Charles University

Faculty of physical education and sports

A case study of the Physiotherapy treatment after Hallux valgus operation

Bachelor Thesis

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ABSTRACT

Title: A case study of the Physiotherapy treatment after Hallux valgus operation.

Thesis aim: The aim of the thesis was to do a research on physiotherapy treatment after hallux valgus operation, in both a theoretical and practical part, and to perform examination and physiotherapy on a patient with this condition. The following thesis was conducted on a 57-year-old woman in January 2013 after a bilateral operation for the correction of hallux valgus. The theoretical part emphasizes on the anatomical, biomechanical, kinesiological properties, and general information about the diagnosis hallux valgus and its surgical approach with rehabilitation. The practical part concerns the 57-year-old woman, 3 weeks after the operation. The practical part includes the patients anamnesis, kinesiological examinations, and the therapy itself.

Clinical findings: The patient was recently operated for the correction of the hallux valgus deformity. The clinical findings were swelling with pain, decreased range of motion, hypertoned muscles, blockage in joints and some weakened muscles. The followed treatment showed great results and a good progress in all terms mentioned.

Methods: Methods used during the rehabilitation of this patient was focused on from the clinical findings found post operational, along with the therapeutic procedures and techniques taught from the Faculty of Physical Education and Sports, the procedures included: Soft tissue techniques, Manual methods and Post isometric relaxation techniques by Lewit. The patient was also instructed and thought to do self-therapy. Methods used for the general part was research in library and in medial databases were suiting articles and books were found for the thesis.

Results: After and during the 5-therapy sessions a great progress was seen and measured. There were excellent results in many aspects including swelling, pain, range of motion, hypertonicity, joint blockage and sensomotoric skills.

Conclusion: The results assessed and evaluated at the end of the special part shows great results of the therapies performed during these 5 sessions both in in a objective and subjective perspective. The progress was indeed better then expected.

Keywords: Hallux valgus, 1st metacarpal deformity, Post-operational rehabilitation, foot, case study, physiotherapy.

DECLARATION

I hereby declare that this is entirely my own, individual work based on knowledge gained from books, journal, reports, attending lectures and seminars at FTVS, and under guidance of my advisor Mgr. Lenka Satrapová and my supervisor Mgr. Zaher El Ali.

I also declare that no invasive methods were used during the practical approach and that the patient was fully aware of the procedures during the entire treatment period.

Prague, April 2013 Christoffer S. Æsøy

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1. INTRODUCTION

This bachelor thesis is divided in two major parts. The first part is a theoretical part, which takes a view on the theoretical perspective of Physiotherapy treatment after Hallux valgus operation. This special part is divided in an anatomical part with kinematics and biomechanics, and a part focused around information about the hallux valgus diagnosis.

In the second part of the bachelor thesis the examination and therapy of a given patient with the relative diagnosis is described and discussed. A fully and complex examination with therapy sessions is performed after the author´s best knowledge and in a close and good cooperation with both a supervisor and advisor. Evaluation and conclusions of the examinations and therapy execution are included at the end, and the highlights of the progressions are pointed out.

The thesis is equipped with a list of literature, pictures, abbreviations explanations and an application of board review, these will be found at the very end of the thesis.

2. GENERAL PART

2.1 Overview of the foot in relation to hallux

2.1.1 Anatomy and osteology

The main function of the foot is to support the body during locomotion and quiet standing. In anatomic position, the foot is at a right angle to the leg with the feet straight ahead. The “at ease” or neutral stance position is with the foot at a right angle, but the feet are slightly abducted. The middle line of the foot is trough the second metatarsal. (1) The skeleton of the foot may be divided into 3 parts: the tarsus, metatarsus and digits (toes). The tarsus consists of seven bones, the talus, calcaneus, navicular, cuboid and the three cuneiform bones. The metatarsus consists of five metatarsals, and the digits are formed by the phalanges (2), which are divided in proximal, middle and distal phalanx. The 7 tarsal bones are short bones that connect the metatarsals to the leg. The 5 metatarsals are weight-bearing bones that provide a foundation for the digits. The phalanx provides the skeletal structure for the digits. (1) A division of the foot can also be done by a functional meaning with a grouping into a rear, mid and forefoot.

The first metatarsal is the shortest, thickest and most mobile metatarsal (2) it is located on the most medial aspect of the foot, the first metatarsal has two regular articulations, the proximal phalanx distal and the medial cuneiform proximal. (1) On occasions the first metatarsal articulates laterally with the second metatarsal. The first metatarso-cuneiform joint permits limited gliding motion. (3) The first metatarsal like the other, are presenting with a base, shaft and head. The base present with a kidney shaped facet for articulation with the anterior surface of the medial cuneiform. The shaft is curved from a concavity inferiorly and convexity dorsally. (3) The shape of the head is quadrilateral and larger then the lesser metatarsals. It is also unique in that it presents with a ridge or crista that begins on the anterior aspect of the articular cartilage and continues plantarly. (1) A sagittal plane dawn trough the crista is parallel to the lateral surface of the shaft of the metatarsal, but is everted by 13 degrees when compared to the base of the bone. During stance, the crista is angulated from the supporting surface by 78 degree, however, during loading of the first metatarsophalangeal joint, the crista become perpendicular to the supporting surface such that each sesamoid carries roughly equal weight. On each of the plantar condyles there is a groove for the articulation with the sesamoids. (1)

The phalanges are the bones that make up the toes. The hallux has two phalanges; the proximal and distal. Each phalanx has a base, shaft and head (2) like the metatarsals. In the proximal phalanx tubercles are present on the inferior side of the base and dorsal side of the head for the attachment of collateral ligaments. The head of the distal phalanx is characterized by a flattened surface for the support of the toenail and a tuberosity plantarly. (1)

Sesamoids are fibrous, cartilaginous, or osseous structures that are almost always contained with a tendon. (1) Their overall configuration is variable, they may be semi-ovoid, circular or bean shaped (3). There are only two regular sesamoids in the foot, the medial and lateral hallucal sesamoid. These sesamoids are located in the tendon of the flexor halluces brevis muscle proximal to the metatarsophalangeal joint and articulate only with the head of the first metatarsals.

Many ligaments and tendons are described as attaching to the hallucal sesamoids. In dissection, however, it's very difficult to separate various layers attaching to each sesamoid. (1) The ligaments of the fist metatarsophalangeal joint provide necessary stability and functional properties that are needed in a normal functioning hallux, they are:

-**Medial and lateral collateral metatarsophalangeal ligaments:** attached to the tubercles on the dorsomedial and dorsolateral head of the metatarsals. (2) They have an important stabilizing function and prevent motions in the transverse and sagittal plane.

-**Plantar metatarsophalangeal ligament:** attached proximally from the first metatarsal head to the base of proximal phalanx. (2) They share an important stabilizing function with support in weight bearing and restrict dorsiflexion.

-The deep transverse metatarsal ligament: Share a common origin with the medial aspect of the second metatarsal, and a separate attachment to the lateral aspect of the first MPJ, joint capsule and sesamoid apparatus. (3)

The sesamoidal ligaments are many; their main function is to increase the mechanical advantage of flexor hallucis brevis, assist in weight bearing during pressure on the great metatarsals, and to elevate the metatarsal head. (4) Important sesamoidal ligaments are:

-Inter-sesamoidal ligament: Is a small broad ligament on intracapsular dissection of the joint, they are extending from the medial and lateral sesamoid.

-Medial and lateral sesamoidphalangeal ligament: are attached from each sesamoid proximally to the plantar aspect of the base of the proximal phalanx.

-Medial and lateral metatarsosesamoideal ligament: are attached from the metatarsal proximally to the sesamoids distally. (3)

The muscles that control the forefoot include both extrinsic and intrinsic muscles. Together with the functional and structural properties of the bone and ligaments of the hallux and feet, the muscles act as engines that are carrying out the movements. The following muscles are involved in the movement of the hallux:

Muscle	**Segmental innervation**	**Function**
Flexor hallucis longus	L5, S1, 2	Flexion of Interphalangeal joint of hallux. Assist in flexion of MTPJ, plantar flexion and inversion of foot. (5)
Flexor hallucis brevis	L4, 5, S1	Flexion of MTPJ hallux. (5)
Abductor hallucis	L4, 5, S1	Abduct and assist in flexion of MTPJ of hallux. Assist in adduction of forefoot. (5)
Adductor hallucis	S1, 2	Adducts and assist in flexion of MTPJ of hallux. (5)
Extensor hallucis longus	L4, 5, S1	Extends the MTPJ and Interphalangeal joint of hallux. Assist in inversion and dorsiflexion of foot. (5)
Extensor hallucis brevis.	L4, 5, S1	Extends the MTPJ of the hallux. (5)
Extensor digitorum brevis.	L4, 5, S1	Extends the MTPJ of 1st to 4th digits. (5)

Table 1 Muscles in movement of hallux

2.1.2 Vascular and neurological supply

The vascular supply to the first metatarsal, as well as the first metatarsal-phalangeal joint, must be well understood when considering surgery upon the hallux, especially surgical corrections. (3) The vascular supply to the first metatarsal and metatarsal phalangeal joint is both extraosseus as well as intraosseus. The extraosseus supply is composed of:

-First dorsal and plantar metatarsal arteries

-Superficial branch of the medial plantar artery

These arteries provide branches to the head, shaft and base of the metatarsal, including capsular branches to the first metatarsal phalangeal joint. (3) These branches divide into finer vessels, which spread over the periosteum. This is especially important when stripping the periosteum in preparation for correction utilizing and osteotomy. The intraosseus vascular supply to the first metatarsal is one of an extensive network. The origin of this vascularity is comprised of three primary sources:

-The periosteal arterial system

-The principal nutrient artery

-The metaphyseal and capital arteries

The anatomical locations of these vessels are extremely important during surgical intervention. Excessive dissection at the level of the head and neck junction, dorsally, laterally and plantarly, should be avoided so as to minimize the probability of avascular necrosis. (3)

The neurological innervation to the hallux with metatarsophalangeal joint is from three primary sources:

-The deep peroneal nerve

-The medial dorsocutaneous nerve

-The medial plantar nerve (3)

It is important to identify and protect these structures considering surgical approaches.

2.2 Kinesiology of the foot in relation to hallux

2.2.1 Kinematics and biomechanics

It is important to keep in mind that the human body is not a purely mechanical system, like often practiced in the modern western societies. It is a complex system and should be treated accordingly.

The hallux is a quite complicated and complex anatomical structure with details in such a small scale that even exceptional experienced surgeons can have problems in related surgeries. The hallux is relatively complex in its way of mechanics. The basic functional anatomy must be first considered in discussing the development of hallux valgus deformity. Regarding the kinematics and biomechanics of the hallux the word "First ray" is an often used abbreviate word. The first ray is a functional unit consisting of the first metatarsal, medial cuneiform, navicular and phalanges of the hallux. (1)

The metatarsophalangeal joint is in case two joints with a common joint capsule and interrelated muscles and ligaments. The distal portion is a partial ball-and-socket type morphology between the first metatarsal and the proximal phalanx, while the second portion is a rounded groove between the plantar first metatarsal and the dorsal surface of two sesamoids. (1) It is a biaxial condylar articulation that relies on a synovial capsule, collateral ligaments, and a fibrous plantar plate to maintain joint stability. The metatarsocuneiform joint is a stable union having a dense plantar ligament that works to fortify the medial longitudinal arch. A medial sesamoid bone and a lateral sesamoid bone, encased in the tendons of the intrinsic muscles, lie beneath the medial cuneiform and the base of the second metatarsal. The base of the first metatarsal makes neighboring contact with the second metatarsal. The Lisfranc ligament connects the first and second metatarsals. Severe hallux valgus deformity may disrupt each of these bony contacts and joint structures. (6)

The first metatarsal in connection with the medial cuneiform is a part of the "first ray" The first metatarsal and cuneiform bone move together as a single unified arch segment, but separately from the second metatarsal. (3)

The first metatarsophalangeal joint has two distinct axes of motion, the transverse axis and vertical axis. The transverse axis provides pure plantarflexion and dorsiflexion of the hallux. (3) Motion is greatest in the sagittal plane in this transverse axis, where the

range of motion has been estimated to be approximately 30-degree plantar flexion to 90-degree dorsiflexion. (7) The vertical axis provides pure adduction and abduction. Normally there is very little or no frontal plane movement in the metatarsophalangeal joint that may sublux the joint. (5)

Because joints do not truly and fully align perpendicular to the cardinal planes, rotations of the hallux and first metatarsal segment occur in some proportion across each of the cardinal planes. Besides describing motion, the terms “abduction of hallux” and “adduction of first metatarsal” describe the direction of the hallux valgus deformity. (6)

2.2.2 Biomechanics during normal ambulation

The first ray is the most heavily loaded structure of the foot during gait; proper weight bearing is essential for physiological gait patterns. (6)

The sagittal plane motion is essential in normal locomotion. During normal ambulation the motion of the first metatarsophalangeal joint goes through three distinct phases;

I) Distraction: begins at the first phase of dorsiflexion that increases the joint space for the next phase.

