Faculty of Physical Education and Sport UK, Prague
Department of Physiotherapy

# Acute Cervical Pain

Bachelor thesis

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**Abstract**

Title: Acute Cervical Pain.

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Thesis Aim: The aim of the thesis is to explain about cervical spondylosis, and to present case study of the patient that was after surgical internal intervention of internal fixation due to cervical spondylosis, to show and explain about the muscles imbalance after such operation and the effect of therapy after five sessions.

Methods: The therapy included five meetings with the patient during two weeks of practice in the hospital.
The used methods were mostly for relaxation of TrP. and tensed muscles by PIR technique, elongation of shortened muscles by stretching techniques, soft tissue technique for realising of the underlying fascias, strengthening exercises for week muscles including strengthening exercises with theraband, Mobilization techniques to improve mobility of the spine and shoulders, breathing exercise were preformed to improve breathing patterns. Autotherapy plan was proposed to the patient for better and quicker effect of the therapy.

Results: After five therapy sessions, initial and final kinesiologic examination was compared, and detected improvements in elongation of shortened muscles, relaxation of hypertonic muscles and TrPs, increase in restricted ROM in most parts of the body, mobility and flexibility of the spine and the shoulders were improved , strength of muscles around scapula and cervical spine was improved.

Key words: Cervical degenerative joint disease, Muscles imbalance, Cervical Spondylosis, Cervical radiculopathy, Neck pain.

**Declaration**

I declare that this Bachelor Thesis has been based on my individual work and on my practice in Revmatologicky Ustav hospital in Prague.

All the information that used for this Bachelor Thesis has been taken from the list of literature in the end of this Thesis.

In Prague Vitaly Kaplunsky.

**Acknowledgement**

I would like to thank my family that was supporting and leading me during all my life, and gave the principles of choosing the right way in my life. They helped me to develop my personality and to fulfill my wishes in the best way.
I choosed Physiotherapy as a profession because I wanted to have satisfaction form my profession during my entire professional life, and the only way how to do it is by helping people to improve their functional, social and other different aspects of the life.
Thanks to my parents I am a student of the Charles University in Prauge and would like to acknowledge them for the opportunity that they gave me and were supporting me during the tree years of studying.

Also, I would like to thanks all the professors and teachers of Charles University in Prague who were leading me and were sharing with their great knowledge.

I want to thank the physiotherapist Mrs. Petra Carmakova, my adviser during the fourteen days practice in Revmatologicky Ustav hospital in Prague. She was patient and helpful and gave us the confidence and guidance to work independently with our patients during the practice.

Finally, I want to thank my supervisor in my bachelor thesis the physiotherapist Mgr. Holubarova Jirina, I am proud of being her student during all the time of my studying, she is admired as physiotherapist and as a personality due to her great knowledge and kindness to the people around.

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## 1. Preface

Already during my early childhood my parents tried to accelerate my development and were taking care about my sport activates program.

When I was four years old, already my parents joined me to the group of ice skating, one year after when I was about five years old my parents joined me to the group of gymnastic. According to the physicians, this early overstrain on the not maturated joints of the lower extremities caused to inflammation of my hip joint. This incident was teaching me that the knowledge about physical development and physical activity at all is influential.

Since this time, I was interested in physical development and wanted to now as much as possible about it, to use it in my further experience in my life and to help the others. After my studies in Prague University I got this knowledge and much more to help and treat people with different disorders.

In my thesis I will give you an example how practically I used all of these knowledge in patient with acute neck pain.

I will present you a complete therapy session including evaluation, examination and conclusions that leads them to the therapeutic plan, and the execution of a therapy proposal with its effect on the patient's rehabilitation program.

# 2. General part:

## 2.1 Anatomy of the spinal column:

The spinal column (figure 1) made up of 33 individual vertebral bones that extends from the skull to the pelvis and it is increases in a size from the first to last vertebrae. The vertebral column divided to five regions (Table1): (6)

| Term | Numbers of Vertebrae | Body Area | Abbreviation |
|---|---|---|---|
| Cervical | 7 | Neck | C1 – C7 |
| Thoracic | 12 | Chest | T1 – T12 |
| Lumbar | 5 or 6 | Low Back | L1 – L5 |
| Sacrum | 5 (fused) | Pelvis | S1 – S5 |
| Coccyx | 3 | Tailbone | None |

**Table 1:** (6)

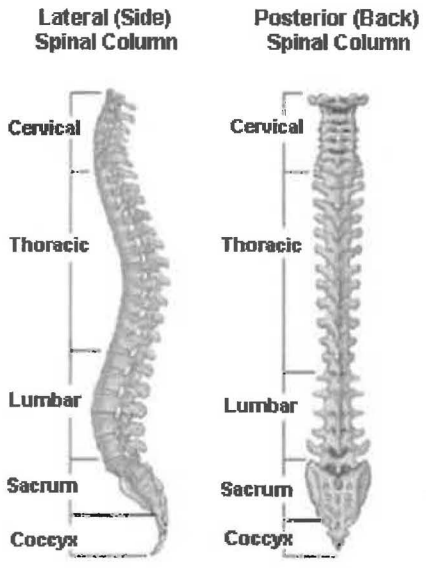



**Figure 1:** (6)

## 2.1.1 Typical vertebrae:

Typical vertebrae consist of: vertebral body, posterior vertebral arch. (figure 2)

The vertebral body is the place of the most of the weight bearing and is connected with adjacent vertebrae by intervertebral disc and ligaments, the size of the vertebral body, as a weight that supported by the vertebrae is rises inferiorly.

The vertebral arch forms the vertebral foramen and all of the adjacent foramens together form vertebral canal which contains the spinal cord.

The posterior vertebral arch contains extending process for muscles attachment and articulation with other bones. The body and the arch of the vertebras are connected by two pedicales that from this pedicales extending two laminaes that are flat sheets of bone that connecting together at the midline.

A spinous process is the projection of two laminaes that is attachment place for ligament and muscles.

From the connection of laminaes and pedicales from each side of the vertebrae are extending transverse processes to postero-lateral direction and articular process to inferior and superior directions which articulate with articular process with adjacent vertebrae. (2)

**Structure of the Vertebra**

The body is composed of spongy tissue, covered by a thin compact bone, that perforated by numerous external openings, some of large size for the passage of vessels, the interior of the bone is traversed by one or two large canals, for the reception of veins, which converge toward an opening at the posterior part of the body. The thin bony lamellć of the spongy tissue are more pronounced in lines perpendicular to the upper and lower surfaces and are developed in response to greater pressure in this

direction. The arch and processes projecting from it have thick coverings of compact bone.

### 2.1.2 Intervertebral disc:

The intervertebral discs made up from fibrocartilaginous cushions and serves as shock absorption system that protect the vertebrae, nerves and other structures. The intervertebral discs are playing role in some vertebral motions like extension and flexion. The movement of individual disc is limited, but when the several discs combined the movement more visible. There is no blood supply and the discs dependent on the end plates to diffuse nutrients. The intervertebral disc is missing between Axis, Atlas and Coccyx vertebras.(6)

The discs are composed from two parts: The annulus fibrosus and nucleus pulposus- The annulus fibrosus is a structure made up of concentric sheets of collagen fibers connected to the vertebral end plates. The annulus fibrosus is situated around the nucleus pulposus.
Both parts are composed of water, collagen, and proteoglycans, but greatest amount of fluid is in the nucleus pulposus. The nucleus pulposus contains a hydrated gel–like matter that resists compression. The amount of water in the nucleus decreasing during the activity. (6)

### 2.1.3 Spinal segment:

Each spinal segment includes two vertebrae that separated by an intervertebral disc, the nerves that leave the spinal cord at each vertebra, and the small facet joints that link each level of the spinal column.

Facet joints connect the vertebras together and the surfaces of the facet joints are covered by articular cartilage that is a smooth, rubbery material that covers the ends of most joints this allows the ends of bones to slide against each other smoothly, without friction, sliding of the facets against adjacent one allows the neck to move in many directions.

The intervertebral disc separates the two vertebral bodies of the spinal segment. The disc works like a shock absorber, it protects the spine against the pull of gravity and during heavy activities that put strong force on the spine, such as jumping, running, and lifting.

The neural foramen is a notch, they situated on the both sides of the vertebra and trough is passing spinal nerve that leaves the spine. (14)

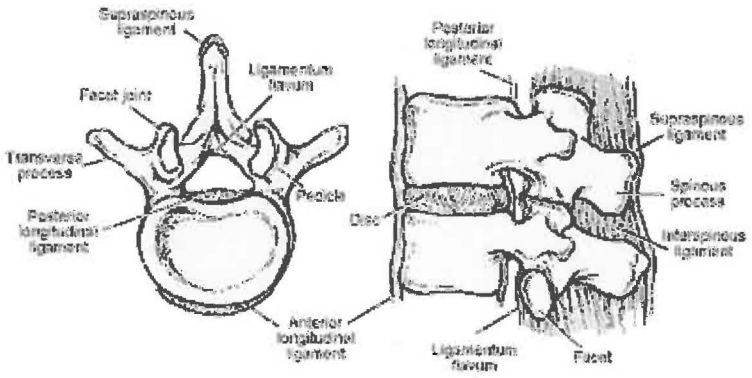



**Figure 2:** Anatomy of a spinal segment. (15)

## 2.1.4 Upper cervical spine: C1-Atlas, C2-Axis and rest of the cervical spine.

C1 is termed Atlas, and this vertebra supports the skull. The atlas is a different in shape and made up of two masses joined at the front and back by the anterior arch and the posterior arch (figure 3).

C2 is termed Axis, because of special shape that allows rotatory movement of the head and atlas around the axis, that the axis is like process projecting upward or usually the name is "dens" (figure 3).

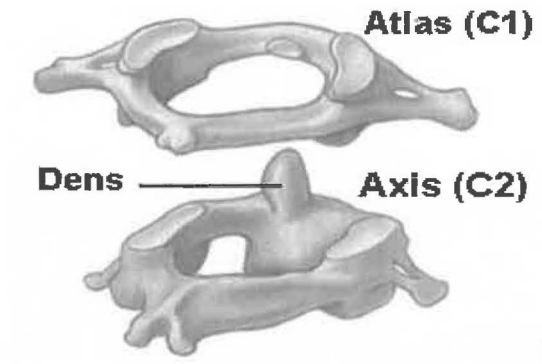


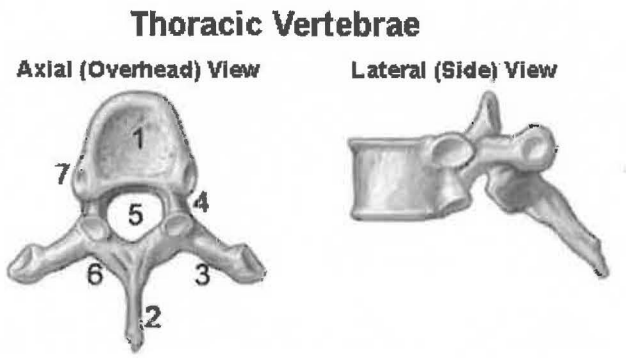

**Figure 3:** Atlas and Axis vertebraes

All the others segments of cervical spine C3-C7 are mostly the same as all typical vertebraes: Each vertebra has two bony processes on the sides of the vertebras are called transverse processes they contain openings for arteries to carry blood to the brain, this openings called transverse foramen, these foramen are smaller in C7 than those in other cervical vertebras.

