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CHRONIC LOW BACK PAIN: CLIENT-ORIENTED INFO EVENINGS

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The purpose of this thesis was to study updated information about chronic low back pain as it is a huge problem affecting to people of almost all ages worldwide. Thus chronic low back pain is a burden to nations' financial institutes as it causes a lot of sick leaves and early retirements, not to mention personal suffering. This is true in Finland as well.

The outcome of this thesis was two info lectures which were held in back association of Satakunta in Pori. The idea was to educate clients about chronic low back pain and give them information about it and how it can be treated with exercises. By understanding some of the reasons' behind chronic low back pain and how it can be affected by itself easies one's life.

The topics discussed in the theoretical part of the thesis include the anatomy of the spine and nervous system, pain and low back pain, brain adaptations and pain, and motor control. The study was conducted qualitative way including features from quantitative as well as there was a feedback questionnaire for the clients in the end of the info lectures.

The result of the thesis, two lectures, were done in order to share information about chronic low back pain as it is a general problem in Finland. Despite its high prevalence the reasons behind the low back pain still remains unknown in most of the cases, but knowledge about it may help to handle the problem. Most of the participants were pleased with the information they got and they felt that it was useful.

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1 INTRODUCTION

Low back pain (LBP) has high prevalence worldwide and it is one of the major concerns in health care in western industrial countries. Chronic LBP is one of the biggest reason for inability to work and persistent disability which causes huge financial costs to countries' social security institutions. Only in Finland there were over 2, 1 million sickness allowance days which cost 119, 8 million euros in year 2012 and all the costs caused by early retirements were 346, 6 million euros. (Luomajoki 2010, 2; Käypä hoito 2014; Waddell 2004, 1, 77.)

Todays' studies show that only 15% of LBP can be diagnosed making the rest 85% of LBP to be non-specific (NSLBP), some studies show the number for NSLBP to be even as high as 95%. (Luomajoki 2010, 3; Manuaali 2/ 2014; McGill 2007, 5.) As patients with chronic non- specific low back pain (CNSLBP) represents a large group of people with complex diagnostic and management challenge a classification which would underline mechanisms behind the pain has been published in order to target better interventions for the patients.

Sensation of pain happens in the brain and chronic pain leaves permanent marks which can e.g. lead to changes in the virtual body in the sensory cortex which represents all the body parts in the brain. There are evidence that people with CNSLBP have altered maps in the sensory and motor cortex and there is discussion whether the altered maps in cortex causes the whole LBP. (Wand et al 2010, 3; Wand et al 2011, 536: Luomajoki 2010, 18; Butler & Moseley 2013, 23.)

Although pain can be explained physiologically cognitive factors, meaning ones' conscious thoughts of own situation, can't be forgot. People have different coping strategies which link beliefs and behavior together, and they can be negative or positive in nature. Negative thinking like fear and catastrophizing can be an obstacle for recovery and rehabilitation and it can aggravate illness behavior and disability. This means that individuals also have own responsibility of their recovery and they do need education of self-care and therapeutic exercises in order to restore function and recover. (Waddell 2004, 226, 232- 233; Physiofile video 2014.)

2 PURPOSE AND AIM OF THESIS

Purpose of this thesis is to plan and run two lectures for clients with low back pain (LBP) in back association of Satakunta (Satakunnan selkäyhdistys). Theme for first client evening is role of brain in prolonged low back pain. The second evening will be about motor control and learning, its disturbance and effect to function. In addition to this, it will include practical training where motor control is tried to restore back to normal. Evenings will be held on spring, 2015. Clients can participate on both evenings, or choose one.

Aim is that by participating to these evenings, clients would understand more about chronic LBP, learn about it, and be less frightened about it. They would receive updated information about chronic pain: Today it is understood that brain has an important role in chronic low back pain, as studies show that brain changes in people with chronic LBP.

3 THE ANATOMY OF BACK

Anatomy provides understanding about body parts, structures and relationships among them (Tortora & Derrickson 2011, 2). In this thesis emphasis will be on the low back (LB) and anatomy of LB will be covered more detail. It includes bony structures meaning the five lumbar vertebras and associated structures like intervertebral discs, muscles involved in LB stability and associated ligaments and fascia.

3.1 Spine

The spine or vertebral column of human consists of twenty-four separate vertebrae which are divided in three region by the following: seven in cervical region (neck), twelve in thoracic region and five in lumbar region. In addition to that, five vertebrae are fused in the sacrum and four fused in coccygeal, making thirty three vertebrae in all together, in five regions (Figure 1). The body and shape of the vertebrae increase in size down from cervical to lumbar spine. (Agur & Dalley 2009, 286.)

When spine is viewed from the side it shows four slight curvatures which are called normal curves. In cervical and lumbar spine curves are bulging out (convex) and in thoracic and sacral region curves are cupping in (concave). The curves of spine has important functions as it increases its strength, help maintain balance in standing position, works as shock absorber during walking and protects vertebrae from fractures. (Tortora & Derrickson 2011, 234.) The natural curves in the spine are not fixed, but they change in different postures and during movement (Neumann 2002, 256).

There is considerable range of movement in the spine: bending forward (flexion), backward (extension), sideways (lateral flexion) and rotation. This movement is produced of summation of movements between adjacent vertebras throughout the vertebral column. Movements of vertebral column are greater in cervical and lumbar region compared to thoracic region which is the most stable due articulations with ribs. There is no movement in sacral and coccyx since they are fused together. (Agur & Dalley 2009, 288, 291.)

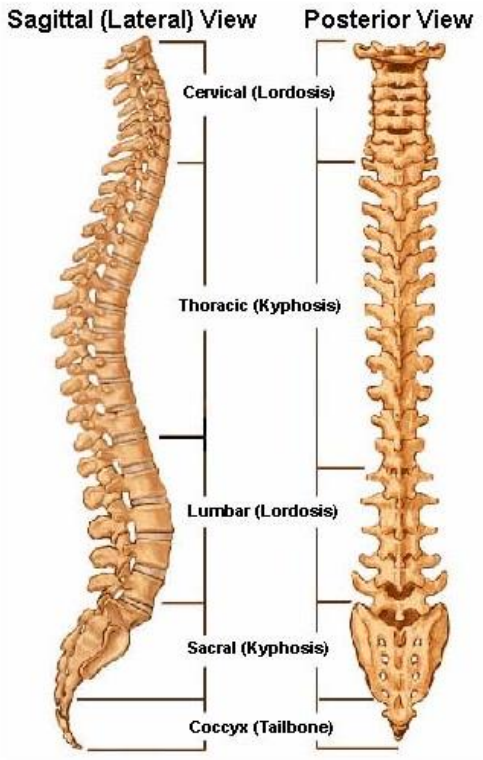

Figure 1. The vertebral column from the side (on the left) and from the back (on the right). The five regions of the vertebral column and curvature are marked. Website of Spine Universe 2014.

3.2 Vertebra

Size of the vertebrae increases downwards along the spine, and in lumbar region vertebras are the largest and strongest of the unfused vertebrae in the vertebral column (Tortora & Derrickson 2011, 241). In the lumbar region vertebrae have massive wide bodies. This is because they need to support the entire weight of the head, trunk, and arms. Their various projections, like laminae and pedicles, are short and thick, and they make up the posterior and lateral walls of the nearly triangular-shaped vertebral canal (Figure 2). (Neumann 2002, 267-268.) Junction of each laminae makes up a spinous process which are thick and broad and they provide attachment for large back muscles (Tortora & Derrickson 2011, 241).

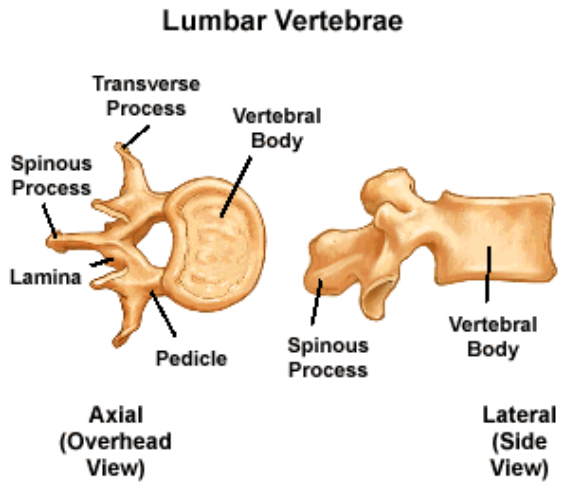

Figure 2. Showing lumbar vertebrae from the top (on the left) and from the side (on the right). Website of Colorado Spine Institute 2013.

3.3 Intervertebral disc

"Intervertebral disc are found between bodies of adjacent vertebrae from second cervical vertebrae to the sacrum" (Tortora & Derrickson 2011, 234). The intervertebral disc consists of two components: nucleus pulpous makes up the center which is surrounded by annulus fibrosus. About 70 % to 90 % of nucleus pulposus consists of water which makes it vertical shock absorber and it also transfers weight between adjacent vertebrae. The annulus fibrosus is made of collagen fibers which are precisely organized. In lumbar disc, annulus fibrosus consist of 10 to 20 concentric layers of collagen fibers which entraps the liquid- based nucleus pulposus. This strictly organized structure creates stability to the vertebral column as it restricts vertical separation, sliding or twisting. (Neumann 2002, 273-274.)

The intervertebral discs are avascular, which means that they do not contain blood vessels (Tortora & Derrickson 2011, 234). Their metabolism is taken care by end plates which are located in the superior (top side) and inferior (bottom side) surfaces of each vertebral body. They allow nutrients and oxygen to pass from blood vessels in the vertebral body to the discs and wastes to remove. (Neumann 2002, 274.)

Since intervertebral discs do not have blood vessels, their oxygen uptake and remove of wastes can be increased by certain exercises where discs are compressed and thus blood circulation increased (Tortora & Derrickson 2011, 234). Loading and movement of the spine changes the shape of the intervertebral disc and position of the nucleus pulposus. Flexion and extension movements causes intervertebral disc to be compresses and elongated simultaneously. (Agur & Dalley 2009, 307.)

3.4 Muscles

Skeletal muscles stabilize body positions and produce movements of the body. They attach to the bones by tendons and produce movement by pulling bones when they contract. (Tortora & Derrickson 2011, 367.) Active muscle force produces the primary form of stability for the spine (Neumann 2002, 329). Spine needs to be stable before movements and forces are produced in order to enhance movement which do not produce injuries. Stability is achieved with co-contraction of all muscles which should be positioned away from the spine, not drawn towards it. The most important stabilizers continually changes as the task being performed is changed. On relative basis those muscles that are the most stabilizing muscles in the back are the ones that are furthest from the spine. (Vleeming, Mooney & Stoeckart 2007, 530,535.) According to their function, muscles can be divided to stabilizers and movers (Table 1).

