SURGICAL TREATMENT OF CHILDREN WITH MOBILE FLAT FEET.

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KEYWORDS
Flat feet, Pes Planovalgus, foot arch, Evans, Kidner, treatment methods for flat feet.

ABSTRACT
This article presents one of the most urgent problems of our century for orthopedists - improved surgical methods, traditional and long-term postoperative results of flat feet.
Materials and methods: Republican Specialized Traumatology and In the Department of "Hand and Foot Claw Surgery" of the Center for Orthopedic Scientific and Applied Medicine, a study was conducted on 74 patients treated with flat feet from 2019 to 2024, in which MSCT, X-ray, podometry, MRI and clinical examination methods were used.

Introduction

Flat feet is one of the most common diseases among young people and adolescents. Traditional treatment methods show that children, teenagers and the frequency of occurrence in adults does not depend on their age. With this disease, parents usually turn to orthopedists because they are worried about the appearance of their children's legs[10].

Research shows that 90% of children under the age of 10 they come to orthopedists with flat feet. The development of children's flat feet for various reasons and the fact that the arch of the foot is a developmental process with age and the changes in children's gait make parents go to the doctor [10]. There are several types of flat feet that require operative treatment, such as congenital deformity of the foot (Pes Planovalgus), mobility of the foot [4]. There are 2 important signs of classic flat feet: a decrease in the arch of the foot and a valgus deformity of the back of the foot. Flat feet is still a problematic condition in orthopedics, and the exact cause of its origin has not yet been determined. In early youth, conservative and in ineffective cases require operative treatment. According to scientists, up to 78% of children have flat feet. At the age of 2-6, this indicator is 37-60%, and at the age of 8-13, it is 4-19%. The main reasons for this are gender, excess body weight, low-quality shoes, and family tendencies [14].

The purpose of the research: The purpose of the research is to improve the effectiveness of surgical treatment of children with longitudinally mobile flat feet.

Materials and methods: 73 patients treated with flat feet were followed up from 2019 to 2024. There were more boys among the examined patients - 47 (64.4%). There were 26 girls (35.6%) of the total number. The age limit for patients is 11 to 24 years old in boys. Female patients are 6 to 30 years old. The average age of the patients was 14.5±3.3 years. Out of the total number of 26 women with flat feet, 22 (85%) patients had bilateral flat feet, and 4 (15%) had unilateral flat feet. Out of 4 patients with unilateral flat feet, 3 (75%) had left-sided and 1 (25%) had right-sided. Out of the total number of 47 boys with flat feet, 36 (77%) patients had bilateral flat feet, 11 (23%) had unilateral flat feet. Out of 11 patients with unilateral flat feet, 9 (81%) had left-sided and 2 (19%) had right-sided. All 73 patients (100%) in this follow-up underwent operative treatment.

Dissertation materials: diagnosis and treatment of patients observed in inpatient conditions at the Department of "Hand and Foot Paw Surgery" of the Republican Specialized Traumatology and Orthopedic Scientific and Practical Medical Center under the Ministry of Health of the Republic of Uzbekistan (head of the center - M.E. Irismetov) is based on the study of the results.

73 patients under observation were divided into 4 groups: the main group A (53 patients with mobile flat feet, 73% of the total number of patients with mobile flat feet was 17 (32% women) and 36 (64% men).

Observation group B (8 patients with a diagnosis of vertical love bone were observed. And it is 11% of the total 73 patients). Of these 8 patients, 7 (87.5% were girls) and 1 (12.5% were boys).

Follow-up group S Torsal cFlat feetlition was observed in 10 (14%) of 73 patients under follow-up. Of the patients in this follow-up, 10/2 (20%) were women and 10/8 (80%) were boys.

Observation group D patients with paralytic flat feet were observed in 2 (2%) of 73 patients under observation, and 2 of these patients (100%) were boys.

One of the characteristics involved in the origin of flat feet is the large calf posterior muscle tendon dysfunction and the patients with extra bone were observed in 7 out of 73 patients (9%) observed in the remaining 91% of patients. 7/5 (71%) of these patients were women and 7/2 (29%) were boys. In 2 patients, only extra bone removal was performed in women, and in patients who did not achieve the desired gFlat feetl, they also underwent a modified Evans and Kidner operation.

