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The role of gravity traction in physiotherapy: A systematic literature review

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Abstract

Since low back pain (LBP) has been studied to be one of the most common health problems in the word, and traction, has been studied to be one treatment method for managing the low back pain.

Physiotherapy field is using different methods in treating pain and low back pain, and recent studies have shown effects on traction to be inefficient and not reliable for treating pain in general, but still, the patient evaluation and proper screening needs to be made to achieve results. Gravity traction is a one method to consider, but the studies and materials related to pain effects are hard to find or controversial.

A systematic literature review aim is to find reliable and evidence-based data about the role of gravity traction and the effects on pain, which tells the need for the study.

Furthermore, by screening through studies and articles, the outcome has been surprising, which characterizes the need for re-studies. Most of the cases, gravity traction needs a device to perform the traction itself, so commercialized businesses has taken advantage from that. Recent open access studies and articles are hard to find and reliability suffers massively.

In conclusion, the role of gravity traction in physiotherapy, is still a big mystery. Suggestion of more open access studies need to be done and the study behind the method of "Gravity traction" needs to be updated.

Key words search from key word list but not link
Gravity traction, physiotherapy, low back pain

CONTENTS

1 INTRODUCTION

Low back pain (LBP) is one of the most typical health problems worldwide (GBD, 2015). In many LBP cases the pathology of the pain remains unknown and is therefore classified as non-specific back pain (Gracey et al., 2002). Since the pain in LBP cases is commonly felt in the lower part of the back, it is termed as low back pain but the distinction from the pain in the higher back is hard to make, because usually the pain is very similar. Yet, LBP is known to be reported four times frequently than mid-back pain and physiotherapy and physiotherapists have a key role in the management of low LBP. (Schaafsma et al., 2015; Niemeläinen et al., 2006.)

Traction therapy in a variety of forms is recognized to be applied for almost 4000 years for different spinal disorders (Gay and Brault, 2012). Latin word 'tractico', which refers to a process of drawing or pulling the structures apart from each other (Saunders, 1979). That is why acknowledging the spinal structure and structures around it is important. It consists of ligaments, muscles, and joints for example and the relation between them needs to be acknowledged to know why traction or gravity traction is or is not reliable method for pain management. (Highsmith, 2020.)

Throughout a systematic literature review, the aim is to gather statistics and data by screening through relevant studies and articles. The aim of this thesis is to study and find out the possible evidence-based effects of gravity traction on the spine in relation with pain management. The objective that this thesis has, is to gather possible evidence of how low back pain can be managed by using gravity traction and because of several arguments about the effects and reliability of traction as a method, this thesis will analyze and review whether the gravity traction has positive or negative implications to manage pain.

2 SPINE

2.1 Anatomy of the spine

Spinal column's role (vertebral column or backbone) is to provide in cooperation structural and nervous system support for the entire body. Strong middle-body muscles, such as transversus abdominis, internal and external obliques and rectus femoris helps the spine stay upright and helps the spine manage stress while moving. (Highsmith, 2019.) Also, to function normally, the spine needs help from back muscles such as intertransverse muscles, interspinal muscles and rotator muscles and one major muscle, the erector spinae (extensor muscles), which lays over the three muscle groups just named, maintains the spines' natural curve. When the vertebral column performs extreme bending, twisting or flexion movements, it needs support for stability from spinal muscles and tendons. (Highsmith, 2020.)

The spinal column is a central vertical support frame to which articulated ribs and hips and skull. the spine is divided into five major sections: the cervical, the thoracic, the lumbar spine, sacrum, and coccyx as seen in Figure 1. The sacrum and the coccyx is located at the base of the spine. The whole vertebral column is covered by total of 33 different bones called vertebrae and naturally fused vertebrae the sacrum and the coccyx. 24 vertebras are movable and the remain 9 are fused. (Highsmith, 2020.)

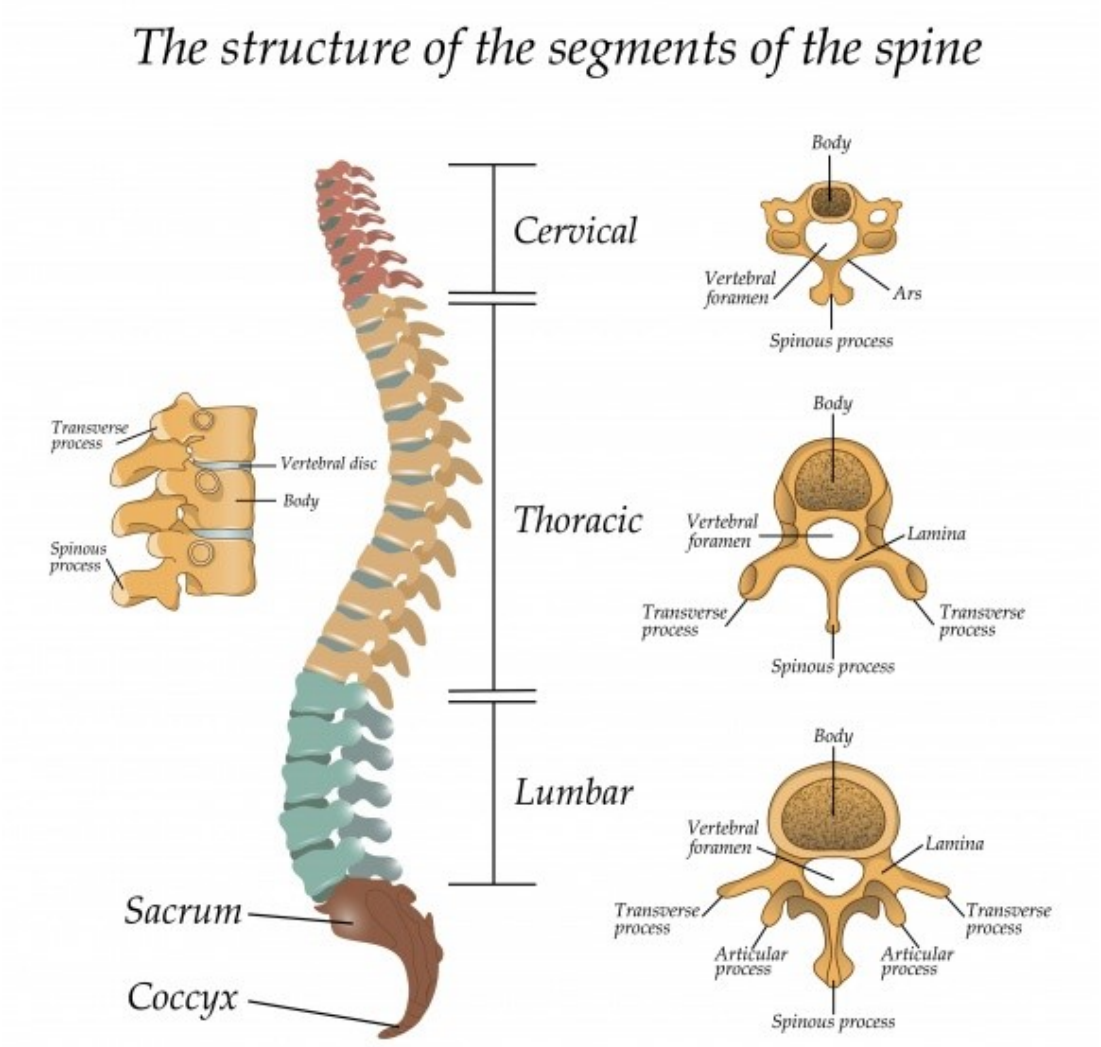

Figure 1. The structure of the segments of the spine (Highsmith, 2020)

Figure 1 shows the structures and regions of the vertebral spinal column. Cervical section of the spine consists of seven vertebrae C1-C7 (C1 is the atlas and C2 is the axis). The Cervical section, also known as neck part, is supporting the head and the whole weight of it. Cervical section provides the most range of motion due the two specialized vertebrae that attached to the skull, but also high flexibility brings high risk of injuries, such as whiplash-injury. Sudden, strong movements can cause harm due the limited muscle supports in the cervical region. (University of Maryland Medical Center, 2020.)