II) Gliding: as the metatarsal plantarflexes and the hallux moves to increase dorsiflexion and extension of the metatarsophalangeal joint.

III) Compression: occurs at the end range of motion as the proximal phalanx compresses against the dorsal surface of the metatarsal head allowing the rigid lever to become complete.

Sesamoid function is necessary for stabilization of the first metatarsophalangeal joint during ambulation. Sesamoids serve a pulley function for the first metatarsophalangeal joint with muscle insertion to stabilize the hallux, against the ground during ambulation. During ambulation as the heel raises, the first metatarsal head moves in a posterior direction as the first ray plantarflexes and the sesamoids move in a more distal position beneath the articular surface. Sesamoidal ridge provides transverse stability for the sesamoids during the propulsive phase of gait. (3)

Instability of the first metatarsophalangeal secondary to hallux valgus may cause wearing down of the crista which, in combination with the other pathological entities involved with the deformity, can lead to dysfunction of the sesamoids, thus decreasing propulsive stability of the hallux during gait. (3)

2.2.3 Pathomechanics

Information about Pathomechanics can be quite useful in combination with the knowledge of general biomechanics and kinematics, to fully understand the progression of hallux valgus, in relation to kinesiology.

The progression of hallux valgus, is not fully and well understood, it is although predictable. The tensile strength of the medial collateral ligament of the first metatarsophalangeal joint weakens and the hallux abducts laterally into valgus. Coincident with abduction of the hallux, the metatarsals shifts medially into adduction, potentially subluxating the sesamometatarsal articulation. The "hallux valgus angle" refers to the offset in first metatarsophalangeal joint positioning. The related separation between the first and second metatarsal, which increases as deformity becomes worse, is called the intermetatarsal angle. (6) Deformity is graded to be severe when the intermetatarsal angle is greater then 16 degrees, with hallux valgus angle greater then 40 degrees. A severe kind of deformity leaves the medial aspect of the metatarsal articular surface uncovered and exposed to trauma. (6)

Lateral deviation of the great big toe and subluxation of the sesamoids represent patho-morphological characteristics of hallux valgus deformity. These changes alter kinematics of the first metatarsophalangeal joint, leading to reduced strength (force-generating capacity) of the plantar flexors. Plantar pressure studies revealed that the great toe assumes a diminishing role in weight bearing of the forefoot. In addition to the lateral transfer forces, the center of pressure shifts laterally. These factors cause decreased weight bearing of the great toe during gait. (6)

Hallux valgus alters bony contact pressure across the first MTP joint members. As a result of incongruity contact pressure, lesions develop in the articular cartilage. Eventually, the cartilage erodes and changes the shape of the first metatarsal head. (8)

Deformity remains and worsens due to the unbalance of moments acting on the hallux during gait. Plantar pressure measurements are highest near the end of the stance when loads carried by the hallux approach 40% of body weight. (6) Walking with a laterally rotated foot angle and walking in excess foot pronation are gait compensations known to redirect the distribution of weight to the medial side of the hallux. (9) Moment generated mostly by the flexor hallucis longus counters the ground force moment reacting to dorsiflexion the hallux. These action-reaction moments have been modeled to explain the progression of deformity. (10)

As the hallux abducts, the ground reaction force acting on the hallux has a medial component that increasingly works to displace the first metatarsal into adduction. The magnitude of this medial force component equals the ground reaction force acting on the hallux multiplied by the tangent of the angle approximating the hallux valgus angle. (10) Added to this is the misdirect moment action of flexor hallucis longus. In response to developing deformity, the resultant pull of the flexor hallucis longus shifts from a plantar direction to a lateral direction, changing the joint moment action form the sagittal plane to the transverse plane. (11)

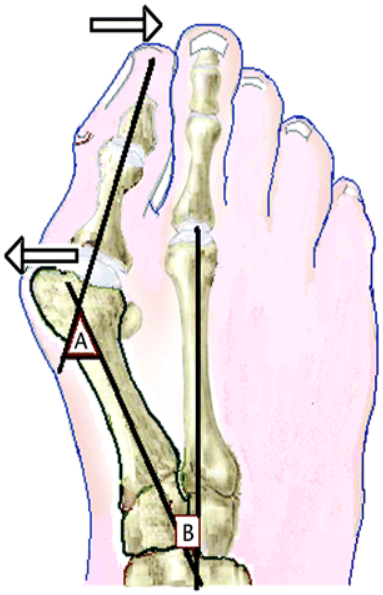

Figure 1 Hallux valgus alignment (Gudas, 2005)

2.3 An overview of the hallux valgus deformity

2.3.1 Definition

Hallux valgus is a forefoot deformity in which the great toe, at the metatarsophalangeal joint takes a valgus position towards the fifth toe. There is no clear agreement as to how many degrees the great toe must deviate from the normal position in order to be called hallux valgus. However, treatment of the condition must be considered even with only slight deviation if the patient is suffering severe pain or if the patient´s daily life and activities is affected. (1)

2.3.2 Epidemiology

Although hallux valgus is the most common foot deformity that accounts for significant numbers of office visits to foot and ankle specialists, the incidence has not been documented accurately. Relatively few studies are available, and much of the information consists of empirical data based on patient observations.

A recent systematic review estimate the prevalence of hallux valgus to be 23% in adults aged 18 to 65 years. It become more frequent with increasing age and is more prevalent in women than men. (13) In a survey done by E. Roddy, W. Zhang and M. Doherty the prevalence of hallux valgus was overall greater in women with 38% prevalence, compared to men with 21% prevalence, in age above 30. The prevalence was greater in women across all age groups, and the prevalence increased as patient age increased. (14) Dr. Gould reported a ratio of 2:1 - 4:1 higher incidence in female versus male. (12)

In the survey done by E. Roddy, W. Zhang and M. Doherty bilateral hallux valgus was reported by 16,9% of subjects compared with unilateral hallux valgus, with 6% in the left foot only, and 7% in the right foot only. In women, 21,2% reported bilateral hallux valgus, 7,6% in left foot only, and 8,2% in right foot only. In men 11% reported bilateral hallux valgus, 3.9% in the left foot only, and 5,4% in the right foot only. The frequency of bilateral hallux valgus increased as patient age increased. (14)

On Univariate analysis, hallux valgus was associated with age, female sex, nodal osteoarthritis, knee pain, big toe pain, knee replacement, hip replacement, osteoarthritis, and self-reported rheumatoid arthritis. (1)

2.3.3 Etiology

The underlying cause of hallux valgus is unknown, but biomechanically instability, structural deformity, traumatic compromise, and neuromuscular and/or arthritic conditions are factors that are known to contribute to hallux valgus development. Gender and age are the most common risk factors, with females and the older adult population being more at risk for this condition. (15) Hallux valgus has on several occasions been referred to as the "hallux valgus complex", meaning that when it occurs, it is associated with a multiple of other symptoms or deformities of the forefoot. These include calluses under the foot, metatarsalgia, splayfoot, flatfoot, plantar fasciitis, and hammer toes. (1)

The issue of shoegear contribution to hallux valgus formation has long been discussed. (3) The Hallux valgus seems to be a deformity that was uncommon until the fully enclosed shoes and boots. Early Greek and Roman sculptures are devoid of this deformity. (1) Shine examined the population in the island of St. Helen and found a prevalence ranging from 2-48%, depending on whether or not the population was using shoes. Fook and Hodges did a study on a portion of the Chinese population, half of which wore shoes and half of which did not. In the shod population, 33% were found to have hallux valgus. The barefoot population demonstrated a frequency of only 1,9%. (3)

Some individuals have considered heredity and the congenital nature of the disease. These are few isolated reports of babies being born with hallux valgus. More then 50% of those who do have bunions report that the deformity was noticed before the age of 20, usually during the pubescent years. (1) Historical evaluation indicates that hereditary factors involve from 60-80% of all patients with hallux valgus deformity. They indicate that inheritance of hallux valgus is an autosomal dominant propagation with incomplete penetrance. The deformity appears to be sex-linked, which could imply a purely genetic axis. The genetic factor is possibly dominant in females, and possibly recessive in males. However, there are obvious variables including shoes, childbirth, and biomechanical abnormalities, which may also account for the statistical over balance in favor of females. (3) Hardy and Clapham demonstrated that, in a group of 91 cases of hallux valgus, there was a 63% positive familial background. (16)

Neuromuscular diseases have been documented as an etiologic factor in the formation of hallux valgus and multiple neurological diseases may contribute to development of

the deformity. (3) Congenital neurological pathology, such as ankle equinus associated with cerebral palsy, and chronic inflammatory conditions have been found to relate to hallux valgus. Damage to the first MTP joint occurs in nearly 25% of patients having rheumatoid arthritis. (6)

Premised on the belief that structure influences function, research has investigated length of the first metatarsal as a separate factor in hallux valgus. Both relative long and short first metatarsals have been reported as associated with deformity progression. These opposing results suggest that length of the first metatarsal may be incidental of the development of deformity. Shape of the first metatarsal head has also been explored as a potential predisposition of hallux valgus. A flattened head is considered to be resistive to deforming forces, whereas a round head is thought more prone to allow the hallux to drift into deformity. (6) A retrospective review of 110 foot radiographs of patients having hallux valgus identified the head of the first metatarsal to be shaped "round" in 100% of those having a long first metatarsal in comparison with their second metatarsal. (17) The predisposition most often identified with hallux valgus is collapse of the medial arch, especially as it related to instability of the first metatarsal. (6)

Other discussed etiologies of hallux valgus deformity are traumatic compromises with Malunions, intra-articular damage, soft-tissue sprains and dislocations. Which have been surveyed as a risk factor for hallux valgus deformity. (6)

2.3.4 Classification

There are several different classifications for hallux valgus. Some of the most common and used classifications use radiographic measurements with standing radiographs. In this classification, two different angles are used for comparison, as seen in picture 1 (page 12). The hallux valgus angle is the intersection of the longitudinal axis of the proximal phalanx and the first metatarsal. A normal hallux valgus angle is considered to be less then 15 degrees. The first until the second intermetatarsal angle is the second angle used for comparison, and the first until second intermetatarsal angle is the intersection of the longitudinal axes of the first and second metatarsals. Less then 9 degrees is considered normal. Subluxation of the lateral sesamoid, measured on the radiographs, can also be used for classification measurement. (18)

-Grade 1 – Mild hallux valgus: Is defined as a hallux valgus angle less then 20 degrees, and an intermetatarsal angle less then 11 degrees, with less then 50% subluxation of the lateral sesamoid. (18)

-Grade 2 – Moderate hallux valgus: Is defined as a hallux valgus angle of 20 to 40 degrees, and an intermetatarsal angle that is less then 16 degrees, with 50 – 70% subluxation of the lateral sesamoid. (18)

-Grade 3 – Severe hallux valgus: Is defined as a hallux valgus angle greater then 40 degrees, and an intermetatarsal angle greater then 16 degrees, with more than 75% subluxation of the lateral sesamoid. (18)

It is not always possible or necessary to take radiographs to determine the severity of hallux valgus. If radiographs are ruled out for some reason, the Manchester scale is most likely used. (21) The Manchester scale consists of standardized photographs of four types of hallux valgus; none, mild, moderate and severe. This tool has good retest reliability, and is also a good tool to use to determine the hallux valgus severity. (22)

2.3.5 Symptoms

Hallux valgus usually becomes symptomatic when the first metatarsal deviates so much it rubs on the shoe, or when the great toe rubs or the second toe. Hallux valgus often causes symptoms in three different ways. First and foremost is pain in the bunion, the pressure-sensitive prominence on the medial side of the head of the first metatarsal. It hurts to wear shoes. Furthermore, the valgus deviation of the great toe often results in a lack of space for the other toes. They become displaced, usually upwards, leading to pressure against the shoe. Finally, normal function of the forefoot relies heavily on the great toe pressing down on the ground during gait. Since the hallux valgus deformity stops this from happening to a sufficient degree, metatarsal heads II – V are overloaded. The resulting pain is referred to as transferring metatarsalgia. (19)

Other symptoms may include:

-Burning or tingling in the dorsal aspect of the bunion, due to partial or complete anesthesia along the course of the medial dorsal cutaneous nerve.

