



ISSN: 2350-0328

**International Journal of Advanced Research in Science,  
Engineering and Technology**

Vol. 6, Issue 6, June 2019

# **Apparel design features for children with locomotor system impairments**

**S. A. Bashirova, F. U. Nigmatova, R. T. Kaldybayev**

PhD student of “Technology and design of light industry products” chair, M. Auezov South Kazakhstan State University

Doctor of Technical Sciences, Professor of “Design and technology of garment” chair, Tashkent Institute of Textile and Light Industry

Candidate of Technical Sciences, Associate professor of “Technology and design of light industry products” chair, M. Auezov South Kazakhstan State University

**ABSTRACT:** This article considers the relevance of apparel design for children with locomotor system impairments, and also shows basic design drawings for children’s apparel for a figure with locomotor system impairments taking into account their features. In order to create ergonomic apparel for disabled children, the apparel design should be based on information about defects in support organs and movement deviations, since these factors, the cardinal syndrome at ICP, influence on the degree of difference from conventional-standard figures and a child’s lifestyle. Deformations of bodies of children with various ICP forms cause stress in various apparel places. In order to correctly predict the apparel properties, it is necessary to study forms of a disease, children’s figures deformation degree, characteristic body positions and movements, as well as associated apparel design features.

**KEY WORDS:** children, design, locomotor system impairments, body posture, defect, dimension feature.

## **I. INTRODUCTION**

One of the most common diseases in the world that lead to disability in childhood due to the locomotor system impairments is infantile cerebral paralysis (ICP). According to experts of the World Health Organization (WHO), an average of 10% of the world’s population are disabled, of whom 150 million are children. In recent years, there has been a clear growth trend of children disability in the Republic of Kazakhstan, and more attention needs to be paid to the etiology and diagnosis of disabling diseases, to the problems of disabled children. According to the National Genetic Register of the Republic of Kazakhstan, between 2000 and 3500 babies are born annually in Kazakhstan with congenital and hereditary pathologies, which is 20.0-24.3 per 1000 newborns. Approximately one fifth of the total children disability is formed by nervous system diseases, in the structure of which more than 50% is attributed to the infantile cerebral paralysis (ICP), one of the most pressing problems of pediatric neurology [1]. According to statistics, in Kazakhstan over the past 10 years, the ICP prevalence increased 1.6 times from 44.6 in 2007 to 73.6 in 2018 per 100 thousand people, where more than 44 thousand disabled children are registered, of which over 10 thousand children with the infantile cerebral paralysis [1]. Data on the ICP frequency fluctuate in a wide range, an average of 2.0-5.9 per 1000 newborns and is largely determined by the society development level.

The consequence of locomotor system impairments is a complex asymmetry of children figures, upper and lower extremities affection, dysmotility, disordered motor functions. Many of them find it difficult to carry out actions that are elementary for healthy children: put on and take off apparel on their own, get rid of apparel for physiological needs. In order not to resort to the help of outsiders, they are forced to be constantly at home, as a result of which their state of psychological depression is aggravated, and negative attitude towards a passive, isolated lifestyle becomes stronger.

Solving the problems of social adaptation of children with locomotor system impairments is strictly connected with providing them with ergonomic, functional and aesthetic apparel [3]. In this regard, development of a new approach to the apparel design for rehabilitation of children with locomotor system impairments is relevant.



ISSN: 2350-0328

# International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 6, June 2019

## II. LITERATURE SURVEY

Research in the field of apparel design for children with ICP are carried out by scientists all over the world: Sherry J. Haar, Knox V., Veena.K., Hay Carl (USA), Lopandina S.K., Kharlova O., Korobtseva N.A. (Russia), RoubinowitsPatrice (France), SaylliWaetz (Great Britain), TomarinoKayoko (Japan), Gafurov B.G., MadzhidovaYe.N. (Uzbekistan). They have created methods of treatment and medical rehabilitation of patients, methodology of adaptive apparel design.

