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Improvements in the treatment of children with congenital clubfoot at an early age

Urinov J.Z, Djuraev A.M
E-mail: zhasurbek.urinov.81@inbox.ru
Respublician specialized research practical medical centre of traumatology and orthopedics, Tashkent, Uzbekistan
Davlatov B.N.
Andijan State Medical Institute
E-mail: dbnaprel@gmail.ru

Introduction. One of the anomalies in the development of the musculoskeletal system in children is a congenital clubfoot. According to WHO statistics, this pathology is 0.1-0.3% of per 1000 newborns. It accounts for 1.5-34.4% of diseases of the musculoskeletal system, and is in the second place after congenital dislocation of the femur.

Materials and methods. For the treatment of children with congenital clubfoot, we used a wide range of treatments, including: staged plastering, achillotomy, functional methods (corrective massage, exercise therapy, wearing functional splints), fixing methods (bandaging, applying staged plaster bandages), physiotherapy (electrical stimulation, hydrotherapy, UHF-therapy, ultrasound, electrophoresis, etc.). Specialized treatment included: orthopedics (braces, orthopedic device).

Results. Analysis of the results of treatment in different age groups showed that the main task of treatment and its success depends on the early restoration of anatomical relationships in the joint. So in children under the age of one year, early diagnosis and the use of atraumatic functional methods of therapy made it possible to achieve good results with a significant reduction in the number of plaster bandages and thereby reducing the duration of treatment in general to 2 months.

Discussion. The study of the experience of treating congenital clubfoot based on our own material showed that the use of one or another method of treatment depends on the assessment of the severity of foot deformity. The chosen treatment tactics should be intensive and consistent, starting from an early period after birth, when the deformity of the foot is mobile and amenable to correction.

Conclusion. In children with congenital clubfoot up to the age of three, it is advisable to carry out the minimally invasive technique of achillotomy developed by the clinic, which is easily feasible in terms of volume on an outpatient basis. This operation, performed on the soft tissues of the foot in 49 children, showed its effectiveness in 89.8% cases.

Keywords: clubfoot, plaster cast, recurrence, orthopedic regimen, children, congenital.

INTRODUCTION. One of the anomalies in the development of the musculoskeletal system in children is a congenital clubfoot. According to WHO statistics, this pathology is 0.1-0.3% of per 1000 newborns. It accounts for 1.5-34.4% of diseases of the musculoskeletal system, and is in the second place after congenital dislocation of the femur.

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Treatment and rehabilitation of congenital clubfoot, due to frequent recurrence, remains one of the unresolved problems of pediatric orthopedics. The problem is related to the imperfection of existing methods of surgical treatment, the lack of a unified point of view, insufficient postoperative rehabilitation, and a small number of publications on long-term results of treatment.

Treatment of children with congenital clubfoot begins from the moment the pathology is detected. In particular, with congenital clubfoot, therapeutic measures are necessary to eliminate the components of the deformation. With anomalies in the development of bones, treatment is aimed at eliminating the deformation of the foot and restoring the abnormal shape of the bones. In cases of neuro-orthopedic pathology, therapeutic measures will be aimed at correcting the shape of the foot and restoring the innervation of the affected limb.

Numerous conservative and operative methods for the correction of congenital clubfoot have been proposed. However, the recurrence statistics, which range from 12% to 36% of cases, does not satisfy either the parents of the child or the specialists dealing with this problem. On the other hand, long-term immobilization with plaster casts in the postoperative period does not allow for the necessary motor rehabilitation, it leads to the limitation of movements in the joints of the foot, hypotrophy of the leg muscles, which aggravates the recovery process.

MATERIAL AND METHODS OF RESEARCH

The study was conducted in 122 children (196 limbs) with congenital clubfoot, under the age of 7 years, who were hospitalized in the Department of Pediatric Orthopedics of the State Institution "RSSPMCTO" and State Institution "ARMMC" from 2015 to 2022.

Table 1 shows the distribution of children by gender and age. Patients were divided into age groups according to the WHO classification, based on the anatomical and physiological characteristics of children of different periods of life (newborn period - up to 29 days, infancy - from 30 days to 1 year, pre-preschool period - from one to three years, preschool - from 3 to 7 years of age).