-Erythema around the bunion.

-Interdigital keratosis.

-Ulceration to the medial metatarsal head.

-Painful overlapping the second digit.

-Restricted motion of the first and second toe.

-Soreness between toes.

-Ingrown toenail. (1)

2.4 Diagnostics and presentation

Determining the diagnosis for hallux valgus is majorly divided into 3 groups: Medical history, physical examination and radiological assessment.

The medical history is important to assess the patient problems before eventual treatment or surgery. Important factors in the medical history are: (18)

-Occupational history: If the patient has a job that requires them to be on their feet all day or wearing stylish shoes. Information should also be acquired about the frequency of recreational activities such as running, jumping, and sports.

-Ask about the pain scale, type, location and what relieves it. Pain can tell a lot about the development and current level the hallux valgus deformity.

-Ask about shoe wear, where relief of pain is the major objective.

-Questions about limitation of physical activity and activities of daily living are valuated for understanding and evaluating the severity of the patient's pain.

-Which treatments have been attempted previously, and the effect of these.

The physical examination includes an assessment of the vascular, dermatologic, neurologic, and musculoskeletal system. The musculoskeletal assessment can be divided into two components: Determining the etiology and evaluation of the presenting deformity. Understanding both these components is essential in determining the most satisfying and successful treatment plan, whether conservative or surgical. (12) The medial eminence (bunion) is often the most visible feature on physical examination.

Pain over the medial eminence is often the primary symptom. (18) The workup of the physical examination is tailored to the patient medical history. If neurological complaints, systemic arthritis, or collagen vascular diseases are mentioned, they should be addressed further in detail. If none of these are present, the focus turns to the biomechanical examination. (12) Physical examination should be performed with the patient both sitting and standing. (18)

Important assessments in the biomechanical assessment is:

-Hallux position, with medial prominence.

-First ray range of motion including metatarsophalangeal joint.

-Subtalar and midtarsal joint range of motion.

-Hip internal and external rotation.

-Genu valgum/varum.

-Tibial torsion.

-Ankle joint dorsiflexion.

-Neutral and resting calcaneus stance position.

-Pain location.

. -Contraction of the extensor hallucis longus with associated deformities. (1)

Radiographic examination should include weightbearing anterior-posterior, lateral, and axial (sesamoid) radiographs, routinely. The radiographic measurement is made using standing radiographs. The radiographic examination is also used to measure the classification of the hallux valgus deformity like explained in **2.3.4 classification.** (18)

At last blood and urine tests are used to fully rule out rheumatoid arthritis, diabetes, collagen vascular diseases and gout. (20)

2.5 Prognosis

Hallux valgus is a complete deformity, and various approaches are available. To date, no satisfactory studies have been performed to compare the various procedures and their success rates. If the deformity and etiology are addressed successfully, the benefits of treatments in almost all cases fairly outweigh the risks of the treatments. (23)

2.6 Treatments

2.6.1 Non-surgical treatment

The first treatment option for hallux valgus is non-operative care. A variety of non-surgical treatments for bunion pain relief and big toe correction can postpone the need for surgery or avoid bunionectomy all together. It is important to keep in mind that every patient is different in the degree of metatarsophalangeal joint deviation and compliance.

A non-operative care is the adjustment of shoes. Shoes need to be adjusted in order to avoid friction. Adjustment of footwear can be utilized to eliminate friction over the medial eminence, e.g. providing a wider and deeper toe box. (18)

Doctors are known to have prescribed orthotic solutions ranging from toe spacers or pads to nighttime splints, all with different outcome:

- Protective pads or cushions, such as gel toe shields and caps, simply protect the bunion from friction, but they do not straighten the big toe.

-Toe-spreading devices take the form of a wedge, its positioned in the space between the hallux and the second toe, so that the hallux is pushed towards the lateral side of the foot. Unfortunately, in order to exert a force, they support themselves against neighboring toes, and causing incorrect position of these.

-Toe straighteners are padded splints that run along the inner side of the foot as a spring with a ring eye at the toe end, to hold the hallux. At the other end, the pad splint is bent to rest against the heel allowing the hallux to be bought out into a normal position, although compliance can be difficult due to discomfort.

-Bunion splint or bracers are the most effective non-surgical treatment in preventing further progression of a bunion, as well as for postoperative purposes.

Well-designed splints address the underlying foot function that contributes to toe deviation, whereas the aforementioned treatments do not. The basic design of a bunion splint has a “holder” for the hallux, extended in a longitudinal direction connected to another “binding” around the mid-foot, resulting in a corrective force of the big toe. (24)

2.6.2 Surgical treatment

When non-surgical treatment has proven inadequate and symptoms are persistent, surgical intervention is indicated. Surgical procedures are tailored to certain factors, such as the patient´s age, the amount of deformity, the degree of loss of motion at the first metatarsophalangeal joint, the amount of degenerative changes present both radiographically and intraoperatively (1)

More than 100 different procedures for the removal of a bunion and correction of hallux valgus have been described. In a rather simplistic classification, these procedures are either soft tissue corrections principally around the first metatarsophalangeal joint or those procedures that employ an osteotomy to correct a structural component of the deformity. The surgical technique for hallux valgus is often based on the degree of deformity. (1)

There are many different kinds of osteotomy procedures. Traditionally the different procedures are quite alike in execution.

One of the oldest and most traditional osteotomies is the Akin procedure. The Akin procedure is described as a transverse closing wedge osteotomy, performing approximately 5mm distal to the articular surface of the base of the proximal phalanx. The first osteotomy is performed parallel to the phalangeal base and the second osteotomy is positioned parallel to the articular surface of the phalangeal head. On removal of the intervening osseous wedge and reduction of the osteotomy, symmetry of the medial and lateral aspects of the phalangeal shaft has been achieved. (1)

Although a painful hallux, often with accompanying pressure against the second digit, is usually the chief complaint, certain preoperative criteria will lead the practitioner to selection of the phalangeal osteotomy. (1)

Other known osteotomy procedures are The Kellers procedure, the Wilson procedure, the Mitchell procedure, distal Chevron osteotomy and the scarf osteotomy. (25)

The postoperative contraindications and care is pretty much the same for all the different procedures with only small deviations in the time perspective:

-Rest, elevation and ice for the first 3-5 days.

- 3 – 4 weeks in a post-operative shoe

- Wide fitting shoe for 6 – 8 weeks.

-Physical therapy starts at the second or third week, home exercises are implemented.

-Regular activities can be resumed at 2 – 3 months as tolerated. (1)

Possible complications of osteotomy surgeries are not major or life threatening, but there are risk associated with any kind of surgical procedures. About 10% of patients experience complications after bunion surgeries. These can include: (26)

-Infection.

-A recurrent bunion.

-Failure of the bone to heal.

-Damage to the nerves.

-Stiffness of the joint.

-Continued long term pain.

-Over correction of bunion (hallux Varus). (26)

2.6.3 Physiotherapeutic methods

The physiotherapeutic methods for hallux valgus can be used both in the preoperative and postoperative phase. In the preoperative phase, the conservative treatment is often used to slow down the deformity and relief pain. In the postoperative phase physical therapy can be used to reach different rehabilitation plans both in long and short term.

Many different types of physical therapy teqnuiches have been documented in the post-operative state, although few studies have been concerned about the effect of the physical therapy.

R. Schuh, S. Hofsteatter, S. Adams, F. Pichler, K. Kristen and H. Trnka did a comprehensive study in 2009 were the purpose was to illustrate the changes of plantar pressure distribution during the stance phase of gait in patients who underwent hallux valgus surgery, and received a multimodal rehabilitation program with physiotherapy. The physical therapy rehabilitation program used were:

-Lymphatic draining and Cryotherapy to reduce swelling.

-Gait exercises, with focus on learning physiological gait patterns.

-Stance phase, with focus on heel-strike and pressure on medial side of foot.

-Weight bearing of first metatarsal during mid-stance and terminal stance.

-Selective strengthening exercises of peroneus longus, to help pronation of the foot.

-Exercise with active push-off by the hallux flexors, the flexor digitorum longus and brevis muscles, and the lumbricales muscle.

-Manual therapy, with mobilization in all metatarsophalangeal joints, Lisfranc, transverse tarsal, Subtalar and ankle joints.

-Concentric strengthening exercises of the great toe flexors and extensors.

-The patients were also instructed to do marble pick-up exercises, apply cold packs, and do strengthening and gait training at home. (6)

The sessions took place once a week for 3 to 6 weeks, with sessions ranged from 35 – 45 minutes. The study had excellent results with an orthopedic foot and ankle society score increasing from 60,7 points to 94,5 points 6 months after surgery. The first metatarsophalangeal joint range of motion increased at 6 months postoperatively, with a significant increase in isolated dorsiflexion. In the first metatarsal head region, maximum force increased from 117,8 N to 126,4 N and the force-time integral

increased from 37 N to 55,6N. In the great toe region, maximum force increased from 66 N to 87N between the postoperative and 6-months assessments. (6)

The result suggests that postoperative physical therapy and gait training may lead to improved function, and weight bearing of the first ray after hallux valgus surgery. (6)

Other studies have shown great postoperatively effects in taping and foot exercises on patients with hallux valgus. B. Bayar, S. Erel, I. Sismek, E. Sumer and K. Bayar did a comprehensive study in 2011where 20 female patients with hallux valgus were treated with taping and foot exercises. Some of the foot exercises where:

-Passive abduction of the hallux with traction of the first metatarsophalangeal joint

-Active abduction of the hallux (27)

The study group was treated with taping in addition to this exercise program. For the taping a non-allergic and non-elastic white tape was used. After an 8-week period, a significant decrease was found in the hallux valgus angle, resting pain, walking pain and a gait improvement. (27)

Other physical therapy programs for hallux valgus not mentioned in these studies includes whirlpool, ultrasound, ice, electrical stimulation, sesamoid mobilization and Sensomotoric training. (1)

3. SPECIAL PART

3.1 Methodology

My case study took place at Centrum Léčby Pohybového Aparátu Vysočany (CLPA) in Prague. The practical part of the case study took place from 07.01.13 until 18.01.13. The CLPA clinic specialized in rehabilitation after adult orthopedics surgery and sport traumatology. The clinic offers a huge variety in therapeutic methods, some of them including; hydrotherapy, electrotherapy, kinesiotaping, and a fully equipped fitness rom with a lot of physiotherapeutic equipment. My case study was conducted on Mrs. S.M, who was admitted for rehabilitation after a hallux valgus operation. The aim of the thesis was to do a research on physiotherapy treatment after hallux valgus operation.

My case study was supervised by Mgr. Zaher El Ali, at CLPA, and all my work was done under the supervision and in close cooperation with him.

My patient was informed from the very beginning, in written form about the case study. The topic for this thesis was approved by the Ethics Committee of the Faculty of Physical Education and Sports, at Charles University (approval number 032/2013) on January the 25th, 2013.

I had the excellent possibility to use both a private therapy room and the fitness room during the examinations and therapy sessions. Some of the equipment a viable and used was:

- Therapy table
- Measuring tape
- Goniometer
- Neurological hammer
- Elastic bands
- Overball
- Sensomotoric equipment; e.g. trampoline.
-Therapy ropes

3.2 Anamnesis

Examined person: Mrs. S.M. (female)

Date of birth: 1956

Diagnosis: M201; Hallux valgus (acquired) bilateral

Present state:

The patient is a 57-year old woman after hallux valgus bilateral operation, at December the 18th 2012, 3 weeks ago. The patient is fully oriented. She explains a feeling of stiffness in lower extremities, especially in her feet and toes. She complains about some pain in both her feet, especially in and around the joints of her 1st toes (big toe). She is not able to wear shoes because of the swelling and pain; she is currently wearing white crocs. During the kinesiology examination she explains the pain in a scale from 1 – 10, as 5. At rest she say that her pain is no more than 1. She explains that the pain increases during movement of toes especially when walking; she avoids both the usage and stepping on toes during her step-phase to reduce this pain. She explains the pain as a sharp and localized, without any form of radiation. She is walking without crutches, and explains that she has no problem walking regardless the pain.

Blood pressure: 170/110 mmHg Heart rate: 75 bpm

Kg: 86 Cm: 165 cm

BMI: 31,2 – Slightly obese.

Medical history:

Chief complaint: Pain and stiffness in lower extremities after hallux valgus operation of both feet. Almost no pain is felt at rest. A greater amount of pain is felt while walking, where she is not able to bend or put pressure on her toes. The pain is felt mainly in flexion and extension of both er 1st toes.

Family history:

-Mother had Hallux valgus on left foot

-Father had arterial hypertension.