At the place where two lamina bones join together at the back of the spine, has projections, called spinous processes especially characterize the large spinous processes of the seventh cervical vertebra. (14),(6)

## 2.1.5 Thoracic Vertebrae:

The thoracic vertebras (T1 – T12) are rising in size from T1 through T12. They are characterized by small pedicles, long spinous processes, and large intervertebral foramen, which result in less incidence of nerve compression.




**1**-Vertebral Body. **2**-Spinous Process. **3**-Transverse Facet. **4**-Pedicle. **5**-Foramen. **6**-Lamina. **7**-Superior Facet.

**Figure 4**: Thoracic vertebrae: lateral and axial view. (6)

Thoracic part of the spine characterized also by the articulation of the rib cage to the thoracic vertebrae by articular process that situated on superior and inferior parts of the vertebral body for articulation with the head of its own rib and the head of the rib below. Each transverse process also has an articular facet for articulation with the tubercle of its own rib. T11 and T12 vertebras are extraordinary because they are not attached to the ribs, they are called "floating ribs."

The thoracic spine's range of motion is limited because of many connections of ribs with the vertebras, and the long spinous processes of the vertebras. (2),(6)

### 2.1.6 Lumbar Vertebrae:

The lumbar vertebrae (L1 – L5) graduate in size from L1 through L5. These vertebrae are characterized by large size and lack of articular facets with the ribs. they bear related body's weight and biomechanical stress. The pedicles are longer and wider than those in the thoracic spine. The transverse processes are thin and long except the last L5 vertebrae that is large and massive one. The spinous processes are horizontal and more squared in shape. The intervertebral foramen, neural passageways are relatively large and triangular in shape. (2),(6)

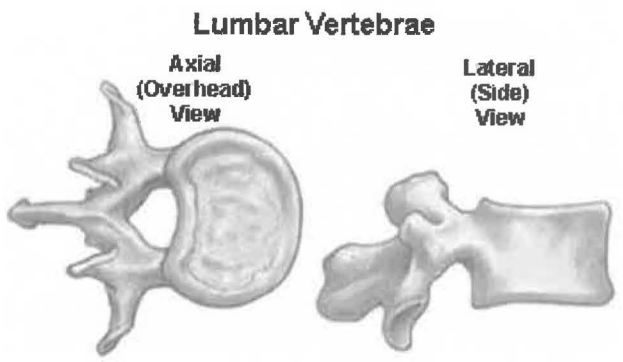



**Figure 5**: Lumbar vertebrae: lateral and axial view. (6)

### 2.1.7 Sacral Spine:

The Sacrum, S1-S5 are five single vertebral bones that fused into a triangular shape with anterior concave and posterior convex sides. The sacrum is located between the two hip bones connecting the spine to the pelvis. The last lumbar vertebra articulates with the sacrum and immediately below the sacrum are five additional bones, fused

together to form the Coccyx. The posterior and anterior surface of sacrum has four pairs of sacral foramina for passage of the nerves roots. (2),(6)

### 2.1.8 Coccyx bone:

Articulates with inferior end of sacrum and represent three or four fused coccygeal vertebrae that are triangular in shape and characterized by small size and by absence of vertebral arches and vertebral canal. (6), (2)

## 2.2 Function of the Spinal Column:

### 2.2.1 Support

In the aspect of support the vertebras are connecting the upper part with the lower part, transmit forces trough the pelvis to the lower limbs, carrying the head and the trunk of body. The vertebras are different in size and correspondingly serving as different weight distribution, the cervical vertebras are the smallest and the weight bearing is the smallest and the lumbar vertebras are the largest one and the weight distribution is the largest.(5),(6)

### 2.2.2 Flexibility and Mobility

The natural curve of the spine has an S-shaped curve when viewed from the side. This shape allows for an even distribution of weight and flexibility of movement. The spine curves in the following way in cervical spine convex forward, begins at the apex of the axis process, and ends at the middle of the second thoracic vertebra; it is the least marked of all the curves. in thoracic spine the spine concave forward, begins at the middle of the second and ends at the middle of the twelfth thoracic vertebra, it is most prominent point behind corresponds to the spinous process of the seventh thoracic vertebra. in lumbar spine it begins at the middle of the last thoracic vertebra, and ends at the sacrovertebral angle, it is convex anteriorly, the convexity of the lower three vertebrae being much greater than that of the upper two. The curve provides resistance and elasticity in distributing body weight and axial loads sustained during movement (figure 6).(5),(6)

### 2.2.3 Protection mechanism

The vertebral column provides a support of the trunk and rigid protection for the spinal cord by surrounding of the spinal cord by vertebras providing bony protection for the spinal cord.(11)

The intervertbral disc is playing a role in absorption of vertical pressure such as exerted by gravity. The disks are perfect shock absorbers, capable of snapping back into place and adjusting to various kinds of movement.

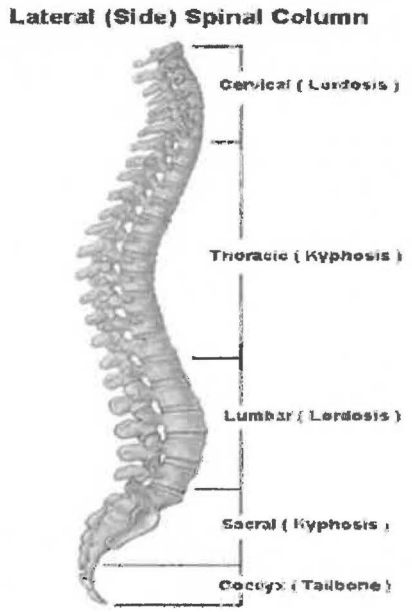



**Figure 6**:(6)

### 2.2.4 Physiological movements of vertebral column:

**Flexion** is the movement forward, the interspaces between the laminae are widened, and the inferior articular processes glide upward, upon the superior articular processes of the subjacent vertebrae. Flexion is the most extensive of all the movements of the vertebral column, and is freest in the lumbar region (table1).

**Extension** is the movement backward, this movement is limited by soft tissue and by the approximation of the spinous processes. It is freest in the cervical region.

**Lateral movement** during the movement sides of the intervertebral disc are compressed, the motion is limited by the surrounding ligaments. This movement may take place in any part of the column, but is freest in the cervical and lumbar regions. Lateral flexion of the spine causes rotation of the vertebrae in the opposite direction to the lateral flexion. If the rotation is restricted or blocked in one segment, the spinal curve during lateral flexion is not fluent-continual but angled in the site of the movement restriction. (13),(5),(4)

**Rotation** is produced by the twisting of the intervertebral discs, this movement very slight between any two vertebras, allows a considerable range of movement when it takes place in the whole length of the column. This movement occurs to a slight extent in the cervical region, is freer in the upper part of the thoracic region, and absent in the lumbar region.(5),(4)

| | |
|---|---|
| ***At lumbal level*** | Flexion $60^0$ Extension $35^0$ |
| ***At thoraco-lumbal level*** | Flexion $105^0$ Extension $60^0$ |
| ***At cervical level*** | Flexion $40^0$ Extension $45^0$ |
| ***Total range*** | Flexion $110^0$ Extension $140^0$ |
| ***Lateral flexion*** | lumbal $20^0$. thoracic $20^0$. cervical 35-$45^0$ total 75-$85^0$ |
| ***Axial rotation*** | lumbar level $5^0$, thoracic level $35^0$, cervical level 45-$50^0$ |

**Table 1**: Excursions of spine ROM in angular degrees. (13)

## 2.3 Anatomy of muscles:

**Important muscles of the head and trunk:**

| Muscle | Origin | Insertion | Action | Notes |
|---|---|---|---|---|
| erector spinae | iliac crest, sacrum, transverse and spinous processes of vertebrae and | angles of the ribs, transverse and spinous processes of vertebrae, | extends and laterally bends the trunk, neck and head | the erector spinae m. is separated into 3 columns of muscle: iliocostalis laterally, longissimus in an |

| | | | | |
|---|---|---|---|---|
| | supraspinal ligament | posterior aspect of the skull | | intermediate position and spinalis medially; each of these columns has multiple named parts |
| iliocostalis | iliac crest and sacrum | angles of the ribs | extends and laterally bends the trunk and neck | the most lateral part of the erector spinae; it may be subdivided into lumborum, thoracis and cervicis portions |
| interspinales | upper border of spinous process | lower border of spinous process above | extend trunk and neck | these are small and fairly insignificant muscles |
| intertransversarii | upper border of transverse process | lower border of transverse process above | laterally bend trunk and neck | these are small and fairly insignificant muscles |
| longissimus | transverse process at inferior vertebral levels | transverse process at superior vertebral levels and mastoid process | extends and laterally bends the trunk, neck and head | the intermediate part of the erector spinae;it may be subdivided into thoracis, cervicis and capitis portions |

| | | | | |
|---|---|---|---|---|
| multifidus | sacrum, transverse processes of C3-L5 | spinous processes 2-4 vertebral levels superior to their origin | extend and laterally bend trunk and neck, rotate to opposite side | semispinalis, multifidus and rotatores make up the transversospinal muscle group |
| obliquus capitis inferior | spinous process of the axis | transverse process of atlas | rotates the head to the same side | greater occipital nerve (DPR of C2) passes superiorly around the inferior margin of inferior oblique |
| obliquus capitis superior | transverse process of atlas | occipital bone above inferior nuchal line | extends the head, rotates the head to the same side | the suboccipital triangle is formed by obliquus capitis superior and inferior and rectus capitis posterior major |
| rectus capitis posterior major | spinous process of axis | inferior nuchal line | extends the head, rotate to same side | none |

| | | | | |
|---|---|---|---|---|
| rectus capitis posterior minor | posterior tubercle of atlas | inferior nuchal line medially | extends the head | rectus capitis posterior minor is deeper and inserts more medial than rectus capitis posterior major |
| rotatores | transverse processes | long rotatores: spines 2 vertebrae above origin; short rotatores: spines 1 vertebrae above origin | rotates the vertebral column to the opposite side | semispinalis, multifidus and rotatores make up the transversospinal muscle group |
| semispinalis | transverse processes of C7-T12 | capitis: back of skull between nuchal lines; cervicis & thoracis: spines 4-6 vertebrae above origin | extends the trunk and laterally bends the trunk, rotates the trunk to the opposite side | three parts are named based on their insertions: capitis, cervicis and thoracis; semispinalis, multifidus and rotatores make up the transversospinal muscle group |
| spinalis | spinous | spinous | extends and | most medial part |

