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Issue Article

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METHODOLOGICAL BASES FOR THE FORMATION OF A REHABILITATION CENTER FOR CHILDREN WITH PATHOLOGICAL ABNORMALITIES. MESSAGE 1

Abstract: *In the article, the authors consider the role of quality as a tool for promoting the philosophy of quality in the production of competitive and in-demand products at light industry enterprises located in the regions of the Southern Federal District and the North Caucasus Federal District. At the same time, the authors absolutely reasonably confirm the possibility of such an implementation if innovative centers are implemented, saturated with universal and multifunctional equipment, creating prerequisites for the production of the entire range of footwear, namely: men's, women's and, most importantly, children's shoes, the demand for which in regions of the Southern Federal District and the North Caucasus Federal District is quite high. And the use of software will provoke a significant reduction in the cost of its production and provide it with a steady demand in domestic markets with unstable demand, including for children with pathological disabilities.*

Key words: *quality, preference, demand, competitiveness, market, profit, demand, buyer, manufacturer, financial stability, sustainable TEP, priority, assortment policy, economic policy.*

Language: *English*

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Introduction

The range of children's shoes should be aimed at buyers with different income levels, for this, in the production of shoes, you can use leather of different

quality: expensive, such as chevro or cheaper - such as chrome-tanned pigskin, shoes from which can be used for "exit", and when you come home, take it off so that the child's legs rest.

Also, when developing the assortment, it is necessary to take into account the fact that girls in the Southern Federal District and the North Caucasus Federal District are born more than boys, so shoes for girls should be produced in a larger volume than shoes for boys.

If manufacturers of shoes for children are guided by taking into account all anthropometric features, then buyers will have the opportunity, depending on their financial situation, to give preference to products of a particular price category, made taking into account the climatic characteristics of the Southern Federal District and the North Caucasus Federal District, the generic characteristics of the population of these regions.

One of the most important requirements of Russians for purchased shoes in general and for children in particular is their compliance with the latest fashion trends. Moreover, recently these trends have begun to spread not only to models for schoolchildren, but also to models for children of school and toddler age. And this applies to both products of famous foreign brands and domestic manufacturers. Of course, there are different price niches in all shoe markets in the world, but the peculiarity of our Russian one is that:

a huge sector of cheap shoes, relatively small - of medium cost and very small - expensive;

a big plug between cheap shoes (up to 9 euros per pair) and expensive ones (from 200 euros per pair).

In the first sector, not only firms from Southeast Asia work, but also Russian wholesalers placing their orders in China. In the second, average, there are Russian factories, as well as enterprises in Eastern Europe and Turkey that produce shoes under their own or licensed brands. In the third - well-known world manufacturers and even fashion houses. At the junction are European-made collections made from natural materials, adapted to the Russian market, but at a reasonable price.

Representatives of the most extensive cheap sector, where the level of competition is very high, are striving in every possible way to reduce the cost of their products through production at cheaper factories, as well as through the use of cheap materials and components.

It should be noted that now the requirements of parents to the hygienic properties of children's shoes have increased dramatically, namely, to the use of natural materials for the uppers of shoes, because many manufacturers from the inexpensive market segment, in an effort to reduce the price, use only insole and lining made of genuine leather. In order for a child's foot to remain healthy, everything must be thought out in shoes for toddlers to ensure that all the requirements set out in both GOST and the technical regulations are met.

When you consider that the growth of the foot, on average, is completed around the age of 18, you can imagine how important it is to use shoes that meet these regulatory requirements. In the process of the growth of the legs, their transformation occurs: when at first the child begins to crawl, then he still has crooked legs in the shape of the letter “O”. With the disappearance of these crooked legs, which is due to growth, crooked legs in the form of the letter "X" appear when the sides of the knees on the inside come into contact with each other. Until about 6 years of age, the foot of a small child grows, maintaining the shape of an "X". When learning to walk, the child seeks to align the body vertically, and the feet are subjected to a large load. The feet and legs begin to develop as they begin to have a functional load on the muscles, ligaments and tendons, begin to adapt to each other. During the period when the child begins to stand up spontaneously, the foot must necessarily be able to develop freely. This also applies to further stages of development and in older children. Shoes, from a hygienic point of view, should protect the body from cooling and overheating, protect the foot from mechanical damage, help the muscles and ligaments to keep the arch of the foot in a normal position, provide a favorable microclimate around the foot, help maintain the necessary temperature and humidity conditions under any microclimatic conditions. external environment. Footwear must meet hygienic requirements: be light, comfortable, not restrict movement, fit the shape and size of the foot. Then the toes are located freely and they can be moved.

Tight and short shoes make it difficult to walk, pinch the leg, impair blood circulation, cause pain and over time change the shape of the foot, disrupt its normal growth, deform fingers, contribute to the formation of ulcers that are difficult to heal, and in the cold season - frostbite, increases sweating. Too loose shoes are also harmful. Walking in it quickly tires, and scuffs can occur, especially in the instep area. The area of support and stability are sharply reduced. The trunk leans back. Such a deviation in the age, when the pelvic bones have not yet grown together, causes a change in its shape, changes the position of the pelvis, which in the future may adversely affect the generic function. This creates a large lumbar curve. The foot rolls forward, the toes are compressed in a narrow toe, the load on the forefoot increases, resulting in flattening of the arch of the foot and deformity of the toes. In shoes with high heels, it is easier to twist the leg at the ankle joint, it is easy to lose balance.

The sole should bend well. A hard sole makes it difficult to walk (the bending angle is limited, the heel of the shoe is pulled off the heel), reduces the performance of the muscles of the ankle joint, increases the temperature of the skin of the leg and

sweating. As much as it is necessary to ensure maximum mobility of the forefoot, it is also necessary to ensure maximum heel stability. The back must be strong, not allowing the foot to slip. The back should protect, tightly cover the heel, prevent its deformation.

In winter, shoes must keep warm inside. For this purpose, fur, felt, cloth, felt are used. On cold winter days not lower than -10 ºC, schoolchildren can wear boots and boots made of porous rubber, insulated with synthetic fur (dacron with cotton) or lined with wool or felt. With chronic cooling of the legs, vasospasms occur and serious malnutrition of leg tissues develops due to obstruction of blood flow. In the summer months, the most hygienic light open shoes with a wide neckline are sandals, sandals, leather shoes or shoes with leather soles with uppers made of textiles and other materials with a porous structure (gunny, denim, etc.). Such shoes contribute to good ventilation and rapid evaporation of sweat due to air circulation around the foot (due to the selection of material).

In wet rainy weather, rubber boots or shoes with soles made of waterproof materials, rubber, rubber, nylon, etc. are comfortable. However, these shoes are characterized by low breathability, so you need to wear them only with insoles that absorb sweat well: felt, cloth, and in summer - from woven straw or cardboard. Care must be taken to ensure that the lining does not become wet. Shoes that meet hygienic requirements help to avoid unpleasant, sometimes painful phenomena. Thus, shoes should not compress the foot, disrupt blood and lymph circulation, or interfere with the natural development of the foot. There should be a space of 0.5 - 1 cm in front of the thumb. Hygienic requirements for shoes for children and adolescents are made up of requirements for the design of shoes, due to the structural features of the foot during the growth period, and the materials from which shoes are made. The size, style and stiffness of the bottom of children's shoes should not interfere with the development of the foot.

The foot of a child at an early age differs significantly from the foot of an adult in its anatomical and physiological structure. The children's foot is characterized by a radial shape, in which the greatest width is noted at the ends of the fingers. The foot becomes fan-shaped. A different ratio of the heel and forefoot: children have a relatively longer back (heel), which should be taken into account when designing shoes. The skeleton of the foot in childhood is formed by cartilage. Ossification is completed only with the end of growth (approximately at 21), therefore, the child's foot can easily be deformed under the influence of mechanical stress. In this regard, such qualities as thickness, flexibility of the sole, mass of shoes, as well as heat-shielding properties are subject to hygienic rationing.

The height of shoes is normalized depending on its type and type. The bottom of the shoe (insole, sole, heel) should have optimal stiffness indicators: resistance (expressed in N / cm) to bending along the line of the connecting head and metatarsal bones up to an angle of 25 degrees. “Shoe flexibility is regulated and should be 7 N/cm for goose shoes, 10 N/cm for preschool shoes, 9–13 N/cm for boys’ school shoes, and 8–10 N/cm for girls’ school shoes.”

The heel artificially raises the arch of the foot, increasing its springiness, protects the heel from bruises on the ground, and also increases the wear resistance of the shoe. When resting on a bare foot (without a heel), most of the load falls on the back of the foot. The absence of a heel is allowed only in shoes for young children (booties) until the child walks. In shoes with a 2 cm heel, the load is distributed evenly between the front and back of the foot. In shoes with high heels, that is, above 4 cm, most of the load falls on the forefoot (with a heel height of 8–10 cm, the load on the forefoot is 7 times greater than on the back). Therefore, the height of the heel should be no more than: for preschoolers - 5-10 mm, for schoolchildren 8-10 years old - 20 mm, for boys 13-17 years old - 30 mm, for girls 13-17 years old up to 40 mm. Children's shoes should have a reliable and comfortable fastening on the foot, not hindering movement. For this, various types of fastening are used: lacing, Velcro, belts, zipper, etc. Open shoes without fasteners (such as boats) are not allowed for school shoes. The mass of shoes depends on the materials used, the design and type of fastening. The norm of the mass of shoes is normalized.

Currently, there are virtually no scientifically based methods for planning and changing the specific and model assortment of an enterprise, taking into account market conditions, which would be based on the use of regularly conducted marketing research, market segmentation, positioning of their products on it, a comparative assessment of the competitiveness of their products and similar products of domestic and foreign manufacturers. Domestic science has been dealing with the problem of assessing the competitiveness of products for a number of years, but there is no single methodological approach to its solution. In particular, there is no scientifically based methodology for assessing the competitiveness of footwear as a product that allows the manufacturer to purposefully and quickly change its assortment policy. In this regard, the problems of forming an assortment of footwear in the industry that best meets the needs and demand of the child population, built taking into account competition in the market and production opportunities, are of particular relevance and are of both practical and scientific interest. To revive the production of children's shoes in the Southern Federal District and the North Caucasus Federal District, first of all, it is necessary to create a number of shoe industry enterprises in the following regions of the district with a pronounced socio-demographic situation and employment in the republics: Chechen, Dagestan, Ingush, Kalmyk.

Newly created enterprises need state support, because their own funds are not enough, and borrowed funds are not available due to the high interest rate on the loan. It is necessary to solve at enterprises the general tasks of technological renewal of the industry, replenishment of working capital, increasing the efficiency of scientific and technical support of production for the manufacture of high-quality and affordable children's shoes. It is necessary to intensify the work of regional and municipal bodies of social protection in organizing targeted assistance to children and their parents, including large and single-parent families. We believe that this is a problem not only of private business, but also of the state, because the downward trend in oil prices is becoming persistent, which worsens the economy and, if measures are not taken in the industry, may lead to a decrease in real annual GDP growth rates (due to a decrease in profitability). This will lead to serious negative consequences in the economy. The positive development of the economy could be without a shock if the state provided "starting" assistance in the revival of light industry, because Today, the light industry remains in crisis, which explains unemployment and a low quality of life, especially in small towns, where, until 1992, the city-forming clothing, footwear, and other light industry enterprises necessarily functioned.

It is worth noting that today only a fifth of the output of light industry is produced by small enterprises. Reasonable expectations are paradoxical here: according to the proposals of the Chamber of Commerce and Industry of the Russian Federation and the Russian Union of Industrial Enterprises, it is obvious that in 2025 the permitting scales of limited production volumes by small enterprises (!) up to 60–70% of the total production volumes. And once again in the development of the above.

Main part

Why is this growth not systematic? After all, there is the main thing: an immense market (the taxable base for imports of goods and light industry products increased by $746 million; loyal consumer; capacities; qualified personnel; (counterfeit, falsified and contraband) products, and domestic footwear will find its consumer.In order to form an idea about the assortment of the footwear market of the Southern Federal District and the North Caucasus Federal District, we analyzed the assortment of children's shoes in the retail network of the regions of these districts, which is shown in Table 1.

Table 1. The structure of the assortment of children's shoes by price

Shoe manufacturing companies	Types of shoes	Price categories, rub.							
		up to 1400	1400–1900	1900–2400	2900–3400	2900–4400	4900–5400	5900–6300	6800–7500
Antelope, Moscow	sandal strap			X					
	Boots					X	X		
	Sport shoes				X				
Kotofey, Yegoryevsk, Moscow Region	orthopedic shoes				X				
	Boots			X	X	X			
	Boots							X	
	low shoes				X	X			
"Foma", Moscow region	Shoes for small children			X					
	Boots for small children			X					
Bombini, Moscow	Shoes for teenagers			X					
	Boots for teenagers						X		
	Low shoes for teenagers					X			
Bagira, Voronezh	Shoes						X		
	Boots							X	
	Boots								X
RIL, Rostov-on-Don	Sandal strap		X						
	Czechs	X							

Based on the analysis of the range of children's shoes entering the distribution network, it can be concluded that, in general, the demand for shoes is met by manufacturers from other regions.

It is necessary to rehabilitate the production of children's shoes at shoe factories located in the regions of the Southern Federal District and the North Caucasus Federal District, since in this case it will be possible to fully satisfy the demand and, most importantly, taking into account the anthropometric characteristics of the feet of children in these regions, significantly reduce the provocation of pathological abnormalities in them and form a healthy image life.

The surface should be soft and easy to take the shape of the foot. It is advisable to choose a product completely made of leather (even the sole). The sole of the new pair should be with an elevation in the heel area (heel). Heel height - small, for children's shoes - in the region of 5 - 10 mm. The rise of the sole should go somewhere from the middle of the foot. The toe should not be narrow. The new shoes should be comfortable, when walking you feel lightness. The materials used for sewing should not cause irritation or allergic reaction. Shoes should not hurt or rub. The elasticity of the sole is medium. The base should bend easily when walking. If in a new pair the sole is dense and does not bend, then the rigidity of such a base is unlikely to change during the period of wearing. From generation to generation, shoemakers have constantly improved the fit of shoes on the foot.

There is a point of view according to which a rigid structure only squeezes the leg. This misconception leads to the fact that on the market you can see many models of shoes that do not provide any protection and support. Under pressure from marketers, stores are focusing more on brand value and less on fit. Here the orthopedic doctor and the shoemaker have an important pedagogical role: it depends on them whether the child will be comfortable in these shoes. Let us formulate the design features of footwear for children with pathological abnormalities, namely:

- heel part. The width of the heel is just as important as the length of the boot. Shape, curves, volume are all critical factors in the fit. A semi-rigid heel counter helps reinforce the last in this area. Shoes should fit the heel perfectly. If the heel is too narrow, the heel will not go all the way into it; if it is too wide, it will move left and right, and the boot will hang on the leg, deviating from the direction of movement, causing discomfort to the child;

- toe section. This part of the shoe should not squeeze the foot. On the contrary, it is good when the child is able to spread his fingers, and the thumb is not constrained at all;

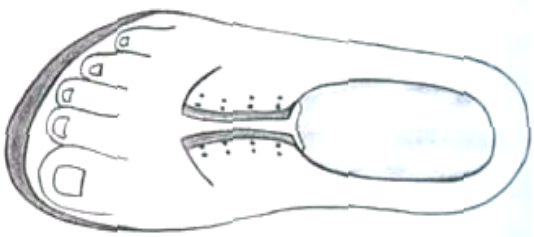


Figure 1. Characteristics of the location of the foot in the shoe along the length

- length and fit on the leg. For each specific size, the manufacturer determines the appropriate parameters (boot length, heel width, comfort factors). The shoemaker must take into account these features and offer those models that best fit the shape of the child's foot (Figure 1);

- length and height. It is necessary to measure the maximum length of the foot and add to it at least one and a half sizes (one size is equal to 6.66 mm) for growth. Standard stop meters in use today already account for this margin. If the berets open too wide, in this case it is enough to add not one and a half sizes, but one, that is, 6.66 mm.

Sometimes parents give in to the temptation to take one more size larger shoe to prolong its life. Such a choice can be justified if the length falls in the middle between two sizes. However, you should know the measure: if the shoes are too large, the foot will be deprived of support from the sides, and folds may form on the vamp that interfere with walking - in such shoes the child will hobble, that is, he will be uncomfortable again in these shoes;

Figure 2. The peculiarity of the formation of the toe of the shoe

- sock lift. If the toe is slightly bent upwards, this contributes to the free movement of the foot when walking, protects the child from falling, makes the wrinkles on the vamp less noticeable and protects the toe of the shoe from premature wear (picture 2);

- entry of the foot into the shoe. The opening should be wide enough for the foot to fit into the shoe without effort. The task will be much easier if you unlace the boot to the very end, unfasten all the Velcro buckles, etc.

Below size 28, the cut of the cycling boot makes it difficult for the foot to enter the shoe; in derby boots, on the other hand, the hole will be wide enough, that is, the choice is up to the parents, taking into account the feelings of the child;

- fastening system. The fastener system should securely fix the heel so that the foot does not slip forward and the toes do not tighten.

If the shoes are laced, the tension should be evenly distributed along the entire length, and a sufficient gap between the berets will ensure good tension. When buying Velcro shoes, you should make sure that the fastening is of high quality and strong enough.

If the shoes are held on the foot by buckles, the tension is unlikely to be accurate enough. It is not always possible to foresee the location of the perforations in the strap in advance. The shoe locking systems comply with the rules and exactly match the coverage of the instep. If in shoes fixing the instep of the foot, this is a serious minus and it is more likely that the child in such shoes will be uncomfortable;

- socks. Natural fiber socks are recommended. Thick and coarse socks with a high content of synthetic fibers should be avoided, which do not allow the leg to breathe and increase the volume of the foot. It is also important to make sure that the seam on the front of the sock will not chafe your fingers. Finally, if the socks are large, they will bunch up;

- lining. Ideally, the lining should be made of natural, unpolished leather (close contact of the foot with the leather lining is a comfort factor), appliqués and decorative stitching should be soft to the touch. Gathering seams should not fall on painful areas (joints, ankle and instep). The flannel lining in the upper part of the boots prevents injury to sensitive areas of the lower quarter of the leg of the foot, and under the tongue it softens the pressure on the rise;

- breaking in a shoe. First of all, you need to make sure that the assembly seams will not rub the child's foot. To soften the skin, stretch it in different directions with your thumb, pressing especially hard on the back. For sandals, stretch the straps.

New shoes are recommended to be worn for short periods of time at first before being worn regularly;

- Break-in at the ankle. If the shoes are low, bend the upper part of the ankles outward with your fingertips so that the edges do not break the leg; for models with high berets, a special horn is used.

Characteristics of shoe details

The vamp is the part of the top that covers the bottom of the instep and toes.

Ankle boots - the part of the top that covers the heel on the side and reaches the lacing.

The tongue is a part located under the lacing.

Figure 3. Characteristics of the details of the top of the shoe

Figure 4. Features of the location of the toe cap and back on the last

The heel counter is a semi-rigid tab at the back of the shoe, between the leather upper and the lining. Its function is to keep the back of the foot in line with the walking line and prevent the heel of the shoe from sinking (Figure 3).

The toe box is a rigid insert between the leather upper and the lining that protects the toes from impacts and prevents the shoe from deforming (Figure 4).

The heel counter is a semi-rigid heel counter that is inserted between the leather upper and the lining.

Fixes the foot on the axis of movement and prevents the block from settling and wrinkling.

Gelenok - a rigid insert in the insole, which starts at the heel and ends about one centimeter in front of the line of beams (it is imaginary, crosses the foot in its widest part, at the level of the articulation of the fingers with the metatarsus). Gelenok gives the bottom of the shoe the necessary rigidity and protects it from deformation. Grasp the front half of the sole with one hand and the heel of the children's boot with the other and start twisting them in opposite directions - a good calf resists this torsion and practically does not change its original position.

The gel helps ensure that the transverse fold that forms on the last while walking is exactly above the transverse fold of the sole, which repeats the bend of the foot. The back of the shoe naturally follows the movement of the foot. This helps her move forward and provides the child with comfort.

The main (set-in) insole is a part made of leather or other materials on which the foot rests. Absorbs natural moisture and adapts to the shape of the footprint.

The removable (hygienic) insole should be thin. Superimposed on the set-in. Unpolished genuine leather is recommended. Synthetic film linings lead to overheating of the foot and are not recommended for use in the manufacture of shoes for children.

Orthoses and insole. If shoes for children are offered with a sufficiently thick insole, then by replacing it with an orthosis or, in other words, an orthopedic insole, the parameters of its fit on the leg corresponding to the selected size are preserved (which cannot be said about shoes with thin insoles). The depth of the boot will remain unchanged, the heel part will still perfectly fit the heel. For an orthopedic doctor, an insole can serve as a template when choosing an orthosis when the question arises of the need for a child to use orthopedic shoes.

Dense rubber provides good dynamics when walking. The surface of the sole should be embossed so that the child does not slip (Figure 5)

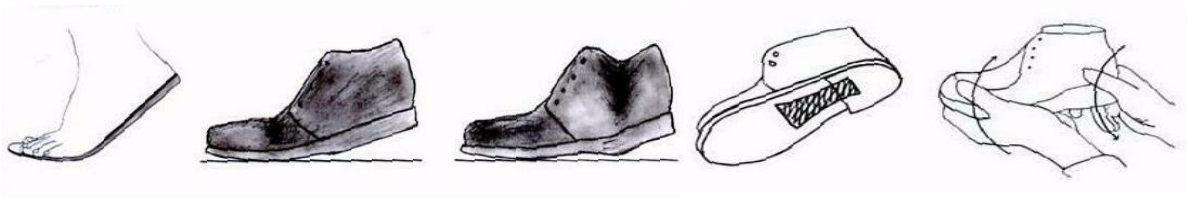


Figure 5. Features of the location of the intermediate and main parts of the bottom of the shoe

Figure 6. Deep-cut shoes with a strap

Figure 7. Features of dance shoes such as "ballet flats"

Characteristics of modern models of footwear for children and their assessment of comfort.

Mary Jane - children's shoes with a deep cut and a strap, the length of which can be adjusted in the instep area. Such shoes hold the heel well (Figure 6).

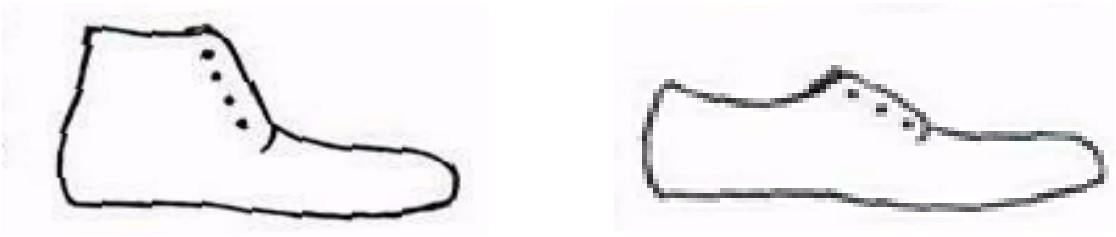
Ballet shoes are dance shoes made of fabric, with a hard toe, which is held on the foot by ribbons wrapped around the ankle (Figure 7). In the popular interpretation, this model is made mainly of thin elastic leather, with a flat sole and a small heel. These shoes are very flexible and do not provide any support to the foot. The neckline, as in boats, is deep, the vamp is short and reaches only to the bottom of the metatarsus. Ballet shoes are held on the leg due to the tension in the longitudinal direction, which is why fingers are guessed under the skin of the vamp.

Ballerinas perfectly fit the foot, but do not give it any support and protection from impacts. The structure of the last emphasizes lightness and flexibility, which is why the reinforcing details typical of other types of children's shoes are absent in ballet flats - in fact, they adopt some of the basic elements of classic pumps. Of course, ballet flats in pastel colors look great with multi-colored summer dresses, but children should not wear them all the time, except for special occasions.

Boots - models with high berets that cover the ankle, provide good support and securely fix the

baby's leg. Boots will be an excellent option for children up to size 26 to guarantee their comfort (Figure 8, a).

Low shoes. Some models of shoes can rub the foot in the ankle area. In such cases, the upper edges of the berets should be stretched beforehand (Figure 8, b).



a b

Figure 8. Features of boots and low shoes for children

Derby. The Derby cut with adjustable cuffs and wide boot opening makes them perfect for kids. These shoes hold the foot well in the heel area.

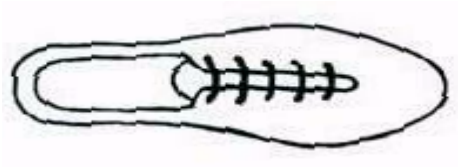


Figure 9. Features of cycling shoes

Cycling shoes. The base of the tongue is very low, at the level of the fingers. Support in the arch area will be quite weak. At the same time, the heel is fixed quite securely (Figure 9).

Boats with a lifting strap. The strap fixes the leg in the instep (Figure 10, a).

Boats with bracelets. The bracelet securely fixes the foot in the heel. However, it can rub the leg in the ankle area. Often, when walking, shoes noticeably lag behind the foot on the sides (Figure 10, b).

a b

Figure 10. Features of shoes of the Boat type "with a lifting strap"(a)and "with bracelets"(b)

Moccasins. Moccasin cut is not suitable for children's feet. Such shoes are devoid of any elements that would allow adjusting the tension in the instep area in order to securely fix the heel, provoking discomfort for the child.

Sandals. You can't do without these shoes in the summer. In sandals for toddlers, the heel should be closed to provide at least minimal support, and the toe box should be stiff enough to protect the toes.

The fit and construction of sandals should be well thought out: support and protection of the foot is a top priority, and hole placement should be considered by the designer and podiatrist.

How to choose shoes for the baby? It would seem, what is easier - we buy bright shoes or sandals with a beautiful clasp and - run, baby! But the aesthetic requirements for children's shoes should not obscure the rational criteria for evaluating them. Parents who pay attention only to the external attractiveness of shoes risk rewarding their child with more than a dozen problems in later life. In the first years of life, bones and ligaments are still very fragile and easily deformed from improperly selected shoes or lack of necessary exercises, but their hobbies, the desire to prevent such deviations of the feet in children, are not always justified, there is a golden mean.

Almost all children are born into the world with healthy legs. The task of parents is to prevent the child from having problems with his feet in the future due

to illiterate care of the baby or due to improperly selected shoes. To do this, it is necessary to understand the patterns of child development and take them into account when choosing shoes.

At about 6-9 months, there is a sharp jump in the development of the child: he begins to master the movements in an upright position. These movements are very important, because. they contribute to the development of understanding of speech and active speech of the child himself, and also train orientation in the world around him.

By the 8th month, the child usually has transitional movements to independent walking: the baby gets up, sits down, sits, rolls over, steps from foot to foot.

Then, by 10 months, he masters moving forward with support (it is better if these are mother's hands, and not artificial devices such as "walkers"), and at 11 months, a normal child takes the first independent steps.

In his first year of birth, a child should be able to walk 3-5 meters without support, overcoming small obstacles in the form of scattered toys, and lures invented by parents.

Speaking about normal development, it should be borne in mind that normally, in 25% of children, walking starts too early, and in 20%, there is a delay. And yet, if the child began to walk too early, which often happens with increased motor excitability, or does not move independently by 12 months, and at the same time is quite phlegmatic and has an increased body weight, you should consult a pediatrician.

Important conditions for the normal development of walking are:

- creation of an appropriate environment: the presence in space of many points of support; the ability to move without the risk of damaging expensive polishing or mother’s favorite vase; the presence of objects that stimulate interest in walking, for example, moving toys, etc;

- a hard surface for walking (it should not be a carpet or a mattress);

– daily complex of gymnastics and massage before night swimming;

- active participation of the hands of an adult in learning to walk. Any skill (sitting, standing, trampling) must be patiently taught, sometimes spending a lot of time and effort. And, nevertheless, remember that the warmth of the hand not only helps to learn something, but also contributes to the formation of a healthy psyche of a small person and tender affection for parents;

- the ability of the child to stand, leaning on the entire foot without support, and the feet should be parallel to each other; the ability to walk forward on the whole foot and the child's understanding of the words "go" and "sit", which is achieved by frequent repetition.

Another important condition for the development of walking is shoes.

It should protect the leg from mechanical damage, provide a favorable microclimate for the foot, and correspond to the anatomical and physiological characteristics of the child's foot.

The sole must be elastic and flexible so that the foot can perform the same movements as when walking barefoot. In general, it is very useful to let the child run barefoot, thus strengthening the ligaments and muscles of the small leg.

Do not put on shoes for children before you start going for walks. In the future, for the correct setting of the foot, you should choose shoes with a strong heel that tightly holds the heel and protects it from slipping and turning sideways.

The optimal heel height for a preschooler is 5–10 mm. The heel artificially raises the arch of the foot, which means it increases its spring properties; in addition, it protects the heel from bruises on the ground and increases the wear resistance of the shoe.

The toe part of the shoe must necessarily be wider than the heel, i.e. shoes should be spacious in the toe area. Narrow shoes can lead to foot deformity, to impaired blood circulation in this area.

When choosing a shoe size, you should also remember that shoes that are too spacious often cause abrasions on the skin of the foot.

Be sure to pay attention to the presence of arch support in the shoes.

The main indicator of size is the length of the foot, which is determined by the distance between the most prominent point of the heel and the end of the longest toe. The unit of measurement is 1 mm. The difference between the numbers is 5 mm. The rules provide for the production of children's shoes of three types of completeness within each size.

It is also not recommended to take shoes "point blank".

Light and soft, shoes should be well attached to the foot with all kinds of fasteners, straps, laces, allowing you to adjust the rise of the shoe. It is better if they are made from natural materials that provide better breathability and ventilation inside the shoe space.

So, when choosing shoes for a child, you must:

- give preference to leather shoes with a wide toe, adjustable buckles and a small heel;

- pay attention to the fullness and size of the shoes (there should be a gap of about 1 cm between the big toe and the toe of the shoe);

- Try on shoes standing on both feet. It is necessary to measure the length of the child's foot at least once every three months.

All these parental cares will be rewarded with a healthy musculoskeletal system of the child's foot.

For those children who already have foot problems, we recommend using corrective anatomical insoles and a set of special gymnastics. The sooner

such treatment is started, the higher the likelihood of a good result. It is only important to choose the right orthopedist and strictly follow his recommendations.

How to correctly measure a child's foot to determine the size?

At home, standing under load, on a piece of paper, circle the child's foot and measure the length of the foot from the heel to the 1st toe, adding + 5 mm. According to table 2, find your size, corresponding only to the Perseus shoe last:

Table 2. Method for determining the length of the child's foot

Shoe size "Perseus"	Foot length + 5mm (cm)	Shoe size "Perseus"	Foot length + 5mm
17	11.5 cm	27	18.0 cm
18	12.0 cm	28	18.5 cm
19	12.5 cm	29	19.0 cm
20	13.5 cm	30	19.5 cm
21	14.0 cm	31	20.5 cm
22	14.5 cm	32	21.5 cm
23	15.0 cm	33	22.0 cm
24	15.5 cm	34	22.5 cm
25	16.5 cm	35	23.0 cm
26	17.0 cm	36	24.0 cm

In addition to size, children's legs differ in fullness and volume.

In the production of Perseus shoes, individual completeness is taken into account:

1st fullness - a narrow foot, 2nd fullness - a wide foot with a high rise, which ensures that the shoe matches the natural proportions of the foot.

Do not forget that children's shoes, unlike adults, should have a wide toe and adjustable fastening on the foot (lacing or straps).

So, during the period of intensive growth of the body - at 3 and 6 months, 1, 3 and 5 years - there is a differentiation of the shape and structure of the bones. Weak bone apparatus, connected by still too extensible ligaments, as well as weak muscles, cause significant fluctuations in the height of the longitudinal arches of the foot under load. This contributes to the occurrence of static deformities of the feet, which can lead to a breakdown in statics and kinematics. In children of this age, during the period of learning to walk, conditions arise for the development of planovalgus deformity, since in order to increase the area of \u200b\u200bsupport and keep the body in balance, the child spreads his legs wide, leaning on the inner sections of the foot. The widespread belief that flat feet in children under 6 years of age is physiological and does not require correction is not entirely correct. It is up to 5 - 6 years,

The fact that children under three years old do not have flat feet is not true. It can be congenital, or it can arise due to dysfunction of the central nervous, endocrine systems, due to infections and a host of other reasons. The most detrimental thing is not pain and deformity, but their consequences - disruption of the entire musculoskeletal system, including the spine. Curvature of the spine in a child can be avoided or at least stopped its development if treatment is started on time. The foot is formed before the age of 5. The earlier flatfoot is detected, the easier it is to treat. After five years of life, it is already more difficult to do this. But, starting treatment, you can improve the condition of the foot, stop the development of flat feet and prevent spinal deformities. It is worth showing the orthopedist a child who quickly gets tired of walking and asks to be held.

Pay attention to the heel of the child: whether it stands vertically, whether it collapses in one direction or another. From a very early age, the entire period of intensive growth of the body - at 3 and 6 months, at 1, 3 and 5 years - it is necessary to regularly visit an orthopedist. It is not worth treating a child on your own. Massage, physiotherapy, corrective devices (orthopedic insoles), therapeutic exercises are prescribed by a doctor who takes into account the age, the severity of the pathology, and also takes into account the main cause of the development of flat feet. As for orthopedic insoles, they must be made strictly individually, taking into account the anatomical-physiological and static-dynamic functions of the children's foot. Children's shoes should be with a small heel, a hard back and a spring individual arch support - a kind of "stones" and "bumps" under their feet.

How to fix flat feet? Visually, the inner surface of the foot will have an angle directed towards the opposite foot. In other words, do not try to put the child in the extreme (classical) positions of the choreography until these joints get stronger. In the beginning, "accustom" the heel to be vertical and the foot to "feel" comfortable on the outside. Initially, it is necessary to correctly form the outer arch of the foot.

He is just the guarantor of the correct formation of the rest.

Flat feet and clubfoot today are one of the most common defects, closely interconnected. Flat feet without adduction can be found, adduction without flat feet is the exception rather than the rule. The adduction itself contributes to the blockage of the heel. And this is already an indicator of flat feet.

And yet, one very significant detail, which we have already talked about. It is necessary to choose the right shoes, and then modify them yourself.

Exercise is, of course, a huge stimulant for the correct formation of the foot, but no matter how much you do it, in terms of the number of repetitions, it is a drop in the ocean compared to the number of steps in the “wrong” shoes that our kids take in a day.

Judge for yourself. The normative volume of movements according to the pedometer for a day stay in a preschool educational institution (DOE) (required in sandals!):

3 years - 9000 - 9500 movements;
4 years - 10000 - 10500.;
5 years - 11000 - 12000.;
6 years - 13000 - 13500 ..;
7 years - 14000 - 15000.

What? For comparison, we, adults, do about 5,000 with you at a rate of 10,000 movements per day. Exit one:

- organize useful games;
- put on the "right" shoes;
- back to jump ropes.

How to finalize shoes?