However, the apparel design taking into account physiological thermoregulation process features of a disabled child, existing variety of types of children's locomotor system impairments, creation of therapeutic and prophylactic product for rehabilitation of disabled children, etc., has not been fully investigated yet. Development of therapeutic and prophylactic products that correct the regimes of increased and decreased load on a spine, allowing to restore balance skills, to correct posture and ambulation, to provide a massage effect on a child's body requires further research. The area of their use is determined by the disease diagnosis, zone or area of a human body. However, to date, the infantile cerebral paralysis prevalence and causes remain insufficiently studied.

Rehabilitation of children with motor disturbances is not only a medical problem, but also, in many respects, of the society's as a whole [3].

The main goal of the society is to help children with locomotor system impairments to become its full-fledged members and create opportunities for improving the physical form and well-being of such children. At present, children with locomotor system impairments dress in ordinary apparel, which does not level the figure defects and also complicates the children's movements, which negatively affects their health [2, 5, 6].

The industry does not produce specialized apparel due to the lack of regulatory, technical and design documentation. To develop such documentation, it is necessary to outline ways to improve the process of designing the children's apparel taking into account morphological features that characterize figures of children with locomotor system impairments and determine structure of initial inform

ation base. Studying the effect of physiotherapy exercises and reflex-load elements in the apparel on the restoration of motor functions will create the prerequisites for creating functional, ergonomic apparel with the rehabilitation effect [3, 7, 8].

## III. SIGNIFICANCE OF THE SYSTEM

The main goal of this article is to study the apparel design features for children with locomotor system impairments.

The problem of designing children's apparel for figures with posture impairments is in the need to take into account differences in sizes and forms of the right and left sides of a body. To solve it, it is necessary to develop methods for obtaining sufficient information on redistribution of muscle and bone masses and taking them into account in the design.

## IV. METHODOLOGY

Children with locomotor system impairments have significant differences from conventional-standard figures on the posture, which is determined by two indicators: values of dimension features "Body position" and "Shoulder height". The "Body position" is projection of neck point on the vertical plane passing through shoulder bones, "Shoulder height" is vertical distance from the level "Base of a neck to the side" to shoulder point [9, 10, 11].

At the same time, figure defects can be different:

- *a right hand defect* – the defect in which the right shoulder is higher or lower than the left (the "Shoulder height" dimension feature is greater or less than that of the conventional-standard figure), at that the value of the "Shoulder height" dimension feature of the left shoulder corresponds to the value of the conventional-standard figure;
- *a left hand defect* – the defect in which the left shoulder is higher or lower than the right (the "Shoulder height" dimension feature is greater or less than that of the conventional-standard figure), at that the value of the "Shoulder height" dimension feature of the right shoulder corresponds to the value of the conventional-standard figure;
- *combined defect* – the defect in which the values of the "Shoulder point height" dimension feature of the right and left sides of a body differ from each other, and the "Shoulder height" dimension feature is greater or less than that of the conventional-standard figure;



ISSN: 2350-0328

# International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 6, June 2019

- *mixed defect* – the defect in which in addition to the defects listed above, there is impairment by the “Body position” dimension feature [12, 13, 14].

When designing the apparel for children with locomotor system impairments, the following features should be considered: children’s body asymmetry relative to the mid-sagittal plane, different volume and length of the right and left sides’ constructive lines. A posture should be taken into account when building the product structure is mandatory, otherwise the product’s proportion (different lengths of shoulder cuts, shoulder gores anteroposterior balance of the product, etc.) and balance (non-vertical line in the center of the fore part and back, neckline displacement, shoulder and side cuts, and also armholes to the right or left side) can be disrupted. To this end, measurement of figures of children with posture impairments should be carried out on both sides of the body [15,16].