| | | | | |
|---|---|---|---|---|
| | processes at inferior vertebral levels | processes at superior vertebral levels and base of the skull | laterally bends trunk and neck | of the erector spinae; may be subdivided into thoracis, cervicis and capitis portions |
| splenius | ligamentum nuchae and spines C7-T6 | capitis: mastoid process & superior nuchal line laterally; cervicis: posterior tubercles of C1-C3 vertebrae | extends and laterally bends neck and head; rotates head to same side | splenius means bandage; it gets its name from its broad, flat shape |
| splenius capitis | ligamentum nuchae and spines of C7-T6 vertebrae | mastoid process and lateral end of the superior nuchal line | extends and laterally bends the neck and head, rotates head to the same side | named for its shape: splenius means bandage and capitis refers to the insertion of this portion of the muscle |

| | | | | |
|---|---|---|---|---|
| splenius cervicis | ligamentum nuchae and spines of C7-T6 vertebrae | posterior tubercles of the transverse processes of C1-C3 vertebrae | extends and laterally bends neck and head, rotates head to the same side | named for its shape: splenius means bandage and cervicis refers to the insertion of this portion of the muscle |
| longus capitis | anterior tubercles of vertebrae C3-6 | basilar portion of the occipital bone | flex the head and neck | none |
| longus colli | anterior tubercles and anterior surfaces of the bodies of vertebrae C3-T3 | anterior arch of atlas, anterior tubercles of C5-6, anterior surfaces of bodies of vertebrae C2-4 | flex neck, rotate and laterally bend neck | none |
| platysma | fascia overlying the pectoralis major and deltoid muscles | inferior border of the mandible and skin of lower face | draws the corners of the mouth down; it aids in depression of the mandible | platysma is derived from the mesenchyme of the second pharyngeal arch |
| rectus capitis anterior | lateral mass of atlas | basilar portion of occipital | flexes the head | none |

| | | | | |
|---|---|---|---|---|
| scalene, middle | posterior tubercles of | bone upper surface | elevates the first rib; | a muscle of respiration |
| rectus capitis lateralis | transverse process of atlas the transverse processes of vertebrae C2-C7 | occipital bone anterolateral to foramen magnum of the first rib behind the subclavian artery | laterally bends the head flexes and laterally bends the neck | none |
| scalene, anterior | anterior tubercles of the transverse processes of vertebrae C3-C6 | scalene tubercle of the first rib | elevates the first rib; flexes and laterally bends the neck | a muscle of inspiration; an important landmark of the neck; it is located between the subclavian vein and the subclavian artery; the roots of the brachial plexus pass posterior to it; the phrenic nerve crosses its anterior surface |
| | | | | (inspiratory); also called scalenus medius;penetrate by the dorsal scapular n. and long thoracic n. |

| | | | | |
|---|---|---|---|---|
| scalene, posterior | posterior tubercles of the transverse processes of vertebrae C5-C7 | lateral surface of the second rib | elevates the second rib; flexes and laterally bends the neck | a muscle of respiration (inspiratory); it is the longest of the scalene muscles |
| splenius | ligamentum nuchae and spines C7-T6 | capitis: mastoid process& superior nuchal line laterally; cervicis:posteri -or tubercles of C1-3 | extends and laterally bends neck and head; rotates head to same side | splenius means bandage; it gets its name from its broad, flat shape |
| sternocleidomastoid | sternal head: anterior surface of the manubrium; clavicular head: medial 1/3rd of the clavicle | mastoid process and lateral 1/2 of the superior nuchal line | Bring the chin toward same side,causes the chin to turn up toward the opposite side;together ,the muscles of the 2 sides F the neck | carotid sheath structures lie deep to it |

**Table 2:** muscles anatomy.(12)

## 2.4 Kinesiology of the cervical spine:

***Atlas-Axis joint:***

Large intervertebral foramen of the Atlas contains the spinal cord and the dens of the axis. The posterior arch of the Atlas serves as a canal for the vertebral arteries that pass from the transverse foramen to the foramen magnum of the scull. The anterior arch, on the dorsal side serves as attachments for transverse ligament that hold the dens of the axis and protect the spinal cord. Weakness of connective tissue between the two vertebras can cause instability and to inclination of the dens toward the spinal cord that can be disaster.

The second vertebra is the axis, serves as pivot for rotation of occiput and atlas, anteriorly the dens articulates with the posterior arch of Atlas. The movement between the two vertbras is in horizontal plane, axial rotation of the head.

The ROM is approximately 20-25$^0$ to each side. Rotation to the left is accompanied with the lateral-flexion to the right. This movement may be restricted by shortening of ligaments or by shrinking of the joint capsule.

There is no intervertebral disc between the two vertebras therefore the articular surface between the two vertebras substitute the mobility function. The inferior Atlantal facets articulate with the superior facet of the Axis both facets are convex due to covering of the cartilages on the facets and during the rotation phase the Atlantal facets first sliding superiorly than inferiorly on the longitudinal plane this referred as "pistoning effect" and during the extension or flexion of the spine the movement of the atlas is in the opposite direction due to biconvexity of the facets.(13),(4)

**Atlanto-Occipital joint:**

The Atlas articulates with the occipital condyles of the skull and provides like a cradle for supporting the head. The primary motions are flexion and extension. The movement in sagittal plane is flexion-extension has the range about 15$^0$.

This movement may be restricted by the shrinking of the joint capsule, by shortening of ligaments or by shortening of rectus muscle. Rotation and lateral flexion between the occiput and Atlas are not possible due to the deep structure of the Atlantal sockets. (13),(4)

**Lower Cervical spine:**

The lower cervical spine includes the C3-T1 vertebras. The role of vertebral body serves as load bearing structure for the weight of the head. The shape of the lower vertebras is a triangle and is adjusted to their functions. The anterior and lateral aspect of the vertebras body serves as attachment for muscles and ligaments. On the lateral aspect of the vertebras body has two projections called uncinate processes they prevent a vertebra from sliding backwards off the vertebra below it and limits lateral flexion. The cervical pedicals are connectors between the posterior and anterior elements of the vertebrae. The transverse process projecting latero-ventral direction contain nerve root that anteriorly is passing vertebral artery through the transverse foramen.

Spinous processes are splits at the end, and therefore the ROM is increased at the segmental level due to preventing approximation of the processes of adjacent vertebras. The ROM of lateral flexion is about $8^0$. This movement may be restricted by ligaments, by shrinking of the joint capsule or by the shortening of obliquus capitis and rectus capitis muscles.

The main role of the spinous process is to provide muscles attachment to create longer lever arm.

Each vertebra contains four articulation facet two superiorly and two inferiorly that the function of it to direct motion and contribute to the weight bearing. The weight bearing is shared by 30% on the facets and 70% on the intervertebral disc. The superior facets of the C4-C7 vertebras face slightly lateral that effort more axial rotation, and the superior facets of the C3 and T1 vertebras face more medialy therefore restrict axial rotation.

The role of intervertebral disc that present between each vertebra is to distribute weight around the entire vertebral body and to permit mobility in each segment, as the higher the disc more mobility present in the segment. (13),(4).

## 2.5 Cervical Spondylosis:

Cervical spondylosis is caused due to degenerative changes in the bones and intervertebral discs of the neck that begins with herniation of the nucleus pulposus of intervertebral discs and formation of osteophytes that compress the spinal nerve root.

The aging is mostly the cause of the sponylosis and usually starts after the age 40 and continiues to progress with the age.

### 2.5.1 Pathophysiology:

Formation of the osteophytes on vertebral bodies it is due to attempting of the body to increase the surface area and stabilize the vertebral joint. It begins with the lose of water from the intervertebral disc specially from nucleus pulposus, as a result of lost of disc material the vertebras are hyper mobile and is more difficult to stabilize them. Therefore mechanical stress at the cartilaginous end plates at the vertebral body is increased. Next step is formation of the osteophytes from subperiostal bones that extends along the ventral part of the spinal canal, This osteophytes put pressure on spinal nerves and the result is pain, weakness, numbness etc.

### 2.5.2 Symptoms of Cervical Spondylosis:

Most common is the pain around the neck and shoulders that begins with neck stiffness that progress over the time, also there is pain in different forms stabbing, burning, or as a dull ache that radiating to the bottom of skull and to the arms.

There is also manifestation of strange feeling as numbness, needles or tingling, with combination of muscle weakness in the neck, and upper extremities.(1)

### 2.5.3 Imaging Studies

**MRI-** Magnetic Resonance Image is noninvasive and radiation-free procedure that allows direct visualization of neural structures and allows a more accurate estimation of the cord space.

Narrowing of the spinal canal with a sagittal diameter of 10-13 mm has been associated with a higher incidence of neurologic deficit and cervical spondylosis.

MRI may detect pathology in some spondylotic changes as osteophytes by calcific densities.

**X-ray-** is a cheap way of assessing spondylotic disease in symptomatic patients, the X-Ray image can demonstrate disk-space narrowing, osteophytosis, loss of cervical lordosis, uncovertebral joint hypertrophy, apophyseal joint osteoarthritis, and vertebral canal diameter.

**CT-** Computer Tomography scanning is another important imaging modality for definition of bony anatomy, CT scanning better defines the neural foramina and used to complement MRI and to provide additional bony detail to characterize a lesion responsible for neural compression.

**Myelography-** is also useful for demonstrating nerve root lesions including the location of a spinal cord injury, cysts, and tumors. Its performed by injection of contrast medium into the cervical or lumbar spine, followed by several X-ray projections. A myelogram may help to find the cause of pain not found by an MRI or CT. (3)

### 2.5.4 Physical examination:

Patients with neck pain due to spondylosis usually present with neck stiffness. This is a nonspecific sign, therefore other causes of neck pain and stiffness must be excluded.

Assessment of radiculopathy:

- Palpation of muscles allows earlier detection of wasting than visualization can provide, muscle testing is also important because muscle findings have more specificity than sensory or reflex findings.
- Sensory and reflex examination are vary important and they often reveals more pain proximally in their limbs and distally signs of paresthesia.
- The neck compression test is useful when assessing a patient for cervical radiculopathy. This test performed in sitting position the patient actively extend his neck, laterally flex, and rotate to the side of the pain. then we apply compression by slight axial load. This maneuver works by narrowing the ipsilateral neural foramina during flexion and rotation, while the initial extension causes posterior disk bulging.
- pectoralis muscle reflex test can be vary helpful, elicited by tapping the pectoralis tendon, hyperactivity is usually sign of compression in the C2-C4 levels. (1),(3)

### 2.5.5 Causes

- State of segmental instability and excessive segmental motion.