Ring-shaped atlas vertebrae (C1) connect directly to the skull which allows the joint to perform flexion and extension primary movements. C2 is peg-shaped and primary

movement of C2 is rotation which is co-operating with C1. C3-C7 are more classic vertebrae than more special C1 and C2. C3-C7 include having pedicle, body, laminae, facet joints and spinous process. The main purpose is to help the range of motion but also unlike other part of the spine it has transverse foramina in each vertebra to provide blood to the brain. (Physiopedia, 2019a.)

Thoracic spine consists of 12 vertebrae T1-T12 which naturally curves outwards, also called kyphosis. T1 connects below C7 and the last vertebrae of thoracic section (T12) connects below rib cage and first vertebra of the lumbar section (L1). (eOrthopod.com, 2020.) Thoracic spine holds the rib cage and protects the lungs, heart, and spinal cord. While the cervical section is built to be more mobile, the thoracic region has limited range of motion when forward and backwards movements are performed, due the rib cage. On the other hand, thoracic section offers more stability to the spine. (Yezak, 2018.) T1-T12 are made of the same vertebrae parts than other sections vertebras and the main section is formed by a vertebral body like seen in Figure 2 and the size varies slightly from the neck down. By increasing the size of vertebra from neck down, it lets the spine to balance and support large muscles, that connect to the lower parts of the spine. Figure 2 shows how the bony ring connects to the back of every vertebral body and this provides protections for spinal cord. When the vertebrae are on top of each other, it forms a tube that protect and surround nerves and spinal cord. Laminae creates a roof for the nerve tissue. (eOrthopod.com, 2020.)

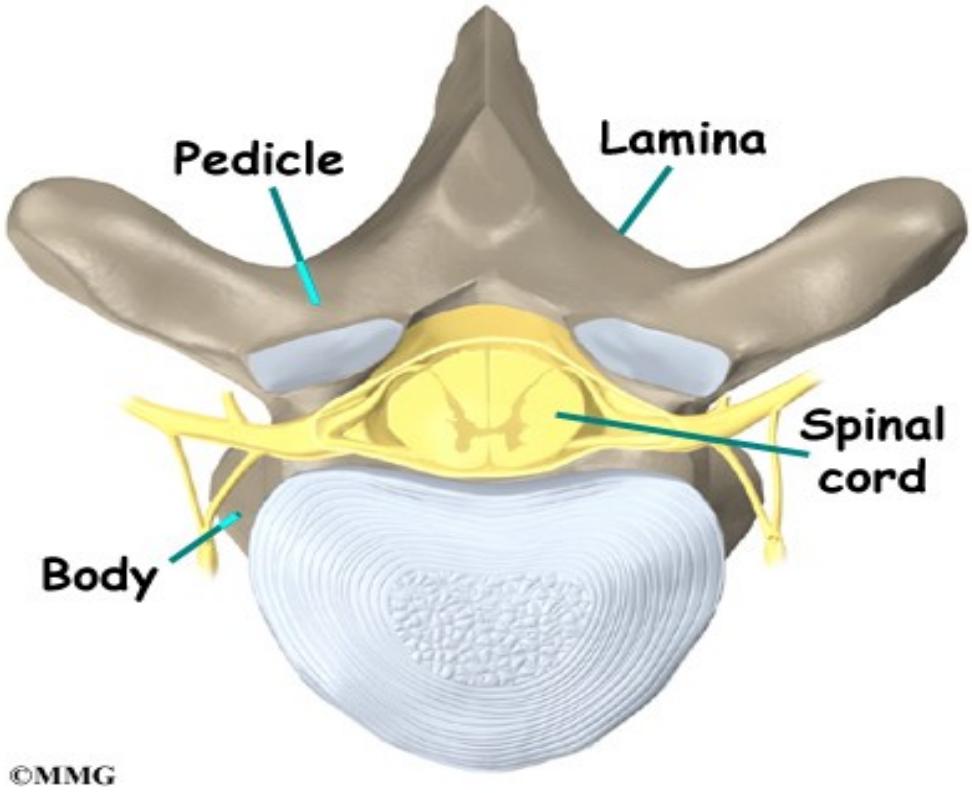

Figure 2. Vertebral body (eOrthopod.com, 2020)

Lumbar spine consists of five vertebrae L1-L5. Normally the spine creates a double-S curve when viewed from the lateral view and it is under a high degree of stress and loads resulting usually pain. Main functions for L1-L5 is to support and stabilize the upper body. Like earlier said, the vertebrae size is larger to more we go down. These vertebrae support the weight of upper body, which includes head and neck. Various primary movements of the trunk come from lumbar section. Including front and back movement, side to side and twisting movement. Like the thoracic section, lumbar section provides protection for the spinal cord. (Beasley, 2020.)

The sacrum is located in the pelvic cavity and organs, urinary bladder, colon and rectum all inhabit within the pelvic cavity. The sacral region consists of S1 and S5, but between 18-30 these vertebrae fuse together to form one solid bone called sacrum. The sacrum supports upper body weight and helps sitting and standing function, but also greatest an anchor for spinal column to attach to the pelvis and provides stability for the core. The sacrum consists of small holes along both sides of the sacrum, also known

foramen. Anterior foramen creates a channel for the blood vessels and sacral nerves to run smoothly. (Brouhard, 2020.)

Like seen in Figure 1 the coccyx locates in the base of the spinal column. However, the individual development, the coccyx may vary from three to five different bones, that are naturally fused- or semi-fused- joints and/or disc- like ligaments. Coccyx is always fused together, but it is not created to be only one solid bone. The movement limitations that coccyx have, is located between the bones permitted by fibrous joints and ligaments. Small movements that coccyx is able to do are slight forward and backwards when the pelvis, hips and legs perform movements. When standing up or sitting down, pelvis, including the coccyx rotates to outward and inward positions to perform better balance and support for the body. The coccyx creates vital functional role for pelvic floor muscles. These muscles are helping with running, walking, anus and aid in defecation and vagina support. (Staehler, 2017.)