Children with congenital clubfoot were divided into groups according to the nature of the lesion (Table 2). Bilateral deformations were observed in 72 (59%) patients, unilateral in 50 (41%). In the case of unilateral deformation, with right-sided or left-sided, the presence of the same number of patients, 25 each, was noted. Thus, bilateral lesions were more common than unilateral.

Table 2

Distribution of patients with clubfoot according to the nature of the lesion

Children's age	Foot lesions			Total	
	Unilateral		Bilateral	abc	%
	right	left			
up to 1 year	9	8	20	52	42,6
1 to 3 years	7	10	20	29	23,8

3 to 7 years	9	7	32	41	33,6
Total	25	25	72	122	100

For the treatment of children with congenital clubfoot, we used a wide range of treatments, including: staged plastering, achillotomy, functional methods (corrective massage, exercise therapy, wearing functional splints), fixing methods (bandaging, applying staged plaster bandages), physiotherapy (electrical stimulation, hydrotherapy, UHF-therapy, ultrasound, electrophoresis, etc.).

RESULTS

In this scientific study, the long-term results of the treatment of congenital clubfoot in 52 children under the age of one year was studied.

While studying long-term results, the following evaluation criteria were used:

- determination of deformation severity on the Catterall-Pirani scale;
- determination of the presence of foot deformation components;
- determination of the range of motion in the ankle joint;
- establishing the shape of the load-bearing part of the foot;

The results of correction of congenital clubfoot were evaluated using the Catterall Pirani scale. The criterion for evaluating the long-term results of treatment of congenital clubfoot was expressed in 3 indicators: good, satisfactory and unsatisfactory.

- the results of treatment were considered good if the scores on the Catterall Pirani scale were 0, there was no recurrence of clubfoot components, the range of motion in the ankle joint was not limited, and the load-bearing part of the foot was correctly formed;

- the results of treatment were considered satisfactory if the scores on the Catterall-Pirani scale were from 0 to 2 points, there was a partial recurrence of the clubfoot components, a limited range of motion in the ankle joint, and a moderate curvature in the load-bearing part of the foot was determined;

- the results of treatment were considered unsatisfactory if the scores on the Catterall-Pirani scale were above 2 points, there was a recurrence of all components of the deformaation, the range of motion in the ankle joint was limited (when the foot was not centered to its original position) and a pronounced curvature in the load-bearing part of the foot was determined.

Children divided into groups: the main group - 37 (71.2%) and the control group - 15 (28.8%); were treated according to the system we proposed in the period from 2017 to 2022 and traditional method between 2015 and 2017.

Children from the main group were treated in 3 stages: plastering, achillotomy and orthopedics.

Plaster bandages in children with congenital clubfoot were applied to the lower limb after the umbilicus fell off (on the 7-14th day after the birth of the child), if the child's weight was not less than 3 kg and there were no concomitant diseases. The plaster bandage was changed every 5-7 days. The number of plaster bandages depends on the severity of the deformation. To correct the components of the deformation, besides equinus, 4-6 plaster bandages were used. The equinus

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component in patients with congenital clubfoot was eliminated by achillotomy, performed according to our proposed method. After the performed achillotomy, the last plaster cast was applied for 3 weeks and an orthopedic device was prescribed.

Figure 1. Patient M., 9 months old. Congenital bilateral clubfoot. Before and after the treatment.

In the control group, children up to 15 days of age were prescribed Fink-Oettingen bandaging and corrective massage. After 15 days, corrective plaster bandages were applied to the deformed lower limb. After applying a plaster bandage, a special window was opened on the lateral side of the anterior-middle section of the foot to develop the foot. The change of the plaster bandage in patients was carried out every 15 days. The number of plaster bandages depended on the severity of congenital clubfoot (Fig.1).

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The severity of deformation in 52 patients was determined using the Catterall Pirani scale. On the Catterall Pirani scale, each feature was rated at 0, 0.5 and 1 point. The scores were used to determine the condition and result of foot deformation correction. A good result was assessed with an indicator of up to 1 point, a satisfactory one - from 1 to 4 points, an unsatisfactory one - more than 4 points (Fig. 2).