Try to find shoes with solid soles or low heels. The problem is not so much the presence of a heel (even “studs” can be made useful), but its shape and placement, and most importantly, the lack of support under the base of the 5th metatarsus, which plays a dominant role in the formation of the arches of the foot. (This is a bone on the outside of the foot, approximately in the middle). The sole should not be wide. The less it protrudes beyond the boundaries of the top, especially the heel, the better. What needs to be implemented by parents or a shoemaker engaged in the production of orthopedic shoes?

1. We cut off the heel at an angle of 5 - 10. We remove the constructive obstruction of the shoe.

2. We determine the angle of cut (αcp) and make a cut from the base to the upper or almost upper edge of the sole (depending on its design). Helps the muscles to abduct the foot.

3. Round off the outside of the front of the sole and part of the heel. For smooth rolling and shaping the outer arch of the foot.

4. Glue the insert under the heel (from the middle, at an angle of 25°-thirty°). For the formation of the internal and transverse arches by twisting the forefoot relative to the rear.

5. Glue the insert under the heads of the 2nd - 4th metatarsus (under the bases of the 2nd - 4th toes). For the formation of the transverse arch and training of the thumb. Please note: for the adducted foot, the top is horizontal, for the flat and retracted - convex. The thickness of the insert is 3 - 5 mm, depending on the age and degree of flattening of the foot.

And now, what can you say about the upper part of the shoes of a friend, workmate? I am sure that in this case we will be more verbose.

Believe me, children who are not yet interested in fashion (at least until 6 years old) will wear what you present them well. The other is more difficult. It is very difficult psychologically to “spoil” a new thing bought with your own money! Especially when someone, and there is sure to be one, from relatives, regularly releases phrases in your address: “You are doing nonsense, it would be better if you did it”, “Everyone goes and nothing”, “It still won’t work”, etc.

You will have to choose. Either you "spoil" the shoes, or they cripple your and children's feet! There is, however, another way - to organize the production of physiological footwear (not to be confused with orthopedic). In our opinion, the most reasonable solution. But not everyone can do it.

The salvation of the drowning is the work of the drowning themselves! Refine your shoes, master the physiological movements, and you will see great results. Many shoe models, of course, will not allow you to fulfill all of our recommendations. The shoes will just fall apart. Do at least a part. It will still work!

We will not describe the physiological problems that arise due to the limitation of the mobility of our toes. Let's say one thing. Bound and walled up by the narrow space of the shoe, they contribute to the formation of foot defects, instead of their direct purpose - to stimulate its proper development.

Fabulous! Nearly perfect shoe shape. Pay attention to children's Czechs. Just beautiful! It remains only to remove the seam from the outside and slightly change the heel. But even in this form, they are much more useful than modern sandals and Czech shoes. And it is quite possible that they will help correct clubfoot and flat feet in children. Theoretically, this is possible. The main thing is to identify the root cause of the defect. Then it will be easier to choose a set of measures for correction.

At present, the problem of prevention and correction of deviations in the state of health of preschool children has become particularly relevant. This is primarily due to the presence of a large number of preschool children (84.9%) with various health problems. In this regard, the importance of organizing preventive and corrective work directly in the conditions of a preschool educational institution (DOE), where the child is almost daily and where, therefore, it is possible to ensure the timeliness and regularity of impacts, increases. However, according to R.B. Sterkina and Yu.V. Korkina, at present, the system of rehabilitation of children in preschool

conditions is practically not formed. There is a disunity in the activities of medical and pedagogical personnel in providing corrective assistance to children, there is a clearly insufficient awareness of teachers and parents in the correctional and preventive issues of the development, upbringing and education of children. Despite the traditional declaration of the importance of early detection and correction of deficiencies in the mental and physical development of the child, correctional and pedagogical activity has not become a priority in the actual practice of the education system, although it should be considered as an obligatory component of the state education standard. In the process of organizing the work of preventive and corrective orientation in the conditions of preschool educational institutions, special attention should be paid to the prevention and correction of disorders of the musculoskeletal system (defects in posture, flat feet), since they have the largest share among functional deviations. In particular, conducted studies have established that 67.3% of children of senior preschool age have flat feet. Flat feet is considered as a violation of the functions of the foot, which externally manifests itself in the omission of the arches of the foot, which is caused by weakening of the muscles and sprain of its ligaments. Other authors understand flat feet as deformity of the foot, which consists in a decrease in the height of its arches in combination with heel pronation and supination contracture of the forefoot. As a result, the medial edge of the foot descends, its ligamentous apparatus is pathologically stretched, the position of the bones changes; arch support muscles, which play an important role in maintaining the arch of the foot, weaken and atrophy. which is caused by weakening of the muscles and sprain of her ligaments. Other authors understand flat feet as deformity of the foot, which consists in a decrease in the height of its arches in combination with heel pronation and supination contracture of the forefoot. As a result, the medial edge of the foot descends, its ligamentous apparatus is pathologically stretched, the position of the bones changes; arch support muscles, which play an important role in maintaining the arch of the foot, weaken and atrophy. which is caused by weakening of the muscles and sprain of her ligaments. Other authors understand flat feet as deformity of the foot, which consists in a decrease in the height of its arches in combination with heel pronation and supination contracture of the forefoot. As a result, the medial edge of the foot descends, its ligamentous apparatus is pathologically stretched, the position of the bones changes; arch support muscles, which play an important role in maintaining the arch of the foot, weaken and atrophy.

The foot is the support, the foundation of the body, so it is natural that the violation of this foundation necessarily affects the formation of the growing organism. Changing the shape of the foot not only causes a decrease in its functionality, but also, most importantly, changes the position of the pelvis and spine. This negatively affects the functions of the latter and, consequently, the posture and general condition of the child. Insufficient development of the muscles and ligaments of the feet adversely affects the development of many movements in children, leads to a decrease in motor activity and can become a serious obstacle to practicing many sports. Thus, strengthening the musculoskeletal system, and in particular the foot, is of great importance in order to exclude pathological deviations.

It is interesting to note that the formation of the correct arch of the feet in children, as well as the prevention and correction of their functional insufficiency, were given great importance in the folk traditions of education. So, for example, when preparing a child to master the skills of standing upright and walking in order to strengthen the muscles of the foot, it was customary to lightly slap him on the soles of his feet, saying various ditties, jokes, fragments from fairy tales.

And although much has been lost today from the invaluable experience of folk pedagogy selected over the centuries, such pestles, nursery rhymes, jokes, the so-called small folklore genres, reflect the traditions and worldview of its creators, their correctness and justification.

At preschool age, the foot is in the stage of intensive development, its formation has not yet been completed, so any adverse external influences can lead to the occurrence of certain functional abnormalities. At the same time, in this age period, the body of children is highly plastic, so it is relatively easy to stop the development of flat feet or correct it by strengthening the muscles and ligaments of the foot.

Successful prevention and correction of flat feet is possible on the basis of the integrated use of all means of physical education: hygiene, natural health factors and physical exercises Table 3.

Table 3. Prevention and correction of flat feet in children by means of physical education

Means of physical education	Nature of use
hygiene factors	Hygiene of footwear and its correct selection in accordance with the purpose. Hygienic washing of feet with cool water before going to bed, after walking barefoot, etc.
Natural health factors	Walking barefoot on natural dirt paths (grass, sand, pebbles, etc.) equipped in group areas during the warm season, on artificial dirt paths (boxes with washed river pebbles) in the cold season. Hardening procedures for the feet (salt path, rubbing the feet, contrast douching of the feet, the "Riga" method, intensive hardening of the feet) in accordance with the individual characteristics of children and the absence of contraindications, with medical supervision
Physical exercise	Special sets of exercises aimed at strengthening the muscles of the foot and lower leg and the formation of the arches of the foot. A feature is the use of figurative names of exercises ("Kittens", "Ducklings", "Cheerful Zoo" and other exercises with objects (hoop, ball, rope). One complex is learned and performed in physical education classes for two weeks, and in subsequent two weeks are included in the content of morning exercises.The next four weeks, another complex is applied.Then for another two weeks, in the process of gymnastics after daytime sleep, the previous complex is repeated

Features of children's shoes with its preventive properties for the treatment of flat feet.

It is impossible to solve the problem of maintaining and strengthening health only with the help of medicine, the external environment and lifestyle are important. At the same time, it is necessary to understand that lifestyle is not only the presence or absence of bad habits. Lifestyle is a social category and includes the level of well-being, culture, education, medicine, as well as the quality of products consumed. So, shoes can also be referred to products that can affect the health of children. The significant prevalence of foot deformities in children, such as flat feet, makes the problem of mass production of shoes with preventive properties relevant. Shoes with preventive properties make up a certain segment of the consumer market for children's and teenage shoes. It is distinguished by the presence of constructive solutions that ensure its maximum comfort in wearing, the presence of special details (inset anatomical insoles, half-insoles, linings), a rational scientifically based internal shape of shoes and the use of high-tech materials in the manufacture of shoes, their strict selection according to physical, mechanical and hygienic indicators. New design solutions and materials are being tested on prophylactic shoes, designed to provide maximum comfort for the wearer, and create the necessary conditions for the prevention of diseases and deformities of the feet.

What are preventive and orthopedic children's shoes?

First of all, what shoes are called orthopedic: Orthopedic shoes, according to GOST R 57761-2017, are shoes whose design is designed taking into account pathological deviations in the foot, lower leg or thigh. Based on this definition, think for yourself: do “orthopedic” shoes need a healthy child? Should proper children's shoes be orthopedic? In our understanding, no. But there is such confusion in this matter that often the correct children's shoes, which are called orthopedic, are sold in orthopedic salons and pharmacies. But in fact, these are preventive shoes, or just shoes made for everyday wear in accordance with GOST 26165-2003. Preventive shoes are shoes, the design of which is designed to prevent the formation of pathological abnormalities in the child's foot.

This definition is given by the very famous Albrecht Institute in St. Petersburg. So, "orthopedic" shoes for children are divided today according to GOST R 57761-2017 into preventive and therapeutic children's shoes.

Prophylactic shoes are the right children's shoes, recommended for healthy children whose feet look the way they should for their age. Let's consider its signs.

What materials should children's shoes be made of?

From soft, natural, ventilated. Both the materials of the upper and the “insides” of the shoes should be natural, so that the child’s foot does not sweat and there is no irritation of the delicate skin of the child’s foot.

Let us clarify the characteristics of the materials of preventive footwear.

What should be the sole? She must be:

Flexible so as not to disrupt the work of the muscles of the foot and lower leg. Moreover, the sole should bend not just anywhere, namely, at the place of the joints, where the metatarsus passes into the fingers.

Non-slip to reduce the risk of falls.

With a roll in the front, that is, its toe should be somewhat raised above the ground. This is necessary for the child to form the correct gait (Figure 11).

Figure 11. Appearance of preventive children's shoes

What should be the toe of the correct children's shoes? It must be wide. There should not be any narrowed socks in children's shoes so that the child's toes feel free. Should there be a heel? Yes, a small heel of 5 - 10 mm should be. Firstly, it prevents the child from falling backwards, which often happens with babies. Secondly, it increases the load on the muscles of the foot and helps to train its muscular apparatus. The shape of the heel should be as shown in Figure 12.

Figure 12. Heel shape for preventive children's shoes

It's a Thomas heel and is longer on the inside to support the midfoot and prevent it from rolling inward.

What should be the back? It must be closed and rigid so that the heel of the child is correctly fixed and not fall anywhere.

What should be the fasteners? They must be adjustable in order to fix the child's leg well.

Velcro fasteners, shown in Figure 13, are most convenient.

Figure 13. View of children's preventive shoes with Velcro fasteners

Do I need an arch support in children's shoes? The arch support is a small elevation on the inner side of the insole, which is located under the longitudinal arch of the foot and "supinates", that is, turns the foot outward (Figure 14).

Figure 14. Corrective detail - arch support for prophylactic and orthopedic children's shoes

Regarding this element, most of all disagreements between orthopedic doctors, the opinion prevails that it is not needed in preventive shoes. Why? Namely:

firstly, it should be located clearly under a certain place of the foot. But often a child is bought shoes “for growth”, and the arch support is not where it should be. This can only harm the child's developing foot;

secondly, if you support the place where the vault should form, then how can it be formed? In our opinion, the arch support only interferes with the training of the child's own foot muscles.

In addition, arch supports are different: small soft or, on the contrary, hard, high. The latter must be made individually for a specific foot. Soft low arch supports are recommended only in children's sports shoes. With great physical exertion, it is important to maintain the longitudinal arch. But if sports shoes are not used for their intended purpose, but in order to “force” them, then the instep support is not needed. Shoes with an instep support should be correctly called “therapeutic and prophylactic” and, in our opinion, it should be recommended by an orthopedist in the initial stages of flat feet in a child.

Thus, the signs of the right children's shoes designed for a healthy child are:

natural materials.

Flexible, non-slip, rolling outsole.

Wide toe box.

Heel 5 - 10 mm

Hard butt.

Adjustable buckles.

Absence of supinator. At least in preschool shoes.

Figure 15. Appearance of summer orthopedic children's (medical) shoes

But it is more correct to conclude that the forced correction of the arches of the foot in children under 6-7 years old disrupts the formation of a child's foot, and if the child has signs of mild flat feet, then the orthopedist will prescribe an insole with a longitudinal

arch in prophylactic shoes. This will be the best solution.

Therapeutic shoes for children, which can be seen in orthopedic salons and pharmacies, are divided into antivarus and antivalgus. Some manufacturers still provide stabilizing shoes, which are used for both minor varus and minor valgus. Such shoes put the foot in the correct position, stabilizing it (Figure 15).

As you might guess, anti-varus shoes are used for varus deformity of the foot, that is, when a child walks on the outer arches - “clubfoot”, and anti-valgus shoes - when he walks on the inner arches, i.e. when the feet "fall" inward. Moreover, these deviations go beyond the physiological characteristics of the child's foot. An antivarus foot looks as if the left leg was confused with the right. In more complex cases, orthopedic shoes are made individually for a particular child, taking into account pathological changes in his foot.

Medical shoes are made on a special orthopedic block - GOST R 53800-2010. A shoe last is a wooden or plastic form for making shoes, designed with a certain pathology in mind. For different pathologies, their own block is used. Such shoes, unlike preventive ones, are higher in order to fix not only the foot, but also the ankle joint in the correct position. Along with a hard back, it has hard berets, that is, hard side inserts that have a certain length. Therapeutic shoes have a Thomas heel: anti-valgus shoes with an elongated inner edge, anti-varus shoes with an elongated outer edge (Figure 16).

Figure 16. Characteristics of children's orthopedic shoes

In medical footwear there should not be an instep support. If necessary, the orthopedic doctor prescribes an insole, taking into account the specific pathology of the foot, possibly individual.

Dear adults, remember that a child's foot is a very "grateful" material for correction. She is soft and pliable. The main thing is not to be late. Foot pathology in children can be corrected up to 10 years of age.

Increased comfort requirements for children's preventive shoes are a combination of anthropometric, hygienic and psychophysiological properties. The use of shoes that do not meet the requirements of hygiene, and also have even a slight deviation in the ratio of shape and size inside the shoe space with the shape and size of the foot, can lead to deviations from the normal anatomical structure and functioning of the foot, and, as a result, adversely affect the general condition child's health.

Currently, there is a significant prevalence of diseases and deformities of the feet of children. In the occurrence of these deformities, among which the initial degree of flat feet and increased sweating are most common, shoes play an important role.

Comfortable conditions in shoes are determined by its ability to maintain the necessary humidity and temperature in the shoe space, which, in turn, depend on the materials chosen for the manufacture of shoes and its design. Moisture released from the surface of the foot is removed from the inside of the shoe space as a result of moisture exchange processes due to the sorption capacity and vapor permeability of materials and the so-called ventilation effect, when moisture is removed from the space between the foot and the shoe.

In closed shoes, a small amount of moisture is removed as a result of the ventilation effect. At the same time, artificial leather (IR), rubber, PVC with low vapor permeability and hygroscopicity are widely used for the top of closed shoes. A large amount of moisture accumulates inside the shoe space of such shoes, which causes discomfort and the appearance of skin diseases. When using low-permeability materials for the top of closed shoes, moisture is removed from the foot mainly as a result of absorption by internal parts - lining and insole. At the same time, most of the moisture is concentrated in the main and insole, so the material of these parts must be moisture-intensive.

Insole materials are characterized by high density, high strength after soaking in water and low abrasion when wet. In addition, insole materials must be flexible, porous, vapor and water permeable, have low thermal conductivity to prevent overheating of the foot in the heat and cooling, do not change size when the moisture content changes, do not warp when moistened and dried, and have elasticity. The removable insole improves the heat-shielding properties of the bottom of the shoe, increases the shock-absorbing ability, prolonging the wear period and making walking easier. The insole should be flexible, soft, resilient, and have a low density. do not warp when moistened and dried, have elasticity. The removable insole improves the heat-shielding properties of the bottom of the shoe, increases the shock-absorbing ability, prolonging the wear period and making walking easier. The insole should be flexible, soft, resilient, and have a low density. do not warp when moistened and dried, have elasticity. The removable insole improves the heat-shielding properties of the bottom of the shoe, increases the shock-absorbing ability, prolonging the wear period and making walking easier. The insole should be flexible, soft, resilient, and have a low density.

The company Omnipel (Italy) created the Micro-Air material for the manufacture of insoles. It is a flexible combined material based on polyurethane with an open cell structure, allowing air and water vapor to pass through. Thanks to the pump effect created when walking, it creates a pleasant microclimate in the shoe space. Its advantages also include good shock-absorbing properties, the ability to use in all types of shoes, low deformation pressure under repeated static and dynamic loads. Micro-Air can be laminated and, if necessary, treated with fungicides and activated carbon.

Emsold has developed Carbosan's formulation for foam parts. It includes activated carbon, which has a deodorizing effect, because it absorbs substances released by the foot. The resulting foam parts (insoles, footbed) have good shock-absorbing properties, destroy bacteria and fungi and have a structure with high hygienic properties. Another promising direction is the production of materials for insoles based on flax fiber. The use of containing textile fabrics in the technology of artificial materials due to the unique properties of flax - high strength, hygroscopicity, antibacterial.

Silicone is widely used as a material for the manufacture of inserts for preventive footwear for various parts of the foot, as it prevents the foot from slipping on the insole. Silicone - the material is elastic, the foot on it seems to be springy, as a result of which the muscles and tendons of the legs relax, blood circulation improves, walking becomes more comfortable, and the legs get less tired. The side of the insole that comes into contact with the skin is usually made antibacterial, moisture and odor absorbent, which also adds comfort during long walks. In addition, the antibacterial coating allows the foot to penetrate the shoe more easily. Silicone is a material that almost never causes allergic reactions and prevents the growth and development of various kinds of fungi and bacteria. Doctors recommend silicone insoles for the prevention and treatment of flat feet, diabetic foot syndrome of initial degree, psoriasis, dermatitis, eczema, rheumatoid arthritis, heel spurs, during rehabilitation after injuries, cracks and dry skin of the foot. Recently, silica gels have been widely used in drying shoes.

It has been experimentally established that under domestic conditions, drying shoes with silica gel is much faster and better (more moisture is absorbed per unit of time). Regeneration (drying) of silica gels is 2 times faster and at a lower temperature than drying of zeolites. Silica gel is an amorphous form of silicon dioxide, artificially produced in the form of hard, uneven granules (which look like crystals), or hard, even balls. The porous structure of interconnected voids creates a vast specific surface area (up to 800 square meters per gram). Silica gel is commercially produced and easy to use, it is able to adsorb a wide range of substances. Most often it is used to absorb water vapor, i.e. it is capable of holding molecules (eg. water) on its inner surface, which is why it is often referred to as a "desiccant". The pore volume of silica gel most often exceeds 0.2 ml/g, and the inner surface exceeds 400 square meters. meters / g. The pore radius varies from 1 nanometer to several hundreds of nanometers. Silica gels are distinguished: by the shape of grains (granular or lumpy); grain size (large and small); by pore size (large-pored and fine-pored).

According to GOST 3956-76, types of silica gel are classified by a four-letter designation: the 1st letter characterizes the size of the granules (K - large, M - fine, A - activated, W - charge); the 2nd letter is always C (silica gel); 3rd letter pore size (K - large-pore, M - fine-pore); The 4th letter is the shape of the particles (G - granular, K - lumpy). and the inner surface exceeds 400 sq. meters / g.

The preventive properties of children's shoes significantly depend on the spacer-support component, which is characterized by the distribution of local overloads on the plantar and dorsal surfaces of the foot and thereby ensures the physiologically normal functioning of the muscles and ligaments of the foot. The spacer-fitting comfort of shoes can be increased with the help of an anatomically profiled insole. At the same time, functional disorders in the physiologically normal deformity of the foot disappear and its musculoskeletal, depreciation and jogging functions improve.

Insertable prophylactic devices allow to increase the supporting surface and the area of contact of the shoe with the foot, due to which the specific pressure decreases and, accordingly, the fatigue of the legs when walking decreases, which in turn ensures the

quality of the shoe. A removable prophylactic insole with an anatomically average foot profile, made of hygienic material with antimicrobial treatment, can solve the problem of shoe comfort. The average rational profile of the removable prophylactic insole is an important factor in creating comfortable shoes for any purpose for wearers without clinical pathology in the anatomy of the foot. It is in this direction that research is being carried out in the field of developing new designs of children's preventive insoles. A well-known design of an insoles for children's preventive shoes, containing the upper, intermediate and lower layers, while the upper layer is made of leather, the intermediate layer is made of thermoplastic foam material that is molded during wear, and the lower frame layer is made of dense thermoplastic material, while the intermediate layer is made of with a recess in the calcaneal part under the calcaneal tubercle in a section of 0.18 D, where D is the length of the foot, and with a uniform layout of the outer and inner arches in the shank with the highest point in the area of the calcaneal-cube joint in a section of 0.36 D. On The upper layer of the insole in the toe part has a size scale and marking lines in the form of color zones, which determine the correspondence of the size of the shoe to the length of the foot. In a different insole design,

The authors used questionnaires and interviews as a method of collecting information. The results of the survey were processed using the methods of mathematical statistics.

When analyzing the number of preventive shoes in a child's wardrobe, the age of the children plays a leading role. For a more visual display of information, the results are presented as a percentage. The results of the survey showed that the vast majority of children aged 1 to 7 years old have 1 and 2 pairs of preventive footwear in their wardrobe, and the percentage of children who have 4 or more pairs of winter leather shoes has also increased.

According to the results of the study, it was revealed that in all age groups, children mainly have two pairs of leather shoes. The percentage of having three or more pairs of shoes in the two older groups is quite high. The majority of respondents (60%) purchased shoes on the market. From this we can conclude that enterprises engaged in the production of leather products need to produce such shoes that would be in full demand.

To the question “What is the most important feature of preventive footwear in your opinion?” the majority of respondents answered that the strength and comfort of shoes and what material these shoes are made of. Hygienic properties are not paid due attention. Children's preventive shoes should be mostly free-form, bright colors, with various decorations. It must be remembered that in this shoe the child has to be mainly on the street, so it must be hygroscopic.

Consider the answers to the question: “What selection difficulties do you face when buying preventive footwear?”. The following options were offered as answers: high price, unsuccessful appearance, excessive rigidity, inconvenient to put on a child's leg, not satisfied with the workmanship, not satisfied with the quality of materials. Parents of children in the 3-4 year group are especially unhappy with the excessive rigidity of the heel of the shoe. Parents of the first age group of children noted the importance of the quality of its manufacture and the convenience of putting on the child's foot when buying shoes. For children of the third age group, parents pointed out the discrepancy between the price and quality of children's shoes, their excessive rigidity and high price.

Analyzing the data obtained, we can say with confidence that the brands of the leading Russian companies Sovenok and Kotofey are the most popular among parents and children, despite the fact that there are local and regional manufacturers of preventive children's shoes.

Flat feet - deformity of the foot, which consists in a decrease in its arches.

Flat feet are not only a cosmetic defect. It is often accompanied by pain in the feet, legs, increased fatigue when walking, difficulty in running, jumping, poor coordination of movements, overload of the joints of the lower extremities, and earlier onset of pain syndromes of osteochondrosis.

The causes of flat feet are: congenital pathology (11.5% of all congenital foot defects), rickets, diseases of the nervous system (paralysis, paresis of the lower extremities, general muscular hypotension and others), foot injuries (fractures of the bones of the foot, ankles, wounds with nerve damage, tendons, muscles) and inadequate static loading. As a rule, several reasons act in a complex. More or less pronounced factors such as rickets, general muscle hypotonia, and inadequate static load are more common. The reason for the latter usually lies not in a violation of the motor regime, but in the wearing of irrational shoes by children with impaired muscle tone, increased elasticity of the bag-ligamentous apparatus.

Types of flat feet

There are the following types of flat feet:

- longitudinal;
- transverse;
- combined (longitudinal-transverse).

Degrees of longitudinal flat feet

I degree: arch angle 131 - 140, arch height 35 - 25 mm. There are no deformities of the bones of the foot.

II degree: vault angle 141 - 155, vault height 24 - 17mm. The talus is shortened, its neck is not emphasized. There may be phenomena of deforming arthrosis in the talonavicular joint or calcification of the ligamentous apparatus on the dorsum of the foot.

Grade III: vault angle 156 and above, vault height less than 17 mm. A small protrusion on the plantar surface of the calcaneus becomes massive. There is also a flattening of the transverse arch, abducting contracture of 1 finger, the foot is pronated, the heel deviates outward.

Degrees of transverse flatfoot.

I degree: the angle between the 1st and 2nd metatarsal bones is 10 - 12, the angle of deviation of 1 finger is 15 - 20.

II degree: the angle between the 1st and 2nd metatarsal bones is 13-15, the angle of deviation of the 1st finger is 21-30.

III degree: the angle between the 1st and 2nd metatarsal bones is 16-20, the angle of deviation of the 1st finger is 31-40.

IV degree: the angle between the 1st and 2nd metatarsal bones is more than 20, the angle of deviation of 1 finger is more than 40.

Diagnosis of flat feet. Children suffering from flat feet may complain of increased fatigue of the legs, pain in the feet, lower legs when running, walking for a long time and by the end of the day. Perhaps the appearance of headaches after motor loads as a result of a decrease in the spring function of the feet. In the feet, pain is localized, as a rule, in the area of the arch of the foot, at the inner edge of the heel, in the talocalcaneal-navicular joint, under the ankles. In the legs, pain is localized in the calf or anterior tibial muscles. The height of the inner and outer arches of the foot is reduced, the foot is lengthened and expanded in the middle and anterior sections. The scaphoid can be outlined through the skin on the medial side of the foot. Characterized by a spanking gait with breeding socks to the sides, when standing, the desire to put the foot on the outer edge, uneven wear of shoes:

No flat feet I degree of flat feet II degree flat feet III degree of flat feet

Figure 18. Characteristics of the number of degrees of flat feet

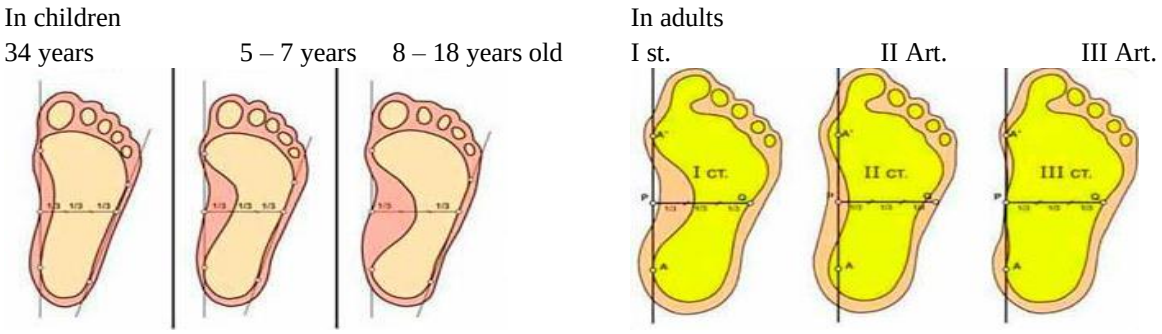


Figure 19. Features of flat feet in children and adults

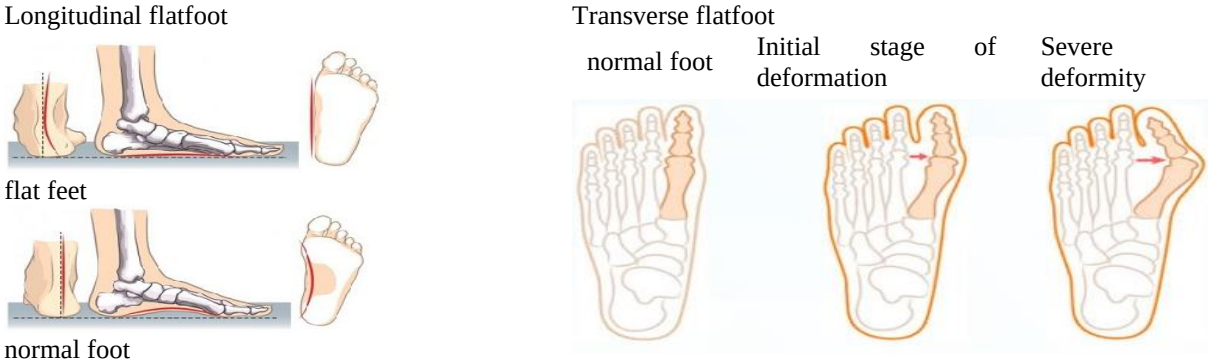


Figure 20. Features of transverse and longitudinal flat feet

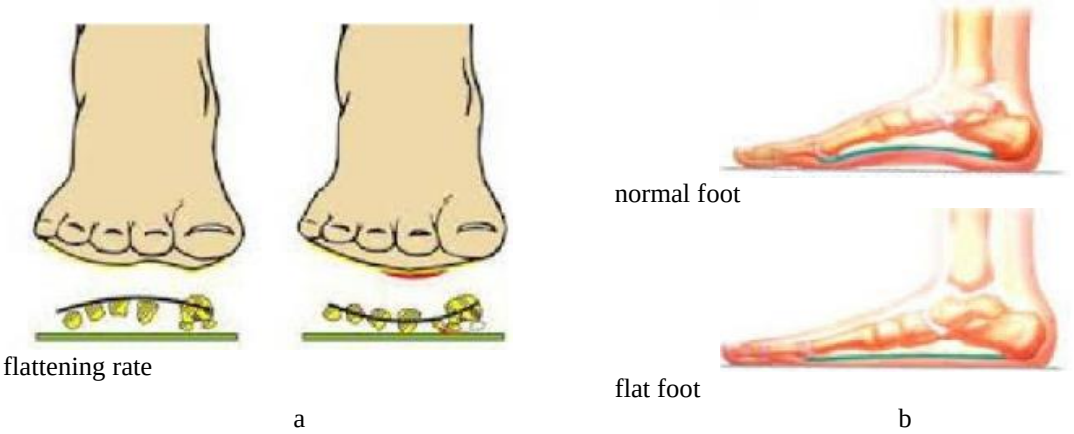


Figure 21. Types of feet in children and adults: a - longitudinal; b - transverse

Figure 22. Assessment of the degree of flat feet

Figure 23. Measurement of feet with pathological deviations

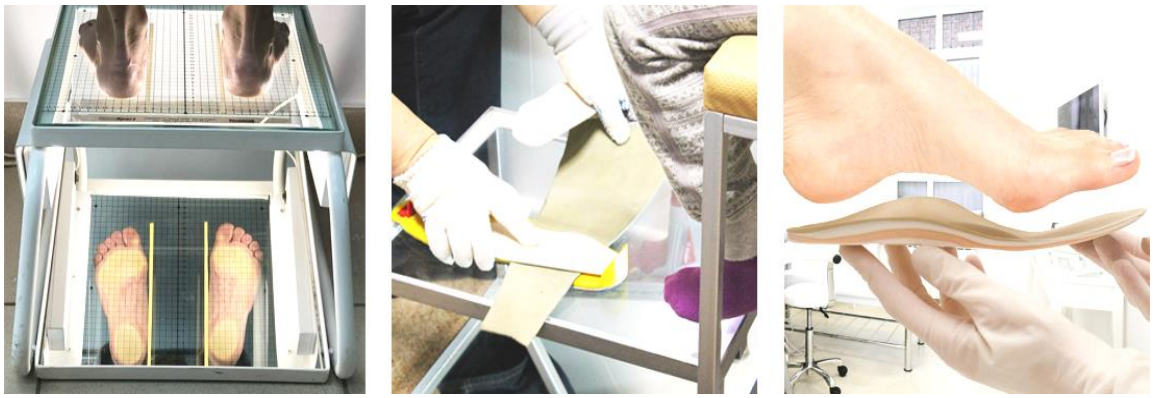


Figure 24. Selection of corrective parts for feet with pathological deviations

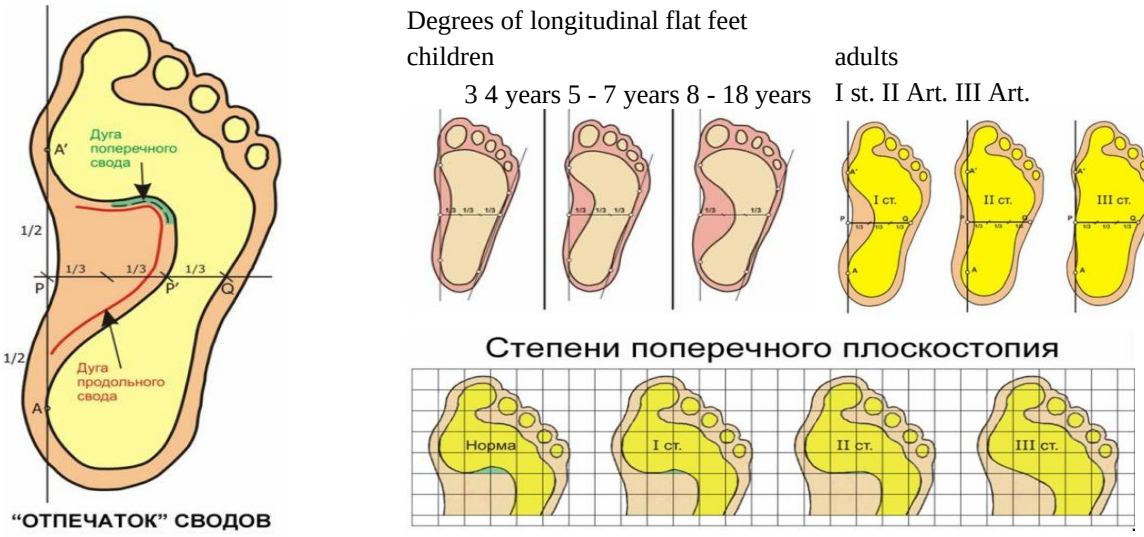


Figure 25. Characteristics of the degree of flat feet in children and adults

The diagnosis of flat feet is confirmed by plantography - obtaining footprints. A plantograph is used to carry out plantography. A frame with a waterproof fabric stretched over it from the bottom side, smeared with paint. The examined child puts his foot on the plantograph and stands up with a uniform load on both legs. The investigated foot is circled. Sometimes a dot is placed between the 3rd and 4th fingers at the level of the heads of the metatarsal bones. On the plantogram, this point is connected to the center of the heel. The resulting line is the border of the cargo and spring vaults. Normally, the cargo arch is painted over, the spring arch is free. There are other ways to process the plantogram.

