METHODS IN NEUROLOGICAL PHYSICAL THERAPY I

BOBATH CONCEPT GENERALITIES.

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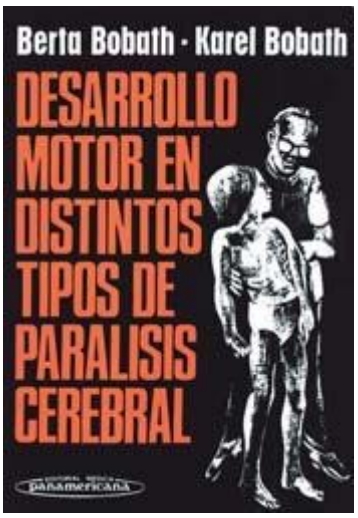
BOBATH CONCEPT. GENERALITIES

Physical Therapy in central nervous system (SNC) disease is performed to avoid abnormal muscle tone and posture, to treat muscle and joint deformities, and to reduce motor and sensory disorders.
Bobath Concept (BC) is the most widespread and is clinically accepted for targeting the CNS and the neuromuscular system.
BC tries to 'teaches' the brain to improve motor performance skills and achieve 'as near normal function as possible'.

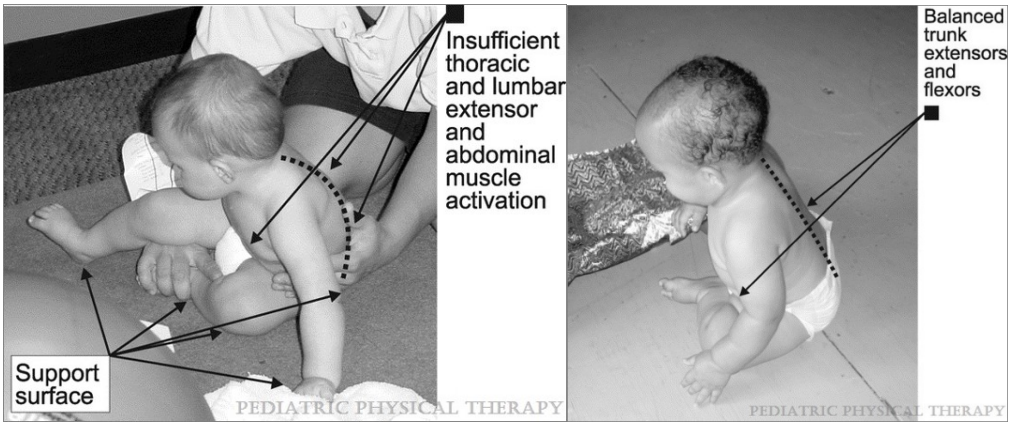
The founders: Berta and Karel Bobath.
Karel Bobath was born in Berlin, Germany in 1906, and trained there as a medical doctor, graduating in 1936. He worked there as a neurologist.
Berta Ottilie Busse was also born in Berlin, in 1907. Her early training was as a remedial gymnast, where she developed her understanding of normal movement, exercise and relaxation.
They both fled Berlin in 1938 just before the Second World War.
They went to London and there they got married in 1941. In London Mrs Bobath trained as a physiotherapist, graduating from the Chartered Society of Physiotherapy in 1950.
Dr Bobath started his career working in pediatrics and later more specifically with children with cerebral palsy. Both died in London in 1991.



"The contemporary Bobath Concept is a **problem-solving approach to the assessment and treatment** of individuals with disturbances of function, movement and postural control due to a lesion of the central nervous system (CNS) and can be applied to individuals of all ages and all degrees of physical and functional disability (International Bobath Instructors Training Association (IBITA), 2007)".

Karel Bobath said in 1986: *"The Bobath Concept is unfinished. We hope that it will continue to grow and develop in years to come"*.

The primary purpose of this approach is to inhibit/correct abnormal postural tone and to facilitate more normal movement patterns for performing skills and activities.



BC is one of the primary intervention approaches for patients with CNS disease. It addresses the sensorimotor aspects of the disorder through the clinician guiding the patient's motor output during functional activities.

The systems approach to motor control provides the foundation of the current theoretical underpinning of the Bobath Concept. **The systems approach to motor control** considers that motor control is based on a nervous system working with both hierarchical and parallel distributive, multi-level processing amongst many systems and subsystems involving multiple inputs, and with modulation on several levels within this processing.

It sees the potential for plasticity as the basis of development, learning and recovery within the nervous and muscular systems.

Neuroplasticity= capacity of the nervous and muscular system to adapt and re-organize itself in response to changes in the task, individual or the environment.

The development of the BC have been in response to, and supported by, advances **in the fields of neuroscience, biomechanics and motor learning.**

Related to this, there have been many changes in the Bobath Concept and many aspects that remain the same.

Aspects that stay the same:

- It is a **problem-solving** and analytical approach.
- **An understanding of tone, patterns of movement and postural control that underlie the performance of functional tasks.**
- The idea that it is possible to **modify the way a task** is performed through **handling and activation** to make it **more efficient, effective and successful for the individual (`normal movement´).**
- It encourages the **active participation** of the individual.
- The importance of **application of movement, with practice, into function**.

Aspects that have changed:

- Changes in the understanding of **tone to encompass both neural and non-neural elements (spasticity is rarely a major source of the patient's movement disorder).**
- Greater openness to the use of **other modalities** and adjuncts which will complement the Bobath Concept such as treadmill training, constrained-induced therapy, structured practice, the use of orthotics and muscle strengthening.
- Changes in "do not allow compensatory strategies".

The Bobath Concept recognizes that changes in the nervous system can be organized or disorganized producing adaptive or maladaptive sensorimotor behavior.

If compensatory strategies become established, they may block potential recovery.

But limited or no movement is the worst experience for the patient as the nervous system is deprived of information.

