Observing Movement and postural statics – "Functional Kinetics" as an analytic Concept for Examination and Therapy

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Abstract

Founder of the FBL Concept– Functional Kinetics, is the Swiss Physical Therapist (PhD h.c. Susanne Klein-Vogelbach (1909 – 1996). Das Konzept wird von der Gruppe der Instruktoren systematisch weiterentwickelt. Anhand definierter Beobachtungskriterien wird menschliche Bewegung detailliert beschrieben. This systematized the movement analysis and the teaching of movement.

Grundlage und Leitmotiv des physiotherapeutischen Handelns ist „Bewegung". Das perzeptiv-manipulativ-didaktische Analyse- und Behandlungskonzept der FBL Functional Kinetics stellt dabei eine wesentliche Grundlage für das Bewegungslernen dar.

Es werden die Prinzipien der Haltungs- und Bewegungsanalyse und die Komponenten der physiotherapeutischen Untersuchung und Therapieplanung dargestellt. Anhand eines Fallbeispiels soll die Vorgehensweise, die Analyse und die Interpretation der Arbeitsergebnisse dargestellt werden.

Key words

Defined observation criteria

Movement and gravitation

Appropriate muscle activity

Balance reactions

Constitution

Statics

Movement behavior

The Concept

FBL Functional Kinetics teaches physical therapists to look at the movement system and at movement behavior of people, from an external point of view. This external view refers to posture and movement. (The analysis of neuro-physiological or cardiopulmonary processes could be seen as an internal point of view.) It contains a movement analysis concept, including defined observation criteria, which can be applied to all joints of the body, on static (rigid) positions and on kinematic chain patterns (5).

Movement observation is a diagnostically important procedure of physical therapists. The usage of movement-analysis is one of the pivotal skills in physical therapy. The skilled application of movement-analysis facilitates instruction and support of patients. Supported by knowledge from physics, biomechanics and functional anatomy, observation and examination results are interpreted and used for diagnosis and therapy.

Principles of movement- and posture analysis

1. The therapist recognizes movement as a change of position of the entire body or single body parts, in reference to space and in context of changed joint placements, furthermore as isolated motions of a specific joint and possible multiple movements.
2. The therapist is always aware of the interdependence of movement and gravitation.

3. From the directional motion and the axis of motion one deduces the appropriate muscle activity.
4. The therapist is always aware that movement behavior is marked by balance reactions.

Observation and palpation are influenced by subjective perception and the experiences and abilities of the therapist – a disadvantage compared with results gained through diagnostic instruments. Still they are not to be substituted in dealing with patients. The observation procedures applied in FBL Functional Kinetics deliver data about the harmony of movement, the coordination, the rhythm, the range of motion and more. They are extremely relevant for treatment and contain the ability to grasp spatial and temporal qualities of movement intuitively. They require observation criteria and belong to the base qualifications of the physical therapists.

Examination

„A majority of spinal dysfunctions are the results of cumulative microtraumas caused by impairments in alignment, stabilization and in movement patterns of the spine“(4). This quotation of the American physical therapist Shirley Sahrmann corresponds with the the FBL Functional Kinetics hypothesis used during an examination.

Components of the examination concept (5)

1. **Condition:** judging the influence of social position, state of mind and the somatic state of the patient on his movement behavior.
2. **Constitution:** it is defined by the lengths, widths, depths and the weight distribution in relation to the hypothetical norm. Deviations of this norm change movement behavior of the person in predictable ways.

Examples:

- While bending down, length deviations play an essential role, because the weight distribution forces a person often toward a certain movement behavior that not always corresponds with sensible ways of bending down (fig. 1). (Buch Abb. 3.5)
- If the shoulder joint distance in relation to the chest measurement is too small, the arms cannot hang down vertically, which leads to tonus changes of the Mms. Trapezius pars descendens, levator scapulae and deltoideus (fig. 2). (Buch Abb. 3.13).

3. **Mobility:** while examining - mobility, range of motion and the quality of movement of the joint is evaluated and recorded. Body reference points are the frame of reference for said evaluation (fig. 3 and 4 a, b) (Buch Abb. 3.33 und 3.37a, b). Deviations influence postural statics and movement behavior.

4. **postural static:** The posture of the patient with regard to postural static is recorded from caudal to cranial at every level of movement, and its influence on the locomotor system is evaluated.

Example (fig. 5 a, b) (Buch Abb. 3.29 b, c)

- + EXT of the thigh in the knee joint and hip joint
- Back inclination of the chest with + lumbal-lordosis and + thoracal-kyphosis
- Ventral-translation of the head
- Protraction of the shoulder belt

Load on passive structures:

- Knee
- Hip
- lumbal spine
- cervical spine

Hyperactivity as a reaction to changed weight distribution:

- Shoulder-cervical muscles reactively on head weight
- Belly musculature reactively on chest weight

5. Movement behavior of 5 body segments

- legs (feet, thighs and lower legs),
- pelvis (pelvis and lumbar vertebral column),
- chest (breast backbone, ribs and sternum),
- head (cervical vertebral column, upper jaw and lower jaw, lingual bone)
- arms (hands, upper arms and forearms, scapula and clavicula)

These body segments by their given structure have certain tasks in movement behavior, so it is possible for the therapist to define a hypothetical norm. Analyzing function of a single muscle (muscle function check according to Kendall in 1983 and Janda in 1979) is insufficient and does not correspond to its comprehensive function in movement behavior. It is clinically expedient to judge the musculature within these kinetic chains. The examinations are based on the knowledge of the myofascial system in relation to environment and gravitation (2).