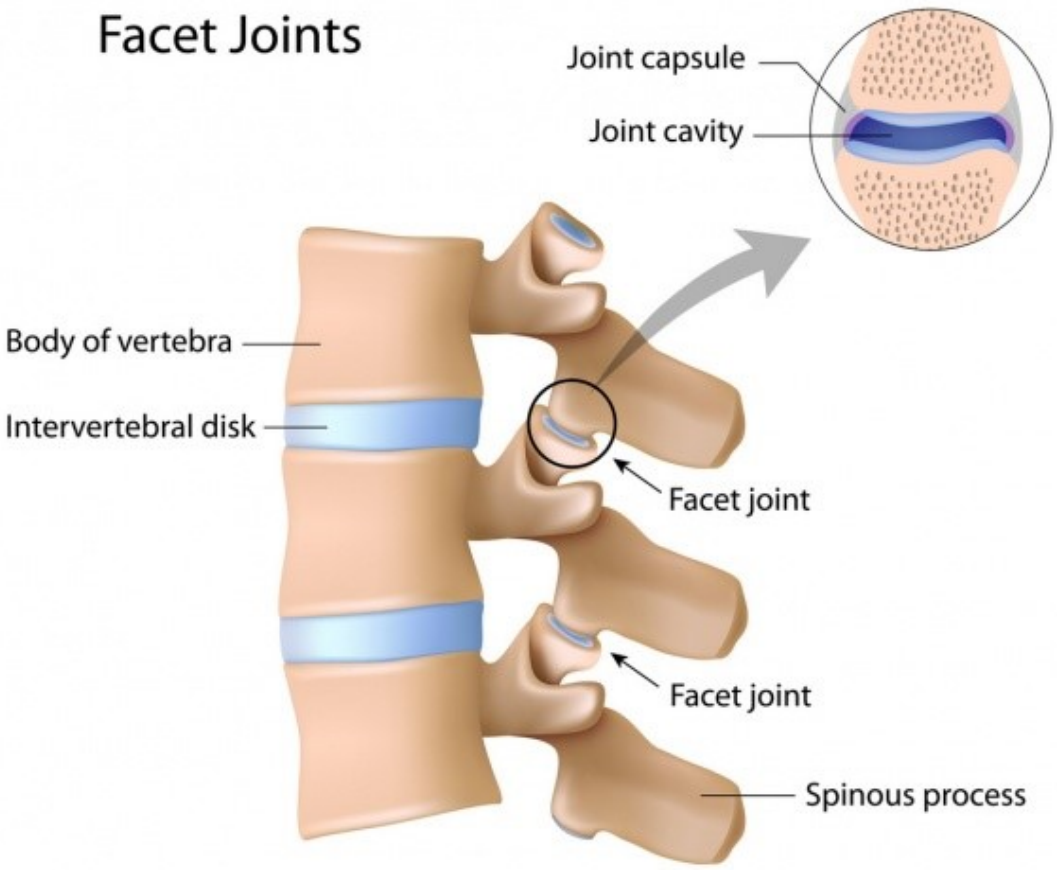

Figure 3. Facet joints (Highsmith, 2020)

The spine does not only consist of bones. It consists of ligaments, muscles, and joints for example. First among other important structures is facet joint. Facet joints are associated with each vertebra. Each vertebra has four facet joints where two of them face upwards and another pair that face downwards. The main purpose of facet joints is to help spine to stabilize while performing flexion, extension, and twisting movements. Capsule of connective tissue encloses each facet joints, it provides nourishing fluid that lubricates the joint which allows the spine to move smoothly. (Highsmith, 2020.) Figure 3 above shows the structure of facet joints.

Facet joint osteoarthritis is widely common with older adult population. With increased age, the facet-mediated pain occurs more with older adults with spinal pain and it might have a crucial role in it. Evidence shows that lumbar facet joint injection and land-based lower back mobility exercise and soft tissue mobilization may have

beneficial long-term outcome for patients with chronic low back pain. (Mayfield Clinic, 2018b.)

Spinal ligaments can be strong, tough, bands of tissue. The purpose is to connect the vertebrae, discs, and facet joints together and help stabilize and support the spine structures. The ligaments perform elastic movement that allows the spine to move within the limited movements. Like seen in the Figure 4, most vital ligaments that prevent excessive movement of the vertebral bones are anterior longitudinal ligament (ALL), interspinous ligament, ligamentum flavum and posterior longitudinal ligament (PLL). (Physiopedia, 2020b.)

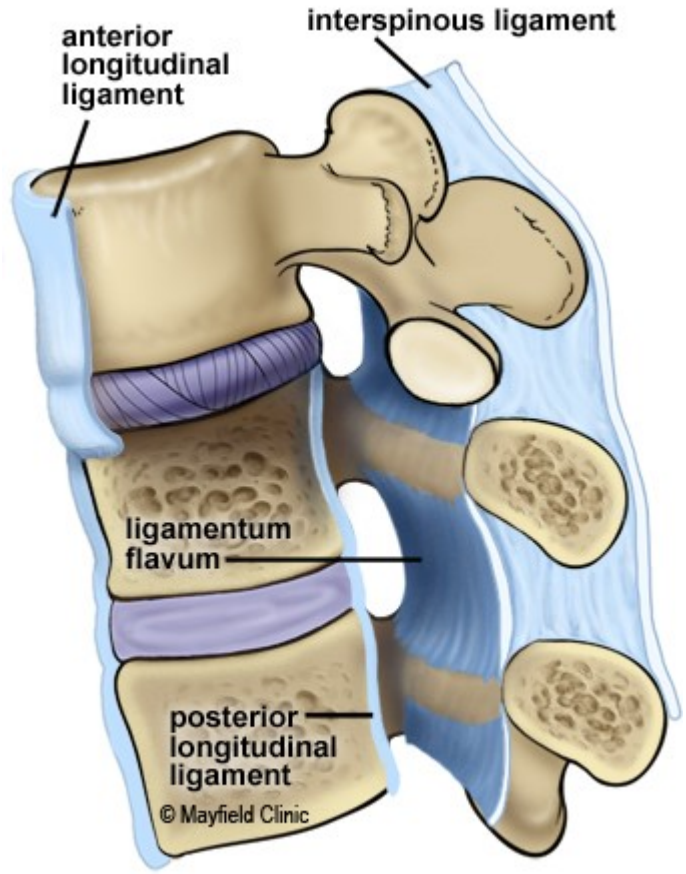

Figure 4. The ligamentum flavum, anterior longitudinal ligament, and posterior longitudinal ligament (Mayfield Clinic, 2018a)

The ligamentum flavum, ALL and PLL keep the bones aligned while allowing the flexion and extension of the spine (Mayfield Clinic, 2018a).

2.2 Spinal discs

First among special spinal structures is the spinal discs, called intervertebral discs (IVD). The spinal discs are like a fibrous pad of tissue and attached in place by cartilaginous end plates. Spinal discs starts from C3 through L5-sacrum. Remarkably, there is no spinal disc between C1 and C2 or between the sacrum and the coccyx. The main function is to help the spine to be flexible, without sacrificing a great deal of power. Intervertebral discs prevent the vertebrae from touching each other and by that specific method it provides shock-absorption. (Physiopedia, 2020c.)

Between every vertebral disc, there can be unique symptoms. The disc itself may cause symptoms, but also it can irritate nearby nerve and at the same time, each IVD has vital role in protecting the nerves that run down the spine and between the vertebrae. (Scioscia, 2017.)

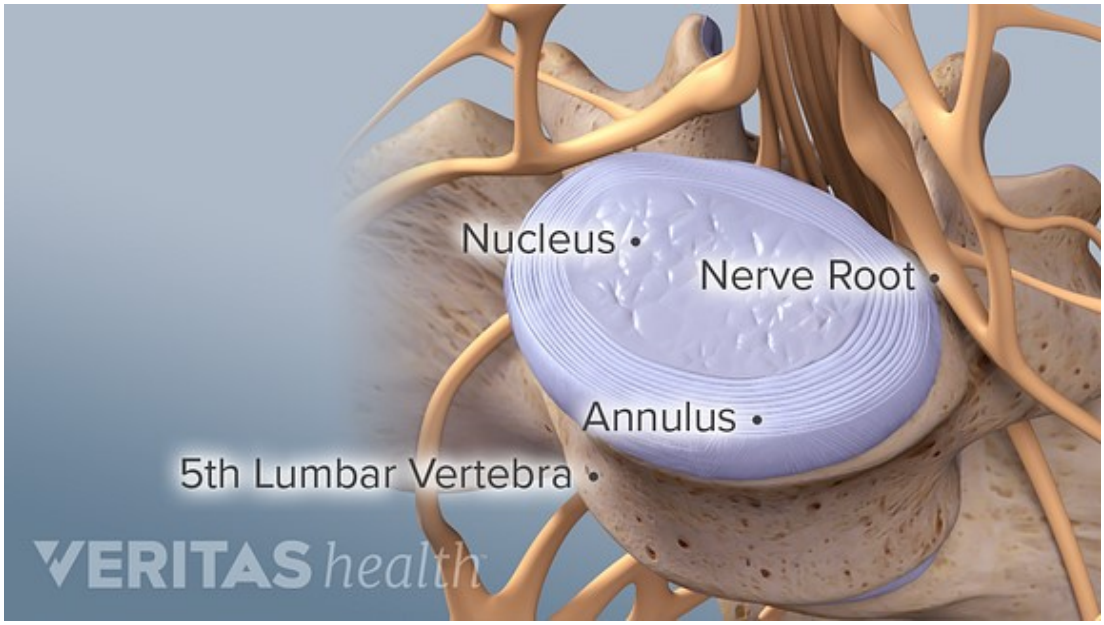

Figure 5. Anatomy of a normal spinal disc L4-L5 (Scioscia, 2017)

Spinal discs consist of two components, like seen in Figure 5. Inner soft core called nucleus pulposus and tougher outer portion called annulus fibrosus. Nucleus pulposus is the inner core that consists of group of fibres suspended in a mucoprotein gel. Nucleus pulposus carries body's axial load and to be able to maintain the strength and pliability it needs water. Annulus fibrosus is the outer layer and it has tough surface

composed of concentric sheets of collagen fibres and together with nucleus it forms concentric cylinder. About 80 percent of the disc is composed of water when humans are born and therefore, like earlier said, to function normally and to be able to carry the body's axial load as it is supposed to, the spinal discs need water, and it must be well hydrated. (Scioscia, 2017.)

