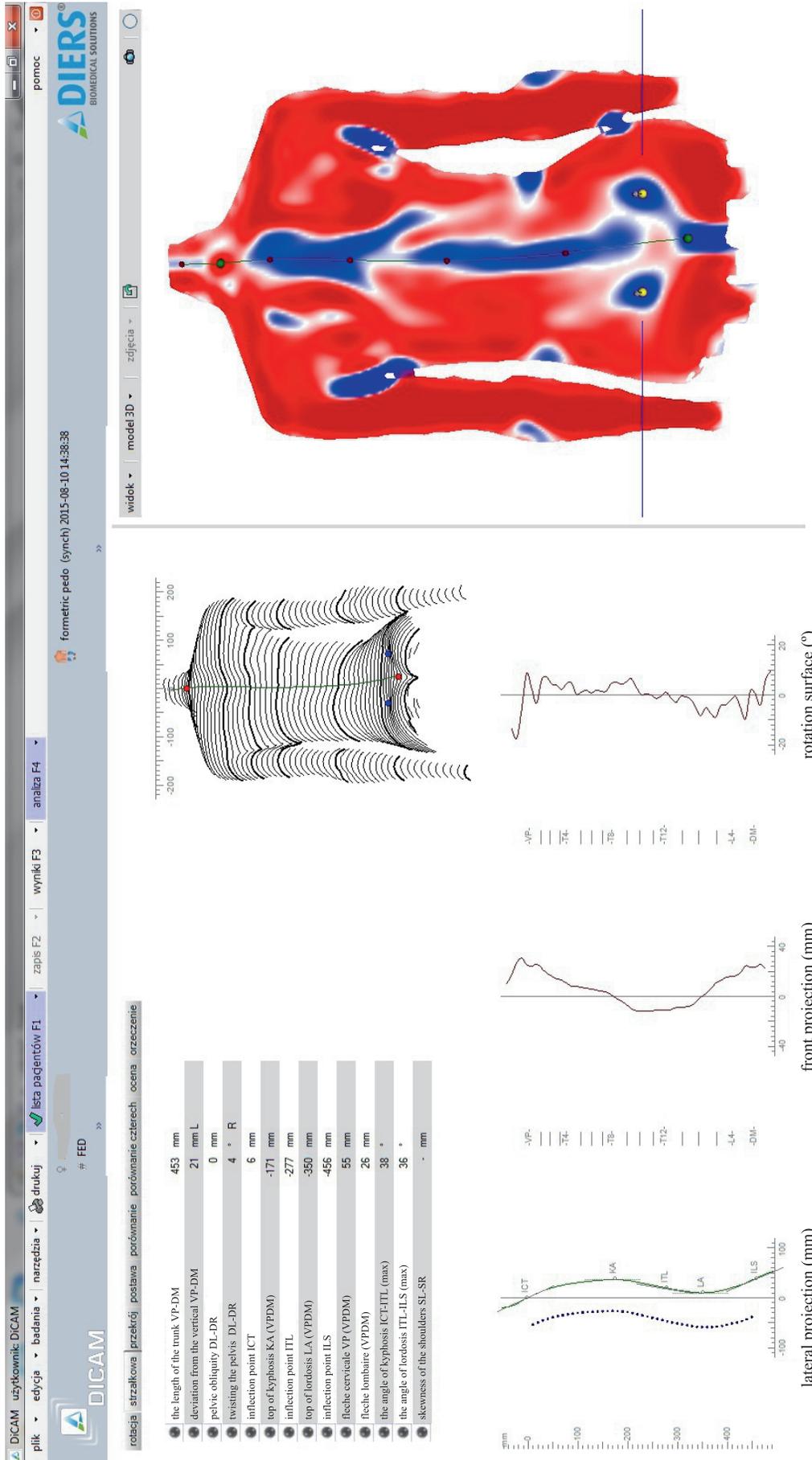


Fig. 8 Initial assessment of the patient on the basis of the DIERS test, patient D. W., age 15

- Evaluation of the plan for further treatment and thus, control of the effectiveness of the treatment shown in Fig.10. - Patient K.R., 13 years old. The area upper testing - October 2015, the lower area test - March 2016
- Communication with the patient, caregiver, doctor