Grouping of patients according to the performed operation (1-table)

Sex	Evans and Kidner modification		Additional bone get		Kidner		Arthrodesis		Arthrodesis + Evans		Sumar Sowell Romsey		Kidner and calcaneal stop		Synostosis resection		Synostosis resection and evans operation		Arthroplasty and synostosis resection		Medial osteotomy	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
A	6	6	1	1	1		1	1			2	3			1	1					1	
E	20	11				3	2	1	1		1	0	1	1	2	1	1		1	1	1	
Total	26	17	1	1	1	3	3	2	1	0	3	3	1	1	3	2	1	0	1	1	2	0

This table showed that boys have higher rates of EI than girls. The fact that the majority of patients with mobile flat feet make up the severe level of flat feet, and this can lead to a decrease in the quality of life of a growing child, is evaluated by the high social importance and significance of our chosen scientific work.

Although patients with mild degree of flat feet (1-D) were observed as outpatients, taking into account that there was no need for surgical procedures, such patients were not included in the observation groups of the study.

Of the 73 patients treated operatively and followed up, Achilles tendon lengthening was observed in 73/19 (26%) patients, and 3 (16%) of these patients were women and the remaining 16 (84%) were men. Of these 19 patients, 17(89%) were patients with Z-shaped Achilles tendon lengthening and 2(11%) were patients with percutaneous Achilles tendon lengthening.

Another group of patients are patients who have additional deformities in the foot apart from flat feet and are formed as a co-morbidity. For example, patients with hallux valgus make up 73/2 (3%) of the total number of patients, and in these patients, in addition to Evans and Kidner operations, additional SKARF corrective osteotomy was performed.

The number of patients presenting with valgus deformity of the knee joint is 73/2 (3%) of the total patients, and these patients underwent modified Evans and Kidner operations after elimination of valgus deformity in the knee joint.

When diagnosing:

X-rays of CAs were performed in standard frontal and lateral projections. When performing lateral examination under lFlat feetd, the X-ray tube was placed on the side perpendicular to the axis of the leg, after making sure that the patient evenly distributed the lFlat feetd on the legs (Fig. 5).

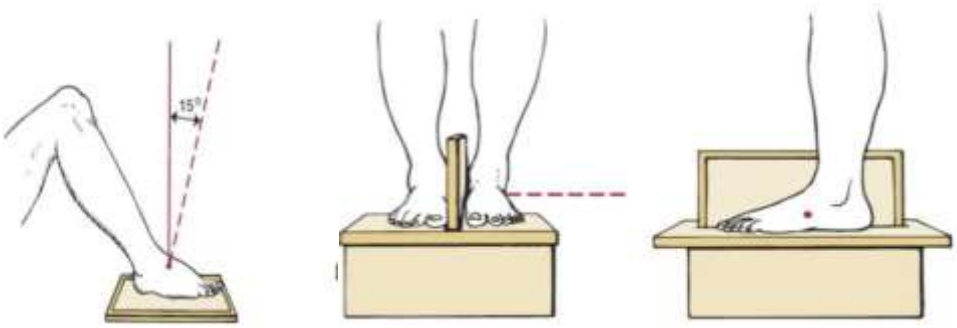

Figure 1. X-ray drawing of the paws: under frontal and lateral lFlat feetd.

Based on radiography, the following angles calculated from the main criteria were measured in order to clarify the degree of deformation of the FLAT FEET (see pictures 6-7):

1. Meary angle (Talus-1-Metatarsal angle) is formed by lines passing through the middle of the head of the talus bone and the middle of the body of the first metatarsal bone. Usually, these lines almost always continue each other. The angle is measured in plantar projection (normally 0-4) and under lFlat feetd in lateral projection (normally 0-4). The height of this angle from the norm indicates the alignment of the inner longitudinal belt.
2. Kite angle (tarsal-heel angle) is measured in lateral and plantar projections. The talus bone is formed by lines passing through the middle of the head and along the outer surface of the calcaneus. Normally it is 15-30.
3. The heel-cuboid angle is formed by lines passing along the outer surface of the heel and along the outer surface of the cuboid bone. Normally, these lines should run almost parallel. This angle will be more than 8, depending on the degree of deformation of Flat feet.
4. The angle of inclination of the ankle bone is measured in the lateral projection: it is formed by the sum of the lines passing along the lower edge of the calcaneus and the plantar surface of the heel. Usually it is 18-20.
5. The scapular angle is also measured in the plantar projection. It is formed by the intersection of the lines connecting the points of the edge of the arc of the articular surface of the navicular bone and the points of the edge of the articular surface of the head of the talus bone. It is normally in the range of 2-7, and an increase in the angle indicates problems in the Shoparov joint.
6. The greater shin-heel angle is determined in the correct projection, formed between the axis of the greater shin and the axis of the calcaneal crest. Usually, the angle is considered normal in the range of 3-7. In case of valgus deviation on the back surface of the foot, the angle can increase to 15.