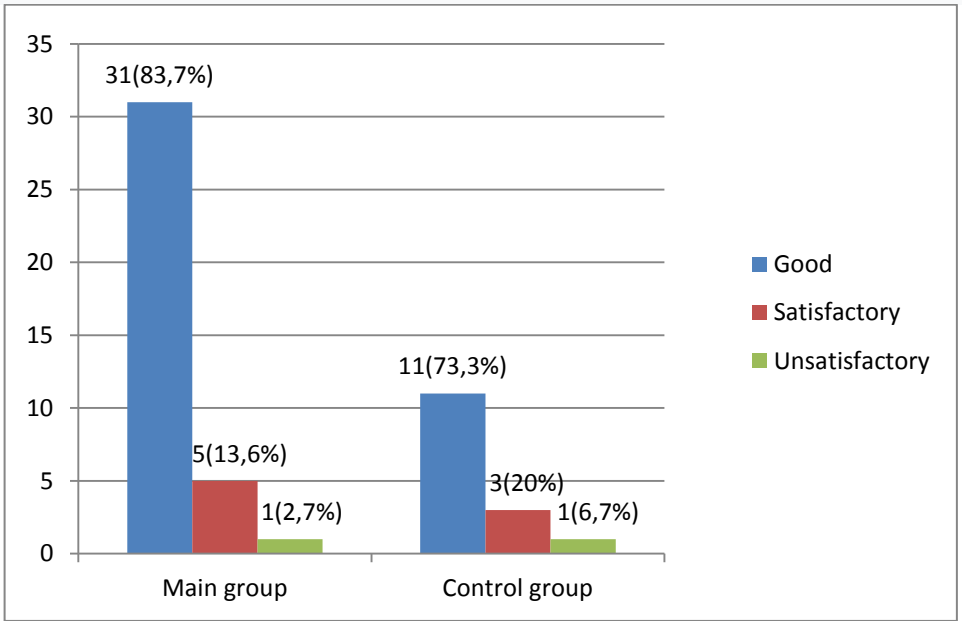

Figure 2. Diagram of comparative results of the research of congenital clubfoot according to the Catterall-Pirani scale in patients under the age of 1 year.

We have studied the results of treatment of congenital clubfoot in 29 children aged from one to three years. Sick children were divided into two groups: main and control.

The main group included 21 (72.4%) children treated in the period from 2017 to 2022 according to the proposed system of treatment. The control group included 8 (27.6%) children treated from 2015 to 2017 by traditional treatment.

Among the children studied, there were also those who turned to orthopedists late, who started treatment in other orthopedic institutions, and with deformation recurrences.

Children from the main group were put on corrective plaster casts, which were changed every 5-7 days. The number of plaster bandages depended on the severity of the deformation. It took 5-7 stages of plaster bandages to eliminate the components of the deformation. In 6 patients with recurrence of the deformation, repeated achillotomy was performed and after that the last plaster bandage was applied for 3 weeks, and then orthopedic devices were prescribed. In the rest of the patients, it was possible to eliminate the components of the deformations only by applying plaster bandages.

For children from the control group, corrective plaster bandages were applied according to the traditional method. 2 out of 8 patients managed to eliminate the

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components of the deformation using a plaster cast. In 6 patients, the remaining deformities were corrected by achilloplasty according to the Bayer method. After achilloplasty, corrective plaster bandages were applied to the lower limb for 1 month.

In patients under the age of 3 years who independently started walking, computer-assisted podometric studies of the feet were performed. A special device with a platform was used to determine the distribution of the load on the load-bearing parts of the foot and assess the severity of their deformation before and after the end of treatment. The effectiveness of the treatment was determined by comparing the obtained results with the primary data, with the mathematical processing of indicators of the podometric study of the condition of the feet.

While studying long-term results, the following evaluation criteria were used:

- establishing the shape of the load-bearing part of the foot;
- determination of the presence of clubfoot components;
- determination of the degree of severity of deformation using computer podometry;
- determination of the load capacity of the foot, when the child walks independently.

The criteria for long-term results of congenital clubfoot were the following indicators:

- the results of treatment were considered good if the foot acquired the correct shape, there was no recurrence of clubfoot, the calcaneal-axial angle was within the normal range, and the child walked with full load on the foot;
- the results of treatment were considered satisfactory if the foot acquired a partially curved shape, there was a partial recurrence of clubfoot, the calcaneal-axial angle was up to 15°, and when the child walked, there was a partial violation in the load-bearing part of the foot;
- the results of treatment were considered unsatisfactory if there was a recurrence of all components of the deformity in the foot, the calcaneal-axial angle is above 16°, and the child walks with a load on the front or outer parts of the foot (Fig. 3.).