The main deep stabilizers of lumbar spine region is considered to be multifidus on the back, and transversus abdominis on the front (Figure 3) (Sahramann 2002, 67-69). Iliopsoas muscle is also considered to have some role in stabilizing lumbar region because its location (Figure 4). Transversus abdominis is considered to be the main stabilizer of the lumbar spine. It attaches to the thoracolumbar fascia in the back and when it contracts it contributes to the stabilization of the lumbar spine. It is also first recruited abdominal muscle for postural stabilization during movements of upper extremities in erect position. (Sahrmann 2002, 73; Vleeming, Mooney & Stoeckart 2007, 59.) Multifidus muscle is large and thick in the lumbar region and it has an important role in maintaining lumbar curve (Tortora & Derrickson 2011, 420). Multifidus exerts compression force on the lumbar spine which provides stability for the spine. Multifidus

has important role in standing and seated posture, during gait, trunk movement and when lifting or carrying load.

Quadratus lumborum attaches to the iliac crest and transverses process and its attachment suggests that it also has some role in stabilizing the spine. Erector spinae is a muscle group which consists of three muscles: spinalis, longissimus and ilicostalis muscles (Figure 5). Lateral ilicostalis muscles and the medial longissimus group make up superficial division of the muscle group. Together with multifidus it has an important role in providing mobility and stability in the lumbopelvic region. Part of erector spinae attaches to the thoracolumbar fascia and cranially to the ribs. Erector spinae muscles works over lumbar spine, but not via direct attachments to it. (Sahrmann 2002, 65, 67; Vleeming, Mooney & Stoeckart 2007, 22, 50-51.)

The muscles which are the main movers of lumbar region and sacrum (lumbosacral spinal column) are multifidus, gluteus maximus and biceps femoris. Together with ligaments these muscles also provides stability to the lumbar vertebrae and sacrum during movements as the weight of the upper body is transferred to the lower limbs. (Vleeming, Mooney & Stoeckart 2007, 5.) The iliacus originates from anterior surfaces of transverse processes of the lumbar vertebras and its main action with psoas muscle is to flex hip. Psoas, which originates from ilium, can also flex trunk laterally and by compression, stabilize the lumbar spine. (Sahrmann 2002, 68.)

Main Stabilizers of the Lumbar Spine	Main Movers of the Lumbar Spine
Multifidus	Multifidus
Transversus abdominis	Gluteus maximus
Quadratus lumborum	Biceps femoris
	Iliopsoas
	Erector spinae

Table 1. Showing the division of muscles in the back according to their function.

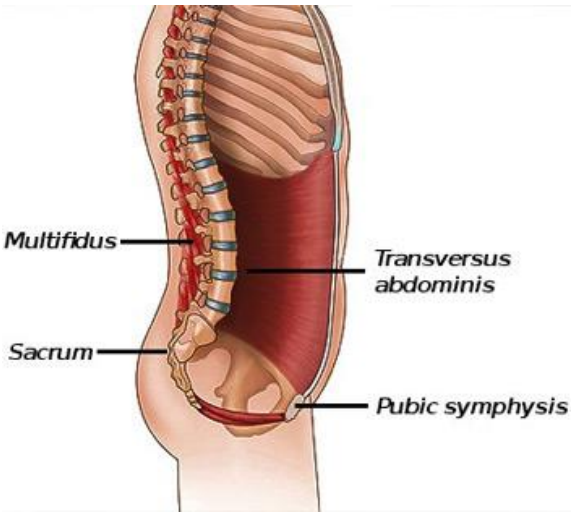

Figure 3. Showing multifidus and transversus abdominis muscles. Website of Physio-active 2014.

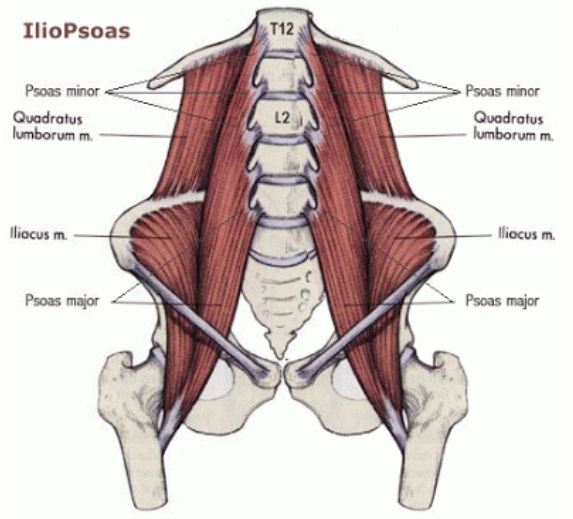

Figure 4. Showing quadratus lumborum and iliopsoas muscles. Website of Corewalking 2015.

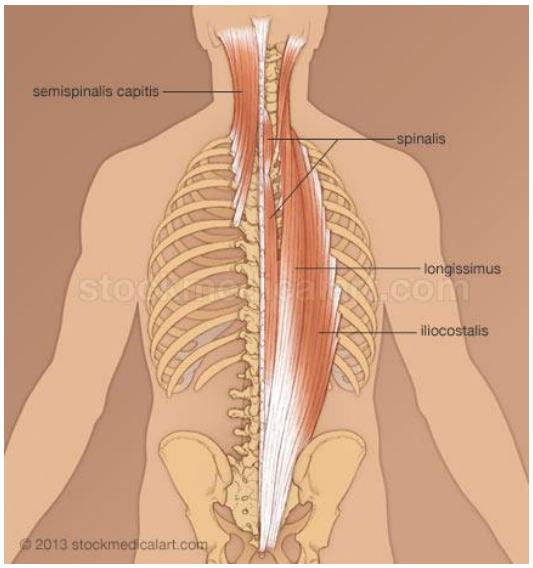

Figure 5. Showing erector spinae group: spinalis, longissimus and ilicostalis. Website of Medicalartlibrary 2013.

3.5 Ligaments

The muscular and ligamentous relationship forms connections and their relationship have an important stabilizing role in the lumbar vertebras and sacrum. Ligaments are formed from tense connective tissue and they also has a role in providing attachment sites for muscles. There are various ligaments in the lumbar vertebral column which are surrounding lumbar vertebras' and sacrum (Figure 6). (Vleeming, Mooney & Stoeckart 2007, 5 -6.)

Connective tissue sheets can be divided into three parts. Neural arch structures, the capsular structures and the ventral or vertebral body structures. Neural arch composes of pedicles, laminae, transverses processes and spine. Two major ligaments are ligamentum flavum and interspinous ligament. Ligamentum flavum is the strongest ligament, it runs from the base of the skull to the pelvis, it attaches in front and between the lamina. The medial fibers of the ligament bridge the gap between the laminae of adjacent vertebrae and fuses together with interspinous ligament which runs deep in the spinal column. Ligament flavum protects the spinal cord and nerves and also forms a roof for the vertebral canal that will not buckle during movements. It composes of elastic fibers (80%) and collagen fibers (20%). Supraspinous ligament attaches tips of

each spinous processes to the other. Articular capsular structure forms the facet or zygapophyseal joints. The two vertebral body ligaments, anterior longitudinal ligament and posterior longitudinal ligament, are primary spine stabilizers. They run the entire length of the spine and are embedded in the sheet of the bone, periosteum. The anterior longitudinal ligament is stronger of these two and it connects the front side of the vertebral body to the annulous fibrosis. The two longitudinal ligaments and ligamentum flavum stabilizes lumbar spine in extension (posterior longitudinal ligament) and flexion (anterior longitudinal ligament). (Vleeming, Mooney, Stoeckart 2007, 6-15; Colorado Spine Universe.)

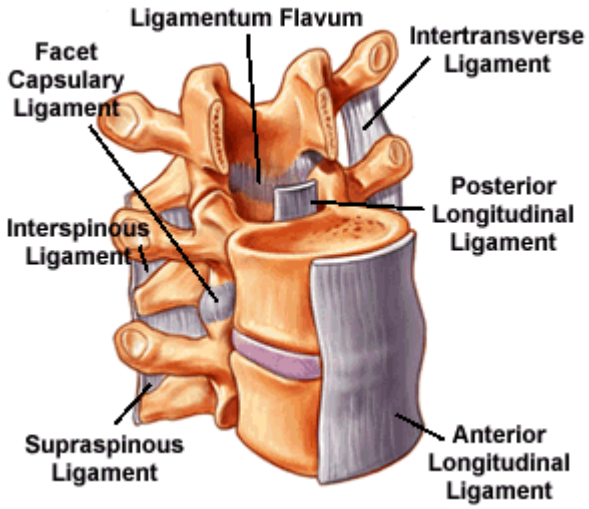

Figure 6. Showing the main ligaments in the lumbar area. Website of Colorado Spine Institute 2013.

3.6 Fascia

Fascia forms a continuous network throughout the human body. It connects all organs and tissues together and supports them. By binding the smallest units of human body, cells, together and by forming a continuous connections it keeps our body together and allows it to move as it supports movements of muscles. Study of fascia is quite new field as it was thought before that it has no important of meaning. But nowadays new reaches and journals show a steady rise. The first Fascia Research Congress (2007) proposed the definition of fascia and it was further developed in the next congress (2009). The term fascia is described as “soft tissue component of the connective tissue

system that permeates" (W. Meyers 2012 13-15; Schleip et al 2013, xv-xviii.) Fascia is found everywhere from the body, but the main focus in this thesis will be on the fascia found around and inside of the muscles, which is called myofascial (W. Meyers 2012, 4).

Each individual muscle is surrounded by connective tissue layer of epimysium which is continuous with the tendon which attaches the muscle to the bone. Each individual muscle fiber is separated by layer called endomysium. The perimysium is a connective tissue which separates muscle up into bundles of muscle fibers. (Schleip et al 2013, 5, 11.) Myofascial combines muscles together and it is now understood that this linkage has a huge role in human movement as it creates linkages between adjacent structures in longitudinal and crosswise direction. This network of myofascial can be understood as one tissue even it covers the whole body. (Myers 2013, 4-5.)

Thomas W. Myers introduced different lines of the myofascial in the body. These lines are straight or they only have a little change in direction and they have attachment to the bones. They are organized in the different depth as some lines are superficial and some deep. There are points in the body where different lines are combined or separated by myofascial but the lines has consistent directions. Basically these lines covers the muscles and fascia involved. The three main lines are superficial frontal-line, superficial posterior line and sidelines. (Myers 2013, 65.) The superficial frontal line produces flexion of the trunk (bending forward), extension of the knee and dorsiflexion of the foot. The function of this line is to balance superficial posterior line and produce stretching support from the top. The superficial frontal line needs to be on balance with superficial posterior line; if one is too tense and it shortens, the other one needs to stretch. The superficial posterior line linkages all the structures in the back together. Its function is to keep body in the vertical position and prevents it to bend forward. Lateral line combines both sides of the body from top to down. It produces side flexion, hip abduction and turns foot outward. (Myers 2013, 73, 97, 115.)