3 PAIN

3.1 Definition

Pain is always a subjective experience for individuals. The influence varies from biological, psychological and social factors. International association for the study of pain revised the definition of pain as a distressing experience with actual or potential tissue damage with sensory, cognitive, emotional and social components. (Williams & Craig 2016, 2420-2423.) The pain can be for example neuropathic pain, visceral pain, nociceptive pain, acute, subacute and chronic pain.

Neuropathic pain, also known as nerve damage pain, is caused by an injury or disease of the somatosensory nervous system. There can be different pain components, such as shock like pain, continuous deep pain and allodynia. (Haanpää, 2007.) Visceral pain is organs-based pain state, which is usually hard to locate due the pain is reflecting to place to place. The reason is that the pain travels through nerves to different part of the body. Nociceptive pain is usually acute and responses to a specific situation. For instance, nociceptors, the specialized nerve cell that detect noxious stimuli or factors that could harm the body, creates a message along the nervous system to the brain, following nociceptive pain when body get damaged. (Dresden, 2017.) Acute, subacute and chronic pain is a term which determinates the timeframe of the pain duration. According to the guidelines of Käypähoito (2017), acute pain means under one-month lasting pain. Subacute pain is one to three months lasting pain and chronic pain is over three months lasting pain, visualized in Figure. 6. (Käypähoito, 2017.) Patients own life experience adapts to the concept of pain and therefore a persons' report of a pain should be respected (IASP, 2017).

Pain relieve therapy and rehabilitation needs to be highly evaluated before professionals makes any plans and planning needs to be in relation with the patient.

To really understand pain, we need to talk about pain gate theory. Pain gait theory (PGT), first proposed in 1965 by Melzack and Wall, is widely used clarification of

pain transmission. It was one of the first models that took both biological and psychological factors into consideration. Considering this theory is simplified and like earlier said, might not be suitable context for everyone, but when interacting with patients this description of pain is useful. PGT theory lays behind actions between sensory nerves α-Beta fibers, α-Delta fibers and C fibers. α-Beta fibers is the largest, myelinated and it causes sharp sensation pain (faster). α-Delta fibers are small, myelinated and causes vibration and light touch (fast). C fibers are small, un-myelinated and causes aching or burning sensation (slow). (Physiopedia, 2020a.)

Acknowledging the size of each sensory nerve is important to understand the interaction between central nervous system, cells, and brain. The size matters, as the bigger a nerve is the quicker the conduction and speed is. When the sensation is interrupted from the nerves, interneurons stop signals travelling up the spinal cord as there is no important information needing to reach the brain. This allows the gates to be "closed". When the smaller fibers are activated the inhibitory interneurons do not perform normally, so the gate opens, and pain is sensed. When the larger α-Delta fibers are stimulated, they reach the inhibitory interneurons quicker and, as larger fibers inhibit the interneuron from working to close the gates. Therefore, after you have burned your finger, or hitted your head, rubbing, cooling it helps as you are accelerating the α-Delta fibres which close the gate. Additionally, phycological effects interacts with different nerve types. Mood and cognition effects influences in the long rung and needs to be taken into consideration. (Physiopedia, 2020a.)

3.2 Acute and chronic pain

Acute pain usually can appear suddenly. It is caused by something specific and usually acute pain does not last more than four weeks, like seen in figure 6 and it disappears when there is no longer an underlying cause of pain. The cause can be caused from combined effects of stimulated nociceptors, local inflammation, systemic stress response mediators, and psychological factors. (Johnson et. al., 2013.)
Decreased pain management usually resolves after the tissues heal and gradually returning to normal activities is recommended. In subacute pain stage, inflammation has settled with growth of scar tissue as part of the healing process. Tissue healing takes

an average of six weeks, which leads the pain to be mechanical and intermittent. Usually certain movements may irritate the structures or scar tissue. (Core Concepts, 2020.)

Chronic pain is ongoing and long-lasting pain type that usually lasts longer than six months. Chronic pain can appear and continue even after injury or illness and pain signals in the nervous system remain active for weeks, months or even years. When pain reaches the level of chronic pain, it can have physical, psychological, biological and social effects on the body. These for instance include muscle tension, a lack of energy, depression, anger and fear or re-injury. (Cleveland Clinic, 2017.)

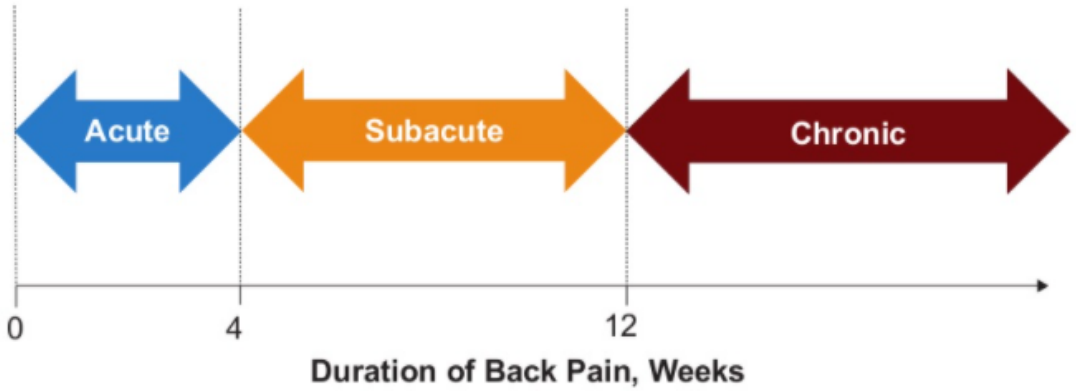

Figure 6. Back pain definitions based on their duration (According to Käypähoito, 2017)

Figure 6 shows the timeline for the definition of different back pains based on their duration. As explained before, acute, subacute and chronic pain various between different elements and pain makes it difficult for professionals to really understand the underlaying pathology or cause behind it. (Physiopedia, 2019b.)

Chronic and acute pain can be classified into four main states: nociceptive, inflammatory, neuropathic, and centralized pain. Table 1 shows what pain states are and what to acknowledge about each pain state.

Table 1 Pain states (According to Vardeh et al., 2016)

PAIN STATE	**SYMPTOMPS**	**SIGNS**

Nociceptive	The pain is limited to the area of stimulus or joint damage.	Normal movement will alert the nociceptors to react in a way that the movement will likely cause pain in the damaged joint or stimulus.
Inflammatory	The affected area is most likely red, warm and/or swollen.	Signs of inflammatory changes, affected area usually reacts to antibiotics
Neuropathic	Shock-like pain, burning, tingling, sometimes spontaneous pain.	Decreased sense to pinprick test, straight leg raise, and/or vibration sense.
Centralized / Dysfunctional	Chronic and usually widespread pain.	No detectable inflammations or structural damage.

Table 1 shows the different typical symptoms and signs per pain states. In nociceptive state, where the pain is localized. Inflammatory pain is caused by sterile or infection and usual symptoms occurs as redness, warmth and swelling of affected spot. Neuropathic pain is caused by damaged sensory nerve. Usually symptoms consist of burning, tingling spontaneous pain that is distressing the body. Centralized is most often chronic pain and no detectable inflammation or structural damages, which makes it hard to diagnose the reason behind it. (Vardeh et al. 2016, 52-53.)