When analyzing the X-rays, attention was also paid to the location and size of the extra bone, os tibiale externum. In some cases, the size of this bone reaches 15 mm and may affect the future operation. When the extra bone grows, it can compress the tendon of the calf back muscle, disrupt its function, and due to this, a flat-valgus deformity can develop. The presence of extra bone is a direct indication for its removal and strengthening of the tendon-muscle complex.

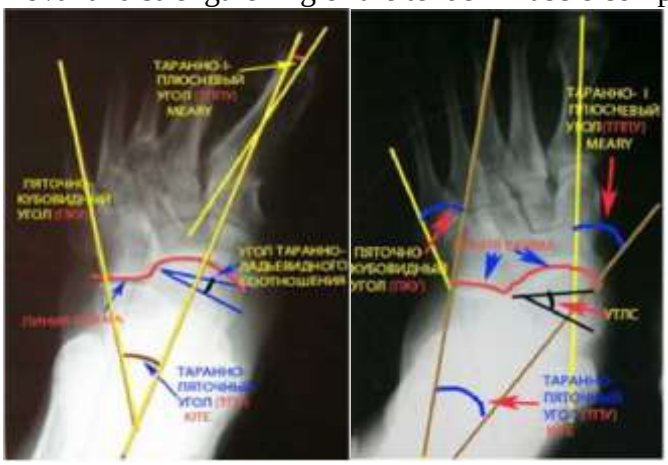

Figure 2. The size of the corners of the norm in X-rays of the feet

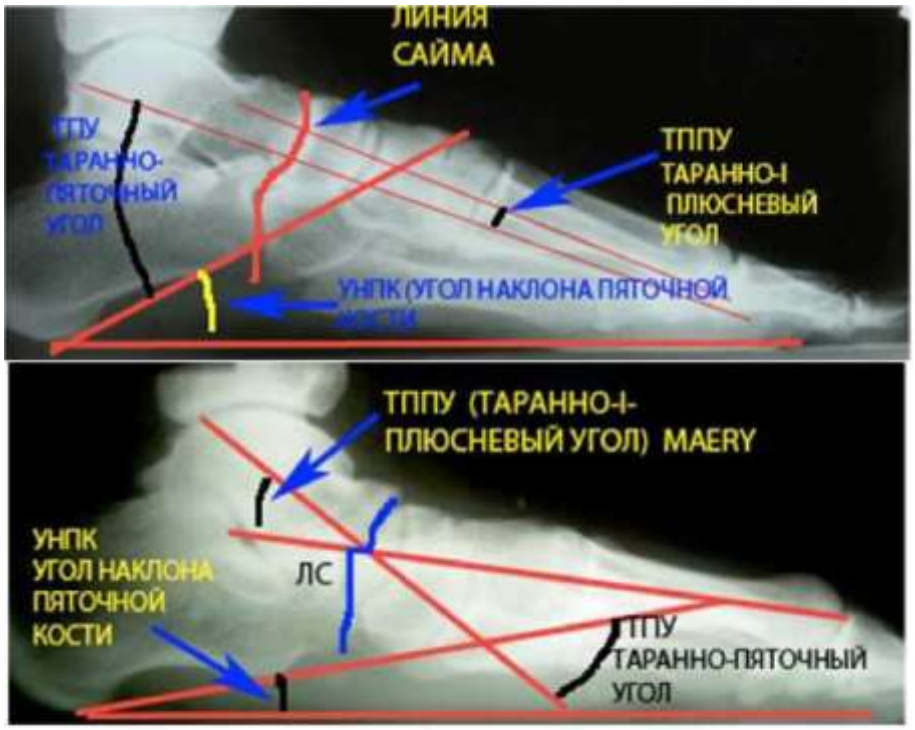

Figure 3. Changes in the corners that can be detected on X-rays in the case of Flat Feet.

Plantography.