History of present problem:
Mrs. S.M. explains that her problems with both her 1st toes started approximately 2 years ago. She explained that she first noticed the development of a bulb (bunion) on the medial part of her 1st metatarsals. The patient noticed this bulb because her feet were painful after a long day with footwear. This bunion developed to become more prominent and her big toe started to deviate inward. During the irascible progression of the inward deviation of both her big toes, she started to develop problems with both her knees with swelling and inflammation. During the year 2012 she had 6 appointments for the follow-up checks on her hallux valgus progression. The last medical check-up was 17.09.2012, were she was prescribed for a bilateral hallux valgus operation. She were operated the 18.12.2012.

Previous injuries:

-Broke shaft of radius as a child.

Previous operations: No previous operations.

Gynecological: 2 births, no abortions.

Childhood disease: Normal childhood disorders

Chronic disorders:

-Arterial hypertension (170/110)

Pharmacology:

-Ibuprofen
-Cortisone cream
-Antibiotics
-Xefo
-Enalpril
-Metropol
-Marcain

Allergies: No allergies.

Abuses: S.M does not smoke, drinks alcohol occasionally.

Occupational anamnesis: S.M works as an accountant.

Social anamnesis:

-S.M. lives with her husband in a two-storey house

-She used to practice dancing, but not for the last years.

-She enjoys walking her dog.

Previous rehabilitation: The patient had no previous rehabilitation

Statement from patient's medical documentation:

18.12.2012:

Osteotomy bilateral MPJ

The operation area is cleaned and anesthesia is applied. Patient is in supine position, lying on the back. Start on the right side and progress to the left side, after operation both feet are put in soft elastic bandage.

Operation went fine on both sides and in same way on left and right.

After operation Marcain and TMC is applied on both sides (wounds).

Operation passed without any complications.

02.01.2013

S: ok

Both minimal swollenness

Soft bandage 3 days

Antibiotics, RHB, pressure massage is applied.

Indication of rehabilitation: Two weeks at Centrum lecby pohyboveho aparatu Vysocany with physiotherapy 3 days per week. With aims to improve range of motion, reduce pain and swelling, prescribed by the patient's doctor.

3.3 Initial kinesiological examination, Performed 10.01.13

3.3.1 Postural examination

Anterior view:

- Flat feet on both sides with decreased arch
- Flat toes on both sides
- Over supination; Standing on lateral aspect of both feet
- Both feet are swollen
- Slightly ER of both feet
- Genu valgum
- High activation of quadriceps on both sides
- Umbilicus in the middle
- Left shoulder is slightly elevated
- Higher trophy on left shoulder
- Head slightly lateral flexed to left

Posterior view:

- Narrow base of both feet
- Over supination: Standing on lateral aspects of both feet
- Normal shape of heels
- ER of both feet
- Gluteal line is aligned
- Spine is in middle of plumb line
- Scapulas ABD
- Head slightly lateral flexed to left

Lateral view: Both sides

- Flat toes, both sides
- Decreased longitudinal foot arch – flat feet both sides
- Small flexion of both knees
- Small prominence of abdomen
- Small flexion of both elbows
- Retraction of both shoulders
- All joints are in good alignment

3.3.2 Scale test

	Kg
Whole body	86
Left side	42
Right side	44
Difference	2 kg – Within the norm

Table 2 Scale test

3.3.3 Pelvic examination

- Slight lateral tilt to the left
- No anterior or posterior tilt
- No torsion

3.3.4 Breathing examination

Performed in standing and supine position

- Type: Abdominal breathing
- Frequency: 24
- Notes: Reduced movement of ribs

3.3.5 Scar assessment

- Length of scar: Left foot: 4cm, Right foot: 3,5cm
- Restriction: Restricted in all directions, both sides.
- Colour: Edema with red colour, both sides.

3.3.6 Gait examination

- Pathological rolling of both feet.
- Starts the step-phase on heels, does not roll to toes, both sides.
- Ends the step-phase without involvement of toes, both sides.
- Small external rotation of feet, more on left foot.
- Loading lateral part of both feet during gait.
- Clapping feet when walking, both sides.
- Short steps
- Lack of proper hip extension

- Lack of proper trunk rotation
- Stiff trunk and upper extremities during gait
- Stiff neck during gait

3.3.7 Special gait examination

Closed eyes:

-Able to perform it without problems

-Shorter steps

-More movement in upper extremity and trunk

Backward walking:

- Able to perform it
- Almost pure walking on heels
- No involvement of toes, they do not touch the ground
- Anxious of falling
- Stiff upper extremity, trunk and neck
- Increased ER of both feet

Squat walking:

- Able to perform it
- Putting load on heels
- Fast fatigue, only a few steps performed
- Increased ER of both feet

Heel walking:

- Able to perform it without problems
- Problems with maintaining balance
- Increased ER of both feet

Tip toe walking:

-Is not able to perform it due to pain localized around the 1st toe of both feet.

3.3.8 Trendelenburg test

Standing on left foot: Negative

Standing on right foot: Negative

3.3.9 Dynamic spine test

Flexion:

-Limited movement in lumbar area

-Hyper flexibility in Thoracic and cervical spine

-Full ROM

-No pain

Lateral flexion (Right):

-Good and fluent movement

-Full ROM

-No pain

-More movement compared to left side

Lateral flexion (Left):

-Good and fluent movement

-Full ROM

-No pain

-Less movement compared to right side

Extension:

-Limited movement in Lumbar area

-Hyper mobility in Thoracic and cervical spine

-Full ROM

-No pain

3.3.10 Examination of basic movement patterns

Basic movement pattern	Right side	Left side
Hip extension	Hip extension is performed with correct movement pattern. Gluteals are primary movement components. Absence of shoulder girdle activation.	Hip extension is performed with correct movement pattern. Gluteals are primary movement components. More activation of shoulder girdle.
Hip abduction	Tensor mechanism; compensatory hip flexion is observed instead of pure abduction.	Tensor mechanism; compensatory hip flexion is observed instead of pure abduction.

Table 3 Basic movement patterns

3.3.11 Lower extremity, length

Measured	Left, cm	Right, cm
Functional length	98	98
Anatomical length	92	92
Femur length	51	51
Calf length	41	41
Foot length	23	23

Table 4 Lenght - lower extremity

3.3.12 Lower extremity, circumference

Measured	Left, cm	Right, cm
Thigh, 10 cm over knee	46	46
Thigh, 15 cm over knee	48	48
Knee	39	39
Calf	36	36
Ankle	25	25
Foot	23	23
Metatarsals	22	23

Table 5 Cirumference - lower extremities

3.3.13 Range of motion examination

Movement	Active R	Active L	Passive R	Passive L
Hip				
Extension	10	10	10	10
Flexion	120	120	125	125
ABD	40	40	45	45
ADD	10	10	10	10
ER	40	40	45	45
IR	30	30	30	30
Knee				
Extension	+5	+5	+5	+5
Flexion	120	120	125	125
Ankle				
Plantar flexion	10	10	15	15
Dorsal flexion	35	35	35	35
Foot				
Inversion	15	15	20	20
Eversion	25	25	30	30
MTP joint				
Flexion				
1	15	15	20	20
2	25	25	30	30
3	25	25	30	30
4	35	35	40	40
5	30	30	30	30
Extension				
1	15	15	15	15
2	15	15	20	20
3	20	20	20	20
4	20	20	25	25
5	20	20	25	25
PIP joint				

Flexion				
1	20	20	25	25
2	30	30	35	35
3	35	35	35	40
4	35	35	40	40
5	35	35	40	40
Extension				
1	20	20	20	20
2	25	25	30	30
3	30	30	30	35
4	30	35	40	40
5	35	35	35	40
DIP joint				
Flexion				
1	20	20	25	25
2	30	30	35	35
3	35	35	35	40
4	35	35	40	40
5	35	35	40	40
Extension				
1	20	20	20	20
2	25	25	30	30
3	30	30	30	35
4	30	35	40	40
5	35	35	35	40

Table 6 Range of motion examination

Pain felt when trying to reach full ROM in 1st and 2nd toe in all small joints.

3.3.14 Examination of shortened muscles

Muscle/muscle group	Right side	Left side
M. Triceps surrae	Moderate shortness	Moderate shortness
Hip adductors	Normal	Normal
Knee flexors	Normal	Normal
Sartorius	Normal	Normal
Tensor fasciae latae	Normal	Normal
Rectus femoris	Moderate shortness	Moderate shortness
Illiopsoas	Normal	Normal
M rectus abdominis	Moderate shortness	Moderate shortness
Back muscles	Normal	Normal
Cervical Lateral flexion	Normal	Normal

Table 7 Shortened muscle examination

3.3.15 Manual muscle testing

Lower Extremities:

Muscle	Right, grade	Left, grade
Gluteus Medius	4	4
Lateral Rotators	5	5
Medial Rotators	5	5
Hip Adductors	5	5
Tensor Fasciae Latae	4+	4+
Sartorius	5	5
Iliopsoas	5	5
Quadriceps Femoris	5	5
Biceps Femoris	5	5
Semitendinosus & Semimembranosus	5	5
Popliteus	4+	4+
Gastrocnemius	4+	4+
Soleus	5	5

Peroneus Longus & Peroneus Brevis	4	4
Tibialis Anterior	4	4-
Tibialis Posterior	4	4
Extensor Digitorum Longus and Brevis	4	4
Peroneus Tertius	4	4-
Flexor Digitorum Longus & Quadratus Plantae	5	5
Flexor Digitorum Brevis	4+	5
Lumbricales	2: 4 3: 4+ 4: 5 5: 5	2: 4 3: 5 4: 5 5: 4+
Plantar Interossei	2: 4- 3: 4 4: 4+ 5: 4+	2: 4- 3: 4 4: 5 5: 4+
Dorsal Interossei	2: 4 3: 5 4: 4+	2: 4 3: 5 4: 5
Flexor Hallucis Longus	4	4
Flexor Hallucis Brevis	4-	4
Extensor Hallucis Longus	4-	4-
Adductor Hallucis	4	4
Abductor Hallucis	4+	4

Table 8 Manual muscle testing

3.3.16 Joint play examination

Interphalangeal joints (distal):

	1st L	1st R	2nd L	2nd R	3rd L	3rd R	4th L	4th R	5th L	5th R
Dorsal	Small	Small	Small	Small	No	No	No	No	No	No
Plantar	Small	Small	Small	Small	No	No	No	No	No	No
Lat. L	No	No	No	No	No	No	No	No	No	No
Lat. R	No	No	No	No	No	No	No	No	No	No
Rotation	No	No	No	No	No	No	No	No	No	No

Table 9 Joint play examination interphalangeal joint (distal)

Interphalangeal joint (proximal):

	1st L	1st R	2nd L	2nd R	3rd L	3rd R	4th L	4th R	5th L	5th R
Dorsal	Small*	Small*	No	No	No	No	No	No	No	No
Plantar	Small*	Small*	No	No	No	No	No	No	No	No
Lat. L	No	No	No	No	No	No	No	No	No	No
Lat. R	No	No	No	No	No	No	No	No	No	No
Rotation	No*	No*	No	No	No	No	No	No	No	No

Table 10 Joint play examination interphalangeal joint (proximal)

* = With pain, L = left, R = right.

Metacarpophalangeal joints:

	1st L	1st R	2nd L	2nd R	3rd L	3rd R	4th L	4th R	5th L	5th R
Dorsal	Yes*	Yes*	Yes	Yes	Sm	Sm	Sm	Sm	Sm	Sm
Plantar	Yes*	Yes*	Yes	Sm	Sm	Sm	Sm	Sm	Sm	Sm
Lat. L	Yes*	Yes*	Sm	Sm	No	No	No	No	No	No
Lat. R	Yes*	Yes*	Sm	Sm	No	No	No	No	No	No
Rotation	Yes*	Yes*								

Table 11 Joint play examination Metacarpophalangeal joint

* = With pain, Sm = small, L = left, R = right.

Metatarsal head:

	1st L	**1st R**	**2nd L**	**2nd R**	**3rd L**	**3rd R**	**4th L**	**4th R**	**5th L**	**5th R**
One against other	Yes*	Yes*	Yes*	Yes*	Sm	Sm	Sm	Sm	Sm	Sm
Dorsal	Yes*	Yes*	Yes*	Yes*	Yes	Yes	Sm	Sm	Sm	Sm
Plantar	Yes*	Yes*	Yes*	Yes*	Yes	Yes	Yes	Yes	Yes	Yes

Table 12 Joint play examination Metatarsal head

* = With pain, Sm = small, L = left, R = right.