The idea that all movements must be perfect is not a workable solution. But compensatory strategies can be minimized to allow the patient to realize their potential **for efficient long-term motor recovery.**

Summary, BC is based on inhibition of abnormal movements, in the facilitation of motor unit recruitment and
learning effective movements by manipulating **KEY POINTS.**

WHAT IS A "NORMAL MOVEMENT"? The new definition of "normal movement"

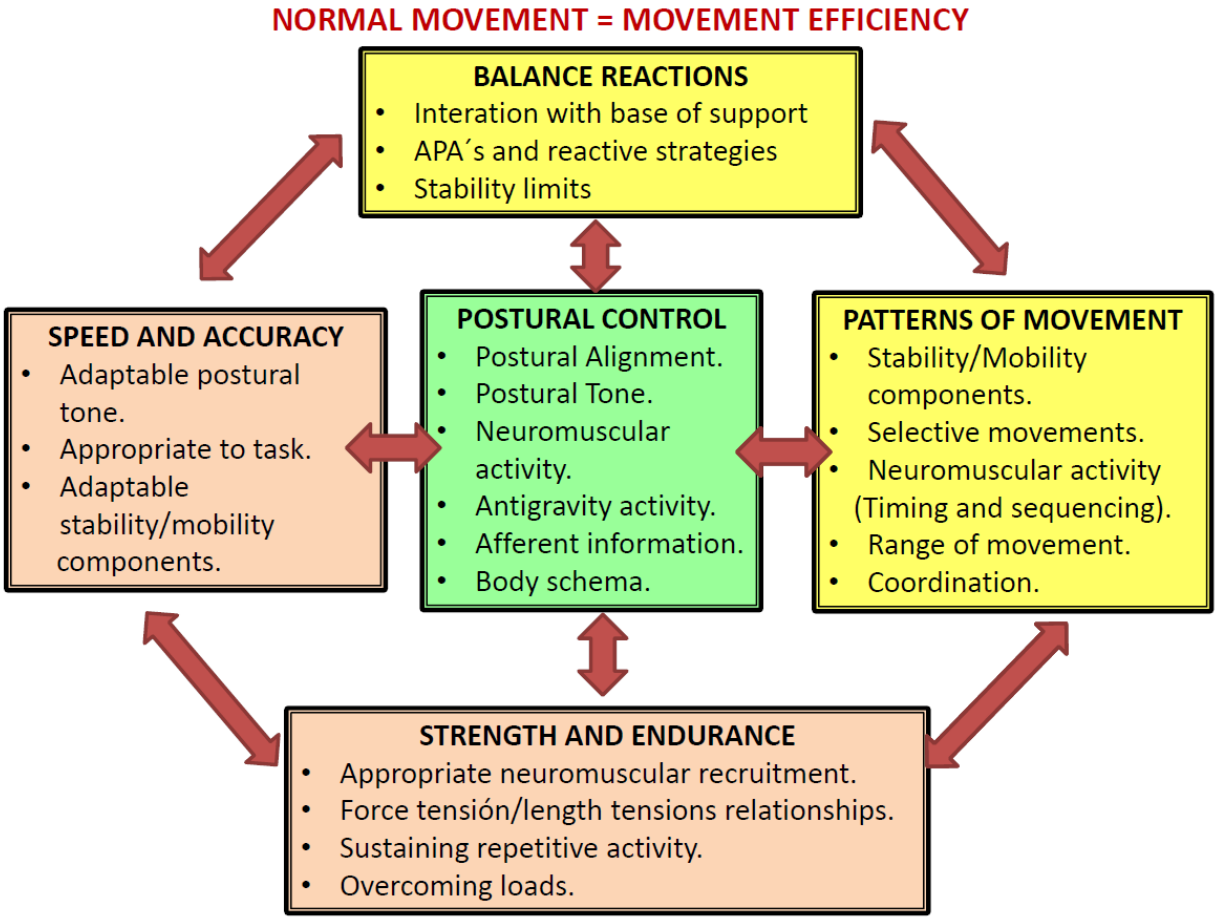
The Bobath Concept is goal orientated and task specific and seeks to alter and construct both the internal (proprioceptive) and external (exteroceptive) environment in which the nervous system (and therefore the individual) can function efficiently and effectively (Raine, 2007).

A normal movement is an efficient movement. Movements associated efficient and effective function included:

- **maximum success** in achieving goals,
- **the least energy** consumption and
- **the shortest time** when performing the movement.

WHAT ARE THE CHARACTERISTICS OF "normal movement"?

- **Goal-Directed.** Minimal associated reactions.
- **Economic (least energy).** Minimal compensations.
- **Adapted.** Shortest time (Quick). Without difficulty.
- **Coordinated.** Aligned, with order and velocity.



FRAMEWORK OF REQUIREMENTS FOR MOVEMENT EFFICIENCY.

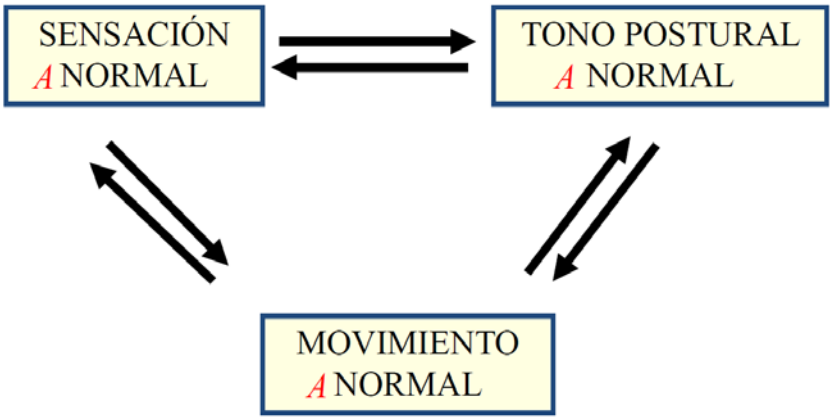
(From: Raine S, Meadows L, Lynch-Ellerington M, eds. *Bobath concept: theory and clinical practice in neurological rehabilitation*. John Wiley & Sons, 2013).