- Repeated occupational trauma or axial overloading.

- Spondylotic disease. CSM may be responsible for functional declines in patients with athetoid cerebral palsy.

- Cerebral palsy, Down syndrome may be risk factors for spondylotic disease.

### 2.5.6 Treatment:

Non-surgical treatment:

The treatment for cervical spondylosis must reduce the compression on the nerve it can be done by neck immobilization, pharmacologic treatments, lifestyle modifications, and physical special techniques as traction, manipulation and exercises.

- Neck immobilization performed by use of soft collar one of non operative treatments that proposed for short term treatment, the big disadvantage is that the collar may reduce muscle tone and cause neck stiffness due to inactivation of

the muscles, therefore is important to exercise on daily regime to limit loss of muscle tone.

- Pharmacologic treatment includes several options:
    - NSAIDs- Non-steroidal anti-inflammatory drugs are the main pharmacologic treatment. they are drugs with analgesic, and anti-inflammatory effects, they reduce pain, fever and inflammation.
    - TCAs- are tricyclic antidepressants they works as muscle relaxants in patients with a spasm in their neck muscles which related to spondylotic changes. it is not recommended for long term application because of tolerance and abuse may occur, with minimal pain relief.
    - Steroids- are used for fast reduction of pain and shortening the course of symptoms in patients with severe radiculopathy, the application can be oral or injection to epidural space in progressive cervical spondylotic myelopathy patients.
- Lifestyle modifications- Education of the proper postural awareness during all day activities. It includes workplace modifications as selecting the proper chair, and instruction about proper movements and proper activation of muscles.
- Different types of physical modalities treatments are used for spine disorders:
    - Cervical mechanical traction, is used for cervical radiculopathy to achieve of loosening adhesions and improve circulation within the dural space, reduce compression of disks.(3)
    - Manipulation, common used by chiropractors and osteopathic physicians. The effects are: temporary relief of musculoskeletal pain, temporary increase in passive range of motion, physiological effects on the central nervous system, disruption of articular or periarticular adhesions.(10)
    - Exercises program is very important for cervical pain and include isometric neck strengthening, back strengthening exercises, neck and shoulder stretching, and aerobic exercises.
    - Physical therapy modalities that used for degenerative disease of the cervical spine are: heat application, cold application, transcutaneous electrical nerve stimulation, acupuncture, massage, trigger-point injection, and low power cold laser.(3)

Surgical treatment:

Surgical treatment is a very extreme solution and performed by correcting the pathologic anatomical degenerative structures that compress a nerve root or the spinal cord.

The indications to surgery are intolerable pain, neurological deficits with documentation of nerve root compression. Surgical treatment does not ensure neck pain relief.

The surgical treatment can be performed in different ways by anterior approach or postero-lateral approach.

Anterior approach usually presents better visualization of pathology without manipulation of nerves structure. Anterior approach usually performed with fusion using an iliac crest bone graft. The fusion decompress and enlarge the neural foramen and cause to better spinal stability that prevent progression of the osteophyte,

Posterolateral approach used for nerve root decompression, when the compression of osteophyte or the intervertebral disk is on the lateral aspect of the spine. the post operative recovery is longer but this approach is avoids the possibility of graft remotion and damage to neck structures. In this approach performed foraminotomy by removing the medial third of the facet joint and the most lateral aspects of the lamina at the involved level, then underlying lateral aspect of the ligamentum flavum is removed to visualize the nerve root. The nerve root is manipulated that it lies free and without compression.(1),(3)

The disadvantage of posterolateral approach is developing of spinal instability after the surgery due to laminectomy, therefore laminectomy combined with lateral mass fusion that the results are without progression to spinal instability.(1),(3)

# 3. Special part

## 3.1 Methods:

During 2 weeks of my practice, since 04.02.08 till 15.02.08 that took place at Revmatologicke ustav hospital in Prague I had five sessions with my patient, that each session was about one hour.

During those five sessions I took anamnesis of the patient, some from the medical documentation and some during interview with the patient, straight after I continued with initial kinesiological examination, conclusions of the examination that was leading me to set up the plan for the therapy. After the therapy I provided final kinesiological examination, and evaluation of therapy effect by comparing the initial kinesiological examination and final kinesiological examination, and finally the prognosis for the patient state.

All the information used for the development of this Bachelor Thesis has been taken from the list of literature at the end of the Thesis.

The patient has signed an agreement, and informed that his case and the results will be presented in the Bachelor Thesis.

**3.2 Input Data:**

**Name:** P.K **Gender:** Male **Age**: 50

**3.3 Diagnosis:** Acute cervical pain.

**3.4 Chief compliant**: Cervical pain stiffness and headache.

**3.5 Anamnesis:**

**Family history:**

Father- died when was 30 years old.

Mother- is 71 years old is healthy.

Two children are healthy.

**History of present problem**:

In 2002 the patient was diagnosed with Cervical Spondylosis between C3-C4 levels due to osteophyte that was compressing the nerve root. Performed surgical treatment of introducing internal fixation in C3-C4 levels.

In 2004 the patient had acute pain and swelling in the cervical area, the patient was treated during 8 days in rehabilitation center in Liberz.

In 31.01.08 the patient woke up with acute pain and swelling in the cervical area.

**Functional history:**

During extended physical work there is soon fatigue and pain in cervical area.

During vocational time the patient mostly is in sitting position that cause to overloading of the cervical spine.

During leisure time the patient used to play soccer but now it is forbidden and he is fishing instead.

**Social history:**

The patient is living with his wife and children.

The patient is working as a policeman in the office.
During leisure time the patient is fishing.

**Medication:** Nimesil, Milurit, Aescin.

**Allergies:** no allergies.

**Diet:** no diet.

**Abuses**- 1 cup of coffee per day, eventually alcohol.

**Past medical and surgical history:**
Had common childhood disease.
High level of cholesterol.
Cholecystitis.
In 2006 was patellar bursitis-performed puncher of the knee.
In 11.07 Urteral stenosis and urolithiasis.
In 11.07 pubis ostitis.
Operations:
In age of 6 years old was performed appendectomy.
In 1998 was operation of Lt. Patellar ligament.
In 2002 performed operation of internal fixation between the C3-C4 levels.

**Previous rehabilitation:**
4 years ago the patient was treated during 8 days in rehabilitation center in Liberec due to pain and swelling in cervical area. He was treated by means of hydrotherapy.

## 3.6 Statement from medical documentation:

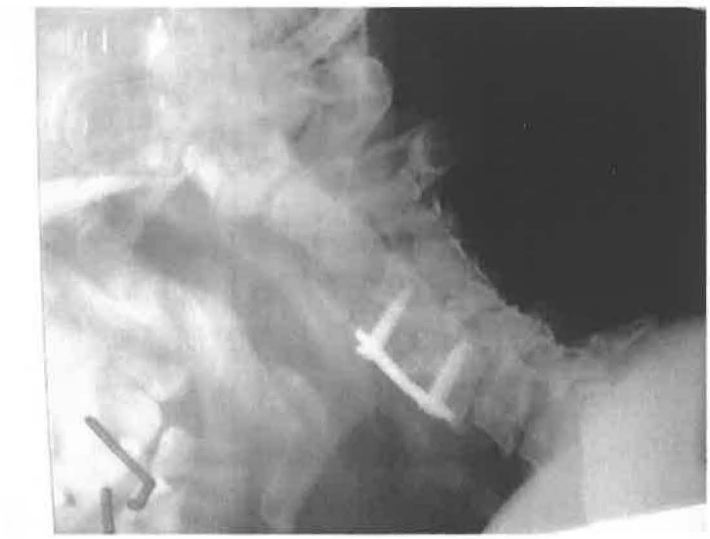


**Figure 1:** X-Ray of the cervical region, segital view

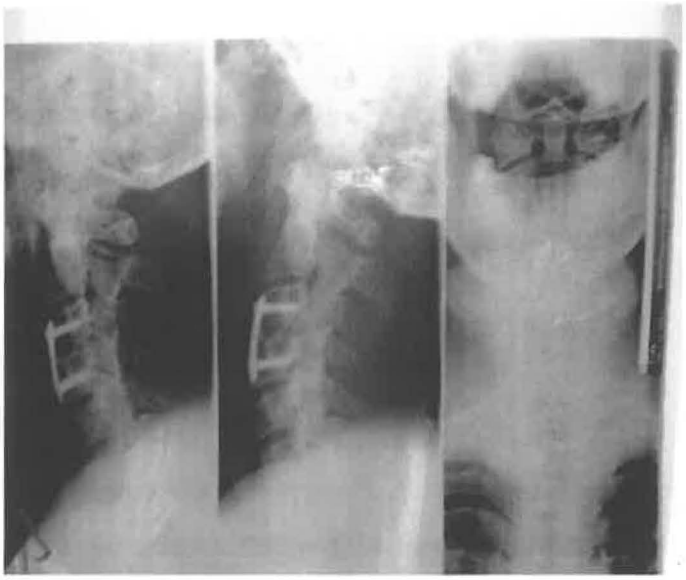


**Figure 2:** X-Ray of cervical region from segital (Lt. and Rt. view) and anterior view.

In the documentations from cervical X-Ray pictures was stated:
Internal fixation by 2 screws between the level C3-C4, scoliosis to the Lt. side at the level C5 and Th/C kyphosis.

**3.7 Indication of rehabilitation:**

The patient referred to rehabilitation due to acute pain in the cervical area.

**3.8 Present state:**

BP- 120/80

HR- 64 bits/min.

Height- 179 cm.

Weight- 95 kg.

BMI- 29.64

The patient feels stiff and restriction of the movements in the upper part of the body due to pain around the neck.

**3.9 Differential consideration:**

- The pain in the neck could be due to internal fixation between the C3-C4 levels that cause to no movement at the level and this expressed by restriction of head movement, this restriction is compensated by other muscles that are overloaded and become tensed and painful.

- Forward head position and Th/C kyphosis of the patient can cause to weakness of deep muscles and overloading of superficial muscles around the neck, there developed unbalance in posture in this area that cause to neck pain.