The main method of instrumental research is ***"X-ray drawing of the paws: under frontal and lateral load"*** was a plantography performed in plantography (Fig. 4). This method of examination provides a wide range of opportunities for assessing the condition of flat feet. With the help of plantography, only two indicators, which are necessary to illuminate our scientific work, were evaluated: 1) level of flat feet; 2) calf torsion angle.

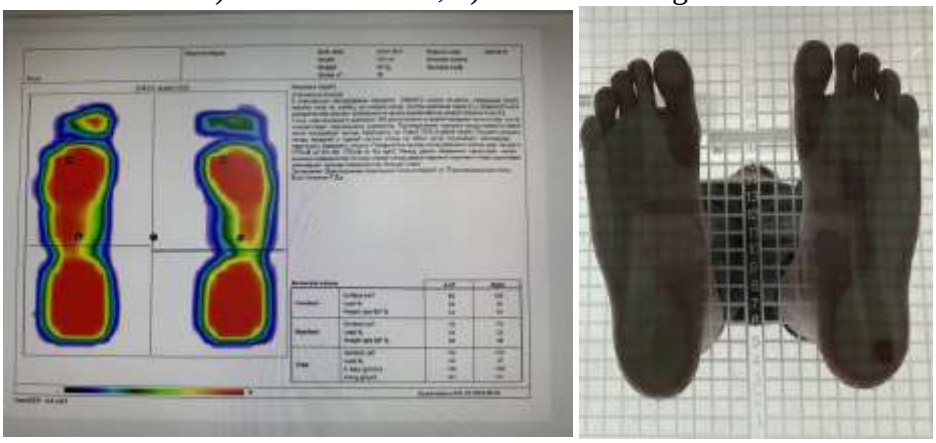

Figure 4. Overview of the plantograph

The following lines and points were drawn on the plantogram to determine the level of flat feet (Fig. 5): a) a line from the center of the heel print (point D) to the space between the third and fourth toes; b) the innermost points of the fingers (point A) and the inner part of the heel (point K) and the line connecting them with a tangent (AK); c) the line connecting the two lines perpendicularly. A perpendicular line is divided into three equal parts. Parts are numbered from inside to outside.

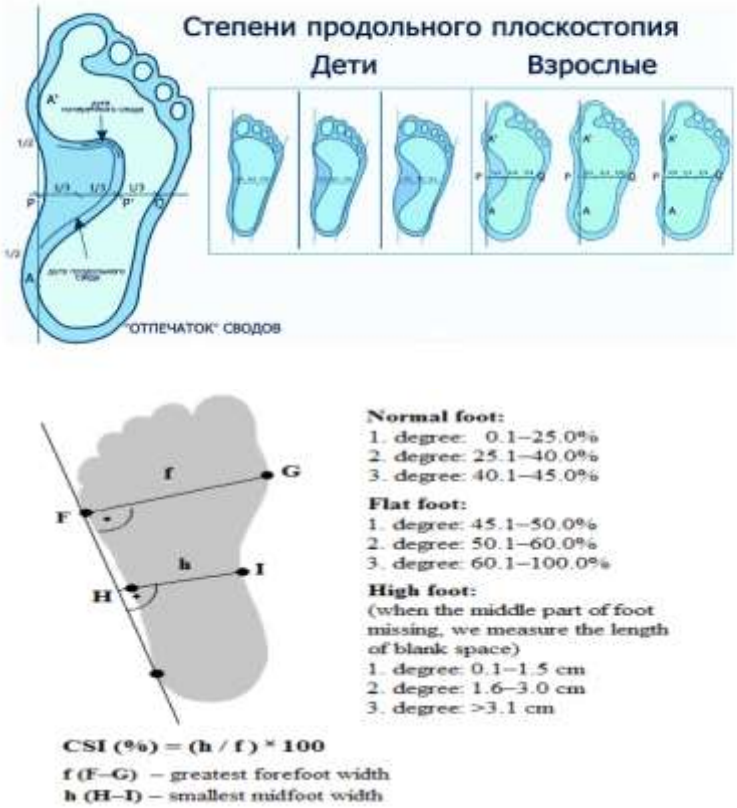

Figure. 5 - diagram of determining the level of CA in plantography.

