Erasmus+

Development of innovative training solutions in the field of functional evaluation aimed at updating of the curricula of health sciences schools

MODULE FUNCTIONAL EVALUATION: CONCEPT AND METHODOLOGY

Didactic Unit F: Functional evaluation assessment: classical assessments vs instrumented analysis

Politechnika Śląska

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AMSE THE ASSOCIATION OF MEDICAL SCHOOLS IN EUROPE

Functional evaluation assessment
(definitions)

A functional abilities evaluation (FAE) or functional capacity evaluation (FCE) or functional evaluation assessment (FEA) is a comprehensive evaluation of your physical and functional abilities, using objective and measurable tests.

The assessment of functional abilities will allow determination of physical possibilities based on the review of medical records, interview processes and objective tests using measuring equipment.

Source: https://www.lifemark.ca/services/fae 15.01.2020

Why and when do we perform functional abilities evaluation ?

Depending on the nature of your injury and the type of work you do, before you return to work after an injury or accident, a functional abilities evaluation may be used to help determine your abilities and outline any immediate or long-term risks from resuming normal at-work functions.

The purpose of the FAE is to objectively identify impairments or disabilities and how they may affect your ability to return to certain parts or all of your normal work duties.

The FAE can also determine which job modifications or restrictions are required to protect your current abilities and prevent future injury.

Source: https://www.lifemark.ca/services/fae 15.01.2020

Classical Assessment

- A set of tests for assessing movement predispositions, most often performed in medical facilities. The classic approach is mainly based on the methods of observing the subject and classifying his mobility using specific scales.

Source: https://www.lifemark.ca/services/fae 15.01.2020

Source : http://triclinium.pl/badania-kliniczne/ 15.01.2020

Classical Assessment in clinical practice

Practical clinical methods consist in assessing the degree of disability of the patient based on observation of his psychomotor performance and coordination, as well as on assessing contact with the environment.

Quantitative methods make it possible to determine the degree of disability using defined scales and degrees using clinimetric tests, apparatus and laboratory methods.

Source: http://triclinium.pl/badania-kliniczne/ 15.01.2020

Classical Assessment in clinical practice

The scales used can be used to assess the degree of disability or to evaluate the progress of therapy.

There are the following scales:

- differential - used for classification into specific groups,
- estimated - specifying therapeutic results,
- prognostic - providing further development opportunities.

Źródło: http://triclinium.pl/badania-kliniczne/ 15.01.2020

Examples of indicators used in clinical practice

GMFCS (Gross Motor Function Classification Scale)

It determines on a five-level scale the patient's independence during normal activities such as:

- move,

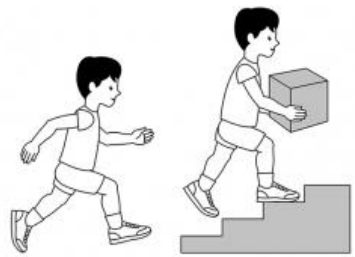
- gait,

- seat.

It is often used in the assessment of children with cerebral palsy.

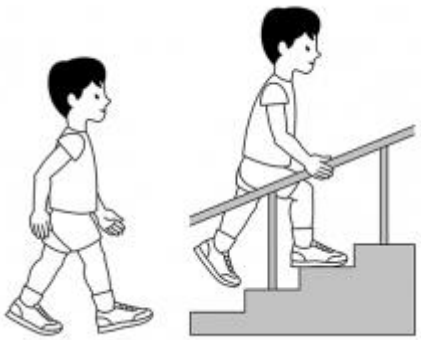
Source: http://triclinium.pl/badania-kliniczne/ 15.01.2020

Examples of indicators used in clinical practice



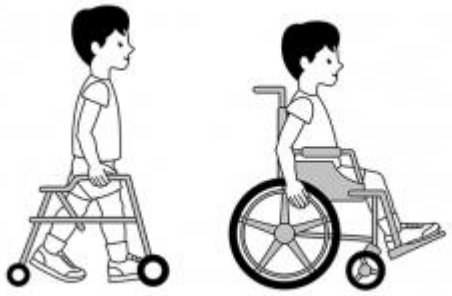
GMFCS Level I
Children walk at home, school, outdoors and in the community. They can climb stairs without the use of a railing. Children perform gross motor skills such as running and jumping, but speed, balance and coordination are limited.