POSTURAL CONTROL

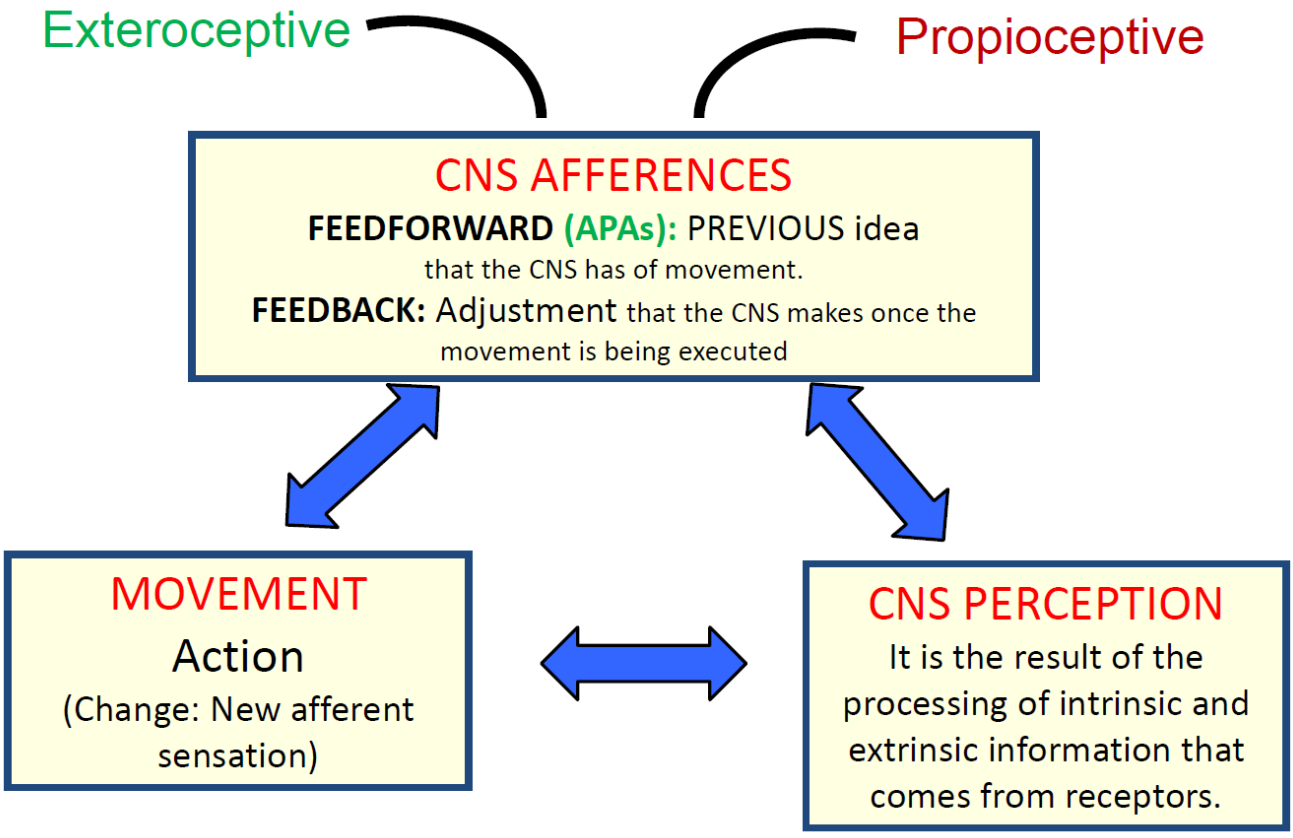
Muscle tone is 'the sensation of resistance that is encountered as a joint is passively moved through a range of motion'. When a joint is moved passively through range the muscles are usually electrically silent, but resistance is felt because of the inertia of the limb and the compliance of the soft tissues.

Postural tone is the sum of all individual muscle tones in each posture: sitting, standing, etc.

We have to identify the presence of abnormal muscle tone and specific movement disorders. For this, it is necessary to understand that an abnormal sensation leads to an abnormal postural tone and therefore to an abnormal movement in neurological patients.



Good postural control needs a good proprioceptive and exteroceptive sensation so that an efficient movement can occur.

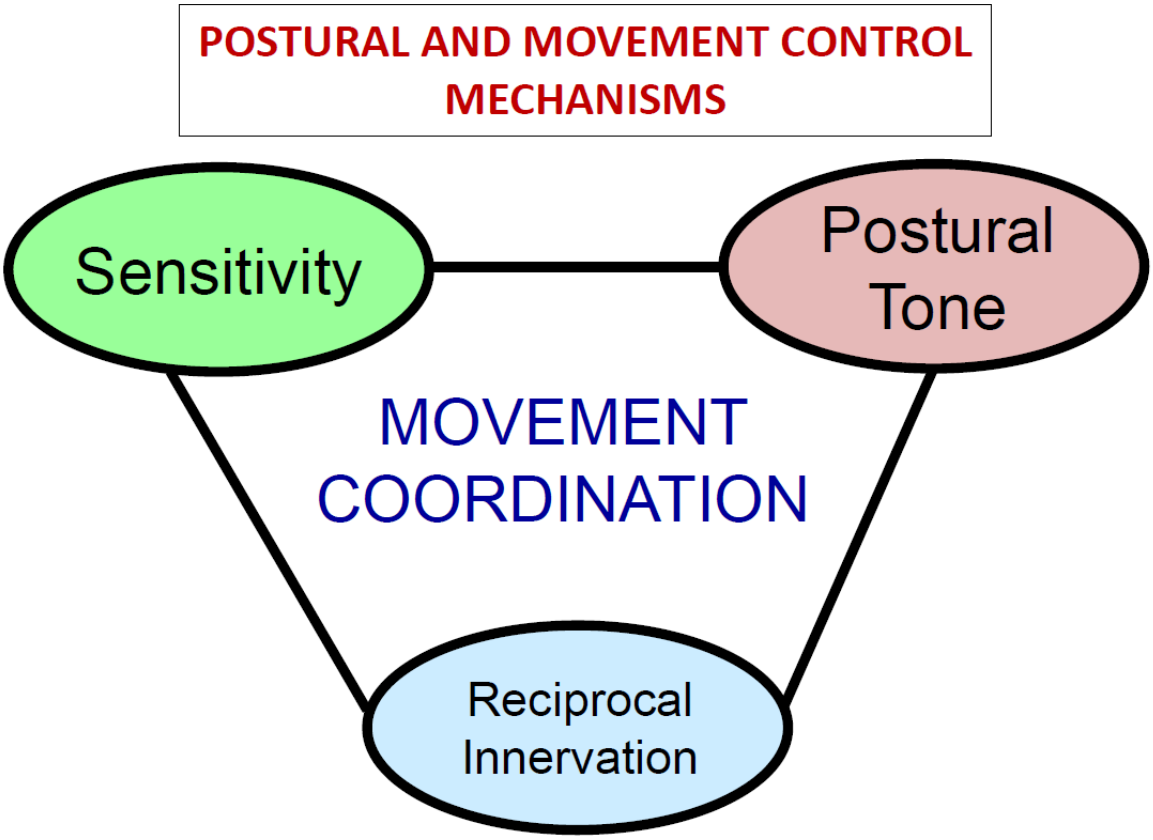


Postural responses occur in anticipation of and alongside movement, and during unexpected perturbations (feed-forward and feedback control).