## 3.10 Initial kinesiologic examination:

### 3.10.1 Postural examination: Static

| **Anterior view:** | |
|---|---|
| Sole weight baring | symmetry |
| Transversal sole Arch | symmetry |
| Longitudinal sole Arch | symmetry |
| Calf side | symmetry |
| Patella | Slight external rotation of Rt. patella |
| Thigh contour | symmetrical in both sides(medial-lateral) |
| Anterior superior iliac spine | Symmetrical |
| Umbilicus | Deviations to the Rt. |
| Sternum | Middle line |
| Nipples | Symmetrical |
| Clavicles | left lateral part elevated |
| Shoulder position | left shoulder elevated |
| dominant hand | left |

**Table 1:** static postural examination, anterior view.

**Figure 3:** Anterior view

| **Posterior view:** | |
|---|---|
| Heel form and position | Symmetrical |
| Achille's tendon | Symmetrical |
| Calf | Symmetrical |
| Popliteal lines | Symmetrical |
| Thigh contour | Symmetrical in both sides(medial-lateral) |
| Subgluteal lines | Symmetrical |
| Posterior superior illiac spine | Symmetrical |
| Ilium crests | Symmetrical |
| Trunk | Symmetrical |
| Spinous processes | Slight lumbar scoliosis to the Lt. side |
| Inferior scapula angles | Left slightly elevated |
| Scapulas medial margin | Rt. Scapulae is abducted |
| Shoulder position | Both elevated-More elevation of left shoulder |
| Auricles | Symmetrical |

**Table 2:** Static postural examination, posterior view.

**Figure 4:** Posterior view

| | Lateral view: |
|---|---|
| Knee joint position | Straight line |
| Position of pelvis | anterversion |
| Lumbar part of spine | hyperlordosis |
| Thoracic part of spine | hyperkyphosis on the upper part |
| Shoulder position | Slight protraction, bilateral |
| Cervical part of spine | Hyperlordosis |
| Head position | Forward head position |

**Table 3:** Lateral view.

**Figure 5:** Lateral view.

**Conclusion of static postural examination:**

According to table1: elevation of the shoulders we can expect shortness, tightness and trigger points of upper trapezius and levator scapulae muscles and more affected on the Lt. side of the body.

according table 2: Abduction of the Rt. scapulae can be due to weakness of Rt. rhomboid m. and elevation of Lt. scapulae due to weakness of lower trapezius m.

according to table 3: anteversion of pelvis can be due to weakness gluteus max. m. that automatically cause to hyperlordosis in lumbar spine.

Thoracic hyperkyphosis can be compesation mechanism due to shortened iliopsoas m. or due to cervical hyper lordosis and lumbar hyper lordosis,

Protraction of the shoulder can be due to shortness of pectoralis minor m.

Forward head position can be result from weakness of deep flexors m. and over loading of deep extensors muscles.

**Dynamic postural examination:**

Balance test(2 scales): Lt. leg- 45 kg. Rt. leg- 50 kg.

Trendelenburg test : positive

| | |
|---|---|
| Shober's distance | 5 cm |
| Lateroflexion distance | Lt./Rt./11 cm |
| Stibor's distance | 8 cm |
| Flesch de forestier distance | 8 cm |
| Cepoje's distance | 2 cm |
| Otto's inclination distance . | 3 cm |
| Thomayer's distance | -32 cm |

**Table 4:** Spine distances.

**Conclusion of dynamic postural examination:**

Trendelenburg test revealed slight difficulties with stabilizing the pelvis and its can be due to weakness of all gluteus muscles or qudratus lumbarum m.

By spine distances according to table 5, we can see very large anterior displacement of the head according Flesch de forestier distance, the movement in the thoracic spin in Otto's distance is restricted it can be the result of Th. hyperkyphosis, Stibor's distance that evaluate mobility of lumbar and Th. spine was normal but most of the movement was observed in a Lum. spine, Capojes distance that express the mobility of the cervical spine revealed restricted mobility probably due to pain and tightness around.

Lateral flexion test revealed decreased mobility of the all spine to the both sides. Thomayer's distance that expresses the mobility of all the spine is correspondently restricted.

**3.10.2 Gait evaluation:**

Without shoes: The walking is with decreased extension in hip joint and with decreased synkinesis of upper extremities.

With closed eyes: Deviation to the Rt. side, slower and shorter steps, disconfidence, disbalance and required concentration.

Walking backward: Shorter steps, with slight concentration, signs of disbalance.

Tiptoes walking: walking with concentration, shorter steps and semi flexion in knees.

Heels walking: shorter steps, semi flexion in hip joint and minus extension in the hip joint.

Knee banded walking: required a lot concentration to perform the walking, no contact of heels with the floor.

**Conclusion of gait examination:**

According to the gait patterns, decrease in extension, semi flexion in hip is due to shortness of iliopsoas m. and weakness of gluteus max. m.

Decrease synkinesis movements of upper extremities is probably because of pain in cervical spine.

Deviation to the side and decrease in step length in walking backward and with close eyes is sign of disbalance and discoordination.

Difficulties with knee banding walking is due to weakness of gluteus max. m. and the balance compensated by walking on tiptoes.

**3.10.3 Examination by palpation:**

**"Kibler" wave palpation:** during the palpation were found hyper algetic zones around the cervical spine, shoulders blades, suboccpital area and Th/C crossing area.

*the palpation around cervical spine was very painful for the patient.

**Examination of fascia**: During the examination of the dorsal thoracic fascia were found restrictions in caudo-cranial direction around the scapulas.

* the palpation around cervical spine was very painful for the patient.

| Right | muscles | Left |
|---|---|---|
| | m.trapezius | |
| Hypertonus,TrP | upper part | More hypertonus, TrP |
| Hypertonus,TrP | Middle | More hypertonus, TrP |
| Hypotonus | Lower | Hypotonus |
| Hypertonus, TrP | m.levator scapulae | Hypertonus, TrP |
| Hypertonus, TrP | m.Rhomboidei | Hypertonus, TrP |
| Normal tonus | m.subscapularis | Hypertonus |
| Hypertonus | m.supraspinatus | Hypertonus |
| Normal tonus | m.teres minor | Normal tonus |
| Normal tonus | m.infraspinatus | Normal tonus |
| Hypertonus, TrP | m.scalenes | Hypertonus, TrP |
| Hypertonus, TrP | m.SCM | Hypertonus, TrP |
| Hypertonus | m.pectoralis minor | Hypertonus |
| Normal tonus | m.pectoralis major | Normal tonus |
| Hypotonus | m.gluteus maximus | Hypotonus |
| Normal tonus | m.iliopsoas | Normal tonus |
| Normal tonus | m.external oblique | Normal tonus |
| Normal tonus | m.internal oblique | Normal tonus |
| Hypertonus, TrP | m.suboccipitals | Hypertonus, TrP |
| Hypertonus | m.rectus abdominis | Hypertonus |
| Hypotonus | m.transverse abdominis | Hypotonus |
| hypertonus | Thoracic paravertebral.m | hypertonus |

**Table 5:** Palpation of muscles.

* The palpation was performed in optimal relaxing muscles position , in supine or prone positions.

**Conclusion of palpation examination:**

*It is not possible to palpate deep only superficial palpation because of pain.

during the palpation were found hyper algetic zones around the cervical spine, shoulders blades, subcapital area and Th/C crossing area, restriction of fascia caudo-cranial direction around the scapulas .

hyper tonus with trigger points were found in upper and med. Trapezius m., levator scpulae m., m.scalenes, m.suboccipitals, m.SCM and rhomboid m., in m.supraspinatus, m.pectoralis minor, m.rectus abdominis and Thoracic Paravertebral.m were only in hypertonus without TrP,subscapularis is in hypertonus only on the Lt. side.

In hypotonus were found lower trapesius, m.gluteus maximus, m.transverse abdominis.

### 3.10.4 Breathing examination:

Upper thoracic type of breathing due to:

Inspiration: During inspiration observed more anterior-posterior and ventral extension of thorax and less lateral extension of thorax, the accessory muscles like SCM, scalene, upper trapezius are over active. Descending of the diaphragm is decreased.

Expiration: according to active controlled, forced expiration we can see overload of rectus abdominis m. and decreased load of transversus abdominis m.

**Conclusion of breathing examination:**

Typical upper thoracic breathing by overloading of SCM, upper trapezius. and scalene m. and during expiration there is overload of rectus abdominis m. and it is the cause to inhibition of the transversus abdominis m.

### 3.10.5 Movement stereotypes:

**Hip extension:** positive

Pathological sign: starting of motion with the activation of hamstring muscles instead of gluteus maximus muscle and then continues to paravertebral muscles of the patient shows predominance of hamstring on gluteus maximus.

**Hip abduction:** positive

Pathological sign: starting the motion with tensor fascia lata m. , then activation of gluteus med.+min then qudratus lumborum m shows on tensor fascia lata compensation mechanism.

**Trunk curl-up:** negative

**Push up:** the patient not able to perform the movement because of pain in the cervical area.

**Neck flexion:** positive.

Pathological sign: starting the motion with the jaw juts, by over activation of SCM m and scaleni m.

**Shoulder abduction:** positive.

Pathological sign: starting the motion with m.supraspinatous but elevation of shoulders begins at 20 degrees. This early elevation shows the overload of m.upper trapezius.(9)

**Conclusion of movement stereotype examination:**

From hip extension test we can see weakness of gluteus maximus muscle.

From hip abduction test we can see typical tensor facia lata mechanism that shows about weakness of gluteus med.+min m.

From neck flexion test we can see weakness of deep flexors m.

From shoulder abduction test we can see overload of m.upper trapezius.

and inhibition of deltoid medial part and m.supraspinatous.

### 3.10.6 Anthropometrical measurements:

**Circumferences of chest:**

normal- 124cm. inspiration-126cm. expiration-121cm

**Conclusion of Anthropometrical measurements:**

According to circumferences of chest during maximal breathing in, we can see enlargement of only 2 cm, it is meaning that the enlargement is restricted. the deference in breathing out is normal.

**3.10.7 ROM evaluation:**(all examinations provided by active movement).

| Right | Shoulder joint | Left |
|---|---|---|
| 130° | Flexion | 135° |
| 45° | Extension | 45° |
| 125° | Abduction | 70° |
| 20° | Internal rotat. | 20° |
| 90° | External rotat. | 90° |
| 85° | Horizontal ABD. | 80° |
| 45° | Horizontal ADD. | 25° |

**Table 6:** ROM of shoulder joint

| Right | Head and neck | Left |
|---|---|---|
| 10° | Lateroflexion | 10° |
| 20° | Rotation | $20^0$ |

**Table 7:** ROM of head and neck

| | Head and neck |
|---|---|
| Flexion | $35^0$ |
| Extension | $35^0$ |

**Table 8:** ROM of head and neck

| Right | Trunk | Left |
|---|---|---|
| 40° | Rotation | $40^0$ |

**Table 9:** ROM of trunk.

* Rotation of head is restricted to both directions with hard barrier due to internal fixation of C3-C4 levels.

**Conclusion of ROM examination:**

According to table 6 there is big restriction of ROM to ABD,F and horizontal ADD in shoulder joint, especially ABD on the Lt. shoulder.