3.3 Low back pain

Low back pain (LBP) is one of the most common reasons for adults to visit a physiotherapist (Preuper & Rosalien, 2011). National institute of Neurological Disorder and Stroke (2020) says that low back pain is also the most common cause of job-related disability. Most of the LBP cases are acute (less than 4 weeks). Rarer case is chronic low back pain (over 12 weeks), and according National institute of Neurological Dis-

order and Stroke about 20 percent of people affected from LBP, develop chronic symptoms at one year. Usually the cause underlays from a mechanical injury or sudden movement, but it can result from certain diseases, such as cancer of the spinal cord, herniated disc rupture, sciatic, arthritis, kidney infection and infection of the spine. (NINDS, 2020.)

Risk factors that impact the cause of low back pain are age, fitness level, obesity, genetics, ergonomics, psychological issues, and smoking. Recent studies show, that also overloading children backpack causes muscles to fatigue and therefore it can strain the back in unnatural positions. (NINDS, 2020.)

There are numerous treatments for LBP like seen in Figure 7 (Physiopedia, 2020d). Recommendations shows that beneficial for acute low back pain is staying active and nonsteroidal anti-inflammatory drugs (NSAIDs) and for chronic low back pain is therapeutic exercise, intensive multidisciplinary treatment program. Likely to be beneficial part needs to be taking into consideration. While the treatment might be beneficial for other, it might be harmful for other. (Koes et al., 2006).

Effectiveness	Acute low back pain	Chronic low back pain
Beneficial	Advice to stay active, NSAIDs	Exercise therapy, intensive multidisciplinary treatment programmes
Trade-off	Muscle relaxants	Muscle relaxants
Likely to be beneficial	Multidisciplinary treatment programmes (for subacute low back pain), spinal manipulation	Analgesics, acupuncture, antidepressants, back schools, behavioural therapy, NSAIDs, spinal manipulation
Unknown	Analgesics, acupuncture, back schools, behavioural therapy, electromyographical biofeedback, epidural steroid injections, lumbar supports, massage, multidisciplinary treatment (for acute low back pain), temperature treatments, traction, TENS	Electromyographical biofeedback, epidural steroid injections, local injections, lumbar supports, massage, traction, TENS,
Unlikely to be beneficial	Specific back exercises	—
Ineffective, or harmful	Bed rest	Facet joint injections

Figure 7. Summary of treatment recommendations (Van Tulder M et al. 2006)

Seen in Figure 7 further studies needs to be done in unknown area. For example, there is many ongoing research that are focusing on subgroups patients with LBP, with different prognosis to identify specific treatments and significant amount of randomized clinical trials are being done to evaluate the effectiveness of commonly available treatments for acute and chronic LBP. (Alrwaily et al., 2016).

American Physical Therapy Association (APTA) published in 2016 Treatment-based classification system for low back pain article, where the article describes certain evidence backing the superiority of any interventions. Primary low back pain classification systems that professionals follow is The mechanical diagnosis and therapy classification model described by McKenzie, The movement system impairment syndromes model described by Sahrmann, The mechanism-based classification system described by O'Sullivan and The treatment-based classification (TBC) system described by Delitto et al. These systems improve professionals to help or improve the ability to identify patterns of signs and various symptoms that LBP have (Alrwaily et al., 2016)

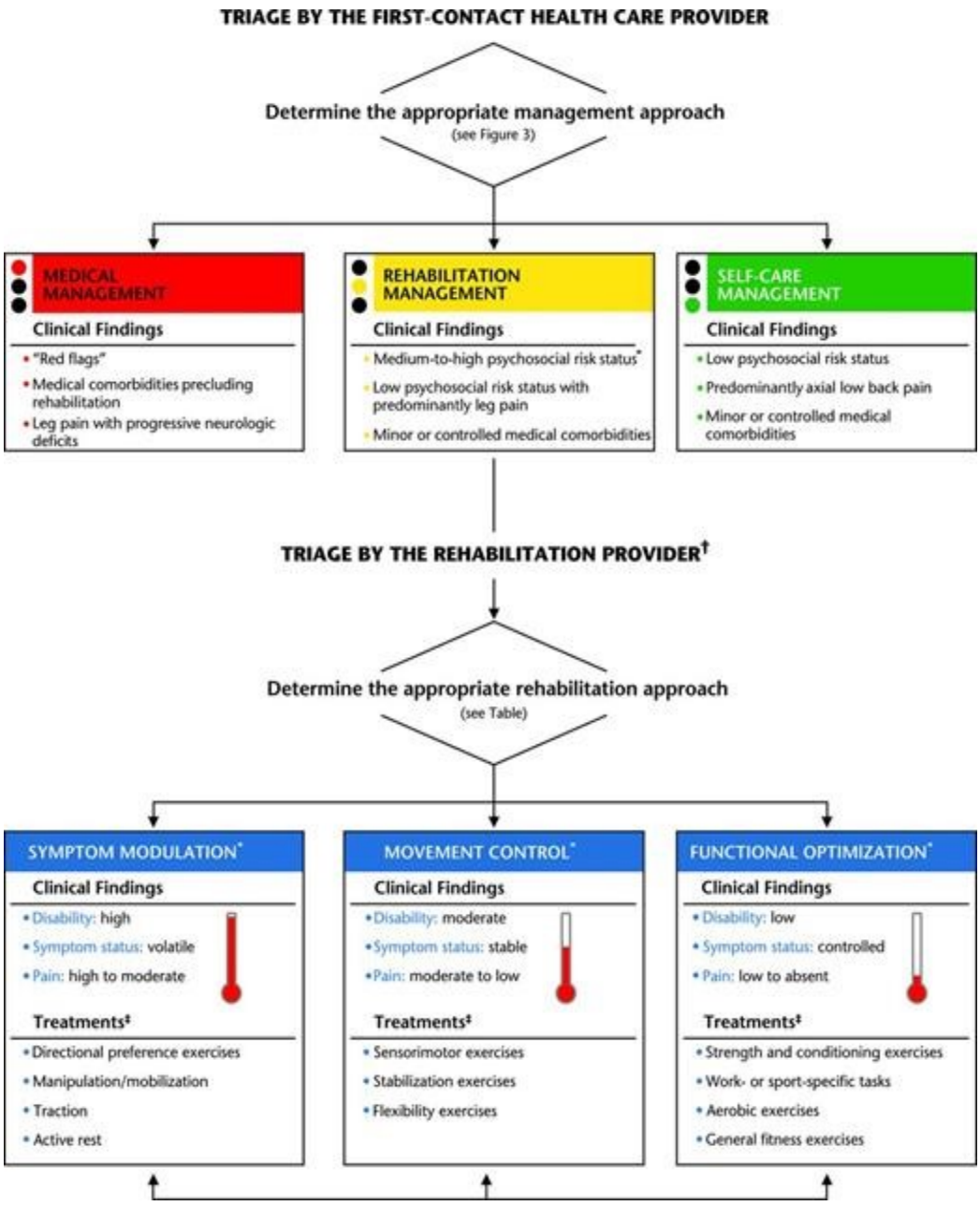

Figure 8. Updated 2015 treatment-based classification system (Alrwaily et al., 2016)

Figure 8 explains the basic structure consists of specific follow up treatment plan, which determinates the appropriate rehabilitation approach. Linking the elements from TBC and APTA guidelines, it provides good structural support for clinicians to follow with low back pain patients. It addresses the limitations of the previous adaptations of involving of a neuromuscular assessment, correct interventions and identifying the goal. (Alrwaily et al., 2016).

3.3.1 Specific low back pain

Low back pain is commonly treated in health care environment with different clinicians. The challenge may consist of muscle tension, stiffness below costal margin and above the inferior gluteal folds with or without sciatica pain, but most important factor is pain tensity and disability. Table 2 lists the specific low back pain pathologies according to Physiopedia (2020e).