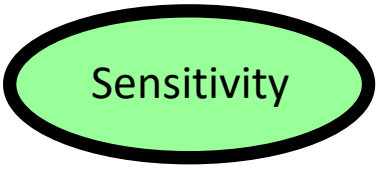
Feed-forward postural responses are also known as APAs. (Anticipatory Postural Adjustments)

These can be divided into preparatory and accompanying APAs.
Preparatory APAs, occurring prior to voluntary limb movement, maintain postural stability by adapting to any destabilizing forces.
E.g. Lack of APA in ataxia. The complex control of APAs in trunk muscles which occur during upper limb movements.

MOVEMENT COORDINATION.
Movement coordination depends on POSTURAL AND MOVEMENT CONTROL MECHANISMS.

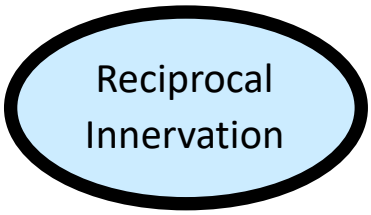


What elements are we going to use to recover the motor control of the patients? Sensitivity, postural tone and reciprocal innervation.



SENSITIVITY
To access the patient through sensitivity we use receptors. They are specialized cells that receive and send extrinsic and intrinsic stimuli to the CNS. Receptors we are going to use in treatment can be exteroceptors or proprioceptors.

- **EXTERORECEPTORS**: Eyes (vision), ears (hearing), nose (smell), tongue (taste), skin receptors (touch), thermoreceptors and nociceptors.
- **PROPRIOCEPTORS**: Muscle spindles, Golgi tendon organ, pressure receptors (joint, skin, deep tissue), vestibular receptors and nociceptors.

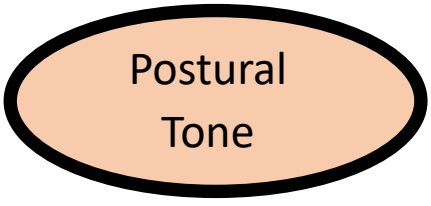


RECIPROCAL INNERVATION

- **GENERAL:** It is the modulation between **excitation and inhibition** within the CNS, which leads to efficient coordination of muscle activity in movement.
- **SPECIFIC:** It is the **exchange between agonist and antagonist** that produces a normal coordination of movement.

RECIPROCAL INNERVATION WE ARE GOING TO USE IN TREATMENT

- Hemibodies:
  - arm or leg right/left.
  - face.
- Cranio-caudal:
  - head/shoulder girdle.
  - shoulder/pelvic girdle.
  - arms/legs.
- Proximal- distal:
  - stable shoulder/mobile elbow and hand.
  - Mobile hip/stable foot.
- Intermuscular: agonist/antagonist.
- Intrarticular o intramuscular: biarticular muscles between the proximal and distal part.



NORMAL POSTURAL TONE

Normal postural tone provides the background on which movement is based: high enough to withstand gravity, low enough for easy movement. Both posture and movement are dynamic and interact to such an extent that they cannot be separated. Postural changes are part of every movement and movements themselves are in effect changes in posture.

During the first year of life on a background of normal postural tone, the primitive reactions become gradually moderated and integrated into the child's voluntary coordinated movements, enabling a group of mature reactions to develop. These are called postural reactions and remain with us throughout life. Gravity affects all our movements
from birth onwards but these reactions help the child to master gravity in conjunction with increasingly organized, coordinated and purposeful movements developed during the child's early years.
These reactions help the child to master gravity, in time enabling the child to stand and walk.

FACTORS INFLUENCING NORMAL POSTURAL TONE

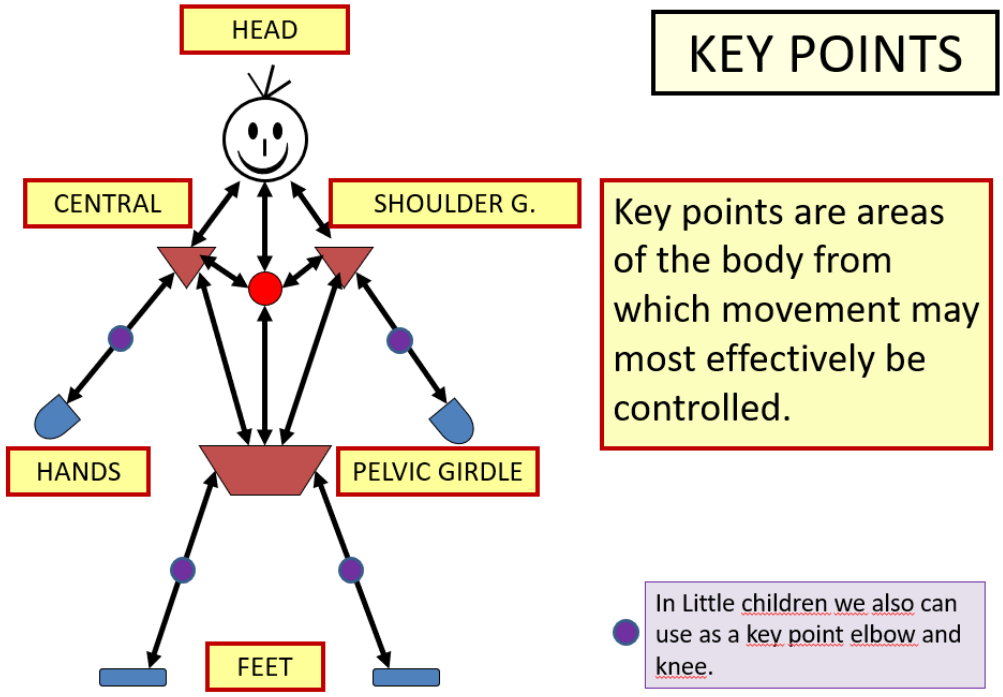
The factors that influence normal postural tone are the base of support, posture in space, function, psychological factors, speed, motor image and **postural set.**

What is a postural set?

To understand what a postural set is for BC, we need to know the concept of **"key point".**
Analysis of postural alignment is an important feature of the assessment process.
Bobath therapists analyze posture and movement through the alignment of key points in relation to each other and in relation to a given base of support.
These areas have a dynamic interrelationship with each other through active control of body musculature in a three-dimensional orientation.
The alignments of key points, within a posture, are described as postural sets.

What are Key points?

The parts of the body that have a large number of proprioceptors and exteroceptors and great biomechanical importance are key points.