Thoracolumbar fascia (TLF) is considered to have an important role in stabilizing the lumbar spine (Figure 7) (Neuman 2002, 306; Vleeming, Mooney, Stoeckart 2007, 120; Schleip et al, 2012, 41). Thoracolumbar fascia is the most extensive in the lumbar region and it provides mechanical stability to the sacroiliac (SI) joint as well. This

tissue is separated into three layers, anterior, posterior and middle layer. Anterior and middle layers are named according to their position relatively to the quadratus lumborum muscle. They attach medially to the transverse processes of lumbar spine and inferiorly to the iliac crests. The posterior layer lies over the posterior surface of erector spinae and latissimus dorsi muscle. (Neuman 2002, 306.) The transversus abdominis and internal oblique muscles are indirectly attached to the TLF through dense connections formed by fusion of the middle layer. Latissimus dorsi, gluteus maximus, part of external oblique muscle and trapezius, are attached to the superficial part of the posterior layer of TLF as well. Deep lamina is continuous cranially with tendons of splenius cervicis and capitus muscle. (Vleeming, Mooney, Stoeckart 2007, 121-122; Schleip et al 2012, 38.) Important stabilizers of the spine, multifidus and transversus abdominis, attaches to the TLF as well and as they contract the tension of the TLF increases as well. The strong TLF is also transferring loads from the trunk to the legs. (Schleip et al 2012, 37.)

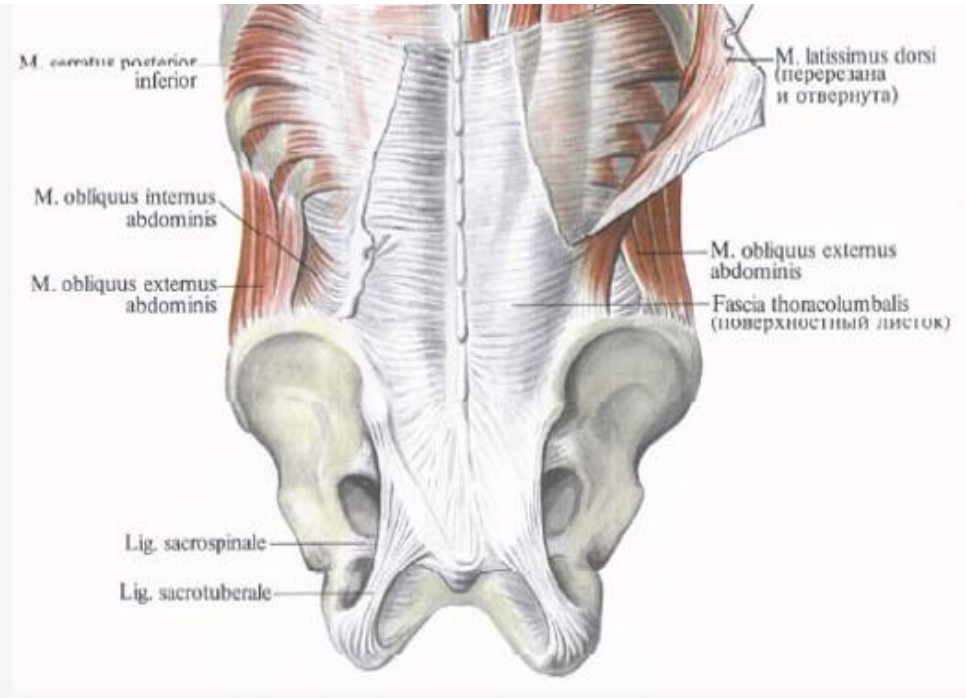

Figure 7. Showing thoracolumbar fascia. Website of Shram Kiev 2015.

4 NERVOUS SYSTEM

Nervous tissue is the most complex system in the body which is responsible for various functions such as perception, sensation, behavior, memories and it also initiates all the voluntary movements, regulates the operation of internal organs and produces speech. These functions can be dived into three groups which are discussed later. Organization of nervous system can be dived anatomically into central nervous system (CNS) which includes the brain and spinal cord, and peripheral nervous system (PNS) which contains all nervous tissue outside of CNS (Figure 8). (Tortora & Derrickson 2011, 447-448.) The CNS processes all kinds of incoming sensory information coming from the sensory receptors located in the walls neurons (nerve cells) in the PNS. Sensory receptors monitors changes in the body. PNS contains twelve pairs of cranial nerves and thirty- one pairs of spinal nerves. (Tortora & Derrickson 2011, 448; Butler & Moseley 2014, 30.)

4.1 Nervous tissue

Nervous tissue consists of two types of cells, neurons and neuroglia. Neurons (nerve cells) have ability to respond electrical stimuli by sending nerve impulses (action potentials) along the neurons surface. That is their way to communicate, graded potentials are used in short distance communication and action potentials for longer distances. This function of nervous tissue is described later more detail. Neurons form a complex network in the brain and the spinal cord, and they connect all regions of the body to the brain and spinal cord. Neurons are responsible of sensing, thinking, remembering, controlling muscle activity and regulating glandular secretion. (Tortora & Derrickson 2011,450, 454-455,458.) A single neuron consists of three main components: cell body, dendrites and axon. Cell body is the center where all the incoming information is conveyed by dendrites, and axons are the ones from where nerve impulses propagates toward another neuron, a muscle fiber, or a gland cell. A bundle of hundreds or thousands of axons and associated connective tissue makes up a single nerve which is located in the PNS. (Tortora & Derrickson 2011, 450-451.) Neuroglia do not convey impulses but they have other actions such as supporting, increase the speed of nerve impulses, nourish and protect neurons (Tortora & Derrickson 2011, 454-455).

4.2 Function of neurons

Action potentials are traveling along the nerve. The communication between neurons or between neuron and muscle cells happens in the region called synapse. (Tortora & Derrickson 2011, 341.) Nerve impulses are conveyed from receptors to CNS and from CNS to muscles or gland cells. According to the direction which way nerve impulse propagates, neurons can be divided into three groups. Sensory (afferent) neurons conveys the information to CNS, motor (efferent) neurons away from the CNS to muscles and glands, and interneurons (association) are the ones that processes incoming sensory information. (Tortora & Derrickson 2011, 454.)

4.3 Functions of nervous system

Functions of nervous system can be divided into three group. The first is sensory function, where sensory receptors, which are located in the walls and in the end of individual nerves, detects internal or external stimuli which can be mechanical, temperature change or chemical change. If sensor responds to stimuli, such as lactic acid, message is conveyed as electrical impulse to the brain thru cranial and spinal nerve where it is processed. (Tortora & Derrickson 2011, 448; Butler & Moseley 2014, 30.) This function of nervous tissue is discussed more detail in the next chapter. The second function is integrative function, which means that sensory information is processed in order to make decisions for appropriate responses. The third function is motor function. Once information from sensors is put together in the CNS nerve impulse travels thru cranial and spinal nerves to the skeletal muscles and stimulation to the muscles generates movement. (Tortora & Derrickson 2011, 448-449.)

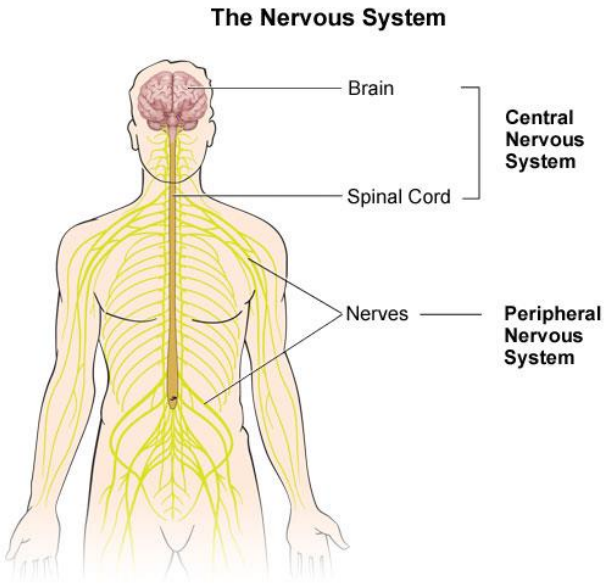

Figure 8. Showing the division of the central nervous system (CNS) and peripheral nervous system (PNS). Website of Highland Hospital 2015.

5 PAIN

According to the International Association for the study of pain (IASP) pain can be defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Website of International Association for the Study of Pain 2014). LBP and headaches are one of the most common pains in the human body (Butler & Moseley 2014, 14). Generally, pain can be divided to acute, and chronic. Acute pain is usually recent and short duration when it is quickly diagnosed and with appropriate treatment it usually resolves. (Koestler & Myers 2002, 9- 10.) Chronic pain is the emphasis in this thesis so it is discussed more detailed.

5.1 Chronic pain

Pain is considered to be chronic when it lasts more than three months and persist beyond the normal tissue healing (Website of International Association for Study of Pain 2014.) Chronic pain can divided into nociceptive and neuropathic pain. Nociceptive pain is caused by tissue damage caused e.g. by injury. In low back pain tear in the

intervertebral disc is a major tissue involved in nociceptive pain. Neuropathic pain is caused by damage or disease in the nervous tissue. (Luomajoki 2010, 11; Website of medicine net, 2015.) Chronic pain can be caused by active disease processes, tissue damage or some other insults to the body. Different conditions can lead to chronic pain, like cancer, rheumatoid arthritis, cardiac diseases headaches and musculoskeletal problems. (Koestler & Myers 2002, 11.) When pain persist and changes into chronic pain it is because brain has, for some reason, concluded that there is danger and it needs to be protected (Butler & Moseley 2013, 11).

5.2 The emergence of pain

The whole nervous system contains sensory receptors called nociceptors, millions of them. They are specialized so that some will react to mechanical stimuli, such as pins, some temperature changes (hot and cold) and some chemicals, either inside of the body (lactic acid) or outside of the body (allergens). They are located in the skin, bones, joints muscles and internal organs. When nociceptor detects stimuli e.g. from the tip of the finger, graded potential is developed in the sensory receptor of the skin. This evokes action potential in the sensory neuron and the action potential (message of the stimuli) travels along peripheral nerve to CNS, to the spinal cord. From there the stimulus travels to the thalamus of the brain and thalamus decides to where the impulse is sent next. Brain gets messages from the receptors simultaneously and the sensation like "painful" is produced in the brain based on all information it receives from all the receptors, not only danger receptors (Figure 10). Pain evokes in the brain, after thalamus has sent the message to different regions of the brain, the input by the nociceptors on its own is not enough to cause the pain. In addition to that, persons old experiences, fears and believes affects to final sensation of the pain. (Tortora & Derrickson 2011, 459-460; Koestler & Myers 2002, 22; Butler & Moseley 2013, 30, 39; Physiofile video, Explain pain.)

Pain can be understood as a response to stimulus when brain judges the situation to be threatening or dangerous. This means that there can be injury in the body, like in the nerve or ligament in the back, but unless brain does not conclude the situation to be dangerous or threatening, it won't evoke any pain. In other way around, there might

not be anything wrong in the tissue, but if brain thinks there is a danger, it will hurt. (Butler & Moseley 2013, 8.)

Brain makes the final decision whether something is dangerous or not and needs proper response, like sensation of pain, which is protecting and maybe vital for survival. Before it was thought that there is only one pain center located in the brain which evokes the pain. Nowadays it's known that there are hundreds of brain parts which are involved in creating the sensation of pain, and these areas are called ignition areas. As pain is a unique experience these parts vary from person to person. These parts of the brain include clusters on nodes used for sensation, movement, emotions and memory. During pain experience these parts link up with chemically or electrically. The precise pattern of activity which causes the pain is called a neurotag of the pain. A possible pain neurotag involves premotor cortex, cingulate cortex, prefrontal cortex, amygdala, sensory cortex, hypothalamus, cerebellum, hippocampus and spinal cord. (Butler & Moseley 2013, 11, 38- 39.)