Table 2 Low back pain pathologies (Physiopedia, 2020e)

Low back pain pathologies
Ankylosing spondylitis
Cauda equina syndrome
Disc herniation
Lumbar spinal stenosis
Lumbar spine fracture
Osteoporosis
Radiculopathy
Scheuermann's disease
Scoliosis
Skeletal metastases
Spondylolisthesis

Diagnosing specific low back pain, the clinical focus is on the red flags. Red flags indicate the possible pathology behind the low back pain and when there appears no red flags, the diagnosis is mostly considered to be non-specific low back pain. Suitable screening and taking yellow flags into consideration helps professionals to evaluate the treatment plan and effectiveness properly. (Physiopedia, 2020e).

3.3.2 Non-specific low back pain

Accurate low back pain diagnose can be done only for 10% of the patient with low back pain. The rest 90% with low back pain patients belongs to non-specific low back pain group. (Airaksinen et al., 2006.) Usually most of the patients recover normally

without any major treatment, but proper clinical evaluation is essential to identify rare cases of severe underlying pathology (Casazza, 2012). According to Van Tulder et al. (2006) non-specific low back pain is classified as acute if the duration of the pain is less than 12 weeks and chronic if the duration is more than 12 weeks (Van Tulder et al., 2006.) Self-management is considered a critical factor for people with non-specific low back pain (Hutting et al., 2020).

Feeling of persistent pain and relevant impairment in the activities of daily living after 12 weeks of treatment should go through a multidisciplinary review. Multimodal treatment should be considered, depending on the result and exercise therapy should be used to treat chronic non-specific low back pain. Psychosocial and workplace-related factors need to be taken into consideration. Nowadays more evidence shows that psychosocial factor and workplace-related factors have vital impact on the pain (pain stays four weeks despite the treatment) and proper screening and standardized questionnaires needs to be done to patients. (Chenot et al., 2017.)

4 TRACTION

4.1 Definition of traction

The word traction comes from the Latin word ‘tractico’, which refers to a process of drawing or pulling (Saunders, 1979). Traction therapy in various forms is known to be used for almost 4000 years for different spinal disorders (Gay and Brault, 2012). The idea in traction process is to apply a stretching force to the vertebrae through weights, pulleys and/ or body weight and to divert individual joints of the spine, and hence reduce pressure of the spine and release pain. Traction can be performed manually or mechanically, and it can be applied to different parts of the body such as lumbar, mid-back or low-back. (Physiopedia, 2020d.)

Recent guidelines published by NICE in the UK, KCE in Belgium, the Danish Health Authority and American college of Physician’s says, that traction as a therapy treatment for low back pain should no longer be a method (Physiopedia, 2020d).
Ortopaedic Physical Therapy Secrets studied how the high-force traction affects with patients with spinal nerve root compression symptoms and disc protrusions, and the CT and epidurography showed reduction on nerve root compression and disc protrusion (Hall-Bibb et al., 2017).

Even though some studies show uplifting results, traction is out of style now. Traction as a method for decreasing back pain is not been proven to be any better than placebo. (Wegner et al., 2013.)
Recent systematic reviews and guidelines says that mechanical lumbar traction is not effective treatment method for treating LBP, whether it is acute or chronic (Madson TJ & Hollman JH, 2015).

4.2 Lumbar traction

Lumbar traction method is done manually or mechanically. The goal of lumbar traction is to help to relieve nerve root compressions and muscle spasms by separation of structures in the spine vertebrae. (Physiopedia, 2020b.)

However, in 2016, Journal of Orthopaedic and Sports Physical Therapy (2016) published researched studied the relation between physical therapy with lumbar spine traction added and the outcome did not improve the exercise alone. The study was done for a group of 120 people with back pain and nerve root impingement. The study used random selection for either lumbar traction with exercises or simple exercises to manage or decrease pain. The consequence was that adding lumbar traction to exercises offered no significant changes and pain did not decrease. (Verywellhealth, 2020.)

Contraindications for lumbar tractions include for example spinal malignancy, spinal cord compression, infections in the spine, osteoporosis, inflammatory spondylarthritis and forces greater than 50% of body weight could be correlated with a possibility of increased blood pressure. On the other hand, side-effects for spinal traction can be worsening the original condition. (Healthline, 2017.)

4.3 Mechanism of gravitational traction

According to Kane et. al (1985) spinal traction has been used for decreasing pain, spine dysfunctions and low back pain since the era of Hippocrates. Since that time, the spinal traction technique has changed massively and in the last three decades, lumbar traction has been a standard treatment for low back pain. The gravitational traction is the most recent technique. The idea is to provide gravitational traction while the subject is in inverted position. Recent studies has not been made for gravity traction benefits but, Kane, Karl & Swain, 1985 published study for effects of gravity-facilitated traction on intervertebral dimensions of lumbar spine, which had exiting results, but further studies needs to be done. (Kane, Karl, & Swain, 1985.)
Study showed significant separation in the intervertebral dimension of the lumbar spine and the vertebral structural separation was performed in a nontraumatic manner without the use of extra weight or mechanical assistance. (Kane, Karl, & Swain, 1985.)

Inversion table therapy is one of the methods that uses gravity for back pain treatment. Underlaying lack of agreement for effectiveness of inversion therapy (upside down) makes the reliability shake. Also known for spinal traction, it uses gravity method to separate the discus structures and nerves in the spine. In 2012 a research study was

made in England to find out the relation with inversion therapy combined with physical therapy and the how does it effect on sciatic pain, and the results showed that the treatment was effective for sciatica pain from a swollen disk and may reduce the requirement for back surgery. (WebMd, 2019.)

5 AIM AND OBJECTIVES OF THE THESIS

The aim of this thesis is to study and find out the possible evidence-based effects of gravity traction on pain management. The research of the study is done by using a systematic literature review. The objective is to gather knowledge of how low back pain can be managed by using gravity traction and how this kind of treatment method is applied.

There are several arguments about the effectiveness of traction as a therapy modality in the treatment of low back pain and the thesis will review and analyze the existing studies to determine whether traction has negative or positive implication to managing low back pain. This study will focus on gravity traction, also referred as inversion therapy, as a form of traction, but it is worth recognizing that there exist other types of tractions, such as gravity lumbar traction, and other types of manual and mechanical traction.

The research question is:

1. How does gravity traction effect on pain?

Since gravity traction treatment method is mostly used for the back and not so commonly for other parts of the body, this study, and its' systematic literature review focus on the effects of pain relief primarily on the low back pain.

6 METHODOLOGY

6.1 Systematic literature review

A systematic literature review (SLR) attempts to answer to a clearly formulated question by identifying, selecting and critically assessing literature from the area of the research question. Based on the findings of the SLR, the researcher can give interpretations or a concrete answer to the studied question and give suggestions for future research or clinical practice. (Piper, 2013.)

According to Khan et al. (2003) the best way to form a systematic review is by following a 5-step process. The steps are:

1. Formulating the research question the literature review aims to address and creating a search strategy.
2. Identifying the relevant publications.
3. Assessing the quality of the included studies.
4. Summarizing the collected evidence and comparing the initial finding.
5. Interpreting the findings and providing a conclusion for the results.

This thesis uses this 5-step process of Khan et al. (2003). The research question is the previously introduced “How does gravity traction effect on pain?” and the search strategy and the other steps are introduced in Chapter 7.

6.2 PICO framework

The analyze of the research question for systematic literature review is recommended to be formed with the PICO framework (Sayers, 2008). The PICO framework is mostly used to frame and answer health care related questions and thus is very suitable for the research question of this thesis (Huang et al., 2006). The PICO abbreviation stands for the words described below (Da Costa et al., 2007):

P = Problem / Population / Patient – The health problem or the type of patients we are investigating.
I = Intervention – The intervention or phenomenon with what we are trying to affect the health problem or patients.
C = Comparison / Control – An alternative intervention to which the investigated intervention can be compared.
O = Outcome – The expected health results the research wants to find.