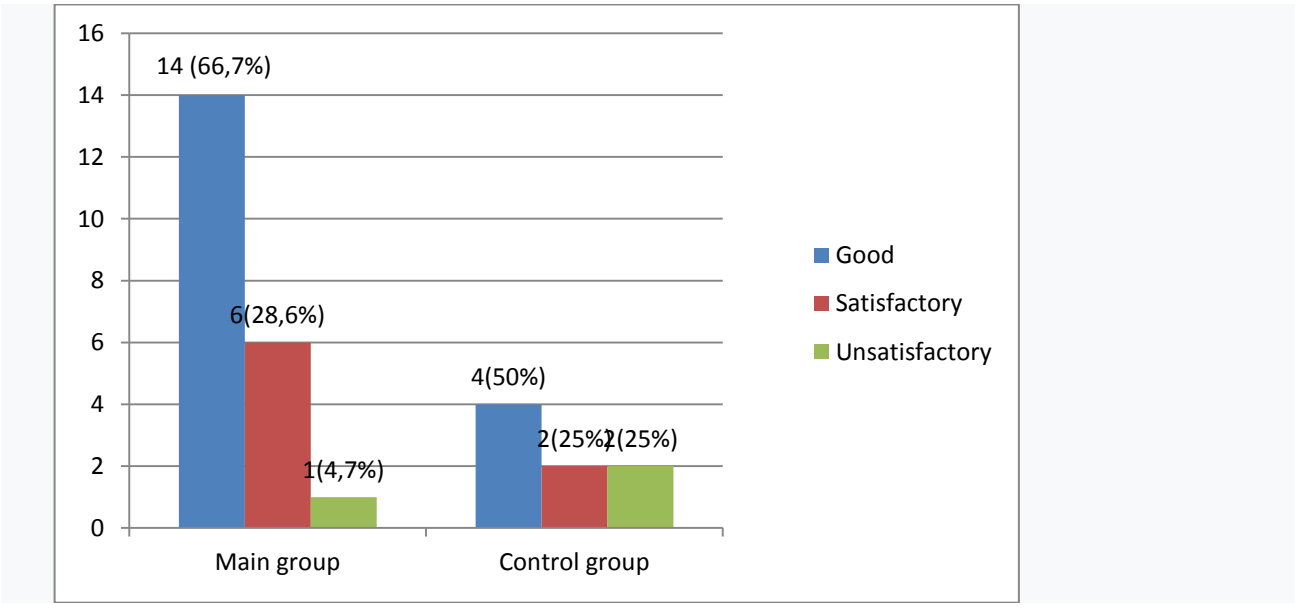

Figure 3. Diagram of comparative results of the research of computerized podometry in patients aged 1 to 3 years with congenital clubfoot.

Previously, a computer-podometric examination in children was carried out to determine the severity of flat feet. Having studied the parameters of podometry, we got an idea about the formation of the load-bearing part of the deformed foot and in a comparative aspect with the normal foot (Fig. 4)

