

T.C.
YEDİTEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF SPORTS PHYSIOTHERAPY

**RELATIONSHIP BETWEEN PAIN,
PROPRIOCEPTION AND KINESIOPHOBIA IN
ACUTE AND CHRONIC NON-SPECIFIC NECK
PAIN PARTICIPANTS**

MASTER'S THESIS

TANSU ALEMDAR, PT. MSc

İSTANBUL, 2023

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SUPERVISOR

Dr. Öğr. Üyesi Feyza Şule HANTAL

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This thesis has been deemed by the jury in accordance with the relevant articles of Yeditepe University Graduate Education and Examinations Regulation and has been approved by Administrative Board of Institute with decision dated and numbered

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DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

15/01/2023

Tansu Alemdar



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Tansu Alemdar



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LIST OF SYMBOLS AND ABBREVIATIONS

ACCROM	Active Craniocervical Range of Motion
BMI	Body Mass Index
DNFE	Deep Neck Flexor Endurance
FABQ Fear	Avoidance Beliefs Questionnaire
FAPS Fear	Avoidance of Pain Scale
FQP	Fear of Pain Questionnaire
G-Pro	Goniometer-Pro
IPAQ	International Physical Activity Questionnaire
MET	Metabolic Equivalent of Task
NDI	Neck Disability Index
PASS	Pain Anxiety Symptoms Scale
ROM	Range of Motion
SCM	Sternocleidomastoid
SD	Standard Deviation
TSK	Tampa Scale for Kinesiophobia
VAS	Visual Analogue Scale

ABSTRACT

Alemdar, T. (2023). Relationship between pain, proprioception and kinesiophobia in acute and chronic non-specific neck pain participants. Yeditepe University, Institute of Health Science, Department of Sports Physiotherapy, MSc thesis, İstanbul.

In this study, kinesiophobia, proprioception, pain, and quality of life were evaluated in patients with non-specific acute and chronic neck pain. 52 patients, 26 with acute (mean age: 35.08 ± 10.877) and 26 with chronic (mean age: 35.58 ± 10.238) non-specific neck pain, who applied to Yeditepe University Hospital in Istanbul participated in this study. Joint range of motion and joint position sense were measured using the Goniometer-Pro (G-Pro), an iPhone application. Endurance was measured with the deep flexor muscle endurance test. The Neck Disability Index (BDI), the Tampa Kinesiophobia Scale (TKS), the Visual Analog Scale (VAS), and the International Physical Activity Questionnaire were used to determine the intensity of the pain, the fear of movement, the level of disability, and the level of physical activity (IPAQ). The study's data were statistically analyzed using the SPSS 20.0 program. Individuals with acute and chronic neck pain showed no significant difference in their sense of joint position or fear of movement. Deep neck flexor muscle endurance was found to be higher in those with chronic neck pain than in people with acute neck pain ($p < 0.05$). The degree of neck disability in both groups, as well as the fear of movement, were found to be significantly correlated. In neither group was there a correlation between sense of joint position and fear of movement. In those with chronic neck pain, there was a significant correlation between the intensity (VAS rest and VAS night) and fear of movement ($p < 0.01$), but not in people with acute neck pain. Joint position sense and pain intensity did not significantly correlate in either group.

In conclusion, it was found that there was a significant relationship between fear of movement and intensity of pain and neck disability in people with chronic neck pain, despite the fact that there was no correlation between fear of movement and sense of joint position in individuals with acute and chronic neck pain. Studies on individuals who suffer from non-specific acute and chronic neck pain have been reported to be limited, and additional research is required in this area.

Key words: Acute Neck Pain, Chronic Neck Pain, Proprioception, Kinesiophobia



ÖZET

Alemdar, T. (2023). Akut ve kronik non-spesifik boyun ağrısı olan bireylerde ağrı, propriosepsiyon ve kinezyofobi arasındaki ilişkinin incelenmesi. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Spor Fizyoterapisi Türkiye., Master Tezi. İstanbul.

Bu çalışma nonspesifik akut ve kronik boyun ağrısı olan hastalarda kinezyofobi, propriosepsiyon, ağrı ve yaşam kalitesi arasındaki ilişkiyi değerlendirmek amacıyla yapıldı. Bu çalışmaya İstanbul Yeditepe Üniversitesi Hastanesi'ne başvuran 26'sı akut (ortalama yaş: 35.08 ± 10.877) ve 26'sı kronik (ortalama yaş: 35.58 ± 10.238) non-spesifik boyun ağrısı olan 52 hasta katıldı. Eklem hareket açıklığı ve eklem pozisyon hissi, bir iPhone uygulaması olan Goniometer-Pro (G-Pro) kullanılarak ölçüldü. Dayanıklılık, derin fleksör kas dayanıklılık testi ile ölçüldü. Ağrı şiddeti Vizüel Analog Skala (VAS), hareket korkusu Tampa Kinezyofobi Skalası (TKS), özürlülük düzeyi Boyun Özur İndeksi (BÖİ) ve fiziksel aktivite düzeyi Uluslararası Fiziksel Aktivite Anketi (Kısa) ile değerlendirildi. Çalışmada toplanan verilerin istatistiksel analizi için SPSS 20.0 programı kullanıldı. Akut ve kronik boyun ağrısı olan bireylerde hareket korkusu ve eklem pozisyon hissi açısından anlamlı bir fark bulunmadı. Kronik boyun ağrısı olan bireylerde derin boyun fleksör kas enduransının akut boyun ağrısı olan bireylere göre daha yüksek olduğu bulundu ($p < 0,05$). Her iki grupta da hareket etme korkusu ile boyun özürlülük düzeyi arasında anlamlı bir ilişki olduğu varken, hareket korkusu ile eklem pozisyonu hissi arasında anlamlı bir ilişki yoktu. Kronik boyun ağrılı bireylerde ağrı (VAS istirahat ve VAS gece) ile hareket korkusu arasında anlamlı bir ilişki bulunurken ($p < 0.01$), akut boyun ağrılı bireylerde bulunmadı. Her iki grupta da eklem pozisyon hissi ile ağrı şiddeti arasında anlamlı bir ilişki yoktu.

Sonuç olarak, akut ve kronik boyun ağrısı olan bireylerde hareket korkusu ile eklem pozisyon hissi arasında ilişki bulunmazken, kronik boyun ağrısı olan bireylerde hareket korkusu ile ağrı ve boyun özur düzeyi arasında anlamlı bir ilişki olduğu görülmüştür. Spesifik olmayan akut ve kronik boyun ağrısı olan bireylerde yapılan çalışmaların sınırlı olduğu ve bu konuda daha fazla çalışmaya ihtiyaç olduğu görülmüştür.

Anahtar Kelimeler: Akut boyun ağrısı, kronik boyun ağrısı, propriyosepsiyon, kinezyofobi

1. STATEMENT AND PURPOSE

Neck discomfort is a frequent disease that many people experience in the general population at some point in their lives. Its worldwide prevalence ranges from 16,7 to 75,1 percent (1).

Chronic pain is defined as a continuous or occasional disturbing condition that persists for at least 3-6 months. Acute pain is protective, while chronic pain is not. Neck pain has been categorized in many ways in the literature. When classified as duration, it is classified as acute up to 6 weeks, subacute between 6 weeks and 3 months, and chronic when it lasts more than 3 months (2).

Learned / established pain behavior restricts the individual's participation in movement and activity, making it inactive / sedentary. The functional limitation that occurs as a result of this causes limitation in the activities of the person in his / her life, which we define as disability due to chronic pain (3). Despite the fact that numerous factors, including age, sex, bad posture, and repetitive traumas, contribute to the etiology of neck discomfort, psychological aspects including anxiety and cognitive problems have also emerged as critical. These elements may significantly contribute to the emergence of kinesophobia, persistent discomfort, and the development of disabilities (4).

Proprioception was first used by Sherrington to refer to deep receptors that the body activates and to characterize the capacity of one's own limbs and body to perceive position and movement. It can separate proprioception into the perception of stationary location and the sense of movement, two submodalities (kinesthesia) (5). Proprioception produces meaningful data to the central nervous system that is utilized in motor planning. Thus, decreased proprioception helps to increase movement control, accuracy, and motor command recruitment timing, which in turn influences posture. The principal source of afferent proprioception in the cervical region is thought to be significantly accumulated muscle spindles in the deep cervical muscles. Because they function as sensors to fine-tune cervical motion and are relatively rich in muscle spindles, the deep and local cervical muscles are thought to be important for stability and postural support (6). Cervical spine position awareness is more likely to be compromised in people with neck discomfort, and it is clear that maintaining position sense during any healing will be crucial (5).

Because of this, the coexistence of kinesophobia and proprioceptive dysfunctions may result in a worsening of the pain's perception, a reduction in quality of life, and ultimately a rise in disability. Therefore, research into the presence of kinesophobia and proprioceptive dysfunctions in acute and chronic neck pain, as well as understanding the connections between kinesophobia, proprioception, quality of life, and pain, may play a significant role in the development of effective treatment plans for neck problems as well as in preventing the problem from becoming chronic. Determining the association between kinesophobia, proprioception, pain, and quality of life in patients with non-specific acute and chronic neck pain is therefore the goal of the current study. Neck discomfort is common in the general population and has a number of negative impacts. The goal of this study was to look at the underlying factors that contribute to both acute and chronic pain recurrence. In this investigation, two hypotheses were questioned:

H0: In patients with non-specific acute and chronic neck pain, there is no correlation between kinesophobia, proprioception, pain, and quality of life.

H1: In patients with non-specific acute and chronic neck pain, there is correlation between kinesophobia, proprioception, pain, and quality of life.

2. LITERATURE REVIEW

2.1. The Anatomy of Neck

The neck reaches from the area between the clavicles and the thoracic inlet on the inferior side to the region between the base of the skull and inferior border of the jaw on the superior side. At the base of the spine, in the cervical area of the vertebral column, the neck's true structure receives strength and movement as well as the vital support for the head above (7).

The neck skeleton consists of vertebrae cervicales, os hyoideum, manubrium sterni and clavicula. Vertebrae cervicales, manubrium sterni, and U-shaped os hyoideum are parts of the axial skeleton. The clavicles are parts of the upper appendicular skeleton (8).

Neck skeleton is formed by the cervical spine. The cervical vertebrae, which are found in the presacral vertebral region between the skull and the thorax, are the tiniest and most movable of all the vertebrae. Cervical vertebrae are smaller bones compared to others. Therefore, they carry less load than the lower vertebrae (8).

The vertebral column has the greatest range of motion in the cervical region. This region has a vast range of motion thanks to the 14 facet joints, 7 cervical vertebrae, 5 intervertebral discs, and numerous ligaments and muscles. In the cervical region, the 1st and 2nd vertebrae differ structurally from other vertebrae. The 7th cervical vertebra is characterized by being a transitional vertebra between the cervical and thoracic regions (9).

The cervical region is divided into 2 parts in terms of anatomical and functional structure.

Upper cervical region: C1-C2 (Atlas and axis), Atlas and axis vertebrae are also called atypical vertebrae (9).

Lower cervical region: C3-7 (Last 5 vertebrae) They are called typical vertebrae. Some publications refer to C7 as an unusual vertebra because its spinous process is longer than the others' (9).

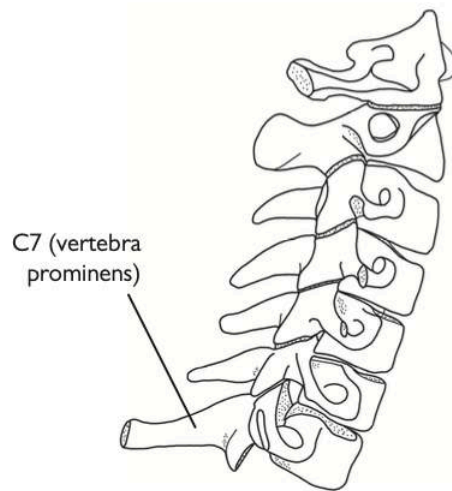


Figure 2.1. Cervical Spine, Lateral View (7)

2.1.1. Atlas (C1 vertebrae)

Atlas; the name given to the first cervical vertebra (9). The atlas, an unusual cervical vertebra, articulates superiorly with the occiput of the skull and inferiorly with the dens of the axis (7).

It has no vertebral body and no true spinous process. Instead of the corpus, it has lateral parts called *massae lateralis atlantis*. (9). The lower articular surface of the *massae lateralis atlantis* (*facies articularis inferior*) articulates with the axis. The *massa lateralis* are connected to each other through the *arcus anterior atlantis* anteriorly and the *arcus posterior atlantis* posteriorly. The dens axis is situated in a pit called the *fovea dentis*, which is at the center of the posterior surface of the *arcus anterior* (10). It is providing the head's rotation as well as its flexion, extension, and lateral flexion (7).