In this:

- Flat feet 1st level - corresponds to the first interval of the internal contour of the print;
- Flat feet 2nd level - corresponds to the second interval of the internal contour of the print;
- Flat feet level 3 - corresponds to the third interval of the internal contour of the print.
- Flat feet level 4 - the inner contour of the print goes beyond the AK line.

Calf torsion angle was estimated using the following method:

On the plantogram, an inter-ankle line connecting the projection points of the tops of the ankles was drawn. Another line was drawn from the center of the back contour of the perpendicular heel towards the second toe (Fig. 6).

1. In the assessment of daily flat feet, it was measured according to the Campbell classification.

Table № 2

Angle	**The norm**	**Level I**	**Level II**	**Level III**	**Level IV**
Angle of the base of the I-II paw bones.	10 ^{0}	10-12 ^{0}	13-15 ^{0}	16-20 ^{0}	20 ^{0} ↑
The angle between the base of the I-paw bone and the proximal phalanx.	10 ^{0}	11-15 ^{0}	16-25 ^{0}	26-40 ^{0}	41 ^{0} ↑

2. Measuring the angles of flat feet that develop as the arch of the foot decreases longitudinally.

Table № 3

	The norm	Level I	Level II	Level III
Angle	125-130 ^{0}	131-140 ^{0}	141 -15 5 ^{0}	1 55 ^{0}

3. Measurement of flatfoot angles developing after trauma according to Bohler.

Table № 4

	The norm	Level I	Level II	Level III
Angle	20-40 ^{0}	19-10 ^{0}	9 - 0 ^{0}	negative

Treatment options: Treatment options for flatness
1. Operations performed on the soft tissues of the medial side of the foot.
—Operation Kidner
2. Osteotomy
— Medializing osteotomy of the foot: Angular osteotomy
— Foot claw orca column:
- Medializing osteotomy of the heel bone;
- Osteotomy of the calcaneus according to Evans;
-Bilateral calcaneal osteotomy-
3. Achilles tendon lengthening practice
- Bayer on this
Methods of surgical treatment of flat foot deformities:
As noted above, flat-footed deformities in the forefoot are considered to be a reflection of changes in the rear and midfoot. These were taken into account during reconstructive operations to eliminate the valgus deformity of the first toe, and the lateralizing osteotomy of the first metatarsal bone was performed at the stage after the deformities in the middle and back segments of the foot-paw were eliminated.
Operations performed in the deformation of the front column of the paw:
The following indications for surgical treatment of valgus deformity of the first toe were taken into account:
- the presence of clinically and radiologically confirmed valgus deformation of the first toe;
- long-lasting pain when there is pressure on the leg, when walking;
- feeling discomfort when wearing shoes, not being able to wear suitable shoes.
Depending on the degree of bending of the valgus deformity of the first finger, 2 types of operations were performed. All surgical operations were performed based on the steps indicated in the methodology.
SCARF (SCARF Osteotomie) and Chevron osteotomies (Chevron Osteotomie) were performed in case of valgus deformity angle up to 20 degrees (includes mild deformities).
Operations performed in the deformation of the middle column of the paw:
The main gFlat feetl of the operations performed in the 1-2 levels of flat feet in the middle part of the foot-paw was to create a correct arthrodesis in the Lisfranc joint and to eliminate the proximal deformity of the front part of the paw. A variety of metal structures, mainly screws and plates, have been used to stabilize the osteotomized bone fragments.
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Apart from this, osteotomy of the medial sphenoid bone was carried out with bone plastic and osteosynthesis with the help of plates and screws to form the arch of the foot.
Kidner's operation: One of the causes of pathological flat feet is the fixation of the large calf muscle to the hypertrophied or extra navicular bone (7). This type of operation restores the normal functional state of the calf muscle towards the back. According to scientists, the same type of surgery helps to obtain good and excellent results in 92% of patients with flatness [1].