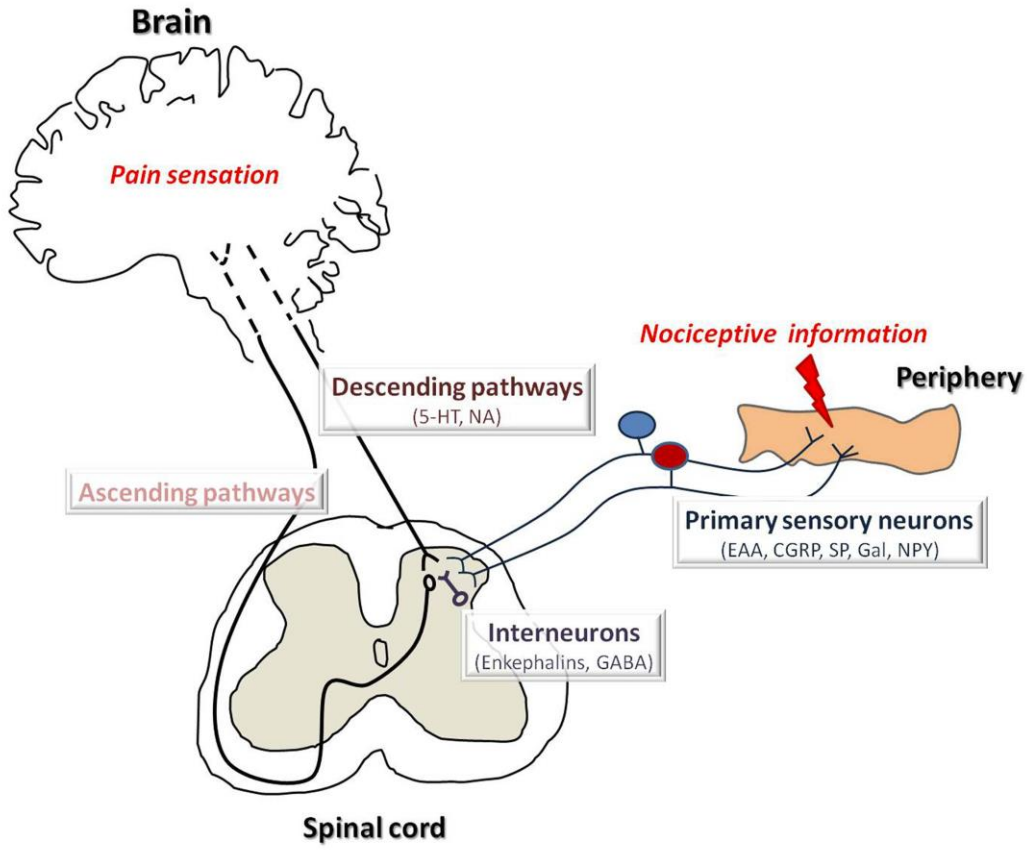

Figure 9. Showing parts that are involved in pain sensation. Website of Intechopen 2014.

5.3 Cognitive factors combined with pain

Cognitive factors mean conscious thoughts what person e.g. with chronic pain has about own condition. These factors have to be taken into consideration with people with chronic pain. Although pain can be explained physiologically, cognitive factors are warning signs for person with pain. Person can have different thoughts and expectations about his or her pain, like fear, which can even maintain the pain. People have different mental strategies they use to cope with pain. Copying strategies link beliefs and behavior together, and they can be negative or positive in nature.

Fear avoidance means that person is too afraid of doing things that might hurt or evoke pain. Person becomes inactive because of fear which usually brings other problems because of overuse of some muscles and underuse of some. When pain becomes chronic, there is very little relation between pain itself and fear-avoidance belief. Catastrophizing is negative thinking and worrying about pain and one's ability to cope with it. Patient may think that the reason for pain will never be found and there might be feeling of hopelessness that pain will never go away. Catastrophizing leads to psychological and physical dysfunction and these kind of people cope quite badly. Hypervigilance means that person's whole life is about pain as person puts all focus on that. Persons' capability to control the pain is called self-efficacy. This means that how patient is able to control own pain and situation. Person's background, like previous experiences and memories has a connection on self- efficacy. (Waddell 2004, 226, 232- 233; Physiofile video 2014.)

Perception of pain is influenced by mental strategies and beliefs one has about pain. Some mental factors are useful but some are not. Negative thinking like fear and catastrophizing can be an obstacle for recovery and rehabilitation and it can aggravate illness behavior and disability. Beliefs give a mental image about the problem and it can lead even to depression. People with pain can have mistaken beliefs about their situation. (Waddell 2004, 232- 233.)

6 LOW BACK PAIN

Even medicine has made great advances past two centuries low back pain (LBP) still remains burden and one of the major concerns in health care in the western industrial countries. LBP has high prevalence in western countries and in Africa, too. The most important consequence of LBP is its' impact on individuals and their families' lives as it affects to daily activities and wellbeing. Chronic LBP is one of the biggest reason for inability to work and persistent disability which causes huge financial costs to countries' social security institutions. Only in Finland there were over 2, 1 million sickness allowance days which cost 119, 8 million euros in year 2012 and all the costs caused by early retirements were 346, 6 million euros. (Luomajoki 2010, 2; Käypä hoito 2014; Waddell 2004, 1, 77.) Todays' studies show that only 15% of LBP can be diagnosed making the rest 85% of LBP to be non-specific (NSLBP), some studies show the number for NSLBP to be even as high as 95%. (Luomajoki 2010, 3; Manuaali 2/ 2014; McGill 2007, 5.)

6.1 Definition

LBP is difficult to distinguish form sacroiliac pain in the pelvis and usually they are studied together as LBP is defined by most surveys between the costal margins and the gluteal folds (Figure 11). There are two ways of viewing LBP. The first is the pathoanatomical model where the origin of pain can be determined and also the stage of condition can be stated. In the second model the pathoanatomical model cannot be found and focus is on where pain is felt and what can be done in terms of centralization of the pain. (Waddell 2004, 71; Vleeming, Mooney & Stoeckart 2007, 381-382.) LBP is also often explained as instability (Luomajoki 2010, 7).

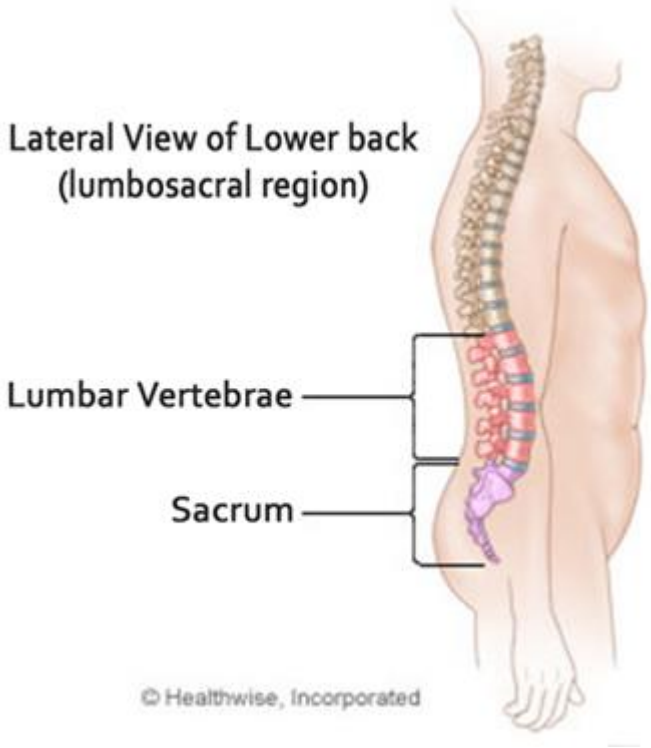

Figure 10. Spine and location of low back pain. Website of My Health Alberta 2015.

6.2 Causes

A lot of different aspects, like structures, peripheral mechanisms, CNS and cognitive-behavioral, have to be considered as a causes of LBP as it is complex and multidimensional symptom. Many clinical findings or structural findings (MRI) are not reliable. (Luomajoki 2014, 22.) Growing evidences show that postural, movement control and proprioceptive deficits may be caused by changes in the central sensitivity (Luomajoki 2010, 22).

Control of the trunk muscles has been proved to change with people with LBP. Pain, fear of pain, swelling and inflammation affects to deep stabilizing muscles of the lumbar spine so that the activation delays which disturbs motor control. As deep stabilizing muscles do not activate early and strongly enough, more superficial muscles starts to work too much in everyday life. Superficial muscles start to be too active, tense and their ability to relax is gets more poor. (Richardson, Hodges & Hides 2004, 129; Manuaali 2-3/ 2012.) People suffering from LBP has been found reduction of size of mul-

tifidus and activation has worsened (Richardson, Hodges & Hides 2004, 152; Vleeming, Mooney & Stoeckart 2007, 23, 52; Manuaali 2-3 /2012). There are same kind of founding's about transversus abdominis muscle as well (Rickhardson, Hodges & Hides 2004, 164). Also it has clinically noted that there is an increased activity in quadratus lumborum and psoas major (Richardson, Hodges, Hides 2004, 147).

It is still not fully understood which comes first, pain or motor control disturbances. Does pain cause changes in motor control or whether changes in motor control lead to pain. Some studies show that deficits in motor control lead to poor control of joint movement which can slowly progress into micro trauma which evokes pain. Opposite can be true as well, pain can lead to motor control disturbance. (Richardson, Hodges, Hides 2004, 130.)

6.3 Risk factors

There is no strong evidence of any single risk factor that could predict LBP. Because back problem has a tendency to recurrent, individual's history with back pain can be considered as risk factor that predicts back pain. Interventions targeted to the risk factors of back pain has not shown any benefits, either. Risk factor can be broadly divided in to individual and environmental. (Käypä hoito 2014; Waddell, 2004, 92.)

Individual risk factors for LBP includes such things as age, gender, smoking, physical fitness, and psychosocial factors. LBP is common in adolescents and teenage aged 11-18 years. There is moderate evidence of competitive sports linked to increased back pain at adolescents. Slightly higher prevalence of back pain has reported from women, but it's also known that women do seek more easily help from the health care than men. There is some clinical evidence which suggest that physically active people recover from acute back pain faster and are less likely to have chronic back pain. Psychosocial factors include negative thinking, like catastrophizing, which has an effect on back pain. (Waddell 2004, 92- 99.)

Environmental factors include things as repetitive heavy lifting, bending and twisting, static work postures and sitting. Spine is most likely damaged during activities that

include twisting, lifting and bending. Companied loading and twisting is a high risk for discuss prolapse. Sitting itself do not cause back pain, but long periods of sitting can provoke the pain, and the cause is still something else. (Waddell 2004, 101-104.)

6.4 LBP classification

Most guidelines divide LBP simply in to three groups: serious, radicular and non- specific low back pain (NSLBP). Serious LBP covers only 1 % of the cases which are usually caused by fracture, tumor or anomalies. Radicular pain covers about 5% of the cases. Nerve root irritation can cause problems in the motor and sensory function in the lower limbs corresponding to the affected nerve root. In NSLBP the reason for pain cannot be found. LBP can also be divided according to the length of the pain to three stages: acute (pain sustains less than 6 weeks), sub-acute (pain sustains 6-12 weeks) and chronic (pain more than 6 months). (Luomajoki 2010, 3; Käypähoito 2014.)