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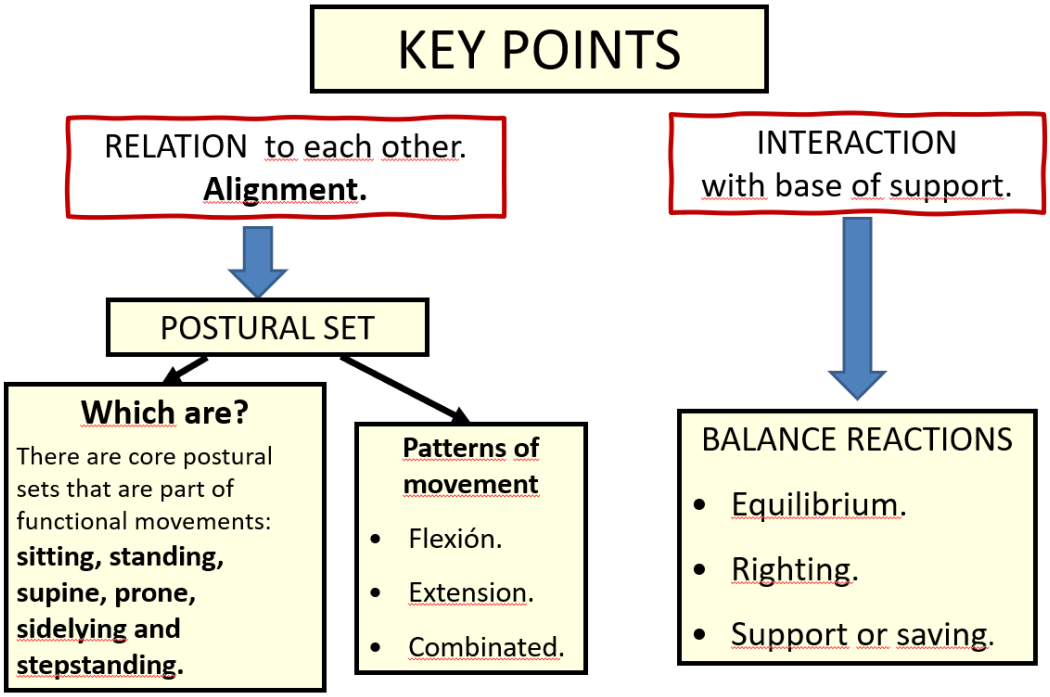
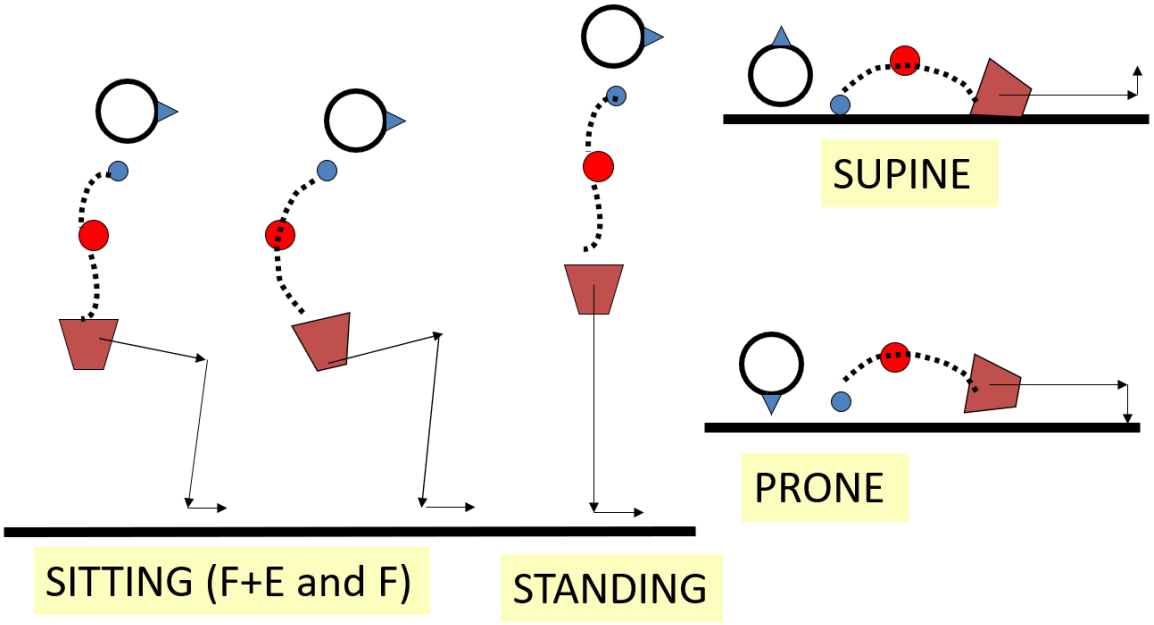


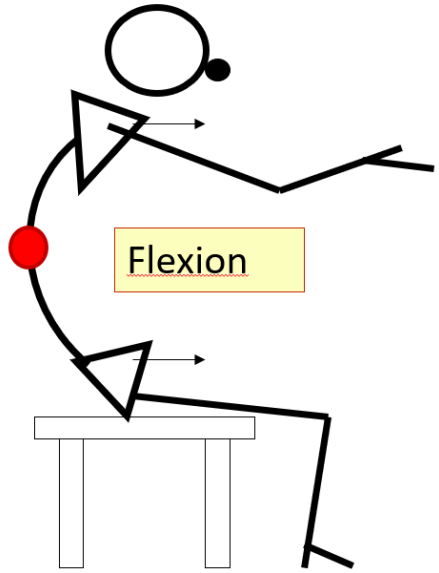
Postural set is a means of identifying the active connections between body segments in different postures and enables the therapist to develop hypotheses as to how the patient has been moving and how they might attempt to move.

There are more favorable postures than others for the execution of certain movements.

BASIC POSTURAL SET



Each postural set determines a motor pattern: flexor or extensor or combinated (F+E).

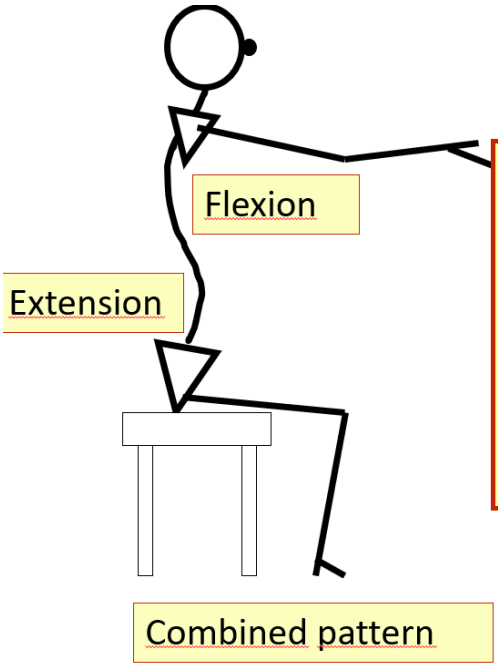


Flexión pattern of movement

Promote the activation of the flexor muscles in the perform task:

- In the shoulder girdle.
- In the pelvic girdle.