Lisfranc joint:

	Left	**Right**
Dorsal	Yes	Yes
Plantar	Yes*	Yes*
Rotation	Yes	Yes

Table 13 Joint play examination Lisfranc joint

* = With pain

Cuboid:

	Left	**Right**
Dorsal	No	No
Plantar	No	No

Table 14 Joint play examination Cuboid

Navicular:

	Left	**Right**
Dorsal	Small	Small
Plantar	Small*	Small*

Table 15 Joint play examination Navicular

* = With pain

Calcaneus:

	Left	**Right**
Lateral (left)	Yes	Yes
Lateral (right)	Yes	Yes
Rotation	Yes	Yes

Table 16 Joint play examination Calcaneus

Talocrural joint:

	Left	**Right**
Dorsal direction	No	No
Ventral	No	No

Table 17 Joint play examnation Talocrural joint

Knee joint:

	Left	**Right**
Dorsal	No	No
Ventral	No	No
Latero-lateral direction	No	No

Table 18 Joint play examination Knee joint

Tibiofibular joint:

	Left	**Right**
Head of fibula Dorsal	Small*	Small*
Head of fibula Ventral	Small	Small

Table 19 Joint play examination Tibiofibular joint

* = With pain

Patella:

	Left	**Right**
Latero-lateral	No	No
Cranio-caudal	No	No

Table 20 Joint play examination Patella

SI joint:

	Left	**Right**
Dorsal	Yes	Yes
Upper SI (ilium against sacrum)	Yes	Yes
Lower SI (Ilium against sacrum)	Yes	Yes

Table 21 Joint play examination SI joint

3.3.17 Muscle tone examination

Muscle	**Tone, left**	**Trigger P. left**	**Tone, right**	**Trigger P. right**
Rectus femoris	Hypertone*	Yes	Hypertone*	Yes
Vastus medialis	Normal	No	Normal	No
Vastus lateralis	Hypertone*	Yes	Hypertone*	Yes
Tensor fasciae latae	Hypertone	No	Hypertone	No
Illiopsoas	Hypertone	No	Hypertone	No
Adductor longus	Hypertone	Yes	Hypertone	Yes
Adductor magnus	Hypertone	No	Hypertone	No
Piriformis	Hypertone	Yes	Hypertone	Yes
Biceps femoris	Hypertone	No	Hypertone	No
Semimembranosus	Hypertone	No	Hypertone	No
Semitendinosus	Normal	No	Normal	No
Gastrocnemius	Hypertone*	Yes	Hypertone*	Yes
Soleus	Hypertone	No	Hypertone	No
Tibialis Anterior	Hypertone*	No	Hypertone*	No
Tibialis Posterior	Hypertone*	No	Hypertone*	No
Plantar aponeurosis	Hypertone*	No	Hypertone*	No
Abductor hallucis	Hypertone*	Yes	Hypertone*	Yes
Adductor hallucis	Hypertone*	No	Hypertone*	No
Flexor hallucis brevis	Hypertone*	No	Hypertone*	No

Flexor dig. brevis	Hypertone*	No	Hypertone*	No
Lumbricales	Hypertone*	No	Hypertone*	No

Table 22 Muscle tone examination

* = With pain

3.3.18 Functional testing of foot

Knee squat in standing position:

-Equal dorsiflexion of both feet

-Over supination; loading and putting pressure the lateral aspect of both feet.

-ER of both feet

-Genu valgum

Twisting/torsion motion of upper extremity and trunk in standing position:

-Pathological supination and pronation of feet

-The pronation pattern on twisting side is not performed

-The supination pattern on the opposite twisting side is normal

-Stiff movement pattern of both feet while twisting from side to side.

Standing on one foot: The same pattern is observed on both sides.

-Grasping and over-activation of toes

-Unstable

-Over-activation of tendons

Tiptoe stance:

-Patient is not able to perform it due to pain and anxiety of increasing the pain. The pain is mainly felt in and around the joint of the 1st metatarsal.

Grasping of toes

-Stiff toes

-Reduced range of motion on both sides

-Some pain is felt, although still able to do it

-Avoids grasping of the 1st toes (big toes).

3.3.19 Neurological examinations:

Deep tendon reflexes:

Reflex	Left	Right
Patellar reflex	2	2
Achilles reflex	2	2
Medioplantar reflex	2	2

Table 23 Deep tendon reflexes examination

Superficial skin sensation:

Examined area	Right, sensation	Left, sensation
Thigh anterior	Physiological	Physiological
Thigh posterior	Physiological	Physiological
Thigh lateral	Physiological	Physiological
Thigh medial	Physiological	Physiological
Calf anterior	Physiological	Physiological
Calf posterior	Physiological	Physiological
Calf lateral	Physiological	Physiological
Calf medial	Physiological	Physiological
Foot dorsal	Physiological	Physiological
Foot plantar	Physiological	Physiological

Table 24 Superficial skin sensation examination

Rhomberg test:

Rhomberg 1: Negative

Rhomberg 2: Negative

Rhomberg 3: Negative

Lean forward test: Negative

3.3.20 Examination´s conclusion:

The initial kinesiological examination was performed January the 10th 2013.
From the initial kinesiological examination we can clearly see the effects a post hallux valgus operation can cause on the whole body structure. From S.M´s posture we can see a definite over-supination where she puts pressure on the lateral aspect of both her feet. This can be caused due to the anxiety, and the protective mechanism created to reduce the stress of pain in the operated side of both her feet. This anxiety is also clearly seen in the gait examination where she walks without the physiological rolling with the involvement on toes, and with the over-supination, also seen in the posture. From the aspection and anthropometry we can see that both feet are still swollen after the operation, which makes her unable to wear normal shoes.

From the range of motion and joint play examination we can clearly see her subjective explanation of the feeling of pain and stiffness in lower extremities, especially her feet and toes. There is a lot of blockage in the lower extremities with reduced range of motion, especially in and around the joints of her 1st toe. Generally the entire lower extremities are affected with hypertonicity, reduced range of motion, and blockage in joints. A lot of trigger points are also found, especially in the major muscle groups in lower extremities.

The functional testing affirms what we have seen in the posture and gait examination, with the anxiety of overloading the 1st toe (big toe) with excessive over-supination of both feet.

The manual muscle testing shows that S.M´s muscle strength condition is in decent shape after the operation. The most affected muscles considering the muscle strength is the small muscles of both feet. We have to put in consideration that these number can be lowered due too the anxiety shown in the usage and movement in this part of her feet. There is also a lot of hypertonicity with trigger points and some shortening in the lower extremities.

3.4 Long-term and short-term plan:

The short-tem plan should be focused on decreasing the edema, pain and the patient's anxiety from the physiological usage of both her feet. It is important to reduce this anxiety for the sake of future progression from the physiotherapy lessons. This anxiety is also reduced in accordance with the edema and pain reduction.

Short-term plan:

-Decrease pain

-Decrease edema

-Decrease anxiety of physiological usage of feet

-Soft tissue technique according to Lewit, to increase fascia mobility.

-Increase Range of motion

-Dynamic strengthening exercises to facilitate the physiological usage of both feet.

-Reduce blockage of joints

-Reduce hypertonicity of hypertoned muscles.

-Improve balance

Long-term plan:

-Ideal gait and posture

-Maintain optimal Range of motion

-Return to previous muscle condition with less hypertonicity and increased strength

-Fully improve the blockage of joints

-Return to previous sport, soft dancing and rhythmical movement without the hard dancing shoes.

3.5 Therapy progress

3.5.1 Therapy session 1

Date: 10.01.13

Subjective: Patient feels stiff in her lower extremities, especially in her feet and toes. She complains about some pain in her joints in and around 1st toe (big toe). In a scale from 1 – 10 she explains the pain as 5.

Objectives:

-Circumference metatarsals:	Left: 22cm	Right: 23cm
-Range of motion; active flexion 1st MTP joint:	Left: 15°	Right: 15°

Goal of today´s therapy unit:

-Perform the initial kinesiological examination

-Apply therapy on the most outstanding parameters

-Decrease pain

-Decrease edema

Procedure:

-Soft tissue scar therapy, performing palpation-rolling transversal and longitudinally with kneading on both feet, the patient is lying supine on a therapy table.

-Soft tissue massage with small rubber ball in all directions, on both right and left foot. The patient is lying supine on a therapy table.

-Post-isometric relaxation: both sides.

*Gastrocnemius

*Hamstrings

*Rectus femoris

-Sensomotoric training: both sides.

*Teach and practice “short foot” both passive and active

Results: Since full kinesiological examination were performed today, there were not much time left for therapy, the patient had a appointment at the bank, so she had to

leave. After the soft tissue and scar therapy the restriction were slightly reduced, she explained that she felt some release when doing normal gait after the therapy. The hypertonicity in gastrocnemius, hamstring and rectus femoris was also reduced when palpating after the post-isometric relaxation therapy. After some practice and help actively, the patient were able to perform a perfect "short foot", she had small pain when performing it passively. The pain was explained to be at the operated area of both feet.

Self-therapy:

-Perform and practice "short foot" in sitting position

-Perform and practice "short foot" in standing while wobbling back and forth, putting pressure on heels – to toe.

-Perform soft tissue massage with a small rubber ball in all directions on both feet.

-Focus on properly loading of the foot when walking with activation of toes, instead of pure lateral loading like seen in gait examination.

3.5.2 Therapy session 2

Date: 11.01.13

Subjective: Patient still feel stiffness in her lower extremities. She explain that she feels some release since the last therapy session, although she still explains tightness in muscles and joints in her feet and toes. She explains some pain in and around the joints of her 1st toe (big toe). In a scale from 1 – 10 she explains the pain as 5.

Objectives:

-Circumference metatarsals:	Left: 22cm	Right: 23cm
-Range of motion; active flexion 1st MTP joint:	Left: 15°	Right: 15°

Goal of today´s therapy unit:

-Decrease pain

-Reduce edema

-Reduce blockage of joints in lower extremities

-Reduce the hypertonicity of muscles in lower extremities

-Increase range of motion in 1-5th toes.

-Practice and perform Sensomotoric training and exercises

-Facilitate strength in lower extremities

Procedure:

-Soft tissue scar therapy, performing palpation-rolling transversal and longitudinally with kneading on both feet, the patient is lying supine on a therapy table.

-Soft tissue massage with small rubber ball in all directions on both right and left foot and calf. The patient is lying supine on a therapy table.

-Joint play, mobilization: performed on both sides.

*Interphalangeal joints (distal) in dorsal, plantar, lateral and rotation.

*Interphalangeal joints (proximal) in dorsal plantar, lateral and rotation.

*Metacarpophalangeal in dorsal, plantar, lateral and rotation.

*Metatarsal head in dorsal, plantar and one against the other.

*Lisfranc joint in dorsal, plantar and rotation.

*Cuboid and navicular in dorsal and plantar

*Calcaneus in lateral and rotation.

*Head of fibula in dorsal and ventral.

*SI joint in dorsal both lower and upper SI.

-Repeated passive and active movement:

Both the passive/active motion is repeated 10 times each.

*Interphalangeal joints (proximal/distal) into maximal flexion and extension

*Metacarpophalangeal joints into max possible flexion and extension

*Plantar and dorsal flexion of heel into max possible flexion and extension

-Post-isometric relaxation:

*Gastrocnemius

*Hamstrings with focus on m. Semimembranosus

*Rectus femoris with focus on m. Vastus lateralis

*Piriformis

*Adductors

-Sensomotoric training:

*Teach and practice “short foot” both passive and active

-Strengthening exercises:

*Sitting with knees in 90 degrees flexion. Patient stands on a long and flat stretching-rope. She will try to pull the rope bands towards her, only using grasping of toes with flexion. She does this 3 times on both feet.

*Sitting on a therapy mat with extended knees. The therapist sits in front of her, facing her feet. A therapy-band (yellow) is attached around her feet. The patient is told to do 6 different movements against the resistance of the therapy-band;

*Maximal dorsiflexion

*Maximal dorsiflexion with eversion

*Maximal dorsiflexion with inversion

*Maximal Plantar flexion

*Maximal plantar flexion with eversion

*Maximal plantar flexion with inversion

This is done 2x10 times on both feet.

Results:

-Improved range of motion both passive and active in Interphalangeal and metacarpophalangeal joints, on both sides.

-Improved range of motion both passive and active in plantar flexion and dorsi flexion of ankle, on both sides.

-Reduced Hypertonicity in gastrocnemius, hamstrings, rectus femoris, piriformis and adductors on both sides. When palpating after the post-isometric relaxation therapy. The patient did also explain subjectively that she felt reduction in tension and pain in these muscles.