According to table 7 there is restriction of head in all directions especially lateral flexion and rotation because of internal fixation at C3-C4 levels.

According to table 8 there is restriction of trunk movement. during flexion examination there was semiflexion in knees probably due to shortening of hamstring m.

*in most of the movement the restriction is because of the pain especially in shoulder and head movements its important to state that the restricted factor in head motion is internal fixation in C3-C4 levels that creating imbalance around the cervical area and the result is pain and restriction in ROM.

### 3.10.8 Examination of shortened muscles:

| Right | muscles | Left |
|---|---|---|
| * 2 | m. trapezius upper part | * 2 |
| * 2 | m. levator scapulae | * 2 |
| * 2 | m. SCM | * 2 |
| 2 | Deep cervical extensors m. | 2 |
| 0 | m. pectoralis major | 0 |
| 1 | m. pectoralis minor | 1 |
| 0 | m. Qudratus lumborum | 0 |
| 1 | m. iliopsoas | 1 |

**Table 10:** (9)

* - the test was provided with restricted neck rotation due to internal fixation of C3-C4 levels.

**Conclusion of examination of shortened muscles:**

According to table 9 we can see shortness of muscles around the cervical spine, it is probably the result of imbalance of muscles due to internal fixation.

### 3.10.9 Muscle testing:

| Right | Muscles | Left |
|---|---|---|
| | m.trapezius | |
| 4 | upper fibers | 3+ |
| 4 | middle fibers | 3+ |
| 4 | lower fibers | 3+ |
| 4 | m. rhomboideus | 3+ |
| 4 | m.Deltoid ant. | 3+ |
| 4 | m.Deltoid pos. | 3+ |
| 4 | m.Deltoid med. | 3+ |
| 4 | m. serratus anterior | 3+ |
| 4 | m.latissimus dorzi | 4 |
| 4+ | Medial rotators of shoulder m. (latissimus dorzi,pectoralis maj.,teres maj.,subscapularis) | 3+ |
| 4+ | Lateral rotators of shoulder m.(teres minor,infraspinatus) | 3+ |
| 4+ | m.supraspinatus | 3+ |
| 5 | m. pectoralis maj.upper part | 5 |
| 5 | m. pectoralis maj.lower part | 5 |
| 4+ | m. pectoralis min. | 4 |
| 4 | m.obliques abdominis (external/internal)+m.rectus abdominis | 4 |
| 4 | m.rectus abdominis | 4 |
| 4 | m.Quadratus lumbarum | 4 |
| 4 | Trunk extensors m.(erector | 4 |

| | | |
|---|---|---|
| | spinae) | |
| 4- | Neck flexors m. (SCM+Scaleni) | 4- |
| 5 | Neck extensors m.(splenius capitis/cervicis,semispinalis capitis/cervicis,cervical erector spinae) | 5 |
| 4 | m.gluteus max. | 4 |
| 5 | m.gluteus med+min | 5 |
| 5 | m.iliopsoas | 5 |

**Table 11:** muscle testing (7)

**Conclusion of muscle testing:**

According to table 10 there is weakness of all muscles around the shoulder and neck, more noticeable weakness is on the Lt. side of body.

most of the weakened muscles are because of the pain, especially around the shoulder and head. the weakness is probably due to internal fixation in C3-C4 levels that creating imbalance around the cervical and shoulder blade area and the result is pain and weakness in ROM.

### 3.10.10 Basic neurological examination:

**Sensation tests:**

Sensation- Normal, same sensation in both sides

**Deep sensation**

| | |
|---|---|
| Vibration | Normal, bilaterally same sensation |
| Sensation of position | Normal |
| Sensation of movement | Normal |

**Table 12**

**Tendon reflexes:**

| | |
|---|---|
| Biceps brachii reflex | Normal |
| Triceps brachii reflex | Normal |
| Flexion of fingers reflex | Normal |

**Table 13**

**Conclusion of Basic neurological examination:**

According to tables 11,12 there were no neurological pathological foundings.

**3.10.11 Joint play examination:**

* it was not possible to examine the joint play of the cevical cpine because of acute pain in this region.(8)

**3.11 Conclusion of initial kinesiological examination:**

The anamnesis is important factor for determination of the main cause for the main complain in this case cervical pain stiffness and headache:

-It is very important to pay attention on patient's functional activities that in this case the patient is most of the day in sitting position in the office and the faulty posture is the result, that in some longer time it is the cause for muscle imbalance and pain.

-In this case most important fact is the medical history of the patient. The patient is after operation and internal fixation of C4-C3 level. And this fact leads to restricted all movements with structural changes, this restriction leads to total imbalance in muscles around it and also to faulty posture and finally to pain and headaches.

- less important is the family history because in this case the problems are not influenced genetically, the patient is after operation with intervention to structure of the spine by internal fixation.

-socially the patient is in good and lovely environment without pathological social factors.

- In this case previous rehabilitation gives us information that this problem of acute pain and stiffness is repeating, we can state that probably because of structural changes, internal fixation is the cause for the problem wich leads to functional postural imbalance.

From muscle shortness, palpation, muscle strength and spine examinations we found imbalance of muscles, tightness of upper trapezius m., levator scpulae m. ,pectoralis

minor m., SCM m., suboccipital m., and weakness of lower trapezius and deep neck flexors. This foundings of shortened and inhibited muscles stated as proximal crossed syndrome.(9)

We found imbalance also around the pelvis, weakness of gluteus max. m., and slightly of rectus abdominis muscle, and shortness of iliopsoas m. and erector spinae m.

This foundings of shortened and inhibited muscles stated as distal crossed syndrome and proximal crossed syndrome are combined, is called layer syndrome.(9)

According to posture examination we found anteversion of pelvis, hyperlordosis in lumbar spine, Thoracic hyperkyphosis , cervical hyper lordosis, protraction of the shoulders, Forward head posture.

According to the gait examination we found decrease in extension and semi flexion of hip joint. This is the result of shortness of iliopsoas m. and weakness of gluteus max. m.

From movement stereotypes examination there is instability in pelvis, cervical deep stabilization and in stabilization of the shoulder.

According ROM examination we found restriction of ROM to ABD,F and horizontal ADD in shoulder joint, restriction of head in all directions we must state that this restriction is structural.

From the result of layer syndrome we will find all pathological signs that we found from the examinations in this case.

The prognosis is poor because of fixed muscles imbalance patterns in CNS, evaluation of muscle imbalance in acute state like in our case must be performed with precaution because the evaluation of tight muscles and movement patterns should be performed only if there is no such strong pain.(9)

## 3.12 Short-term and long-term rehabilitation plan:

The rehabilitation plan will be constructed first to relax and stretch shortened and tense muscles to reduce acute pain, to make it possible to work on muscles imbalance and correction of faulty posture and than to maintain the proper balance between the muscles to keep the optimal posture of the body, and to improve the ADL activities.

**Short term rehabilitation plan:**

- Relaxation of TrP. and tensed muscles.
- Stretching of shortened muscles.
- Decrease stiffness and pain in cervical/thoracic area.
- Increase ROM and mobility of spine, neck and shoulders.
- Stimulation of correct diaphragmatic breathing.
- Education of correct breathing, sitting, sleeping and walking patterns.
- Proper stimulation and activation of deep stabilization system of trunk and neck.
- Increase muscles power of inhibited muscles.

**Long-term rehabilitation plan:**

- To keep the optimal state of muscles strength and optimal ROM in joints.
- Improve the balance and coordination of the body.
- Improve and maintain proper ADL functioning activities.
- Maintain correct posture during sleeping, standing, sitting, walking activities.
- Maintain correct breathing patterns.

## 3.13 Rehabilitation:

**Day to day therapy-**

**First session: 4/03/08**

- Taking of anamnesis, and providing of kinesiological examination.
- Soft tissue techniques around the shoulder blade area for better blood circulation to the area and release of dorsal and cervical fascia and the underlying structures.
- PIR for m.trapezius upper part, m.levator scapulae, m.rhomboidei, m.supraspinatus, suboccipital muscles , m. erector spinae, m. pectoralis minor, Lt. m. subscapularis, m.SCM, m.scalenes.(10)
- PFS for Lt. m. subscapularis, m.trapezius upper part, m.SCM, m.scalenes.

**Second session: 5/03/08**

- Soft tissue techniques around the shoulder blade area for better blood circulation to the area and release of dorsal and cervical fascia and the underlying structures.
- PIR for m.trapezius upper part, m.levator scapulae, m.rhomboidei, m.supraspinatus, suboccipital muscles , m. erector spinae, m. pectoralis minor, Lt. m. subscapularis, m.SCM, m.scalenes.(8)
- PFS for Lt. m. subscapularis, m.trapezius upper part, m.SCM, m.scalenes.
- Breathing exercises in supine for activation of m.transverse abdominis and facilitation of diaphragmatic breathing.
- Active exercises of head with attention to use deep neck flexors and not m.SCM.
- Education of correct posture patterns in sitting, standing, walking and sleeping positions.
- **Auto-therapy program:**
    - Keep attention on correct posture in sitting, standing, walking and sleeping positions during all day.
    - Self PIR of m. trapezius upper part, levator scapulae, m. suboccipitals, and m.subscapularis.(8)
    - Breathing exercises for the diaphragmatic training, activation of m.transverse abdominis

**Third session: 6/03/08**

- Soft tissue techniques around the shoulder blade area for better blood circulation to the area and release of dorsal and cervical fascia and the underlying structures.
- PIR for m.trapezius upper part, m.levator scapulae, m.rhomboidei, m.supraspinatus, suboccipital muscles , m. erector spinae, m. pictoralis minor, Lt. m. subscapularis, m.SCM, m.scalenes.(8)
- PFS for Lt. m. subscapularis, m.trapezius upper part, m.SCM, m.scalenes.
- Breathing exercises in supine for activation of m.transverse abdominis and facilitation of diaphragmatic breathing.
- Active exercises of head with attention to use deep neck flexors and not m.SCM.
- Stimulation of correct posture patterns in sitting and standing positions.
- Mobilization technique of shoulders blade, mobilization to extension of thoracic spine in sitting position to increase mobility of the spine.(8)
- Active stretching of neck muscles.
- Exercise with theraband for strengthening of m.rhomboidei, m.trapezius lower part, m.gluteus maximus,. m.deltoid, m. serratus anterior, medial and lateral rotators of shoulder.
- **Auto-therapy program**:
    - Keep attention on correct posture in sitting, standing, walking and sleeping positions during all day.
    - Self PIR of m. trapezius upper part, levator scapulae, m. suboccipitals, and m.subscapularis.(8)
    - Breathing exercises for the diaphragmatic training, activation of m.transverse abdominis.
    - Active stretching of neck muscles.