Example:

Examination of muscles of the body segment Legs

There are 6 observation criteria with recorded consequences for decreased coordination or decreased anticipatory ability of the musculature. The therapist selects for the examination a typical situation in movement behavior (e.g., weight takeover of the supporting leg). Following is *one* example of observation criteria of the body segment legs (1).

Criteria: Muscular rotatory twisting of the leg axis (fig. 6 a). (Buch Abb. 3.47)
Decreased coordination ability of the musculature is evident typically (fig. 6 b). (Buch Abb. 3.48)

- in sagging longitudinal curvature with concurrent valgus osteotomy of the hindfoot
- in misalignment of the knee joint (valgus deformity and/or media rotation of the femurkondylus)
- in dropping the pelvis on the pivot leg side (adductive/inside rotation). Adduction of the pelvis on the pivot leg hip joint indicates inhibition of the abductor muscle within the rotational synergy system.

Therapy planning

A physical therapist's diagnosis differs substantially from the medical diagnosis and indicates no pathology. It could be called a movement diagnosis describing the most probable symptom-causing malfunction in the movement system as well as describing the consequences on the organism and the life of the patient.

Therapy planning is an extremely complicated mental process. The agreed upon goals and the selected interventions must be compared and verified according to Clinical Reasoning. Corresponding with the goals, a therapeutic process should be developed into which the patient must be actively integrated.

Basis and guiding theme of the physiotherapeutical action according to FBL Functional Kinetics is movement. The task of the therapist is to induce the patient to moving within the boundaries of current loading capacity and correspondingly, the functional demands in everyday life.

A change of movement behavior can be reached only by active cooperation of the patient. Functional training connotes always a perception training for the patient and kinesthesia is improved. The didactic concept of perception manipulation of FBL Functional Kinetics is an essential basis for learning motor activity.

Systematic observation of people in state of rest and motion shows a constant conflict with gravitation. This causes constant dealing with bodyweights and requires suitable balance reactions. Based on this knowledge the therapeutic exercises of the FBL Functional Kinetics were compiled. These exercises consist of complex motions, which require a lot of coordination and reactions of the whole movement system. The model exercises described in FBL Functional Kinetics can serve as a basis to developing individual exercises. Above all, the exercises with the Swiss ball are built on the principle of reactive practice. It consists of expertly managed movements and thereby causing a therapeutically intended goal of a natural motion sequence to appear automatically and inevitably.

Selective muscle training requires the coordination of muscular activities, i.e. the muscles involved with movement must co-operate harmoniously. This selection may affect a certain muscle, but also specific muscle groups. The therapist decides according to purpose and permissible load. Mobilizing massage, resistance mobilizations are part of the treatment concept of FBL Functional Kinetics. They are based on a common concept consisting of perceptive, manipulative and didactic elements. The techniques emphasize single structures, but affect the general functions of motion. The transition from one to the other is often the case (3, 5).

Case Study Shoulder

Personal Data

Name: Robert G.

Age: 47 Years

Height/Weight: 170 cm / 74 kg

Diagnosis: hand-shoulder syndrome

Occupation: builder

Hobbies**:** reading

Sport: long distance running, weight training, bicycling

He is a self employed builder and dependent on his ability to performing strenuous physical labor and fit for work.

Anamnesis

3 months ago, Robert G. climbed up a ladder with a 45 lb bucket in his right hand and subsequently lifted said bucket over a scaffolding board (head high). The next day he felt, what he described as a „funny feeling“ in his back and noticed that he had difficulties pushing up an extension ladder. While bench-pressing at the gym he

noticed that he could not press his regular weight and he compensated this weakness with compensatory movements.

10 years ago, after an extended backpacking trip with a heavy load, a similar „funny feeling“ occurred and the ensuing diagnosis stated – sudden scapula alata, presumably caused by paralysis of serratus anterior.