Recognition of flatfoot diseases in children has some features, since the foot of a growing organism goes through certain stages of formation, which should be taken into account.

Anatomical studies show that in newborns, the arches of the feet are well defined. However, the vaulted structure is masked by abundantly developed subcutaneous adipose tissue, and when viewed from the sole of the foot, the foot appears flat. From the second year of life, when the child begins to walk and learns to run, there is a true decrease in the longitudinal arch of the foot under the influence of the load on the still fragile foot. From the age of 3, there is a significant development and strengthening of the ligaments and muscles, due to which there is a gradual increase in the height of the arches. Thus, the vaulted structure of the structure of the foot more and more receives its external outlines. The older the child, the better the arches of the foot are expressed during examination. Thus, the outwardly flat shape of the foot in younger children cannot be attributed to the true disease of flat feet, but is only a phase of normal development. It should be remembered that a flat foot, as a variant of the norm, can persist for life and does not cause any functional disorders (a person can perform any work on his feet, with weight lifting, and there is no pain). Due to the already noted anatomical and physiological features in children, when determining flat feet from sole prints, a mistake can be made, since in early childhood all or almost all children are flat feet. And if there are doubts about determining the nature of flat feet, the child (patient)

should be referred for a consultation with a specialist - an orthopedist.

Types and causes of flat feet.

Analysis of the performed studies allows us to identify three main functions inherent in a normal foot: spring - the ability to elastically spread under the action of a load; balancing - participation in the regulation of late activity when standing and walking; jogging - the message of acceleration to the general center of mass of the body during the locomotor act. The most important design feature of the human foot is its vaulted structure. Since the longitudinal and transverse arches of the foot are convex upward, in a vertical position, the pressure on the sole is distributed mainly on 3 points (calcaneal tubercle, heads of I and V metatarsal bones) and the outer edge of the sole. Therefore, the area of effective support of the foot is less than the area of its sole. The arch of the foot is supported and strengthened by the muscles of the lower leg, therefore, its damping properties are determined not only by the anatomical features of its bones, but also by the active work of the muscles. The human leg is naturally very well designed. The human foot in the process of evolution has acquired a shape that allows you to evenly distribute the load. But the ideal foot is found in less than half of humanity. According to scientists, from 40 to 80% of the entire population of the globe suffer from flat feet, of which 90% are women.

There are 5 types of flat feet:

Type of flat feet	Cause
Static flat feet - 82.1%	Decreased muscle tone
Paralytic flat feet - 5.7%	A consequence of poliomyelitis
Traumatic flat foot - 6.2%	Result of tarsal fractures
Rachitic flat feet - 3.2%	Rickets
Congenital flat foot - 2.8%	Malformations of conception, amniotic constriction, etc.

Types of static flat feet

Acquired longitudinal flatfoot: with this disease, the foot is deformed with a flattening of its longitudinal arch. The reasons for the development of longitudinal deformity of the arch of the foot are diverse, depending on the state of the muscular-ligamentous-bone apparatus, calcium content, and external influences.

Traumatic form of deformation - as a result of fractures of the bones of the foot and ankle joint, with damage to the soft tissues that strengthen the arch of the foot.

Paralytic deformity - develops due to paralysis or paresis of the muscles that support the arch of the foot. Such a deformity of the foot is typical for the transferred poliomyelitis, static paralysis, diseases of the spinal cord. The muscles that hold the longitudinal arch of the foot are shown in Figure 26.

Figure 26. Muscles that hold the longitudinal arch of the child's foot

Static deformity of the feet: develops as a result of overloading the foot. The reason may be a rapid increase in body weight (obesity, pregnancy), hard physical work associated with stress, as well as the exhaustion of compensatory capabilities with age, with general atrophic phenomena (poor nutrition, prolonged starvation, etc.).

The diagnosis of longitudinal flatfoot is substantiated by an orthopedist based on clinical examination, plantography and radiography. Patients pay attention to the appearance of fatigue in the lower extremities. Frequent and periodic pain in the longitudinal arch of the feet, in the legs when walking, by the end of the day. With the development of the disease, pain in the hips and lower back begins to bother. As a result, gait disturbances, edema of the feet and ankle joints appear, arthrosis of the foot joints develops.

Surgical treatment of longitudinal deformity of the foot is used extremely rarely, in exceptional cases. The treatment of longitudinal flat feet is predominantly conservative, aimed at relieving pain and preventing the progression of foot deformity. Apply warm foot baths with saline solutions, herbal decoctions, foot massage. Therapeutic gymnastics is aimed at strengthening the muscular-ligamentous apparatus of the foot. These are exercises for flexion and supination of the feet, flexion and extension of the toes, using objects: a ball, a rolling pin, etc. In case of severe pain, it is recommended to limit the load on the feet, often bed rest for 2-3 weeks, and then foot massage and therapeutic exercises . Physiotherapeutic procedures include paraffin and ozokerite applications, hydrocortisone phonophoresis, novocaine electrophoresis. It is necessary to regularly repeat courses of conservative treatment during the year. Patients suffering from longitudinal flat feet are recommended to wear orthopedic shoes, individual orthopedic insoles, which allows you to create a position that is comfortable for the foot.

The most common cause of the development of transverse flat feet is a constant increased static load on the feet against the background of a constitutional predisposition, less often due to trauma, diseases of the nervous system. Transverse flatfoot is a consequence of insufficiency of the muscular-ligamentous apparatus in combination with functional weakness of the muscles of the foot and lower leg. However, the role of muscle weakness in the formation of transverse flatfoot remains controversial, since there are no muscles on the foot that bring together the metatarsal bones. Nevertheless, electromicrographic studies indicated primary changes in the functional properties of the leg and foot muscles during the development of transverse flatfoot. Transverse flatfoot is clinically manifested by deformities of the foot. This is the deviation of the big toe (1st toe) to the side; osteocartilaginous growths along the inner edge of the head of the 1st metatarsal bone; tension of the extensor tendons of the toes (under the skin, on the back of the foot); the appearance of calluses of the skin on the plantar part of the foot; the so-called hammer deformity of the 2nd, 3rd toes. With the development of foot deformity, the head of the 1st metatarsal bone, which protrudes to the inside, is constantly pressed by shoes, which is one of the reasons for the appearance of osteocartilaginous growths along the medial edge of the bone and the development of bursitis of the 1st metatarsophalangeal joint. The outwardly deviated 1st toe and the hammer-like deformity of the 2nd and 3rd toes are more strongly subjected to constant pressure from the edges of the shoe. The consequence of this is the formation of an ingrown toenail of the 1st toe, the appearance of calluses on the area of the interphalangeal joint of the 2nd and 3rd fingers.

The orthopedic doctor establishes the diagnosis of transverse flatfoot on the basis of clinical examination, plantography and X-ray examination. Patients suffering from acquired transverse flatfoot usually complain of fatigue of the lower extremities when walking or standing for a long time. Also disturbing are periodically appearing pains in the heads of the 1st metatarsal bone, pain from the sole, in the projection of the heads of the 2nd and 3rd metatarsal bones. All this causes difficulties in the selection of shoes. Treatment of acquired transverse flatfoot is usually conservative - aimed at eliminating pain and preventing further progression of foot deformity. The complex of traditional conservative treatment includes: warm foot baths with saline solutions, with decoctions of herbs; therapeutic gymnastics and foot and leg massage.

The physiotherapeutic methods used include ozocerite and paraffin applications, electrophoresis of drugs (novocaine solution, etc.), phonophoresis with hydrocortisone. They also use a variety of foot-correcting devices: silicone cuffs worn on the forefoot; interdigital spacers between the 1st and 2nd fingers; individual orthopedic insoles for permanent wearing in shoes. With the 1st degree of transverse flatfoot, only conservative methods of treatment are usually used. Since it is impossible to eliminate the developed deformity of the feet by conservative methods, methods of surgical correction of the foot are also used, according to the indications. With the 2nd and 3rd degree of transverse flatfoot, accompanied by persistent pain syndrome, impaired function of the foot (support and walking), progressive deformity of the foot,

Clinically, orthopedic doctors distinguish 5 stages of flat feet:

1. Prodromal stage. At the first stage, fatigue increases when walking, and by the end of the day changes in the foot appear - sweating, "corns", calluses. There is an increased sensitivity to microtrauma, pain after a long static load, a feeling of fatigue by the end of the day. Physical performance decreases, general fatigue is expressed. Headaches are possible as a result of a decrease in the spring function of the foot. The net result of all this is sleep disturbance.

2. Stage of intermittent flat feet. Increased pain in the foot by the end of the day. The longitudinal arch of the foot at the same time is visually compacted, after rest it is restored. There may be some swelling of the feet and coming (temporary) contracture of the muscles. By morning, these symptoms are gone. Already at this stage, changes occur in the area of the knee joints, swelling in the ankles, blood circulation in the lower extremities is disturbed, which is manifested by heaviness in the legs, orthostatic edema. Pain in the feet leads to a decrease in motor activity: preference is given to movement by car. Insufficient muscle mobility leads to impaired

microcirculation, changes in lymphovenous outflow. At these two stages, there are no significant visible changes in the area of the feet, and only the accompanying deficiencies lead to a cosmetologist-dermatologist.

The main complaints in this case are thickened, loose tissue in the area of the knee joints, which is not always of fatty origin: an increase in volume is obtained due to micro-effusion from the knee joint, which also suffers from flat feet. In other patients, the pathological process is localized in the ankle joint: it becomes wide, edematous and loses its grace.

3. Stage of development of a flat foot. Fatigue develops rapidly as a result of muscle overwork. The pain is constant and aching. Reducing the height of the longitudinal arch. The deformity of the legs is clearly visible; the contours of the navicular bone are distinguished at the medial (inner) edge of the foot, the calcaneus deviates outward, acting as an ugly tubercle, usually bluish-red in color, easily injured until scuffs appear. The gait changes, as the range of motion in the joints of the feet is limited.

4. Stage of the flat-valgus foot. The longitudinal arch is sharply flattened. When walking, pain quickly appears in the area of \u200b\u200bthe inner ankle. Expressed reflex spasm of the muscles of the leg and foot. The tendons in the rear area of the foot are stretched. There is a deformation of the thumb with the formation of "bones" and rough corns. The latter are often combined with callused warts. The patient pays attention to the plantar wart and comes to the dermatologist, usually late, when pain already appears. The cause of callused warts is also flat feet. Therefore, without concomitant orthopedic correction, treatment may be ineffective.

5. Stage of contracture flat feet. Foot pain is constant. The foot is in a position of sharp pronation (the inner surface is trampled). Walking is noticeably disturbed and difficult.

Prevention of flat feet at the earliest stages includes the timely and complete treatment of rickets, pathologies of the central nervous system, strengthening the muscles and ligamentous apparatus of the lower extremities with the help of gymnastics and massage. In a later period, starting from the year when the child masters the vertical posture, walking, it is equally important to wear rational shoes. Walking barefoot or in socks on the floor for preschool children is harmful. They can walk barefoot on sand, pebbles, grass, an inclined plane up and down, peas, beans. For the prevention of flat feet and strengthening the muscles of the feet, it is useful to use the Plant insoles, in which the arch area is lined with massage elements. These insoles are recommended to be worn no more than 5-6 hours a day. It is convenient to put Plant's insoles in the shoes that the child wears in a children's institution. The time of a child's activity in a preschool educational institution is approximately equal to the recommended time for wearing insoles. On weekends, the child does not attend preschool and the feet rest. In the presence of foot defects, it is useful to use orthopedic insoles that help correct the defect, or to carry out a special shoe correction.

During the formation and differentiation of the child's foot, the risk of its deformity is high. The deformation of the foot in children is due to the fact that the child, in an effort to increase the area of support, tries to spread his legs as wide as possible - while the internal sections of the feet are used as much as possible. It also affects the increased extensibility of the ligaments and the insufficiently strong bone apparatus. The risk of such phenomena as valgus and varus deformities is especially high, deformity of the toes is less common, the orthopedist establishes a pathological deviation and issues recommendations to parents and the child about the activities that they should implement with his participation in order to alleviate the child's condition and provoke the correction of the presence He has pathological abnormalities.

According to the experts of the St. Petersburg Scientific and Practical Center for Medical and Social Expertise, Prosthetics and Rehabilitation of the Disabled. G.A. Albrecht, orthopedic insoles up to size 140 should be made only individually as prescribed by an orthopedic doctor.

With flat feet due to the slow development of the arches, arch-forming insoles and semi-insoles are shown, made with the lining of the inner and outer longitudinal arches of the foot, which are located between sections 0.20L and 0.60L. The maximum height of the layout of the longitudinal arches, both from the inside and the outside, is the same. It is located at the level of the calcaneus-cube joint, i.e. for sizes from 140 to 200 - in a section of 0.36 L and is from 5 to 7 mm, for sizes from 205 to 245 - in a section of 0.33L and is from 8 to 10 mm. The size of the recess relative to the edges of the insole in the heel is 3 - 4 mm for children's and small children's insoles and 5 - 6 mm for the rest.

In case of functional insufficiency of the muscular-ligamentous apparatus and moderate pronounced static non-fixed flat feet, arch-supporting insoles and semi-insoles are prescribed, made with the layout of the inner and outer longitudinal arches of the foot, which are located between sections 0.20L and 0.60L. In this case, the layout of the inner arch is higher than the layout of the outer one. The location of the maximum calculation of the inner and outer longitudinal arches is at the level of the heel-cube joint, similar to that described above. Depending on the size of the foot, the layout of the outer arch is from 5 to 8 mm, and the inner from 9 to 12 mm.

Features of resuscitation of impaired vital functions of the organism of children

At present, the problem of prevention and correction of deviations in the state of health of preschool children has become particularly relevant.

This is primarily due to the presence of a large number of preschool children (84.9%) with various health problems. In this regard, the importance of organizing preventive and corrective work directly in the conditions of a preschool educational institution (DOE), where the child is almost daily and where, therefore, it is possible to ensure the timeliness and regularity of impacts, is increasing. However, at present, the system of rehabilitation of children in preschool conditions is practically not formed. There is a disunity in the activities of medical and pedagogical personnel in providing corrective assistance to children, there is a clearly insufficient awareness of teachers and parents in the correctional and preventive issues of the development, upbringing and education of children. Despite the traditional declaration of the importance of early detection and correction of deficiencies in the mental and physical development of the child, correctional and pedagogical activity has not become a priority in the actual practice of the education system, although it should be considered as an obligatory component of the state education standard. In the process of organizing the work of preventive and corrective orientation in the conditions of preschool educational institutions, special attention should be paid to the prevention and correction of disorders of the musculoskeletal system (defects in posture, flat feet), since they have the largest share among functional deviations. In particular.

The foot is the support, the foundation of the body, so it is natural that the violation of this foundation necessarily affects the formation of the growing organism. Changing the shape of the foot not only causes a decrease in its functionality, but also, most importantly, changes the position of the pelvis and spine. This negatively affects the functions of the latter and, consequently, the posture and general condition of the child. Insufficient development of the muscles and ligaments of the feet adversely affects the development of many movements in children, leads to a decrease in motor activity and can become a serious obstacle to practicing many sports. Thus, strengthening the musculoskeletal system, and in particular the foot, is of great importance. It is interesting to note that the formation of the correct arch of the feet in children, as well as the prevention and correction of their functional insufficiency were given great importance in the folk traditions of education. So, for example, when preparing a child to master the skills of standing upright and walking, in order to strengthen the muscles of the foot, it was customary to lightly slap him on the soles of his feet, saying:

Forge, forge, kovalek, Shoe a shoe: On a small leg, a golden shoe. Give a hammer to shoe a shoe!

And although much has been lost today from the invaluable experience of folk pedagogy selected over the centuries, such pestles, nursery rhymes, jokes, the so-called small folklore genres, reflect the traditions and worldview of its creators.

At preschool age, the foot is in the stage of intensive development, its formation has not yet been completed, therefore, any adverse external influences can lead to the occurrence of certain functional abnormalities. At the same time, in this age period, the body is highly plastic, so it is relatively easy to stop the development of flat feet or correct it by strengthening the muscles and ligaments of the foot. Successful prevention and correction of flat feet is possible on the basis of the integrated use of all means of physical education: hygiene, natural health factors and physical exercises.

Valgus deformity of the foot in children

“Plano-valgus foot placement” - this is the diagnosis that parents often hear from a pediatric orthopedist (figure 27). If everything seems to be clear with the word “flat”, then the second part of this diagnosis - “valgus” is not so obvious. And in general, what kind of disease it is and what to do about it requires explanation. Valgus - in other words - X-shaped installation of the feet. Everyone knows what "exic feet" is - the same thing with feet. The feet are flattened and “littered” inward - these are flat-valgus feet.

The diagnosis of "flat-valgus (or X-shaped) setting of the feet" is made quite often. With this deformity, the feet become flatter and seem to collapse inward.

The reason is that the weak ligamentous apparatus of the child's foot does not always withstand the load of the body. Accordingly, the longitudinal arches are flattened, and the inner edge of the foot sags, the anterior section is retracted. If you look at the photo of flat feet in children from above, the letter “X” will be clearly visible. The first signs of the X-shaped setting of the feet can be traced already at the first steps. The main thing is to immediately identify violations in order to conduct timely treatment of foot deformity.

Varus deformity of the foot in children

Signs of varus planting of the feet are knee joints bent in an O-shape, not connected together in a straight line. Therefore, when walking, the child will rely on the outer arches of the feet. Such deformities are most often found in infants, as well as in children with cerebral palsy, brain tumors, and diabetes mellitus. Timely diagnosis of pathologies and successful correction of clubfoot, treatment of flat feet in children is possible - for this you need to regularly visit an orthopedist and follow his recommendations.

Figure 27. Flat-valgus foot in children

This happens because the weak ligamentous apparatus of the child's foot cannot withstand the load of the body. Flattening of the longitudinal arches leads to sagging of the inner edge of the foot and abduction of the forefoot. This is how an X-shaped stop setup is formed.(figure 28). The first signs of flat-valgus foot placement appear simultaneously with the first steps of the child. Individual orthopedic insoles allow you to effectively correct the flat-valgus installation of the feet and, in combination with children's orthopedic shoes, provide the child's foot with the correct position. Strengthening the musculoskeletal apparatus of the foot is of great importance in the treatment. Therefore, physiotherapy for the feet is an indispensable component.

a b

Figure 28. Characteristics of varus deformity of the foot in children: a - X-shaped; b - "littered" inside

Features of plano-valgus deformity of the foot.

As you know, the foot of an adult has an arched structure. The longitudinal and transverse arches of the foot perform a spring, balancing function, and also participate in the adaptation of the foot to the supporting surface when walking. The arches of the foot of a child under 3 years old are not yet formed. Due to the significant amount of subcutaneous fat, the foot of a child at this age looks almost “flat”. As the child grows, the height of the arches increases, and each age group is characterized by a certain height of the longitudinal arch.

Since, on the foot and, in particular, on its plantar surface, there are “projections” of various organs of the human body. From these positions, in order to maintain a normal state of health, it is necessary to use only rational footwear that contributes to the normal functioning of people. This is especially important for growing children's feet, especially for feet with various deformities. According to various studies, the most common foot deformity is flat feet and one of its varieties is flat-valgus feet. It is accompanied by the following deviations:

- flattening of the longitudinal arch; valgus position of the posterior section;
- abduction-pronation position of the anterior section.

The maximum percentage is observed in children of primary school and preschool age. However, physiological flat feet, even at the age of up to 3 years, must be distinguished from pathological, when the decrease in the longitudinal arches is combined with valgus deformity of the foot. If the angle of the valgus deviation of the heel part of the foot of a three-year-old child is more than 70, then we can talk about a flat-valgus foot. An indirect sign of a flat-valgus foot of a child can be considered a characteristic wear of the heel, mainly along the inner edge and deformation of the heel of the shoe. Very often, a child with flat-valgus feet complains of pain in the knee and ankle joints that occur during physical exertion, he gets tired when walking and running. Plano-valgus deformity of the feet requires orthopedic treatment. Lack of necessary treatment, as a rule, leads not only to a change in the shape of the foot, but also to spinal deformity: a violation of posture and scoliosis. Plano-valgus deformity of the feet is a very common type of deformity. In this case, the arches of the foot decrease and the heel of the foot deviates outward. More common in children. This causes rapid fatigue when walking, pain in the lower leg and knee joints, swelling. Shoes, as a rule, are bent, deformed, the inner part of the heel wears out. As a result, a pelvic tilt, shortening of one leg, back pain, intervertebral hernia and other problems. Most often, the cause of plano-valgus deformity is hypermobility of the joints, weakness of the muscular-ligamentous apparatus. With age, degenerative changes in the bones and joints of the feet, circulatory disorders can develop. Treatment, especially at an early age, It is aimed at strengthening the muscles of the arches of the foot and lower leg. As a result of the examination, the orthopedic doctor will determine the degree of deformity, select the desired foot correction program and make individual orthopedic insoles or orthoses necessary for a particular patient. For a long time, there was no generally accepted clinical classification of flat-valgus deformity of the foot. Known classifications were based on the pronounced signs of deformation and the stages of its development. For example, the classification of PP Vreden is known, which is based on the main clinical forms of flat feet, representing a number of gradations that affect the choice of treatment method: necessary for a particular patient. For a long time, there was no generally accepted clinical classification of flat-valgus deformity of the foot. Known classifications were based on the pronounced signs of deformation and the stages of its development. For example, the classification of PP Vreden is known, which is based on the main clinical forms of flat feet, representing a number of gradations that affect the choice of treatment method: necessary for a particular patient. For a long time, there was no generally accepted clinical classification of flat-valgus deformity of the foot. Known classifications were based on the pronounced signs of deformation and the stages of its development. For example, the classification of PP Vreden is known, which is based on the main clinical forms of flat feet, representing a number of gradations that affect the choice of treatment method:

prodromal form of flat feet; intermittent flat feet;

a simple form of flat feet; flat feet complicated by abduction of the forefoot; contracture flatfoot.

Among the developed classifications of plano-valgus deformity of the feet, the classification of posterior tibial tendon dysfunction (TTT) by K.A. Johnson and DE Strom modified by MS Myerson. It is based on the relationship between the elasticity of the flat-valgus foot and the development of dysfunction of the tendon of the posterior tibial muscle - the more pronounced the flat-valgus deformity of the foot, the faster the degenerative changes in the MVSS occur, the more rigid and persistent is the flattening of the internal longitudinal arch. MS Myerson added the fourth stage, which described degenerative changes in the ankle joint, to the three stages of development of planovalgus deformity proposed by them. This classification is quite informative, as it includes both many signs of plano-valgus deformity, and stages of its development. Classification of plano-valgus foot deformity in children. According to statistics, almost every child under 5 years of age who has deviations in the development of the feet (40-80%) also has a diagnosis of plano-valgus deformity of the feet.

In children, flattening of the arch of the foot, as a rule, occurs during the period when the baby is just taking the first steps; this is due to quite serious loads on the legs when trying to take a step. Of course, you can't expect a perfectly correct foot placement or hip-to-hip gait from a baby right after he first got on his feet.

Plano-valgus is accompanied by the following deviations:

flattening of the longitudinal arch;

abduction-pronation position of the anterior section;

valgus position of the posterior region.

The maximum percentage is observed in children of primary school and preschool age. Although there are times when this diagnosis can be considered unauthorized.

The shape of the foot, formed in the course of evolution, provides an even distribution of body weight. The bones of the foot, connected by strong interosseous ligaments, form its arch, the role of which is to provide maximum cushioning of movements when running and walking. Convex arches are oriented in two directions - transverse and longitudinal. Therefore, normally, the foot of an adult has three points of support - the head of the first metatarsal bone, the calcaneal tubercle and the fifth metatarsal bone. In children, flattening of the arch of the foot, as a rule, occurs during the period when the

baby is just taking the first steps; this is due to quite serious loads on the legs when trying to take a step. Of course, you can't expect a perfectly correct foot placement or hip-to-hip gait from a baby right after he first got on his feet. As a rule, for the first time complaints of parents arise, when the child takes the first independent steps. In this case, it is necessary to clearly distinguish between the physiological flattening of the arch of the foot of a child who has not yet reached the age of three years, and the flat-valgus deformity proper, which already requires the supervision of an orthopedist. Up to three years of age, children have a "fat pad" on the plantar aspect of the foot, so the arch of the foot is not visible with a simple visual inspection. But it will be noticeable if you ask the baby to stand on his toes. Bone tissue in a child continues to form up to 5-6 years, so only during this period it makes sense to start a conversation about the absence or presence of flat-valgus deformity in the baby as such.. Although it should be borne in mind that flat-valgus feet in children can lead to such negative consequences as:

severe curvature of the spine;

constant pain in the legs;

"adult" diseases - osteochondrosis, arthrosis.

In some cases, the diagnosis of "valgus feet" is made to the child in the hospital. In this case, the congenital nature of the disease (vertical ram) takes place.

Causes of foot deformity:

connective tissue dysplasia (78%). Polluted water and air, poor quality food lead to the fact that the connective tissue, which is the basis of the ligamentous apparatus of the joints (as well as all other organs), is formed incorrectly;

improper children's shoes (soft models with a flat sole that are not able to fix the leg properly);

the baby is not engaged in physical education in preschool institutions and in the family;

genetic and endocrine (diabetes, thyroid disease) disorders;

osteoporosis (damage to the bones of the skeleton);

various foot injuries.

Doctors identify a number of theories that can be used to explain the etiopathogenetic mechanisms:

anatomical theory;

vestimentary theory;

static-mechanical theory;

theory of hereditary muscle weakness;

theory of constitutional weakness of the connective tissue.

Doctors distinguish three degrees of severity of flat-valgus deformity of the feet: mild, moderate and severe. The so-called rocker foot (vertical ram, paperweight foot) is the most severe degree of deformity. It is detected immediately at birth, the incidence of detection is 1 per 10,000 newborns. The etiopathogenesis of this deformity has not yet been fully elucidated. As the most likely cause of the deformity, doctors single out a malformation of the germ and a delay in its development at one of the stages of embryo formation.

Foot parameters are normal:

- if you draw two lines - along the lower contour of the calcaneus and the first metatarsal bone - so that the top of the angle is in the region of the navicular bone, this angle should be 125;

- height of the longitudinal arch - 39–40 mm;

- valgus position of the hindfoot from 5 to 7;

- the angle of inclination of the calcaneus relative to the plane of support from 20 to 25.

The height of the longitudinal arch of the foot in preschool children can normally be 19 - 24 mm.

Light degree is characterized by the following parameters:

the height of the longitudinal arch of the foot is reduced to 15 - 20 mm;

vault height angle reduced to 140;

the angle of inclination of the calcaneus - up to 15;

valgus position of the posterior section up to 10;

abduction of the forefoot 8 - 10.

Average degree:

the arch of the foot is reduced to 10 mm;

vault height reduced to 150 - 160;

the angle of the calcaneus up to 10;

valgus position of the posterior section and abduction of the anterior section up to 15.

Severe degree:

the arch of the foot is reduced to 0 - 5 mm;

the angle of the height of the arch of the foot is reduced to 160 - 180;

heel bone inclination angle - 5 - 0;

valgus position of the posterior section and abduction of the anterior section more than 20;

severe deformity is rigid and cannot be corrected;

constant pain syndrome in the region of the Choparov joint.

The foot is the foundation, the "foundation" of our body. And if the foundation is crooked, then an even, reliable house cannot be built on it. Plano-valgus deformity of the feet entails valgus (X-shaped) deformity of the knee and ankle joints, incorrect position of the pelvis, and posture disorders. The curvature of the axes of the spine and limbs leads to an overload of the muscles, which will unsuccessfully try to keep the body in the correct position. As a result - the appearance of pain, the early development of arthrosis, osteochondrosis. Measures for the timely prevention of SNS progression should be considered appropriate as adequate orthopedic support, the need for which, according to various authors, is up to 78% of the population. Traditionally, orthopedic support is limited to the appointment of orthopedic shoes or insoles inserted into normal shoes. Orthopedic insoles are produced by prosthetic and orthopedic enterprises.

In recent decades, attempts have been made to create, in particular, removable orthopedic insoles for an impersonal consumer. However, the limited design options and a number of other shortcomings did not allow to significantly change the nature of orthopedic support in general. The cause of the flat-valgus foot in a child, as a rule, is the hypermobility of the joints. Weak muscles and ligaments do not "hold" the weight of the child and pronation (valgus deviation) of the foot occurs. Treatment of the flat-valgus foot of a child is carried out in a complex manner. It is necessary to carry out activities aimed at strengthening the musculoskeletal apparatus involved in arch retention. This is a complex of therapeutic exercises, massage, physiotherapy. It is necessary to wear individual orthopedic insoles.

When designing children's shoes, the requirements of convenience and comfort are brought to the fore. The quality of children's shoes is determined not only by their wear resistance and appropriate aesthetic design, but also by sufficient comfort, which is understood as the ability of shoes to provide conditions for the normal functioning of the foot. The comfort of shoes is a complex indicator, the properties of which are usually divided into three groups:

the first group consists of physiological properties that ensure the normal biomechanical functioning of the foot;

the second includes hygienic properties that affect the safety and harmlessness of the conditions of its wear; the third characterizes footwear in terms of its rationality and convenience, represents anthropometric properties;

the third group of properties includes spacer and support stiffness, formability and the degree of compression of the foot by shoes, which depends on the magnitude of the resulting pressure.

Of particular interest for assessing the comfort of shoes is the indicator "pressure of the top of the shoe on the foot". The amount of pressure of the top of the shoe on the foot and the nature of its change in the process of wearing primarily depend on the size and internal shape of the shoe, determined by the size and shape of the shoe. In addition, due to the increase in the size of the foot, additional pressure is created due to the properties of the materials of the shoe blank and its design. It is known that in the process of movement, the increase in the volume of the unshod foot in the metatarsophalangeal joint is on average 4%. The initial dimensions of the foot do not remain constant throughout the day. Their change is influenced by the duration and intensity of walking, as well as the microclimate in the shoe space. An increase in the temperature and humidity of the foot leads to an increase in its volume and, consequently, affects the amount of compression of the foot by shoes. Excess pressure adversely affects the physiological state, which manifests itself in a change in the moisture-temperature regime, a shift in the center of gravity, and the accumulation of static electricity on the skin. As a result, the child experiences discomfort, manifested in increased fatigue of the lower extremities and the occurrence of pain. In addition, prolonged pressure of the top of the shoe on the forefoot contributes to the development of various pathological abnormalities. Increasing this group of footwear comfort is facilitated by soft edges and pads used in shoe upper models. Of no small importance in the development of comfortable shoes are the materials used for the details of the top and bottom, which should be soft and elastic, as well as fastening methods. For the manufacture of unlined shoes, elastic leathers, including leathers of increased thickness, textile and artificial materials, characterized by properties similar (especially in hygroscopicity) to elastic natural leathers, can be used as upper materials. The comfort (in particular, hygroscopicity) is influenced by the lining used in the shoe. This, as a rule, is natural leather of chrome-tanned drum or aniline dyeing in light colors, as well as textile materials. Thermoplastic backs and toes must be soft and elastic and dimensionally stable. One of the main conditions that reduce the spacer stiffness of shoes is the design of children's shoe lasts. The toe shapes recommended for children's shoes - an expanded oval and a rounded caret - are predetermined by the stability of the lasts. Support comfort, as a component of the integral concept of shoe comfort, reflects the conditions for the most favorable interaction of the plantar part of the foot with the system of the bottom of the shoe, which are determined by an array of optimal indicators obtained by contacting the foot of a person of normal weight with an average soil. In the complex of criteria for assessing support comfort, three main ones are distinguished, in accordance with which design changes should be introduced, characteristics should be calculated and materials of the shoe bottom system should be selected, namely:

pressure distribution over the supporting surface of the foot (criterion - pressure distribution);

reaction to the heel part from the base in the phase of body weight transfer to the supporting leg (criterion - depreciation);

tension that has arisen in the plantar muscles and ligaments when the foot is loaded (criterion - expansion force).

The transition from the interaction of the foot with elastically plastic soil to contact with a rigid system of the bottom of the shoe - asphalt (concrete) causes the appearance of a high concentration of stresses in some areas of the plantar part, since the interaction force is realized through a contact surface reduced by about 1.3 times. This makes it necessary to bring the pressure distribution to the optimum by changing the elastic and geometric parameters of the support. One of the prerequisites for the design of

shoes with supportive comfort should be the installation of a main profiled insole with special processing and an insert made of foam materials, allowing it to be easily molded to the foot. The problem of designing comfortable shoes cannot be solved without activating the work of related industries, developing materials and products for this footwear. Indicators of footwear comfort, such as its convenience, lightness, softness, elasticity, can only be achieved if the materials and products that make up these shoes have the appropriate properties. It was determined that footwear is one of the factors influencing the formation, development and normal functioning of the body of adolescents. So, flattening of the foot leads to a violation of posture, diseases of the spine, improper location, and hence the work, of the internal organs. A decrease in the physiological curves of the spine (flat back), especially in combination with flat feet, leads to permanent microtrauma of the brain, impaired memory and attention. A similar chain can be built when analyzing the influence of shoes on the emotional development of adolescents, on which personal and social health depend. To do this, it is necessary to understand how the process of social maturation of the child proceeds, and how important his appearance, and hence the objects of consumption, such as clothes and shoes, are.

Calluses, abrasions, curvature of the fingers and feet in general, etc. Consumer objects that form the external image of a teenager are not just elements of a costume for him, but also a way to express his individuality, declare his interests and indicate belonging to a particular community. The absence in the wardrobe of a teenager of shoes in the style inherent in his comrades may serve as a misunderstanding on their part. And conflicts in relationships with peers give rise to difficult experiences, are regarded by adolescents as a personal drama, and therefore affect personal and social health. Another possibility of the influence of shoes on the psychophysiological and social health of a teenager lies in the increased self-criticism of their external data inherent in this age. Fullness of the lower leg, large or small size of the foot.

The main signs include the following manifestations:

with tight compression of the knees, the distance between the ankles reaches 5 cm or more;

with X-shaped legs, there is a noticeable bending of the joints;

fingers and heel look up, and the axis of the foot is significantly curved;

a deformed foot negatively affects the child's condition: the legs hurt when walking, swelling appears in the afternoon.