As patients with chronic non- specific low back pain (CNSLBP) represents a large group of people with complex diagnostic and management challenge a classification which would underline mechanisms behind the pain has been published in order to target better interventions for these patients. Classification is difficult since group is large and heterogenic and different countries have different approaches. Different subgroups help to identify and treat people suffering from the NSLBP more effectively and individually. New classification was published in 2005 by O' Sullivan. In that classification NSLPB is divided into three group, each containing 30 % of the cases. Subgroups are into central, or maladaptive, movement impairment and movement control impairment (MCI). Subgrouping has also been criticized by some researchers who states that the main problem with CNSLBP is the representation in the brain and current approaches are ineffective. Central pain is considered to be caused by psychosocial factors like catastrophizing and fear avoidance which can lead to depression and maladaptive mood. Movement impairment causes painful restrictions of movement. In MCI active movement control is impaired during functional movements, it can cause pain in certain positions like sitting, standing or twisted positions. Sustained position may provoke back pain but functional movements are not restricted. MCI is direction

specific provoked because of flexion, extension, rotation or multidimensional direction movement. (Luomajoki 2010, 6-7; O' Sullivan et al 2014, 311-312; Niemi 2012, 8, 9-11.)

6.5 Therapeutic exercise

Therapeutic exercise is well and systematically planned performance of bodily movements, postures or physical activities. Aim is to prevent impairments, restore physical function, reduce health related risk factors or optimize health, fitness or sense of well-being. Therapeutic exercise is planned for individual needs and it can contain different activities or actions. (Kisner & Colby 2012, 2-3.)

Treatment of CLBP is a challenge as it is psychophysical condition where holistic approach is needed. According to evidence based treatment guidelines therapeutic exercise is one of the rare recommended therapy and its importance in sub-acute and chronic back pain is undeniable. (Lehtola 2014, 4.) Therapeutic exercise which focuses on training motor control and stabilization of the back muscles is proved to reduce pain and returning of functional capacity. By training motor control, activation order of muscles is tried to restore back to normal. That reliefs pain and contributes tissue healing if there is inflammation. Motor control exercises effects to CNS' and PNS' ability to work together. During motor control exercises deep stabilizing muscles must activate at the right time with right power generation and hold that activation for long enough. Specific motor control exercises restores functional capacity with people suffering from CLBP. After two weeks of specific transversus abdominis muscle activation exercises the function of motor cortex was restored almost back to stage with person who has not back pain. (Niemi 2012, 10-11; Kuukkanen 2014, 5.)

There is evidence that lumbar multifidus muscle is affected with people suffering from LBP. As it has such a big role in stabilizing lumbar spine it has to be taken into account in therapeutic exercise. (Richardson, Hodges & Hides 2004, 152.) The most effective training method is exercises that influences by increasing cross- sectional area of the multifidus with people with CLBP (Vleeming, Mooney, Stoeckart 2007, 54).

LBP has tendency to recurrent and there is no consensus on the factors that causes it (Luomajoki 2010, 3). Deep stabilizing muscles of the back do not restore back to their normal function after onset of back pain without exercising and lack of exercising is also a risk factor for recurrent of LBP. Impaired motor control is also a risk factor for recurrent of LBP. (Niemi 2012, 13.)

7 BRAIN ADAPTATIONS AND PAIN

Central nervous system (CNS) has inherent capacity to adapt, or reorganize, according to its functional demands and this adaptation is called brain plasticity. Adaptation in the CNS can include i.e. structural changes. These changes refer to organism's history, meaning earlier learning and experiences. CNS retains its capacity to adapt throughout life. This reorganization of CNS is part of normal behavior and learning. (Carr & Shepherd 2010, 3-4.) Plastic changes has also been seen in pain related areas in brain in people with LBP and recent evidence shows that neural mechanisms affects in transition from acute to chronic pain, even the exact mechanism behind chornification of LBP still remains unclear. These changes can be seen with neuroimaging devices like functional magnetic resonance spectroscopy (fMRS) and electroencephalography (EEG). Changes can be categorized to different groups as neurochemical, structural or functional. (Wand et al 2010, 1-2; Ivo et al 2012, 1958-1959.)

7.1 Neurochemical changes

Neurochemical profile has been compared between healthy individuals and people with CLBP. Evidences show that there is awry with people with CLBP; significant changes in the dorsolateral prefrontal cortex (DLPFC), thalamus and orbitofrontal cortex has been found. Shift from normative increases as duration and pain increases. DLPFC has an important role in controlling pain perception and some results from studies show that it has role in brain reorganization in CLBP. Thalamus has an important role in sending nociceptive input to the cortex. There is no evidence which would show that pain would cause these changes in the brain, but still some more data

is needed in order to understand these causes of ongoing pain. (Wand et al 2010, 1-2; Ivo et al 2012, 1959.)

7.2 Structural changes

Many studies show structural changes in the brain with people with CLBP. Especially reduction of gray matter volume in different parts of brain has been seen in DLPFC, the right anterior thalamus, the brainstem, the somatosensory cortex and the posterior parietal cortex. Atrophy of grey matter affects the perception and modulation of chronic pain. Distinct gray matter volume reduction have been observed in addition to CLBP in various types of headaches, fibromyalgia, and rheumatoid arthritis. (Wand et al 2010, 1-2; Ivo et al 2012 1959; Mao 2013, 2981–2990.)

7.3 Cortical changes

Growing evidence shows cortical reorganization in brains with people with CNSLBP (Wand, et al 2011, 536; Ivo et al 1959). In motor and sensory cortex different body parts are represented in virtual body called ‘homunculus man’ (Figure 11) Homunculus is plastic and thus representation is changing all the time and it can be affected with training, rehabilitation and drugs. Different body parts have different representation in the cortex according to need. Areas which need very exact control and differentiation have bigger representation, like hands, lips and tongue. They also have more sensitive sensation and resolution compared e.g. to low back which have smaller representation and thus smaller differentiation. Sensory cortex of the brain registers which parts from the body afferent stimulus are coming. Motor cortex sends output through corticospinal tract to the muscles and results in controlling movements or sequences of movements. (Luomajoki 2010, 17-19; Physiofile video.)

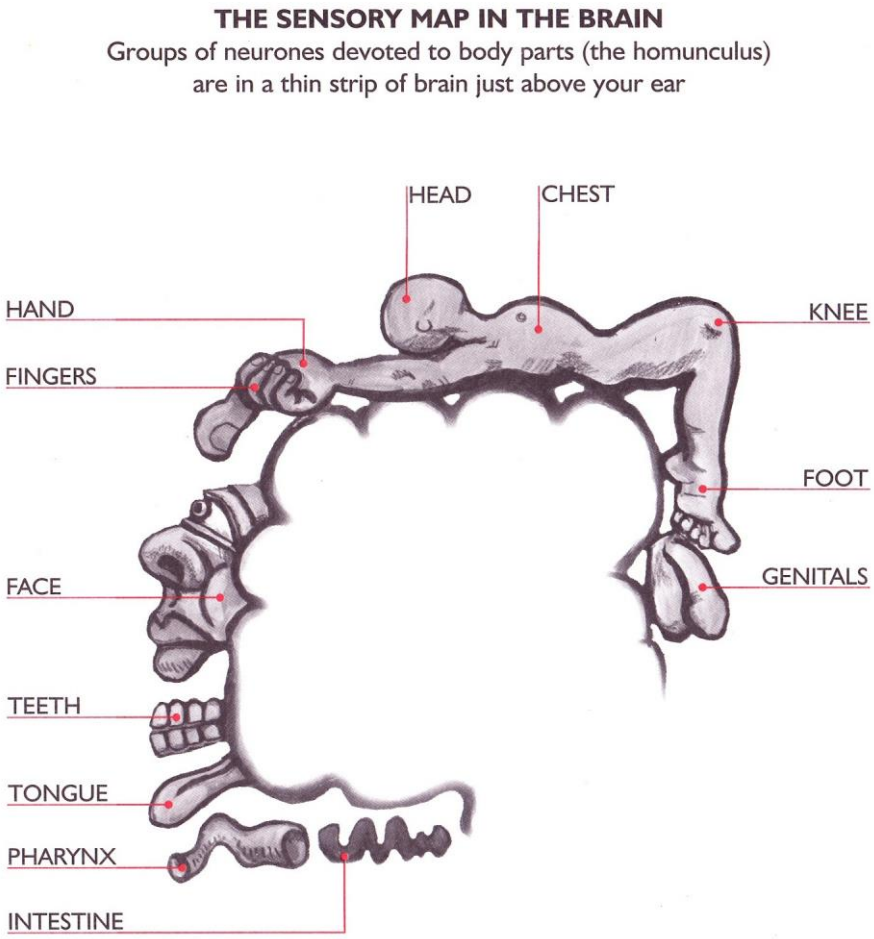

Figure 11. Shows the relationships of representations of the different body parts in the sensory cortex. Website of Specialist Pain Physio 2015.

There is evidence that people with CNSLBP have altered maps in the sensory and motor cortex and there is discussion whether the altered maps in cortex causes the whole LBP. These people have perceptual disturbances, and altered body perception and this is considered to be due disruption of cortical representation. They might have difficulties in outlining their back when it is asked to perform, they are worse identifying letters drawn to their back, they have poorer tactile acuity and problems making judgments of the direction of trunk rotation. In some cases people with CLBP have reported that they have feeling of back being apart from them and they consider that back can't be controlled anymore. (Wand et al 2010, 3; Wand et al 2011, 536: Luomajoki 2010, 18.) Two point discrimination test can be used as a measurement tool when evaluating the tactile acuity of the skin of low back. Patients' ability to distinguish

between two light stimuli which are applied to skin simultaneously with a specific measurement tool is being tested. (Luomajoki 2010, 18.)

Virtual body in the brain can become smudging due to changes in the motor and sensory cortex. This makes it difficult to locate the pain and also difficult to use that body part as motor control activation worsens as well (Figure 12). In addition, areas in the brain which are usually separated to different body parts or functions starts to overlap. Brain is changing all the time, like if index finger is used more the area in the homunculus man increases as well, so it can be effected with training and exercising. Also the parts of the brain which are involved in making the sensation of "pain" become more sensitive, which means that it is more sensitive to the pain because it decides more easily what is dangerous. The longer pain persists, the more there will be changes in the brain. (Butler & Moseley 2013, 23, 38, and 76.)