-Scar still restricted in all directions on both feet

-Soft tissue still restricted in all directions on both feet

-Still edema

-Subjectively the patient explained a reduced tightness and pain while performing gait after the therapy session.

Self-therapy:

-Perform and practice “short foot” in sitting position

-Perform and practice “short foot” in standing

-Perform soft tissue massage with a small rubber ball in all directions on both feet.

-Focus on properly loading of the foot when walking with activation of toes, instead of pure lateral loading like seen in gait examination.

3.5.3 Therapy session 3

Date: 15.01.13

Subjective: The patient explained that her gait feels more fluently with less pain and the feeling of stiffness in both operated feet is reduced. She explained that after the therapy session on Friday the pain slightly increased during the afternoon and midnight, but she were painless the next morning. She still has the feeling of some stiffness in her lower extremities with tightness in muscles, although she explains that she feels improvement after the therapy on Friday and during the weekend. She explains some pain in her joints around 1st toe. In a scale from 1 – 10 she explains the pain as 4.

Objectives:

-Circumference metatarsals:	Left: 21,5 cm	Right: 22,5cm
-Range of motion; active flexion 1st MTP joint:	Left: 20°	Right: 20°

Goal of today´s therapy unit:

-Decrease pain
-Reduce edema
-Reduce blockage of joints in lower extremities
-Reduce the hypertonicity of muscles in lower extremities
-Increase range of motion in 1-5th toes and small joints in foot.
-Practice and perform more advanced Sensomotoric training and exercises
-Facilitate strength in lower extremities
-Practice balance in combination with Sensomotoric training.

Procedure:

-Soft tissue scar therapy, performing palpation-rolling transversal and longitudinally with kneading on both feet, the patient is lying supine on a therapy table.

-Soft tissue massage with small rubber ball in all directions on both right and left foot and calf. The patient is lying supine on a therapy table.

-Joint play, mobilization: performed on both sides.

*Interphalangeal joints (distal) in dorsal, plantar, lateral and rotation.

*Interphalangeal joints (proximal) in dorsal plantar, lateral and rotation.

*Metacarpophalangeal in dorsal, plantar, lateral and rotation.

*Metatarsal head in dorsal, plantar and one against the other.

*Lisfranc joint in dorsal, plantar and rotation.

*Cuboid and navicular in dorsal and plantar

*Calcaneus in lateral and rotation.

*Head of fibula in dorsal and ventral.

*SI joint in dorsal both lower and upper SI.

-Repeated passive and active movement:

Both the passive/active motion is repeated 10 times each.

*Interphalangeal joints (proximal/distal) into maximal flexion and extension

*Metacarpophalangeal joints into max possible flexion and extension

*Plantar and dorsal flexion of heel into max possible flexion and extension

-Post-isometric relaxation:

*Gastrocnemius

*Hamstrings with focus on m. Semimembranosus

*Rectus femoris with focus on m. Vastus lateralis

*Piriformis

*Adductors

-Sensomotoric training:

*Teach and practice “short foot” both passive and active

*Walking on an “S” formed narrow rope with slowly movement, one foot in front of the other at all times. Her hip is supported and stabilized by the therapist under the entire exercise. She walks along the rope 3 times, faced forwards.

*Step on posturomed with both foot planted on the posturomed before stepping off with alternating foot. Focus on short foot and optimal posture. Performed 5 times with each foot.

*Step on and off posturomed with only one foot at the posturomed at the time, alternating feet. Focus on small foot and optimal posture. Performed 5 times with each foot.

Strengthening exercises:

*Sitting with knees in 90 degrees flexion. Patient stands on a long and flat stretching-rope. She will try to pull the rope bands towards her only using grasping of toes with flexion. She does this 3 times on both feet.

*Sitting on a therapy mat with extended knees. The therapist sits in front of her, facing her feet. A therapy-band (yellow) is attached around her feet. The patient is told to do 6 different movements against the resistance of the therapy-band;

*Maximal dorsiflexion

*Maximal dorsiflexion with eversion

*Maximal dorsiflexion with inversion

*Maximal Plantar flexion

*Maximal plantar flexion with eversion

*Maximal plantar flexion with inversion

This is done 2x10 times on both feet.

Results:

-The patient have some problems maintaining balance on the "S" formed rope; she often needs to step on the ground to maintain balance.

-Some pain is felt during the strengthening exercise.

-Improvement in mobility of the scar and soft tissue around the foot were observed for the first time today.

-After the joint play and passive/active motion we could clearly observe more movement in the small joints of feet both passively and active.

-Reduced Hypertonicity in gastrocnemius, hamstrings, rectus femoris, piriformis and adductors on both sides. When palpating after the post-isometric relaxation therapy. The patient did also explain subjectively that she felt reduction in tension and pain in these muscles.

-Reduced edema is observed for the first time today.

Self-therapy:

-Perform and practice "short foot" in sitting position

-Perform and practice "short foot" in standing while wobbling back and forth, putting pressure on heels – to toe.

-Perform soft tissue massage with a small rubber ball in all directions on both feet.

-Focus on properly loading of the foot when walking with activation of toes, instead of pure lateral loading like seen in gait examination.

- Perform repeated passive and active movement:

Both the passive/active motion is repeated 10 times each.

*Interphalangeal joints (proximal/distal) into maximal flexion and extension

*Metacarpophalangeal joints into max possible flexion and extension

*Plantar and dorsal flexion of heel into max possible flexion and extension

3.3.4 Therapy session 4

Date: 16.01.13

Subjective: The patient explained that her gait feels more fluently with less pain and the feeling of stiffness in both operated feet is reduced even more. She explains that she can clearly feel an improvement in active motion in her feet end toes. Even though she still has a small feeling of some stiffness in her lower extremities with tightness in muscles. She explains that she can clearly see and feel a reduction in both pain and edema; she is now able to wear normal shoes for the first time since the operation. The pain in her joints around 1st toe, in a scale from 1 – 10 is reduced to 3, and she is almost able to walk without the provocation of pain.

Objectives:

-Circumference metatarsals:	Left: 20,5 cm	Right: 21,5cm
-Range of motion; active flexion 1st MTP joint:	Left: 30°	Right: 30°

Goal of today´s therapy unit:

-Decrease pain

-Reduce edema

-Reduce blockage of joints in lower extremities

-Reduce the hypertonicity of muscles in lower extremities

-Increase range of motion in 1-5th toes and small joints in foot.

-Practice and perform more advanced Sensomotoric training and exercises

-Facilitate strength in lower extremities

-Practice balance in combination with Sensomotoric training.

Procedure:

-Soft tissue scar therapy, performing palpation-rolling transversal and longitudinally with kneading on both feet, the patient is lying supine on a therapy table.

-Soft tissue massage with small rubber ball in all directions on both right and left foot and calf. The patient is lying supine on a therapy table.

-Joint play, mobilization: performed on both sides.

*Interphalangeal joints (distal) in dorsal, plantar, lateral and rotation.

*Interphalangeal joints (proximal) in dorsal plantar, lateral and rotation.

*Metacarpophalangeal in dorsal, plantar, lateral and rotation.

*Metatarsal head in dorsal, plantar and one against the other.

*Lisfranc joint in dorsal, plantar and rotation.

*Cuboid and navicular in dorsal and plantar

*Calcaneus in lateral and rotation.

*Head of fibula in dorsal and ventral.

*SI joint in dorsal both lower and upper SI.

-Repeated passive and active movement:

Both the passive/active motion is repeated 10 times each.

*Interphalangeal joints (proximal/distal) into maximal flexion and extension

*Metacarpophalangeal joints into max possible flexion and extension

*Plantar and dorsal flexion of heel into max possible flexion and extension

-Post-isometric relaxation:

*Gastrocnemius

*Hamstrings with focus on m. Semimembranosus

*Rectus femoris with focus on m. Vastus lateralis

*Piriformis

*Adductors

*Tibialis anterior

*Tibialis posterior

-Sensomotoric training:

*Teach and practice “short foot” both passive and active

*Walking on a “S” formed narrow rope with slowly movement, one foot in front of the other at all times. Her hip is supported and stabilized by the therapist under the entire exercise. She walks along the rope 3 times, faced forwards.

*Step on posturomed with both foot planted on the posturomed before stepping off with alternating foot. Focus on short foot and optimal posture. Performed 7 times on each foot.

*Step on and off posturomed with only one foot at the posturomed at the time, alternating feet. Focus on small foot and optimal posture. Performed 7 times on each foot.

Strengthening exercises:

*Standing on the ground with both feet. Patient stands on a long and flat stretching-rope. She will try to pull the rope bands towards her only using grasping of toes with flexion. She does this 3 times on both feet.

*Sitting on a therapy mat with extended knees. The therapist sits in front of her, facing her feet. A therapy-band (yellow) is attached around her feet. The patient is told to do 6 different movements against the resistance of the therapy-band;

*Maximal dorsiflexion

*Maximal dorsiflexion with eversion

*Maximal dorsiflexion with inversion

*Maximal Plantar flexion

*Maximal plantar flexion with eversion

*Maximal plantar flexion with inversion

This is done 2x15 times on both feet.

Results:

-The patient is now standing in the grasping of toes exercise.

-Progressively more mobility on the scar and soft tissue around the foot is observed.

-After the joint play and passive/active motion we could clearly observe progressively more movement in the small joints of feet both passively and active.

-Reduced Hypertonicity in gastrocnemius, hamstrings, rectus femoris, piriformis and adductors, on both sides. When palpating after the post-isometric relaxation therapy, no more trigger points could be found. The patient did also explain subjectively that she felt reduction in tension and pain in these muscles.

-Progressively reduction in edema is observed.

-Because of reduction of pain and anxiety we were able to perform the post isometric relaxation of Tibialis anterior and posterior today.

Self-therapy:

-Perform and practice "short foot" in sitting position

-Perform and practice "short foot" in standing while wobbling back and forth, putting pressure on heels – to toe.

-Perform soft tissue massage with a small rubber ball in all directions on both feet.

-Focus on properly loading of the foot when walking with activation of toes, instead of pure lateral loading like seen in gait examination.

- Perform repeated passive and active movement:

Both the passive/active motion is repeated 10 times each.

*Interphalangeal joints (proximal/distal) into maximal flexion and extension

*Metacarpophalangeal joints into max possible flexion and extension

*Plantar and dorsal flexion of heel into max possible flexion and extension

3.3.5 Therapy session 5

Date: 18.01.13

Subjective: The patient explained that she is now able to wear shoes completely without pain; a small pain is provoked after excessive walking. The swelling is reduced even more since last time. She feels safer, and she is progressively putting less pressure on the lateral part of her feet, and she is slowly involving her toes during gait. The pain in her joints around 1st toe, in a scale from 1 – 10 is reduced to 1.

Objectives:

-Circumference metatarsals:	Left: 20,5 cm	Right: 20,5cm
-Range of motion; active flexion 1st MTP joint:	Left: 35°	Right: 30°

Goal of today´s therapy unit:

-Decrease pain

-Reduce edema

-Reduce blockage of joints in lower extremities

-Reduce the hypertonicity of muscles in lower extremities

-Increase range of motion in 1-5th toes and small joints in foot.

-Practice and perform more advanced Sensomotoric training and exercises

-Facilitate strength in lower extremities

-Practice balance in combination with Sensomotoric training.

Procedure:

-Soft tissue scar therapy, performing palpation-rolling transversal and longitudinally with kneading on both feet, the patient is lying supine on a therapy table.

-Soft tissue massage with small rubber ball in all directions on both right and left foot and calf. The patient is lying supine on a therapy table.

-Joint play, mobilization: performed on both sides.

*Interphalangeal joints (distal) in dorsal, plantar, lateral and rotation.

*Interphalangeal joints (proximal) in dorsal plantar, lateral and rotation.

*Metacarpophalangeal in dorsal, plantar, lateral and rotation.

*Metatarsal head in dorsal, plantar and one against the other.

*Lisfranc joint in dorsal, plantar and rotation.

-Repeated passive and active movement:

Both the passive/active motion is repeated 10 times each.

*Interphalangeal joints (proximal/distal) into maximal flexion and extension

*Metacarpophalangeal joints into max possible flexion and extension

*Plantar and dorsal flexion of heel into max possible flexion and extension

-Post-isometric relaxation:

*Gastrocnemius

*Hamstrings with focus on m. Semimembranosus

*Rectus femoris with focus on m. Vastus lateralis

*Adductors

-Sensomotoric training:

*Teach and practice “short foot” both passive and active

*Walking on an “S” formed narrow rope with slowly movement, one foot in front of the other at all times. Her hip is supported and stabilized by the therapist under the entire exercise. She walks along the rope 3 times, faced forwards.