Is not good enough for:
- manipulation in a table.
- Hold head keeping horizontal gaze.



Combinated pattern movement:
Flexion pattern in the upper part of the body and extension in the lower part:

- Is good for manipulation on a table.
- Is good for balance strategies, (promote rotation).
- Is good to prepare moving between sitting and standing.

POSTURAL REACTIONS OR AUTOMATIC REACTIONS

Keep the center of gravity (Cg) with a little movement inside the Base of support (BOS).

Postural reactions provide the child with a stable postural base so that the child can maintain and adapt the body's position against gravity, keep the body in alignment and, with the weight evenly distributed and sufficient stability at the shoulder and pelvic girdles, move the limbs independently.

This truncal stability also enables the child to shift the body weight against gravity.

Righting reactions

They appear clearly when the center of gravity moves close to the limit of the base of support. They try to **maintain a fixed BOS** and the center of gravity inside this BOS.

These reactions form the basis of future coordinated movements. When a child is moved or moves independently the child maintains the typical position of the head in space and the typical position of the head in relation to the body trunk and limbs. Righting reactions underlie many of a child's movement activities such as rolling over, sitting up, getting on to the hands and knees and kneeling up – all sequences of movements which will enable the child to stand in time.

These reactions become integrated with the equilibrium reactions.

Equilibrium reactions.

The function of the equilibrium reactions is as an automatic rapid response to a loss of balance. Equilibrium reactions help the child to maintain and to regain balance, thus making free and independent movements of the head, body and limbs possible in all positions.

Equilibrium reactions keep the center of gravity (Cg) with a little movement inside the Base of support (BOS).

Support or saving reactions

They are postural strategies to change the BOS due to the impossibility of maintaining the center of gravity within it.

Very sudden or unexpected loss of balance elicits saving reactions. Their purpose is primarily to protect the face and head. If the child should lose balance and fall, the arms are thrust out, usually with straight elbows and open hands, which are placed on the nearest supporting surface to protect the head and face from injury.

Stepping reactions, grasp with hand and protective extension of the upper extremities.

In the child with CP these mature automatic postural reactions will often be absent, incomplete or exaggerated.

BALANCE REACTIONS ARE FORM BY pAPAs, APAS and Postural strategies.

pAPAs: anticipatory balance strategies which prepare the body for movement, whilst accompanying APAs occur during the movement (unexpected displacements).

APAs: APAs prepare the body for expected movement displacements and therefore are important in maintaining postural orientation during functional activity.

APAs enable stability of one body segment for the mobility of another during functional movement. (ej. appropriate core muscle recruitment can increase the capacity of muscle activation in the extremities).

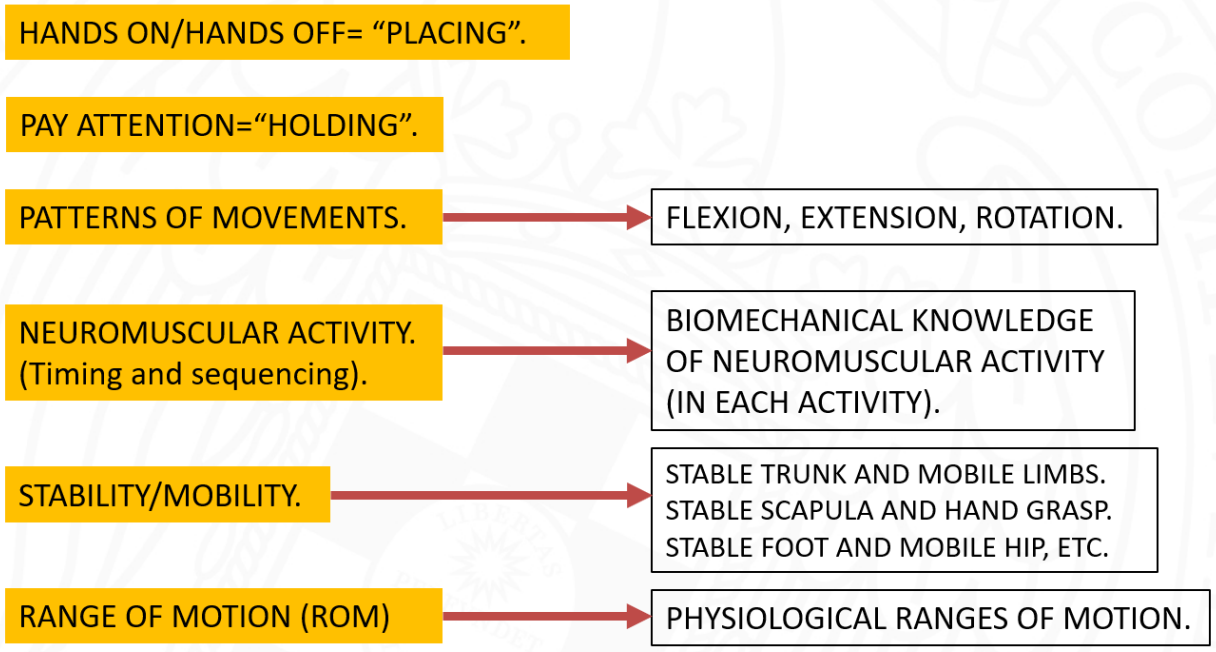
Postural strategies.

- to maintain a fixed BOS: ej. ankle and hip strategy.
- to change the BOS: stepping reactions, grasp with hand and protective extension of the upper extremities.

The balance strategies: therapist are going to facilitate are APAs and postural strategies because they are produced by weight displacement.
Therapists must learn to facilitate the transfer of the body's centers of gravity in relation to the base of support.
We are going to do this through functional basic movements from:

- **Supine to sitting.**
- **Sitting to standing.**
- **Standing to stepstanding.**
- **Supine to sidelying to prone.**
- **Upper limb function: reach, grasp or manipulate.**
- **Gait.**

WHAT ARE WE GOING TO ASSESS AND USE IN THE TREATMENT BASED ON THESE MOVEMENTS?