Figure 29. Corrective parts for correcting the deformity of the thumb

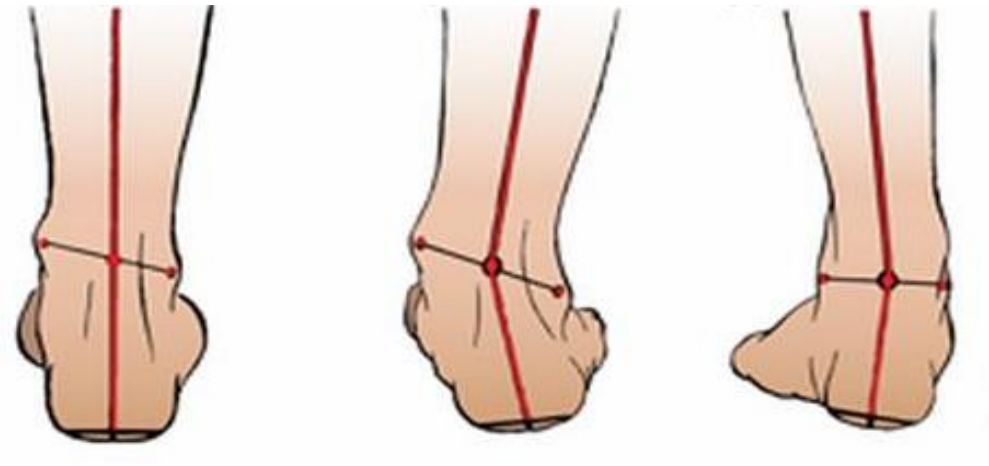
With pain in the legs, rapid wear of shoes, you need to carefully examine the child's feet and check if he has symptoms of flat-valgus deformity. At the slightest suspicion of problems with the joints or muscles, you should contact an orthopedic doctor.

The corrective details shown in Figures 29-32 will help correct the flat-valgus foot.

Figure 30. Characteristics of corrective parts of shoes for children with varus and valgus deformities of the feet

Figure 31. Types of corrective parts for children with pathological abnormalities

Another common disease in children is flat-varus deformity of the feet. With flat-varus deformity, in which the curvature of the arches and the axis of the feet is characteristic, we are already talking about clubfoot. But there is still a difference between these diseases. Figure 32 shows the characteristics of the installation of the heel of the foot.



a b c

Figure 32. Characteristics of the installation of the heel of the foot: a - correct installation; b - valgus heel; c - varus heel

Anti-valgus shoes are special shoes for children with hallux valgus.

Parents do not have to worry that special shoes will spoil the appearance of the child: corrective sandals, boots, boots do not look different from traditional models. Fashion models have long since replaced the unsightly anti-valgus shoes produced only 20 years ago (Figure 33).

Anti-valgus securely fixes the ankle and talocalcaneal joint in flat valgus foot changes.

Figure 33. Corrective, anti-valgus orthopedic shoes

Thanks to the special design of anti-valgus shoes:

the mobility of bone joints is corrected, stopping the deformation;

corrective shoes are distinguished by a high beret, which allows you to firmly fix the ankle;

need insoles in orthopedic shoes, so all models have a removable insole that ensures the correct layout of the longitudinal arch of the foot in a child;

in case of severe pathologies, an arch support insole is made in special laboratories;

parts for orthopedic products are made to order.

An arch support is a special protrusion, during the manufacture of which the master forms a bulge, taking into account the anatomical features of the child's legs.

The Thomas orthopedic heel ensures proper fit and helps prevent inward turning of the foot. During production, the heel is made longer on the inside.

The most common concomitant deviations of the lower extremities in cerebral palsy are: flat feet, hollow foot, valgus and varus deformities of the feet, foot paresis, shortening of the lower extremities, various deformities of the fingers. This requires the introduction of certain additions to the design of shoes. Shoes for children with cerebral palsy should be made of high quality materials. Distinctive features are specially designed pads that have a wide toe section to ensure the natural position of the toes, and the child's foot is not deformed and occupies a comfortable position. In shoes, it is recommended to use soles with sufficient elasticity and flexibility. Some models have a prophylactic sole with a special heel with an elongated crocodile to support and unload the foot. This reinforces the sole under the midfoot and prevents it from sinking inward. The use of a heel helps both in the prevention and treatment of foot defects. Orthopedic provision of patients with a drooping foot is determined by active mobility in the ankle joint, as well as the presence of lateral deviations of the foot. In cases where dorsiflexion in the ankle joint is preserved and there are no lateral deviations of the foot, shoes are prescribed in combination with a cuff and rubber bands. If the sagging is not fixed and there are slight lateral deviations of the foot, it is recommended to use orthopedic boots in combination with a cuff and rubber bands, as well as shoes with double lacing. Pronounced lateral deviations of the sagging foot require the appointment of orthopedic boots with one-sided hard berets and heel extension, and the intersole layer should be supplemented with a pronator or arch support. With a fixed sagging or excessive mobility in the ankle joint, boots with bilateral or circular hard berets are recommended. The circular rigid beret, along with a more secure fixation, creates some front stop, which is necessary for the implementation of the roll. The product range is limited. Recommended designs for children with cerebral palsy are boots and high sandals. The shoe height is designed based on the doctor's prescriptions and is presented in Table 4 in accordance with GOST R 54407-2011.

Table 4. Calculation of the parameters of custom-made orthopedic shoes

Gender and age group of shoes	Shoe height, mm, not less than boot
For toddlers	0.3/ + 53
Little children's	0.3/ + 59
preschool	0.3/+63
For school girls	0.45/+50
For schoolboys	0.4/+55
Maiden	0.3/+45
boy's	0.3/+45

Practice has shown that, on average, the height of the shoe is overestimated by 50 mm from the outer ankle bone. The heel height is 20 mm. For children's shoes, this heel height is optimal. Strict requirements are also imposed on the shape of the toe of the shoe. The shape of the toe should be anatomically correct, as much as possible correspond to the shape of the child's foot. It should not deform and squeeze the toes. For the convenience of putting on shoes, berets, as a rule, are designed shortened, which ensures the maximum degree of opening of the shoe. Laces are the most effective method of fixation, since in these shoe designs the maximum fixation of the child's foot in the shoe and its adjustment in accordance with the individual parameters of the foot are important. An important role in footwear for children with valgus and varus deformities of the feet is played by a comfortable anatomical insole. An obligatory element of the insole is the laying out of the arch to support the arch of the foot. In addition, based on the doctor's prescriptions, an arch support or pronator of the toe or heel of the foot is designed on the details of the bottom. The design of the intermediate parts in the footwear under consideration also has its own characteristics. This is necessarily a high hard beret, a hard back with elongated wings.

Acceptable methods of securing shoes to the foot are shown in Figure 34.

When designing boots, two main designs are used: boots with a tuning vamp and boots with tuning berets. The front line of the vamp is shifted towards the toe for a more complete "opening" of the tongue, which is important when putting on and taking off shoes and fixing it on the foot. The high hard beret is made of hard leather or plastic. Its purpose is to securely fix the foot and ankle joint, so it can be strengthened. One of the most common designs, studies have shown, are sports-style cuffs with a cropped vamp. Lining material can be textile, natural lining leather, lint or fur, depending on the season. The list of materials is presented in table 5.

a b c

Figure 34. Shoe models for children with valgus and varus deformities of the feet: a - with laces; b - with buckles; c - with Velcro fastener

When designing the details of the top, the following features should be highlighted: the angle between the upper edge of the tibia and the inflection line of the vamp should be close to 90 for the greatest distance under the laces, due to which the fixation of the foot is largely ensured.

Table 5. List of materials used for the manufacture of orthopedic shoes for children with varus and valgus deformities of the feet

Name of parts	Materials and designation of regulatory and technical documents
Upper details	Leather for uppers according to GOST 939, GOST 3717, GOST 1838, GOST 9705, elastic leathers; shoe drape and cloth in accordance with GOST 28000, shoe fabric
Upper interior details	Leather for shoe lining according to GOST 940, GOST 1838, fabrics for shoe lining according to GOST 19198, GOST 28000, GOST 29298 and according to technical documents, knitted fabric according to technical documents
Upper intermediate pieces. Interlining	Fabrics for interlining according to GOST 19196, GOST 29298, cotton fabric for interlining with hot-melt adhesive coating
toe cap	Leather in accordance with GOST 29227, GOST 1903, shoe nitro-leather-T in accordance with GOST 7065, elastic and thermoplastic materials for the toe cap - according to technical documents
Backdrop	Leather in accordance with GOST 29277, GOST 1903, cardboard in accordance with GOST 9542, shoe nitro-leather-T in accordance with GOST 7065, thermoplastic material for the backdrop - according to technical documents
External bottom details. Sole	Leather for the bottom of shoes in accordance with GOST 29277, GOST 1903, porous rubber plates in accordance with GOST 12632, lightweight porous rubber plates
hard part	Leather for the bottom of shoes in accordance with GOST 1903, GOST 29277, saddlery leather in accordance with GOST 1904 (for a false back)
soft detail	Leather according to GOST 939, GOST 940, rawhide according to GOST 1562, yuft saddlery according to GOST 1904
metal detail	Steel grade 65G according to GOST 14959, steel grade I2X1BH10T according to GOST 5632, steel grade 40 according to GOST 1050, aluminum according to GOST 21631
Accessories. Fastening shoes on the foot	Blocks, hooks, rivets, eyelets, buckles, fasteners, metal frames, shoe laces, textile fasteners, elastic shoe tape - according to technical documents
Molded insole (on the intersole layer)	Leather according to GOST 29227, GOST 1903, GOST 1838, GOST 939, saddle leather yuft according to GOST 1904, leather for shoe lining according to GOST 1904, leather for shoe lining according to GOST 940

With increasing requirements for the degree of fixation of shoes on the foot, a combined method of fastening shoes can be introduced into the design. Allowances for intermediate parts should also be taken into account. The thickness of the intermediate parts can reach 2 - 3 mm, so it is recommended to add

0.5 - 1 cm to the given volumes of the feet. All this significantly affects the quality of footwear operation. The design can rub the leg in the lower leg due to the rigidity of the parts, so the presence of a small soft piping is recommended. It is not recommended to design a soft edge that is too large, as it can reduce the degree of fixation on the foot. The development of designs, taking into account the considered requirements, makes it possible to provide a qualitative relationship between consumer preferences and medical limitations. Comfort models have the so-called orthopedic Thomas heel, which is extended from the inside to support the foot in the middle section and prevent the foot from falling inward. Molded outsole with Thomas heel.

Thomas heeled sole

An important role in footwear for children with cerebral palsy is played by correctly selected shoe designs. Shoes must comply with the requirements of GOST and have special structural elements characteristic of these models. Orthopedic shoes are characterized by the presence of parts of a special shape and size. There are special details: soft, hard and metal, as well as inter-insole layers. Special soft details include: additional lacing, pulling strap, side inner strap, pulls, cuff. Special hard parts include: heel, toe cap, vamp, semi-union, barrel, tongue, valve, berets, upper curly insole. These details additionally fix the shoe and increase its shape stability.

A hard back is an intermediate or outer part of the top of orthopedic shoes, located in the heel-shank part.

Along the length of the wing, a hard back is distinguished with an extension through the shank or with an extension to the fifth finger, depending on the appointment of an orthopedic doctor.

Rigid back extension, structural elements

A rigid toe increases the strength of the lateral and is often used in orthopedic shoes.

One-sided hard beret - a detail located in the heel-shank part of the orthopedic boot.

A double-sided hard beret is an internal or intermediate part located in the heel-shank part of an orthopedic boot. The part has protrusions on the lateral surfaces of the tibia above the ankles, which limit the mobility of the subtalar joint.

Circular corset is a detail of orthopedic shoes covering the back, side and dorsal surfaces of the foot and lower leg above the ankles, limiting mobility in the ankle joint.

The intersole layers include: laying out the arches, braid, reverse braid, cork, pronator and arch support.

Intersole layers are the internal parts of the top of orthopedic shoes to redistribute the load along the plantar surface of the foot. They are located between the curly and the main insole.

The laying out of the vaults has a minimum thickness and is necessary to level the relief of the heel-to-heel part of the footprint of the orthopedic shoe. Serves to maintain the longitudinal arches of the foot. Insole with lining of the arch (view on the block).

The kosok is located in the heel-shank part, has a certain thickness in the heel part, which disappears in the beam part. The kosok looks like a wedge and serves to compensate for the shortening of the leg. Koski are sheer or beveled in one direction or another (outer, inner, forward or backward).

The cork is located under the entire plantar surface of the foot. The thickness of the beam and heel parts of the cork is the same. A wedge-shaped plug to compensate for the shortening of the lower limb in children is not used to prevent the pathological installation of the foot in the vicious equinus position.

A pronator is an insole that elevates the outer edge of the foot. Pronator with arch lining (view from the insole surface of the block).

An arch support is an insole detail that raises the inner edge of the foot.

There is a pronator or arch support for the entire footprint, anterior or posterior section of the intersole layer. Shoe designs differ in their operational purpose and gender and age group and possible accompanying deformations, so the design has its own characteristics.

With a serious deformity of the foot, complex orthopedic shoes for children are prescribed, which are mainly made to order. Found its application. footwear and in rehabilitation programs for children with disabilities, including those with varus and valgus deformities of the feet (Figure 35).

The main goals for which orthopedic shoes are prescribed for children with varus and valgus deformity of the feet include:

correction of the position of the ankle and foot and maintaining it while walking;

correct redistribution of the load from individual parts of the foot to the entire foot;

compensation of anomalies, for example, shortening of the leg;

improved support and ease of movement.

The main difference between the special footwear consists in the presence of a special shoe designed for a specific deformation. Also, orthopedic shoes for children with cerebral palsy must meet the following characteristics(figure 36):

- the presence of a high back - it is needed for reliable fixation of the ankle, therefore it must be of the optimal degree of rigidity;

- the presence of high and hard berets, used to prevent the collapse of the foot when walking;

- there must be a low heel and removable insoles, the latter must have additions with special elements.

Figure 35. Complex shoes for disabled children with varus and valgus deformities of the feet

Also, shoes should be comfortable to put on and take off, so its good opening is also an important factor.

As a rule, complex orthopedic shoes for children with cerebral palsy are classified into three large groups. The division is based on the type of complexity of the shoe and the disease for which it is intended. So allocate:

1) anti-valgus shoes;
2) antivarus models;
3) stabilizing orthopedic shoes.

Figure 36. Orthopedic spec. shoes for children with varus and valgus deformities of the feet

Anti-valgus shoes. The main purpose in its application is the X-shaped setting of the feet, caused by the fact that the ligaments of the foot cannot withstand the child's body. This may be due to excess body weight, or weak muscle tone in the arch of the foot. At the same time, the inner edge of the foot sags, and the front edge is retracted outward. Anti-valgus shoes are characterized by:

double-sided high tibia of a rigid type, providing stabilization of the ankle in a vertical position;

an elongated inner tibia that keeps the heel from falling;

arch support with longitudinal tabs necessary to support the arch of the foot.

Antivarus models are designed to correct clubfoot, in which the knee joints are bent to the sides. As a result, the child has to rely on the outer arches of the feet when walking. This diagnosis implies the presence of shoes with rigid fixation of the hindfoot

with simultaneous abduction of the forefoot. Such a special shoes must be equipped with:

high back up to a third of the ankle in its lower part;

hard back, on the inside, extended to the fingers;

insole - pronator.

Stabilizing orthopedic shoes are used for equino-vargus and equino-varus anomalies of the foot, characteristic of cerebral palsy(figure 37). Shoes develop movement skills, forming the correct gait and preventing further deformation. The salient features of the models are:

high back to mid-calf;

double-sided beret of a hard type;

arch support insole;

fixing element in the sole.

Figure 37. Shoes for equino-vargus and equino-varus foot anomalies

Therapeutic and prophylactic, uncomplicated orthopedic footwear performs diagnostic, preventive and therapeutic functions. In the process of wearing such shoes, you can independently check the presence or absence of defects in the development of the child's feet by examining which zones have undergone abrasion on the sole.

In the case of the correct development of the child's feet, such shoes can be worn as a prophylactic for the correct formation of the joints of children's legs. In case of detection of any deformity of the foot, it is recommended to wear preventive shoes constantly with the use of orthopedic insoles.

The main task of these shoes is the prevention of pathology and the correct formation of the arch of the foot. The most important advantage of this shoe is the presence of an orthopedic arch support insole glued at the factory, the purpose of which is to prevent the occurrence of flat feet and relieve pain when walking.

In the production of these shoes, only natural high-quality materials are used: leather and nubuck, allowing the foot to “breathe”. Models are characterized by the presence of a high hard back. The design of the fasteners allows you to fix the child's foot in the correct position. There is an optimal heel, flexible non-slip sole. Thanks to this, the shoes ensure the correct development of the child's feet, both as preventive shoes and as medical shoes.

Specialists (orthopedists, pediatricians, neuropathologists) note the practicality, convenience and comfort of this shoe, its compliance with modern requirements that apply to children's shoes. Caring parents buy beautiful, expensive shoes, which, unfortunately, at best, do not fit the child, and often harm the child's legs.

Additionally, the hard surface (asphalt, concrete, linoleum, laminate) that surrounds the baby in the city affects. Children with "problem" feet cannot wear regular factory-made shoes, even those labeled "ortopedic" by the manufacturer. To solve this problem, designs of children's shoes have been developed for the prevention of plano-valgus deformity of the foot. Shoes for a child with a flat-valgus foot should have a hard back that fixes the ankle joint well with laces, straps or Velcro. Sketches of shoe models for plano-valgus deformity of the foot were developed (Figure 38).

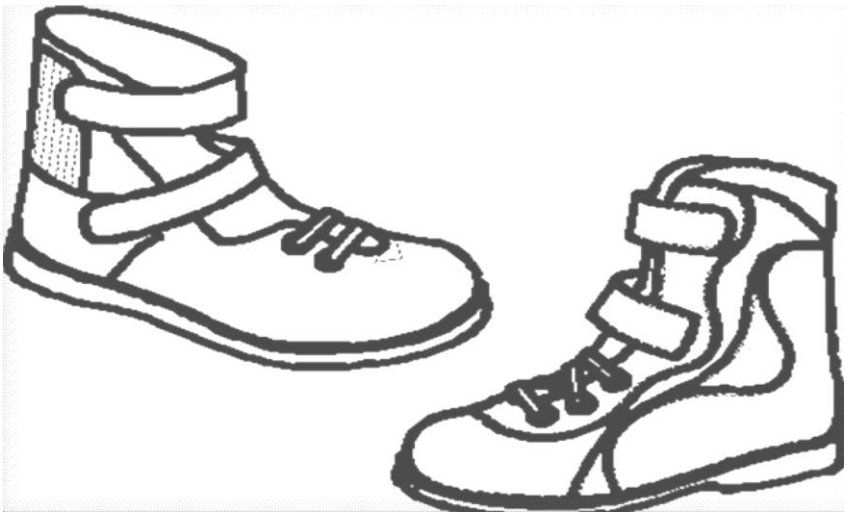
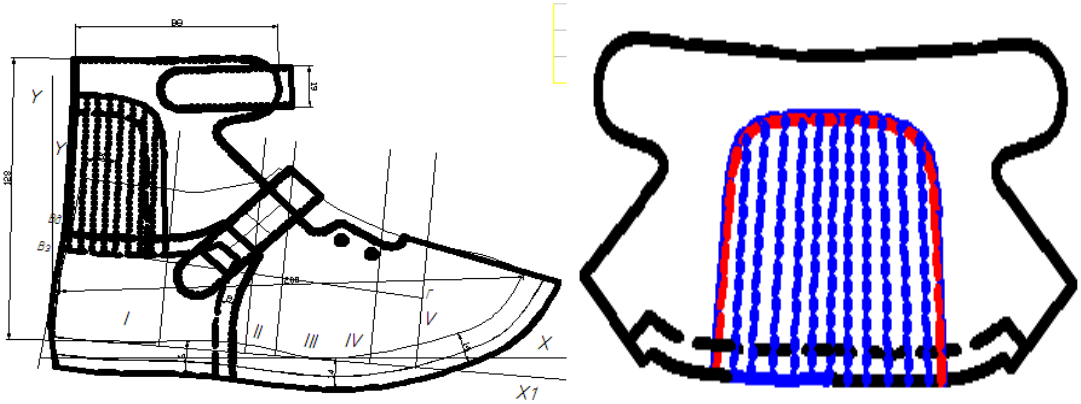


Figure 39. Sketches of shoe models for plano-valgus deformity of the foot

To fix the ankle, a design of the heel part of the shoe is proposed, in which a certain rigidity is created due to technological parameters, namely, an additional unit is used in the heel part, consisting of an outer part, an intermediate part and a lining (Figure 40, b). An intermediate part made of batting, which is attached to the top part in parallel lines at a certain distance (Figure 40, a). This creates the necessary stiffness of the heel.



a b

Figure 40. The design of the details of the top of children's shoes for the prevention of flat-valgus foot: a - Ground model of the top of the shoe for prevention; b - the knot of the top of the shoe in the heel part

Conclusion

Based on research to determine consumer preferences, it has been established that currently sold children's shoes with preventive properties have some drawbacks regarding both materials and structural and external features.

Consumers experience a clear lack of children's preventive footwear of domestic production. Based on the analysis of the design features of preventive footwear, the main design features of footwear are established. To solve the issue of tight fixation of the child's foot and ensure the necessary rigidity of the heel part of the shoe upper, designs have been developed that fix the ankle joint with laces, straps or Velcro. To fix the ankle, a design of the heel part of the shoe is proposed, in which a certain rigidity is created due to technological parameters, namely, an additional unit is used in the heel part, consisting of an outer part, an intermediate part and a lining,

It is shown that anthropometric studies of the feet and the development of scientifically based requirements for the design of footwear for children and adolescents is an urgent problem for the shoe industry. It has been determined that the main factor in the formation of requirements for children's shoes should be the preservation of health, since this age is vulnerable to the action of the external environment. The place of shoes in the complex of health factors is determined. It has been established that footwear has an impact on all categories of health: somatic, personal and social. Thus, the use of orthopedic equipment in standard mass-produced shoes, in the

form of insoles and other inserts, can serve as an effective means of improving its preventive properties, including for the flat-valgus foot.

It has been established that anthropometric studies of the feet and the development of scientifically based requirements for the design of shoes for children and adolescents is an urgent problem for the shoe industry. It has been determined that the main factor in the formation of requirements for children's shoes should be the preservation of health, since this age is the most vulnerable. The place of shoes in the complex of health factors is determined. It has been proven that footwear has an impact on all categories of health: somatic, personal and social.

The use of orthopedic equipment in the form of insoles and other inserts in standard mass-produced footwear can serve as an effective means of improving its preventive properties, including preventing flat feet in children. To do this, specialists in the design and manufacture of mass-produced shoes should receive timely current information about new designs of these orthopedic devices, as well as indications for their use.

On the basis of the research conducted to determine consumer preferences, it has been established that currently sold children's shoes with preventive properties have some drawbacks regarding both materials and structural and external features.

Parents of children with pathological abnormalities, including those with flat feet, experience a clear lack of domestically produced children's preventive footwear. Based on the analysis of the features of preventive footwear, its main design features are established. Shoes with preventive properties make up a certain segment of the consumer market for children's and teenage shoes. It is distinguished by the presence of constructive solutions that provide maximum comfort in wearing, the presence of special details (inset anatomical insoles, half-insoles, linings and other corrective details), a rational scientifically based internal shape of the shoe and the use of high-tech materials in the manufacture of shoes, their strict selection according to physical and mechanical and hygienic indicators.

To solve the issue of tight fixation of the child's foot and ensure the necessary rigidity of the heel part of the upper of the shoe, the design of backs is proposed, fixing the ankle joint additionally with the help of laces, straps or Velcro.

To fix the ankle joint, a design of the heel part of the shoe is proposed, in which a certain rigidity is created due to technological parameters, namely, an additional unit is used in the heel part, consisting of an external part, an intermediate part and a lining.

The developed designs of the top of the shoe, together with an anatomical instep support, provide the most effective support for the arch of the foot and correction of the angle of its inclination. Thus, it is important to have a permanent alliance between the podiatrist and the manufacturers of corrective parts in order to guarantee the comfort of the child's foot and high confidence to the parents about the prevention of the development of pathological abnormalities in their child.

Thus, the database combines and structures the information necessary for the fashion designer, reduces the time spent on design and guarantees consumers the manufacture of popular orthopedic shoes, taking into account pathological deviations of children's feet.Based on the conducted research to determine consumer preferences, it has been established that - currently sold children's shoes with preventive properties have some drawbacks regarding both materials and structural and external features;

- to solve the issue of tight fixation of the child's foot and ensure the necessary rigidity of the heel part of the upper of the shoe, the design of the backs is proposed, fixing the ankle joint additionally with the help of laces, straps or Velcro;

– to fix the ankle joint, a design of the heel part of the shoe is proposed, in which a certain rigidity is created due to technological parameters, namely, an additional unit is used in the heel part, consisting of an external part, an intermediate part and a lining;

- the developed design of the upper of the shoe, together with an anatomical instep support, provides the most effective support for the arch of the foot and correction of the angle of its inclination. Thus, it is important to have a permanent alliance between the orthopedist and the manufacturers of corrective parts in order to guarantee the comfort of the child's foot and high confidence to him and his parents about the prevention of the development of pathological abnormalities in their child;

- the concepts "masses and ultra-customized" shoes, Under the definition of "mass-customizedorthopedic shoes" refers to shoes, the design of which is developed on the basis of the average typical features of a group of patients homogeneous in terms of diagnosis. Customization is carried out by adjusting insert corrective elements, design features of models that regulate the volume of the shoe space and frame parts that provide a rehabilitation effect. Ultra-customized shoes are models designed taking into account the individual anatomical features of the foot of a particular patient based on typical designs of mass-customized shoes;

– an analysis of the anthropometric characteristics of the feet of children with cerebral palsy was carried out to clarify the parameters of the lasts of mass-customized shoes. It was revealed that in the regions of the Southern Federal District and the North Caucasus Federal District, shoe lasts for children's orthopedic shoes do not correspond to the average parameters of the feet of children with cerebral palsy. The parameters of lasts for the production of mass-customized shoes for children with cerebral palsy are proposed;

– the degree of consumer satisfaction with the designs of orthopedic shoes made on blocks with corrected parameters was revealed;

– the concept of creating lasts with adjustable volumes for the designs of ultra-customized shoes was proposed;

– an analysis of the assortment of children's orthopedic shoes was carried out, from which 4 basic designs of mass-customized orthopedic shoes with a high rehabilitation effect for patients with cerebral palsy were identified, namely:

- boots with adjustable berets;
- summer shoes with a high tibia part with an open toe;
- summer shoes with a high tibia and a vamp with an elongated tongue;
- summer shoes with a high tibia and a closed toe:

- a classification of orthopedic shoes is proposed, based on the rehabilitation effect, which is based on the results of studies on the rigidity of the structure, methods of fixing shoes on the foot, corrective elements of the removable orthopedic insole;

– a method for designing ultra-customized orthopedic shoes using the AutoCAD program was proposed for the following cases:

- with different girths of the feet;
- with different heights of berets in a pair;
- with different track lengths in a pair;
- in case of shortening of the lower extremities, a database of designs of mass-customized orthopedic shoes for children with cerebral palsy is proposed, which includes typical designs recommended for this disease in order to make comfortable orthopedic shoes.

The questions considered by the authors are:

- the possibility of preventive measures and corrective products to restore impaired functions of children's vital functions;
- resuscitation of sharply disturbed functions of the vital activity of the organism of children;
- rehabilitation deformity of the feet of children with cerebral palsy;
- correction of the deformity of the arch of the foot of children with clubfoot corrective products for restoring impaired functions of the child's body, - practically contain answers to the entire bouquet of questions that parents have, which allows you to make a reasonable choice of corrective products to restore children's impaired vital functions of their body.

Remember that manufacturers use their own sizing charts. Therefore, marking with the same Latin letters does not guarantee that you have two models in front of you that are identical in size. Always read the specifications carefully and seedimensional grid.

The development of measures was carried out taking into account the strategic goals, legislative acts that determine the policy of the state in the development of light industry in the medium and long term:

- **Increasing the competitive advantages of the light industry in the production of children's shoes, demand and consumer preferences, technical regulation:**

— ensuring compliance of Russian products with international standards in terms of quality, environmental safety and design;

— increase in production volumes of competitive new generation products with qualitatively new output consumer characteristics, functional properties and with a high share of added value that are in demand by the market;

— outpacing growth of the beneficial effect compared to the growth of costs for new and previously mastered types of similar and functionally homogeneous products, efficiency in the execution of orders and consumer requirements.

- **Technical re-equipment and modernization of the production of children's shoes:**

— modernization of the bulk of the operating technological equipment, allowing to improve its technical, economic and operational characteristics;

— creation of new equipment with a high degree of automation, corresponding to the world competitive level and capable of mastering advanced technologies and ensuring a quick change of assortment, development of technical documentation and requirements for its manufacture;

— use of leasing for the purchase of imported equipment or direct purchases of new high-performance imported equipment and spare parts for it that are not produced in our country;

— development of VIP-projects (anti-crisis programs) for the financial recovery of the industry, providing for technical re-equipment, modernization, reconstruction and creation of high-tech industries, attraction of foreign capital, investments of Russian business and budgetary funds for their implementation.

- **Development of innovative activities of the light industry for the production of children's shoes:**

— implementation of structural and technological restructuring, development of proposals for the preservation and development of the intellectual potential of light industry, the creation of a state scientific innovation center for light industry;

— development and development of basic industrial technologies (including nanotechnologies and nanomaterials, systemic information technologies of the intersectoral level), modular and flexible technological systems for the production of competitive world-class science-intensive products used in strategically important areas;

— organization of mass production of an innovative product at the enterprises of the industry, including modifications of the product and the technological process, structural changes in the range of manufactured products, training and retraining of personnel for servicing equipment operating on new technologies;

— development of international cooperation with foreign countries on the basis of bilateral and multilateral agreements and programs for the development, acquisition and sale of technologies, licenses, holding joint scientific and technical symposiums, conferences, exhibitions.

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Issue Article

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METHODOLOGICAL BASES FOR THE FORMATION OF A REHABILITATION CENTER FOR CHILDREN WITH PATHOLOGICAL ABNORMALITIES. MESSAGE 2

Abstract: *In the article, the authors consider the role of quality as a tool for promoting the philosophy of quality in the production of competitive and in-demand products at light industry enterprises located in the regions of the Southern Federal District and the North Caucasus Federal District. At the same time, the authors absolutely reasonably confirm the possibility of such an implementation if innovative centers are implemented, saturated with universal and multifunctional equipment, creating prerequisites for the production of the entire range of footwear, namely: men's, women's and, most importantly, children's shoes, the demand for which in regions of the Southern Federal District and the North Caucasus Federal District is quite high. And the use of software will provoke a significant reduction in the cost of its production and provide it with a steady demand in domestic markets with unstable demand, including for children with pathological abnormalities.*

Key words: *quality, preference, demand, competitiveness, market, profit, demand, buyer, manufacturer, financial stability, sustainable TEP, priority, assortment policy, economic policy.*

Language: *English*

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Introduction

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The developed designs of the shoe upper, paired with an anatomical instep support, will provide the most effective support for the arch of the foot and

correction of the angle of its inclination. This ensures the correct development of the articular surfaces and eliminates the further development of deformation. The essence of the developed design of the insole is that it has an additional intermediate layer, which is a flexible surface covered with silica gel granules located above the elastic lining layer over the entire surface of the insole. The insole is a multi-layer structure consisting of an upper layer, an additional intermediate layer and a flexible material, the surface of which is covered with silica gel granules of various diameters in various areas, located above the intermediate elastic layer-liner over the entire surface of the insole and the bottom layer. In the sketches of children's shoes for the prevention of flat-valgus foot, models are developed on the basis of a single figurative solution, style, and material properties. At the first stage, it is proposed to develop 4 - 5 models of the product being designed in order to select the optimal design and color solution for the base model; when developing them, it is necessary to take into account the design of the block, the shape of the toe. The final decision on the choice of the base model is made after agreement (Table 1). At the same time, a comparative assessment of the model is carried out in terms of manufacturability, unification, and technical aesthetics. When developing sketches of leather products, one should approach from the main positions:

functional, predetermined by the purpose of products;

constructive (constructive-technological), reflecting the rational and economic use of the material;

aesthetic. Pad index 311251 Size-180

Table 1. Pad characteristic

Name of the classification feature	The established value of the classification feature
1. Gender and age group of pads	children's
2. Pad subgroup (heel height)	10 mm
3. Numbering system	metric
4. Initial block number	180
5. Completeness of the block	4
6. Pad type	For closed shoes
7. Shoe construction	articulated
8. Numbers of pads in the series	175 - 200
9. Number of obligatory completenesses, numbers of completenesses	3
10. Interval between adjacent widths by girth, mm	6
11. Pad index	311251

On the basis of the selected model, a sketch sheet is developed, where, along with the base model, another 4-5 models are placed, which differ from the base one in the presence of additional or modified parts, or accessories, fastener designs, soles, heels, etc. At the same time, the main details should not be changed, because. when cutting, it is necessary to keep the same cutter. You can change one or two details. In the text it is necessary to make references to the assigned model numbers of the unified series, indicating these numbers. Give a detailed description of all models of a unified series and their designs, distinctive features, the sketches must reflect the type of materials used. A unified series is created on the same basic base for shoes; for leather goods - two unified rows. When choosing materials for the details of the top and bottom of shoes, it is necessary to proceed from the type and type of shoes, their purpose, requirements for details, fashion trends. For all details of the top of the shoe (one pair), one type of material is usually used, only sometimes two types of material are combined. When using leather, some difference in the requirements for the details of the upper of the shoe is taken into account by the selection of its thickness, density and ductility. So, the most important part (the yoke) is cut out from the leather saddle, and the secondary part (tongue) is cut out from the floor areas, which are more viscous and have a smaller thickness. The toe part of the vamp is the most protruding part of the shoe, therefore, the material for this part is subject to increased aesthetic requirements: it must be resistant to cracking, abrasion, dirt, its surface should be easily cleaned of dirt. The materials for the vamp are subject to more stringent technological and consumer requirements than for other parts, since the vamp works in a more complex force field both in the manufacture of footwear and during its operation. It is in this zone that the greatest stretching of the shoe upper blank occurs during molding and the maximum multiple bending occurs when worn.

From the point of view of hygienic requirements, the material for the upper of the shoe must provide a normal microclimate inside the shoe space, i.e. be waterproof on the front side, heat-resistant, have low thermal conductivity, be vapor-permeable,

hygroscopic, sweat-resistant, have high rates of moisture absorption and moisture return. Shoe upper material should not emit or release in minimal quantities substances that can cause diseases of the skin of the foot and other organs. According to GOST 26165-2004 "Children's shoes", chrome-tanned leather according to GOST 939-88 can be used on the outer details of the top. Leathers for shoe uppers are divided into two main groups: Leathers for uppers and linings of mainly lame tanning for casual shoes. A special subgroup is suede - leather of fat and formaldehyde-fat tanning; Leathers for the upper and lining of shoes are divided according to the types of raw materials from which they are made, the configuration and method of tanning, the method and nature of the finish. In addition, the skin is divided by area, thickness, and also depending on the quality into varieties. State standards provide for the following types of finishing of the front surface of leather: smooth leather with natural unpolished, with polished and polished front surface; leather with an embossed front surface; skin with a cut front surface; patent leathers and wrinkled leathers. smooth leathers with a natural unpolished, with a polished and polished front surface; leather with an embossed front surface; skin with a cut front surface; patent leathers and wrinkled leathers. smooth leathers with a natural unpolished, with a polished and polished front surface; leather with an embossed front surface; skin with a cut front surface; patent leathers and wrinkled leathers.

Skins are produced with the following types of front surface coating; casein, emulsion-casein, emulsion, nitroemulsion.