For this study the PICO framework will consist of the next terms, which are then used as the search terms in the systematic literature review as presented in the chapter of search strategy. The first word written in capital letters is the main search word, and the other words are synonyms or substitutes for the main search word.

P = LOW BACK PAIN – LBP, back pain, spine
I = GRAVITY TRACTION– mechanical traction, inversion therapy, inversion traction, inversion table,
C = MANUAL TRACTION – belt traction, gravitational lumbar traction
O = PAIN RELIEF – effect, efficacy

With these terms we can directly find the relevant research done within the same area as the study of this thesis and probably find an answer for the research question.

6.3 Schedule

The schedule of the thesis was planned in Autumn 2019. Due to different reasons and circumstances, such as the coronavirus, the time frame for the thesis has been quite long.

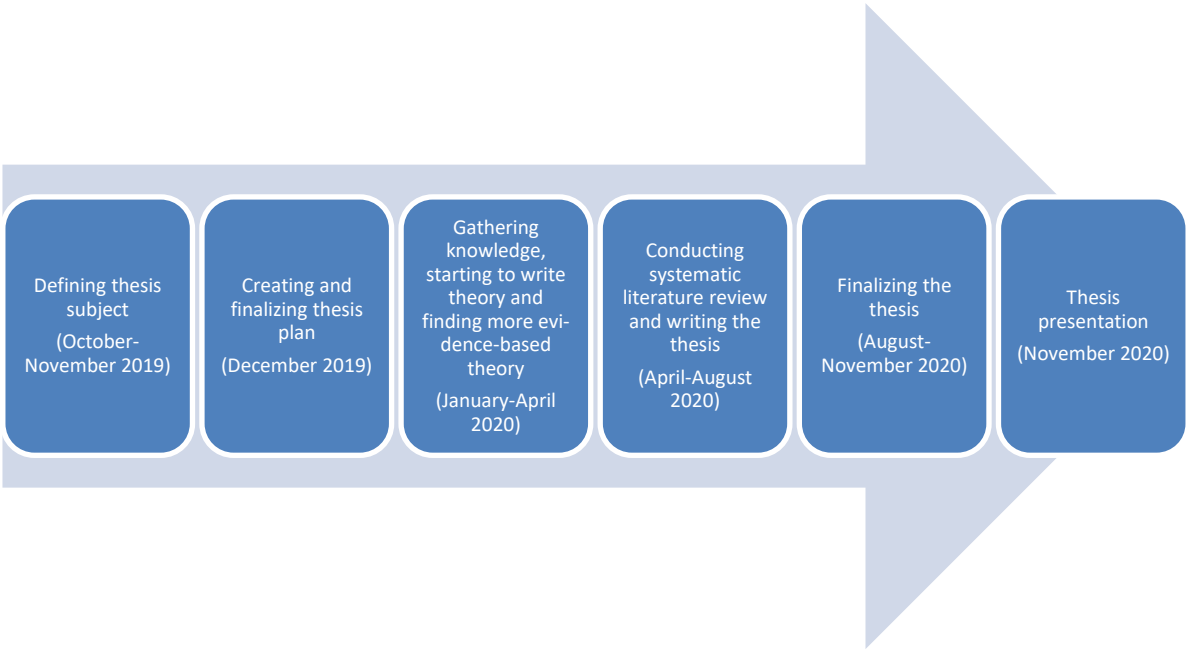

Figure 8. Timeframe of the thesis

Figure 8 represents the timeframe of the thesis. December 2019, plan was to finalizing thesis plan and starting to gather literature and articles. January to April 2020, starting to gather literature and studies related to the topic, starting to write theory part and finding more evidence-based theory. April to August 2020, starting to write the thesis, based on the literature. August to November finalizing the materials and research and finishing the thesis. November presenting the results and thesis

7 RESULTS

7.1 Search strategy

According to Khan et al. (2003) after defining the research question the next step was to create a search strategy to find the most relevant studies to answer the research question. Based on a quick assessment of the different available databases, three databases where to conduct the search for the literature were chosen: EBSCOhost, PubMed (NCBI) and ScienceDirect. These three databases are reliable and used by thousands of institutions and millions of users and they have leading resources for medical scientific data.

The search words / key terms were constructed with the PICO framework as presented in Chapter 6. Since gravity traction is the core of this study, the search term gravity traction is utilized as the main term combined with the other key words, for example as demonstration: Gravity traction AND Pain. Table 2 shows the entry terms and the number of results per search per database.

The criteria and filtration for the literature search was to be published between 01.01.2010-31.12.2020, in English, the text has open access, and the field of the study is nursing and health professionals and/or medicine and dentistry.

Entry Terms		EBSCO	PubMed (NCBI)	ScienceDirect
Gravity traction	AND "Back"	1	522	47
	AND "Spine"	2	301	33
	AND "Pain"	1	443	79
	AND "Low back pain"	0	214	20
	AND "LBP"	0	27	2
	AND "Pain relief"	0	124	17
	AND "Manual traction"	0	290	42
	AND "Low back pain relief"	0	84	7
	AND "Effect"	1	963	69
	AND "Effect on pain"	0	333	35
	AND "Gravitational traction"	0	145	7
	AND "Inversion traction"	0	94	12
	AND "Inversion therapy"	0	51	7
	AND "Inversion table"	0	64	8
Total		5	3655	385

7.2 Study selection

Figure 9 clarifies the study selection process and why studies were excluded at different stages. The total amount of studies was 4045 which achieved the criteria of being published between 01.01.2010-31.12.2020, in English, the text has open access and the field of the study is nursing and health professionals and/or medicine and dentistry category. In PubMed (NCBI), there was no option for any health-related categories, which explain the number of many studies. When using "Gravity traction" as a key word, the search results include many studies related to engineer or other scientific studies concerning gravity as center of gravity or gravitational effect.