Examination results

1. Constitution

widths: + frontotransversal diameter chest (fig. 7) (Buch Abb. 11.1)

2. Mobility

Spinal column

Extension: + lumbothoracal, - lower cervical spine

Flexion: - lower cervical spine

Lateralflexion: - lower cervical spine in both directions

Rotation: thorax to the left (evasive mechanism)

Humeroscapular joint:

Full mobility

Scapulocostal:

Reduced cranial rotation

3. Muscles

Relaxation ability

pectoral girdle

Stabilization ability

Reduced stabilization ability of scapula on thorax

Heightened tension

M. trapezius, pars descendens, M. levator scapulae right

Reduced stretchability

M. subscapularis right

Strength:

M. serratus anterior right (muscle rating 4)

M. supraspinatus, infraspinatus and teres minor (muscle rating 4)

4. Statics

Side view:

- thoracic spine-Kyphose

front and back

+ shoulder higher on right (fig. 8) (Buch Abb. 11.2)

+ Protraction of pectoral girdle

5. Movement Behavior

Moving arms

to the side: pectoral girdle lifts prematurely

to the front: Elevation/Retraction

With weigth (ventrally): Depression/Retraction

Pushing to the front (putting in screws): Ventral rotation (fig. 9) (Buch Abb. 11.3)

6. Interpretation of examination results / working hypothesis

The decreased ability of the pectoral girdle to stabilize on the chest presumably results from a partial paresis of the serratus anterior, which has not recovered

completely after the sustained damage 10 years ago. The movement restrictions of the lower cervical vertebral column interfere with thoracicus longus, which further increases the dysfunction.

The limited cranial rotation of the scapula prevents optimized centering of the head of humerus. Weight training and construction work have caused an extraordinary burden on the rotator cuff.

7. Therapy plan

An MRI should determine whether the rotator cuff is injured. In addition an EMG should ascertain, whether the N. thoracicus longus is fully functioning.

- Mobilizing massage of the pectoral girdle and the lower cervical spine to improve mobility of thoracicus longus (fig. 10 a, b, c) (Behandlungstechniken-Buch Abb. 4.19 a,b und 4.27 a) (3)
- Electrotherapy to support activation of the M. serratus anterior.
- selective activation of the rotator cuff and the M. serratus anterior
- Strengthening of abdominal muscles to stabilize the vertical axis of the body
- Training therapy focused on the trunk musculature (priority on abdominal muscles).
- Behavioral training: No weight training (arms), since compensatory evasive movements increase danger of wearing out rotator cuffs. The movements of the arm should be initiated from the scapula (Angulus inferior after ventral activation).

ICF Documentation

Tab. 0.1. Diagnosis: hand-arm Syndrome

Therapy goal: selective activation of serratus anterior and rotator cuff to increase stability of pectoral girdle.

	Structure / Function	Activity	Participation
Patient	Weakness in right arm Feeling of apprehension (unease)	Working above head almost impossible	Cannot work as efficiently anymore Carrying weights is difficult
Therapist	Reduced stabilisation ability of scapula on thorax Reduced mobility of lower cervical spine in sagittal and frontal direction. Inhibited mobility of scapula in cranial rotation.	Lifting of heavy loads only possible through compensatory movements	

	Diminished strength of serratus anterior and rotator cuffs.		
Contexture (+) oder (-)			
Environmental factors		Personal context	
(-) often inaccessible worksites (-) heavy weights and no supportive means		(+) physical condition excellent (+) excellent compliance (+) high motivation	

Documentation of progression

Tab. 0.2.			
Name: Robert G.		Main diagnosis	Patient evaluation
		Secondary diagnosis	
	Goal Problem	**Intervention**	**Results**
	Improving movability of thoracicus longus	Mobilising massage of pectoral girdle and lower cervical spine	Good
	Enhancing stabilisation of body segment arms	Selective activiation of rotator cuff and M. serratus anterior a) scapula setting in different starting positions b) scurrying while crawling on all fours	Good
	Stabilising vertical axis of the	Invigoration of abdominal muscles	Very good

	upper body		

Final evaluation (fig. 11 a-e) (Buch Abb. 11.4 a – e)

Goals	Intervention	Fast	Medium	Slow	Yes	No	Reasons
Improving mobility of N. thoracicus longus	Mobilizing massage of pectoral girdle und lower cervical spine		X		X		
Enhancing stabilization of body segment arms	Selective activation of rotator cuff and M. serratus anterior - scapula setting in different starting positions - scurrying while crawling on all fours		X		X		After further examination, the N.throracicus longus is still not functioning properly. The ability to stabilize still impaired. The result is nonetheless satisfactory (Abb.11.8 a - e).

	- Electrotherapy						
Stabilizing vertical axis of the upper body	Build up abdominal muscles	X			X		

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Legends to figures

1) Constitution: Bending horizontal by + length of the legs and – length of the trunc
2) Constitution: shoulder joint distance in relation to the chest measurement is too small, the arms cannot hang down vertically, which leads to tonus changes of the Mms. trapezius pars descendens, levator scapulae and deltoideus
3) Examination: abduction humeroscapular

4) a) Examination: transversal Flexion humeroscapular

   b) Examination: transversal Extension humeroscapular

5) Examination: posture static and aftereffect for joints, passive structures and musculature (as a reaction to changed weight distribution)

6) a) Muscular rotatory twisting of the leg axis

   b) Decreased coordination ability of the musculature is evident typically

7) + frontotransversal diameter

8) shoulder higher on right

9) Ventral rotation by pushing to the front

10) Mobilizing massage of the pectoral girdle and the lower cervical spine to improve mobility of thoracicus longus

11) Final Evaluation