Depending on the type of raw material, chrome leathers are subdivided into calciner, outgrowth, half-skinner, cowhide, bullock, etc. Comparison of the main physical and mechanical characteristics of the three types of materials is given in Table 2.

Table 2. Comparison of materials in terms of physical and mechanical properties

No. p / p	The name of indicators	Unit measurements	The value of indicators according to GOST or TU		
			Chromium. yalovka	Chromium. semi-leather	Chromium. outgrowth
1	Tensile strength (average value from longitudinal and transverse samples)	kgf/mm2	21/18	21/19	26/23.5
2	Elongation under load 1kgf/mm2	%	18 – 30	18 – 30	15 – 25
3	Stress at the appearance of cracks in the front layer (average value)	kgf/mm2	17	18.5	21-15
4	Coating resistance to repeated bending	Bending not less than	1500	1500	1500
5	Skin thickness at standard point	mm	0.9 - 1.2	0.9 - 1.2	0.8 - 1.1
6	The content of substances washed out by organic solvents	%	3.8 - 8.8	3.8 - 8.8	3.8 - 8.8
7	Chromium oxide content	%	4.3	4.3	4.3
8	Moisture content not less than	%	10 – 16	10 – 16	10 – 16
9	Average skin area	dm2	240	195	75
10	Wetting	%	18	16	16
11	Breathability	cm3/s	60 - 80	60 - 80	50 - 75
12	Vapor permeability	%	49	40 - 65	40 - 65
13	Average weight of skins	kg	21	11	6.5

Based on the data in Table 2, it follows that when choosing the outer parts of the top of a chrome yoke, the cost of a set of shoe uppers will be the lowest, which has a significant impact on the cost of shoes as a whole. But for aesthetic reasons, a chrome outgrowth was chosen for the outer details of the top. When choosing materials, it is recommended to use more widely new materials that replace natural leather, guided by the requirements of GOST or TR for finished products.

Description of the appearance of the product

1. Kind of shoes: preschool.
2. Type of footwear: boots.
3. Shoe style: 311212.
4. Mounting method: Adhesive.
5. Upper material: chrome leather outgrowth.
6. Bottom material: porous rubber.
7. GOST for shoes: GOST 26165-04 "Children's shoes"
8. Blank construction: closed type boots with c/p velcro strap, leather piping, heel and heel details. As an artistic design, a combination of colors was used.(picture 1).

Figure 1. Children's shoes for the prevention of flat-valgus foot

Table 3. Model passport

No.	Name of parts	Quantity per couple	Material name	Part thickness	GOST for material
1	Soyuzka	2	chrome outgrowth	1.1 - 1.3	939-88
2	Berets	2	jeans fabric	1.1 - 1.3	19196-84
3	Backdrop	4	jeans fabric	1.1 - 1.3	19196-84
4	Upper back piece	2	chrome outgrowth	1.1 - 1.2	939-88
5	NPR	2	chrome outgrowth	1.1 - 1.2	939-88
6	CPR detail	2	chrome outgrowth	1.1 - 1.2	939-88
7	Back detail	2	chrome outgrowth	1.9 - 1.0	939-88
8	Vamp lining	2	Sheepskin lining	0.9 - 1.1	940-81
9	Beret lining	2	Sheepskin lining	0.9-1.1	940-81
10	CPR lining	2	Sheepskin lining	0.9 - 1.1	940-81
11	Rear shock absorber	2	Foam rubber	10	NTD
12	Vamp lining	2	Termobaz	+	THAT
13	Heel interlining	4	Termobaz	+	THAT
14	toe cap	2	Thermoplastic material for toe cap	1.1 - 1.5	TU 17-21-597-83
15	Backdrop	2	Thermoplastic	+	TU 17-24-84
16	Insole prophylactic	2	Lining leather sheepskin+waste PU	+1.8	19196-84
17	Soft heel pad	2	Foam rubber	+	BAT
18	Main insole	2	Leatherboard	2.3 - 2.4	9245-84
19	Bedding	2	Batting	+	BAT
20	Heel	2	foam rubber	20	12365-84
21	Sole	2	foam rubber	8 - 10	12365-84

Product appearance description:

Figure 2 Children's shoes for the prevention of flat-valgus foot with leather back

1. Kind of shoes: preschool.
2. Type of footwear: boots.
3. Shoe style: 311212.
4. Mounting method: adhesive.
5. Upper material: chrome leather outgrowth.
6. Bottom material: PVC.
7. GOST for shoes: GOST 26165-04 "Children's shoes".
8. The design of the workpiece: open-type boots, consists of a vamp detail of the vamp, ankle boots, ZNR, soft edging of the ankle boots and a black belt with a buckle.

A combination of colors, decorative seams and perforation on the vamp (Figure 2) were used as decoration.

Table 4. Model passport

No.	Name of parts	Quantity per couple	Material name	Thickness details	GOST for material
1	Soyuzka	2	chrome outgrowth	1.1 - 1.3	939-88
2	vamp detail	2	jeans fabric	1.1 - 1.3	19196-84
3	Berets	4	jeans fabric	1.1-1.3	19196-84
4	The upper part of the beret	2	chrome outgrowth	1.1 - 1.2	939-88
5	NPR	2	chrome outgrowth	1.1 - 1.2	939-88
6	ZNR	2	chrome outgrowth	1.1 - 1.2	939-88
7	Back detail	2	chrome outgrowth	1.9 - 1.0	939-88
8	Vamp lining	2	Sheepskin lining	0.9 - 1.1	940-81
9	Beret lining	2	Lining leather	0.9 - 1.1	940-81
10	CPR lining	2	lining leather sheepskin	0.9 - 1.1	940-81
11	Rear shock absorber	2	Foam rubber	10	NTD
14	toe cap	2	Thermoplastic material for toe cap	1.1 - 1.5	TU 17-21-597-83
15	Backdrop	2	Thermoplastic	+	TU17-24-84
16	Insole prophylactic	2	lining leather sheepskin+PU waste	+1.8	19196-84
17	Soft heel pad	2	Foam rubber	+	BAT
18	Main insole	2	Leatherboard	2.3 - 2.4	9245-84
19	Bedding	2	Batting	+	BAT
20	Sole	2	Rubber	8–10	12365-84

Walking is an automated motor act, carried out as a result of an extremely complex coordinated activity of the skeletal muscles of the trunk and lower extremities. Human walking consists of separate steps, which are a simple locomotor cycle, where two phases are distinguished: transfer and support. With cerebral palsy, the formation of all motor functions is delayed and impaired. At the same time, motor impairments can vary widely. When developing designs of orthopedic shoes with a high rehabilitation effect for children with cerebral palsy, it is important to take into account the specifics of static, locomotor functions and movement disorders. Human movements and the normal functioning of muscles in general are possible only with normal innervation. All nerves entering and passing through the muscles should not be damaged and have breaks. With flaccid paralysis or paresis, the tone of the affected muscles is sharply reduced, active movements are absent or weakened, and there are no tendon reflexes. Either hypotrophy (a decrease in the number of muscles capable of functioning normally) or atrophy (a complete lack of movement) of the muscles occurs, therefore, when walking in patients with flaccid paralysis or paresis of the lower extremities, wobbling in the joints is observed. For flaccid paralysis or paresis of the lower extremities, an equinus foot is characteristic (that is, the foot is in a state of plantar flexion or, in other words, a drooping foot). With this position of the foot, in order not to touch the supporting surface while walking, the patient has to strongly bend the leg at the hip and knee joints. tendon reflexes do not exist.

There are several types of walking: normal, with additional support and pathological, which can occur when mobility in the joints is impaired, muscle functions are lost or impaired, as well as when the mass-inertial characteristics of the lower extremities are impaired. It is customary to consider the biomechanical structure of walking, highlighting the following elements: the spatial structure of walking;

temporal structure of walking; kinematics of walking; walking dynamics; innervation structure of walking.

The main biomechanical features of walking were established: reduction of the duration of the transfer phase, flexion position of the lower extremities, limitation of movements in the joints, reduction and deformation of the curves of the components of the support reaction.

A detailed comparison of the kinematics of the joints during normal walking and with cerebral palsy is shown in Figure 3.

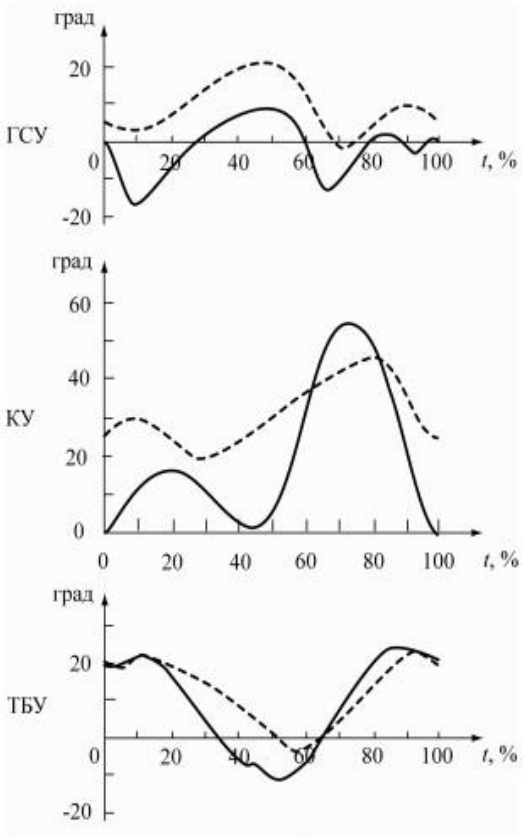


Figure 3. Graph of angular displacements in the joints of the lower extremities during normal walking (—) and patients with cerebral palsy (- - -): HCA – ankle angle; KU - knee angle; TBU - hip angle

From the graph of angular movements of the ankle angle (AGC) it can be seen that the first plantar flexion is reduced due to a short-term roll over the heel. Dorsal flexion in the support phase increases due to the preliminary tilt of the lower leg forward, the second plantar flexion decreases, which indicates insufficient repulsion of the foot from the support; dorsiflexion in the transfer phase has a small amplitude, which causes the possibility of touching the supporting surface with the toe.

From the analysis of angular displacements in the knee joint (KE), it can be concluded that the patient, without fully extending the leg in the joint, during the transfer phase, puts a half-bent limb on a support, then slightly unbends it, and as soon as the foot begins to roll over the anterior section, bends again. When analyzing the angular displacements in the hip joint (TBU), only a reduction in the extension angle is noted, while maintaining the main elements of the curve.

Studies of the phases of movement of the feet and the state of the ankle joint have shown that the time of support of the foot and the area of support are related to the design of the shoe. Thus, the biomechanics of the movements of children with such a disease determines the choice of a constructive and technological solution for the manufacture of shoes. So, in the case of maximum support on the toe part of the foot, the design of the shoe is performed with increased rigidity of the frame parts in the toe-beam part. With a longer phase of support on the heel - reinforce the frame parts in the heel-shank part. In this regard, in order to create designs of orthopedic shoes, it is important to analyze musculoskeletal disorders.

Musculoskeletal disorders in children with cerebral palsy are associated with developmental pathology or damage to the motor mechanisms of the central nervous system (CNS). The imbalance of the muscles of a child with cerebral palsy manifests itself in the inability to perform voluntary movements. At the same time, the acts of standing and walking,

coordination of movements are violated. There is a predominance of flexor tone, adductor, penetrating muscles. Flexion (flexion-pronation) attitudes and contractures in the extremities, kyphoscoliosis, kyphosis, and scoliosis of the spinal column develop. With spastic phenomena, there is no phase of muscle relaxation, which leads to a slowdown in its growth and the development of a "short muscle syndrome", resulting in contractures. In the future, tissue hypotrophy develops and its replacement with connective tissue with a loss of contractility.

With cerebral palsy, there are violations of muscle tone, which plays a leading role in the reconfiguration of movements, their resistance, stability, and elasticity. There is a dysfunction of the "kinetic melody" of movement: from a smooth it turns into a jerky, disautomated, consisting of separate, unrelated elements. With post-central disorders of the cerebral cortex, afferent apraxia and insufficiency of cortical analysis of kinesthetic impulses are observed, which is expressed in difficulties in choosing the desired combination of movements.

The phenomena of underdevelopment include synkinesis: involuntary movements that are not related in meaning to voluntary movements. Table 3.10 shows data on movement disorders depending on the form of cerebral palsy.

The symptomatology of the disease may decrease somewhat against the background of ongoing conservative treatment (medicines, the use of botulinum toxin preparations, exercise therapy, etc.), but this is possible only at an early age (usually up to 5-6 years) and often to a small extent. In the future, in patients against the background of a persistent high muscle tone, their irreversible degeneration and shortening occurs, which leads to limitations in the range of motion in the joints (contractures), bone curvature, and the development of subluxations and dislocations.

Table 5. Movement disorders in cerebral palsy

Form of cerebral palsy	Movement disorders
Spastic diplegia	Impaired muscle function on both sides. Varies from severe paresis to mild awkwardness. Delay of rectifying reflexes of the trunk
double hemiplegia	Rigidity of the muscles always predominates, enhanced under the influence of tonic reflexes preserved over time.
hyperkinetic	Paralysis and paresis, manifested in the form of slow, viscous worm-like movements and convulsions with muscle contraction. Delayed reduction of tonic and adjusting reflexes. Muscular rigidity of the neck, trunk and legs. involuntary muscle movements
Atonic-astatic	Low muscle tone in the presence of pathological tonic reflexes. Absence or underdevelopment of installation reflexes. High tendon and periosteal reflex. Trunk ataxia. Impaired coordination of movements
Pemiparetic	Trophic disorders, slowing of bone growth. One side of the body is affected

The general functional activity of the patient in his usual environment can be assessed according to the Global Motor Function Classification System (GMFCS). It is important that it is the daily level of activity that is assessed, and not the maximum possible, demonstrated only during the study. The scale is divided into 5 levels, each of which has different motor abilities and different age periods. The scale establishes the child's ability to move, including with the use of assistive technologies. The levels of motor functions according to the GMFCS scale are shown in Figure 4.

Figure 4 shows that consumers of orthopedic shoes are patients of the first, second and third levels of motor functions according to the GMFCS scale. At the same time, patients of the first level in most cases use orthopedic shoes, supplemented with an individual orthopedic insole. Patients of the second and third levels are more likely to use exclusively individual shoes. The interrelation of violations of the accuracy of movements with the form of cerebral palsy is important. So, in the atactic form of cerebral palsy, there is an imbalance associated with a defect in the regulation of the distribution of muscle tone in the muscle group that ensures the maintenance of the posture and the accuracy of movements.

In the spastic form, the biomechanical component of maintaining posture stability is disturbed, in the dyskinetic form, the extrapyramidal postural control is impaired. Disorders in the motor apparatus can be either primary, directly related to CNS damage, or arise due to root causes. A more detailed description of the types of disorders in the motor apparatus in cerebral palsy is shown in Figure 5.

Figure 4. Levels of motor functions according to the GMFCS scale

Figure 5. Types of disorders in the motor apparatus in cerebral palsy

An important characteristic of statics and movement, both of a healthy person and a person with cerebral palsy, is to find the position of the common center of gravity (center of mass) and its projection onto the support area. Distinguish between the common center of gravity (GCT) of the human body and the centers of gravity of its parts.

The common center of gravity of the whole body is an imaginary point to which the resultant of the gravity forces of all links of the body is applied. The BCT is composed of the centers of gravity of individual links of the body and affects the balance of the body and the degree of its stability.

When the posture changes, the GCM of the body shifts, and in some cases, in particular, when bending forward and backward, it can be outside the human body. The center of gravity of the foot is located on a straight line connecting the calcaneal tubercle of the calcaneus with the end of the second toe, at a distance of 0.44 from the first.

The analytical method for determining the GCC is based on the addition of the moments of gravity according to the Varignon theorem: "The sum of the moments of forces, relative to any center, is equal to the moment of the sum of these forces (or the resultant) relative to the same center."

Any body can be considered as a set of material points, which are, for example, molecules. Newton's laws for a material point are applicable almost without changes to a real body, if we introduce the concept of the center of mass (CM).

The mass of the body and the masses of its individual segments are very important for various aspects of biomechanics. To analyze the movements of the torso, the method of segmenting the human body is used: it is dissected into certain segments. For each segment, its mass and the position of the center of mass are determined.

Thus, compensation of balance disturbances in structures is achieved due to the balance of all parts of products used by humans. We extrapolate the above in relation to the design of orthopedic shoes.

When developing orthopedic shoes, it is necessary to focus on its weight. Shoe weight control is necessary to maintain or change the body's center of mass.

As shown above, the center of mass of the human body depends on the masses of the material points of which it consists. When calculating the center of mass, it is necessary to take into account the weight of the technical means of rehabilitation (TCR), in particular, orthopedic shoes, the weight of which will also affect the change in the center of mass. STO 46429990-010-2015 "Children's shoes with leather uppers" and the Technical Regulations of the Customs Union TR TS 007/2011 "On the safety of products intended for children and adolescents" it follows that the weight of small children's shoes should not exceed 300 gr .; preschool - 380 gr. and relate to mass-produced casual shoes. GOST R 54407-2011 “Orthopedic footwear. General Specifications” states that the mass of orthopedic shoes with individual manufacturing parameters is not regulated.

However, there are cases in which the weight in half-pairs of shoes is different. This may be due to the different composition of the corrective elements of the insole; the weight of the materials of the upper parts of the shoe, caused by the design features in general or the features of the frame parts; the weight of the fittings, determined by the design features; the weight of the soles associated with the presence of corrective elements (shortening compensation due to the sole, heel extensions, etc.). Figure 3.46 shows a sample of shoes, in one of the half-pairs of which the frame part is fixed on the foot with a metal buckle.

At the same time, the difference in the weight of the right and left semi-pairs is 86 grams. Thus, wearing shoes with different weights of semi-pairs manifests itself in the difference in weights of body segments (lower limbs) and leads to a shift in the general center of gravity, the position of which affects the biomechanics of movement.

Figure 6. Shoe sample with different weights of semi-pairs

The author considers the body of a healthy child as a system of material points with a known center of mass (CM), and claims that its mass is uniformly distributed relative to the axis of symmetry. Thus, the child maintains a state of balance, equalizing the internal forces of the body. In the event that the human figure has any morphological disturbances, the condition for maintaining balance remains unchanged, but in such a situation the child is forced to compensate for the displacement of one of the body segments by changing the position of the others, thereby making up for the lack of mass and equalizing the torque. When a load is added to one of the body segments, the CM torque changes. Thus, knowing the coordinates of the CM of the system, we can assume that by shifting the center of mass of one of the segments of the body, and thereby changing the torque, the child's body will strive to return the CM point of the whole body to its original position. It follows that maintaining the conditions of balance equilibrium is a key point in the design of products for cerebral palsy. The main task in developing the design of shoes is to find the placement of fixing parts to ensure a minimum amplitude of oscillatory movements and increase the sensations of one's own body.

Based on the foregoing, we propose a methodology for developing designs of orthopedic shoes that provide balance. It includes:

analysis of the morphological features of the figure and deformities of the lower extremities of the child;

obtaining a digital image of the child's figure;

building a balanced geometric spatial and conditional mechanical models of the child's body;

determination of the location of the fixing parts for weighting agents;

testing the balance of the child's body.

By the definition of "details-fixators" we mean tuning details-pockets on the berets of shoes, which are designed to accommodate weighting agents in them.

According to the results of testing the body balance of a child with cerebral palsy, depending on the morphological features, we proposed the topography of the location of fixing parts for weighting shoe structures (Table 6).

Table 6. The location of fixing parts in shoe designs depending on the morphological features of a child with cerebral palsy

Morphological features of the patient	The direction of the effect of the weighting agent	The location of the weighting element
Lower limb flexor contractures	It is necessary to influence muscle groups with reduced tone	The clamps are placed in the lower parts of the tibia with an anterior displacement
Supination of the foot	It is necessary to influence the foot from the inside to turn to the correct position.	Clamps are located at the bottom of the berets on the inside
Foot pronation	It is necessary to influence the foot from the outside to turn to the correct position.	Clamps are placed in the lower part of the berets from the outside
Atonic-astatic form of cerebral palsy	A weighting effect is necessary to reduce the amplitude of oscillatory movements	It is advisable to combine with a suit with weighting agents. In the design of shoes, place clamps on the berets in the ankle area

When developing the design, it must be taken into account that the maximum weight of all weighting agents in the fixing parts placed on a half-pair of shoes should not exceed 1.5% of the body weight.

As weighting agents, it is recommended to use steel or lead shot, the specific gravity of which is 7.8 and 11.3 g/cm3, respectively.

To develop health-saving designs of orthopedic shoes for children with cerebral palsy, you need to know the parameters of their feet and the park of technological equipment that is used to make such shoes.

In the practice of prosthetic and orthopedic enterprises for children with cerebral palsy, as a rule, complex orthopedic shoes are made, which are divided into two groups: corrective, for correcting deformities that can still be corrected, and compensatory, the purpose of which is to compensate for various incurable deformities.

GOST R 55638-2013 "Services for the manufacture of orthopedic shoes" provides a classification of services for the manufacture of orthopedic shoes by methods, which includes the individual manufacture of orthopedic shoes and the selection of orthopedic shoes. The composition of services for the manufacture of these types of shoes is different.

Depending on the location of the tuning parts-pockets for weighting agents that provide balance balance, products can be classified into 9 groups (table 7).

Table 7. Classification of shoes depending on the location of pockets for weighting agents that provide balance

Location of tuning parts-pockets for weights	Illustration
in the lower parts of the tibia on both sides with an anterior displacement	
in the lower part of the tibia from the outside with an anterior displacement	
in the lower part of the tibia on the inside with an anterior displacement	
in the lower part of the berets on both sides	
in the lower part of the berets from the outside	
in the lower part of the berets from the inside	
on berets on both sides in the ankle area	
on the berets from the outside in the ankle area	
on the berets from the inside in the ankle area	

In case of individual production, instead of the service “Selection of finished orthopedic shoes in accordance with GOST R 54407-2011”, a number of services are introduced (determining the parameters of special orthopedic parts and choosing materials for their manufacture; determining parameters or obtaining initial data for a mathematical model (scanning) of the foot and lower leg consumer; selection and adjustment or production of individual technological equipment, production of orthopedic shoes, including fitting), which significantly increase labor and material costs, as a result of which the cost of the product increases. Therefore, it is economically beneficial to increase the share of services for the selection of orthopedic shoes, followed by equipping with an insert orthopedic insole and additional corrective elements.

When transferring shoes from the status of individual production to the status of “selection”, it is necessary to satisfy the needs of the customer as much as possible by developing designs with a set of corrective elements designed for various deformities of the lower extremities. From the analysis of research sections, subsequent descriptions of the features of cerebral palsy disease and the possibilities for improving the designs of products for people with cerebral palsy, it can be concluded that the range of orthopedic shoes includes designs that provide a different level of rehabilitation effect. This gives us reason to approach the classification of these types of shoes from the standpoint of customization. Such a trip is attractive primarily for ethical reasons: the consumer feels that the product (in this case, shoes) is made personally for him and satisfies his personal needs to customize - customize, change something, making it more suitable for the needs of a particular consumer) is interpreted as the individualization of products for the orders of specific consumers by making structural or design changes (usually at the final stages of the production cycle). Consider a model of the life cycle of orthopedic shoes in terms of customization. At its core, the model is staged with the possibility of iteratively repeating some of them (Figure 7).

Figure 7. The life cycle of the product development process in terms of customization

Figure 7 shows that at the first stage, a general idea is formed about the product, its main functions and the tasks solved with its help. To develop designs for orthopedic shoes, it is very important to get as much information as possible and fix it in the source documents. However, it should be borne in mind that not all the wishes of the customer can be reflected in the terms of reference (TOR), especially with an integrated approach to the decision to create a product, which is orthopedic shoes: some positions may contradict each other or be simply untenable due to various circumstances (for example, organizational and technical). However, this cannot serve as a basis for their exclusion. At the second stage, the design of the product is carried out, on which sketches, drawings, technological and instructional maps are developed, other data and documents necessary for the manufacture of a product sample. Thus, the following stages of the life cycle of shoes in general are covered: market analysis (search for a product idea) - preliminary design - design - creation of experimental samples - production, which determine important points in the formation of shoe quality.

The production itself is a key element in the life cycle of an orthopedic product: shoes are made, which are tested during fitting. At the same time, a discrepancy in the prototype elements is allowed (for example, additional fastenings or other fittings that determine the degree of fixation of the shoe on the foot), which, in accordance with earlier decisions, were secondary. The data obtained make it possible to evaluate not only the technical, but also the price characteristics of the product and decide on the advisability of its further development.

If a decision is made to continue the customization process, then product development moves on to the next stage - making changes and corrections. Appropriate amendments must be made to all design and technological documents. The stages of designing and making subsequent changes can be repeated several times until a result is achieved that satisfies all the requirements of the Customer. Experience in the manufacture of orthopedic shoes shows that the number of iterations is usually one or two, and almost never exceeds three.

Various levels of individualization in the assortment of orthopedic shoes, all designs from the standpoint of customization can, in our opinion, be divided into ultra-customized masses.

The definition of mass-customized orthopedic shoes is understood as shoes, the design of which is developed on the basis of the average typical features of a group of patients homogeneous in terms of diagnosis. Customization is carried out by adjusting the insert corrective elements, the design features of the models that regulate the volume of the shoe space and frame parts that provide a rehabilitation effect. Ultra-customized shoes are models designed taking into account the individual anatomical features of the foot of a particular patient based on typical designs of mass-customized shoes.

Wearing orthopedic shoes forms the correct walking stereotype, suppresses hyperkinesis, eliminates contractures, prevents the development of foot deformities, and develops motor skills. The rehabilitation effect of orthopedic shoes depends on the shape and size of the shoe space, which in turn is determined by the shape and size of shoe lasts.

Having studied the range of lasts of prosthetic and orthopedic enterprises, we have compiled a classification of shoes according to the degree of conformity of their internal shape to the patient's foot:

orthopedic shoes made on blocks corresponding to GOST or TU;

orthopedic shoes made on blocks, the dimensions of which are adjusted to the individual parameters of the feet;

orthopedic shoes made individually from a plaster cast of the foot, or based on its 3D scans.

Within the framework of this monograph, the parameters of shoe lasts were refined to create mass-customized shoes for prosthetic and orthopedic enterprises in the regions of the Southern Federal District and the North Caucasus Federal District.

To do this, we carried out anthropometric studies of the feet of children with cerebral palsy, as well as measurements of the parameters of Russian-made orthopedic shoe lasts, which are used at prosthetic and orthopedic enterprises in the regions of the Southern Federal District and the North Caucasus Federal District for the manufacture of orthopedic shoes.

According to statistics, in the regions of the Southern Federal District and the North Caucasus Federal District, there are about 2,000 children with cerebral palsy. Let's take this number as the total population of the sample. Then for a 85% confidence level and a 5% confidence interval, the required sample size is 390 people.

On the territory of the cities of Rostov-on-Don and Krasnodar, measurements were taken of the feet of 390 children aged 2-17 years with various forms and severity of cerebral palsy. The experiment involved children growing up in families and in specialized institutions.

According to the research results, it was found that for a larger number of measured foot lengths are in the range from 145 to 200 mm. According to GOST 54407-2011, this corresponds to the sizes of small children and preschool groups of shoes, which include girls and boys from 3 to 7 years old. The proportion of children aged 4-7 years is 18.1%. Consequently, the general population of the sample for this sex and age group is 267 people. With a 95% confidence level and a 5% confidence interval, the required sample size is 217 people. The number of measurements in this sex and age group is 220 people, which allows further research.

Foot measurements were taken on a thin toe. Foot length was measured using a stopometer. The scheme for obtaining the girth parameters of the feet for the selection of lasts in the manufacture of shoes is necessary: parameter No. 1 - the girth of the foot in bundles; parameter number 2 - the girth of the foot in a straight lift; parameter No. 3 - oblique foot girth; 4 - girth of the lower leg above the ankles.

Measurements of the latitudinal parameters of the feet are made only in the case of the manufacture of an individual block.

In the manufacture of shoes for children with cerebral palsy, in most cases, tibia blocks are used, since the designs cover the ankle and have frame parts to maintain and normalize the biomechanics of the foot. The value of the parameters of the tibial tube of the blocks depends on the length of the track. From statistical data processing it follows that the height of the tibia with a foot length of 140-150 mm should be 140 mm, with a length of 150 to 180 mm - 150 mm and from 180 to 190 mm - 160 mm.

The height of footwear is regulated by GOST R 54407-2011 “Orthopedic footwear. General technical conditions”, but it is allowed to change it as prescribed by an orthopedic doctor. The recommended GOST R 54407-2011 parameters for the height of the berets of orthopedic shoes made for selection are shown in Table 8.

Table 8. Recommended heights of the berets of orthopedic shoes made for selection

Gender and age group	Shoe size	Shoe height, mm, not less than		
		Recommended	0.3L+59	0.3L+63
Little children's	135	100	99.5	
	145	105	102.5	
	155	110	105.5	
	165	110	108.5	
preschool	155	110		109.5
	160	115		111.0
	165	115		112.5
	170	115		114.0
	175	120		115.5
	185	120		118.5
	190	125		120
	195	125		121.5
	200	125		123

For further research, we measured three lines of shoe lasts intended for the manufacture of orthopedic shoes for patients with cerebral palsy. Orthopedic shoes must meet not only a set of technological, but also medical requirements. When measuring the feet of patients, medical prescriptions for orthopedic insoles were recorded by the doctor.

So, a product with a removable orthopedic insole should correspond to the anatomical structure of the foot and ensure its normal functioning. Loose shoes

do not contribute to the necessary function of correcting the pathology: due to slipping of the foot inside the shoe, abrasions and calluses can form. Excessively tight shoes violate the physiology of the foot, causing injury and progression of deformities.

Thus, in the manufacture of mass-customized orthopedic shoes, an additional volume of intra-shoe space for an orthopedic insole must be provided.

The removable orthopedic insole is made of leather, thermoplastic and other materials, no more than 3 mm thick. On the corrective elements of the insole, such as arch support, pronator, arch lining, etc. foam or thermoplastic materials are used. The size and position of the corrective elements is prescribed by an orthopedist, based on the nature and degree of foot deformities. For further research, we have compiled a classification (Figure 8) of corrective elements (CE) according to their position in the shoe space.

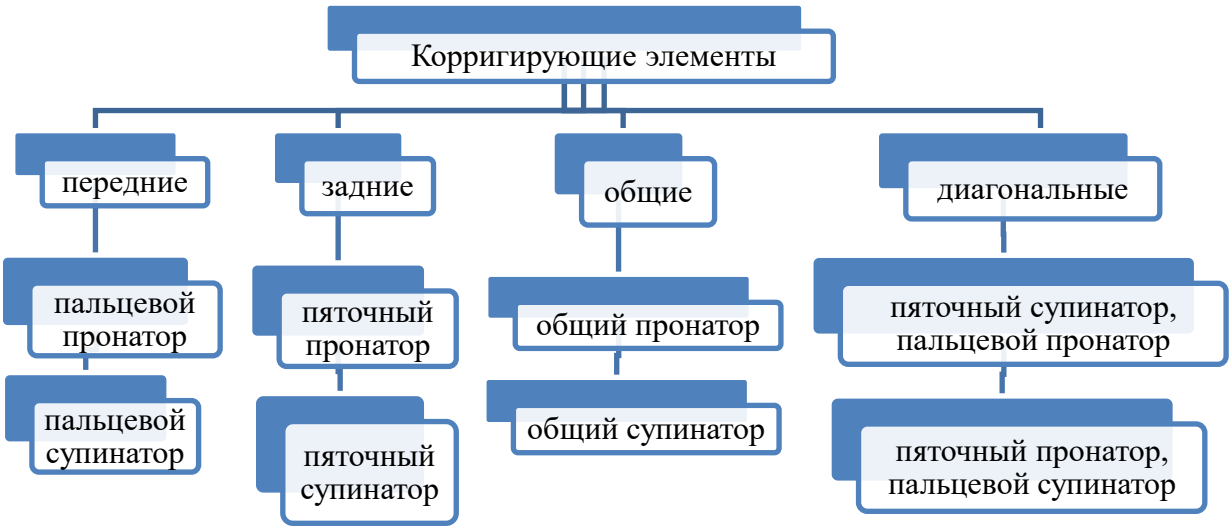


Figure 8. Classification of corrective elements according to their position in the shoe space

Based on the analysis of medical prescriptions for patients with cerebral palsy, carried out at enterprises in the regions of the Southern Federal District and the North Caucasus Federal District, we compiled a diagram of the distribution of the frequency of use of corrective elements (CE) in shoes for children with cerebral palsy (Figure 9).

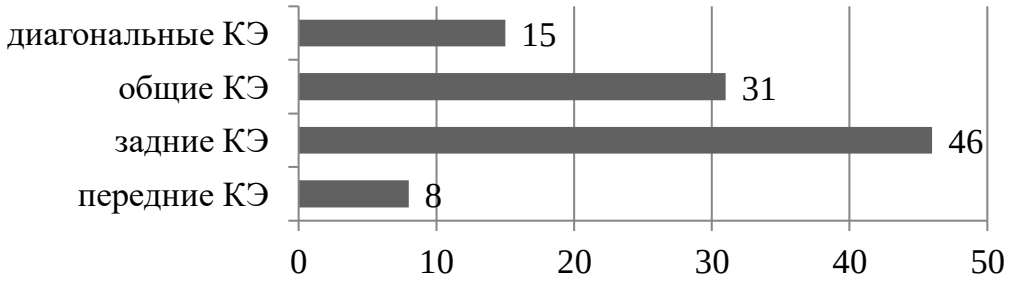


Figure 9. Distribution diagram of the frequency of use of corrective elements in shoes for children with cerebral palsy

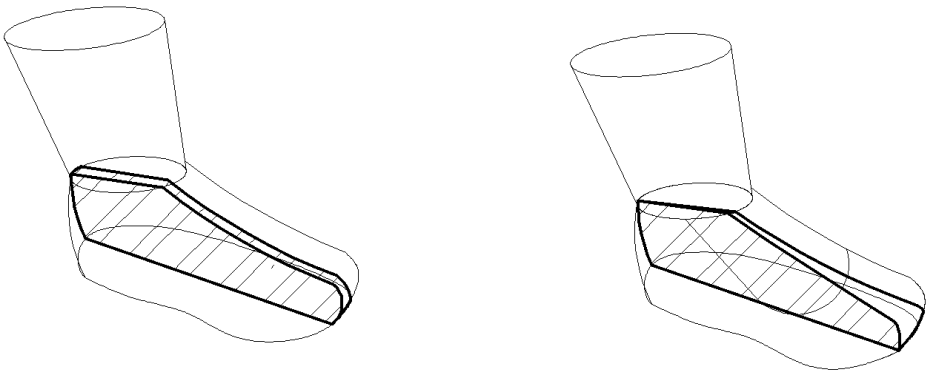
The designs of mass-customized shoes for children with cerebral palsy have intermediate frame parts for fixing the ankle joint. This element of footwear can be made of leather of increased thickness or thermoplastic materials. In order to avoid injuries to the child's foot in the form of corns and abrasions during the operation of shoes, the structures are equipped with an unlock in the ankle area, which provides additional space between the frame parts and the patient's foot. At the same time, it is recommended to duplicate the unblocked area during the production of shoes with a soft rubber-like material. The height of the tube of the last must be at least 10 mm higher than the workpiece of the top of the shoe. This ensures the convenience of molding the frame parts of the shoe in the area of the berets. Taking into account the requirements and results of measuring the feet of patients, a table has been compiled,

To test the results obtained, we took pads from the Rostov Orthopedic Factory, the parameters of which were brought to those established by the results of the studies performed (Figure 10).

a b

Figure 10. Blocks: a - original form; b - brought to the set parameters

These lasts were used to make shoe lines, which were offered to patients as ready-made or fitting shoes. The design of orthopedic shoes with a high tibia and with vertical flat and wedge-shaped inserts is shown in Figure 11.



a b

Figure 11. Structural diagrams with vertical flat(a)and wedge-shaped(b)inserts

The shoes have a double-sided hard beret and a removable orthopedic insole, which can be supplemented with the necessary corrective elements. Below are the main principles of the concept of developing such a design:

take the minimum girths of the foot obtained during the study as the parameters of the initial block;

to adjust the "girth in bundles" parameter, a set of wedges is offered that increase the girth in 5 mm increments. An increase in the girth of the feet can be caused by a large fullness, deformity of the fingers, flattening of the forefoot. Therefore, both vertical and horizontal wedges are needed;

the girth of the lower leg above the ankles is measured in 5 mm increments. Therefore, the size of the wedges should increase the volume of the block tube with the same step;

in some cases, an increase in ankle releases is required. To do this, it is necessary to provide a technological hole in the design of the block for installing the blocking cloth.