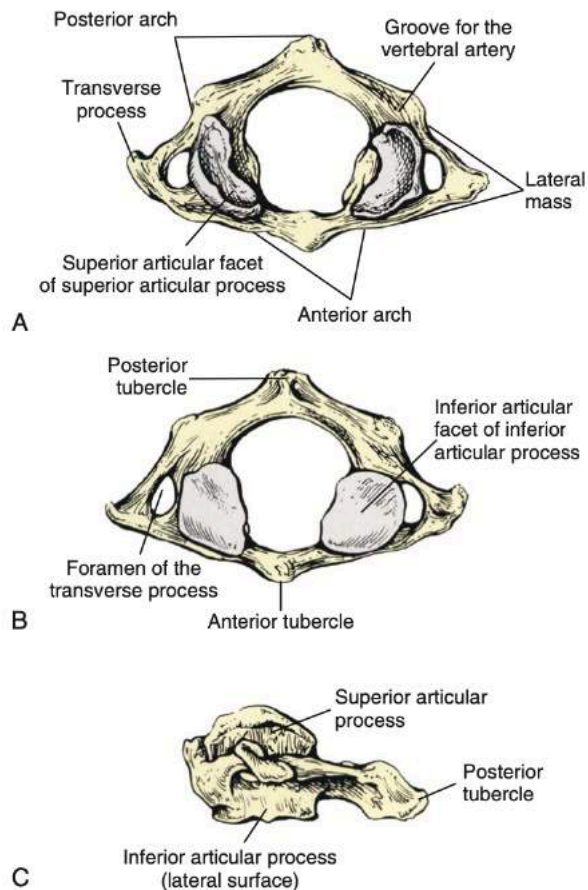


Figure 2.2.The Atlas (11)

2.1.2. Axis (C2 vertebrae)

It is the name given to the second cervical vertebra. It contains a corpus (9). The odontoid process (dens) allows for the specific identification of Axis. Dens has a conical shape and is around 15 mm long (7). C2 is the strongest vertebra. Because C1, which carries the weight of the skull, rotates on the axis (8). The atlas's fovea dentis and the dens axis anteriorly articulate. The apical ligament and alar ligaments connect to the lateral and upper ends of the dens, respectively. The ligamentum flavum attaches to the axis via its pedicle and lamina, which are thicker than the other cervical vertebrae. Processus spinosus thick, processus transversus small and blunt ends. Other parts are the same as typical cervical vertebrae (9).

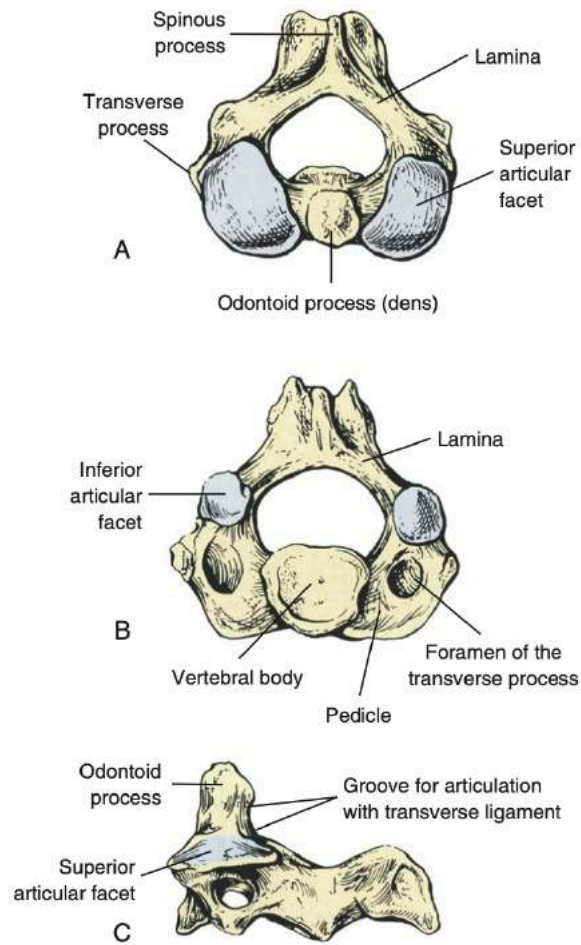


Figure 2.3. The Axis (11)

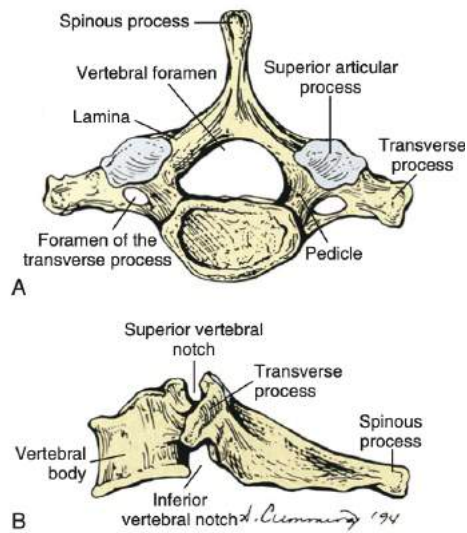
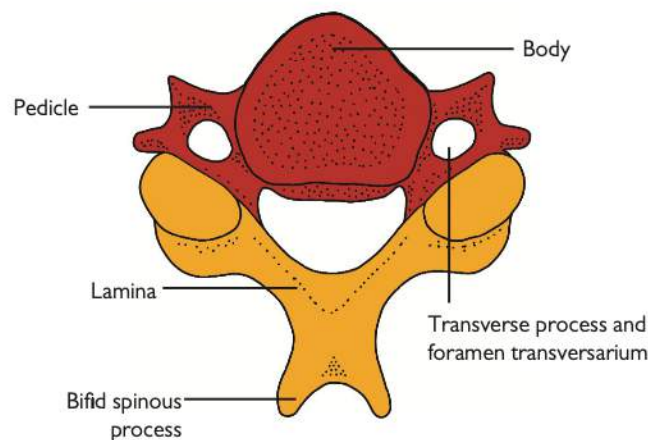


Figure 2.4. Views of C7 (11)

2.1.3. Typical vertebrae (C3-C7)

Vertebrae other than atlas and axis are also called typical vertebrae. Typically, each vertebra has common structures, although it varies according to the localities. These vertebrae basically consist of the corpus vertebra anteriorly and the arcus vertebrae posteriorly. Because of this formation, columnna vertebralis mainly consisted of 2 columns (9). Cervical vertebrae have a short triangular body. The corpus is relatively small in comparison to the thoracic and lumbar vertebrae and gets bigger as the strain is reduced. Arcus vertebrae start from the lateral parts of the corpus vertebrae. The pediculus arcus vertebrae, which are the beginning parts of the corpus vertebrae, curve backwards to form the processus transversus. Unlike other vertebrae, there are holes on the processus transversus called foramen transversarium. These openings become a canal through which the vertebral artery and vein flow when the cervical vertebrae are stacked. The processus spinosus starts from the posterior middle of the arcus vertebrae and extends posteriorly and downwards. In addition, the length of the forked processus spinosus, which ends with a tuberculum, increases as it goes down.(12).



A Typical Cervical Vertebrae (C4), Superior View. Anterior Components, Red; Posterior Components, Yellow (11).

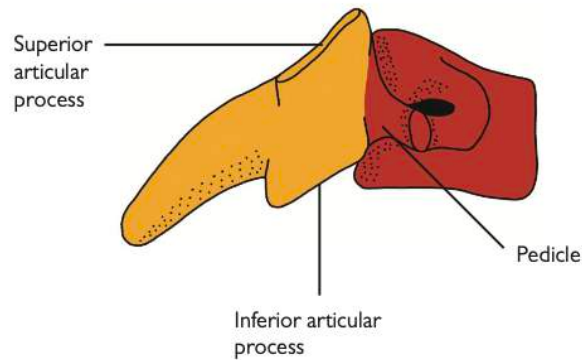


Figure 2.5. A Typical Cervical Vertebrae (C4), Lateral View. Anterior Components, Red; Posterior Components, Yellow (11)

2.1.4. Cervical spine joints

2.1.4.1. Atlanto-Occipital joint

The cup-shaped superior articular surfaces of the atlas support the occipital condyles, which are curved in the sagittal plane. Together, the right and left atlanto-occipital joints create an ellipsoid-type joint that can bend, extend, and, to a lesser extent, flex laterally. A small amount of rotation also occurs between the occiput and the atlas. The opposition between the condylar fossa of the occiput and the posterior portion of the superior articular process of the atlas limits the extension movement. Soft tissue obstacles like the posterior atlanto-occipital membrane restrict flexion mobility (13).

2.1.4.2. Atlanto-Axial joints

Three atlanto-axial joints (median, left, and right lateral) move together at the same time. Oval-shaped planar joints are lateral atlanto-axial joints. Each lateral joint's thin, floppy fibrous capsule joins to the upper and lower articular faces of the atlas and axis, respectively. Each capsule has a synovial membrane covering it. The dens and the ring-shaped structures that surround the dens constitute the middle atlanto-axial joint, which is of the trochoid type. Most motion in atlanto-axial joint is axial rotation motion, which is limited by the alar ligaments (13).

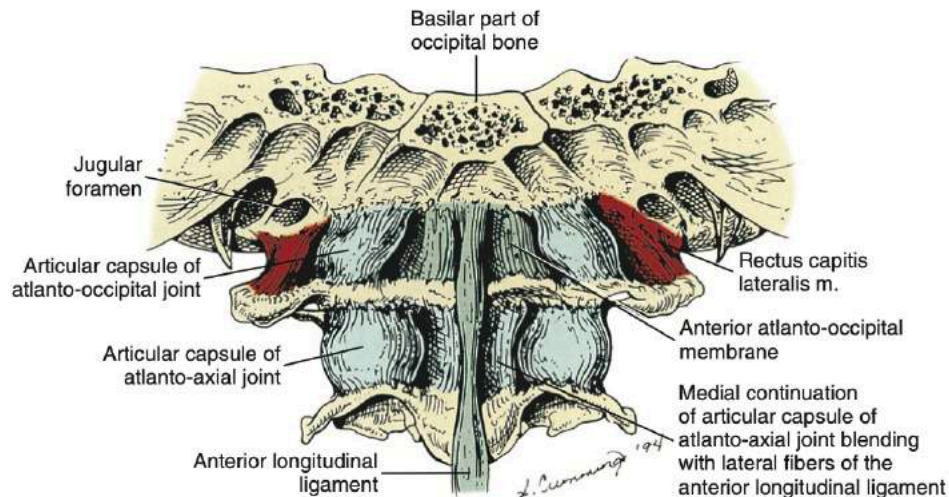


Figure 2.6. Cervical Spine Joints

2.1.4.3. C2 to C7 joints

The C3-C4, C4-C5, and particularly the C5-C6 joints are where the majority of flexion-extension movement occurs. The C2-C3, C3-C4, and C4-C5 vertebrae are mostly involved in lateral flexion and axial rotation movement. The caudal segments have less mobility and mixed motions are seen. This results from where the facet articular surfaces are located. Ipsilateral rotation always coexists with lateral flexion. For instance, rotation to the left occurs in conjunction with lateral flexion movement to the left. The combined rotation diminishes toward the caudal part of the spine and is most prominent in the C2-C3 section. The facet joints, uncovertebral joints, intervertebral joints, and intervertebral discs make up the anterior section of the lower cervical spine, which moves (14).

2.1.4.4. Intervertebral joints

The complex that is the intervertebral joint is made up of two vertebral bodies and the disc in between. As a shock absorber during axial loading, the disc also helps to evenly distribute weight on the surface of the vertebral body during flexion motions, increasing mobility between the vertebrae. The primary stabilizing structures for these joints are uncovertebral joints and anterior and posterior longitudinal ligaments (14).

2.1.4.5. Uncovertebral joints

When fissures develop on the lateral surface of the intervertebral disc, these begin in childhood and cause a split in the spine of adults. Despite the possibility of degenerative

alterations, they should be regarded as pseudo-joints because they lack articular cartilage and synovial fluid. These auxiliary joints help to maintain lateral stability (14).

2.1.4.6. Facet joints

The ligaments between the laminae and facet joints and the spinous processes connect the vertebrae posteriorly. Given that they feature articular surfaces coated in cartilage, a synovial membrane, and a fibrous joint capsule that holds synovial fluid, facet joints are classified as diarthrodial joints. The articular line is oblique; at the level of C2-C3, it extends from anterosuperior to posteroinferior at a 45° angle, reducing to 10° in the C7-T1 segment. The cervical region moves more than the thoracic and lumbar levels because the joint line is oblique and the joint capsule is flexible. Ipsilateral side flexion always occurs in conjunction with rotation. The upper surface of the lower vertebra moves backward on the lower surface of the left upper spine during left rotation. The reverse occurs in the right rotation (14,15).