GMFCS Level II
Children walk in most settings and climb stairs holding onto a railing. They may experience difficulty walking long distances and balancing on uneven terrain, inclines, in crowded areas or confined spaces. Children may walk with physical assistance, a handheld mobility device or used wheeled mobility over long distances. Children have only minimal ability to perform gross motor skills such as running and jumping.



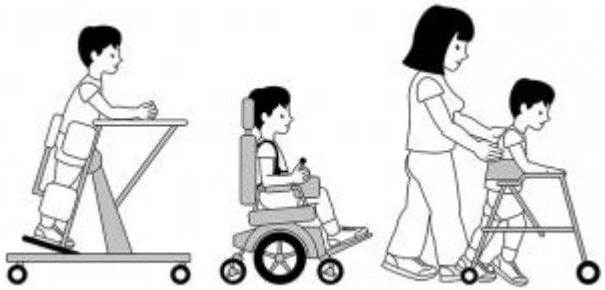
Source https://cerebralpalsy.org.au/our-research/about-cerebral-palsy/what-is-cerebral-palsy/severity-of-cerebral-palsy/gross-motor-function-classification-system/ 15.01.2020

Examples of indicators used in clinical practice



GMFCS Level III
Children walk using a hand-held mobility device in most indoor settings. They may climb stairs holding onto a railing with supervision or assistance. Children use wheeled mobility when traveling long distances and may self-propel for shorter distances.

GMFCS Level IV
Children use methods of mobility that require physical assistance or powered mobility in most settings. They may walk for short distances at home with physical assistance or use powered mobility or a body support walker when positioned. At school, outdoors and in the community children are transported in a manual wheelchair or use powered mobility.



Source https://cerebralpalsy.org.au/our-research/about-cerebral-palsy/what-is-cerebral-palsy/severity-of-cerebral-palsy/gross-motor-function-classification-system/ 15.01.2020

Examples of indicators used in clinical practice

GMFCS Level V

Children are transported in a manual wheelchair in all settings. Children are limited in their ability to maintain antigravity head and trunk postures and control leg and arm movements.

Source https://cerebralpalsy.org.au/our-research/about-cerebral-palsy/what-is-cerebral-palsy/severity-of-cerebral-palsy/gross-motor-function-classification-system/ 15.01.2020

Examples of indicators used in clinical practice

GMFM (Gross Motor Function Measure) – the patient has specific movement sequences, and each task is available in sizes. The value of the set is the sum of various grades obtained by the respondents.

There are two versions of the GMFM. The GMFM-88 is the original 88-item measure. Items span the spectrum of gross motor activities in five dimensions.

A: Lying and Rolling,
B: Sitting,
C: Crawling and Kneeling,
D: Standing,
E: Walking, Running and Jumping.

Examples of indicators used in clinical practice

MACS (Manual Ability Classification System) - manual skills classification system. The patient's ability to make specific movements is assessed when handling everyday objects. Traffic flow is also taken into account.