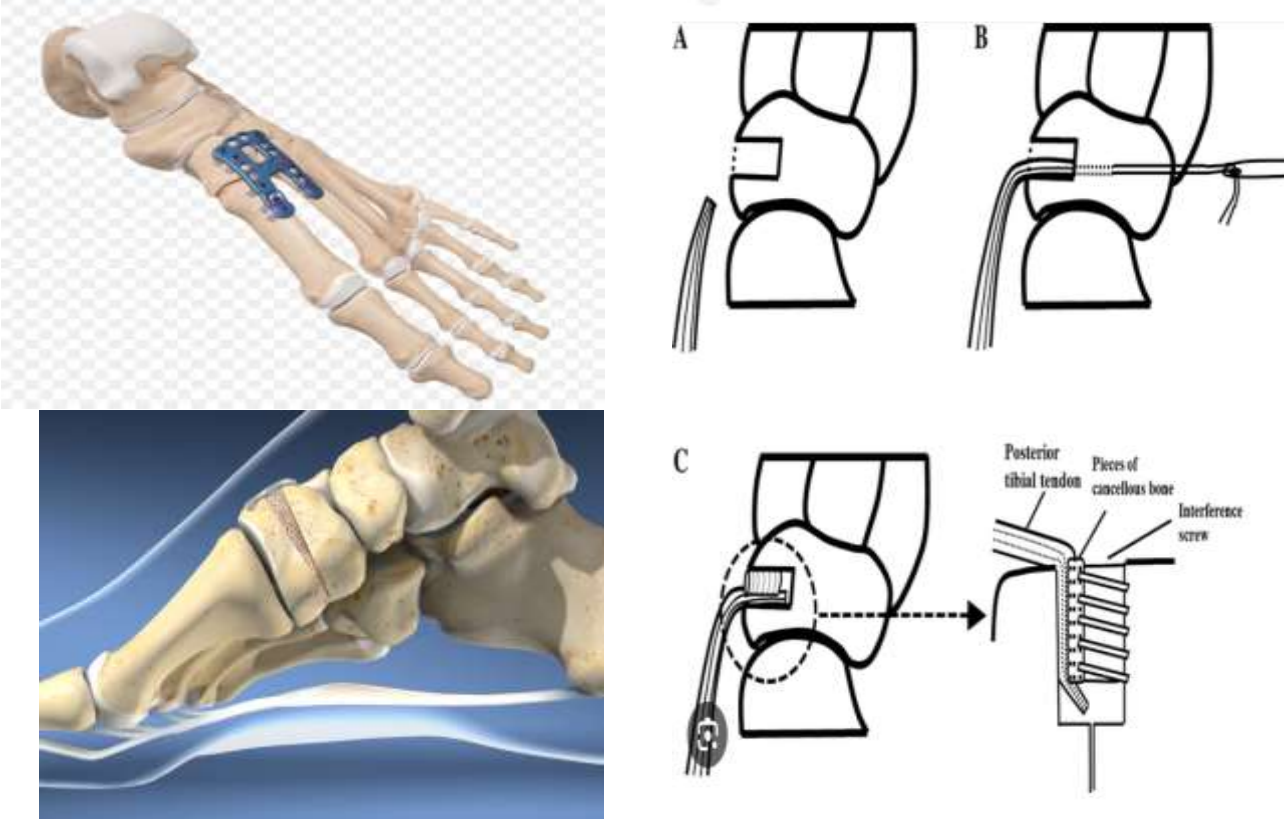

Figure 6: Operations performed in the deformation of the rear column of the foot.

Medialization osteotomy of the calcaneus is considered one of the most widespread methods in the treatment of flat feet. In particular, this method is most often used in valgus deformations. The main gFlat feetl of this procedure is to restore the biomechanics of the Achilles tendon [2]. This method has several forms - an osteotomy is performed from the body of the calcaneus [4,13].

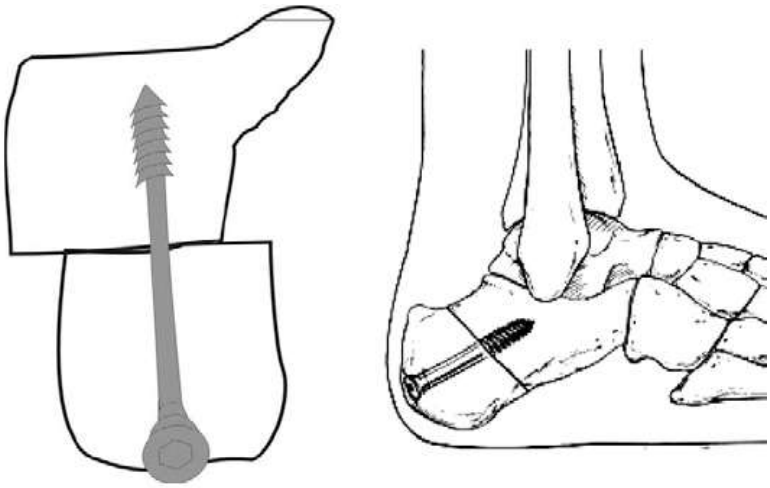

Figure 7: Osteotomy of the calcaneus according to the Evans method.