The body of the higher vertebra moves backwards during neck extension. The lower facets open at the front and close at the back by sliding backwards and downwards as well as bending rearward. During the flexion motion, there is a reversal that opens the joint posteriorly and closes it forward. This is caused by the lower sections of the upper spine sliding forward, rising, and bending forward (12,14).

2.1.5. Cervical spine ligaments

The cervical spine's soft tissues play a significant role in clinical stability. The strength and restrained elongation of ligaments play a significant role in maintaining the stability of the craniocervical joint. Two separate ligament systems are highlighted in relation to how the cervical ligaments work (12).

Among the lengthy spinal ligaments are the supraspinous ligament, the anterior and posterior longitudinal ligaments, and others.

A sizable fibrous network called the anterior longitudinal ligament connects to the front surfaces of the vertebral bodies. It forms a strong ligament that extends from the cervical spine's anterior to the C2 vertebral body, anterior to the C1 tubercle, and the base of the occipital bone. The anterior longitudinal ligament has a smaller diameter where it joins the annular fibers of each intervertebral disc. This ligament is made up of several

layers. The fibers that are closest to the skin are the longest, spanning three to four vertebrae. The medium fibers go between two and three vertebrae, whereas the deepest fibers run from one vertebral body to the next. Short fibers link the lateral sides of the vertebrae. The anterior longitudinal ligament considerably compresses and fuses with the atlanto-occipital membrane between the atlas and occipital bone. The anterior longitudinal ligament limits excessive lordosis and extension in the cervical area (11,12,16).

Contrary to the anterior longitudinal ligament, the posterior longitudinal is broader where the annular fibers enter the intervertebral disc. It extends from the sacrum to the body of the axis through the spinal canal. It attaches to the posterosuperior and posteroinferior edges of the vertebral bodies. The posterior longitudinal ligament's upward extension toward the skull is continued by the tectorial membrane, a robust, wide band connected to the basilar region of the occiput. Three or four vertebrae are connected by superficial fibers, whereas deeper fibers, which act as perivertebral ligaments connecting adjacent vertebrae, merge with the intervertebral disc. The posterior longitudinal ligament contributes to the stability of the vertebral column (11,14,16).

The supraspinous ligament is also known as the ligamentum nuchae, and it extends from the sacrum to C7 along the extremities of the spinous processes. From C7 to the occiput, the ligamentum nuchae is a flat, membrane-like tissue. The superficial fibers reach between three and four vertebrae, the intermediate fibers between two and three vertebrae, and the deep fibers join adjacent vertebrae. In a flexion stretch, it is the first structure to crumble. Ligaments mechanically change as a result of vertebral separation. Additionally, the anterior and posterior longitudinal ligaments may get strained as a result of the disc bulging.(8,11,16).

Intersegmental ligaments that join nearby vertebrae include the Ligamentum Flavum, Interspinous, Intertransverse, and Capsular Ligaments. At the Ligamentum Flavum, the anterior lower margins of the aforementioned laminae meet the anterior upper laminae boundaries. It connects the vertebrae in the area from the sacrum to the axis by crossing the posterior spinal canal components. The flexibility of these ligaments helps to return the spinal column to its neutral position after flexion. Ligaments made of collagen also resist flexion. It can also protect discs from damage. The ligamentum flavum creates the medial and anterior portions of the capsular ligaments (7,8,11).

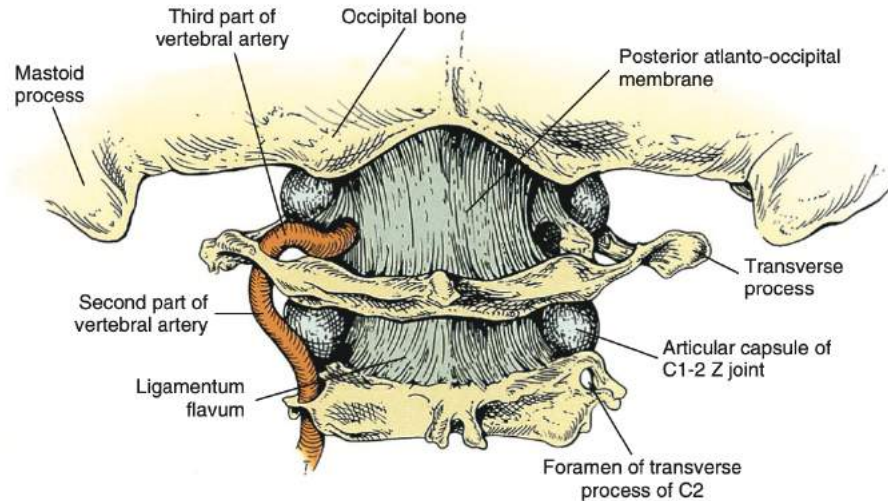


Figure 2.7. Upper Cervical Spine's Posterior Ligaments (11)

Almost membranous in appearance, interspinous ligaments are thin. They link the nearby spinous processes, which are united anteriorly and posteriorly by the ligamentum flavum and the supraspinous ligament, respectively. They are extremely underdeveloped as a part of the ligamentum nuchae in the cervical region. Interspinous ligaments improve spinal stability by minimizing excessive spine bending. Along with the supraspinous ligament, the interspinous ligaments are the first to rupture under extreme flexion (11,13,17).

Intertransverse ligaments attach to the ipsilateral transverse processes of adjoining vertebrae. The opposing side's lateral flexion movement stretches the intertransverse ligaments. Capsular ligaments join adjacent articular processes by attaching peripherally to the lateral borders of the articular surfaces. The capsule is substantially thinner and less securely bonded at the back. The medial and anterior fibers' elasticity and the posterior and inferior laxity of the capsule allow for substantial movement in a variety of orientations. As a result of the weight that the facet joints must bear due to disc degeneration, the articular cartilage is destroyed, which causes the facets to tangle or break apart (7,11).

2.1.5.1. Upper cervical spine ligaments

The anterior and lateral portions of the occiput, atlas, and axis are connected by the superior cervical ligaments.

The posterior atlanto-occipital ligament is a slender membrane that connects the back of the foramen magnum to the back of the atlas. This wide ligament creates a dome-shaped structure over the vertebral artery's right and left channels on the side. This tissue allows passage of the suboccipital nerve, vertebral artery, and veins (11).

The tectoral membrane, a potent ligament that stretches the posterior upward, is the longitudinal ligament. It traverses the foramen magnum, the atlanto-axial median joint, and joins to the middle of the skull (8).

2.1.5.2. Accessory atlantoaxial ligaments

They extend from the base of the odontoid process to the inferior medial surface of the lateral mass of the atlas on the same side. They strengthen the posterior interior of the capsules of the lateral atlanto-axial joints (11).

The spinal cord is strongly protected by the transverse and longitudinal elements of the cruciform ligament. The transverse segment of this ligament maintains the atlas in its proper position and prevents compression of the spinal cord during head and neck flexion. It enables the atlas to spin on its axis in a functional sense. The dens, which breaks before the ligament ruptures, is typically weaker than the transverse ligament. The longitudinal bands of the cruciform ligament maintain the transverse portion of the ligament in place and assist in placing the atlas against the odontoid process (8).

Alar ligaments originate from the dens axis' lateral sides and connect to the foramen magnum's outside margins. Our head rotates to the right and left under the supervision of these ligaments, which extend between the C2 vertebra and the skull bone (8).

The apical ligament, or thin apical ligament, is roughly 2.5 cm long and extends from the densin's apex to the foramen magnum's anterior boundary between the alar ligaments. Its fibers entwine with the deep bands of the cruciform ligament's upper band.

The occiput's anterior shear stress and some vertical translation are believed to be somewhat inhibited by the apical ligament.(12,18).

The foramen magnum's anterior margin, which is in front of the apical ligament, lies between the upper part of the atlas' anterior arch and the atlanto-occipital membrane. The wide membranous ligament joins laterally with the capsular ligaments of the atlanto-occipital joint. It regulates the C1 occiput's range of motion. The anterior longitudinal ligament's fibers, which also form a robust central band between the anterior tubercle of the atlas and the occiput, support the anterior atlanto-occipital membrane medially (12,18).

2.1.5.3. The articular capsules

The facet joint capsules in the cervical region have a greater range of motion than those in the lumbar and thoracic regions because they are longer and more supple there. The capsule consists of three layers: a synovial membrane on the inside, a vascular core layer comprised of areolar tissue and loose connective tissue, and a robust fibroelastic connective tissue layer on the exterior. The anterior and medial sides of the facet joint capsule are composed of ligamentum flavum (12,18).

The ligaments of the spine are positioned to support the spine while allowing for adequate spinal movement and using the least amount of energy possible. To safeguard the neuronal components of the spine, these ligaments must limit motion within physiological bounds. The ligaments of the spine are built to endure tensile stress. Additionally, they support the preservation of the spine's natural curve. Long spinal ligaments and short intersegmental ligaments are two different types of vertebral ligaments (18).

2.1.5.4. Intervertebral discs

Due to the lack of discs between the C1 and C2 vertebrae, there are six cervical discs. While the final cervical disc is situated between the C7 - T1 junction, the initial disc is situated between the axis and C3 vertebrae. According to the vertebra above, names are assigned. The disc between the C4 and C5 vertebrae, for instance, is known as the C4 disc. The cervical spine has a lordotic curvature that is unrelated to the anatomy of the vertebral bodies because the cervical region's discs are almost a third thicker

anteriorly than posteriorly. More than 20% of the cervical spine's length is made up by intervertebral discs, which provide significant motion in the cervical area. A fibrocartilaginous junction called an intervertebral disc makes a joint between the vertebral bodies. It connects and separates adjacent vertebral bodies by exerting hydrostatic pressure through the nucleus pulposus, which is positioned in the middle of the vertebra. This front portion of the spine, which bears the majority of the body's weight, is subject to severe compression forces. When motions in the disc result in shear and torsion forces, the detrimental consequences of axial loading increase (11,12,18).

The disc, annulus fibrosus, nucleus pulposus, and two cartilaginous endplates make up this structure. The disc can recover following compression thanks to the nucleus' crucial elastic rebound. There is just a small layer of vertical fibers in the shape of a ring in the posterior and posterolateral portions of the annulus fibrosus, which are weak (11).

Through the perforations in the bony endplates, 10% of the vascular spaces in the vertebral marrow can touch the cartilaginous endplates, forming critical pathways for the diffusion of nutrients to the disc's center (11).

It has been discovered that the intervertebral disc is innervated both vasomotor and sensory pathways. Small arteries and vasomotor fibers are connected along the annulus fibrosus' surface region. It is believed that sensory fibers have nociceptive (pain-sensitive) and proprioceptive properties. Additionally, golgi tendon organs and pacinian corpuscles were discovered posterolateral to the disc.(11,18).

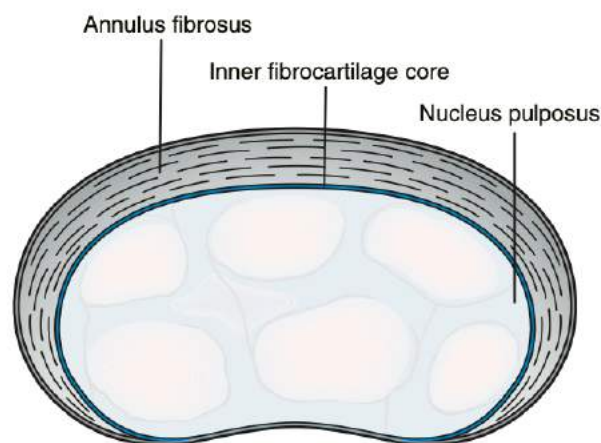


Figure 2.8. Cervical Intervertebral Disc (11)

2.1.6. Cervical spine muscles

The two main functions of the cervical area muscles are to maintain the head's erect posture against gravity and to place the head in space for the best possible positioning of the sense organs. In addition to allowing the scapula to move, it stabilizes the head and neck at the same time (13,16). In a standing upright position, the center of gravity passes in front of the neck, creating a flexion moment in the head and neck. Posterior muscles and ligaments in the cervical region resist the flexion moment to keep the head in an upright position. Rapid and synchronized motions are frequently required to position the head for different sensory organs. For instance, when we hear a loud sound, our heads immediately swivel in that direction. Due to the very complicated structure and functions of the muscles in the cervical area, the head can move widely, the spinal cord is sufficiently stable, and the upper extremity can move (12,18).