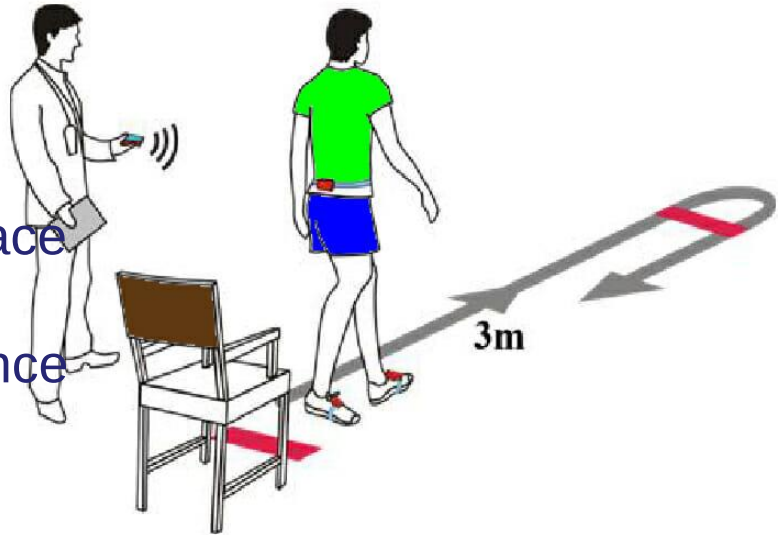
BMFM (Bimanual Fine Motor Function) – similar to MASC but only for upper limbs

FAQ (Gillette Functional Assessment Questionnaire) – evaluation system, which consists of a ten-level walk classification during 22 activities performed, assessed on the Likert scale from 0 to 5

Test Up and Go as an example of a test for assessing the patient's functional abilities - test used in clinical sssessment

At the "START" command, the subject has the task of:

1. Stand up from the chair
2. Cover the distance 3 meters at a normal pace
3. Cross the line ending the designated distance
4. Make a 180 degree rotation
5. Return to the chair and re-sit



Source https://x10therapy.com/wp-content/uploads/2019/08/TUG-TEST.jpg 15.01.2020

Test Up and Go as an example of a test for assessing the patient's functional abilities - test used in clinical sssessment

RESULTS :

<10 seconds - norm, proper functional efficiency (low risk of falls)

10-19 seconds - the examined person can go outside on their own, does not need walking equipment, independent in most everyday activities, in-depth assessment of falls risk is recommended (average risk of falls)

> / = 19seconds - significantly reduced functional efficiency, cannot go outside alone, auxiliary walking equipment recommended (high risk of falls)

Source http://dpssopot.pl/wp-content/uploads/2014/06/
15.01.2020

Advantages and disadvantages of assessing functional abilities in classic clinical assessment

Advantages

1. They do not require a lot of time
2. They do not require specialized equipment
3. They can be carried out in clinical settings
4. They can be performed by a person after a short training

Disadvantages

1. Subjective
2. Inaccurate
3. Non unique results

LIMITATIONS

1. They do not allow accurate measurements of the patient's movement system
2. They are based solely on external observations (they do not allow assessing the patient's internal tissues)

Instrumented Analysis

- Methods for analyzing physical phenomena and / or movement possibilities using specialized measuring devices. This analysis is most often carried out in specialized laboratories, often in combination with scientific units (universities)

Source: https://www.lifemark.ca/services/fae 15.01.2020

Source : https://www.ncn.gov.pl/finansowanie-nauki/przyklady-projektow/switonski 15.01.2020

Instrumented Analysis

The results of instrumental analysis are most often biomechanical quantities describing e.g.:

1. Gait parameters
    1. speed
    2. stride length
    3. percentage value of foot load in individual walking cycles
    4. angular ranges in individual joints

2. Ability to maintain balance
    1. center of pressure path length
    2. average field of the ellipse determined from the center of pressure displacements

    and other measurable physical quantities.

Instrumented Analysis

Based on the measured quantities that are available with data described in detail in terms of some of the characteristics of the patient being examined.

The indicators are determined on the basis of basic measured unit sizes.

For measuring the quantities used, advanced laboratory equipment is used, which are most often used by engineers of tools to support the process of diagnosis of the musculoskeletal system

Engineering tools to support the process of diagnostics of the human locomotor system

BIODEX SYSTEM 4 PRO

A set for assessment and training in isometric, isotonic (concentric) conditions and eccentric), isokinetic (eccentric and concentric), reactive eccentric and passive traffic with the option of full archiving and data export for statistical analysis.