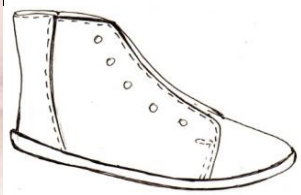
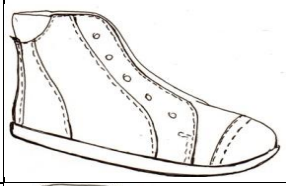
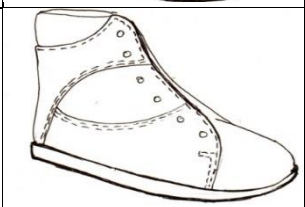
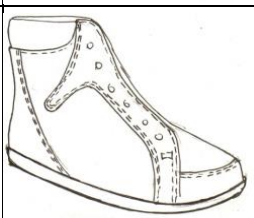
In addition to the internal shape of the shoe, the degree of the rehabilitation effect is affected by the design of the product, therefore, the next section is devoted to the analysis of the range of children's orthopedic shoes for patients with cerebral palsy.

The range of children's orthopedic shoes is wide, so its classification and identification of basic models are required. To solve this problem, we analyzed the designs of shoes produced by Russian enterprises specializing in the manufacture of orthopedic shoes.

Thus, envelope-type structures are manufactured by prosthetic and orthopedic enterprises in Rostov-on-Don, Stavropol, Krasnodar, Sochi, Kirov, Lipetsk, Kaliningrad, Rostov, Syktyvkar.

Table 9 shows photographs of insulated footwear models taken from the production catalogs of orthopedic enterprises. For clarity, the designs are transformed into a technical drawing when describing their structural elements.

Table 9. Boot designs with adjustable berets

Product illustration	technical drawing	Structural and decorative elements
		Lace-up boots with soft piping. Decorative stitching used as decoration
		Lace-up boots. Adjusting decorative elements of a contrasting color are used as decor.
		Lace-up boots with soft piping. Used as a decor: articulation of details, details of contrasting colors
		Lace-up boots with soft piping. Used as a decor: a combination of colors, stitching in a contrasting color
		Lace-up boots with soft piping. Partitioning of details, details of neutral colors were used as decor.
		Velcro boots with soft piping. Used as decor: articulation of parts, details of related colors

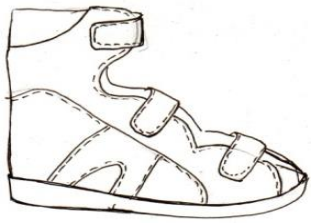
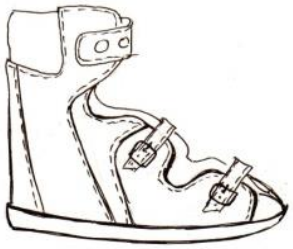
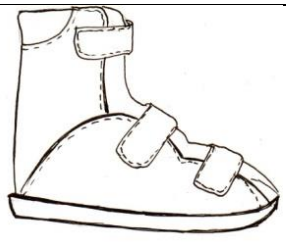
The most popular design is the "envelope" type boots with berets that cover the ankle for the use of frame details. Good opening is required in shoes, which is achieved by lengthening the berets to the V base line or going beyond it. Methods for fixing the model are different, laces are the priority, but the use of Velcro tapes and buckles is not excluded. A variety of designs in this case is achieved through the division of parts, the use of fittings and various color schemes. Orthopedic shoes with a high tibia and a full opening for the entry of the foot are the most popular among summer models, as they can be prescribed for various deformities of the lower extremities. Product illustrations, technical drawings and design descriptions are shown in Table 9. When analyzing designs, 3 main methods of fixing shoes on the foot

are distinguished: laces, Velcro tapes, buckles. Laces along the entire arc of divergence for the entrance of the foot create the greatest degree of fixation in the ankle joint due to the minimum possible distance between the fixing elements (laces threaded through the blocks and changing the full parameters of the shoe by tightening or relaxing the lacing. In the production of shoes, there are combined methods of fixation on the foot The most popular combination is "velcro tape - buckle". This is due to the convenience for the patient to put on and take off shoes on his own. Due to impaired motor skills, the use of a buckle with a buckle is almost impossible in most cases.

Consider the design of summer shoes with high berets and a vamp with an elongated tongue fixed with straps. Due to the vamp with an overestimated tongue in the shoe, enhanced fixation of the ankle joint is achieved. Design options for this model are shown in Table 10.

The closed beam part of the shoe makes it difficult to put on shoes for patients with severe ankle joint contractures and foot paresis. There are 2 methods of fixing shoes on the foot: Velcro tapes and buckles, as well as in the previous model, their combination is possible.

Table 11. Designs of summer shoes with an open toe

Product illustration	technical drawing	Structural and decorative elements
		Shoes with soft edging on Velcro tapes. Used as decor: articulation of parts, combination of colors, appliqué
		Velcro shoes. Used as decor: articulation of parts, combination of colors, appliqué
		Shoes with soft edging on Velcro tapes and buckles. Used as decor: articulation of parts, combination of colors, appliqué
		Shoes with soft edging on Velcro tapes. Used as decor: division of parts and a combination of colors
		Shoes with soft edging on Velcro tapes. Partitioning of parts was used as a decoration

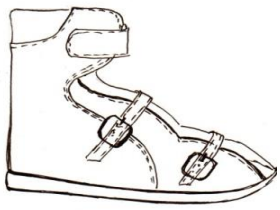
		Shoes with soft edging on Velcro tapes and buckles. Used as decor: division of parts and a combination of colors

Table 12. Designs of summer shoes with high berets and a vamp with an elongated tongue

Product illustration	technical drawing	Structural and decorative elements
		Summer shoes with a closed toe and vamp-tongue. The fixation method on the foot is Velcro tapes. Used as decor: division of parts and a combination of colors
		Summer shoes with a closed toe and vamp-tongue. The fixation method on the foot is Velcro tapes. Used as decor: articulation of parts, combination of colors, appliqué
		Summer shoes with a closed toe and vamp-tongue. The fixation method on the foot is Velcro tapes. Used as decor: articulation of parts, combination of colors, appliqué
		Summer shoes with a closed toe and vamp-tongue. Method of fixation on the foot - belts with buckles. Unusually shaped buckles and a preformation on the vamp were used as decor.
		Summer shoes with a closed toe and vamp-tongue. Method of fixation on the foot - belts with buckles. Used as decor: stitching in a contrasting color and perforation on the vamp

The third model is summer shoes with high berets and a closed toe (Figure 12).

The model has a number of limitations: it is categorically not suitable for patients with severe ankle joint contractures, foot paresis, toe deformities, etc.

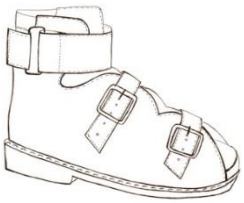
Figure 12. Models of summer shoes with an overestimated part of the berets and a closed toe

Figure 13. Model of summer shoes with a vamp increased due to the belt

To prescribe such a design to patients with foot paresis or minor contractures, it is necessary to shorten the allied part of the shoe for easy entry of the foot into the shoe space. To obtain a constructive norm for the length of the vamp, a Velcro tape with a width of 2.5 cm or more is used, which lengthens the vamp part of the shoe (Figure 13).

Thus, 4 main shoe designs for patients with cerebral palsy have been identified. Let's take them as base. Examples of structures and their description are given in table 13.

Table 14. Description of the basic models of orthopedic shoes for patients with cerebral palsy

Boots	Summer shoes with a high tibia		
tuning berets	open toe	closed toe (toe with extended tongue)	closed toe (toe without tongue)
			
			

Various modifications of these models can be obtained by dividing the parts, using decorative tuning parts, decorative elements and fittings to ensure a comfortable condition for the child's foot. The most common concomitant deviations of the lower extremities in cerebral palsy are: flat feet, hollow foot,

valgus deformity of the feet, foot paresis, shortening of the lower extremities, various deformities of the fingers. This requires the introduction of certain additions to the design of shoes. Shoes for children with cerebral palsy should be made of high quality materials. Distinctive features are specially designed pads that have a wide toe to ensure the natural position of the toes and the child's foot is not deformed and occupies a comfortable position. In shoes, it is recommended to use soles with sufficient elasticity and flexibility. Some models have a prophylactic sole with a special heel with an elongated crocodile to support and unload the foot. This is a heel extended from the inside of the sole. This reinforces the sole under the midfoot and prevents it from sinking inward. The use of a heel helps both in the prevention and treatment of foot defects. Orthopedic provision of patients with a drooping foot is determined by active mobility in the ankle joint, as well as the presence of lateral deviations of the foot. In cases where dorsiflexion in the ankle joint is preserved and there are no lateral deviations of the foot, shoes are prescribed in combination with a cuff and rubber bands. If the sagging is not fixed and there are slight lateral deviations of the foot, it is recommended to use orthopedic boots in combination with a cuff and rubber bands, as well as shoes with double lacing. Pronounced lateral deviations of the sagging foot require the appointment of orthopedic boots with one-sided hard berets and heel extension, and the intersole layer should be supplemented with a pronator or arch support. With a fixed sagging or excessive mobility in the ankle joint, boots with bilateral or circular hard berets are recommended. The circular rigid beret, along with a more secure fixation, creates some front stop, which is necessary for the implementation of the roll. The product range is limited. Recommended designs for children with cerebral palsy are boots and high sandals.

Table 14. Calculation of the parameters of custom-made orthopedic shoes

Gender and age group of shoes	Shoe height, mm, not less than
Toddler boot	0.3/ + 53

When designing orthopedic shoes, in addition to the intra-shoe space and the parameters of the orthopedic insole, a significant rehabilitation effect is achieved through frame parts.

The degree and topography of the rigidity of the product is determined taking into account the entire complex of foot deformities. Special frame parts of orthopedic shoes for children with cerebral palsy include a hard heel counter, hard berets, hard toe cap, hard vamp, hard barrel, etc. A hard barrel in most cases is combined with a hard corset, berets or back. Statistics on the use of frame parts for fixing the ankle joint according to the Rostov Orthopedic Factory of the Ministry of Labor and Social Protection of the Russian Federation is shown in Figure 14.

Figure 14. Frequency of use of skeletal parts for fixation of the ankle joint

Prevailing in frequency of use are a hard beret in combination with a hard barrel (41%) and without it (22%). Shoes with double-sided hard berets in combination with a hard barrel are recommended in mass-customized shoes for people with cerebral palsy.

The degree of fixation of the foot in the intra-shoe space is influenced by the methods of fixing shoes on the foot. Typical fixation methods are shown in Figure 15.

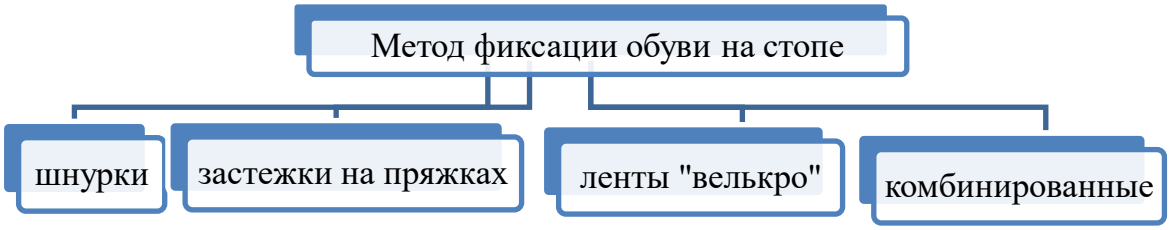


Figure 15. Methods for fixing shoes on the foot

The traditional ways of fastening shoes on the foot, providing a secure fit of the foot in the inside of the shoe space, are laces. In this case, the volume inside the shoe space can vary with high accuracy, while increasing the rehabilitation effect of orthopedic shoes. With the development of technology and changes in fashion trends for children's shoes, orthopedic shoes use the fixation method on the foot with the help of Velcro tape, which is used by fashion designers in various types of shoes. In the design of footwear, on average, from 2 to 4 Velcro tapes are used, spaced evenly at a distance of 2–3 cm from the edge of the berets. This is enough to fix on a healthy foot of a child. But, when it comes to maximum fixation with frame parts, the use of Velcro tapes cannot create sufficient fixation of the foot in the shoe space. The foot does not take a fixed position, therefore, the therapeutic and prophylactic significance of shoes is reduced.

To ensure the necessary degree of fixation of shoes on the foot with Velcro tapes, it is proposed to design recesses in the berets at the bend of the ankle joint, thus changing the distribution of resistance forces. An example of the proposed design solution is shown in Figure 16. In the design of the presented type, Velcro tapes are located in two directions: to fix the lower leg and the back of the foot. Not only the fixation of shoes on the foot increases, but also the comfort of using the product. The design provides a qualitative relationship between consumer preferences and medical prescriptions. This model is included in the assortment of the Rostov Orthopedic Factory and is actively used.

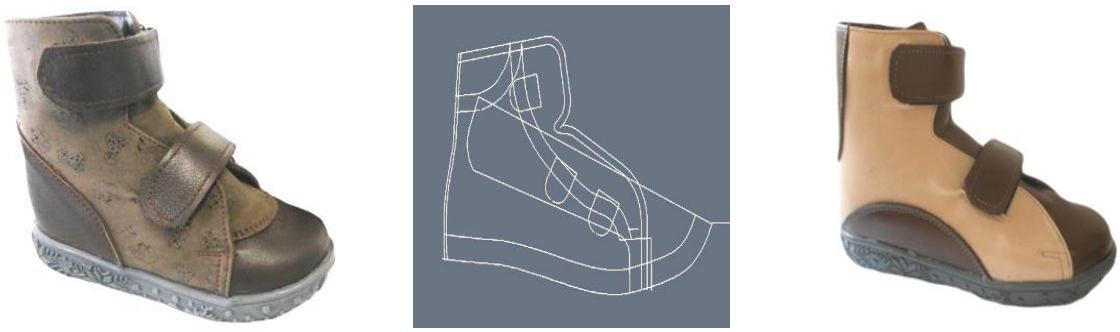


Figure 16. Options for changing the shape of the berets of orthopedic shoes

When analyzing the designs of orthopedic shoes from the point of view of fixing the foot in the shoe space, which is achieved due to frame parts, fixation methods on the foot and volumetric parameters of shoe lasts, 3 main degrees of fixation can be distinguished: weak; increased; significant. Figure 17 shows a drawing of the design of shoes with a high hard back (shaded) with a weak degree of fixation. The shoe design is prescribed for minor deviations in the lower extremities. The rigidity of the backs is ensured by using polymeric materials or leathers of increased thickness.

Buckles, velcro straps, or laces are recommended methods for securing the shoe to the foot in these designs. In the model with an increased degree of fixation of the foot (Figure 18), a high rigid beret is used as frame parts (shaded). Buckles and laces are the recommended methods of securing shoes to the foot.

In the model shown in Figure 19, the frame parts are high rigid berets in combination with rigid barrels, which provides a significant degree of fixation. This shoe design is designed for children with significant deformities of the lower extremities.

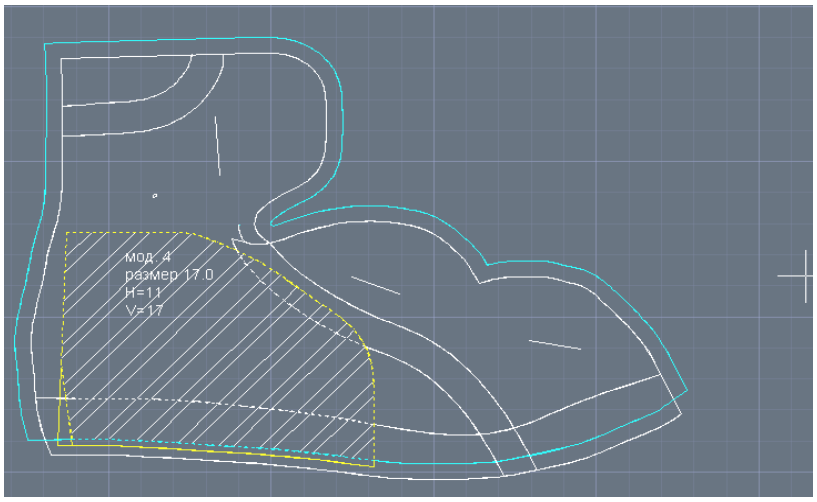


Figure 17. The design of shoes with a high rigid back (with a weak degree of fixation of the foot in the shoe space)

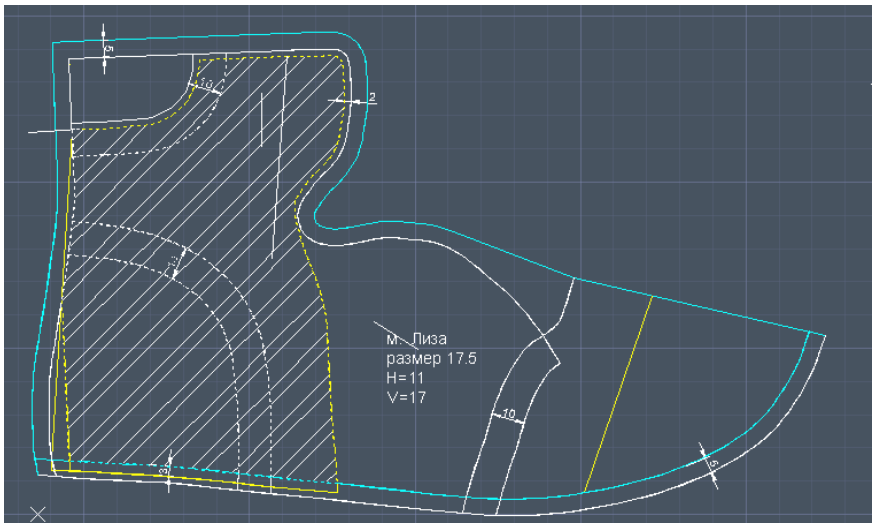


Figure 18. The design of shoes with a rigid ankle (with an increased degree of fixation of the foot in the inside of the shoe space)

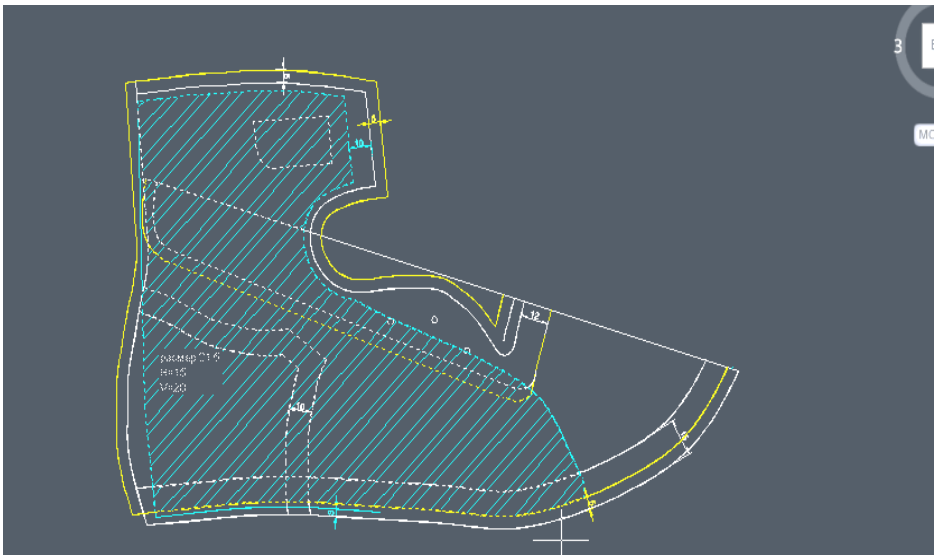


Figure 19. The design of shoes with hard berets and hard barrels (with a significant degree of fixation of the foot in the shoe space)

The presence of extensions in the calf part significantly increases the fixation of the foot in the shoe space in comparison with the previous design. The recommended methods of fixation on the foot are buckles and laces. Summarizing the data concerning orthopedic insoles, frame parts, methods of fixing shoes on the foot, as well as solutions for typical shoe designs, we proposed to distinguish 7 levels of rehabilitation properties of structures. These levels characterize the main functions of rehabilitation when using orthopedic shoes. The classification scheme is shown in Figure 20.

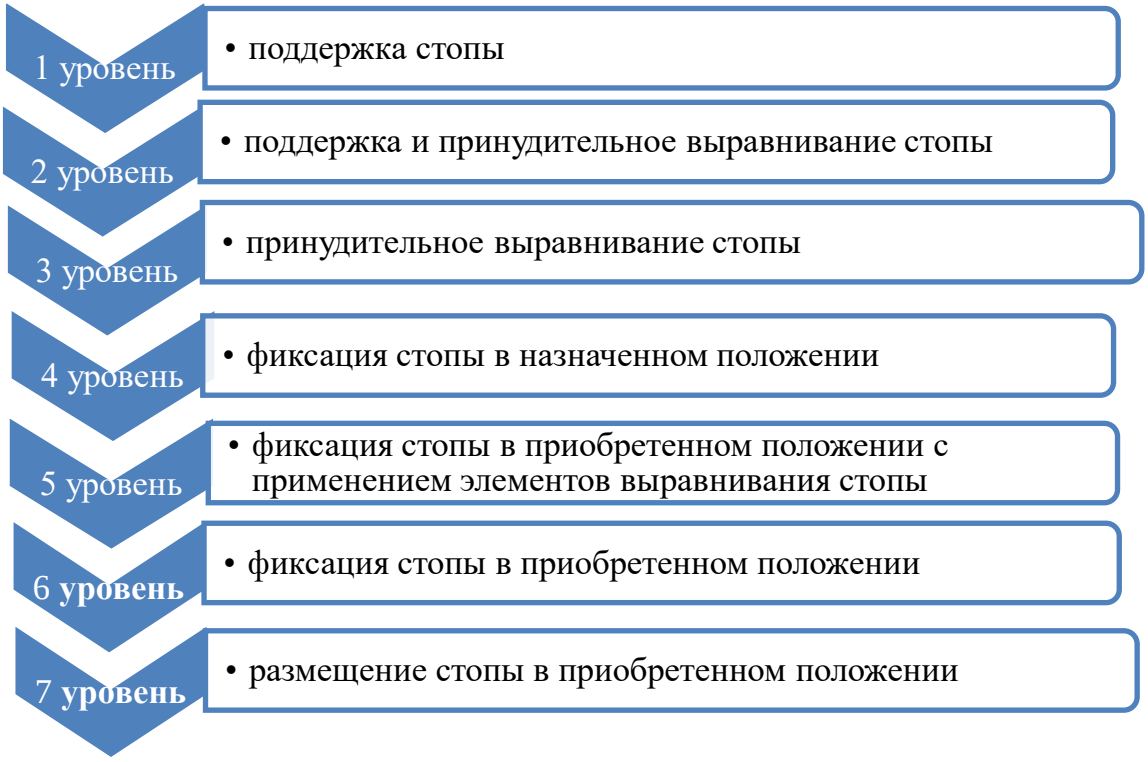


Figure 20. Classification of the rehabilitation properties of orthopedic shoe structures

It follows from the scheme that for patients with 1-3 levels of motor functions, shoes are made according to the GMFCS scale. For levels 2 - 5, lasts must be used in accordance with GOST R 53800-2010 “Orthopedic shoe lasts. General technical conditions”, or individual pads with parameters as close as possible to the parameters obtained during the measurement of the feet. Particular attention should be paid to the angle between the running and tibia parts of the block. In shoes of levels 2 - 5, the angle remains fixed, which has a rehabilitative effect. Level 6 and 7 shoes can be made from casts of the foot. The angle between the running and tibial part of the foot can be prescribed by an orthopedic doctor based on the results of the examination of the patient. A more detailed description of frame parts, orthopedic insoles and shoe designs in terms of the level of rehabilitation effect is given in Table 15.

Table 15. Classification of shoes according to the level of rehabilitation effect

Levels	frame details	Features of the orthopedic insole	Shoe design features
1	hard back	vault support	shoes with a high tibia with any method of fixation on the foot
2	hard back	with arch support and additional corrective elements (pronator, supinator)	shoes with a high tibia with any method of fixation on the foot
3	high hard back or hard beret	with arch support and additional corrective elements (pronator, supinator)	shoes with a high tibia with any method of fixation on the foot
4	hard beret in combination with a hard barrel or the use of corsets	with arch support and additional corrective elements (pronator, supinator)	shoes with an overestimated tibia part with fixation on the foot with straps or laces

5	hard beret in combination with a hard barrel or the use of corsets	with arch support, additional corrective elements (pronator, instep support) and elements that compensate for foot deformities (insole according to the impression)	shoes with an overestimated tibia part of the "envelope" type design with fixation on the foot with straps or laces
6	hard beret in combination with a hard barrel or the use of corsets	with arch support, additional corrective elements (pronator, instep support) and elements that compensate for foot deformities (insole according to the impression)	shoes with an overestimated tibia part of the "envelope" type design with fixation on the foot with straps or laces
7	rigid back or other frame part necessary for movement	with elements that compensate for foot deformities	shoes with an overstated tibia part of the "envelope" type design with any method of fixation on the foot

To ensure a comprehensive rehabilitation effect of the design, in addition to the design features of the model, its color scheme is important, affecting the psyche of a child with cerebral palsy, which should be taken into account. There are numerous methods for designing various shoe structures: designing boots, boots, low shoes, pumps, moccasins and strap-sandals. In all cases, the design process is carried out on the last, implying the fact that the details of the right and left half-pair in the shoe set are symmetrical and do not differ in any way. When creating orthopedic shoes, asymmetries are often encountered, which gives us reason to pay attention to the peculiarities of the methods for developing such structures, which, in accordance with the terminology we have adopted, belong to the mass category and ultra-customized. Currently, various shoe design methods are used, including computer technologies based on matrices of basic geometric shapes of structural elements of the shoe shape. Specialized CAD designed for designing shoes (ShoeMaker, ASSOL-OBUV, ASKO-2D, IRIS, etc.) are widely used at shoe enterprises. They contain tools and functionality for the development and design of all types of shoes, as well as the creation of databases, which is not the case for small businesses or custom-made shoe shops. To improve the quality of drawings while reducing labor intensity and creating electronic databases, we propose a method for designing shoes using a wide range of CAD systems. The design of shoes according to the method is simple, manufacturable, structured, low material and labor costs. At the same time, the most common in the practice of prosthetic and orthopedic enterprises is the design of shoes according to the URC, obtained using paper templates, which includes the following steps:

development of a sketch of shoes;

obtaining an average sweep of the side surface of the block (URC);

inscribing the URC in the coordinate axes, drawing a grid of base, auxiliary and control lines;

drawing the constructive basis of the top of the shoe, internal and intermediate parts;

production of templates for shoe parts.

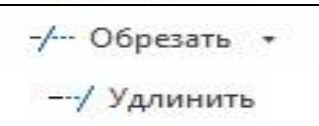
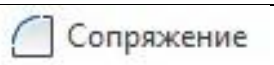
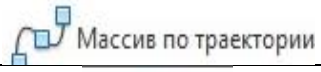
Therefore, we will present the content of the work of the proposed design methodology in comparison with that used in the practice of prosthetic and orthopedic enterprises (Table 16).

Table 16. Comparison of the stages of the original and proposed shoe design methods

Stage	Traditional Design Method	New Design Method
1	Obtaining a conditional sweep of the inner and outer sides of the side surface of the block. Obtaining the average sweep of the side surface of the pad (URK)	Applying a grid of basic, control and auxiliary lines to the block (method of V.F. Peshikov, Ars Sutoria). Drawing a sketch of the future model on the outside of the block. Get URC. Obtaining a sweep of the block trace.
2	Inscribing URC in the coordinate axes. Drawing a grid of basic, auxiliary and control lines	Construction of high-rise parameters of shoes based on the results of measurements of the customer's foot and the type of deformities of the lower extremities
3		"Trying on" gluing the resulting soil model of shoes onto a last with a note if further adjustments are needed
4	Drawing the structural basis of the upper, lining details and shoe interlining	Digitization of the contours of the model, construction of structural allowances. Construction of the lining and interlining of shoes
5	Obtaining shoe detail templates	Obtaining part templates from a finished drawing using the Copy and Paste commands
6		Entering the received drawing into the database with the necessary information

At the second stage, the URC is placed in conditional coordinate axes, taking into account the height of the heel and oblique girth. The upper edge of the shoe is designed with an angle of inclination of 84 - 86 degrees or based on the deformation of the foot. The slope of the upper edge is checked visually during the "fitting" of gluing the primer model on the block. In the program of the AutoCAD package for 2D design, the digitization of the contours of models and the correction of the drawing are carried out using the tools presented in Table 17.

Table 17. AutoCAD tools used in design

Tool designation	Tool functionality
	Outlining objects, building straight lines
	Lingering edge outline
	Construction of perforations, blocks, decorative elements of a round shape
	Construction of the heel rounding; roundings that cannot be created using fillets
	Construction of parts with a break line
	Drawing Adjustment Tools
	Construction of rounding parts
	Construction of structural allowances and displacement of drawing lines by a given value
	Construction of perforations, decorative elements of footwear
	Building markup for blocks
	Grouping objects
	Ungroup objects for adjustment

Corrections of the drawings already available in the database based on the results of the “fitting” of gluing the soil model onto the block are carried out electronically. The content of the work will vary depending on the features of the model being developed. In case of correction of a drawing already in the database, it is necessary to ungroup it and perform operations, mainly using the “displacement” tools, while changing the height and latitude parameters of the structure. Figure 21, as an example, shows drawings of basic models for patients with cerebral palsy, developed in the AutoCAD program.

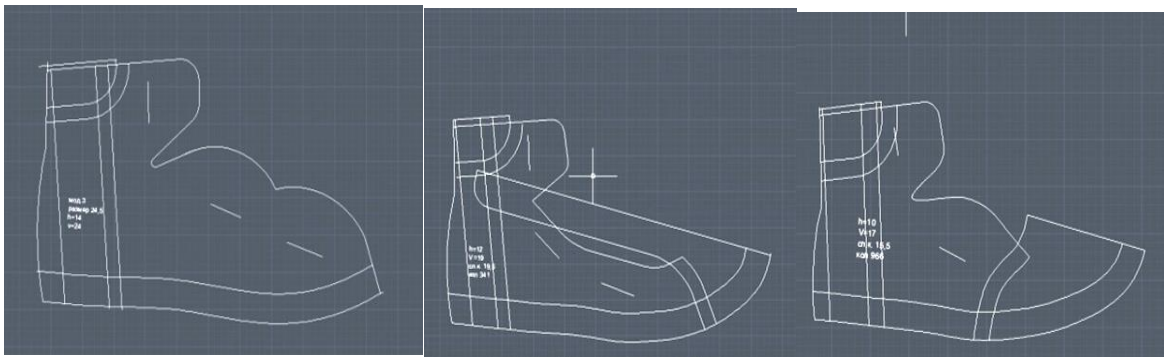


Figure 21. Shoe drawings developed in AutoCAD according to the proposed method

Designing shoes according to our proposed method speeds up the construction of drawings and allows you to create designs of both ultra and mass-customized shoes based on databases. In the manufacture of ultra-customized orthopedic shoes, there are cases when the girths of the right and left feet of the patient differ significantly from each other. At the same time, the fashion designer needs to create anatomically correct shoes and achieve the most aesthetic appearance of the product. In most cases, in the manufacture of shoes for patients with cerebral palsy, tibia blocks are used, since in order to create a shoe design with a high rehabilitation effect, it is necessary to tightly fit the shoe top blank to the shoe tube. In the event that the parameters of one of the feet correspond to the average, and for the manufacture of shoes there is already a ready-made drawing, then for a foot of increased fullness, an already prepared ground model must be applied to the most convex points of the heel and tufts and fixed (Figure 22). Having determined where there is not enough volume, it is necessary to make appropriate adjustments in the electronic soil. Important from the point of view of visual perception of shoes is the construction of a soft edging detail. Figure 23 shows a diagram of the distribution of consumer opinions regarding the size of the soft piping in finished shoes. Important from the point of view of visual perception of shoes is the construction of a soft edging detail. Figure 23 shows a diagram of the distribution of consumer opinions regarding the size of the soft piping in finished shoes. Important from the point of view of visual perception of shoes is the construction of a soft edging detail. Figure 23 shows a diagram of the distribution of consumer opinions regarding the size of the soft piping in finished shoes.

Figure 22. The position of gluing the primer model on the block

After analyzing the difference in girths in one half-pair, it was found that from a visual point of view, it is recommended to design soft edges of the same size relative to the back seam if the difference in girths does not exceed 21%. If the difference is more than 21%, it is recommended to increase the detail of the soft edging, leaving the same distance to the edge of the tibia. Examples of a drawing and a finished shoe model are shown in Figure 23. With an increase in girth, the front arch of the tibia decreases. It is important to consider the type of means of fixation on the foot. In the case of laces, it is appropriate to reduce the number of blocks in a half-pair of larger girth. At the same time, the distance from the extreme blocks to the edge of the berets should remain the same. When using Velcro tapes or belts with buckles, it is necessary to take into account the width of the belts in advance, relative to both half-pairs.