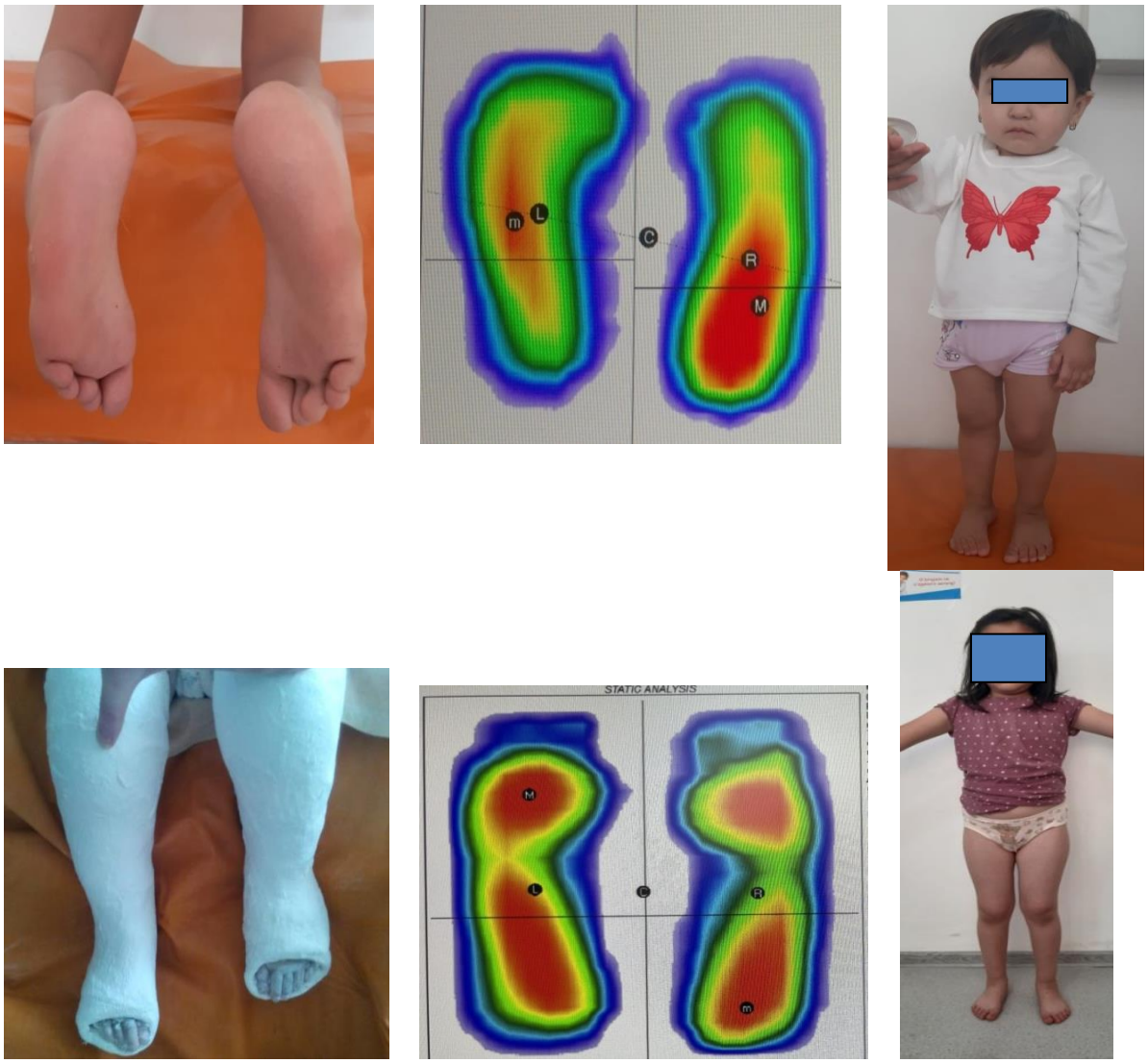

Figure 4. Patient K., 38 months old. Congenital bilateral clubfoot. Before and after surgery.

The results of treatment in 41 sick children with congenital clubfoot aged from three to seven years were studied. Sick children of this age category were divided into 2 groups: main and control.

The main group included 24 (58.6%) children who were treated in the period 2017 to 2022. In these children, staged treatment was carried out using the Ilizarov compression-distraction apparatus, the imposition of a corrective plaster bandages for 1 month, and the installation of an orthopedic device on the lower limb.

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The control group included 17 (41.4%) children who were treated in 2015-2017. These children were treated using various techniques. In 9 children, achilloplasty was performed with the application of the Ilizarov apparatus to the lower limb and subsequently wearing orthopedic shoes, and in 8 children, after achilloplasty, plaster bandages were applied to maintain the achieved correction, and after removing the plaster bandage, orthopedic shoes with a hard back were recommended to children in the control group.

When studying the long-term results in 41 sick children with congenital clubfoot aged from three to seven years, the following evaluation criteria were used:

- establishing the shape of the load-bearing part of the foot;
- determination of the presence of clubfoot components;
- determination of the deformation severity using radiography of the ankle joint;
- determination of the load capacity of the foot when the child walks independently.

The criteria for long-term results of congenital clubfoot were the following indicators:

- the results of treatment were considered good if the foot acquired the correct shape, there was no recurrence of clubfoot, all radiological parameters were normal and the child walked with full load on the foot;
- the results of treatment were considered satisfactory if the foot acquired a partially curved shape, there was a partial recurrence of clubfoot, despite a slight deviation from the norm on the radiograph of the ankle joint, and when the child walked, there was a partial violation of the loaded part of the foot;
- the results of treatment were considered unsatisfactory if there was a recurrence of all components of the clubfoot in the foot, a significant deviation was noted on the radiograph of the ankle joint, and the child walked with a load on the front or outer parts of the foot (Fig. 5).