It has been established [4] that the difference between the height of the right and left shoulders in the posture impairment ranges from 2.2 to 7.1 cm. The value of the “Body position” feature varies from 4.0 to 11.5 cm. Hence, due to the significant deviations in the sizes of dimension features, the apparel design method for conventional-standard figures of children is unsuitable for the apparel design for children with locomotor system impairments.

In order to create ergonomic apparel for disabled children, the apparel design should be based on information about defects in support organs and movement deviations, since these factors, the cardinal syndrome at ICP, influence on the degree of difference from conventional-standard figures and a child’s lifestyle. Deformations of bodies of children with various ICP forms cause stress in various apparel places. In order to correctly predict the apparel properties, it is necessary to study forms of the disease, children’s figures deformation degree, characteristic body positions and movements, as well as associated apparel design features.

## V. EXPERIMENTAL RESULTS

### Research object and methods.

This work is carried out in collaboration with the medical and treatment institution “Rehabilitation Center No. 6” of the Shymkent Health Department of the Republic of Kazakhstan, which treats children with locomotor system impairments. The analysis of living conditions and factors affecting the general condition of disabled children was carried out on materials of field observations and sociological studies of patients conducted in the neurological department of the center.

The scientific literature review has shown that the psycho-physiological state of children with locomotor system impairments, the needs and requirements for apparel are determined by the degree of disability and physical activity of a child. His diagnosis, according to medical professionals, to some extent characterizes the degree of restriction of his capabilities and physical activity. The diagnosis can be used as a basis for figure classification.

As a result of the research, it has been revealed that the vast majority of children with locomotor system impairments today find it difficult to get comfortable, safe apparel that allow to create an attractive image, and increase their independence in the performance of basic physiological needs. In this case, wardrobe and apparel design should be developed taking into account the fact that:

- children with ICP have very imperfect thermoregulation mechanisms, overcooling and overheating of the body can lead to disturbances in health;
- children with ICP have very sensitive and sore skin;
- being in a wheelchair or moving with the help of a walker, specific features of these children’s bodies shapes determine the utilitarian approach to the apparel. In this case, the product design must have a compromise solution that ensures a satisfactory fit of the product in both sitting and standing positions;
- apparel for disabled children, of course, must be designed taking into account individual characteristics of each figure – on the basis of measurements taken in a sitting and standing position, and increased gains taking into account the dynamic gains of some dimension features. In addition, the constructive solution of shoulder and waist apparel should correspond to the spatial position of the body of a sitting child;
- heavy sweating determines the need of frequent apparel modification and its convenience for removing and dressing, the presence of a certain type of zippers, removable parts, adjustments, allowing easily remove and wear the apparel. This will affect the choice of constructive solution for zippers and other functional elements of products;
- rational organization of the material package structure, the use of natural materials or materials with a small percentage of artificial fibers; the hygroscopicity of the materials used is not less than 6% (pre-school group), not less than 4% (school group) [17,18];
- the apparel and its details design should, if possible, hide, but not emphasize external figure defects. The main specific functions of adaptive apparel are psychological adaptation of the disabled person to the environment,