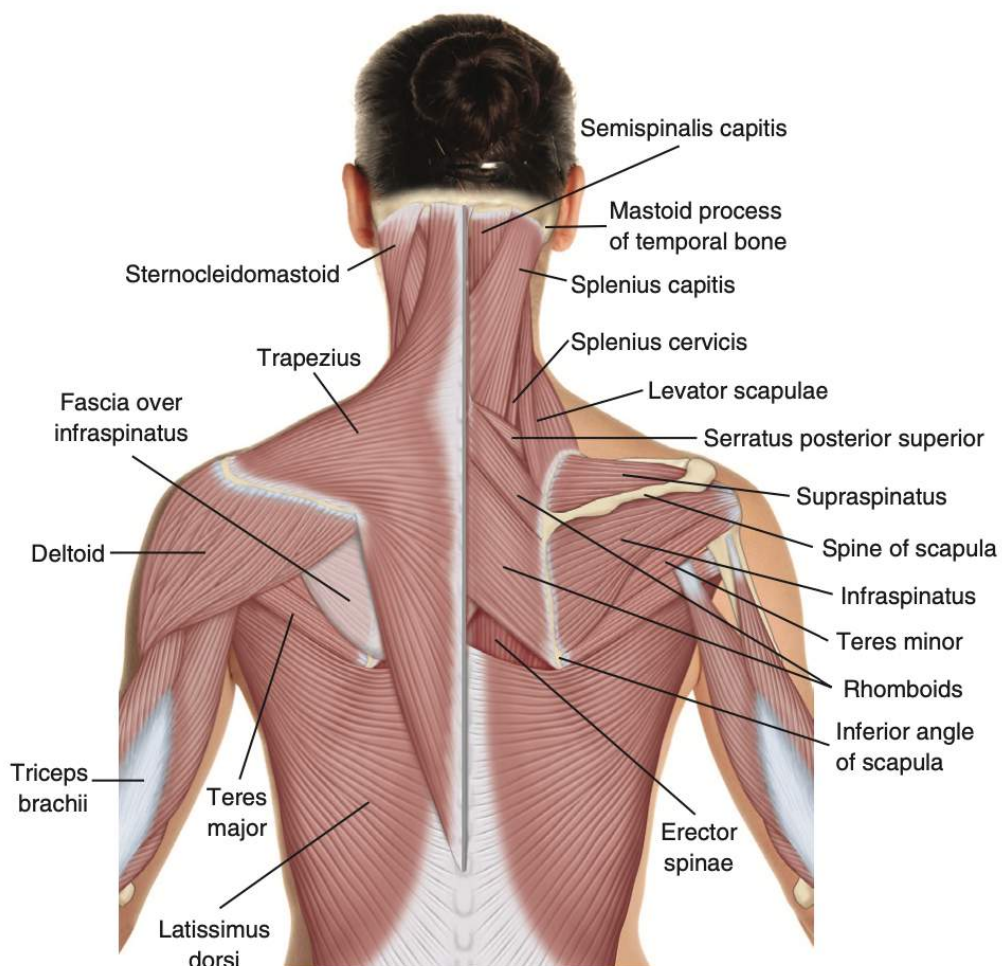


Figure 2.9. Posterior View of The Cervical and Thoracic Muscles (11)

2.1.6.1. Posterior cervical muscles

The upper thorax and the back of the neck are covered by the trapezius, a flat triangle-shaped muscle. The paired trapezius muscles attach medially in the shape of a diamond to the apices of the spinous processes, the ligamentum nuchae, and their supraspinous ligaments from C7 to T12. The acromion, the lateral third of the clavicle, and the scapular spine are all attached to it laterally. The trapezius muscle mainly keeps the scapula in place, however because of its attachments to the lower cervical vertebra and occiput in the upper part, whiplash victims may have issues with it.¹¹ In some head and neck motions, the top half of the trapezius muscle works in tandem with the sternocleidomastoid (SCM) muscle, primarily acting as a scapular stabilizer (18).

Levator Scapula is located under the trapezius muscle. Levator scapula 1-4. It starts from the processus transversus of the cervical vertebrae and attaches to the superior angulus and margo medial of the scapula. When the upper extremity is stable, the ipsilateral lateral flexion and rotation of the cervical vertebrae are caused by the very large-diameter levator scapula muscle, which elevates and rotates the scapula downward. The cervical spine is optimally placed to provide posterior shear force. Cervical vertebrae are subjected to a continuous anterior shear force due to gravity and lordosis. The levator scapula resists these forces (12).

Under the levator scapula muscle are the splenius capitis and splenius cervicis muscles. With its large and flat structure, it starts from the processus spinosus of the cervical and thoracic vertebrae and the ligamentum nucha and attaches to the mastoid process and the transversus processes of the vertebrae. It is the primary generator of force for the head and neck because of its sizable muscle cross-sectional area and sizable moment arm. When bilaterally contracted, it extends the head and neck, but when unilaterally contracted, it rotates the ipsilateral side (16).

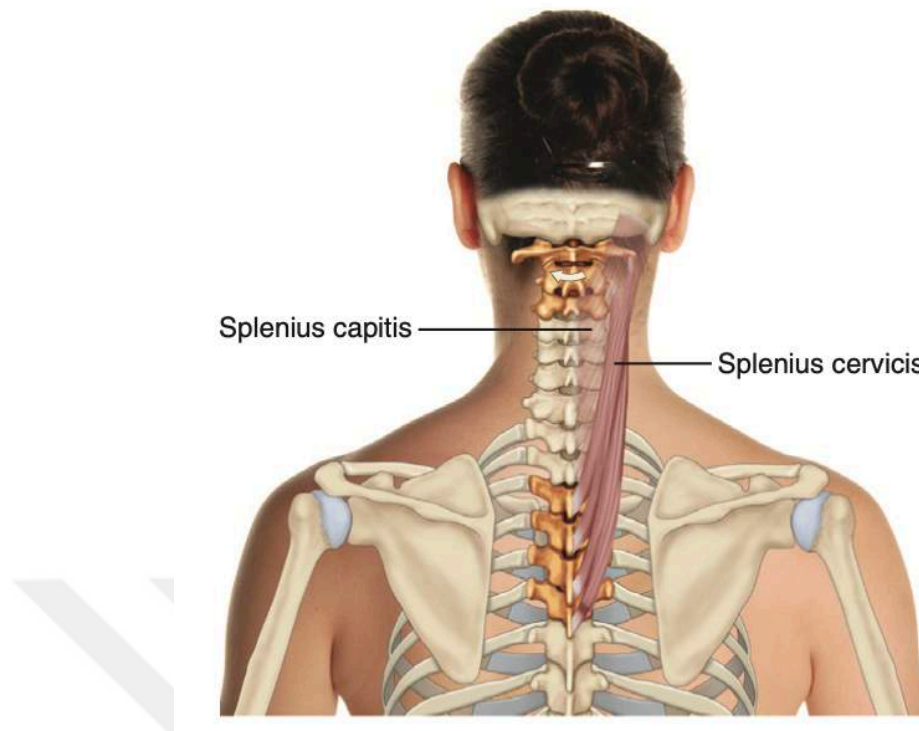


Figure 2.10. The Right Splenius Cervicis and Splenius Capitis (11)

The semispinalis capitis and semispinalis cervicis muscles are a part of the splenius muscle group. The semispinalis cervix is situated between the transversus processes of the thoracic vertebrae and the spinous process of the cervical vertebrae, and the semispinal capitis is situated between the occiput and the latter. These muscles can extend the head and neck and increase cervical lordosis because they have a highly adequate pull line and a big moment arm (16).

The lateral and lower portions of the semispinalis muscle group contain the longissimus capitis and longissimus cervicis muscles. They cannot generate extensor force due to their deep location, close proximity to the axis of rotation, and short force arm. They cause ipsilateral lateral bending of the head and neck when unilaterally contracted. They aid in stabilizing the cervical spine in the frontal plane when they contract bilaterally (16).

The suboccipital muscles are the deepest muscles posterior to the cervical region. The posterior, major, minor, inferior, and superior oblique muscles make up the rectus capitis. This muscle group is located between the occiput and cervical 2nd vertebra and allows the movement of the craniocervical region independently of the lower cervical region. When this muscle group contracts together, it makes occipital extension of the

head. It performs ipsilateral rotation and lateral flexion when unilaterally contracted. It is believed that these muscles offer joint position sensing rather than power and movement due to their limited cross-sectional area (12,16).

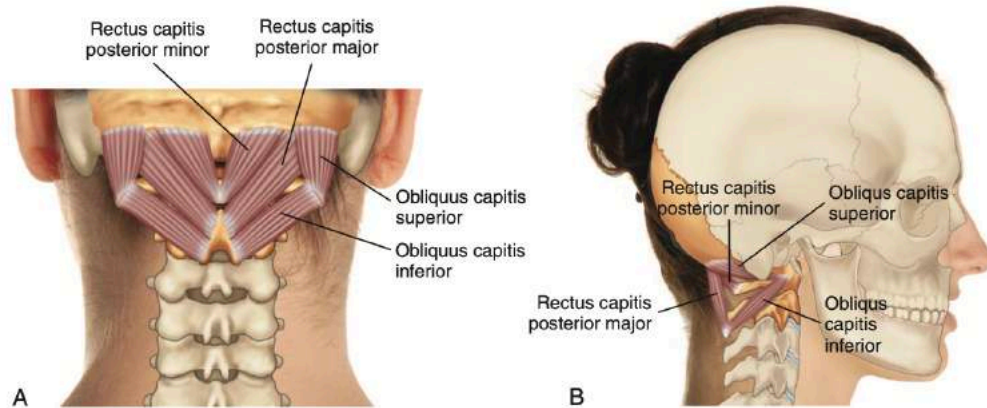


Figure 2.11. The Suboccipital Muscles (11)

2.1.6.2. Lateral cervical muscles

When the posterior part of the longissimus muscle and the scalene muscles, which are situated lateral to the cervical region, are flexed together, the cervical region is stabilized in the frontal plane. The anterior and middle scalene muscles, which are connected to the anterior tubercle of the processus transversus of C3-C6, are derived from the first rib. Together, the muscles of the levator scapula and anterior scalene stabilize the neck region in the sagittal plane. The anterior scalene muscles execute ipsilateral lateral flexion and rotation when they are contracted unilaterally, and they cause head and neck flexion when they are contracted bilaterally. More lateral than the anterior part is the middle portion of the scalene muscles. This raises the traction angles and improves frontal plane stabilization. Starting at the second rib, the posterior scalene muscle joins to the posterior tubercle of the processus transversus of C3-C7. The posterior scalene muscle's primary job is to bend the head and neck to the side (12,16,18).

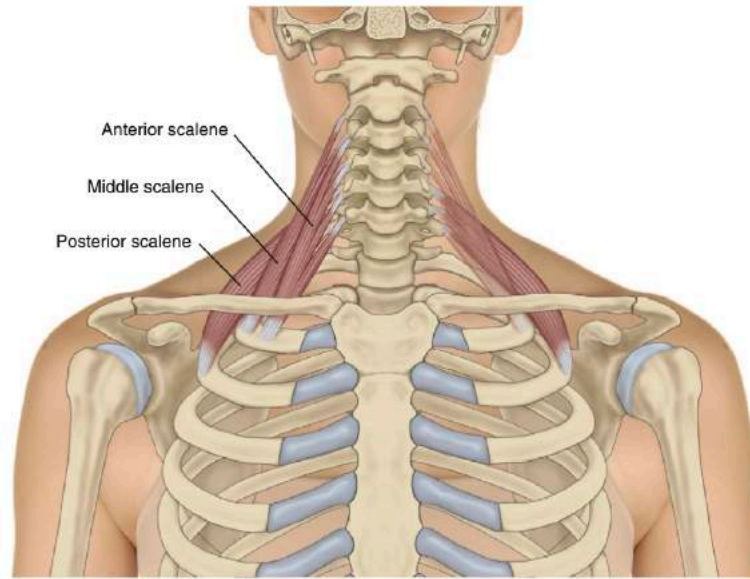


Figure 2.12. The Anterior Scalenes and Posterior Scalenes (11)

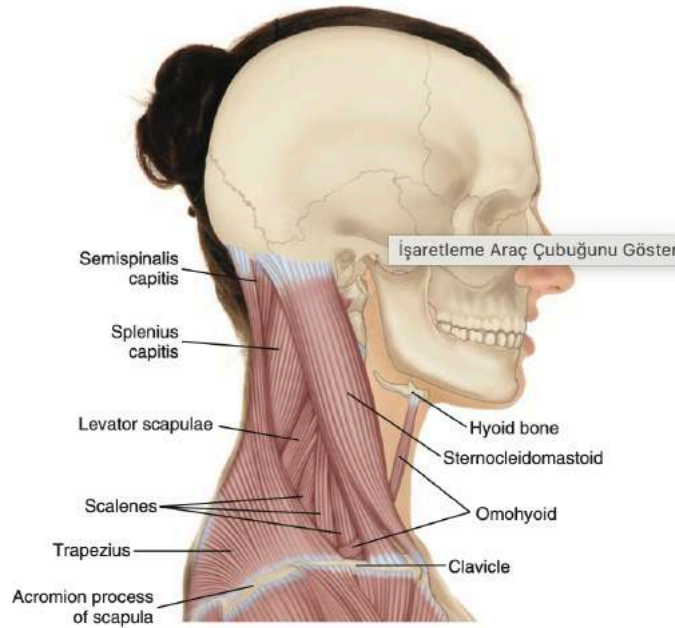


Figure 2.13. The Lateral and Superficial Cervical Muscles (11)

The sternum, distal clavicle, and acromium serve as the origin of the sternocleidomastoid muscle, which extends to the mastoid process. It leans posteriorly, medially, and superiorly at an angle. This tilt angle allows it to make many movements in different planes. When the muscle contracts bilaterally along the line of force anterior to the center of rotation, the lower cervical vertebrae flex as a result of the inclination angle. At the same time, the line of force passing above the joint rotation center of the muscle also extends the head. When unilaterally contracted, it causes ipsilateral lateral flexion and rotation of the head and neck (12,16).