According to the Evans-method calcaneus osteotomy, 1.5 cm of the calcaneus is cut into the calcaneal-cubic joint, and the interosseous area is filled with a graft, as a result, the calcaneus is lengthened from the lateral side, and the size of the graft should be from 5 mm to 15 mm

[5,6,12]. This method works very well on mobile platforms. 80-90% of such patients had good and excellent results after operations [8,11].

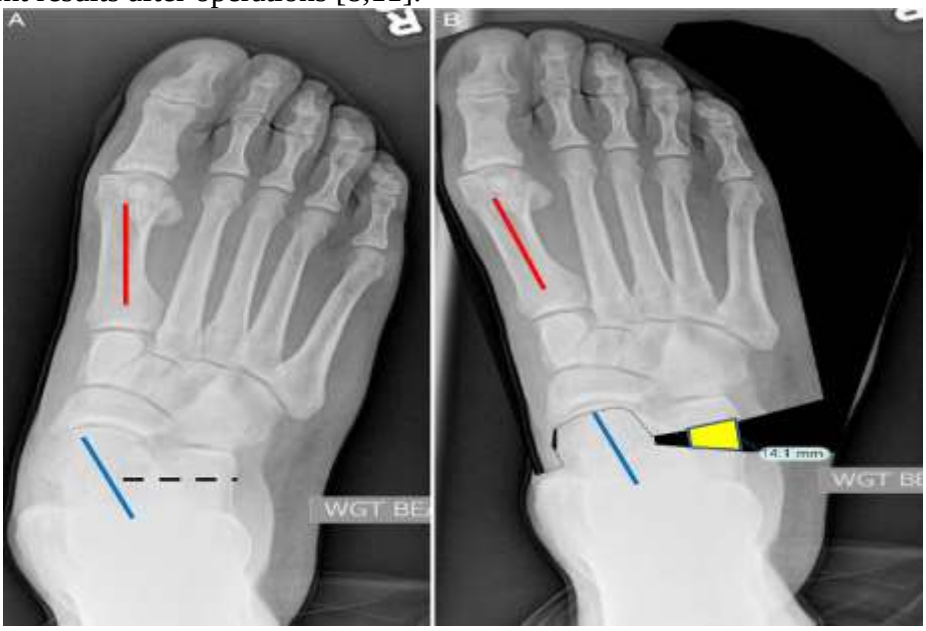

Figure 8: Evans is the Achilles heel of the method.

Achilles tendon lengthening is performed in patients with short Achilles tendon. It is lengthened using the Bayer method or percutaneous axillotomy procedures. Which method to choose depends on the shortness of the patient. Achilles tendon shortening occurs in children with mobile flat feet, and in most cases in children with cerebral palsy.

Achilles tendon lengthening procedure - this type of procedure results in equino-plano-valgus deformity of the flatfoot in patients with BTsP. In this case, according to Bayer, the Achilles tendon is cut and lengthened in a "Z" shape. As a result, "Equinus" is eliminated due to sprain of the Achilles tendon, as well as the foot

After the operation, early rehabilitation of the patients was started, no complications were observed in any of the patients. Good to excellent results were achieved in all patients.

We will consider as an example the patients who were monitored and treated operatively. We will consider the example of a patient who underwent a surgical operation using a modified Kidner and an improved Evans operation developed by the center's staff.

Patient Yu. A., born in 2011. According to the anamnesis, he considers himself to be sick. According to this disease, the place of residence is treated conservatively several times at the polyclinic and TTB. Valgus deformity in the leg, he walks with a slight limp, he feels pain in both ankle bones. The back of both legs is deformed with valgus. Both calf muscles have a muscle strength of 4. X-ray, MSCT examinations show a decrease in the arch of the foot along the length of the foot.