HANDS ON/HANDS OFF= “PLACING”. The therapist moves the patient's body, leg or arm and assesses whether the patient can support it against gravity and the weight becomes lighter. **WITHOUT ASKING.**

It is observed if in this test the patient **performs** normal or abnormal patterns of movement

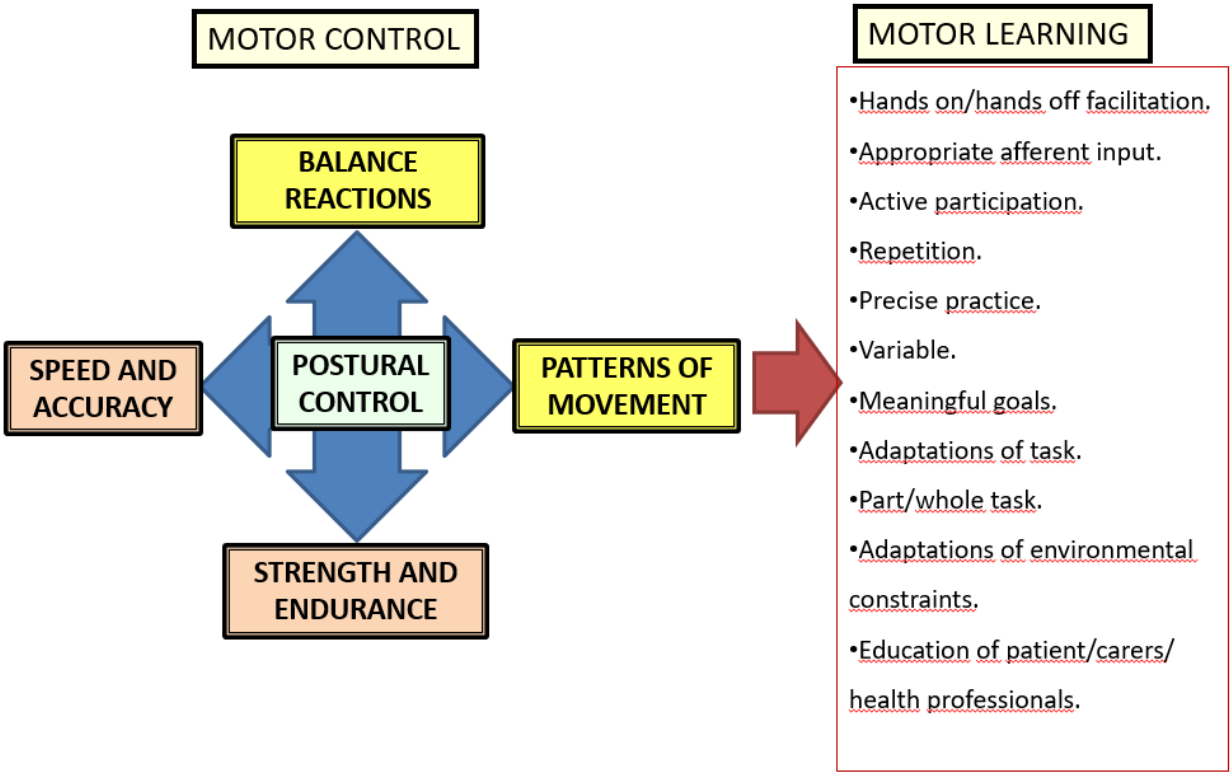
PAY ATTENTION= “HOLDING”.
If the patient does not maintain automatically, **they are asked to maintain it voluntarily.**

BOBATH CONCEPT ASSESSMENT/TREATMENT

The clinical reasoning process includes factors such as:

- initial data gathering based on movement analysis (MOTOR CONTROL/MOTOR LEARNING);
- initial hypothesis and objectives generation;
- refinement and testing of hypothesis with specific intervention;
- evaluation of outcome and further hypothesis generation.

KEY FEATURES OF MOTOR CONTROL AND MOTOR LEARNING USED AS BASIS FOR CLINICAL REASONING.



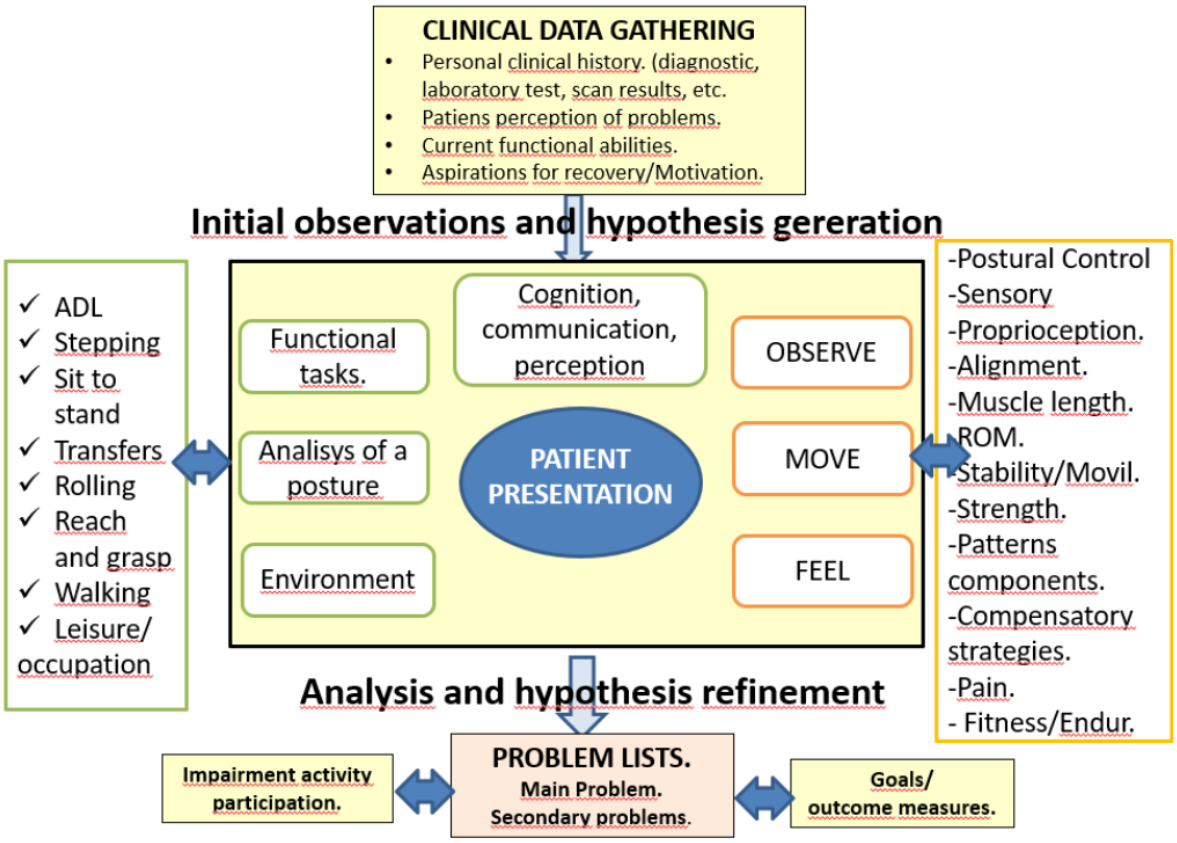
BOBATH CONCEPT ASSESSMENT

Assessment and treatment are integrated with a continuous interaction in between.
The assessment process is systematic but flexible as it does not follow the same sequence for each patient.
The starting point for assessment will vary as will the progression, with both being determined in response to the individual's clinical presentation.