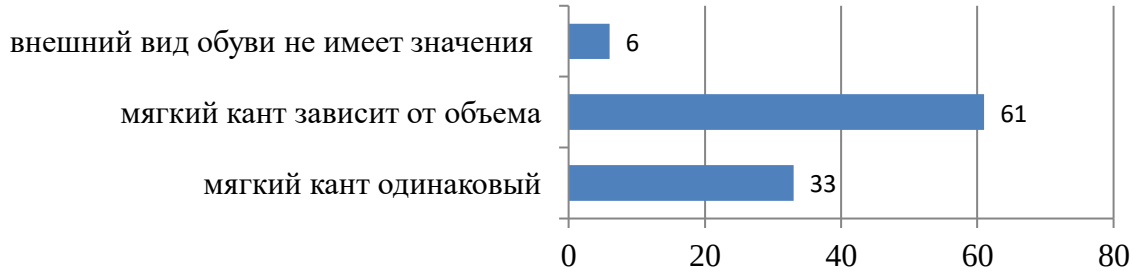
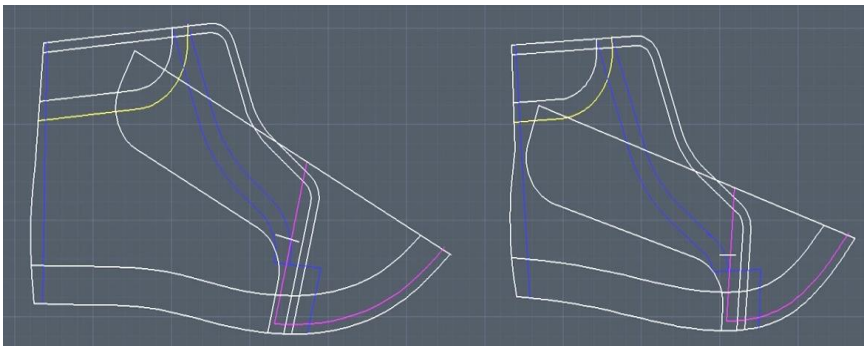


Figure 23 Distribution of consumer opinions regarding the size of soft piping in finished shoes



a

b

Figure 24. Examples of a drawing (a) and a finished shoe model (b) of ultra-customized shoes with different girth parameters

The reason for the different heights of shoes in a pair can be both a shortening of the limb, and significant deformations on only one of the feet. Shoes of different heights in a pair are prescribed by a doctor and agreed in advance with the patient. When designing such structures, it is necessary to strictly maintain the height and width parameters of the tibia part of the shoe. Examples of shoes with different heights of the tibia are shown in Figure 25.

Figure 25. Examples of ultra-customized shoes with different shin heights

With a difference in the height of the berets up to 3 cm, the number of fixing elements, such as buckles and Velcro tapes, is recommended to be left the same. In the case of fixation with laces, the number of blocks may differ. With a difference in the heights of the ankle boots over 3 centimeters, the number of buckles and Velcro tapes should be sufficient to securely fix the foot. From an aesthetic point of view, it is recommended to leave the height of the cut-off backs and the soft edge the same. If there is a cork in the intersole layer, the decorative elements of the foot fold assembly must be placed at an anatomically correct level, stretching the edges of the parts up and down along the vertical axis of the shoe. In the manufacture of ultra-customized orthopedic shoes, footprint length differences of up to 1 cm are common and are not difficult to design. In this case, adding length can be done evenly by lengthening the vamp and the back of the cuffs. With a difference in track length of up to 5 mm, with manual tightening of shoes, half-pairs can be made of the same size. From the point of view of design, it is interesting to create shoe designs with a difference in footprint length of more than 1 cm. As an example, Figure 26 shows a drawing of half-pairs of summer shoes with a difference in footprint length of 50 mm (220 and 270 mm, respectively).

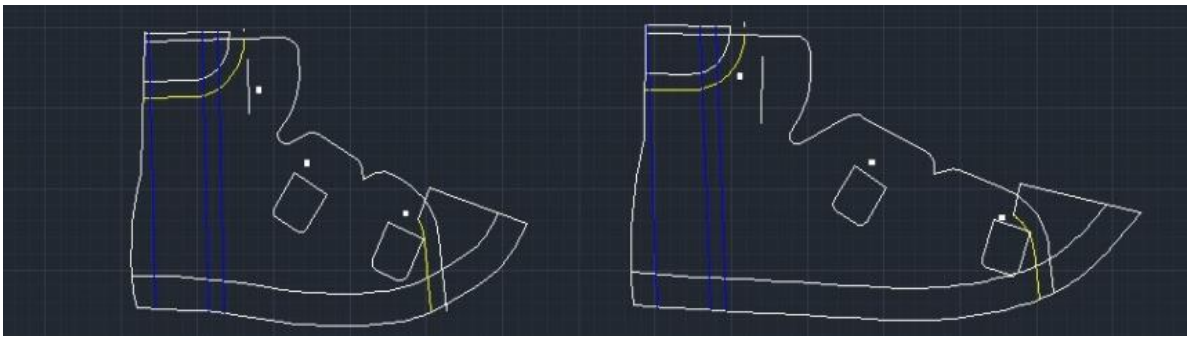


Figure 26. Shoe drawing with 50 mm footprint difference

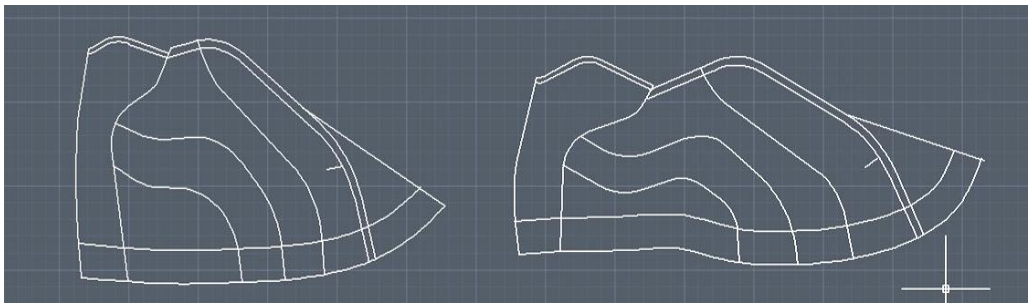
Figure 27. An example of an ultra-customized shoe with different footprint lengths and midsole

The construction of a soft edge is performed according to the method described above. When constructing vamps, it is necessary to calculate the length for both half-pairs of shoes. In a combination of different track lengths, if there is an insole layer in the toe part that compensates for the shortening of the lower limb, it is necessary to take into account the height of the latter to determine the length of the vamp (Figure 27).

The whole or composite tibia part expands evenly along the horizontal axis. In this case, the knot in the area of the fold of the foot must be built for each half-pair separately.

The length and height of the details that make up the beret are drawn by the fashion designer, based on the most harmonious visual perception of the future design. A drawing and a photograph of finished shoes with different track lengths are shown in Figure 27.

When distributing fixing elements (buckles and Velcro tapes), it is necessary to first analyze the patient's disease and the purpose of the frame parts of the shoe. Recommendations for the distribution of fixing elements are shown in Figure 29.



a

b

Figure 28. Drawing (a) and photograph (b) of finished shoes with different track lengths

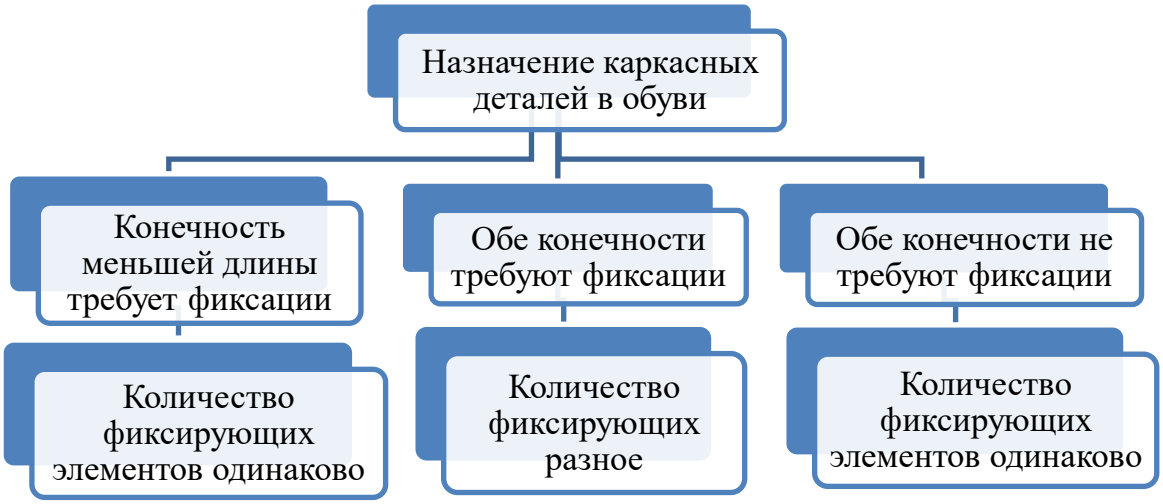


Figure 29. Recommendations for the distribution of fixing elements in shoes with different footprint lengths

Bilateral symmetrical shortening is manifested in a mismatch in the proportions of the limbs and torso. It occurs with achondroplasia (underdevelopment of long bones, leading to dwarfism) and other hereditary diseases. Anomalies in the development of the upper and lower extremities lead to asymmetric shortening. Unilateral shortening causes various diseases. The following types of it are distinguished: true (anatomical), relative (dislocation), apparent (projective), total (functional or clinical). With true shortening, the total length of the lower leg and thigh of one limb is less than the other. It occurs with organic bone lesions due to congenital deformity or certain diseases. With relative shortening, the ratios between limb segments are violated. This is due to the displacement of the articular ends of the bone due to congenital dislocations or intra-articular fractures. Relative shortening is characterized by the fact that one limb seems shorter than the other, but when measured, it turns out that the thighs and lower legs of the two legs are of the same length. Apparent (projective) shortening occurs due to forced flexion due to a fixed pathological setting in the spinal column or joints. As can be seen from Figure 28, the number of fixing elements directly depends on the purpose (functions) of the frame parts of the shoe. From the point of view of designing ultra-customized shoes, it is interesting to create designs of orthopedic shoes with shortening of the limbs. Shortening of one or two limbs by more than 2 cm is considered pathological. The classification of shortening of the lower extremities is

shown in Figure 30. The reasons for this flexion: post-traumatic contracture, which appears most often due to the development of ankylosis. With projective shortening, as with relative shortening, the lengths of the legs seem to be different, but measurements show that they are the same. An example of such a defect can be scoliosis of the lumbar spine with a pelvic tilt. The total (functional or clinical) shortening is characterized by the fact that the patient has several types of limb shortening. Orthopedic shoes in most cases are prescribed only for unilateral true shortening, when, due to the intersole layer of the limb, the shorter leg is brought to the level of a healthy one. With projective shortening, as with relative shortening, the lengths of the legs seem to be different, but measurements show that they are the same. An example of such a defect can be scoliosis of the lumbar spine with a pelvic tilt. The total (functional or clinical) shortening is characterized by the fact that the patient has several types of limb shortening. Orthopedic shoes in most cases are prescribed only for unilateral true shortening, when, due to the intersole layer of the limb, the shorter leg is brought to the level of a healthy one. With projective shortening, as with relative shortening, the lengths of the legs seem to be different, but measurements show that they are the same. An example of such a defect can be scoliosis of the lumbar spine with a pelvic tilt. The total (functional or clinical) shortening is characterized by the fact that the patient has several types of limb shortening. Orthopedic shoes in most cases are prescribed only for unilateral true shortening, when, due to the intersole layer of the limb, the shorter leg is brought to the level of a healthy one. that the patient has several types of limb shortening. Orthopedic shoes in most cases are prescribed only for unilateral true shortening, when, due to the intersole layer of the limb, the shorter leg is brought to the level of a healthy one. that the patient has several types of limb shortening. Orthopedic shoes in most cases are prescribed only for unilateral true shortening, when, due to the intersole layer of the limb, the shorter leg is brought to the level of a healthy one.

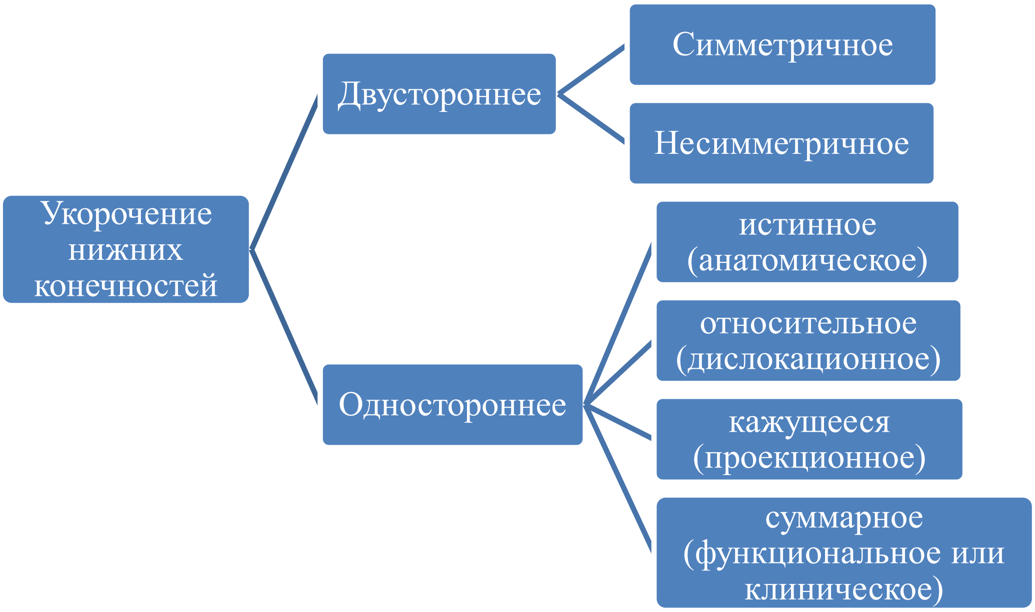


Figure 30. Classification of shortening of the lower limbs

a b

Figure 31 Drawing (a) and photograph (b) of finished shoes for limb shortening

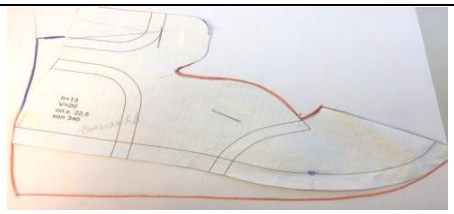
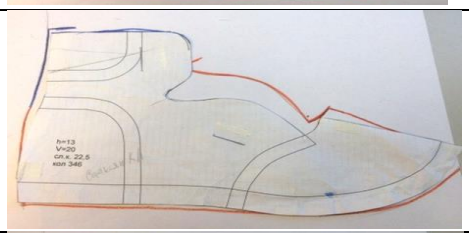
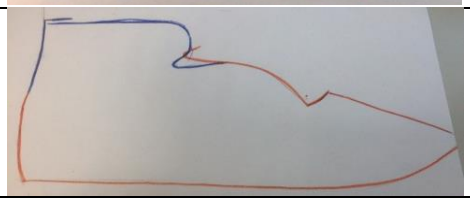
Figure 32. Shoe design with a seam on the vamp

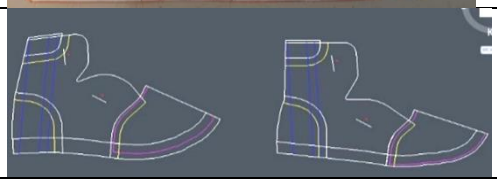
Figure 31 shows a drawing and a photograph of the finished product for a patient with a trace length of 195 mm and a shortening of 35 mm, to compensate for which plug 35 was used×20 mm.

With a cork in the toe part with a height of more than 3 centimeters, a seam can be provided for the most accurate fit of the workpiece on the block. An example of such a design is shown in Figure 32.

Based on the analysis of drawings, literature sources and the experience of employees working in this field, a methodology for designing shoes for shortening the lower limb has been developed. The description of the technique is presented in the form of table 32.

Table 17. Shoe design technique for limb shortening

Action Description	Illustration
Selection or construction of a soil model for a healthy (without shortening) leg (hereinafter referred to as the initial soil)	
Fixing the gluing of the primer model in bundles and the heel on the block with a cork	
Measurement of future adjustments: cork allowance, back seam allowance, height adjustment, upper tibia angle adjustment	
Making adjustments to the drawing of a new model when fixing the gluing of the soil model in bundles and the heel	
Making adjustments to the drawing of a new model when fixing the initial soil relative to the horizon line	
Making adjustments to the ground model (in this case, reducing the height of the tibia at the place of fixation of the ankle joint)	

Trying on gluing the resulting workpiece onto the block	
Drawing lines of the drawing from the original soil with adjustments. (Performed manually or electronically)	
Model drawing development	

It can be seen from the diagram that with a probability of 87%, no adjustments were required to the resulting model. The remaining 13% required no more than 2 adjustments. This is due to the complexity of the designs being developed and the combination of limb shortening with other foot deformities. With a large number of drawings, it becomes necessary to structure them and create databases (DB), which are an effective means of presenting and storing information. Combining drawings into databases makes it easier to access and edit information about shoe models, which reduces the burden on employees and reduces the time required to find the right information. The software eliminates redundancy and duplication of information. To create a database, MS Access software was chosen, which is included in MS Office, available in most businesses. Thus, the creation of a database in this program does not require additional costs for the purchase of new software. The developed database has a button form that allows you to select a model for further printing and adding new drawings, viewing reference information. When you select a model from a previously proposed set, its brief description and image are displayed on the screen. The screen form of the windows of the MS Access program, in which the type and model of footwear is selected, is presented below. viewing help information.

When choosing a model from the proposed catalog, the required size and height-latitudinal parameters are specified. In the developed database, one shoe size of the selected model can have an almost unlimited number of drawings with different height-latitudinal parameters. When you select a drawing, you are transferred to the AutoCAD program. To avoid possible unplanned adjustments or deletions of the drawing, the changes made in the open window are not saved. It is possible to correct the drawing without further saving (in the event that not all elements of the file need to be printed), as well as to print the drawings. The developed database allows expansion by introducing new drawings at all stages: drawings with new height-latitudinal characteristics in the selected size; entering a new size in the selected model; adding a new model to the database. Such operations are performed by selecting the "Add model" command in the button form of the database. In addition to selecting and creating drawings, the developed database also includes directories that contain information necessary for the production of shoes with high technological and rehabilitation properties. The screen form of the window - with the ability to select reference information, as well as information related to lasts for the production of shoes.

Correction of impaired vital functions of the organism of children with clubfoot.

Most of the concerns parents have about flat feet and curvature of the legs are unfounded. Developmental options are numerous and with age, the foot takes on its normal shape. Only a competent orthopedist can determine if everything is normal with your child's legs. The best thing you can do for your child is to encourage him to move and avoid overeating. Remember that so-called corrective boots, liners, arch supports, braces, etc. are ineffective and will only make your child miserable. Let the magical power of time and growth do its work. What shoes should be worn? The model should be chosen of high quality, made of genuine leather. The ideal option is an elastic sole with good cushioning. From the unbending it is better to refuse a rigid base - it interferes with the work of muscles and movable joints of the joints when walking - they do not work, gradually relaxing. Advice to parents: when buying shoes for children, bend the sole. The front of the base should be pliable, and the back rigid. If you could not

compress the base, look for another model. This is the advice of an orthopedic doctor (Figure 33):

Figure 33. Types of orthopedic shoes for children

The rubber sole for corrective footwear is ideal. The toe of orthopedic shoes should not create a lot of space for the toes, but should not exert pressure either. It is forbidden to purchase corrective shoes “for growth”: shoes should tightly cover the foot. A closed heel is a must, including for summer models. Open sandals lead to the fact that when walking, the heel begins to move, “fidget”, increasing the deformation of the joints. With the correct setting of the heel, the curvature of children's legs is absent. Overweight children should wear closed-toe sandals. Proper children's shoes. We destroy stereotypes. We ask questions:

What should be the right children's shoes?

Why do children develop flat feet, and how to avoid it?

Is it true that the first shoes for the baby should be "orthopedic"?

Should a child wear shoes at home?

What should be indoor shoes for a child?

Do children's shoes have to have an arch support?

The topic is burning: very often orthopedic shoes are prescribed for crumbs, and often orthopedic doctors contradict each other. One puts a child at 2 years old with flat feet and directs them to get orthopedic shoes, the other says that, they say, your baby is absolutely healthy, and advises mom to drink motherwort, and the child to run, jump and enjoy a carefree childhood. One says that children's shoes must have an arch support, the other categorically disagrees with this. How is a child's foot formed? We have already considered in the message one what a foot is. So, the first thing to understand: a child is born with a flat foot. Remember, dear parents, what the feet of your children looked like when they didn’t even walk under the table (Figure 34). As you can see, the place that will later become the longitudinal arch is now filled with fat. And it is right. After all, the vault is what? This is a spring that springs up when we walk to absorb shock loads and not “bomb” the joints of the legs and spine. Why would such a child need a spring? Because he doesn't walk yet. Is it logical?

Figure 34. General view of the child's foot

Recall another important point: the arched shape of the vaults is supported by the muscles of the lower leg and foot. But the muscles are not yet developed, because our baby does not yet walk, run, or jump. And when he gets on his feet and takes his first steps, the fat pad of his feet is very useful to him:

firstly, it increases the area of support and increases the stability of our child, so that he understands that walking is good! And you will see

more, and you will feel more, and you don't have to call your mother, you can walk to her. First, along the wall, then in short dashes, and now "the bull is walking, swinging";

secondly, plantar fat is needed for cushioning, while there is no full-fledged spring yet.

Such a voluminous fatty pad remains in children up to 3 years of age, and then begins to gradually dissolve. By the age of 5, a longitudinal arch emerges, and at 7-10 years old we already see a foot that is very similar to an adult. And the complete formation of the human foot ends at about 20 - 21 years old, for girls - 2 - 3 years earlier. This means that by this age, ossification of all cartilaginous structures of the foot occurs. But while the baby begins to walk confidently, he will go through a difficult school of balancing act. As soon as he gets up on his feet, he rests more on the outer arches of the foot. This is called "varus stopping." It happens in children up to about 1.5 years (Figure 35). As the baby learns to walk, he tries to keep his balance by spreading his legs wide. It is precisely the same fat pad that helps him maintain balance. about which we spoke above, and on which he begins to rely. It turns out some blockage of the stop inside. This is called hallux valgus. Here's what it looks like (Figure 36).

Figure 35. Characteristics of the outer arch of the child's foot

Figure 36. General view of a child's clubfoot

This condition is noted, as a rule, in 2 - 4 years. Further, as the musculoskeletal apparatus of the feet strengthens, the shape of the legs usually levels out: the lower leg, knees and thigh line up in one line. And if normally the angle of valgus deviation of the calcaneus at 3 years is 5-10, then by 7 years it is 0-2. norm option.

So if your two or three year old has been diagnosed with flat feet, know that everything is going according to plan and there is nothing to worry about. And there is absolutely no need to run for orthopedic shoes. Well, what did the doctor prescribe? Are you a mother or what? It is better to concentrate your attention on strengthening the muscles of the feet and legs of your child, and you will all be happy: both parents, and the baby, and his feet. Let's go back to the past. In the 60s of the last century, employees of the Leningrad Institute of Prosthetics. Albrecht conducted a study in which about 5,000 children participated. They assessed the "maturation" of the arches of the

foot. And look what happened: at 2 years old, flat feet were detected in 97.6% of children, and at 9 years old, it remained only in 4% of those observed. Of course, if we conduct this study in our days, the indicators will be more deplorable, and if we remove all computers, gadgets, phones now, what will children do? What about adults? I wonder if jump ropes are on sale now, or is it already a rarity? Do modern children know the game "dodgeball"? Do they play badminton? We did not sit at home, especially on the weekend. We ran and jumped all the time, so the diagnosis of “pathological abnormalities” was not stored in our childhood memory. Pathological deviation - clubfoot in children (Figures 37 - 38).

Figure 37. Characteristics of the measurement of feet with pathological deviations

Figure 38 Features of the selection of orthopedic shoes for feet with pathological deviations

child's foot

The foot is formed by 26 bones, not counting the sesamoid bones, connected to each other by means of joints and ligaments. The latter give the foot a rather complex shape, resembling a spiral or a propeller blade and providing mobility in three planes. Maintaining the shape and performance of the functions of the foot contributes to the activity of 42 muscles of the foot and calf muscles (Figure 39).

The feet undergo changes throughout a person's life, but the formation of the arches of the feet is most intensive in the first 7 years. Further, the periods of rapid growth of the child during the school years, periods of hormonal changes, will be critical for maintaining the shape and function of the feet. The foot in the human body performs three biomechanical functions: spring, balancing and pushing. With flat feet, all functions of the foot suffer. Spring function - softening shocks when walking, running, jumping. It is possible due to the ability of the foot to elastically spread under the action of a load, followed by the acquisition of its original shape.

Figure 39. Skeleton of a child's foot

Studies have shown that when walking fast in shoes with a hard heel on a parquet floor, accelerations in the heel area reach a value that is 30 times greater than the acceleration due to gravity (g). In people with healthy feet on the shins, the acceleration is 5-6 g, and only 1 g reaches the head. With flat feet, shocks are more sharply transmitted to the joints of the lower extremities, the spine, and internal organs, which contributes to the deterioration of the conditions for their functioning, microtraumatization, and displacements. Balancing function - regulation of a person's posture during movements. It is performed due to the possibility of movement in the joints of the foot in three planes and the abundance of receptors in the bag-ligamentous apparatus. A healthy foot sculpturally covers the irregularities of the support. A person feels the area through which he passes. With flat feet, the position of the bones and joints changes, the ligamentous apparatus is deformed. As a result, children suffer from coordination of movements, stability. The jogging function is the message of acceleration to the human body during movements. This is the most difficult function of the foot, since it uses both the spring and the ability to balance. The weakening of this function is most clearly manifested when running, jumping (Figures 40-41).

Figure 40. Orthopedic shoes for summer

Since ancient times, another function of the foot has been known that is not directly related to biomechanics. The foot is an area rich in nerve receptors and is the "energy window" of the body. It is known that the cooling of the feet causes reflex vasoconstriction of the mucous membrane of the upper respiratory tract, which is most pronounced in a non-tempered person. In traditional oriental medicine, it is believed that through the foot you can access any part of the body.

Treatment from mother nature is the safest, cheapest and most effective. Today we should voice such a problem as clubfoot. This is a congenital pathology, so parents, after traumatic orthopedic manipulations that barely improved the condition of their baby, give up. However, there are many alternative techniques that can stop the progression of pathology. These include osteopathic treatment. Clubfoot (intoeing - fingers inside) is a term not known to official medicine (unlike clubfoot).

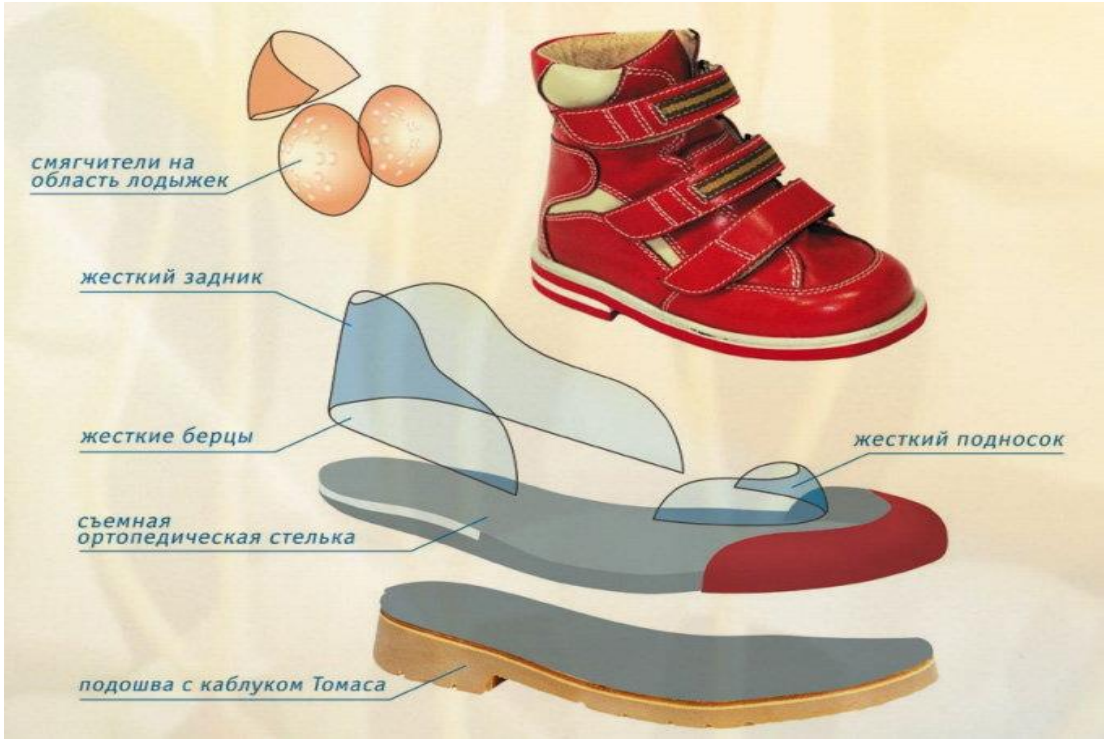


Figure 41. Features of orthopedic shoes for summer

This term was most likely invented by the parents themselves at the suggestion of illiterate doctors. Under the clubfoot, in most cases, parents mean the child walking with the feet turned toes inward. Since there is no official name for this condition in Russian medicine, for brevity we will use the English version of intoing (intoeing). Intoing is a very common occurrence in childhood that usually goes away as we get older. There are three causes of intoing that the podiatrist can determine during the examination.(figure 42):

curvature of the foot;

torsion (twisting) of the bones of the lower leg;

torsion of the femur.

Curvature of the foot is caused by the position of the fetus inside the uterus(figure 43). Most positional curvatures of the feet go away on their own, without treatment, during the first months of a child's life. Although in some cases, improvement in the shape of the foot may continue until the age of three. In rare cases, when the curvature of the foot is very pronounced, slowly disappears, the foot is stiff, it is necessary to apply corrective plaster bandages. Special boots do not lead to improvement in this situation.

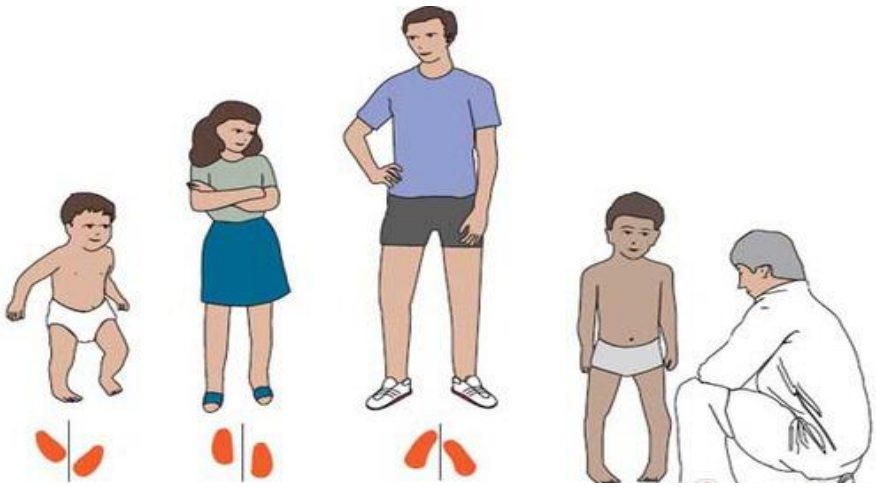


Figure 42. The influence of the age of the child on the characteristics of his pathological abnormalities

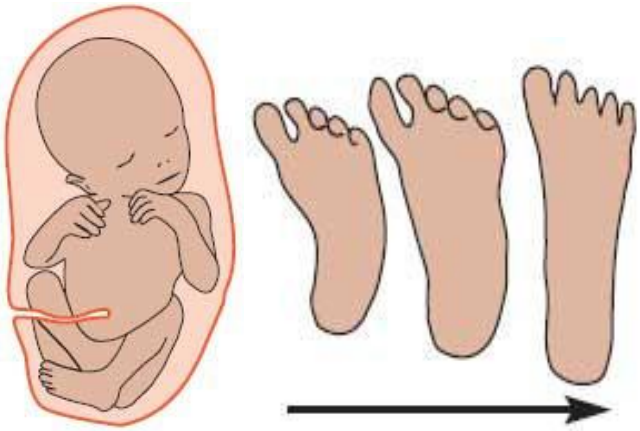


Figure 43. Causes of the formation of clubfoot in the fetus in the womb

Torsion of the lower leg is the twisting of the bones of the lower leg, in this case medially, along its axis. This is a normal variant and is very common in newborns and young children. Orthoses, special exercises, brace or orthopedic shoes are not able to correct the twisting of the bones and, in fact, can be harmful. In most children, the bones "straighten" on their own, without any treatment, in the first years of life. Hip torsion is the twisting of the femur, causing internal rotation (rotation) of the leg and intoing. Hip torsion is usually the cause of walking with the feet turned inward in children aged 5 to 6 years. For most children, the situation returns to normal by the age of 10. Shoe inserts, special orthopedic boots or braces are not able to reduce hip twist and correct gait.

Curvature of the legs (O-shaped and X-shaped legs).

During normal growth, a child's legs can take on a variety of shapes. With the onset of walking, O-shaped legs are very often formed, which straighten on their own by two years. In some children, by the age of 1.5 - 2 years, X-shaped legs are formed (knocking knees, knocked knees, in English literature). The vast majority of X- and O-shaped legs straighten on their own by the age of 5-6 years. Shoe inserts, special orthopedic shoes and exercises do not affect the process of leg growth in any way, but they can cause discomfort to the child and make him feel sick. Only a competent orthopedist can decide whether there are any violations in the growth of the child's legs or not. The doctor may suspect a pathology if the deformity of the legs is severe, expressed mainly on one side or the curvature of the legs can be seen in other family members, especially if most of the close relatives are small in stature. Barefoot people have the best feet! Your child needs soft, flexible shoes that allow maximum freedom for normal foot development. It is better to choose shoes a little looser. Rigid, "orthopedic" shoes are not suitable for the feet, because they restrict the movements that are necessary for developing strength and flexibility of the foot. A child's feet need protection from cold and sharp objects, as well as freedom of movement. Falling children can cause injury. A flat sole that doesn't stick to the floor and doesn't slip the best. which gives maximum freedom for the normal development of the foot.

What lies behind the diagnosis of clubfoot?

Clubfoot is a congenital anomaly of the anatomical structure of the joints of the foot. The defect affects and affects the functioning of the bones and muscles of the lower leg, ligaments and tendons. Incorrect anatomy of the body structure is formed in the early stages of pregnancy. Doctors have not yet fully established the causes of this violation. This completely deprives medicine of the ability to prevent the formation of clubfoot, and reduces the effectiveness of treatment of the legs after the birth of a baby with this pathology. Outwardly, the clubfoot looks like an unusual inversion of the foot inward and slightly down. With such a structure, it is very difficult for a little man to learn to walk. It is impossible to fully step on the foot in this position (Figure 44). Types of clubfoot. Congenital clubfoot can be of varying severity, have its own signs, so in medicine there is the following division of pathology into types:

typical (still characterized as primary) clubfoot of a mild form;

typical clubfoot affecting soft tissues;

typical bone-shaped clubfoot;

atypical (referred to as secondary) neurogenic clubfoot;

atypical clubfoot of the amniotic form;

atypical clubfoot caused by congenital deformity of the joints;

secondary clubfoot caused by underdevelopment of the tibia.