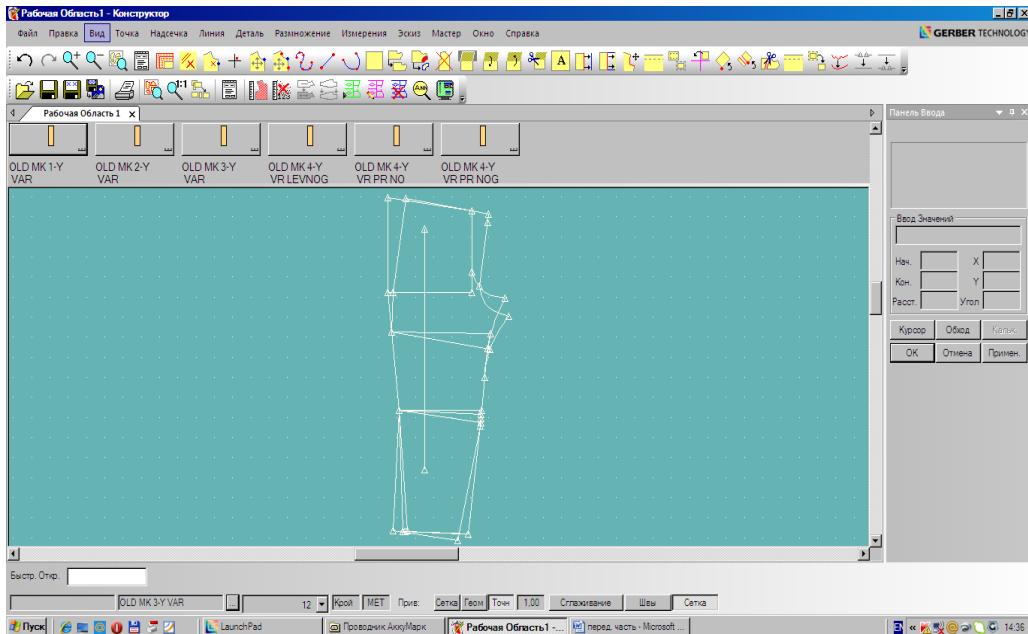
psycho-physiological, sanitary-hygienic and physiotherapeutic effect, static-dynamic conformity of apparel to the living conditions of the disabled person, leveling the physiological characteristics caused by disability.

In order to develop methods for designing apparel with improved ergonomic and operational properties for children with locomotor system impairments, a set of their characteristic movements for various groups of disabled people has been studied. Based on long-term visual observations, photographs and filming of the “day”, the most frequent movements of children, including those that spend most of their time in wheelchairs, have been identified. Ergonomic schemes of characteristic postures and movements in each group have been made, the range of modifications in the movements of legs, arms and body has been determined. Ergonomic schemes have been detailed in the three most characteristic poses of disabled persons: the degree of leg movement in a standing or sitting position (for those who use wheelchairs), as well as when walking; the maximum span of movement and lifting up arms; body bent forward and to the sides in a sitting position.

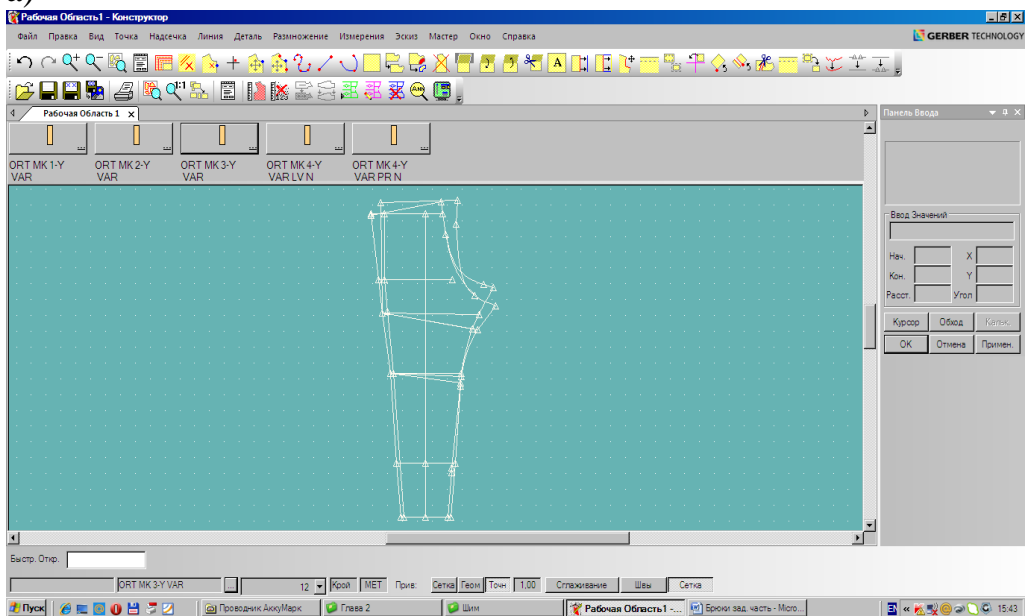


Fig.1. Schemes of characteristic movements and poses of children with ICP (fragment)