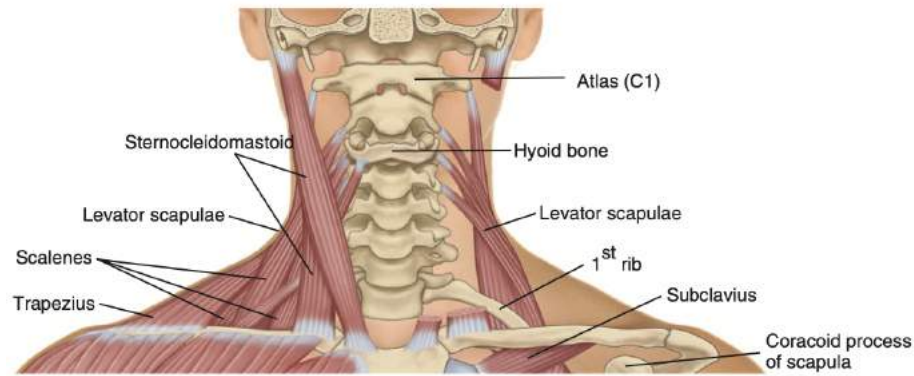


Figure 2.14. View of the Lateral and Superficial Cervical Muscles from the Front (11)

2.1.6.3. The anterior cervical muscles

The deep set of muscles in the anterior cervical region are the longus colli and longus capitis. The longus capitis, which connects to the occiput, originates from the front tubercle of the processus transversus of the cervical vertebrae. The longus colli, which comes from the corpuscles of the trocal vertebrae, is received by the anterior tubercle of the processus transversus of the cervical vertebrae. These muscles run close to the bodies of the vertebrae and are relatively close to the joint rotation center. It has enough force arm to create head flexion, but it creates more compression force than flexion in the segment where it is located (13,16). Because the longus colli and longus capitis help to stabilize the head and neck, the trapezius can raise the scapula (16).

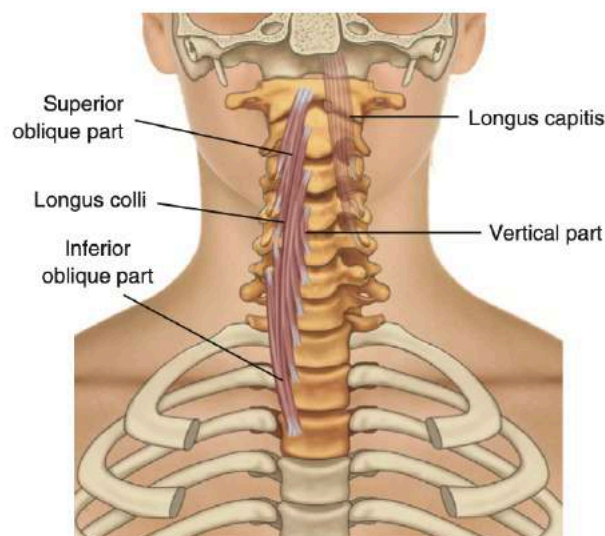


Figure 2.15. The Right Longus Colli and Longus Capitis (11)

The rectus capitis anterior and rectus capitis lateralis muscles, considering the traction angles, they take part in the flexion of the head. However, given their small cross-sectional area, it is thought to provide joint position sense with the suboccipital muscles rather than generating strength and movement (16).

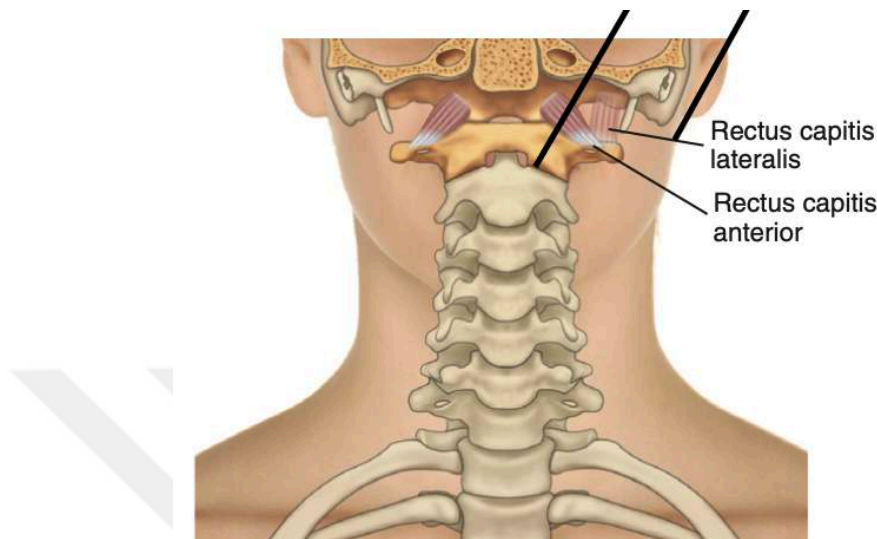


Figure 2.16. The Rectus Capitis Lateralis and Rectus Capitis Anterior (11)

2.1.7. Nerve supply of the neck

The neural foramina allow cervical nerves, which are created by joining the ventral and dorsal roots, to exit the spinal canal. The spinal nerves split into ventral and dorsal rami after giving birth to the meningeal branch. The dorsal ramus innervates the zygapophyseal joints, superficial muscles (splenius cervix and capitis, longissimus cervix and capitis, iliocostalis cervix) and deep muscles (semispinalis cervix and capitis, multifidus, suboccipital and interspinal muscles) located posterior to the intervertebral foremen. The ventral rami of the spinal nerves attach to the brachial plexus between C5 and T1. The ventral rami of the spinal nerves that run between C1 and C4 make up the cervical plexus. They also give the neck, cheek, and ear cutaneous sensation. The atlanto-occipital joint is innervated by the C1 ventral ramus, while the atlanto-axial joint is innervated by the C2 ventral ramus. The meningeal branch of the spinal nerves innervates the durameter spinalis, posterior cranial fossa, atlanto-axial region ligaments, 1/3 posteriolateral of the intervertebral disc, and the annulus fibrosus (12,18,19).

2.1.8. Blood supply of the neck

The vertebral artery, the first and largest branch of the subclavian artery, supplies all bone, joint, muscle, and neural components in the cervical region. The vertebral artery enters the skull from the foramen magnum, travels through the foramen transversarium on the processus transversus of the C3-C7 vertebrae, and joins the other vertebral artery to form the basilar artery. Cervical venous recycling is provided by the brachiocephalic veins through the internal and external systems.(19).

2.2. Kinematics of the Cervical Spine

2.2.1. Cervical spine sagittal plane kinematics

The spinal column's entire craniocervical area is the most movable. The head may be placed in the ideal position for vision, hearing, smell, and balance thanks to specialized joints. Every joint within the craniocervical region normally interacts with each other with a high degree of coordination. The usual ranges of mobility for each part of the craniocervical region are listed in the table below. Due to the wide range and variability in the data given in the literature, the numbers in this table are more useful in recognizing the value of relative kinematics between joints but less useful as an absolute objective guide for assessing motion in patients (9,20).

Table 2.1. The Three Planes of Movement for the Joints in the Cranium's Approximate Range of Motion (20)

Joint or Region	Flexion and Extension (Sagittal Plane, Degrees)	Axial Rotation (Horizontal Plane, Degrees)	Lateral Flexion (Frontal Plane, Degrees)
Atlanto-occipital joint	Flexion: 5 Extension: 10 Total:15	Negligible	About 5
Atlanto-axial joint complex	Flexion: 5 Extension: 10 Total: 15	35-40	Negligible
Intracervical region (C2-C7)	Flexion:35-40 Extension: 55-60 Total: 90-100	30-35	30-35
Total across craniocervical region	Flexion:45-50 Extension: 75-80 Total: 120-130	65-75	35-40

2.2.1.1. Extension and flexion osteokinematics

A total of 120 to 130 degrees of flexion and extension are made by the entire craniocervical area. From the natural position of around 30 to 35 degrees of extension, the craniocervical region extends an additional 75 to 80 degrees and flexes 45 to 50 degrees. Although extremely varied, the majority of research data show that in the craniocervical region, extension normally outweighs flexion by a factor of about one to five times.

In addition to muscles, the craniocervical region's connective tissues also prevent excessive movement. For instance, approximation of the apophyseal joints greatly limits excessive extension while the nuchal ligament and interspinous ligaments significantly limit excessive flexion. Additionally, compression forces at the annulus fibrosus's posterior boundary limit extension whereas compression pressures at its anterior edge

limit flexion. The table includes a list of other tissues that limit and hinder sagittal plane movement in the craniocervical region. (9,12,20).

Table 2.2. Selected Illustrations of Connective Tissue That May Regulate Vertebral Column Motions (20)

Motion of the Vertebral Column	Connective Tissues
Flexion	Ligamentum nuchae Interspinous and supraspinous ligaments Ligamentum flava Apophyseal joints* Posterior annulus fibrosus Posterior longitudinal ligament
Beyond neutral extension	Apophyseal joints Cervical viscera (esophagus and trachea) Anterior annulus fibrosus Anterior longitudinal ligament
Axial rotation	Annulus fibrosus. Apophyseal joints Alar ligaments
Lateral flexion	Intertransverse ligaments Contralateral annulus fibrosus Apophyseal joints

The atlanto-occipital joint and atlanto-axial joint complex account for 20% to 25% of the entire sagittal plane movement in the craniocervical area, with the remaining movement taking place at the C2 and C7 apophysis joints. In each of the three joint regions, the axis of rotation for flexion and extension is positioned medio-laterally.(20).

In full flexion, the cervical spinal canal diameter is largest; in full extension, it is smallest. Therefore, when doing activities in the final degrees of extension, a person with vertebral canal stenosis is more vulnerable to suffering a spinal cord injury (9,17,20).

2.2.1.2. Flexion and extension arthrokinesis

The atlanto-occipital joint swings back and forth like a rocking chair as the convex occipital condyles roll back in extension and forward in flexion within the concave superior atlas articular facets. According to conventional convex-concave arthrokinematics, the condyles should roll while also slightly sliding in the opposite direction. Tension in the joint capsules, accompanying atlanto-occipital membranes, and alar ligaments determine the boundaries of arthrokinematics (20).

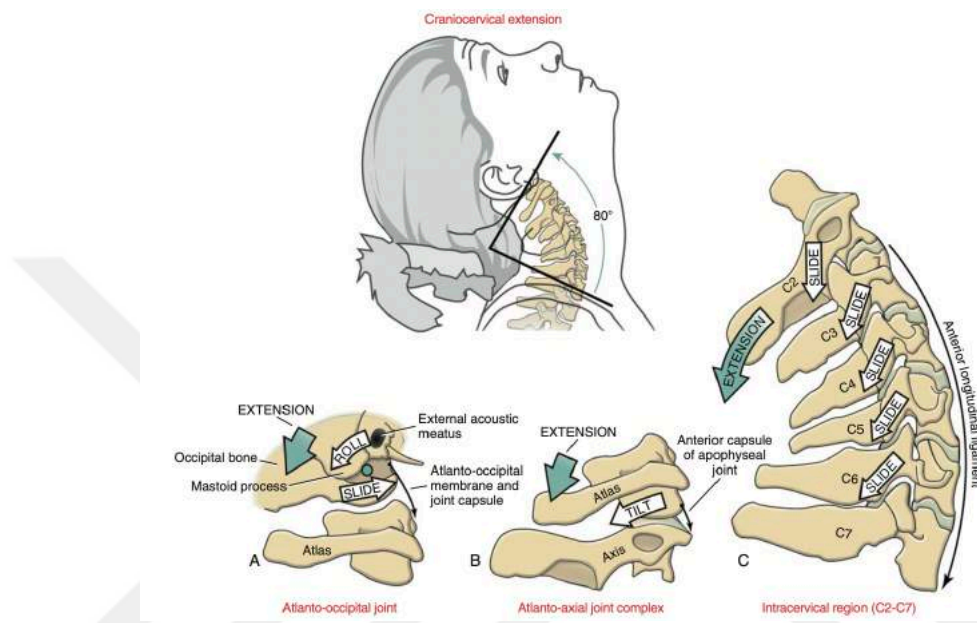


Figure 2.17. Craniocervical Extension Kinematics (20)

Axial-atlanto junction Although the atlantoaxial joint's primary motion is axial rotation, up to 15 degrees of flexion and extension are also conceivable. During flexion and extension, the ring-shaped atlas, which separates the skull from the axis, leans forward. The contact between the transverse and dens of the atlas during flexion and the anterior arch and dens of the atlas during extension somewhat limits the degree of tilt (16,20).