Since clubfoot is a congenital disease, its occurrence is influenced by adverse factors that affect the fetus in the womb. The reasons for the formation of clubfoot are as follows:

incorrect position of the fetus, as a result of which the walls of the uterus put pressure on the foot, and an abnormal anatomical structure of the foot develops;

the fetus has an incorrect laying and development of muscles, ligaments, joints, which leads to foot deformity;

toxic effects on the child's body of certain medicinal components that the expectant mother could take in the early stages of pregnancy;

insufficient intake of the mother's body and, as a result, a lack of vitamins and important trace elements for the fetus (Figure 44).

Treatment of clubfoot by methods of classical medicine.

The most common method of eliminating congenital clubfoot is gypsum. Plaster boots are put on the baby's legs, fixing the previously deployed foot in the correct position. Mild clubfoot is corrected with soft bandages. In general, the method is similar to plastering (Figures 45 - 46).

Removable devices - orthoses - are used for the treatment of clubfoot. It can be special fixators for the foot, and simple insoles for shoes. Also, children are prescribed additional massage and therapeutic exercises. It is important for parents to remember that there comes a time when clubfoot is no longer amenable to correction, and it will no longer be possible to help the child. Therefore, treatment should begin from the first days after birth (Figure 47).

Figure 44. Features of clubfoot in children

Figure 45. The effectiveness of the "Family" program to reduce pathologies of the fetus of a child in the womb

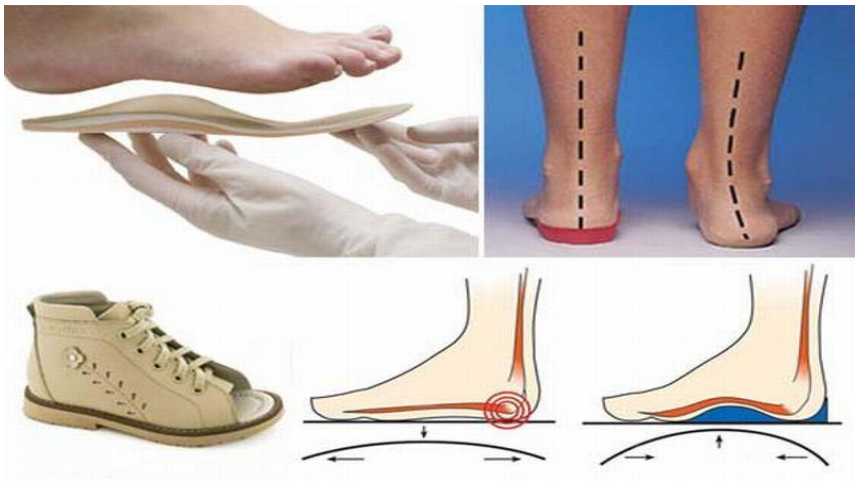


Figure 46. Preparation for the treatment of clubfoot

Figure 47. Features of fitting an orthopedic insole for clubfoot feet

Figure 48. Types of massage to correct clubfoot

Osteopathic practices in the fight against clubfoot.

The osteopathic doctor eliminates the clubfoot defect by giving the bones and joints an anatomically

correct direction. In this case, the ligamentous apparatus comes into the desired position. Manipulations with the child's leg are carried out carefully and delicately. During the first week after therapy, the mobile joints will return to the anatomically correct course. After this time, the result will become obvious. Treatment with an osteopath can be started at any age, but the correction of a defect in the first days of life is the key to the proper development of your child. The sooner treatment is started, the higher the chance that the child will get rid of clubfoot, be able to actively play and run, and maybe even make a career as an athlete.

Clubfoot or clubfoot is a deformity of the arch of the foot, as a result of which it changes its location and thereby causes a lot of inconvenience to a person, both in terms of pain when walking, and in aesthetic terms. Most parents are interested in why clubfoot develops in childhood. One child in a thousand is born with a clubfoot. That is, with one or two feet turned inward. If you leave everything as it is, the child will not only get on his feet later than his peers, he will get up completely different from them. With clubfoot, the heel is pulled up, and the toes are turned inward. The child steps on the outside of the foot. And if he goes like this, the foot will deform even more, and behind it - the whole leg. It's uncomfortable, and most importantly, it hurts. The person becomes disabled. Fortunately, clubfoot is treatable. There are many ways(figure 64)baby's supple feet bounce back in just a couple of months. One of the first in Russia to master it was the Yaroslavl orthopedist Maxim Vavilov. Now he heads the Russian Ponseti Association, and in the Yaroslavl region there are virtually no clubfoot children older than six months. Children from all over Russia, Belarus and Kazakhstan go to M. Vavilov and his colleagues at the Constanta clinic for treatment. Including - within the framework of a joint program with Rusfond.

Figure 49. Examination by an orthopedic doctor of a child after plastering

A description of how this happens is given below:

Clinic "Constanta" occupies the entrance of a residential five-story building. Maxim Vavilov, a military-minded man with a short haircut, greets us at the entrance and immediately hurries to the office of his colleagues Ilya Gromov and Ekaterina Solovieva: the operation is in half an hour. Without having time to figure anything out, we are already eating with them in the elevator to the fifth floor, to a small children's section with a playground in the corridor. M. Vavilov looks into one, the other chamber. And confidently enters the third. The girl smiles shyly. Mom explains that Eva had a Ponseti cast as a baby and wore medical shoes - brace until she was three years old. These are such boots with a crossbar - people on the street confuse them with a skateboard, although there are no wheels. As soon as the brace was removed, the left foot began to deform. A more detailed description of the brace is given below.

“We didn’t know that brace should be worn (at least sleep in them) until the age of five or six,” Mom explains. “Our orthopedist suggested a major operation that leads to relapses. We decided to go here, to the specialists. And here Eva is here for two weeks in a cast - we are pulling the ligaments, and today there will be a small operation.

The anesthetist comes to Eva, and the orthopedists and I rush to follow the mobile Vavilov back into the elevator - now to the third floor, to the operating room. Giving us sterile trousers and a robe, M Vavilov explains:

– Clubfoot has always been treated with casts and surgery, but over time the methods have become more humane (Figure 49). Even 15 years ago, we performed another operation on clubfoot. They cut the skin around the ankles, then cut the tendons and muscles, releasing the joint. They fixed it with plaster and waited until all the tissues were healed. All those operated on had ugly scars. Most of them have pain and an inactive foot. A third returned to the operating

table with a relapse. Now, after plastering according to the Ponseti method, 98% of patients live without relapses and without operations. For the rest, relapses usually occur due to errors in wearing braces.

While we were changing clothes, the little Magpie had already fallen asleep on the operating table. There we see not even a sleeping girl, but her leg: the rest is hidden by disposable green diapers. They put a tourniquet on the girl's thigh to stop the blood from flowing. M. Vavilov wipes his leg with a large swab soaked in iodine. The leg turns yellow. The doctor wraps the leg from the toes to the knee with an elastic bandage and holds it vertically for a minute to completely bleed it. Unwound, puts on the table. The yellowish leg now looks like a silicone trainer.

After making the first tiny incision above the heel, the doctor literally cuts the Achilles tendon in seconds to lengthen it. This micro-operation - achillotomy - is not at all spectacular. For many clubfoot, this operation is done under local anesthesia, almost at the reception with parents.

Then the doctor makes two of the same bloodless incisions - longer, along the top of the foot. He takes a needle with a thick blue thread and begins to literally alter the tendons, similar to white braid. Like Dr. Aibolit in the pictures with a bunny. He hooks a tendon braid with a needle in one incision and fastens the thread in it with a couple of stitches, as they teach at school in labor lessons. Then he drags the tape under the skin to another incision and pulls it out. The foot stretches after the braid and immediately rises as it should: at a right angle to the lower leg. The orthopedist sews this tendon in a new place. And then famously pierces the foot with a needle through and ties a purl knot in the center of the sole with a thread. Everything takes no more than 15 minutes. It remains to sew up the incisions with absorbable threads and plaster the leg for a couple of months (Figure 50).

In difficult cases, like in the case of a six-year-old ward of Rusfond, such an operation is indispensable. The girl was born with several leg pathologies at once, including clubfoot. She also has, for example, three toes on each foot. All this was found in the hospital.

- Clubfoot is visible on ultrasound as early as the twentieth week of pregnancy, - says M. Vavilov. – However, in Russia in 90% of cases it turns out to be a surprise after birth. But it is better for parents to know in advance what problem they will face, to find specialists and start treatment in the first month of life, so that the legs immediately develop correctly.

Figure 50. Examination of the child's foot by an orthopedist after surgery

The doctors offered the girl's parents to observe her from half a year. But they took the girl to Moscow, where she was cast according to the Ponseti method. At a year and a half, the big-eyed blonde with black eyebrows was already walking herself, in braces, which she wore around the clock until she was five years old. Then her left foot was deformed, and not in the most usual way - due to a defect in the formation of the ankle joint. In addition, the leg has become shorter than the right. It became difficult for the girl to walk. An orthopedist from the Filatov hospital recommended that M. Vavilov be consulted.

- Ten years ago, says M. Vavilov, he treated clubfoot, and then it turned out that different people come on the basis of clubfoot: with problems of the lower leg, knee, and hip joints. - And now he prefers to treat the lower limb - it's more effective. They can treat the girl in stages. Now - just straighten the clubfoot and send home. After two or three months - remove the knitting needles and let her walk for six months so that she returns to the hospital with a short straight leg. And only then put the Ilizarov apparatus to stretch the bone. But we can do all this in one anesthesia, so that in six to seven months the Girl walks with full support on the corrected leg in order to beat the time. More precisely, try to beat the time. This operation - more precisely, several operations in a row - drags on for hours. Now the orthopedist looks like a bloodthirsty barmaley. He not only has to cut a lot - both skin, and tendons, and muscles - but also chip off

pieces of a too wide fibula. Otherwise, the foot simply does not rise to the lower leg. Doctors exchange short business remarks. But they look wild: one doctor holds a child's leg, and the second, with a chisel and a hammer, hammers a bone and throws large fragments into a jar. And then he inserts a knitting needle into the drill, screwing it into a living leg with a buzzing sound and cutting off the ends with wire cutters. And so four knitting needles in a row - along and across the foot. Yes, he jokes, cheering up tired colleagues. When the nurse hands Vavilov scissors with very thick blades, he bats his long eyelashes, asking her? Do you work for the Inquisition?

- This is from a set of plastic surgeons, - she answers to the general joy (Figure 51).

Figure 51. Traumatologist-orthopedist M. Vavilov is preparing for surgery

But the curved foot, which at first seemed to us completely different from the usual one, with a huge callus on the side, as if with a second heel, looks good after an hour. Except for the tips of the spokes sticking out of it and the slowly flowing blood. And the doctors still have to sew everything up. And then put the Ilizarov apparatus, which is also fastened with knitting needles in the bone tissue.

– Are you waiting for breakthroughs in orthopedics? I often ask M Vavilov. - Anything more humane than the spokes and the Ilizarov apparatus?

“No, no,” he replies. - In the spring, he went to Tel Aviv for a conference: he didn’t see anything new, they still do the same in good Russian centers. The main breakthrough now can only be in reducing the cost of expensive metal structures. This will change many lives (Figure 52).

In Russia, there are already many orthopedic doctors practicing modern methods of treatment, but you can hardly find them in regional clinics.

- In the clinic, a practicing doctor complains that he has neither a nurse nor a plaster room. “And even if there was, she still wouldn’t use the Ponseti method: too little time and money are allocated for plastering. Today they can only observe children with clubfoot, since out of 13 thousand they have only two of them.

So the parents of clubfoot have to spend once or twice a year on brace, which cost from 10 thousand rubles, and after five years - on a special stand, on which you need to stand every day for half an hour. And also a doctor. After all, even in a good situation, you need specialist control over a child up to ten years old.

Figure 52. Fragment of the operation in the clinic of M. Vavilov

The course of treatment of clubfoot according to the Ponseti method.

Treatment includes three stages. The first stage is the correction of the deformity with plaster bandages. Treatment according to the Ponseti method consists in a weekly change of plaster casts, while a phased plaster correction is performed with the removal of the foot from the deformity position to the correction position 10-15 degrees at a time, per week. As a rule, a complete correction of a deformed foot, even in difficult situations, is achieved in 5-6 changes of plaster casts.

During the first cast, the cavus and adduction are corrected. The foot remains in the same plantar flexion. At the second, third and fourth casting, adduction and varus are corrected. The first element of the method is to correct the cavus of the foot by properly aligning the front of the foot with the back.

Figure 53. First cast of a child's foot

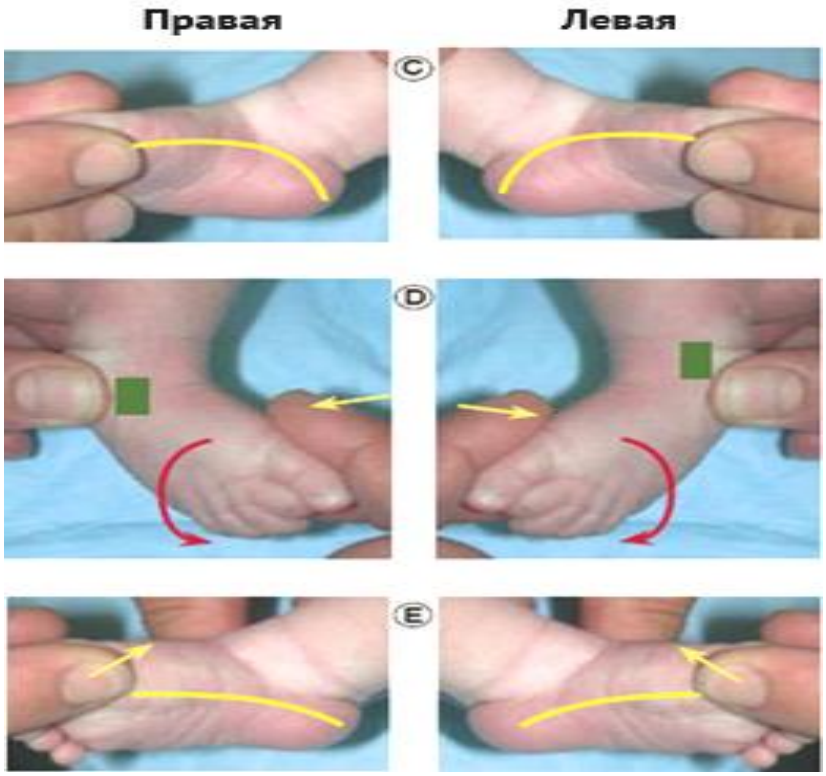


Figure 54. Cavus of the foot

The cavus of the foot (high arch (see Figure 54, C, yellow arch) is formed due to the pronation of the forefoot in relation to the hindfoot. In newborns, the cavus of the foot is always elastic and requires only supination of the forefoot to normalize the longitudinal arch (see Figure 52, D and E).

Further correction will consist of abducting the foot under the fixed head of the talus. Note that the correction of all components of the clubfoot, except for the equinus, is carried out simultaneously. For correction, you first need to correctly determine the location of the head of the talus, it will be the fulcrum during the correction. Palpate the ankles with the thumb and forefinger of the hand - Figure 55, A, and with the other hand - Figure 55, B - fix the metatarsus and toes. Move thumb and forefinger - Figure 52, A - forward to palpate the head of the talus (indicated in red), which is located anterior to the fork of the ankle joint. Since the scaphoid (yellow) is displaced medially, and the tuberosity of this bone is practically in contact with the medial malleolus, you can palpate the convex lateral part of the head of the talus (red), covered only by skin and located in front of the lateral malleolus. And the anterior part of the calcaneus (indicated in blue) will be palpated below the head of the talus. As you move the forefoot outward in supination with your hand - Figure 55B, you will feel the movement of the navicular bone in front of the head of the talus and the movement of the calcaneus outward under the head of the talus (Figure 55).

Next, the talus is stabilized. Place your thumb on the head of the talus (see Figure 55, A, this is indicated by yellow arrows). Stabilization of the talus provides a pivot point around which the foot rotates outward. The index finger of the hand holding the head of the talus should be behind the outer malleolus. This further stabilizes the ankle joint with maximum abduction and avoids the tendency of the posterior calcaneofibular ligament to move the fibula posteriorly.

Further abduction of the supinated foot (see Figure 55, A) with stabilization by thumb pressure on the head of the talus (as indicated by the yellow arrow) continues until it becomes uncomfortable for the child.

With light pressure, hold the correction for about 60 seconds, then release. As the clubfoot is corrected, lateral mobility of the navicular and anterior calcaneus increases (see Figure 55, B). After the 4th or 5th cast, a complete correction becomes possible. For particularly rigid feet, more casts are needed.

During the second, third and fourth casts, the varus and adduction of the foot are completely corrected. The distance between the tuberosity of the navicular bone and the medial malleolus, determined by palpation, tells us about the degree of correction. When the clubfoot is corrected, this distance is about 1.5 to 2 cm, with the navicular covering the anterior surface of the head of the talus. Improvements are observed with each plastering.

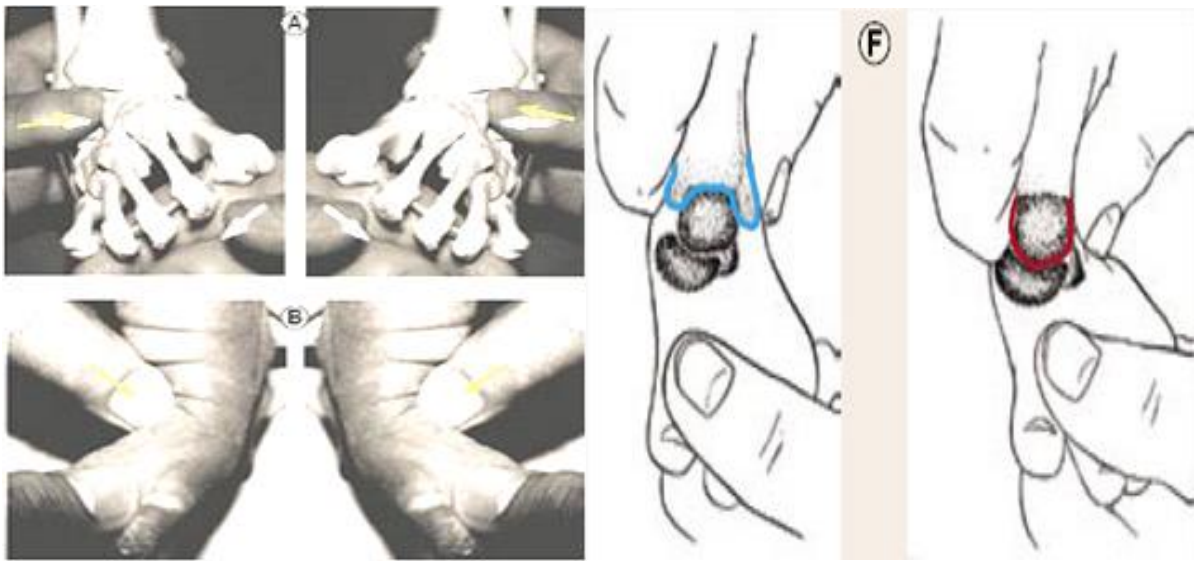


Figure 55. Polpation of the ankles

The equinus, or plantar flexion, is gradually corrected with the correction of varus and adduction. This partial correction is due to dorsiflexion of the calcaneus as it is retracted under the talus. Until heel varus is corrected, no direct effort should be made to correct plantar flexion.

Complete correction of the cavus, adduction of the foot and heel varus, partial correction of the equinus is not enough, a tenotomy of the Achilles tendon is necessary. With very flexible feet, the equinus can be corrected with an additional cast without Achilles. However, if in doubt, surgery is indicated.

The second stage is achillotomy, a very important part of the treatment (Figure 56). In clubfoot, the Achilles tendon is always shortened, so most children need to lengthen it. The Ponseti method involves the use of the most gentle method of lengthening it - a closed achillotomy. In most cases, subcutaneous transection of the Achilles tendon is performed to complete the correction of the equinus - plantar flexion of the foot. After the operation, the last plaster is applied for a period of 3-4 weeks. This period is sufficient for the Achilles tendon to heal to the length required for correction.

On average, the total period of treatment in plaster is 1.5 - 2 months.

Figure 56. Fragment of the use of a sparing method of lengthening - closed achillotomy

The third stage: fixing the result. For this, specially designed tires are used (brace) to avoid deformation return. To avoid relapse, you need to wear braces strictly according to the regimen prescribed by the orthopedic doctor. A cured child should undergo regular examinations until the age of 2 to 5 years.

The effectiveness of the treatment of severe clubfoot according to the Ponseti method in children reaches 95%. But relapses occur after treatment by

this method. The most common reason relapse is non-compliance with the mode of being in brace and poor quality of fixation in brace after achillotomy. According to University of Iowa orthopedists, relapse occurs in only 6% of families who carefully follow the doctor's instructions, and in more than 80% of families who are inattentive to the doctor's recommendations. Among the causes of recurrence, there may be an imbalance in the muscles of the lower leg, in particular the features of the attachment of the tendon of the anterior tibial muscle. Therefore, in order to avoid relapse, parents should follow the recommendations of the attending physician. After having completed a course of correction with manipulations and plaster casts, the attending physician begins to work with brace, adjusting the angular characteristics:

the distance from the inner edge of the heel of one shoe to the inner edge of the heel of the other shoe is equal to the distance from one shoulder to the other;

for permanent use, the brace is usually adjusted in this way: for a clubfoot foot, the abduction is 70 degrees, for a healthy one - 40 degrees;

with bilateral clubfoot, the abduction is 70 degrees on both sides;

for a clubfoot foot, dorsiflexion (flexion of the foot at the ankle joint) is usually 5 to 10 degrees. As a rule, this position corresponds to the position of the foot in the last cast. Ankle flexion is not necessary for a healthy foot.

Schemes for the use of shoes for clubfoot for children under 6 months and after have differences. Let's consider them in more detail in tables 3.23 - 3.24.

At first, the child wears brace 23 hours a day, this period lasts 3-4 months. Further, under the supervision of a doctor, the wearing time is gradually reduced to 18 hours, depending on the condition of the feet. At the same time, brace should be used for all types of sleep - this protects the child's psyche. A habit is instilled, and the child understands that you need to wear braces every day, without being indignant about the fact that “today I slept without braces, and tomorrow they need to be put on again.” After reaching the age of 2, a child visiting the garden, in order not to differ from his peers, can walk in the garden without clamps. However, braces are mandatory at home.

Babies don't feel well during the first time they wear braces, they don't sleep well and cry more than usual. The limited freedom of movement, the fragility of the skin after plastering negatively affect their well-being. All this should not be a cause for your concern. At first, children can take analgesics, sedatives. The child will get used to the new shoes after two days. It is very important that parents do not give up and wait until the child gets used to it. If there is severe redness, you need to consult your doctor. In addition, a doctor should be consulted if the child sleeps restlessly in brace for more than 3 nights.

Corrective products for correcting clubfoot of children's feet

Braces are a bar-fixator for abducting the foot with shoes, special shoes for clubfoot. They can only be used after the clubfoot has been completely corrected by manipulation and plaster casts (Figures 73-800).

Conclusion

Based on research to determine consumer preferences, it has been established that currently sold children's shoes with preventive properties have some drawbacks regarding both materials and structural and external features.

Consumers experience a clear lack of children's preventive footwear of domestic production. Based on the analysis of the design features of preventive footwear, the main design features of footwear are established. To solve the issue of tight fixation of the child's foot and ensure the necessary rigidity of the heel part of the shoe upper, designs have been developed that fix the ankle joint with laces, straps or Velcro. To fix the ankle, a design of the heel part of the shoe is proposed, in which a certain rigidity is created due to technological parameters, namely, an additional unit is used in the heel part, consisting of an outer part, an intermediate part and a lining.

It is shown that anthropometric studies of the feet and the development of scientifically based requirements for the design of footwear for children and adolescents is an urgent problem for the shoe industry. It has been determined that the main factor in the formation of requirements for children's shoes should be the preservation of health, since this age is vulnerable to the action of the external environment. The place of shoes in the complex of health factors is determined. It has been established that footwear has an impact on all categories of health: somatic, personal and social. Thus, the use of orthopedic equipment in standard mass-produced shoes, in the form of insoles and other inserts, can serve as an effective means of improving its preventive properties, including for the flat-valgus foot.

It has been established that anthropometric studies of the feet and the development of scientifically based requirements for the design of shoes for children and adolescents is an urgent problem for the shoe industry. It has been determined that the main factor in the formation of requirements for children's shoes should be the preservation of health, since this age is the most vulnerable. The place of shoes in the complex of health factors is determined. It has been proven that footwear has an impact on all categories of health: somatic, personal and social.

The use of orthopedic equipment in the form of insoles and other inserts in standard mass-produced footwear can serve as an effective means of improving its preventive properties, including preventing flat feet

in children. To do this, specialists in the design and manufacture of mass-produced shoes should receive timely current information about new designs of these orthopedic devices, as well as indications for their use.

On the basis of the research conducted to determine consumer preferences, it has been established that currently sold children's shoes with preventive properties have some drawbacks regarding both materials and structural and external features.

Parents of children with pathological abnormalities, including those with flat feet, experience a clear lack of domestically produced children's preventive footwear. Based on the analysis of the features of preventive footwear, its main design features are established. Shoes with preventive properties make up a certain segment of the consumer market for children's and teenage shoes. It is distinguished by the presence of constructive solutions that provide maximum comfort in wearing, the presence of special details (inset anatomical insoles, half-insoles, linings and other corrective details), a rational scientifically based internal shape of the shoe and the use of high-tech materials in the manufacture of shoes, their strict selection according to physical and mechanical and hygienic indicators.

To solve the issue of tight fixation of the child's foot and ensure the necessary rigidity of the heel part of the upper of the shoe, the design of backs is proposed, fixing the ankle joint additionally with the help of laces, straps or Velcro.

To fix the ankle joint, a design of the heel part of the shoe is proposed, in which a certain rigidity is created due to technological parameters, namely, an additional unit is used in the heel part, consisting of an external part, an intermediate part and a lining.

The developed designs of the top of the shoe, together with an anatomical instep support, provide the most effective support for the arch of the foot and correction of the angle of its inclination. Thus, it is important to have a permanent alliance between the podiatrist and the manufacturers of corrective parts in order to guarantee the comfort of the child's foot and high confidence to the parents about the prevention of the development of pathological abnormalities in their child.

Thus, the database combines and structures the information necessary for the fashion designer, reduces the time spent on design and guarantees consumers the manufacture of popular orthopedic shoes, taking into account pathological deviations of children's feet. Based on the conducted research to determine consumer preferences, it has been established that - currently sold children's shoes with preventive properties have some drawbacks regarding both materials and structural and external features;

- to solve the issue of tight fixation of the child's foot and ensure the necessary rigidity of the heel part of the upper of the shoe, the design of the backs is proposed, fixing the ankle joint additionally with the help of laces, straps or Velcro;

– to fix the ankle joint, a design of the heel part of the shoe is proposed, in which a certain rigidity is created due to technological parameters, namely, an additional unit is used in the heel part, consisting of an external part, an intermediate part and a lining;

- the developed design of the upper of the shoe, together with an anatomical instep support, provides the most effective support for the arch of the foot and correction of the angle of its inclination. Thus, it is important to have a permanent alliance between the orthopedist and the manufacturers of corrective parts in order to guarantee the comfort of the child's foot and high confidence to him and his parents about the prevention of the development of pathological abnormalities in their child;

– the concepts of “mass and ultra-customized” shoes are formulated. The definition of “mass-customized orthopedic shoes” means shoes, the design of which is developed on the basis of the average typical features of a group of patients homogeneous by diagnosis. Customization is carried out by adjusting insert corrective elements, design features of models that regulate the volume of the shoe space and frame parts that provide a rehabilitation effect. Ultra-customized shoes are models designed taking into account the individual anatomical features of the foot of a particular patient based on typical designs of mass-customized shoes;

– an analysis of the anthropometric characteristics of the feet of children with cerebral palsy was carried out to clarify the parameters of the lasts of mass-customized shoes. It was revealed that in the regions of the Southern Federal District and the North Caucasus Federal District, shoe lasts for children's orthopedic shoes do not correspond to the average parameters of the feet of children with cerebral palsy. The parameters of lasts for the production of mass-customized shoes for children with cerebral palsy are proposed;

– the degree of consumer satisfaction with the designs of orthopedic shoes made on blocks with corrected parameters was revealed;

– the concept of creating lasts with adjustable volumes for the designs of ultra-customized shoes was proposed;

– an analysis of the assortment of children's orthopedic shoes was carried out, from which 4 basic designs of mass-customized orthopedic shoes with a high rehabilitation effect for patients with cerebral palsy were identified, namely:

boots with adjustable berets;

summer shoes with a high tibia part with an open toe;

summer shoes with a high tibia and a vamp with an elongated tongue;

summer shoes with a high tibia and a closed toe:

- a classification of orthopedic shoes is proposed, based on the rehabilitation effect, which is based on the results of studies on the rigidity of the structure, methods of fixing shoes on the foot, corrective elements of the removable orthopedic insole;

– a method for designing ultra-customized orthopedic shoes using the AutoCAD program was proposed for the following cases:

with different girths of the feet;

with different heights of berets in a pair;

with different track lengths in a pair;

in case of shortening of the lower extremities, a database of designs of mass-customized orthopedic shoes for children with cerebral palsy is proposed, which includes typical designs recommended for this disease in order to make comfortable orthopedic shoes.

The questions considered by the authors are:

the possibility of preventive measures and corrective products to restore impaired functions of children's vital functions;

resuscitation of sharply disturbed functions of the vital activity of the organism of children;

rehabilitation deformity of the feet of children with cerebral palsy;

correction of the deformity of the arch of the foot of children with clubfoot corrective products for restoring impaired functions of the child's body, - practically contain answers to the entire bouquet of questions that parents have, which allows you to make a reasonable choice of corrective products to restore children's impaired vital functions of their body.

Remember that manufacturers use their own sizing charts. Therefore, marking with the same Latin letters does not guarantee that you have two models in front of you that are identical in size. Always carefully read the specifications and see the dimensional grid.

The development of measures was carried out taking into account the strategic goals, legislative acts that determine the policy of the state in the development of light industry in the medium and long term:

Increasing the competitive advantages of the light industry in the production of children's shoes, demand and consumer preferences, technical regulation:

ensuring compliance of Russian products with international standards in terms of quality, environmental safety and design;

increase in production volumes of competitive new generation products with qualitatively new output consumer characteristics, functional properties and with a high share of added value that are in demand by the market;

outpacing growth of the beneficial effect compared to the growth of costs for new and previously mastered types of similar and functionally homogeneous products, efficiency in the execution of orders and consumer requirements.

Technical re-equipment and modernization of the production of children's shoes:

modernization of the bulk of the operating technological equipment, allowing to improve its technical, economic and operational characteristics;

creation of new equipment with a high degree of automation, corresponding to the world competitive level and capable of mastering advanced technologies and ensuring a quick change of assortment, development of technical documentation and requirements for its manufacture;

use of leasing for the purchase of imported equipment or direct purchases of new high-performance imported equipment and spare parts for it that are not produced in our country;

development of VIP-projects (anti-crisis programs) for the financial recovery of the industry, providing for technical re-equipment, modernization, reconstruction and creation of high-tech industries, attraction of foreign capital, investments of Russian business and budgetary funds for their implementation.

Development of innovative activities of the light industry for the production of children's shoes:

implementation of structural and technological restructuring, development of proposals for the preservation and development of the intellectual potential of light industry, the creation of a state scientific innovation center for light industry;

development and development of basic industrial technologies (including nanotechnologies and nanomaterials, systemic information technologies of the intersectoral level), modular and flexible technological systems for the production of competitive world-class science-intensive products used in strategically important areas;

organization of mass production of an innovative product at the enterprises of the industry, including modifications of the product and the technological process, structural changes in the range of manufactured products, training and retraining of personnel for servicing equipment operating on new technologies;

development of international cooperation with foreign countries on the basis of bilateral and multilateral agreements and programs for the development, acquisition and sale of technologies, licenses, holding joint scientific and technical symposiums, conferences, exhibitions.

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DECISION OF PRESIDIUM OF INTERNATIONAL ACADEMY

According to the results of research work of the past 2022 and published scientific articles in the journal «Theoretical & Applied Science», Presidium of International Academy of Theoretical & Applied Sciences has decided to award the following scientists - rank Corresponding member and Academician of International Academy, as well as give diplomas and certificates of member of International Academy.

Presidium of International Academy
congratulating applicants with award of a rank of

Corresponding member of International Academy TAS (USA)

Scopus ASCC: 2000. Economics, Econometrics and Finance.			
1	**Barybina Polina Dmitrievna**	Institute of Service and Entrepreneurship (branch) DSTU Shakhty, Russia	
2	**Tikhonov Artyom Alexandrovich**	Institute of Service and Entrepreneurship (branch) DSTU	
3	**Rumyanskaya Natalya Sergeevna**	Institute of Service and Entrepreneurship (branch) DSTU	Ph.D., Associate Professor

4	**Golubeva Olesya Anatolyevna**	Don State Technical University (Rostov-on-Don)	Candidate of Technical Sciences, associate professor
Scopus ASCC: 3300. Social Sciences.			
6	**Davlyatova Gulchekhra Nasirovna**	Ferghana State University Ferghana city, Uzbekistan	Associate Professor, Candidate of Pedagogical Sciences, Department of Russian philology
Scopus ASCC: 2200. Engineering.			
7	**Deryaev Annaguly Rejepovich**	Scientific Research Institute of Natural Gas of the State Concern „Turkmengas", Ashgabat, Turkmenistan	Candidate of Technical Sciences, Senior Researcher
Scopus ASCC: 1200. Arts and Humanities.			
8	**Khatamov Ildar Urakovich**	Karshi Engineering-Economic institute, Karshi, Uzbekistan	Russian Language teacher Department of Uzbek Language and Literature
Scopus ASCC: 1700. Computer Science.			
9	**Kozhevnikov Vadim Andreevich**	Peter the Great St.Petersburg Polytechnic University	Senior Lecturer

Presidium of International Academy
congratulating applicants with award of a rank of

Academician of International Academy TAS (USA)

Scopus ASCC: 2000. Economics, Econometrics and Finance.			
1	**Prokhorov Vladimir Timofeevich**	Institute of Service and Entrepreneurship (branch) DSTU Shakhty, Russia	Doctor of Technical Sciences, Professor
2	**Volkova Galina Yurievna**	LLC TsPOSN «Ortomoda» Moscow, Russia	Doctor of Economics, Professor
Scopus ASCC: 1500. Chemical Engineering.			
3	**Chemezov Denis Alexandrovich**	Vladimir Industrial College Russian Federation	M.Sc.Eng., Lecturer

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GIF (Australia)	0.356	0.453	0.564							
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РИНЦ (Russia)		0.179	0.224	0.207	0.156	0.126		3.939	0.671	
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