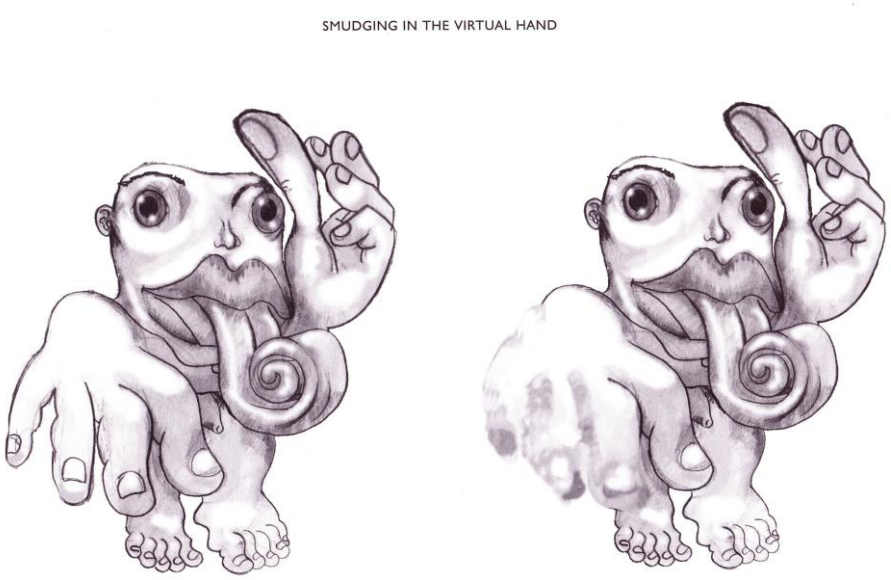

Figure 12. Shows how body part which is affected by chronic pain can start to be smudging in the virtual body in the brain. Website of the Specialist Pain Physio 2015.

8 MOTOR CONTROL

Movement is needed in everyday life since it is essential ability to perform such tasks as running, eating and playing. Movement arises from interaction of different processes, like those that are related to perception, cognition and action. Before performing movement output arises from the CNS and goes to muscles and glands. Also interaction of three factors, task, individual and environment, is needed in order to produce movement. (Shumway- Cook & Woollacott 2007, 4-5.) Motor control is the "ability to regulate or direct the mechanisms essential to movement" (Shumway- Cook & Woollacott 2001, 1). Motor control involves multiple processing levels including many parts of brain such as spinal cord, brain stem, diencephalon and the cerebellum (Shumway- Cook & Woollacott 2007, 46).

8.1 Motor learning

Before performing any skilled movement or exercise individual must first learn. Motor learning is described as "a complex set of internal processes that involves the acquisition and relatively permanent retention of skilled movement or task through practice" (Kisner & Kolby 2007, 27). This means that learning involves processes and it results in relatively permanent changes. Motor learning is a result of practice and experience and it cannot be measured directly but it can be seen from the individual's behavior. (Kisner & Kolby 2007, 31; Shumway- Cook & Woollacott 2001, 27.) Motor learning is about acquisition and modification of the movement. The amount of practice is the most important factor in retaining the motor skill. (Shumway- Cook & Woollacott 2007, 22, 35.)

In addition, the amount, type and variability affects in extend of learning and retaining the motor skill. Types of practice can e.g. include part practice and whole practice. In part practice the task is broken down into smaller dimensions and after learning the separate segments they are put together so the whole task is being performed. In whole practice the task is not practiced in separate segments. Types of practice can also include physical and mental practice. In physical practice task is functionally performed but in mental practice visualization about how motor task is being performed is used

with functional training. Mental practice has been shown to enhance motor skill learning faster compared using physical practice alone (Kisner & Colby 2007, 32.)

Motor learning has three stages which are cognitive, associative and autonomous. In the first, cognitive stage, individual need to figure out 'what' to do and 'how' to do. In this stage active thinking is needed in all segments in order to perform the task. As individual need to focus on the task itself and on own body alignment, learning can be distracted if attention is disturbed because of environment, such as noise. Variation between the performances may be huge. Progress is fast and one benefits form the constant feedback. In associative stage individual is able to use self-correct errors when needed. One is able to make slight variations and modifications to movements as well. Performance improves and becomes more stable and less attention is needed when practicing. When individual is able to perform the task correctly without need to pay attention to tuning of the movement one has reached the final, autonomous stage. Individual is able to adapt the movement and little of any instructions are needed in this stage. Movements are well coordinated and stable, and only little progress happens in the performance. (Kauranen 2011, 356; Kisner & Colby 2007, 27, 30-31.)

Motor learning is individual due to individual's characteristic and different performances, earlier experiences and developmental stage. Because skills and learners are different motor learning is different every time. Sometimes learning can be linear which means that the more there is practice the more one will learn. Another option is that learner learns fast in the beginning but then it slows down during the learning process. This can also happen vice versa, that first learner learns slowly and then the process becomes faster. (Jaakkola, Liukkonen & Sääkslahti 2000, 163-164.)

Feedback is considered to be the second most important variability after practice. Feedback can be described as "sensory information that is received and processed by the learner during or after performing or attempting to perform the motor skill" (Kisner & Colby 2007, 32.) In motor learning feedback provides information about the quality of the task and about the result, is the goal reached or not. (Kauranen 2011, 382.)

Feedback can be divided into intrinsic and extrinsic feedback. Intrinsic feedback are the sensory information individual gets when performing the required task. Intrinsic

feedback can be coming from inside the body which means proprioceptors or outside which means sensory information from receptors in the eyes, ears or sense of smell. Extrinsic feedback comes from outside, it is additional to proprioceptive feedback. Physical and cognitive status influences on the types of feedback that is given and has the most positive impact. It can be verbal, visual or auditory. It has been shown that feedback which focus on the outcome has better effect on enhancing a new motor skill than feedback which focuses on details. When individual gets feedback one gets information how to reach the goals. (Kisner & Colby 2007, 32.)

8.2 Teaching

Teaching is relationship between the learner and the teacher. This will evolve feelings for one another, like joy, rejection, acceptance and maybe anger. Teacher should find the best way to translate the education and goals for the learner so that he or she could be able to use it in everyday life. When teaching takes place teacher or instructor should take into consideration that people learn different way. Visual person learns when watching. Another can learn better when hearing someone to explain. Kinesthetic person learns the best when things are concrete, one can try and make mistakes and learn that way. Analytic learner enjoys problem solving and learns that way the best. (Jaakkola, Liukkonen & Sääkslahti 2000, 165; Mosston & Ashworth 1994, vii.)

When learning a new motor skill the one who is teaching should also know in which stage the learner is, in cognitive, associate or autonomous stage. In that way the instructor is able to choose right type of exercises, commands and feedback according to learner's skills which will benefit the learner the most. In the first stage learner is responsive which should be taken into consideration. When focus is put to the task itself which is being learned it will promote learning. In the first stage instructor needs to give clear and short commands. Environment should be closed and feedback should be given once only for one thing and it should focus on the main points in the task. In the associate stage more detailed parts can be exercised and variation can be applied as well. Environment can be open and feedback can be a summary of different things. Learner can monitor him- or herself and mental practice can be taken part of the program as well. In the final, autonomous stage, practice can be modified in the different

environments. Performance will be finalized and feedback can be summarized. Learner needs to take more responsibility of exercising. Amount of mental practice can be added. (Kauranen 2011, 419- 421.)

8.3 Motivation

Motivation is defined as “how we move ourselves or others to act” (Kisner & Colby 2007, 46). Motivation can also be described as something that makes people to reach own or community’s aims. Motivation is process where individual’s personal, social and cognitive factors are combined. It can give energy to certain behavior or it can guide the behavior to certain direction, e.g. thanks to motivation athlete may be able to train hours per day in order to improve his or her results. Motivation can be divided into intrinsic and extrinsic. In intrinsic motivation one does something for him or herself, and that action may bring joy and experiences. According to studies, intrinsic motivation is a key factor in order to learn and enjoy about the activities. One is also more likely to stay in these kind of activities. As person enjoys activities she or he is performing the learning process is also progressing better. In extrinsic motivation activities are performed because of some kind of reward or punishment. Orders come from someone else and they can be in conflict with own feelings and views. (Jaakkola 2000, 117-119.) Cognitive factors are related to motivation as well. Self-efficacy is one’s belief or confidence in completing the task, goal or needed change. Positive self-efficacy is studied to be one of the key factors is successful participation in physical activity. (Kisner & Colby 2007, 46.)

9 SATAKUNNAN SELKÄYHDISTYS/ BACK ASSOCIATION OF SATAKUNTA

Back association of Satakunta has been founded in 1997. Its activities are fully based on volunteer work, they don’t have any workers who would get paid. However, they still have an office which is provided by the city of Pori for free. Pori city also funds their activities by giving money every year. Back association of Pori has approximately 200 members and their membership fee provides the biggest financial income

for association. The core activities at the moment are lectures provided every month with variable topics. In addition to that they have every week aqua gymnastics and gym group. All in all, back association provides information about healthy lifestyles and tips for back pain. Instructors and lecturers do not get paid and most of the evenings are open for everyone, not only for those who are members of association. According to chairman K. Lohivuo. (Personal communication on 21.5.2015.)

10 PRACTICAL IMPLEMENTATION

Practical implementation included two lectures which were held in Satakunta back association (Photograph 1) (Satakunnan selkäyhdistys) in the city of Pori. Both of the evenings were organized on Thursday afternoons' and they were held in Finnish since all the participants were Finnish. Need and interest for these kind of lectures came from the back association. Association also did the marketing in the local newspaper and they also used advertisement made by me and Anna Makeeva from my class.

The first evening was held 12th of February 2015. For the first evening 14 came to listen, 11 of them were women and 3 were men. Mean age between the participants was 68 years. Feedback was asked after the lecture, in which 11 of them replied. Most of the questions were open questions which turned out to be bad decision since participants were lazy to answer to them. That's why I decided to change the feedback form for the second evening so that it included closed questions. It makes it easier and faster for participants to answer. First question was that how long they have had chronic back pain. Four of them did not answer anything, one answered that for one month, two that for ten years, one that twenty years, one that thirty years and one that 55 years. The second question was that how useful they considered that the evening was for them. Nobody answered that evening was not at all useful; most replied that it was really useful.

First part of the evening was the actual lecture. Topic was the role of brain in prolonged back pain. Lecture took approximately 25 minutes and after that there was a practical part which included the two point discrimination test. It was optional for participants

to take part for that, but most of them were eager to try and see the results as it was a new tool for most of the people.

Photograph 1. The theoretical part of the lecture in the back association of Satakunta.

The second evening took place in 21st of May. In that evening 7 people showed up to listen, 5 of them were women and 2 of them were men. Their mean age was 70 years. Feedback was asked this time, too, but I had done some modification for the questionnaire in order that it would be easier for them. This time everybody gave answers, but I also gave the feedback form early enough so that they did not have chance to leave before I had handed it. First question was that for how long they have experienced back pain, one participant left that empty but others answered. It was pretty clear that most of them has been experiencing back pain for over 20 years (Table 2). Theoretical part was considered to be the most interesting part of the evening, it was asked in the second question (Table 3).

1-5 months	-
6 months- 1 year	1 answer
1-5 years	-
6-10 years	1 answer
11- 20 years	-
over 20 years	4 answers

Table 2. Showing the answers for the question how long you have been experiencing back pain?

Pain	-
Motor Control	2 answers
Practical part	5 answers

Table 3. Showing the answers for the question what was the most interesting topic?

When asked, participants told that they liked the evening and they felt that it was useful. In the first implementation I felt nervous but in the second evening I was more relaxed. Only setback was experienced before the second evening started: their laptop did not start to work which meant that I could not show my power point show. It was pity but as nobody was able to fix that problem I had to speak without it. Afterwards I sent the presentation to the association so that they could check it.