Flexion and extension along the C2-C7 vertebrae occur at the intracervical articulations (C2 to C7) in an arc that follows the oblique plane denoted by the articular facets of the apophyseal joints. When in extension, the inferior articular facets of the superior vertebrae slide inferiorly and posteriorly in respect to the superior articular facets of the inferior vertebrae. The degrees of extension produced by these motions range between 55 and 60 (12,20).

Contrary to how extension arthrokinematics work, flexion arthrokinematics work in the intracervical area. The inferior articular faces of the superior vertebrae slip superiorly and anteriorly in relation to the superior articular facets of the inferior vertebra. 35–40 degrees of flexion are produced by sliding between the articular surfaces (9,20).

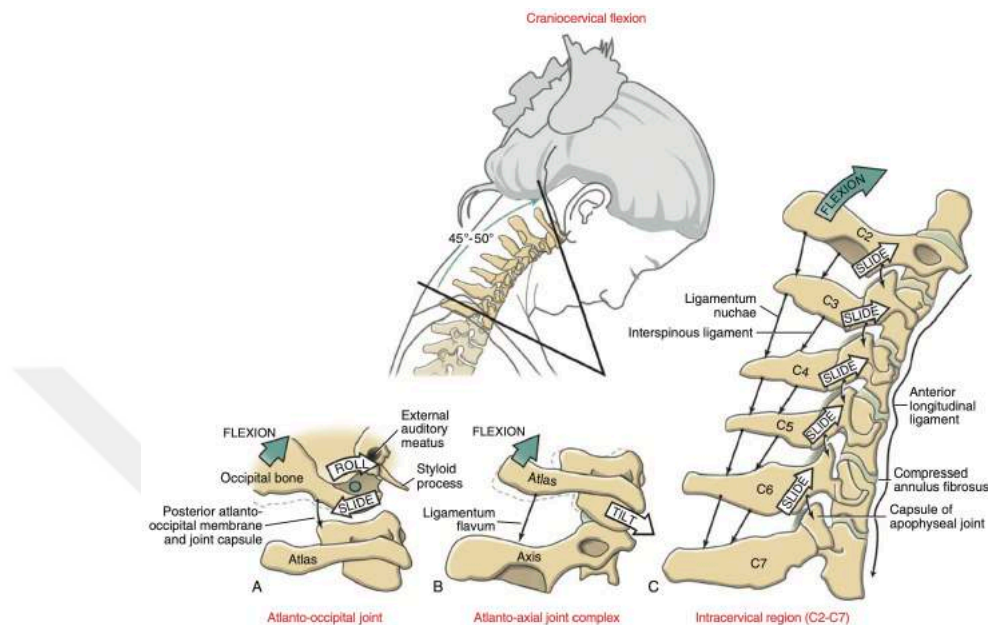


Figure 2.18. Craniocervical Flexion Kinematics (20)

2.2.1.3. Protraction and retraction osteokinematics

In addition to flexion and extension in the craniocervical region, the head can also translate forward (protraction) and backward (retraction) in the sagittal plane.

Typically, protraction of the head extends the upper craniocervical region while flexing the lower-mid cervical spine. Retraction of the head, on the other hand, causes the upper craniocervical area to flex while the lower-mid cervical spine to straighten or lengthen. The physically healthy head movements of protraction and retraction are frequently linked to better eyesight. However, prolonged protraction can cause a chronic anterior tilt posture of the head, resulting in increased tension in the craniocervical extensor muscles (9,12,20).

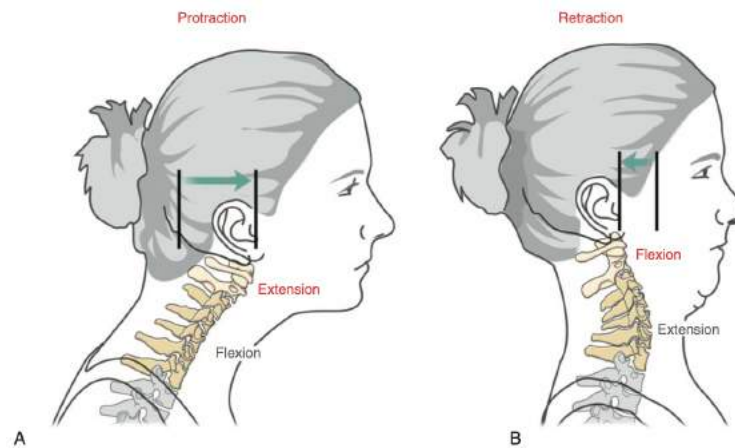


Figure 2.19. Cranium Protraction and Retraction (20)

2.2.2. Kinematics of the horizontal plane

Safety ultimately depends on the ability of the head and neck to rotate axially, which is closely related to vision and hearing (20).

According to studies, the atlanto-axial joint complex accounts for between 50 and 60 percent of the axial rotation of the craniocervical area, with the remaining 40 percent occurring between C2 and C7 (17).

2.2.2.1. Axial rotation arthrokinematics

Maximum horizontal rotation is intended for the atlantoaxial joint complex. Around the dens, the ring-shaped atlas and its transverse ligament spin, causing an axial rotation of roughly 35 to 40 degrees in each direction. The cranium virtually gradually follows the atlas' rotation due to the atlanto-occipital joint's restricted axial rotation. The vertical dens serves as the axis around which the head and atlas rotate. During full rotation, both vertebral arteries are strained (20).

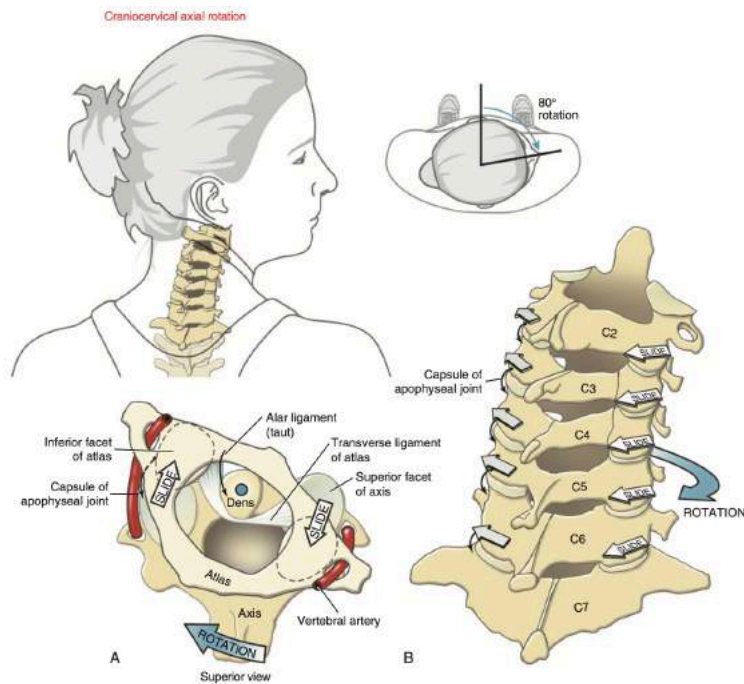


Figure 2.20. Craniocervical Axial Rotation Kinematics (20)

On the same side as the rotation, the inferior facets of the intracervical articulations (C2 to C7) slide posteriorly and slightly inferiorly; on the opposite side, they slide anteriorly and somewhat superiorly. This arthrokinematic produces an axial rotation of approximately 30 to 35 degrees on either side of the C2 to C7 region, which is approximately equal to the allowed range of the atlanto-axial joint complex (8).

2.2.3. Kinematics of the frontal plane

2.2.3.1. Osteokinematics of lateral flexion

The craniocervical region has an average of 35 to 40 degrees of lateral flexion in all directions. The C2-C7 area is where most of the lateral flexion takes place (9).

2.2.3.2. Lateral flexion arthrokinematics

At the atlanto-occipital joint, the occipital condyles slightly roll from side to side on the superior articular facets of the atlas. The occipital condyles are anticipated to roll somewhat in the opposite direction from sliding based on the concave-convex connection of the joints (20).

Intracervical articulations (C2 to C7), Lateral flexion of the vertebral segments between C2-C7. The arthrokinematics is shown in the figure below (8).

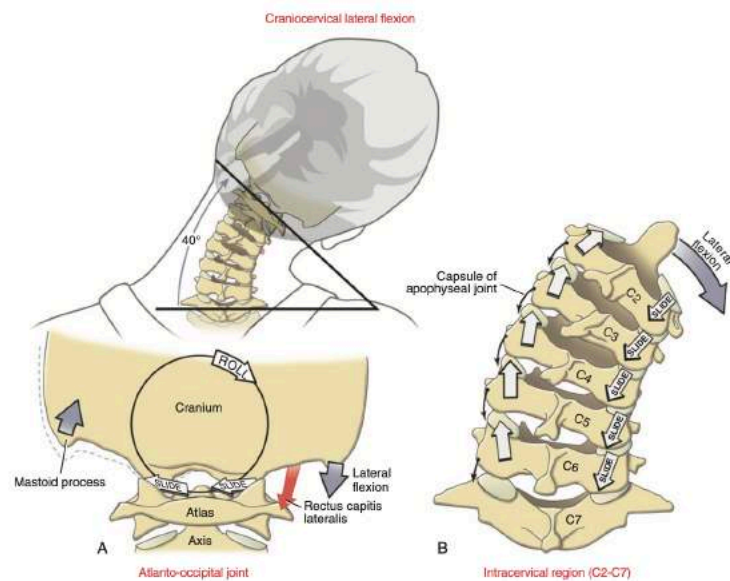


Figure 2.21. Craniocervical Lateral Flexion Kinematics (20)

2.3. Neck Pain

Neck discomfort is a widespread condition that has a substantial societal and economic burden. The discomfort and incapacity brought on by neck pain have a substantial impact on people, their families, communities, healthcare systems, and businesses.²¹ In the general population, neck soreness is a common condition that affects many people at some point in their lives. Its prevalence varies between 16.7% and 75.1 % globally (1).

Back pain in the neck between the superior nuchal line and the first thoracic vertebra's spinous process is referred to as neck discomfort (22). Ache in the jaws, upper thoracic region, and thoracic region sometimes follow neck pain. Clinical studies have shown that neck discomfort, even in those who show no signs of nerve roots, can transfer pain along myotomal patterns to the anterior chest, arm, and dorsal spine regions (2).

The complex etiology of this condition is caused by a number of factors, including ergonomics (strenuous physical activity, use of force and vibration, poor posture, repetitive movement), individual (age, body mass index, genome, history of musculoskeletal pain), behavioral (smoking and level of physical activity), and psychosocial factors (job satisfaction, stress level, anxiety, and depression) (1). Advanced age, gender, and hereditary factors are the most important unavoidable risk factors for neck discomfort. Neck pain is more common in women than in males. Other risk factors

include psychological issues, smoking, exposure to secondhand smoke, insufficient physical activity, patient-reported poor health status, obesity, cultural differences, and occupational conditions. Previous neck pain and low back pain are also risk factors. Neck pain trauma (especially whiplash injuries), psychosocial factors, inflammatory arthropathies, metabolic diseases, infection, malignancy, neurological problems related to the cervical region (radiculopathy, myelopathy), fibromyalgia, carotidinia, torticollis, thoracic outlet syndrome, visceral problems, visual disorders, stroke, it may occur due to many diseases such as upper extremity and upper extremity related disorders. However, a serious health problem such a tumor or infection is rarely the cause of neck pain (23,24).