**Fourth session: 7/03/08**

- Soft tissue techniques around the shoulder blade area for better blood circulation to the area and release of dorsal and cervical fascia and the underlying structures.
- PIR for m.trapezius upper part, m.levator scapulae, m.rhomboidei, m.supraspinatus, suboccipital muscles , m. erector spinae, m. pictoralis minor, Lt. m. subscapularis, m.SCM, m.scalenes.(8)
- PFS for Lt. m. subscapularis, m.trapezius upper part, m.SCM, m.scalenes.
- Stretching of m.trapezius upper part, m.SCM, m.scalenes and m. pictoralis minor, suboccipital muscles
- Breathing exercises in supine for activation of m.transverse abdominis and facilitation of diaphragmatic breathing.
- Active exercises of head with attention to use deep neck flexors and not m.SCM.
- Stimulation of correct posture patterns in sitting and standing positions.
- Mobilization technique of shoulders blade, mobilization to extension of thoracic spine in sitting position to increase mobility of the spine.(8)
- Active stretching of neck muscles.
- Exercise with theraband for strengthening of m.rhomboidei, m.trapezius lower part, m.gluteus maximus,. m.deltoid, m. serratus anterior, medial and lateral rotators of shoulder.
- **Auto-therapy program:**
    - Keep attention on correct posture in sitting, standing, walking and sleeping positions during all day.
    - Self PIR of m. trapezius upper part, levator scapulae, m. suboccipitals, and m.subscapularis.(8)
    - Breathing exercises for the diaphragmatic training, activation of m.transverse abdominis.
    - Active stretching of neck muscles.

**Fifth session: 8/03/08**

- Final kinesiological examination.
- Soft tissue techniques around the shoulder blade area for better blood circulation to the area and release of dorsal and cervical fascia and the underlying structures.
- PIR for m.trapezius upper part, m.levator scapulae, m.rhomboidei, m.supraspinatus, suboccipital muscles , m. erector spinae, m. pictoralis minor, Lt. m. subscapularis, m.SCM, m.scalenes.(8)
- PFS for Lt. m. subscapularis, m.trapezius upper part, m.SCM, m.scalenes.
- Stretching of m.trapezius upper part, m.SCM, m.scalenes and m. pictoralis minor., suboccipital muscles
- Breathing exercises in supine for activation of m.transverse abdominis and facilitation of diaphragmatic breathing.
- Active exercises of head with attention to use deep neck flexors and not m.SCM.
- Stimulation of correct posture patterns in sitting and standing positions.
- Mobilization technique of shoulders blade, mobilization to extension of thoracic spine in sitting position to increase mobility of the spine.(8)
- Active stretching of neck muscles.
- Exercise with theraband for strengthening of m.rhomboidei, m.trapezius lower part, m.gluteus maximus,. m.deltoid, m. serratus anterior, medial and lateral rotators of shoulder.
- **Auto-therapy program:**
    - Keep attention on correct posture in sitting, standing, walking and sleeping positions during all day.
    - Self PIR of m. trapezius upper part, levator scapulae, m. suboccipitals, and m.subscapularis.(8)
    - Breathing exercises for the diaphragmatic training, activation of m.transverse abdominis.
    - Active stretching of neck muscles.

### 3.14 Final kinesiologic examination:

* The sings of improvement are represented in highlighted letters.

### 3.14.1 Postural examination: Static

| **Anterior view:** | |
|---|---|
| Sole weight baring | symmetry |
| Transversal sole Arch | symmetry |
| Longitudinal sole Arch | symmetry |
| Calf side | symmetry |
| Patella | Slight external rotation of Rt. patella |
| Thigh contour | symmetrical in both sides(medial-lateral) |
| Anterior superior iliac spine | Symmetrical |
| Umbilicus | Deviations to the Rt. |
| Sternum | Middle line |
| Nipples | Symmetrical |
| Clavicles | **Symmetrical** |
| Shoulder position | **Symmetrical** |
| dominant hand | left |

**Table 14:** Anterior view

| **Posterior view:** | |
|---|---|
| Heel form and position | Symmetrical |
| Achille's tendon | Symmetrical |
| Calf | Symmetrical |
| Popliteal lines | Symmetrical |
| Thigh contour | Symmetrical in both sides(medial-lateral) |
| Subgluteal lines | Symmetrical |
| Posterior superior illiac spine | Symmetrical |
| Ilium crests | Symmetrical |
| Trunk | Symmetrical |

| | |
|---|---|
| Spinous processes | Slight lumbar scoliosis to the Lt. side |
| Inferior scapula angles | **Symmetrical** |
| Scapulas medial margin | **Symmetrical** |
| Shoulder position | **Less elevation, both elevated Symmetrically** |
| Auricles | Symmetrical |

**Table 15:** Posterior view

| | **Lateral view:** |
|---|---|
| Knee joint position | Straight line |
| Position of pelvis | **Improved, slight anterversion** |
| Lumbar part of spine | **Improved,slight hyperlordosis** |
| Thoracic part of spine | **Improved,slight hyperkyphosis on the upper part** |
| Shoulder position | **normal** |
| Cervical part of spine | **Very slightly decreased in Hyperlordosis** |
| Head position | **Still forward head position, but less than before** |

**Table 16:** Lateral view

**Postural examination: Dynamic**

| | |
|---|---|
| Shober's distance | 5 cm |
| Lateroflexion distance | **Lt./Rt./20 cm** |
| Stibor's distance | 8 cm |
| Flesch de forestier distance | **5 cm** |
| Cepoje's distance | **3 cm** |
| Otto's inclination distance | **4 cm** |
| Thomayer's distance | **-10 cm** |

**Table 17:** spine distances.

### 3.14.2 Gait evaluation:

Without shoes: **more stable walking patterns.**

### 3.14.3 Examination by palpation:

**"Kibler" wave palpation:** no hyper algetic zones.

**Examination of fascia: no restriction of fascia**

| **Right** | **muscles** | **Left** |
|---|---|---|
| **Less hypertonisity ,no TrP**<br>normal<br>Hypotonus | trapezius<br>upper part<br>Middle<br>Lower | **Less hypertonisity ,no TrP**<br>normal<br>Hypotonus |
| **Less hypertonisity ,no TrP** | m.levator scapulae | **Less hypertonisity ,no TrP** |
| **Less hypertonisity** | m.Rhomboidei | **Less hypertonisity** |
| Normal tonus | m.subscapularis | **normal** |
| **normal** | m.supraspinatus | **normal** |
| Normal tonus | m.teres minor | Normal tonus |
| Normal tonus | m.infraspinatus | Normal tonus |
| **Less hypertonisity ,no TrP** | m.scalenes | **Less hypertonisity ,no TrP** |
| **Less hypertonisity ,no TrP** | m.SCM | **Less hypertonisity ,no TrP** |
| **normal** | m.pectoralis minor | **normal** |
| Normal tonus | m.pectoralis major | Normal tonus |
| Hypotonus | m.gluteus maximus | Hypotonus |
| Normal tonus | m.iliopsoas | Normal tonus |
| Normal tonus | m.external oblique | Normal tonus |
| Normal tonus | m.internal oblique | Normal tonus |
| **Less hypertonisity ,no TrP** | m.suboccipitals | **Less hypertonisity ,no TrP** |
| Hypertonus | m.rectus abdominis | Hypertonus |
| Hypotonus | m.transverse abdominis | Hypotonus |
| **Less hypertonisity ,no TrP** | Thoracic paravertebral.m | **Less hypertonisity ,no TrP** |

**Table 18:** Palpation of muscles

* The palpation was performed in optimal relaxing muscles position, in supine or prone positions.

### 3.14.4 Breathing examination:

Upper thoracic type of breathing due to:

Inspiration: During inspiration observed more anterior-posterior and ventral extension of thorax and less lateral extension of thorax, the accessory muscles like SCM, scalene, upper trapezius are over active. Descending of the diaphragm is decreased.

Expiration: according to active controlled, forced expiration we can see overload of rectus abdominis m. and **there is improvement in activation of transverse abdominis m.**

### 3.14.5 Movement stereotypes:

**Hip extension:** positive

Pathological sign: starting of motion with the activation of hamstring muscles instead of gluteus maximus muscle and then continues to paravertebral muscles of the patient shows predominance of hamstring on gluteus maximus.

**Hip abduction:** positive

Pathological sign: starting the motion with tensor fascia lata m. , then activation of gluteus med.+min then qudratus lumbarum m shows on tensor fascia lata compensation mechanism.

**Trunk curl-up:** negative

**Push up:** positive

Pathological sign: the patient performed the movement but the scapulas were not fixed and they elevated and abducted, there were tremor as well that it is sign of weakness.

**Neck flexion:** positive.

Pathological sign**: normal movement but with signs of weakness**.

**Shoulder abduction:** positive.

Pathological sign: starting the motion with m.supraspinatous, **elevation of shoulders begins at about 50 degrees.** (9)

**3.14.6 ROM evaluation:**(all examinations provided by active movement).

| Right | Shoulder joint | Left |
|---|---|---|
| **From 130 ° improved to 150 °** | Flexion | **From 135 ° improved to 150°** |
| 45 ° | Extension | 45 ° |
| **From 120 ° improved to 150°** | Abduction | **From 70 ° improved to 120°** |
| **From 20 ° improved to 50°** | Internal rotat. | **From 20 ° improved to 50°** |
| 90 ° | External rotat. | 90 ° |
| **From 85 ° improved to 90°** | Horizontal ABD. | **From 80 ° improved to 90°** |
| 45 ° | Horizontal ADD. | **From 25 ° improved to 40°** |

**Table 19:** shoulder joint.

| Right | Head and neck | Left |
|---|---|---|
| **From 10 ° improved to 20 °** | Lateroflexion | **From 10 ° improved to 20°** |
| **From 20 ° improved to 30 °** | Rotation | **From 20 ° improved to 30 °** |

**Table 20:**ROM head and neck

| Head and neck | |
|---|---|
| Flexion | **From 35 ° improved to 40 °** |
| Extension | **From 35 ° improved to 40 °** |

**Table 21:** ROM head and neck

| Right | Trunk | Left |
|---|---|---|
| 40 ° | Rotation | $40^0$ |

**Table 22:** ROM of trunk

* Rotation of head is restricted to both directions with hard barrier due to internal fixation of C3-C4 levels.

### 3.14.7 Examination of shortened muscles:

| Right | muscles | Left |
|---|---|---|
| * 1 | m. trapezius upper part | * 1 |
| * 1 | m. levator scapulae | * 1 |
| * 1 | m. SCM | * 1 |
| 1 | Deep cervical extensors m. | 1 |
| 0 | m. pectoralis major | 0 |
| 0 | m. pectoralis minor | 0 |
| 0 | m. Qudratus lumborum | 0 |
| 0 | m. iliopsoas | 0 |

**Table 23**:(9)

* the test was provided with restricted neck rotation due to internal fixation of C3-C4 levels.

