

# AN APPROACH TO ADAPT WHEELCHAIRS

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The Rehabilitation Centre of People with Physical Disabilities is a national organization active in the complex rehabilitation of people with physical disabilities, among them people with severe physical and multiple disabilities. The main goal of our EU-funded national program named “Rolling” is to enhance the social and labor market integration of people with physical disabilities through the establishment of a national network of regional workshops for the development of assistive technology and special sports equipment.

One of our main goals is to establish a national service that adapts assistive technology to the individual needs of users. This means the individual setup of the best suitable assistive equipment that requires the least energy from its user.

It is very important that the adaptation and maintenance of assistive and sports equipment be based on a personal examination of the client by rehabilitation experts. The theoretical and practical training of rehabilitation experts as well as the dissemination of ICF (International Classification of Functions and Disability) methodology are natural components of the project.

The paper presents the short description of the project, the risk assessment of the use of wheelchair and finally the methods and tools which can minimize the risk of Pressure ulcers and the RSI.

## **Introduction**

Ageing and also injury-related disabilities may prevent people from performing simple tasks, and pose extreme difficulties for living a normal life. The quality of life can, however, be enhanced or restored by specialized equipments. The problems are often specific to the individual. Therefore, the solutions should be individualized for optimal results. Equipment, for example can be tailored to the specific need of the individual. There should be an optimal process for realizing the needs, generating a solution, assessing the results and making final adjustments that requires the least time and effort from the disabled person.

The EU-funded national program named “Rolling” is associated with the Rehabilitation Centre of People with Physical Disabilities in Hungary. Our goal is the integration of people with physical disabilities through the establishment of a national network of regional workshops for the development of assistive technology and special sports equipment. Rehabilitation experts base the adaptation and the maintenance of assistive equipment on personal examination of the client. We provide the rehabilitation experts theoretical and practical training in the ICF (International Classification of Functions and Disability) methodology and provide them with a workflow for individualized care and methodology for assessment, including the initial and final questionnaires.

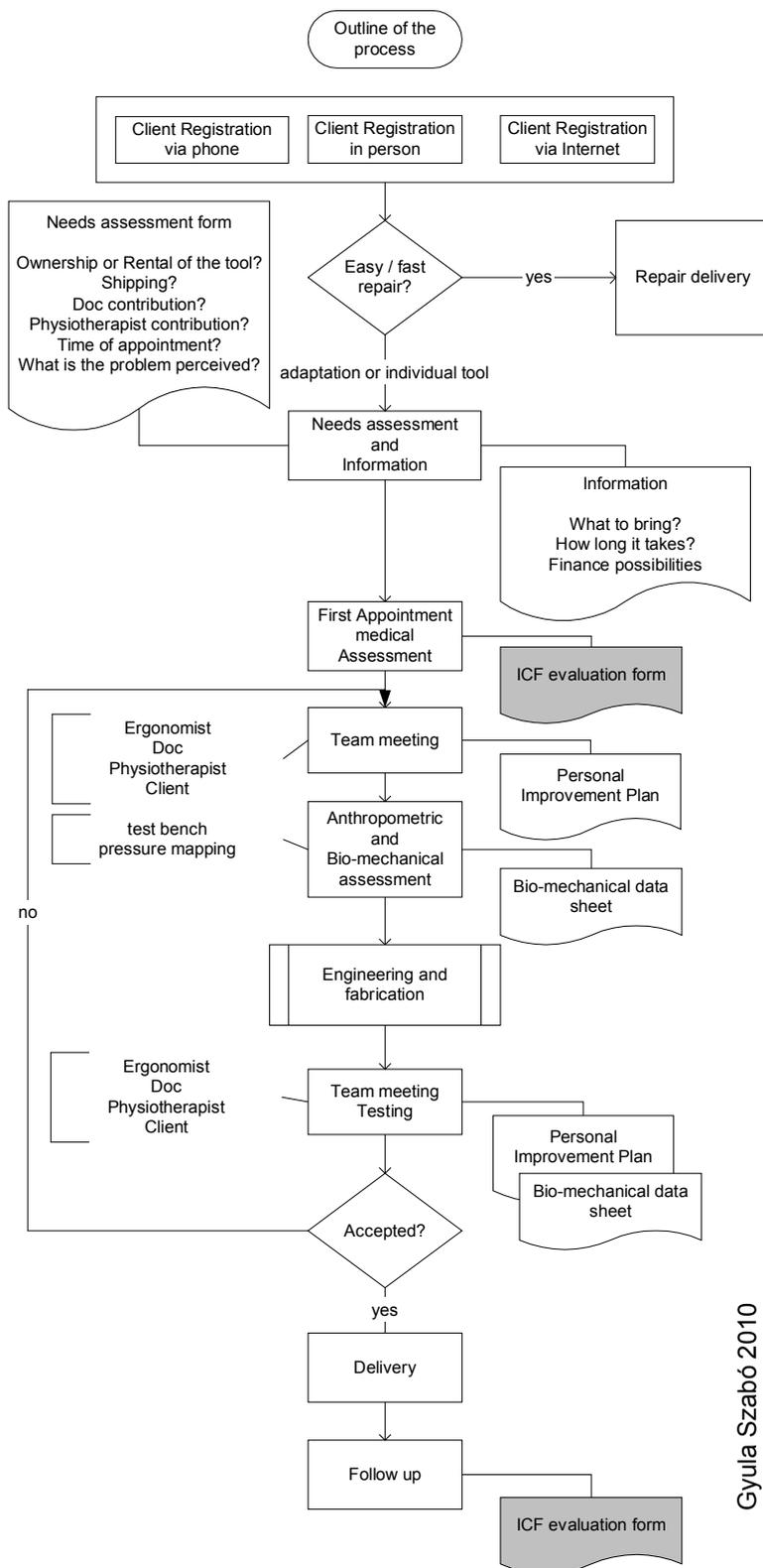
We provide here a proof of principle example to illustrate the activities of the “Rolling” project. We include here the general workflow and a case study for the risk assessment analysis applying ICF, the process of the adaptation of a wheelchair to a client with severe disabilities including the adjustment and the final evaluation of the modified wheelchair. This case prompted us to develop the methods and tools, which can be utilized for wheelchair adjustment in such a way that minimizes the risk of Pressure ulcers and the RSI.