Neck pain due to mechanical disorders such as degenerative changes without any underlying systemic disease or abnormal anatomical structure is characterized as non-specific neck pain. Concerning neck pain, there was, however, no agreement. In addition to non-specific neck pain, the definitions of chronic neck pain, mechanical neck pain, occupational neck pain, and neck pain from sporting activities may also be found in the literature (23). In industrialized nations, nonspecific neck pain affects 27% to 48% of the population each year. Although the severity and course of the pain may differ, the majority of patients report chronic or recurring pain. 10% of patients eventually experience functional impairments, while 5% of patients experience disabilities (22).

2.3.1. Neck pain clinical classification

The Neck Pain Task Force Group defines neck pain as pain with or without radiating to the head, trunk and upper extremities in the anatomical region of the neck, and suggested that people with neck pain be classified into four categories (25).

Level 1: Neck pains where daily activities are slightly affected, there is no significant pathology, there may be stiffness in the muscles and sensitivity on palpation in addition to neck pain.

Level 2: It is neck pain that does not have any major pathological findings and affects daily life activities quite a lot.

Level 3: Decreased deep tendon reflexes in the upper extremity, muscle weakness, sensory involvement, neck pain in which spinal nerve/cord dysfunction may occur.

Level 4: Fracture, spinal cord injury, infection, neoplasm, etc. neck pain with major structural pathologies (25).

Neck Pain Workforce Group Levels 1 to 3 neck pain is considered nonspecific neck pain (26).

Chronic pain is defined as a continuous or occasional disturbing condition that persists for at least 3-6 months. Acute pain is protective, while chronic pain is not. Neck pain has been categorized in many ways in the literature. When classified as duration, it is classified as acute up to 6 weeks, subacute between 6 weeks and 3 months, and chronic when it lasts more than 3 months (2).

2.4. Neck Assessment Methods

Different clinical evaluation techniques are used on patients with neck pain to identify the cause of the pain, the course of the disease, and the recommended course of treatment. History: In patients with spinal pain, a comprehensive history is essential to understand the pain-related difficulties of the patient. The person's gender, age, height, body weight, educational status, occupation, smoking history, trauma history, past medical history must be recorded in the patient's file (12,23).

The following factors must be questioned while taking the patient's history in cervical region problems. These factors will provide detailed preliminary information about the source of the disease, as well as allow the development of appropriate treatment strategies (12,23).

Duration of pain, it should be determined whether the problem is acute, subacute or chronic.

Type of pain, it gives important clues about the affected anatomical structures and the disease process (18,23).

Somatic pain can originate from deep (ligaments, tendons, or vessels) or superficial (skin) tissues. While the localization of superficial pain is well defined, the localization of deep pain cannot be determined exactly. Spondylosis, discogenic pain, facet joint pain or myofascial pain are pathological processes that reveal deep somatic pain (12,23).

Radicular (neurogenic) pain is felt along the sensory distribution of the nerve as a result of irritation caused by conditions such as compression or inflammation. It is typically a sharp pain and is likely to be accompanied by dysesthesia or paresthesia. Spondylopathic myelopathy or cervical radiculopathy causes radicular pain.(12,23).

Localization of pain and changes in symptoms throughout the day should also be questioned.

2.4.1. Pain assesment

The pain intensity, Visual Analogue Scale, and Mcgill Pain Questionnaire are the three subjective measuring methods that are most frequently used to gauge the level of pain in patients with spinal pain. Pressure pain threshold, pressure pain threshold measurement in cervical and thoracic region pain is a very frequently used objective evaluation method. Painful trigger points are determined by palpation and bilateral measurements are made on these points. When measuring compression pressure, the measurement is taken as soon as the sensation of pressure equals the sensation of pain. Compression pressure is applied by holding the device's probe perpendicular to the measuring surface. Evaluation of pain localization, a body diagram showing the body from anterior, posterior and bilateral lateral aspects is used. Patients are asked to mark the painful areas on the diagram (12,18,23,26).

Observation, head, neck, shoulder and scapula position should be examined from anterior, posterior and lateral aspects. The presence of scoliosis, chest deformities, upper cross syndrome, kyphosis, head and neck tilt, skin lesions and color changes should be investigated (23).

Evaluation of the range of motion, range of motion measurements are essential for planning treatment, monitoring the patient's progression, and determining the effectiveness of treatment. Flexion, extension, lateral flexion, and rotation should be assessed in both active and passive joint motion. Measurements can be made with the help of tape measure, goniometer, digital inclinometer and proven applications.(23,27).

2.4.2. Neurological tests

Muscle strength, changes in muscle strength provide information about disease progression and the effectiveness of treatment. Different techniques such as isometric

resistance test, manual muscle test, and hand-held dynamometer can be used to perform muscle testing (12,23).

Cotton and a needle are used in sensory evaluation to examine the perception of light touch and pain in the cutaneous distribution of nerve roots in the upper extremities. In this context, the lateral deltoid (C5), 1st and 2nd finger (C6), 3rd finger (C7), 4th and 5th finger (C8) dermatome areas are tested (23).

While the patient is sitting, reflexes, biceps (C5, C6), brachioradialis (C6), and triceps reflexes are assessed (12).

2.4.3. Cervical muscle endurance

The motor output of the cervical muscles is compromised by neck discomfort. Muscle endurance, strength, and stability are decreased, and cervical muscle activity is altered. For instance, deep postural muscle activity is reduced, directional specificity is decreased, the onset of muscle responses is delayed, muscle fatigue sets in, and there is an increase in neck muscle co-contraction. Neck pain has the ability to disrupt all neck muscle functions. Deep and superficial neck muscles' behavioral (activity) alterations in both functional and predictive tasks have recently been studied (28,29).

Chronic neck pain has frequently been linked to the development of neck muscle endurance. According to studies, persons with persistent neck discomfort have weaker and less resilient neck muscles than asymptomatic subjects (30).

In the last few decades, muscle endurance has been frequently evaluated in problems related to the cervical region. Deep neck flexor muscle endurance test, which has proven to be a reliable method in this evaluation, is frequently preferred (23).

For this test, the patient was assessed while lying on his or her back with the arms by their sides. Patient is instructed to tuck his chin in and look at the level of his chest. After flexing the upper cervical region, he raises his head about 2.5 cm straight from the bed. He maintains this position for as long as possible. When the patient cannot maintain the position any longer or the upper cervical region flexion is impaired, the time is stopped and recorded in seconds (23,29).

Palpation, by palpating the structures of the cervical region, tissue tension, muscle spasm, edema, temperature increase and soft tissue. mobility is evaluated (23).

In order to identify the cause of the pain by inducing a decrease or rise in symptoms, neck-specific clinic tests are employed. In particular, it is necessary to distinguish the pain caused by cervical region problems from pain originating from different anatomical structures such as lateral epicondylitis and carpal tunnel syndrome. Therefore, many tests used for differential diagnosis have been described. These tests should be used only when necessary. Some of these are those (18,23):

When the patient is seated and doing Spurling's test, the head of the patient is rotated and bent to the affected side. A positive test indicates cervical nerve root compression (23,31).

Romberg's test, it is regarded as favorable when the patient sways or falls while standing with their feet together and their eyes closed. All proprioceptive deficiency causes, including myelopathies from various causes, tabes dorsalis, and sensory neuropathies, have been connected to a positive Romberg's test (32).

In a vertebral artery test, the patient's head is moved into an extended, lateral-flexed, and rotated position while they are supine and kept there for 10 to 30 seconds. Vertebral artery occlusion may cause neck pain as well as problems such as dizziness, nausea or nystagmus (23,33).

Tinel's sign, used to test for brachial plexus lesion (23).

2.4.4. Adson test, test positive in thoracic outlet syndrome

Respiratory tests, it is used to test breathing in conditions such as severe scoliosis or ankylosing spondylitis (23).

Outcome measurements, today, many questionnaires with proven validity, reliability and sensitivity have been developed that evaluate the patient's self-assessment and measure health status in musculoskeletal problems.

The neck disability index is a commonly used scale to measure pain and impairment. It was created exclusively for people with neck pain.(23,34).

Diagnostic imaging modalities, Although diagnostic imaging methods confirm the possible diagnosis in patients with spinal pain, they are not always necessary. When necessary, radiography, magnetic resonance imaging, computed tomography are the most commonly used imaging methods (23).

2.5. Proprioception

Proprioception, rooted in the Latin word "proprius: being on one's own, is the ability to transmit the body's sense of position, to interpret the processed data, and to respond consciously and unconsciously to the stimulus that will make posture and movement (35,36). Proprioception is the ability to recognize the position and motion of a limb or joint in space, as well as the forces being applied there by the central nervous system, and to generate rational reactions that will maintain the joint in the safest possible state (37).

Position-movement sensation was first described by Julius Caesar Scaliger in 1557 as a sense of locomotion. In 1826, Charles Bell used the term "muscle sense" and first described the physiological feedback mechanism. According to Bell, afferent information was originating to the brain through the muscles, and commands were sent from the brain to the muscles. Henry Charlton Bastian proposed using the term "kinesthesia" rather than "muscle sense" in 1880 because the brain was receiving afferent information from tendons, meniscus, ligaments, and the skin in addition to muscles. After this approach, Alfred Goldscheider in 1889 classified the kinesthetic sensation into three as muscle, tendon and joint sensitivity. Sherrington, on the other hand, worked on definitions very close to the present day in 1906: Proprioception (muscle-tendon and joint), Interoception (internal organs) and Extroception (skin, eyes, mouth and ears, etc. (35,38).

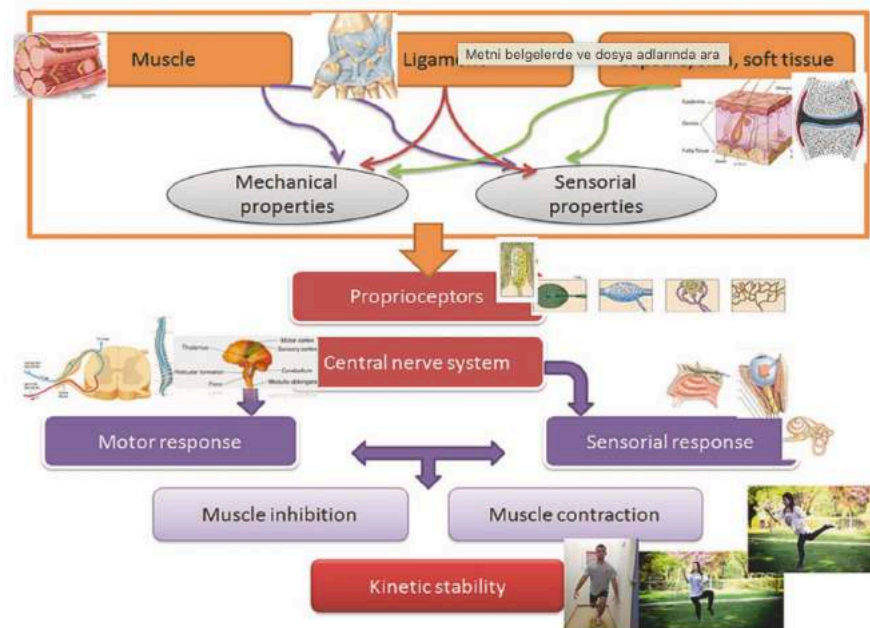


Figure 2.22. Proprioception (38)

The somatosensory and sensorimotor systems are in charge of the coordinated and fluid movement of bodily components. In actuality, these systems are rhythmically organized by the proprioceptive sense (35).

Both physical (hardware) and psychological (software) components make up proprioception. To be more precise, it is the awareness of one's own body's position and motion in three dimensions. The overall proprioceptive performance is influenced by the quality of the proprioceptive information that is accessible as well as a person's proprioceptive talent. As a result, the software (central processing) uses the proprioceptive information that the peripheral mechanoreceptors (hardware) send to the brain for integration (39).

A somatosensory system is made up of sense receptors, sensory neurons in peripheral structures, and deeper neurons in brain regions. Thermoreceptors, photoreceptors, mechanoreceptors, and chemoreceptors make up the somatosensory system. These receptors carry sensations from the skin and epithelium, skeletal muscle, bone and joints, internal organs, and cardiovascular system to the upper centers, including proprioception, touch, heat, and nociceptive peripheral somesthetic sensations. Meissner's corpuscles, Pacinian corpuscles, Merkel's discs, and Ruffini's corpuscles are specialized encapsulated mechanoreceptors that send sensations of touch, pressure, vibration, and cutaneous tension to the brain (35,38).

The sensorimotor system is like a large organized company. The president, namely the cortex, receives detailed information from the body in general, especially the lower levels (motor neurons and muscles), interprets it and commands for the motor response. The sensorimotor system works with the peripheral nervous system to provide voluntary control of movement. The sensorimotor system consists of efferent nerves that connect with the skin and skeletal muscle and are responsible for all muscle contraction. For a proper motor response, there must be an accurate and entire transfer of the information to the higher levels (37,38).