### 3.14.8 Muscle testing:

| Right | muscles | Left |
|---|---|---|
| | m.trapezius | |
| 4 | upper fibers | 4 |
| 4 | middle fibers | 4 |
| 4 | lower fibers | 4 |
| 4 | m. rhomboideus | 4 |
| 4 | m.Deltoid ant. | 4 |
| 4 | m.Deltoid pos. | 4 |
| 4 | m.Deltoid med. | 4 |
| 4 | m. serratus anterior | 4 |
| 4 | m.latissimus dorzi | 4 |
| 4+ | Medial rotators of shoulder m. (latissimus dorzi,pectoralis maj.,teres maj.,subscapularis) | 4 |
| 4+ | Lateral rotators of shoulder m.(teres minor,infraspinatus) | 4 |
| 4+ | m.supraspinatus | 4 |
| 5 | m. pectoralis maj.upper part | 5 |
| 5 | m. pectoralis maj.lower part | 5 |
| 4+ | m. pectoralis min. | 4 |
| 4 | m.obliques abdominis (external/internal)+m.rectus abdominis | 4 |
| 4 | m.rectus abdominis | 4 |
| 4 | m.Quadratus lumbarum | 4 |
| 4 | Trunk extensors m.(erector spinae) | 4 |

| | | |
|---|---|---|
| 4+ | Neck flexors m. (SCM+Scaleni) | 4+ |
| 5 | Neck extensors m.(splenius capitis/cervicis,semispinalis capitis/cervicis,cervical erector spinae) | 5 |
| 4 | m.gluteus max. | 4 |
| 5 | m.gluteus med+min | 5 |
| 5 | m.iliopsoas | 5 |

**Table 24:**(7)

## 3.15 Therapy effect evaluation, prognosis:

**Therapy effect:**

After five sessions of the therapy we found in final kinesiologic examination improvement in the most of the aspects that were treated.

Changes in posture were that the scapulae is more stabilized, less anterior displacement of head, hyperkyphosis in Th. spine is decreased, position of the shoulder still elevated but they are symmetrical.

Muscle tone of the tense muscles is decreased and all the TrP. removed.

The length of shortened muscles around the shoulders and neck is increased.

The gait is with better walking patterns.

HAZ were removed and the fascia around the scapulas released and much more moveable.

The breathing is still upper thoracic type, but we achieved activation of the transverse abdminis muscle.

There is some improvement in muscle stereotype movements, the neck flexion patterns were better but still during the movement there was tremor that is a sign of deep flexors weakness.

In shoulder abduction test was improvement that we achieved relaxation of trapezius m. and the elevation of the shoulder was latter and no at the beginning of the movement.

In push up test he could to perform it because there was no pain but he did it with difficulties and with wrong patterns movements.

The spine distances are improved and showed more flexibility in the most levels of the spine.

Increasment of ROM was detected in both shoulders but much greater on Lt. shoulder in all directions. The ROM of the head is increased also a bit but we have to state that there is structural restriction by internal fixation.
The power of the muscles around the shoulders and the neck are improved especially on the Lt. side of the body.
In the conclusion there is big improvement especially on the Lt. side of the body, the pain is much decreased, we achieved symmetry between the both sides that it is very important.
The patient should continue the auto-therapy exercise, and to continue with long term rehabilitation plan to achieve long term maximal effect.

**Prognosis:**

The prognosis is very bad because the distal crossed syndrome and proximal crossed syndrome are combined. The prognosis is very bed for rehabilitation because of fixed muscles imbalance patterns in CNS level.(9)
I think that the only way how to improve the state and to avoid worsening of the state is to keep the long term of the rehabilitation plan as every day living activity, otherwise the improvement is only for the short time because the internal fixation in cervical area restricts the movements in the cervical spine and muscles imbalance will start and progress to the same state.

## 4. Conclusion:

It was great opportunity for me to practice and to apply all my knowledge during five sessions on the patient and more over to see the success and improvement with each session, this fact makes me to believe in my power to help and treat people as a physiotherapist.

The patient was with great motivation to recover and to get rid of the pain and therefore performed all the exercises and auto therapies with great effort.

Thanks a lot to my assistant Petra Carmakova that was leading me during the practice to the success in my therapies.

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## 6. Abbreviation list:

**TrP**- trigger point

**PIR**- post isometric relaxation

**PFS**- post facilitative stretching

**ROM**- range of motion

**C**- cervical vertebrae

**T**- thoracic vertebrae

**L**- lumbar vertebrae

**S**- sacral vertebrae

**F**- flexion

**E**- extension

**MRI**- Magnetic Resonance Image

**CT**- Computer Tomography

**CSM**- cervical spondylotic myelopathy

**NSAIDs**- Non-steroidal anti-inflammatory drugs

**TCAs**- are tricyclic antidepressants

**Lt.**-left

**Rt.**- right

**Th/C**- cervico thoracic crossing

**BP**- blood pressure

**HR**- heart rate

**BMI**- body mass index

**m.**- muscle

**max.**-maximus

**kg**- kilogram

**cm**-centimeter

**SCM**- sternocleidomastoid

**med.**- medialis

**min.**- minimus

**max.**- maximus

**ABD**- abduction

**ADD**- adduction

**Pos**- posterior

**Ant** - anterior

**maj.**- major

**CNS**- central neuro system

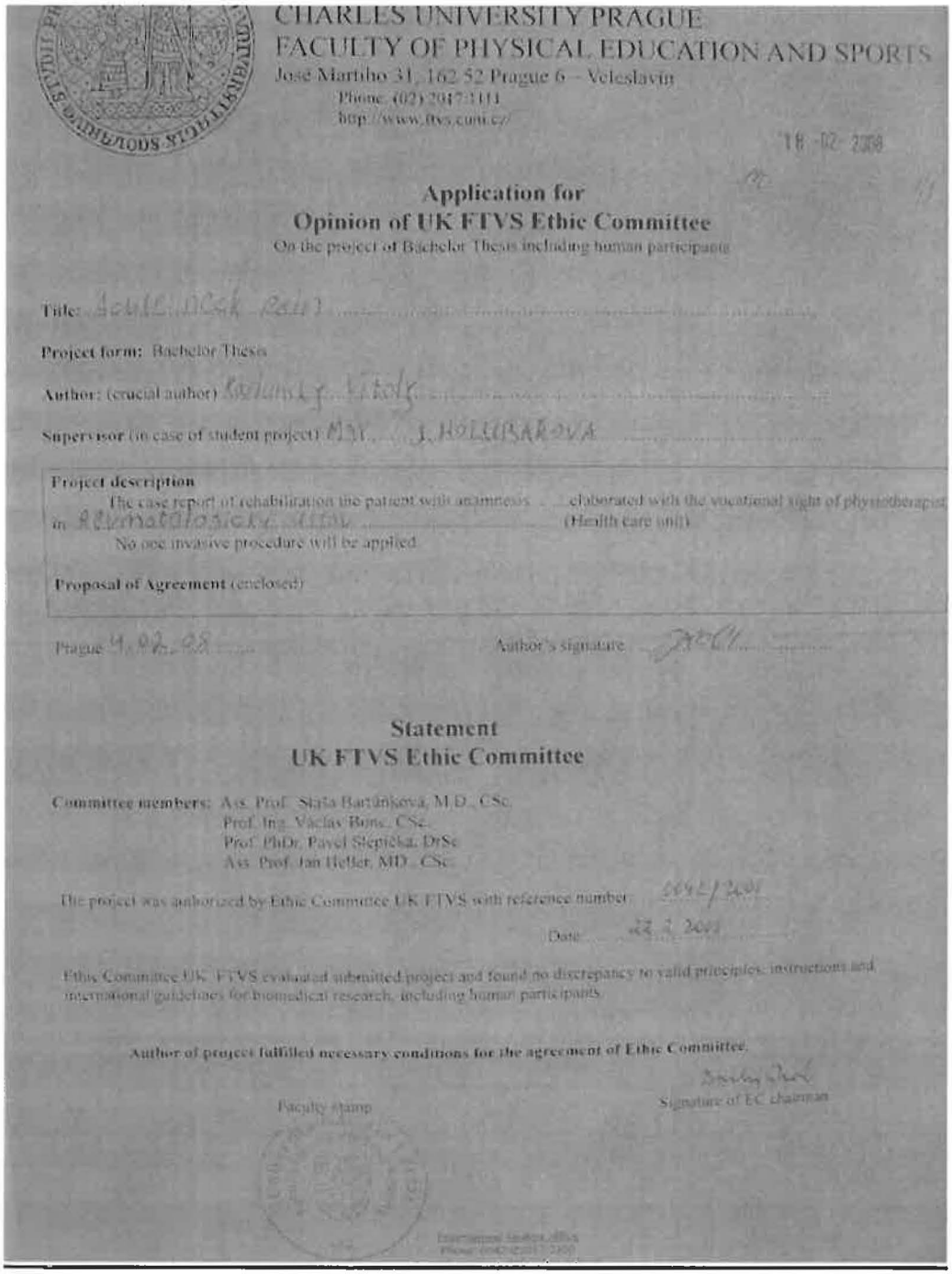
**ADL**- activities of daily living

**HAZ**- hyper algetic zone

## 7. Supplements

The project was authorized by ethic committee UK FTVS with reference number 0042/ 2008

Date: 22.02.2008



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18 -02- 2008

**Application for**
**Opinion of UK FTVS Ethic Committee**
On the project of Bachelor Thesis including human participants

Title: Ischiadická bolest

Project form: Bachelor Thesis

Author: (crucial author) Kolumbus Vitalij

Supervisor (in case of student project) MUDr. J. HOLUBÁŘOVÁ

**Project description**
The case report of rehabilitation the patient with ischialgia elaborated with the vocational sight of physiotherapist in Rheumatologická klinika (Health care unit).
No one invasive procedure will be applied.

**Proposal of Agreement** (enclosed)

Prague 4.02.08 Author's signature

**Statement**
**UK FTVS Ethic Committee**

Committee members: Ass. Prof. Slaša Bartůňková, M.D., CSc.
Prof. Ing. Václav Bunc, CSc.
Prof. PhDr. Pavel Slepička, DrSc.
Ass. Prof. Jan Heller, MD., CSc.

The project was authorized by Ethic Committee UK FTVS with reference number 0042/2008

Date 22. 2. 2008

Ethic Committee UK FTVS evaluated submitted project and found no discrepancy to valid principles, instructions and international guidelines for biomedical research, including human participants.

**Author of project fulfilled necessary conditions for the agreement of Ethic Committee.**

Faculty stamp

Signature of EC chairman