Determined quantities:

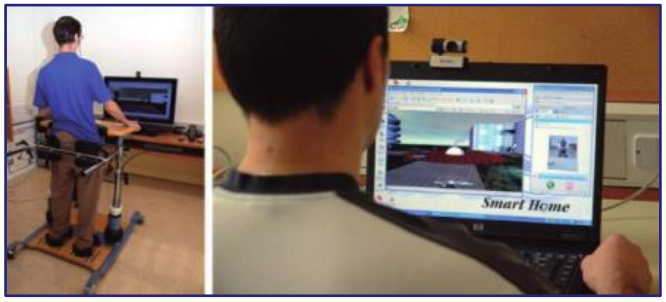
- Strength values of individual muscle parts of the lower limbs
- Weight measurement of individual segments
- Measurement of symmetry of forces in the limbs
- Measurement of force moments
- Measurement of achieved angles in the joints
- Speed measurement by limb movement

Source: https://technomex.pl/ 15.01.2020

Engineering tools to support the process of diagnostics of the human locomotor system

- Motion Capture Analysis
- Stabilomethry
- Methods for measuring ground reaction
- Methods for identifying loads in the musculoskeletal system

Therapeutic systems supporting upper limb rehabilitation using computer games



Rehabilitation system based on 2D projections using a computer monitor

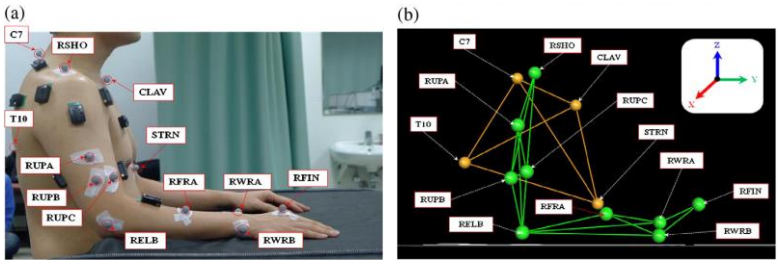
Research and diagnostic systems with a 2D projector

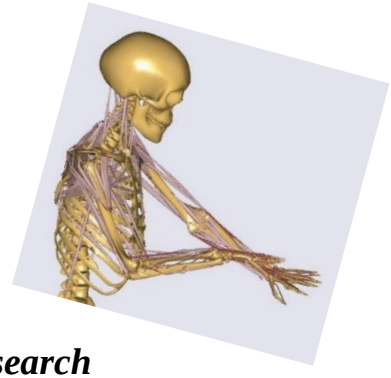
Engineering tools to support the process of diagnostics of the human locomotor system

Methods for identifying loads in the musculoskeletal system:

- **Direct measurement of interaction in joints using measuring implants,**
- **Determination of muscle strength based on EMG measurement,**
- **Identification of muscle strength and joint effects**

using modeling and optimization methods

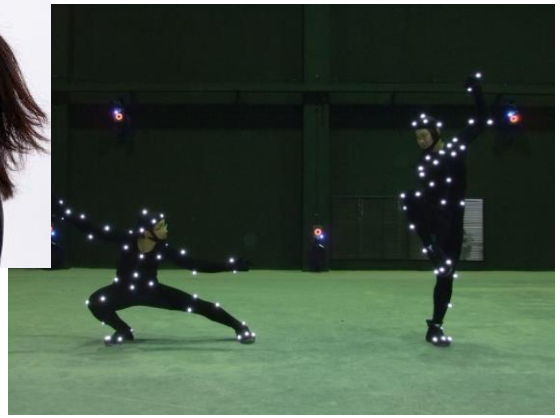




Model of upper limbs based on research Kyung Kim

Engineering tools to support the process of diagnostics of the human locomotor system

Xsens MVN - Motion Capture Systems



Source: https://www.xsens.com/ 15.01.2020

Advantages and disadvantages of assessing functional abilities in instrumented analysis