Otherwise both evenings went well. No other problems occurred and I was on time when preparing the presentations. Challenge was to be able to speak so that clients could understand my message, which meant that I could not use any special words since the topic was complicated anyway. Overall practical implementation went well and I and the clients were pleased. I can recommend this type of thesis for everyone. It forces you to learn thoroughly the topic and gives valued experience of giving lectures, which is basic work for some physiotherapists'.

11 THESIS PROCESS

Thesis process began in October 2014 and ended in October 2015 (Table 4) In October 2014 topic was decided and after that started the research of the topic. Actual writing started in the end of December 2014. Contract was signed in the January 2015 and implementations were held in February and May 2015. During the process there were no problems or delays, and all in all the process was quit smooth. Co-operation with the client went well as well and it was nice to work with them.

October 2014	Topic was decided and agreed with teacher.
November 2014	Meeting the client at Satakunta back association.
December 2014	Researching topic relating to LBP and writing theory.
January 2015	Meeting the client and signing the contract.
January- February	Writing theory.
February 12th 2015	First implementation evening at Satakunta back association.
March- April 2015	Writing theory.
May 21st 2015	Second implementation evening at Satakunta back association.
August- September 2015	Finalizing the written part.
October 13th 2015	Presenting the thesis.

Table 4. Showing the thesis process.

12 DISCUSSION

I came across with this topic when it was proposed by a teacher at the school. My field of interest is musculoskeletal physiotherapy and as LBP is a common problem it was not difficult to say yes to this topic. I have met a lot of clients with LBP in my clinical

practices and I was eager to deepen my knowledge of it. This topic was strongly connected to physiotherapy and as I already had little knowledge of this I felt that it was easy to continue from what I had learned at school and in clinical practices by writing a thesis of it.

After deciding the topic I started to research about LBP. I started with studying other peoples' thesis' which came out to be fun and useful thing to do. Not only did I learn how to write a thesis but I also learned about references that I could use as well. As there is a lot of surveys done considering LBP there is also a lot of books written about it and many of them are found from the school library.

The next step was to go to the library to seek some of those books and to do some research of references. First it felt easy but the more I red and searched for information the more difficult it became. I was not sure how to build the framework and what to cut out. But little by little it became clear what I should include and in the end of the autumn term I finalized the table of content. It took time to do and it was difficult at times but in the end when it was done it was done. Only slight changes were done later during the writing process.

The actual writing started on December. Table of content was my map for writing. I had had little holiday until I started to write and I was full of energy at the time I started to write. During Christmas brake I had two weeks to write without any other stress factors in my life, which was good. I could focus on my thesis and I knew I had time but at the same time I knew that I need to write as much as possible. When school starts there will be other things as well so I had to write as much as possible in advance.

When school started I felt really loaded. It was really hectic at school already during the autumn and the same continued on the spring term. I had to write the theory after school days couple times a week at least and on some weekends as well. As I was writing I felt constantly that there is not enough time. At the same point I was not sure if I had enough time to plan and prepare the first evening for back association.

Time flew and weeks went by, but luckily I made everything in time, even it felt a bit rushed through. The first lecture went well and majority of the clients were pleased for

the content. After first implementation I had time to continue writing and I made the final changes in the theory. At that time I had more time and I was relaxed since we did not had any schooling left. The second evening went well, too. It was just before the summer and after that I started my holiday and I did not think my thesis at all. During the summer there was no progress in my thesis but when autumn term started I continued finalizing my thesis. I was able to do it without any rush before I started another clinical practice once again.

All in all, the whole process of thinking, planning, writing and implementing went quite nicely. At times I felt loaded and stressed because other school work had to be done simultaneously but then I just decided to take the time for writing. Even if it was Friday evenings after school, but that style suited me well. Under pressure this thesis was put together less than a year which was good thing to me and maybe for a teacher, too.

For the future, I can recommend similar kind of lectures to be held. As LBP is a common problem and there is a lot of research material available I think this is great way to spread the word for the people who suffers of this problem. Theory and practice can be met in this kind of evenings. People with LBP can find a lot of information from the internet of their own but it’s not always easy to determine the right kind of information there is found. These evenings gave the relevant and updated knowledge they can adapt to everyday life and understand LBP little more.

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APPENDIX 1


Aivojen rooli pitkittyneessä alaselkäkivussa
Johanna Kanto
12.2.2015

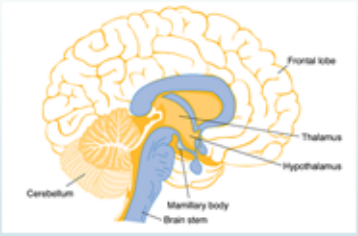

Illan sisällys:
Kivun aistiminen
Aivojen mukautuminen kipuun
Kahden pisteen erottelutesti

Kivun aistiminen

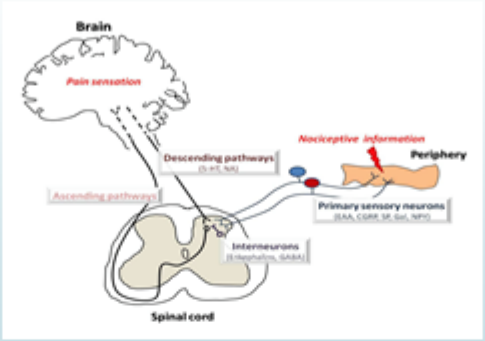
- Tuntohermopäätteet lähettävät viestejä aivoihin
- Kivun aistiminen syntyy aivoissa, pelkästään hermopäätteiden aktivoituminen ei riitä herättämään kipua
- 'Kipu' voidaan ymmärtää aistimuksena, joka syntyy kun aivot tulkitsevat tilanteen uhkaavaksi tai vaaralliseksi

Kivun aistiminen

- Tuntohermopäätteistä kipuviesti siirtyy talamukseen aivoissa, joka lähettää viestin eteenpäin
- Aivoissa sadat eri alueet ovat mukana tuottamassa lopullisen kipuaistimuksen
- Lopulliseen kipuaistimukseen liittyy myös omat uskomukset, pelot ja kokemukset



Kivun astiminen



Kivun aistiminen

- Kipu voidaan ymmärtää aistimuksena, jossa aivot tulkitsevat tilanteen vaariliseksi tai uhkaavaksi

Voiko kipuun tiedollisesti vaikuttaa?

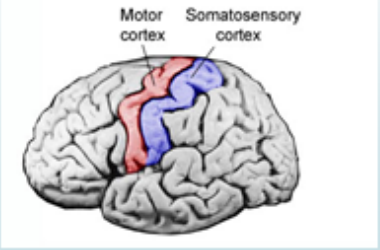
- Negatiivinen ajattelu voi olla kuntoutuksen tai parantumisen esteenä
- Stressi ja pelko voi johtaa kivun pitkittymiseen
- Krooninen kipu saattaa johtaa vääristyneisiin uskomuksiin omasta tilanteesta

Voiko kipuun tiedollisesti vaikuttaa?

- Pelkoväittämiskäyttäytyminen→ pelko liikkua
- Katastrofisointi→ liioittelu, toivottomuus
- Hypervigilanssi→ liika keskittyminen vaivaan, joka alkaa haitata elämää

Aivot mukautuvat kipuun

Figure F-3: Motor and Somatosensory Cortex



Aivot mukautuvat kipuun

- Krooninen kipu jättää aivoihin 'merkkejä' jotka häiritsevät motorista ja sensorista liikealvokuorta, jotka sijaitsevat aivoissa vierekkäin
- → kivun sijainti on vaikeampi hahmottaa
- → liikkeiden säätelyn hallinta vaikeutuu
- Virtuaalinen hahmo, 'homunculus' sensorisessa aivokuoressa edustaa kaikkia kehonosia, krooninen kipu voi muuttaa virtuaalisen kehon häiliyväksi
- Alueet jotka tutkitsevat 'kivun' tulevat herkemmiksi

Aivot mukautuvat kipuun

Aivot mukautuvat kipuun

- Kahden pisteen erottelutesti

kehonosa	Erottelutarkkuus
sormet	2-3 mm
ylähuuli	5mm
poski	6mm
nenä	7mm
kämmen	15mm
otsa	15mm
jalkaterä	20mm
maha	30mm
olkavarsi	35mm
SELKÄ	**39mm**
olkapää	41mm
reisi	42mm

Aivot mukautuvat kipuun

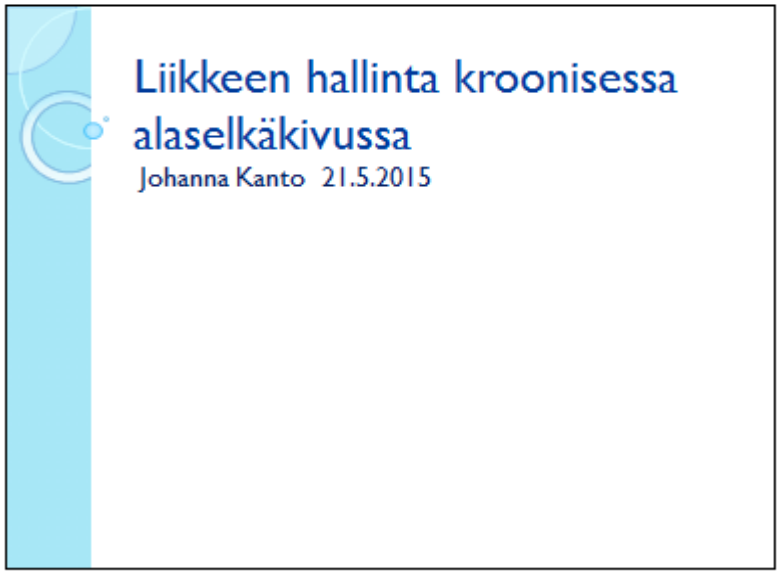
- Motorisen ja liikeaivokuoren kartat ovat muuttuneet
- → Kehon hahmotus on häiriintynyt
- → Vaikea tuntea selän ääriviivat tai vartalon kiertoliikkeet
- → Vääristyneitä liikemalleja

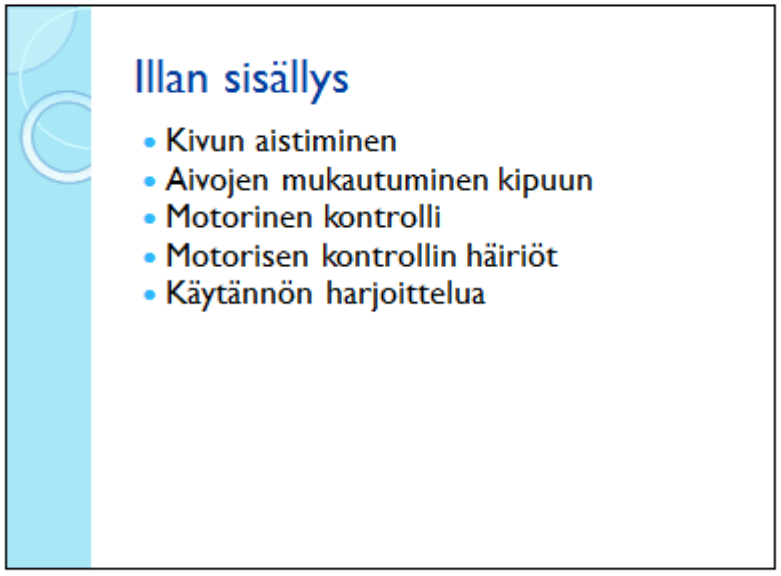
Aivot mukautuvat kipuun

- Keskushermostolla on periytyvä ominaisuus muovautua tai mukautua toiminnan mukaan
- Muutoksia huomattu myös kroonisesta alaselkäkivusta kärsivien aivoissa
- Muutokset sitä voimakkaampia, mitä kauemmin kipua on ollut