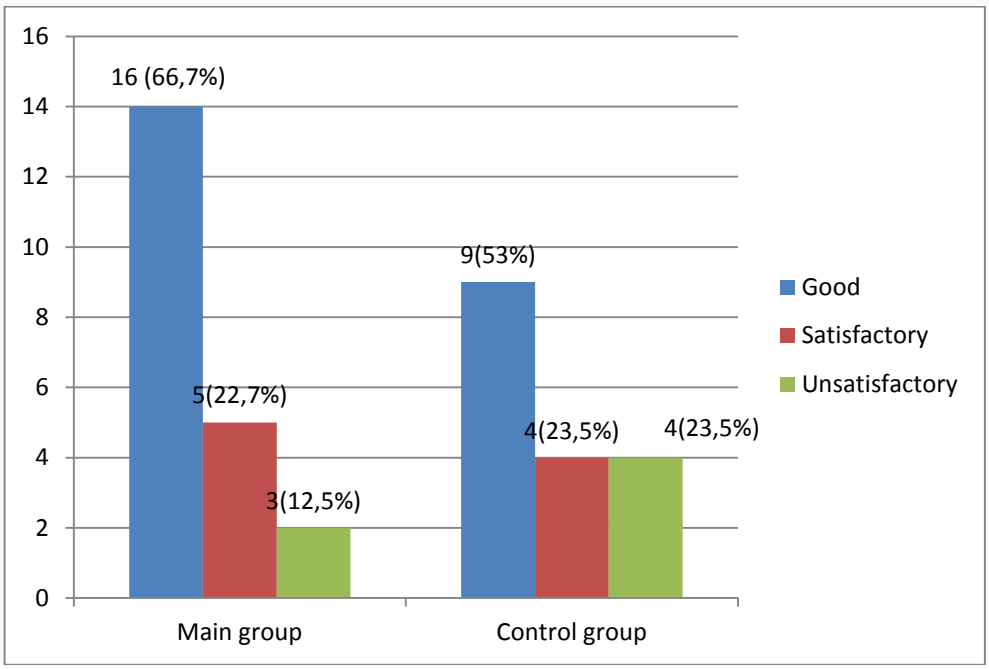

Figure 5. Diagram of comparative results of radiometric parameters of congenital clubfoot in patients aged 3 to 7 years.

DISCUSSION. A deformed foot has a negative effect on the child when walking. The foot is the distal region of the lower limb of the human body and performs the main function in a dynamic and static position. Each violation of the shape of the foot negatively affects the psyche of the child, limits physical activity, and further complicates the choice of profession. Subsequently, there is a violation of movements in the ankle joint. The skin, tendons, muscles on the medial side of the foot are shortened, and on the lateral side they are elongated. This deformity can occur in an isolated form and in combination with other pathologies of the foot. Mixed deformation of the foot is difficult to treat and often recurs. Untimely treatment of congenital clubfoot can lead to disability of the patient.

The study of the experience of treating congenital clubfoot based on our own material showed that the use of one or another method of treatment depends on the assessment of foot deformation severity. The chosen treatment tactics should be intensive and consistent, starting from an early period after birth, when the deformation of the foot is mobile and amenable to correction.

CONCLUSIONS. Deformitions in the joints of the lower extremities in patients with CC develop in antenatal period, until the age of 3, movement disorders of an unfixed nature are still amenable to minimally invasive orthopedic correction. In the future, secondary changes occur in the soft tissues and bone structure of the musculoskeletal system, mixed stable contractures develop in the joints of the foot, requiring combined surgical intervention. The program of diagnostics and choice of treatment method developed by us allows us to assess the motor abilities of the child and choose the best option for correcting the identified deformation

1. Treatment of children with congenital clubfoot must begin from the first days after the child is discharged from the maternity complex.
2. To prevent recurrence, it is advisable to carry out rehabilitation treatment and adherence to the orthopedic regimen up to 4-5 years of age.
3. Compliance with the orthopedic regimen during the period of treatment and outpatient observation leads to a good result.

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