*Step on posturomed with both foot planted on the posturomed before stepping off with alternating foot. Focus on short foot and optimal posture. Performed 7 times on each foot.

*Step on and off posturomed with only one foot at the posturomed at the time, alternating feet. Focus on small foot and optimal posture. Performed 7 times on each foot.

*Standing on a trampoline with both feet, alternating steeping from heel to toes.

*Standing on a trampoline with both feet, alternating shifting the weight of her upper extremities putting pressure on the medial side of her feet.

*Standing with both feet on a wobble board, focusing on small foot and perfect posture. The therapist pushes the patient softly in different directions, while the patient tries to maintain balance.

Strengthening exercises:

*Sitting with knees in 90 degrees flexion. Patient stands on a long and flat stretching-rope. She will try to pull the rope bands towards her only using grasping of toes with flexion. She does this 3 times on both feet.

*Sitting on a therapy mat with extended knees. The therapist sits in front of her, facing her feet. A therapy-band (yellow) is attached around her feet. The patient is told to do 6 different movements against the resistance of the therapy-band;

*Maximal dorsiflexion

*Maximal dorsiflexion with eversion

*Maximal dorsiflexion with inversion

*Maximal Plantar flexion

*Maximal plantar flexion with eversion

*Maximal plantar flexion with inversion

This is done 2x20times on both feet.

Results:

-A significant improvement in balance is observed, the patient have excellent balance performing the walking on the “S” formed rope. Improvement is generally seen in all the Sensomotoric excersises.

-The scar is almost completely without restriction in all directions on both feet.

-The grasping of toes exercise is significantly improved where improved range of motion is clearly seen.

-When observing gait after the therapy session better loading is seen with more activation and loading of toes.
-No more pain is felt during the strengthening excersises, and the patient is gradually increasing the amount of repetitions.
-Progressively reduction in edema is observed.

Self-therapy:

-Perform and practice “short foot” in sitting position
-Perform and practice “short foot” in standing while wobbling back and forth, putting pressure on heels – to toe.
-Perform soft tissue massage with a small rubber ball in all directions on both feet.
-Focus on properly loading of the foot when walking with activation of toes, instead of pure lateral loading like seen in gait examination.
-Perform repeated passive and active movement:
Both the passive/active motion is repeated 10 times each.

*Interphalangeal joints (proximal/distal) into maximal flexion and extension
*Metacarpophalangeal joints into max possible flexion and extension
*Plantar and dorsal flexion of heel into max possible flexion and extension

-Self post isometric relaxation of gastrocnemius and hamstrings, which is showed and performed by the therapist at the end of the last therapy session.

3.6 Final kinesiological examination, performed 18.01.13

3.6.1 Postural examination

Anterior view:

- Flat feet on both sides with decreased longitudinal arch
- Flat toes on both sides
- Normal loading of foot, no longer purely loading on lateral part
- Both feet are very slightly swollen
- Slightly ER of both feet
- Genu valgum
- Normal activation of quadriceps
- Umbilicus in the middle
- Left shoulder is slightly elevated
- Higher trophy on left shoulder
- Head slightly lateral flexed to left

Posterior view:

- Normal base of feet´s
- Slightly ER of both feet
- Normal shape of heels
- Normal loading of foot, no longer purely loading on lateral part
- Gluteal line is aligned
- Spine is in middle of plumb line
- Scapulas ABD
- Head slightly lateral flexed to left

Lateral view: Both sides

- Flat toes, both sides
- Decreased longitudinal foot arch – flat feet both sides
- Small flexion of both knees
- Small prominence of abdomen
- Small flexion of both elbows
- Retraction of both shoulders
- All joints are in good alignment

3.6.2 Scale test

	Kg
Whole body	85
Left side	42
Right side	43
Difference	1 kg – Within the norm

Table 25 Scale test examination

3.6.3 Pelvic examination:

- Slight lateral tilt to the left
- No anterior or posterior tilt
- No torsion

3.6.4 Breathing examination:

Performed in standing and supine position

- Type: Abdominal breathing
- Frequency: 21
- Notes: Reduced movement of ribs

3.6.5 Scar assessment

- Length of scar: Left foot: 4 Cm Right foot: 3,5 Cm
- Restriction: Small restriction in all directions, both sides.
- Colour: Small edema, normal colour.

3.6.6 Gait examination

- Physiological rolling of feet.
- Properly end the step-phase with toes
- Reduced external rotation of feet
- Normal loading of foot during gait, no longer purely loading on lateral part.
- No longer clapping with when walking
- Normal steps
- Normal hip extension

- Lack of proper trunk rotation
- Stiff trunk and upper extremities during gait
- Stiff neck during gait

3.6.7 Special gait examination

Closed eyes:

-Able to perform it without problems

-Normal steps

-More movement in upper extremity and trunk

Backward walking:

- Able to perform it
- Almost pure walking on heels
- No involvement of toes, does not touch the ground
- Anxious of falling
- Stiff upper extremity, trunk and neck

Squat walking:

- Able to perform it
- Put load on the whole foot sole
- Increased ER of both feet

Heel walking:

- Able to perform it without problems
- Good balance
- Increased ER of both feet

Tiptoe walking:

-Tiptoe walking is not performed due to the risk of provoking pain.

3.6.8 Trendelenburg test:

Standing on left foot: Negative

Standing on right foot: Negative

3.6.9 Dynamic spine test

Flexion:

-Limited movement in lumbar area

-Hyper flexibility in Thoracic and cervical spine

-Full rom

-No pain

Lateral flexion (Right):

-Good and fluent movement

-Full ROM

-No pain

-More movement compared to left side

Lateral flexion (Left)

-Good and fluent movement

-Full ROM

-No pain

-Less movement compared to right side

Extension:

-Limited movement in Lumbar area

-Hyper flexibility in Thoracic and cervical spine

-Full ROM

-No pain

3.6.10 Examination of basic movement patterns

Basic movement pattern	Right side	Left side
Hip extension	Hip extension is performed with correct movement pattern. Gluteals are primary movement components. Normal activation of shoulder girdle.	Hip extension is performed with correct movement pattern. Gluteals are primary movement components. More activation of shoulder girdle.
Hip abduction	Tensor mechanism; compensatory hip flexion is observed instead of pure abduction.	Tensor mechanism; compensatory hip flexion is observed instead of pure abduction.

Table 26 Basic movement patterns examination

3.6.11 Lower extremity, length

Measured	Left, cm	Right, cm
Functional length	98	98
Anatomical length	92	92
Femur length	51	51
Calf length	41	41
Foot length	23	23

Table 27 Lenght lower extremity

3.6.12 Lower extremity, circumference

Measured	Left, cm	Right, cm
Thigh, 10 cm over knee	47	47,5
Thigh, 15 cm over knee	50	51
Knee	40	40
Calf	37,5	37
Ankle	24	24
Foot	21	21
Metatarsals	20	20

Table 28 Circumference lower extremity

3.6.13 Range of motion

Movement	Active R	Active L	Passive R	Passive L
Hip				
Extension	10	10	10	10
Flexion	120	120	125	125
ABD	40	40	45	45
ADD	10	10	10	10
ER	40	40	45	45
IR	30	30	30	30
Knee				
Extension	+5	+5	+5	+5
Flexion	120	120	125	125
Ankle				
Plantar flexion	20	20	20	20
Dorsal flexion	40	40	45	45
Foot				
Inversion	20	20	25	25
Eversion	30	30	35	35
MTP joint				
Flexion				
1	35	35	40	40
2	35	35	40	40
3	35	35	40	40
4	40	40	45	45
5	40	40	45	45
Extension				
1	30	30	35	35
2	30	30	35	35
3	35	35	35	35
4	35	35	40	40
5	35	35	35	35
PIP joint				

Flexion				
1	30	30	35	35
2	35	35	40	40
3	40	40	45	45
4	40	45	45	45
5	40	40	45	45

Extension				
1	30	30	35	35
2	35	35	40	40
3	35	40	40	40
4	35	35	40	40
5	35	35	35	40
DIP joint				
Flexion				
1	35	35	35	35
2	35	35	35	35
3	40	40	45	45
4	40	45	45	45
5	40	40	45	45
Extension				
1	30	30	35	35
2	35	35	40	40
3	35	35	40	40
4	35	35	40	40
5	35	35	35	40

Table 29 Range of motion examination

No pain felt when trying to reach full ROM in 1st and 2nd toe.

3.6.14 Examination of shortened muscles

Muscle/muscle group	Right side	Left side
M. triceps surrae	Normal	Normal
Hip adductors	Normal	Normal
Knee flexors	Normal	Normal
Sartorius	Normal	Normal
Tensor fasciae latae	Normal	Normal
Rectus femoris	Normal	Normal
Iliopsoas	Normal	Normal
M rectus abdominis	Moderate shortness	Moderate shortness
Back muscles	Hypermobility	Hypermobility
Cervical Lateral flexion	Hypermobility	Hypermobility

Table 30 Shortened muscle examination

3.6.15 Manual muscle testing

Lower extremities.

Muscle	Right, grade	Left, grade
Gluteus Medius	4	4
Lateral Rotators	5	5
Medial Rotators	5	5
Hip Adductors	5	5
Tensor Fasciae Latae	4+	4+
Sartorius	5	5
Iliopsoas	5	5
Quadriceps Femoris	5	5
Biceps Femoris	5	5
Semitendinosus & Semimembranosus	5	5
Popliteus	4+	4+
Gastrocnemius	5	5
Soleus	5	5

Peroneus Longus & Peroneus Brevis	4+	4+
Tibialis Anterior	4+	5
Tibialis Posterior	5	4+
Extensor Digitorum Longus and Brevis	4+	4+
Peroneus Tertius	5	4+
Flexor Digitorum Longus & Quadratus Plantae	5	5
Flexor Digitorum Brevis	4+	5
Lumbricales	2: 4+ 3: 4+ 4: 5 5: 5	2: 4+ 3: 5 4: 5 5: 4+
Plantar Interossei	2: 5 3: 5 4: 5 5: 5	2: 5 3: 5 4: 5 5: 4+
Dorsal Interossei	2: 5 3: 5 4: 4+	2: 5 3: 5 4: 5
Flexor Hallucis Longus	5	5
Flexor Hallucis Brevis	5	4+
Extensor Hallucis Longus	5	5
Adductor Hallucis	5	5
Abductor Hallucis	5	4+

Table 31 Manual muscle testing

3.6.16 Joint play examination

Interphalangeal joints (distal):

	1st L	1st R	2nd L	2nd R	3rd L	3rd R	4th L	4th R	5th L	5th R
Dorsal	Small	Small	No	No	No	No	No	No	No	No
Plantar	Small	Small	No	No	No	No	No	No	No	No
Lat. L	No	No	No	No	No	No	No	No	No	No
Lat. R	No	No	No	No	No	No	No	No	No	No
Rotation	No	No	No	No	No	No	No	No	No	No

Table 32 Joint play examination interphalangeal joint (distal)

Interphalangeal joint (proximal):

	1st L	1st R	2nd L	2nd R	3rd L	3rd R	4th L	4th R	5th L	5th R
Dorsal	Small	No	No	No	No	No	No	No	No	No
Plantar	Small	No	No	No	No	No	No	No	No	No
Lat. L	No	No	No	No	No	No	No	No	No	No
Lat. R	No	No	No	No	No	No	No	No	No	No
Rotation	No	No	No	No	No	No	No	No	No	No

Table 33 Joint play examination interphalangeal joint (proximal)

Metacarpophalangeal joints:

	1st L	1st R	2nd L	2nd R	3rd L	3rd R	4th L	4th R	5th L	5th R
Dorsal	Small	Small	No	No	No	No	No	No	No	No
Plantar	Small	Small	No	No	No	No	No	No	No	No
Lat. L	Small	Small	No	No	No	No	No	No	No	No
Lat. R	Small	Small	No	No	No	No	No	No	No	No
Rotation	Small	Small								

Table 34 Joint play examination Metacarpophalangeal joint

Metatarsal head:

	1st L	1st R	2nd L	2nd R	3rd L	3rd R	4th L	4th R	5th L	5th R
One against other	Sm	Sm	No	No	No	No	No	No	No	No
Dorsal	Sm	Sm	No	No	No	No	No	No	No	No
Plantar	Sm	Sm	No	No	No	No	No	No	No	No

Table 35 Joint play examination Metatarsal head

Lisfranc joint:

	Left	**Right**
Dorsal	No	No
Plantar	No	No
Rotation	Yes	Yes

Table 36 Joint play examination Lisfranc joint

Cuboid:

	Left	**Right**
Dorsal	No	No
Plantar	No	No

Table 37 Joint play examination Cuboid

Navicular:

	Left	**Right**
Dorsal	No	No
Plantar	No	No

Table 38 Joint play examination Navicular

Calcaneus:

	Left	**Right**
Lateral (left)	No	No
Lateral (right)	No	No
Rotation	Yes	Yes

Table 39 Joint play examination Calcaneus

Talocrural joint:

	Left	**Right**
Dorsal direction	No	No
Ventral	No	No

Table 40 Joint play examinatino Talocrural joint

Knee joint:

	Left	**Right**
Dorsal	No	No
Ventral	No	No
Latero-lateral direction	No	No

Table 41 Joint play examination Knee joint

Tibiofibular joint:

	Left	**Right**
Head of fibula Dorsal	No	No
Head of fibula Ventral	No	No

Table 42 Joint play examination Tibiofibular joint

Patella:

	Left	**Right**
Latero-lateral	No	No
Cranio-caudal	No	No

Table 43 Joint play examination Patella

SI joint:

	Left	**Right**
Dorsal	Yes	Yes
Upper SI (ilium against sacrum)	Yes	Yes
Lower SI (Ilium against sacrum)	Yes	Yes

Table 44 Joint play examination SI joint

3.6.17 Muscle tone examination

Muscle	**Tone, left**	**Trigger P. left**	**Tone, right**	**Trigger P. right**
Rectus femoris	Normal	Yes	Normal	Yes
Vastus medialis*	Normal	No	Normal	No
Vastus lateralis	Normal	No	Normal	No
Tensor fasciae latae	Hypertone	No	Hypertone	No
Illiopsoas	Normal	No	Normal	No
Adductor longus	Normal	Yes	Normal	Yes
Adductor magnus	Normal	No	Normal	No
Piriformis	Normal	No	Normal	No
Biceps femoris	Normal	No	Normal	No
Semimembranosus	Hypertone	No	Hypertone	No
Semitendinosus*	Normal	No	Normal	No
Gastrocnemius	Normal	Yes	Normal	Yes
Soleus	Normal	No	Normal	No
Tibialis Anterior	Normal	No	Normal	No
Tibialis Posterior	Normal	No	Normal	No
Plantar aponeurosis	Hypertone	No	Hypertone	No
Abductor hallucis	Hypertone	No	Hypertone	No
Adductor hallucis	Normal	No	No	No
Flexor hallucis brevis	Hypertone	No	Hypertone	No

Flexor dig. brevis	Hypertone	No	Hypertone	No
Lumbricales	Hypertone	No	Hypertone	No

Table 45 Muscle tone examination

3.6.18 Functional testing of foot

Knee squat in standing position:

-Equal and increased dorsiflexion of both feet

-Normal loading of foot, no longer purely loading on lateral part

-Slightly ER of both feet

-Genu valgum

Twisting/torsion motion of upper extremity and trunk in standing position:

-Physiological supination and pronation of feet

-The pronation pattern on twisting side is performed correctly

-The supination pattern on the opposite twisting side is performed correctly

-Slightly stiff movement pattern of both feet while twisting from side to side.

Standing on one foot: The same pattern is observed on both sides.

-Small grasping

-No over-activation of toes

-Stable

-Some activation of tendons

Tiptoe stance:

-Is not performed due to the risk of provoking pain.

Grasping of toes

-Good mobility of toes

-Increased range of motion on both sides

-No pain is felt

-Grasps with all toes, included the 1st toe

3.6.19 Neurological examinations:

Deep tendon reflexes:

Reflex	Left	Right
Patellar reflex	2	2
Achilles reflex	2	2
Medioplantar reflex	2	2

Table 46 Deep tendon reflexes examination

Superficial skin sensation:

Examined area	Right, sensation	Left, sensation
Thigh anterior	Physiological	Physiological
Thigh posterior	Physiological	Physiological
Thigh lateral	Physiological	Physiological
Thigh medial	Physiological	Physiological
Calf anterior	Physiological	Physiological
Calf posterior	Physiological	Physiological
Calf lateral	Physiological	Physiological
Calf medial	Physiological	Physiological
Foot dorsal	Physiological	Physiological
Foot plantar	Physiological	Physiological

Table 47 Superficial skin sensation examination

Rhomberg test:

Rhomberg 1: Negative

Rhomberg 2: Negative

Rhomberg 3: Negative

Lean forward test (Vele´s test): Negative

3.6.20 Examination´s conclusion:

The final kinesiological examination was performed January the 18th 2013.
From the final kinesiological examination we can clearly see a great improvement in many aspects, compared to the initial kinesiological examination. One of the most outstanding improvements from the final kinesiological examination is seen in functional testing, posture and gait examination, were the patient has evolved to a better loading and usage of both feet without the anxiety showed in the initial kinesiological examination. The patient now shows a physiological rolling of feet with normal loading instead of the purely lateral loading as seen before. The clapping of feet during gait is no longer present and the steps are longer and they show more confidence.
Improvement is seen as well in the special gait examination. From the subjective aspect, the patients explains the feeling of a more fluently gait with less stiffness, pain and anxiety. She also explains a feeling of better balance with safer gait.

The anthropometry and scar assessment gives us a sight about the patients subjective feeling regarding a more fluently gait with less stiffness and pain. The anthropometry clearly shows a great reduction in edema, which was present in the initial kinesiological examination. The scar is also less restricted which gives the feeling of more mobility. Due to the reduced edema along the therapy sessions the patient were able to wear normal shoes for the first time since the operation.

Regarding the range of motion and joint play examination, the numbers show us significant results. In the final kinesiological examination the blockage in almost the entire lower extremities is reduced, and there is no more pain while performing joint play examination and mobilization. The range of motion examination shows us a great improvement in range of motion, especially in 1 – 5th toes, were no more pain is felt when trying to reach the fully range of motion. The greatest improvement is seen in the 1st toes joints.

The last aspect in the final kinesiological examination, which is one of the most outstanding, is regarding the muscle conditioning. In the muscle tone examination a normal tone is examined in almost the entire lower extremities, from a predominantly hypertoned conditioning seen in the initial kinesiological examination. The amount and

presence of trigger points is also reduced. In the Manual muscle testing a increased strength is seen in the muscles of the lower part of foot, even though we have to put in consideration that these number might be distorted due too the anxiety shown in the usage and movement in this part of her feet in the initial kinesiological examination.

3.7 Evaluation of the effects of the therapy

Even though the therapist sessions were rather few, great progress is seen when comparing the initial and final kinesiological examination. I believe the therapeutic procedures and exercises used were both beneficial and efficient for the patient. The different procedures and exercises could have been more varied throughout the therapy sessions, but with progress seen from session too session the continuation of the same type of exercises is emphasized. In a great variety of different therapeutic procedures and exercises it can be hard to differentiate the progressive and helping once. Since the patient had rehabilitation for both feet after the hallux valgus operation a time aspect were also to be considered throughout the therapy sessions.

All the goals of the short-term rehabilitation plan, which had the major focus during the therapy sessions for these two first weeks, showed great results in the final kinesiological examination. Pain was significally reduced. In the final kinesiological examination, no pain was felt during any examination, including trying to reach full range of motion in the 1st toes. If we take a look at the subjective pain scale, it was reduced from 5 in the initial kinesiological examination, to 1 at the last therapy session. Swelling were reduced, which is shown in the anthropometry examination and the availability for the patient to wear shoes for the first time after the operation. The most outstanding factor is related to the circumference of the metatarsals, which decreased 2 cm in the left foot and 3 cm in right. The decrease in anxiety of physiological usage of both feet is well showed in the gait and functional examination in combination with the subjective aspects. A physiological stepping, loading and rolling during gait is showed, with a gait full of confidence. The restriction of the scar with improvement of colour and swelling is shown in the scar assessment, with almost no restriction in the final kinesiological examination. The great improvement in range of motion and joint play mobilization is showed in the final range of motion and joint play examination. The

most outstanding improvement is showed in the flexion in the 1st toes metatarsophalangeal joints, which increased from 15-degrees active flexion in the initial kinesiological examination to 35-degrees active flexion in the final kinesiological examination. In the muscle conditioning we can see that a great reduction in hypertonicity is observed, were 11 muscles went from a state with hypertonicity in the initial kinesiological examination too a state with normal tone in the final kinesiological examination.

The patient showed excellent motivation and cooperation throughout all the therapy sessions and examinations. After the first meeting with the patient, poor awareness of body posture and gait were observed, but after the first therapy sessions with focus on this awareness, a fast and steadily improvement were observed. I believe the patient performed her self-therapy with great effort and commitment. She felt better after every therapy session, and had a slightly but steadily improvement. She responded well to the treatment, and did a good job explaining the subjective progression form session to session, and throughout the five-rehabilitation session we had together, noticeable improvement were observed.

I find it quite hard to differentiate the effects between the therapies, because of the overall progress. From my personal points of view, and after talking to my patient after the different therapy session, I found the Passive range of motion, joint play, post isometric relaxation and Sensomotoric exercises to have the best progress and effect from therapy to therapy. These were the specific therapies, that showed the greatest progress, and it was also procedures that the patent personally found most satisfying.

I personally believe that with the great motivation and willingness shown during these 5 sessions, the patient will have no problem reaching the long-term rehabilitation goals, and return to best possible previous shape.

4. CONCLUSION

I was introduced to my patient on my 4th day of practice at Centrum Léčby Pohybového Aparátu Vysočany (CLPA). We were suppose to have 6 sessions together, but lost one due to illness. The sessions gave me a great opportunity to follow the patient over these two first weeks of rehabilitation, and it proved to be a great learning experience for me. At times, barriers during the treatment connected with age, and the fact that S.M and myself did not have the same native language; despite the language barrier we were able to work well together with a good and positive dialogue.

The fact that the patient had a bilateral operation made me realize the time-related problems a physiotherapist may have during a hectic working day. I'm glad for that fact that the patient had a bilateral operation, it made me repeat a lot of the teqnuiches and therapies performed during these two week. I have learned a lot about the complications, which can be caused by a rather small operation like hallux valgus, and the influence this may have on the entire body structure.

Having the bachelor practice at the rehabilitation department of CLPA gave me the excellent opportunity to work with a lot of different patients, with a huge differentiation in diagnosis. I was given a lot of hours in both the ambulance rooms and the fitness gym, which gave me a lot of wisdom and practical experience. I have had the opportunity to practice both my theoretical and practical knowledge under the supervision of an experienced and skilled supervisor. I can from the bottom of my heart say that I have learned a lot at CLPA during these two weeks with bachelor practice. It has been an honor to do my practice at CLPA and to be able to work with such a delightful patient and supervisor.

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6. APPENDIX

6.1 Approval of the ethics board committee

6.2 Informed consent/Informovaný souhlas

V souladu se Zákonem o péči o zdraví lidu (§ 23 odst. 2 zákona č.20/1966 Sb.) a Úmluvou o lidských právech a biomedicíně č. 96/2001, Vás žádám o souhlas kvyšetření a následné terapii. Dále Vás žádám o souhlas knahlížení do Vaší dokumentace osobou získávající způsobilost k výkonu zdravotnického povolání v rámci praktické výuky a s uveřejněním výsledků terapie v rámci bakalářské práce na FTVS UK. Osobní data v této studii nebudou uvedena.

Dnešního dne jsem byla odborným pracovníkem poučena o plánovaném vyšetření a následné terapii. Prohlašuji a svým dále uvedeným vlastnoručním podpisem potvrzuji, že odborný pracovník, který mi poskytl poučení, mi osobně vysvětlil vše, co je obsahem tohoto písemného informovaného souhlasu, a měla jsem možnost klást mu otázky, na které mi řádně odpověděl.

Prohlašuji, že jsem shora uvedenému poučení plně porozuměla a výslovně souhlasím s provedením vyšetření a následnou terapií. Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uveřejněním výsledků terapie v rámci studie.

Datum:..... Osoba, která provedla poučení:..... Podpis osoby, která provedla poučení:..... Vlastnoruční podpis pacienta /tky:.....

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6.5 List of Abbreviations

FTVS – Fakulta telesné vychovy a sportu

MPJ – Metacarpophalangeal joint

MTPJ – Metatarsophalangeal joint

N – Newton

CLPA - Centrum Léčby Pohybového Aparátu Vysočany

RHB – Rehabilitation

CM – Centimeter

Bpm – Beats per minute

Kg – Kilogram

BMI – Body mass index

ER – External rotation

ABD – Abduction

ROM – Range of motion

Active R – Active Right

Active L – Active Left

ADD – Adduction

PIP – Interphalangeal joint (proximal)

DIP – Interphalangeal joint (distal)

L – Left

R – Right

Sm – Small