Aivot mukautuvat kipuun

- Kivun aistiminen tapahtuu aivoissa
- Kipu syntyy koska aivot ovat tulkinneet tilanteen uhkaavaksi
- Omalla ajattelulla voi vaikuttaa kipuun
- Krooninen kipu jättää aivoihin 'merkkejä' joka aiheuttaa hahmotushäiriöitä ja vääristyneitä liikemalleja
- → Hahmotusta voi harjoitella esim. piirtämällä selkään kirjaimia
- Krooninen kipu herkistää niitä osia aivoista, jotka osallistuvat kivun tuntemuksen tuottamiseen
- Kivun kroonistumisen tarkkaa syytä ei vielä tunneta


Liikkeen hallinta kroonisessa alaselkäkivussa
Johanna Kanto 21.5.2015

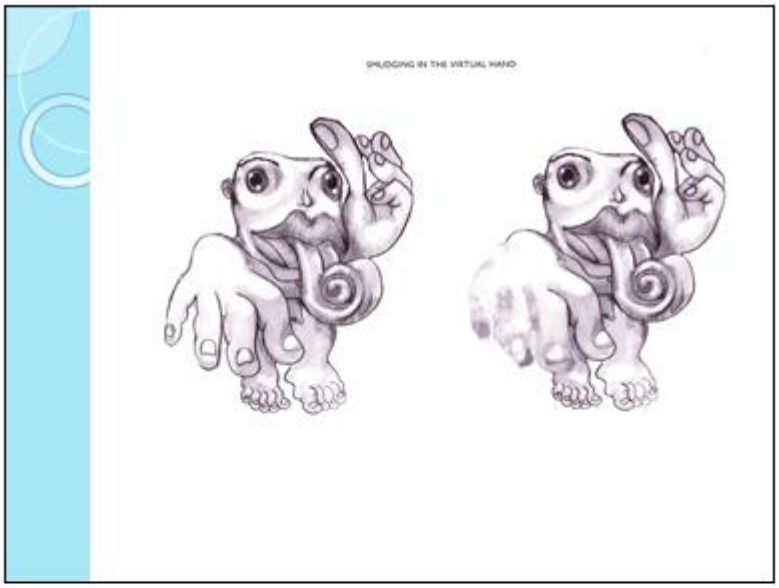

Illan sisällys
Kivun aistiminen
Aivojen mukautuminen kipuun
Motorinen kontrolli
Motorisen kontrollin häiriöt
Käytännön harjoittelua

Kivun aistiminen

- Tuntohermopäätteet lähettävät viestejä aivoihin
- Kivun aistiminen syntyy aivoissa, pelkästään hermopäätteiden aktivoituminen ei riitä herättämään kipua
- 'Kipu' voidaan ymmärtää aistimuksena, joka syntyy kun aivot tulkitsevat tilanteen uhkaavaksi tai vaaralliseksi

Aivot mukautuvat kipuun

- Krooninen kipu jäätää aivoihin 'merkkejä' jotka muuttavat virtuaalista kehoa aivokuoressa
- → Kehon hahmottaminen vaikeutuu
- → Liikkeiden säätely vaikeutuu
  → Vääristyneitä liikemalleja



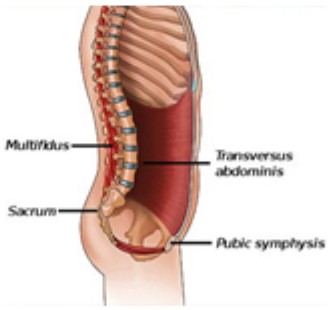
Motorinen kontrolli

- "Kyky säädellä ja ohjata liikkeiden ja liikkumisen kannalta keskeisiä elinjärjestemiä" (Kauranen 2011)

Motorinen oppiminen

- Kolme vaihetta:
  - Tietoinen vaihe
  - Harjoitteluvaihe
  - Autonominen vaihe
- Harjoittelu
- Palaute
- Motivointi

Syvät (stabiloivat) lihakset



Syvät lihakset

- Syvien lihasten tehtävänä on vastata stabiliteetista ennen liikkeen alkamista sekä asennon ylläpitämisestä
- Tulisi olla aktiivisia koko liikkeen ajan
- Poikittainen (syvä) vatsalihas ja multifidus kiinnittyvät alaselän lihaskalvoon ja siten stabiloivat lannerankaa
- Yhdessä nivelsiteiden kanssa syvät lihakset vastaavat alaselän stabiloinnista

- Alaselkäkivusta kärsivillä on todettu syvien lihasten:
  - Kontrollin puutetta
  - Aktivaation viivästymistä
  - Toimimattomuutta
  - Surkastumista (lihaksen poikkipinta-ala pienentyy)
  - → Palautuminen vaatii pitkäjänteistä ja kontrolloitua harjoittelua
  - → Pinnalliset lihakset joutuvat 'ylitöihin'

Pinnalliset lihakset

- Tuottavat liikettä
- Vastaavat voimantuotosta

- Kun pinnalliset lihakset aktivoituvat liian herkästi, ne jännittyvät, ja niiden kyky rentoutua heikkenee

Alaselkäkipu ja motorinen kontrolli

- Kun syvien lihasten aktivointi viivästyy pinnallisten lihakset aktivoituvat liian herkästi
- →Liikkeiden säätely (motorinen kontrolli) häiriintyy
- → Vääränlaisia liikemalleja

Terapeuttinen harjoittelu

- Terapeuttisella harjoittelulla pyritään palauttamaan lihasten aktivaatiojärjestys (motorinen kontrolli)normaaliksi
- Syvien lihasten tulee aktivoitua tarpeeksi aikaisin, oikealla voimantuotolla ja aktivaatio pitäisi pysyä tarpeeksi kauan
- → Lannerangan tuki
- → Kipu vähentyy
- → Toimintakyky parantuu

Käytännön harjoituksia

- Minikyykky:

1) Hartioiden levyinen haara-asento
2) Paino tasaisesti jalkapohjilla ja varpaiden tyvinivelillä
3) Koukistetaan lonkat ja polvet
4) Viedään takapuolta taaksepäin, ikään kuin istuisi tuolille

Hei!

Opiskelemme kolmatta vuotta fysioterapiaa Satakunnan Ammattikorkeakoulussa ja teemme kaksi erillistä opinnäytetyötä yhteistyössä Satakunnan selkäyhdistyksen kanssa. Tarve opinnäytetöistä on tullut selkäyhdistykseltä, ja olemme kiinnostuneita aiheesta.

Ensimmäisen opinnäytetyön toteutus on kaksi selkäiltaa: ensimmäinen ilta pidetään 12.2.2015 ja toinen 21.5.2015. Ensimmäisen illan aihe on aivojen rooli pitkittyneessä selkäkivussa ja toisen keskivartalon hallinta ja motorinen kontrolli.

Toisen opinnäytetyön aihe on kinesioteippauksen vaikutus krooniseen alaselkäkipuun. Tämän toteutukseen tarvitaan noin kymmenen vapaaehtoista, teippaus suoritetaan 12.2 pidettävässä selkäillassa. Teippi pidetään noin viisi päivää. Tarkoituksena on tutkia kinesioteippauksen vaikutus krooniseen alaselkäkipuun. Osallistujilla ei saa olla teippiallergiaa, ongelmia alaselän ihon kanssa (ihottuma, infektiot), myös raskaus saattaa olla este osallistumiselle.

Toivotamme kaikki aiheesta kiinnostuneet tervetulleiksi! Selkäilloissa olisi hyvä olla päällä mukavat ja juostavat vaatteet ☺

Terveisin opiskelijat Johanna Kanto ja Anna Makeeva.

APPENDIX 4

Palaute selkäillasta

12.2.2015

Ikä_____

Sukupuoli: mies nainen

Kuinka kauan sinulla on ollut kroonista alaselkäkipua?

_____

_____

_____

Oliko ilta sinusta hyödyllinen?

Ei yhtään hyödyllinen Hyvin hyödyllinen

1 2 3 4 5

Mahdolliset kommentit:

_____

_____

_____

_____

Mistä olisit halunnut kuulla lisää?

_____

_____

_____

Mistä aiheista haluaisit tulevaisuudessa kuulla selkäilloissa?

_____

_____

APPENDIX 5

Palaute selkäillasta

21.5.2015

Ikä_____

Sukupuoli: mies nainen

Kuinka kauan sinulla on ollut kroonista alaselkäkipua? (ympyröi)

1-5 kk

6kk- vuosi

1-5 vuotta

6-10 vuotta

11- 20 vuotta

yli 20 vuotta

Mikä oli kiinnostavin aihe? (ympyröi yksi vaihtoehto)

1 kipu
2 motorinen kontrolli
3 käytännön harjoittelu

Oliko ilta sinusta hyödyllinen?

Ei yhtään hyödyllinen Hyvin hyödyllinen

1 2 3 4 5

Mahdolliset kommentit:

_____

_____

Mistä aiheista haluaisit tulevaisuudessa kuulla selkäilloissa?

_____

Lupa ottaa valokuvia

Tilaisuudessa otetaan valokuvia, joissa saatat esiintyä. Saako kuvia käyttää opinnäytetyössä?

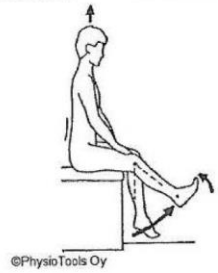
kyllä ei

Allekirjoitus ja nimen selvennys

_____

_____

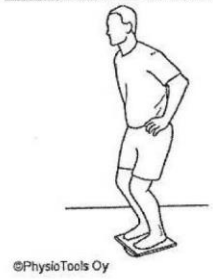
Kuvia käsitellään luottamuksellisesti eikä niitä käytetä muuhun tarkoitukseen.



Polven ojennus istuen
ALKUASENTO: Istu ryhdikkäästi selkä keskiasennossa, hartioiden painopiste lantion yläpuolella ja jalat rentoina.

SUORITUS: Pidä selkä keskiasennossa (alaselässä normaali notko), ojenna hitaasti toista polvea. **Älä anna lantion kallistua taaksepäin, kiertyä tai selän taipua**. Älä nojaa taaksepäin. Kädet voi pitää lanteilla, jotta tuntee selän hallinnan.

(adpt Sahrmann PhD, PT)



Minikyykky

Ohjeet:
Seiso jalat rinnakkain, jalkaterät ja polvet osoittavat samaan suuntaan. Kyykisty pieneen kyykkyyn **koukistamalla lonkkia ja polvia**. Pidä selkä ja niska suorana.