The results obtained formed the basis of methodology for adaptive apparel design for children with locomotor system impairments. The methodology is schemes and algorithms for modifying a standard basic design (SBD) into the apparel design for children with locomotor system impairments. Modifying the SBD in the design for the child's figure is made taking into account the difference in the size of the dimension features taken from the photographic image, the values of the standard dimension features on the conventional-standard figure, the introduced additional dimension features, schemes and rules for modifying the apparel designs. A fragment of the scheme of modifying the SBD for the child with ICP is shown in Fig.2.



a)



b)

Fig. 2. The fragment of modifying the SBD of front (a) and rear halves (b) of trousers for children with ICP

The products made on the modified design have been tested in terms of wearing by individual customers and received their positive assessment. Fig. 3 shows a set of transformable apparel for the child with locomotor system impairments.

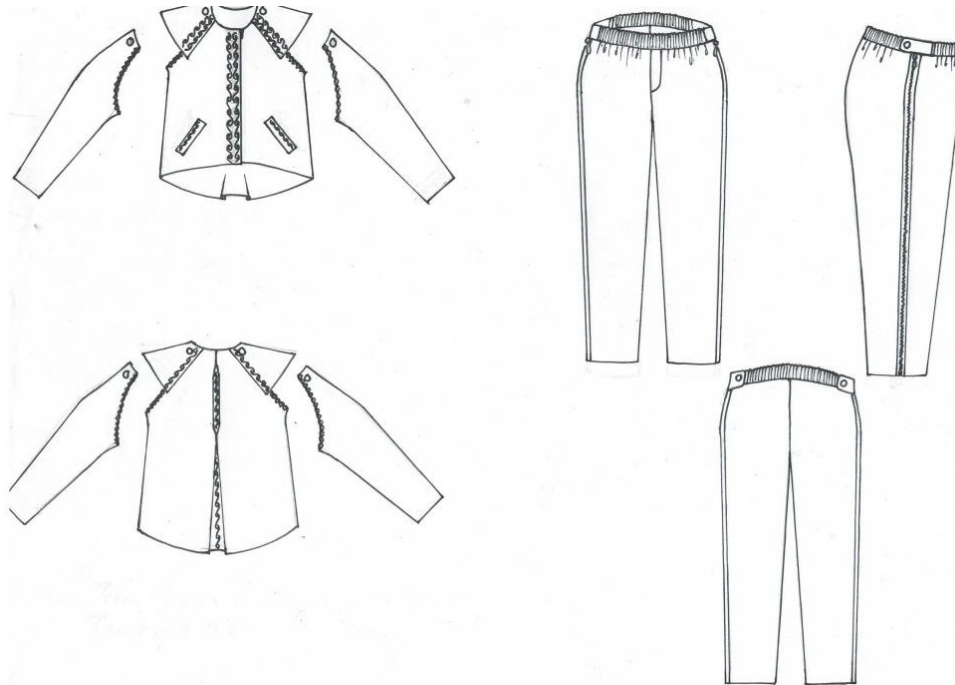


Fig. 3. Design of a set of apparel for the child with rachiopathy (infantile cerebral paralysis)

Checking the quality of fit on the figures of disabled children confirms the correctness of the developed concept of the design methodology, which will ensure the release of commensurate ready-made apparel for children with any manifestations of defects in the locomotor system structure.