Advantages

1. Repeatable and accurate analysis results
2. Measurements of many quantities
3. Thorough functional analysis
4. Objective analysis

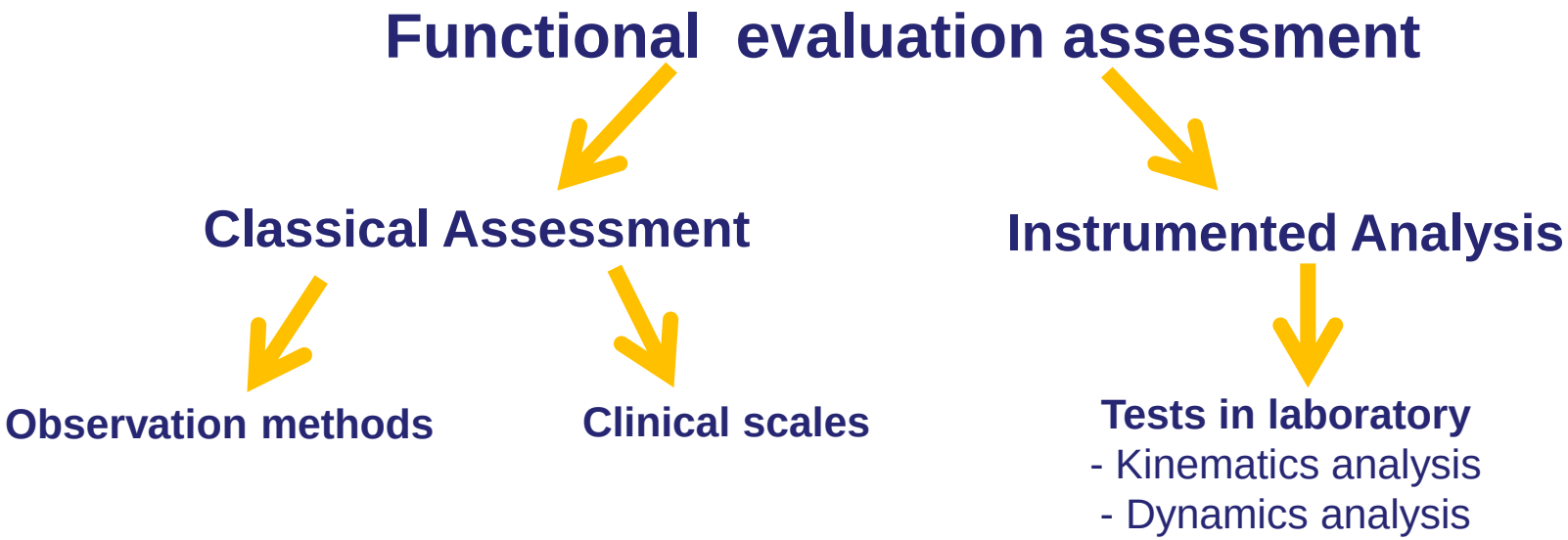
Disadvantages

1. Time consuming analyzes
2. They require specialized equipment
3. They require extensive knowledge and skills of using the equipment

LIMITATIONS

1. They may only be carried out in specialized laboratories

Conceptual Map



1. *They do not require a lot of time*
2. *They do not require specialized equipment*
3. *They can be carried out in clinical settings*
4. *They can be performed by a person after a short training*

1. *Repeatable and accurate analysis results*
2. *Measurements of many quantities*
3. *Thorough functional analysis*
4. *Objective analysis*

Key ideas of the course

1. Functional assessment is a comprehensive assessment of physical and functional abilities, carried out using measurable tests

2. In functional assessment, it is possible to use classic clinical tools and advanced measuring devices

3. The clinical approach most often includes functional tests enabling rapid but low accurate assessment of the functional level of patients

4. Instrumental analysis provides accurate information about patients' mobility, but requires professional measuring equipment and trained personnel

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