## **Results**

In this case study of the “Rolling” project we applied ICF evaluations in determining the client’s needs and for testing the results of the procedure for improving the client’s mobility. The workflow is presented in Figure 1. The subject of the case study was a quadriplegic person. He had very limited mobility due to previous spinal injury. He depended on the use of an electric wheelchair for his indoor and outdoor activities. His major concern was that he was not able to stand up and reach objects on shelves. Another concern was that constant sitting restricted his circulation and increased his blood pressure. He was concerned that constant sitting will result in developing pressure ulcers and RSI.

The technical experts of the “Rolling” Project performed the initial assessment in 2006 in the form of an interview. ICF codes were utilized to assess the life situation and the needs of the client using the initial questionnaire. Exact measurements were taken from the client and from the existing electric wheelchair. Special pressure-sensing pillow was used to optimize the supporting device. A plan was designed for improving the mobility of the client. The technical details were planned taking into consideration the possibilities provided by the existing wheelchair. The adopted wheelchair was fabricated at the “Rolling” Workshop in Budapest. The device was tested technically. The use of the device was explained to the client and was tested by the client. Final adjustments were performed to optimize the device. In 2010 a final assessment was performed using ICF codes to measure the improvement in the client’s life. This was done by interview and using the final questionnaire.

A comparison was made between the initial and final assessments. Certain functions did not improve but also did not get worse after the procedure. Table 1 shows a limited number of functions that did not change. The assessment included the complete list of functions related to mobility (data not shown). None of the functions worsened due to the modified device (data not shown). Importantly, several functions have considerably improved (Table 2) with the specific technologies applied (Table 3).



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**Figure 1: Outline of the process**

Body functions	ICF 2006 / 2010*	Extent of impairments*
b710 Mobility of joint functions	b710.2	2 Moderate impairment
b715 Stability of joint functions	b715.0	0 No impairment
b730 Muscle power functions	b730.3	3 Severe impairment
b740 Muscle endurance functions	b740.3	3 Severe impairment
b280 Sensation of pain	b280.3	3 Severe impairment
b265 Touch function	b265.3	3 Severe impairment

**Table 1. Extracts of ICF assessments from year 2006 and 2010 of the client**

Control functions that did not change due to the procedure (partial list). ICF codes are listed at the initial assessment (2006) and at the final assessment (2010). The codes remained the same. \* 2010 identical with 2006

Activities and Participation	ICF 2006	ICF 2010	Performance 2006	Performance 2010	Capacity 2006 / 2010*
d4153 Maintaining a sitting position <sup>1</sup>	d4153.34	d4153.24	3 Severe difficulty	2 Moderate difficulty	4 Complete difficulty
d445 Hand and arm use <sup>2</sup>	d445.33	d445.23	3 Severe difficulty	2 Moderate difficulty	3 Severe difficulty
d620 Acquisition of goods and services	d620.34	d620.14	3 Severe difficulty	1 Mild difficulty	4 Complete difficulty

**Table 2. Improved functions and technologies applied**

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<sup>1</sup> due to the side support

<sup>2</sup> Use of hands with power assistance

Comparisons are shown for those ICF functions that exhibited improvement between the electric wheelchair and the modified wheelchair. ICF codes are listed at the initial assessment (2006) and at the final assessment (2010). The codes verify improvements. The modified wheelchair had the option for manual wheel movement with optional electric power boost and for elevating the client into standing positions. Code **d** refers to performance.

ICF 2006	ICF 2010	ENVIRONMENTAL FACTORS	Facilitator 2006	Facilitator 2010
e1201 <sup>3</sup> +1	e1201+2	e1201 Assistive products and technology for personal indoor and outdoor mobility and transportation	+1 Mild facilitator	+2 Moderate facilitator
e150+3	e150+3	e150 Design, construction and building products and technology of buildings for public use	+3 Substantial facilitator	+3 Substantial facilitator

**Table 3. Comparison of the technologies**

Code **e** refers to the environmental factors that affects the improvement. The first and second decimals show the performance with and without using the device, respectively.

### **Discussion**

Our study shows the importance of assessment and reassessment in assisting clients with devices that improve their mobility. The results were clearly measurable in a number of functions. The client's life situation has improved. Now he lives a more active life. He returned to work. He can now stand up and reach objects with ease. Standing also improves his circulation and expected to improve his high blood pressure. He became more independent and can get around in an unobstructed environment. The side support has extra benefits for his special way of sitting. The lift option gives support in the optimal body segment taking into consideration the position of injury.

The initial, intermediary and final assessments have been performed using the ICF code system. This allows the use of well-defined codes for describing the performance of each function and technical device. Empirical determination of the needs and accomplishments allowed the planning and optimization of the entire process.

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<sup>3</sup> The difference is due to the change of the electric wheelchair to a wheel-hub mounted power supported hand rim wheelchair

## References

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