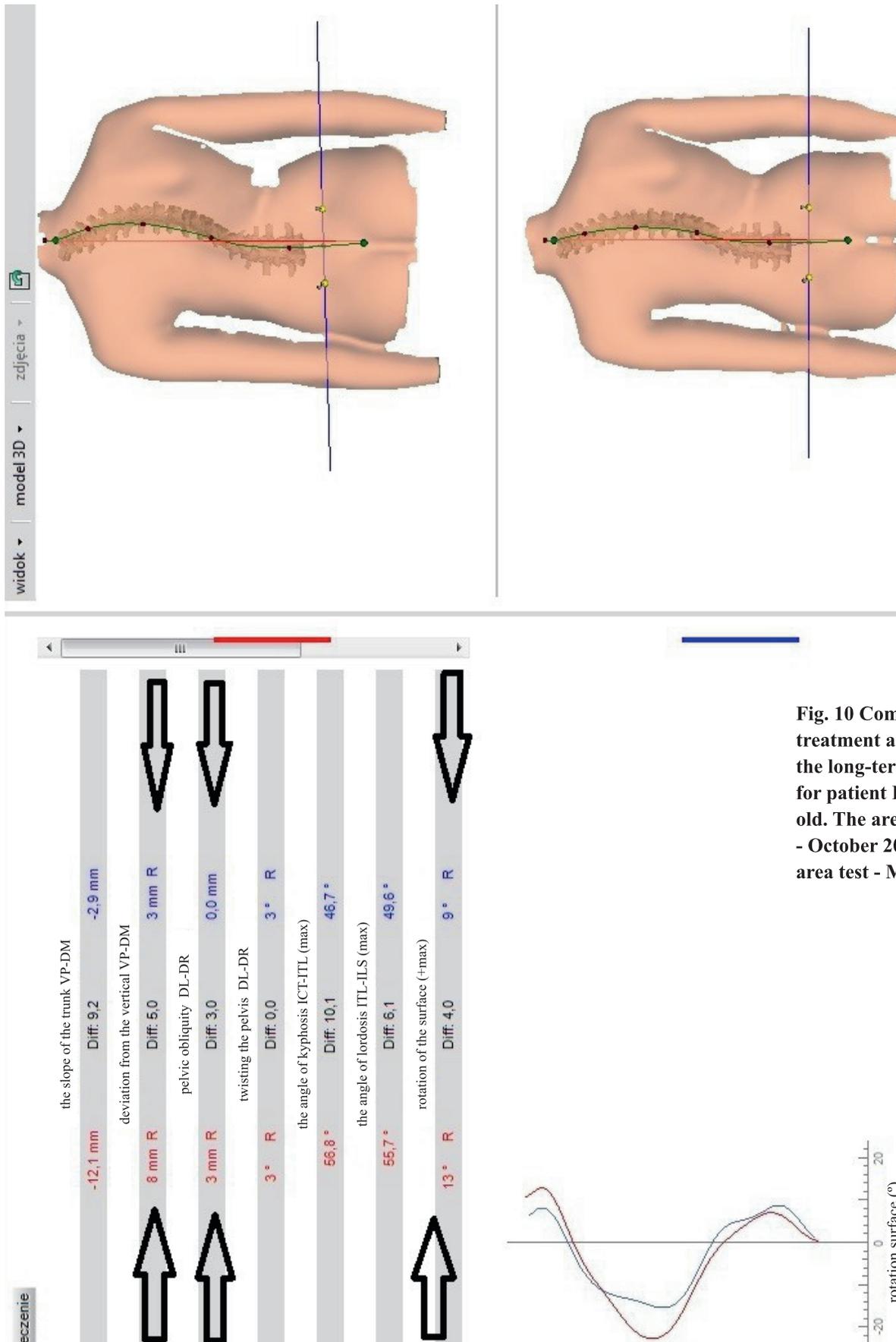


Fig. 10 Comparison of the treatment and the results of the long-term therapy plan for patient K.R., 13 years old. The area upper testing - October 2015, the lower area test - March 2016

Conclusions

1. Idiopathic scoliosis is a huge diagnostic and therapeutic problem and if left untreated, it leads to massive deformations of the trunk of the patient.
2. There are difficulties with standardized assessment of therapeutic process and evaluation of habitual posture of patients with idiopathic scoliosis.
3. The use of the DIERS Formetric 4D device allows obtaining conclusive results of standardized parameters defining the posture of the patient. They allow the comparison of the results of individual tests and evaluation of therapeutic proceedings.
4. Objective and standardized assessment of posture allows for a dialogue between therapists and parents / guardians of the patient.

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