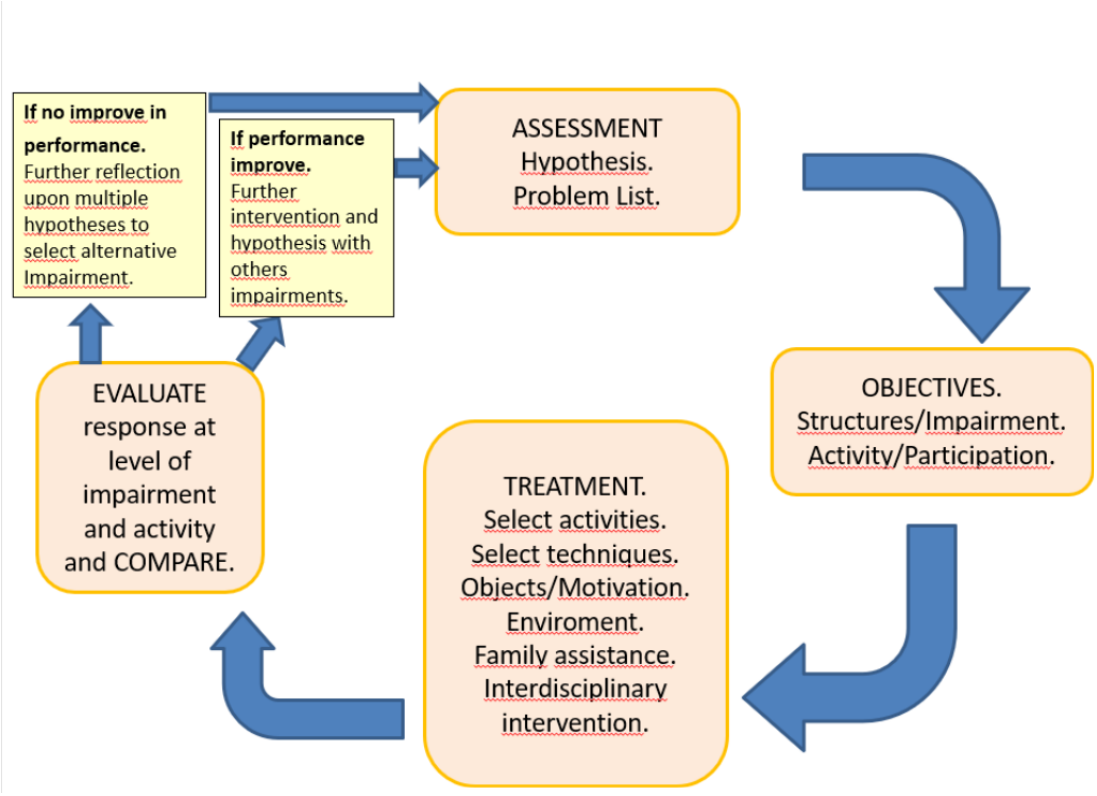
The key questions described by Bobath (1990)
'What can the patient do now?'
'What can the patient do with a little help from the therapist?'
still apply in the assessment on contemporary Bobath Concept.

Therapist's 'help' is understood as the manipulation of afferent input to the CNS to offer the patient an opportunity to produce a more efficient movement strategy in relation to a given functional task.
Therapist's 'help'= put your hands in `key points´, which modifies postural or movement strategies.

CONTEMPORARY BC PROCESS OF ASSESSMENT



BOBATH CONCEPT CLINICAL REASONING



Assessment: Continuously observation postural and movement patterns: **Before, during and after treatment.**

"We assess while we treat and we treat while assessing and so we modify our performance." Berta Bobath

Since the beginning:

- What can he perform?
- How he do it? Postural
- What can he do?
  - By itself?
  - with the help of a person?
  - with an orthosis?

ASSESSMENT. OBJECTIVES.
MAIN OBJECTIVE

- **Structures/Impairment.**
  - To decide what is most urgent for each patient in this very moment.
  -Treatment of the main problem to obtain the maximum potential.
- **Activity/Participation.**
  - Motivation: leisure, occupation, school…

Secondary objectives:
Other goals that are important for the evolution of the patient and can help us to reach main goal.

ASSESSMENT. Purpose:
To plan the treatment in a methodical and individualized way, according to the age of the child or the stage in which he is. Explain to parents and child our assessment if possible.

REFERENCES.

1. Raine S, Meadow L, Lynch-Ellerington M (ed.). Bobath concept: theory and clinical practice in neurological rehabilitation. United Kingdom: John Wiley & Sons; 2013.
2. Díaz-Arribas MJ, Martín-Casas P, Cano-de-la-Cuerda R, Plaza-Manzano G. Effectiveness of the Bobath concept in the treatment of stroke: a systematic review. Disabil Rehabil. 2020 Jun;42(12):1636-1649. doi: 10.1080/09638288.2019.1590865.
3. Díaz Arribas MJ. Métodos específicos de intervención en fisioterapia III (fisioterapia neurológica adulto: Concepto Bobath) [apuntes]. 3º Curso Grado en Fisioterapia 2021-2022 Universidad Complutense de Madrid, Facultad de Enfermería, Fisioterapia y Podología. 2022. [inédito].

WEBS

- International Bobath Instructor Training Association.
https://ibita.org/

- European Bobath Tutors Association.
https://www.bobathtutors.com/

- Bobath Centre (London).
https://bobath.org.uk/

- Neurodevelopmental treatment Association.
https://www.ndta.org/

- Clinica de Neurorehabilitación Bettina Paeth.
https://www.bobath-es.com/

- Fundación Bobath
https://fundacionbobath.org/