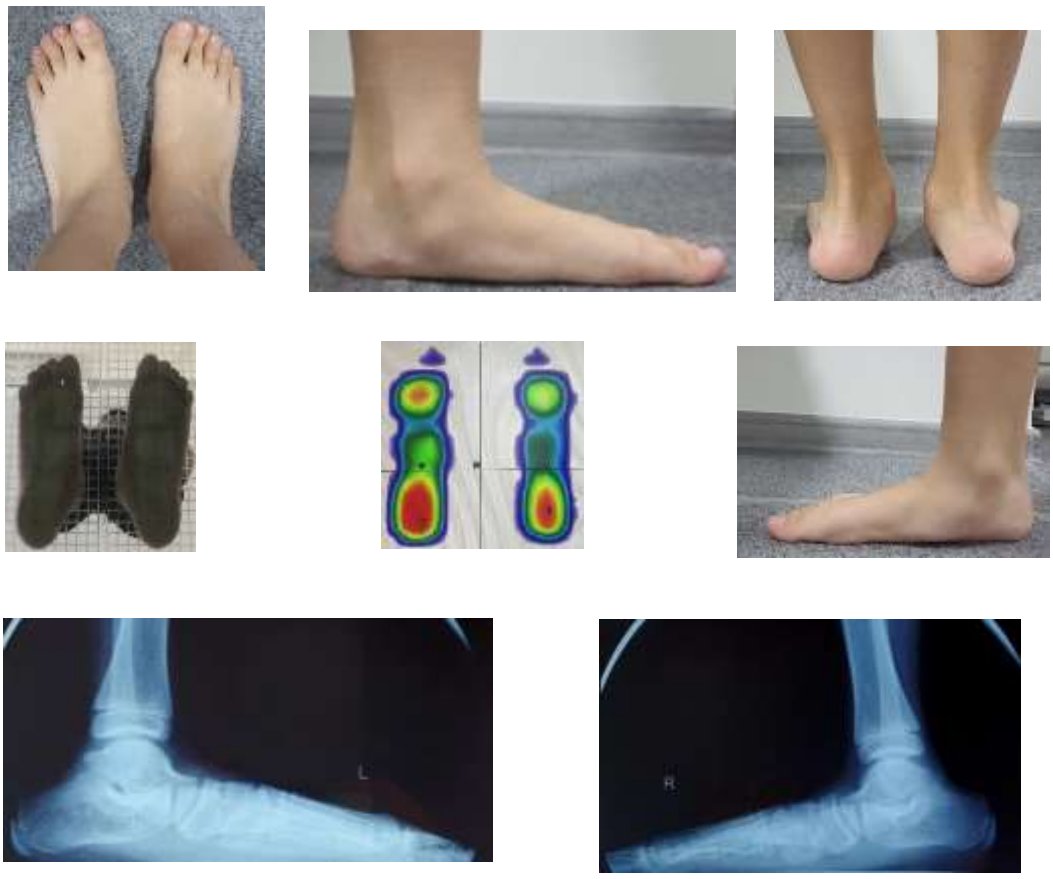

Figure 9 A shows the patient's preoperative clinical condition.

Figure 9 B shows the complete surgical sequence of the Modified Kidner operation.

case of a decrease in the arch of the foot, and the resected part was filled with bone and fixed with plates and screws. Only Kidner, Evans operation and Achilles tendon lengthening were performed in this patient. The patient was fixed with a plaster bandage for 1 month. In the 2nd

month, he began to use the joints in rehabilitation without giving pain to the leg. After 2 months, the patient was on his feet. Good results were obtained in all patients treated operatively with this diagnosis.

Thus, expected results were obtained in all patients treated with this method of treatment.

Below are the long-term results after 6 months on the patient's left leg, and after 1 year on the right leg. The patient underwent a Kidner operation on his right leg, and a modified Kidner operation using the Clinic method on his left leg. From our performed operations, it became clear that the dysfunction of the large back muscle tendons and spring-like ligaments plays the most important role in the development of this disease, and also in the treatment of these anatomical structures, reconstructive surgical procedures provide reliable and expected results.

Conclusions: In conclusion, I would like to say that flat feet is a common pathology in pediatric, adolescent and adult orthopedics. A lot of research has been done to fully understand the disease, but still many questions remain unanswered. Treatment of flat feet, diagnostic criteria, as well as methods are still debated and debated. In our center, 29 operative treatment procedures were performed for patients with flat feet of different ages during 2019-2021. These include torsal cFlat feetlition, transverse flat feet, longitudinal flat feet with a decrease in the arch of the foot, other valgus deformed flat feet, equinus flat feet developed as a result of BTsP, as well as several of the above conditions can develop in one patient. Depending on the type of disease developed in the patients, the following procedures were performed.

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