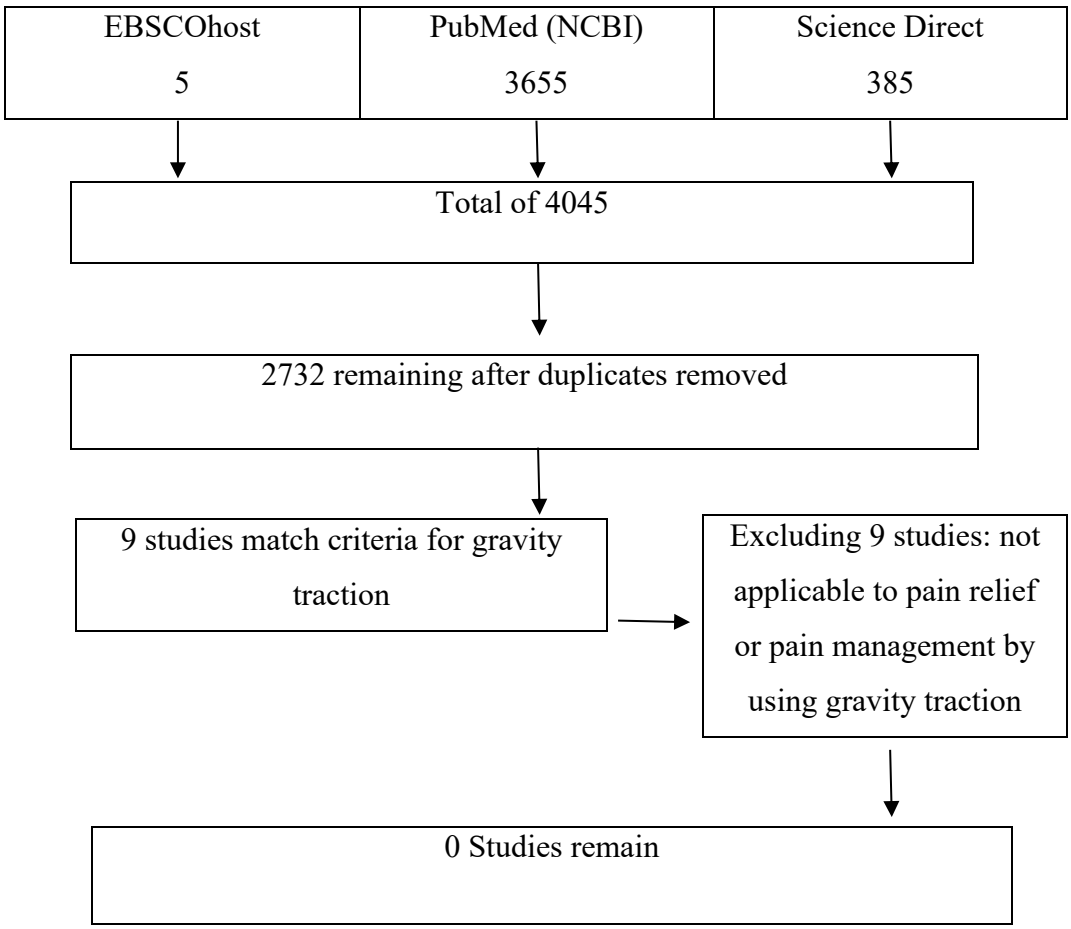

Figure 9. Flow diagram of study selection

As Figure 9 shows, the final result of the systematic literature review was that there were zero studies that matched the relevancy to be included for the purpose of answering this study's research question. Reasons for excluding the studies was that none of the articles or studies did not include gravity traction method for pain relieve as a part of the study or text. Additionally, the key word "Gravity traction" gives results where the most part of the studies had halo-gravity traction as their main focus. Halo-gravity is not in the scope of this study which resulted that many of the studies had to be excluded. The SLR also revealed that traction has been more researched in the form of manual traction. Also, recent studies concerning gravity traction and the method's effect on pain were not found as free access studies, which resulted that the SLR was unable to find any relevant studies from the research area. As explained in Chapter 4, many studies had also excluded traction and/or gravity traction out of their research since there has not been any evidence-based studies that gravity traction would give any significant pain relief.

The fact that there are no results from the systematic literature review can be seen from two point of views. On one hand, gravity traction might be considered as a low-quality method for treating pain and has no results of effectiveness. The fact that pain is always a subjective experience for individuals and pain relief might be hard to track and study, the results of gravity traction are hard to proof. On the other hand, to perform gravity traction, some sort of equipment is always needed. These equipment are almost inevitably manufactured by commercial companies, which makes the results of using gravity traction for pain relief treatment method easily biased. Furthermore, if the study of gravity traction is made by a commercial company the quality of the study might suffer. However, the most important finding of systematic literature review is that there is a need for evidence based high quality research on this topic.

7.3 The effect of gravity traction on pain

Thus there was no results from the systematic literature review, in this chapter we analyze studies found from other sources than systematic literature review, studies with not so strict criteria than in the systematic literature review and studies that where

most close to the subject of gravity traction effect on pain and might still give some important views on the subject.

Article from The Journal of Physical Therapy Science (2016), an study about electromyographic activities of the lumbar erector spinae and the method that the study used to evaluate the different changes in the structure of it was inversion traction. The study included 60 healthy male adults that were selected equally and randomly and assigned to a different group. The groups consisted of 30-30-degree group, 30-60 degree group and a 60-60 degree group. Inversion traction was applied for six minutes and effects in lumbar electromyographic activities of the lumbar erector spinae was measured. Study compared the root mean square values (RMS) after inversion traction. The results showed changes in the muscle tension. The size of the traction angle determined the muscle tension increase, more than the process of traction angle application. The inversion traction uses gravity traction as a method, but it is not a relevant article for this systematic literature review, since it does not take a stand on effects on pain. (Kim, C. Y & Kang, J. K, 2016.)

In 1985, The Journal of Orthopaedic and Sports Physical Therapy published article, on the effects of gravity-facilitated traction of the lumbar spine. Aim was to study possible effects of gravity traction on lumbar spine and to measure the vertebral separation. The results showed significant separation int the intervertebral dimension of the lumbar spine and the results were arguing if separation of lumbar vertebrae plays a big role in relieving low back pain. (Kane, Karl, & Swain, 1985.) The results indicates that the gravity traction might have possible effects on pain management, but the exclusion from the systematic literature review was done due to the fact that the study was outdated literature, it is written about 30 years ago, so it did not fulfill the 2010-2020 criteria.

To conclude the reliability and effectiveness can not be determinate and further studies needs to be done.

8 CONCLUSION

The frequency, commonness, vast social and health consequences of global pain requires health society to acknowledge the issue of pain. Low back pain (LBP) is one of the most common reasons for adults to visit a physiotherapist. (Preuper & Rosalien, 2011.) Therefore, it is important to acknowledge different methods for pain treatment.

Gravity tractions tends to lean on treating low back pain, but further studies need to be done to evaluate the effectiveness. The biggest limitation of this study was that there were no results on systematic literature review and therefore the study had to focused on different literature from other sources then SLR. Study selection process and why studies were excluded at different stages revealed in a discouraging way. The exclusion process showed why systematic literature is important to find relevant evidence behind the topic and research question. Even though two of the studies, explained earlier showed positive results, further studies need to be done in this area and to study the effects of pain.

Usual need for equipment for performing gravity tractions makes the results of using gravity traction for pain relief treatment method easily subjective. Additionally, if the study of gravity traction is made by a commercial company the quality of the study suffers and the evidence-based literature is hard to find. However, the most important finding of systematic literature review is that there is a need for evidence based high quality research on this topic.

9 DISCUSSION

The analyze of the underlying cause of lack of evidence and literature of gravity traction in relation with pain is inevitable. Even though, traction as a pain relieve method is widely used, the theory behind it is fading and it is becoming less popular among professionals. The reason for choosing this topic was to investigate the possible effects of gravity traction for spine and pain. Once the study plan was made, it cleared the idea why to do it and how to do it.

Narrowing and specifying the subject was difficult to do. To more the research advanced, the more it came clear that the gathered data available is limited. Even though the criteria's for searching data were strict, the lack of reliable evidence-based studies or literatures was surprising. Difficulties making this study brings the commercial companies' role in using and marketing gravity traction as a pain treatment method topic up. Quality of the research suffers when the studies are not free to access and the updated knowledge or research is not available.
The limitations showed that the structure around this topic is hard to cover properly with latest evidence and the methodology is hard to comprehend. There are studies advancing with the topic of gravity effects or inversion traction, which uses the gravity, but open access materials are not available for everyone. Like many times said, future evidence-based studies need to be done to see the effects of gravity traction on pain.

The role of formulation the research question in a correct way, plays an important manner when planning your research strategy. For instance, if the research question was "how does the gravity traction effect on structures around the spine", the Article from The Journal of Physical Therapy Science (2016) an study about electromyographic activities of the lumbar erector spinae would have been beneficial to research further in systematic way. Even though the results were disappointing, the result showed that even if during systematic literature review the result is zero, that is also a result, and this can lead to open both the researchers and the readers eyes and studies can be made in the future.

To note, the halo-gravity traction is various studies has been made, because of the impact and results it has had. Halo-gravity traction uses gravity method for treating kids with scoliosis for example. (KidsHeatlh, 2019.) Uplifting studies has shown effectiveness for the gradual correction of cervical kyphosis, atlantoaxial subluxation, basilar invagination and os odontoideum (Verhofste et al., 2019). It is a great tool for surgeons and physiotherapists in this field, but gravity traction on its own, as a pain relieve is not studied and further studies need to be done in the future.

Hence, there exists some literature giving some sort of insight for the research question but the research from the area needs to be widened. The study of Chung and Jong (2016) could be repeated in different manners and with a subject group consisting of patients with LBP rather than with healthy adults. Additionally, the study of Kane et al. (1985) should be modernized with newer equipment and technology, that would help to have more evidence-based results on the gravity traction subject.

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