## VI. CONCLUSION

The disabled children need apparel that takes into account the morphological, physiological and psychological characteristics of the children with locomotor system impairments. The children with locomotor system impairments have various deformations in the locomotor system, differing in diversity and complexity, therefore, the apparel design for such category children should be based on information about defects in support organs and movement deviations, since these factors, the cardinal syndrome at ICP, influence on the degree of difference from conventional-standard figures.

In order to create ergonomic apparel for disabled children, the apparel design should be based on information about defects in support organs and movement deviations, since these factors, the cardinal syndrome at ICP, influence on the degree of difference from conventional-standard figures and a child's lifestyle. Deformations of bodies of children with various ICP forms cause stress in various apparel places. In order to correctly predict the apparel properties, it is necessary to study forms of the disease, children's figures deformation degree, characteristic body positions and movements, as well as associated apparel design features.

## REFERENCES

1. [Electronic recourse] – Access mode: URL: <https://kaznmu.kz/press/2012/09/28/анализзаболеваемостии-профилактик-2>
2. Kurenova S.V., Savelieva N.Yu. Apparel design, Rostov-on-Don; Publishing house Phoenix, 2003. – 480p.
3. Gross N.A. Physical rehabilitation of children with impaired functions of locomotor system, M., Publishing house Soviet Sport, 2000. – 224p.
4. Lopandina S.K., Melnikova R.A. Research of dependence of changes in the basic parameters of the design of shoulder apparel on the degree of defect in the structure of the children's locomotor system // Apparel industry. – 2007. - № 3. – 45 p.
5. Korobtseva N.A. Features of apparel design for children with ICP in the framework of social rehabilitation // Apparel industry. – 2010. - № 2. – 47 p.
6. Apparel design: training aid / E.K. Amirova, O.V. Sakulina, B.S. Sakulin, A.T. Trukhanovs. – M.: Publishing center Academy, 2012. – 416 p.
7. Koblyakova Ye.B. Apparel design with elements of CAD, M., KDU, 2007. – 464 p.
8. Yanchevskaya Ye.A. Apparel design, M., Academy, 2005. – 384 p.



ISSN: 2350-0328

**International Journal of Advanced Research in Science,  
Engineering and Technology**

**Vol. 6, Issue 6 , June 2019**

9. Beskorovainaya G.P., Kurenova S.V. Design children's apparel. M., Mastery, 2000. – 96 p.
10. Salamatova S.M. Apparel design, M., Publishing house Light and food industry, 1984.–272p.
11. Koblyakova Ye.B., Savostitsky A.V., Ivleva G.S. Basics of apparel design, M., Light industry, 1980.–448p.
12. Dunayevskaya T.N., Koblyakova Ye.B., Ivleva G.S. Dimension population typology with the basics of anatomy and morphology, M., 1980.–216p.
13. Shershneva L.P., Larkina L.V. Apparel design, M., Forum: INFA-M, 2006.–288p.
14. Laboratory practical course on the apparel design with elements of CAD / Koblyakova Ye.B., Martynova A.I., Ivleva G.S.et al.; Under the editorship of Koblyakova Ye.B., M., Legprombytizdat, 2002.–320p.
15. Shershneva L.P. Basics of women's and children's apparel design, M., Legprombytizdat, 1987.–223p.
16. Rogova A.P. Basics of men's and children's outerwear design, M., Legprombytizdat, 1986.–207 p.
17. F.U. Nigmatova, Z.R. Igamberdiyeva, Sh.T. Kasymov, M.Sh. Shomansurova. Problems of adaptive apparel design for people with limited locomotive abilities // Problems of textiles №1. – 2018. – p. 45-50.
18. F.U. Nigmatova, M.Sh. Shomansurova, Z. Abdullakhodzhayeva, A. Dzhurayeva. Formation of initial data for the design of adaptive costume for children with locomotor system impairments. Proceedings of scientific practical conference. Tashkent Institute of Textile and Light Industry. – 16-17.05.2018. – p. 15-17.