There is frequently confusion between the terms proprioception (also known as the sixth sense), kinesthesia, and neuromuscular control. By combining stimuli from the somatosensory, vestibular, and visual systems, proprioception allows the central nervous system to control the periarticular muscle activity that stabilizes joints. Kinesthesia is the term for the proprioceptive system's capacity to perceive movement, speed, and direction.(35).

2.5.1. Pathways and proprioceptive receptors

2.5.1.1. Pathway of proprioception and peripheral receptors

Proprioceptors are mechanoreceptors that provide us awareness. Complex body movements are carried out smoothly and appropriately thanks to the sensory information carried by muscle spindles, golgi tendon organs, and joint mechanoreceptors. The vestibular system, which communicates information about head movement and position, works in conjunction with proprioceptors. Four to eight specialized muscle fibers that run parallel to the extrafusal muscle fibers make up muscle spindles, which reveal information about the length of the muscle. When opposed to muscles that conduct delicate movements, muscles that perform gross movements have fewer muscle spindles (18,38).

Muscle spindles are the most significant proprioceptors, even if Golgi tendon organs, joint receptors, and other sensory systems are useful for proprioception. Skeletal muscles contain sensory organs called muscle spindles, which are sensory receptors that are enclosed and transmit information to the brain about variations in muscle length. Muscle spindles serve as stretch detectors, determining how quickly and how much a muscle will lengthen or shorten (40).

Muscle spindles are crucial for controlling posture and movement. Muscle spindles have been demonstrated to be crucial to the pathophysiology of muscle pain syndromes and to improving muscle tone in several investigations. Some muscles with a high number of muscle spindles are associated with syndromes of chronic muscle discomfort. Deep within the suboccipital region of the brain are four neck muscles: the rectus capitis posterior major, rectus capitis posterior minor, oblique capitis inferior, and oblique capitis superior. They participate in the delicate rotational movements of the head and support the stability of the cervical spine. In comparison to the semispinalis capitis and the splenius capitis, the deep neck muscles' muscle spindle density is about five times higher (29,41).

The Golgi tendon organ is the sensory proprioceptors located in the insertion and origin of the skeletal muscle (at the muscle-tendon junction). When excessive tension occurs, the golgi tendon organ informs the motor cortex to "stop contraction" of the muscle. The sensory terminals are depressed due to the force generated by muscle contraction (38).

Joint mechanoreceptors include golgi-like receptors, pacinian corpuscles, and ruffini endings.

Joint movement activates ruffini endings, which are slow-adapting receptors with a low excitation threshold. In response to axial loading, ruffini endings control the tensile tension of the ligament and the tension of the muscles around the joint. The stratified Pacinian corpuscles (deep pressure sensors), which are small and oval in shape and situated close to the Golgi tendon organ in the deep layers of the skin, are extremely responsive to mechanical stimuli. They are susceptible to deep pressure and quick motion. Similar to Ruffini endings, golgi-like endings are dormant at rest and only activate at the most severe joint motion. This characteristic makes golgi-like sensors crucial for detecting tensile strength at the locations where joint mobility ends (35,37).

In the organization of peripheral proprioceptive reactions, peripheral "musculo-ligament reflexes" play an important role. These intricate, high-level spinal reflexes enable accurate motor control of the joint. These mono- and poly-synaptic spinal reflexes, which control the activity of the ligaments and muscles around the joint, are transmitted to the higher levels of the spinal cord by the dorsal horn. "Feedforward" inhibition

controls reflexes at the brain level, and "feedback" inhibition organizes reflexes in response to peripheral stimuli. The arrangement of movement's velocities, onsets, and terminations depends heavily on these inhibition mechanisms. The regulation of the muscular agonist-antagonist action impacted by these systems also involves spinal level reflexes (37,38).

2.5.1.2. Proprioception's cortical receptors and pathway

Excitatory and inhibitory synapses on afferent neurons transmit peripheral proprioceptive data to higher cerebral levels. The major somatosensory area in the parietal lobe of the cerebral cortex interprets somatosensory data acquired from peripheral receptors via sensory nerves and pathways (37,38).

The somatosensory circuit contains three neurons. The first is in the spinal nerve's dorsal root ganglion. Second, the neuron's ascending axons leave the cell and decussate on the other side of the spinal cord. The reticular system and cerebellum are where some of these neurons' axons terminate, but the thalamus is where the majority of them do. The third neuron originates in the thalamus and travels to the parietal lobe's postcentral gyrus before dying (37,38).

The motor cortex and alpha and gamma motor neurons are connected descendingly via the corticospinal circuit. Kinesthetic information from the upper extremity's muscle afferents is sent to the cortex by the dorsal column. The lower extremity's muscle afferents send kinesthetic information to the cortex via Clarke's column and the dorsal spinocerebellar pathway. Before information is transmitted from the periphery to the cortex, it travels along ascending routes such the dorsal column medial lemniscus and ventral spinothalamic synapse in the reticular formation and thalamus. Spinocerebellar circuits in the ventral and dorsal hemispheres transmit information to regulate balance and posture. The spinocerebellar pathway, which controls the activity of muscle spindles via the gamma motor neuron, is used by the cerebellum, which controls coordinated motor movement, to plan and modify motor activity (37–39). Through the medulla, cerebellum, and dorsal column, the spinocerebellar route transmits peripheral information from skin, muscle, and joint structures to the sensory/motor areas. The interpretation of smooth and suitable input from muscle spindles and stretch receptors at the cerebellum level shapes kinesthesia and joint position sensation (35).

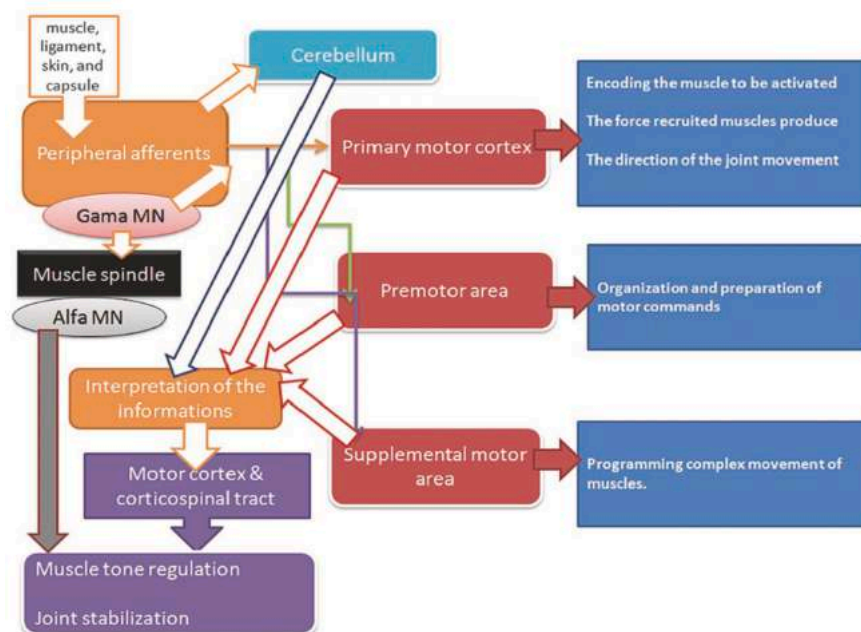


Figure 2.23. A List of The Proprioception's Cortical Pathways (38)

2.5.2. Cervical proprioception

Proper awareness of the head's position in three dimensions is necessary for daily activities like balance, posture, and motor coordination. Information regarding the head's position in relation to gravity is provided by the vestibular system. The visual system uses extrasensory cues to establish where the head is in relation to the environment. It is now understood that a highly sensitive proprioceptive system resides in the cervical spine, where it controls balance and posture, synchronizes the vestibular and visual systems, and determines where the head is in relation to the body. The main proprioceptors in the neck are assumed to be the spindles of the cervical muscles, not the joint capsules. The cervical muscles have a substantially higher spindle density than the shoulder and thigh muscles. Humans have numerous spindles in their deep cervical muscles, especially the little suboccipital muscles (18,42).

Patients with non-specific neck discomfort have been shown to have motor control impairments, although the particular weaknesses of the underpinning regulatory system are still unclear. Researches in the literature has shown that, neck pain itself clearly affects proprioception and neck sensorimotor control, which in turn affect orientation (42).

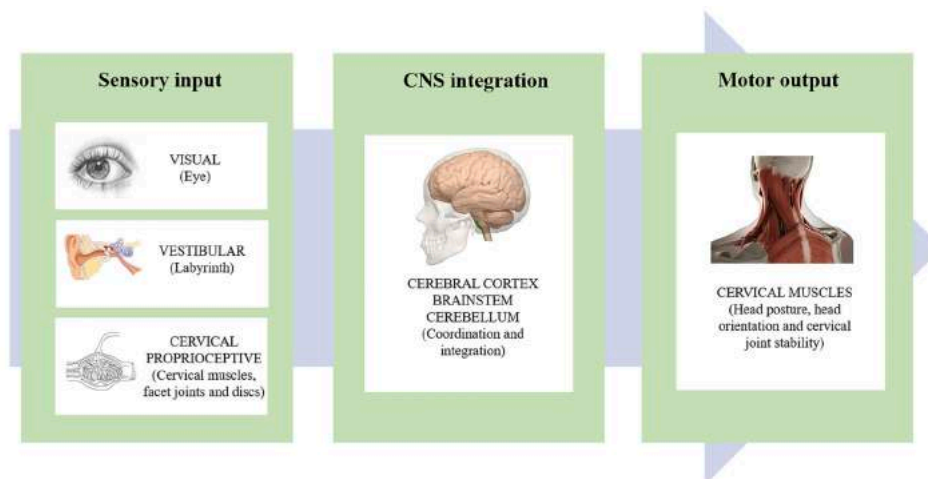


Figure 2.24. Schematic Diagram of Cervical Sensorimotor Control (42)

Joint position sense, an important component of proprioception, is the ability to reproduce/perceive predetermined positions or ranges of motion of a joint. Joint position sense error is the mistake people make when trying to recreate a previously specified position. Joint position sense inaccuracy is higher in people with neck pain, according to studies (36).

2.6. Kinesiophobia

Kinesiophobia, which comes from the Greek words 'kinesis = movement, phobus = fear', means 'fear of movement'. According to Kori et al., kinesiophobia is a severe, illogical dread of suffering another painful injury, which inhibits physical activity and mobility (35). Kinesiophobic patients worry that moving will re-injure them and make their current discomfort worse. Physical inactivity, functional impairment, disuse, depression, and a decline in quality of life are all long-term effects of this.(43).

The fear linked to pain can be expressed in a variety of ways. Lethem et al. coined the phrase "fear avoidance model of heightened pain perception" in 1982 to describe the relationship between fear and pain. This concept describes how pain and anxiety are related to learning avoidance behavior as well as how and why certain people experience intense social pressure to hide their pain issues. Later in 1990, Kori, Miller, and Todd coined the term kinesiophobia to refer to chronic pain with fear-avoidance and physical movement.(35,44).

Recently, the fear-avoidance model (FAM) has become a key concept for figuring out how chronic pain develops. Various psychosocial factors have a significant role in

the complex, multiple developmental processes that constitute pain disorders. It has been challenging to pinpoint the methods by which urgent issues develop into long-term ones. As a result, the "fear-avoidance" paradigm has received support from numerous studies. The fear-avoidance model is a model in the most recent literature that describes how the fear-avoidance role leads to chronic musculoskeletal pain as a result of fear-based activity avoidance in individuals. According to FAM; Patients with negative thoughts about post-injury pain will develop pain-related, pain-related fear and hypervigilance. According to the FAM, the risk of pain or re-injury is one of the factors that contributes to functional incapacity and persistent discomfort, which makes people avoid physical exercise (35).

Localized inflammation of the injured tissue makes peripheral sensory neurons (nociceptors) more sensitive, which causes the central nervous system to receive improper afferent input repeatedly. The prefrontal cortex, the region of the brain that regulates cognition, personality expression, and social conduct, has been found to have smaller volume in persons with chronic pain. Kinesiophobia has been shown to produce avoidance and evasion behaviors and has been discovered to be directly associated to chronic pain (45).

Kinesiophobia is a condition in which a patient has an exaggerated and escalating fear of physical movement and behaves as a result of a belief that they are at risk of suffering a serious injury or reinjury. The possibility of pain's bad effects increasing, being unable to stop thinking about stressful things, and feeling helpless to deal with pain are its defining characteristics. These routines could be helpful during the acute pain stage. The problem, paradoxically, gets worse in chronic pain, worsening impairment and pain thresholds as patients fall into a vicious loop that prolongs chronic pain and functional disability (3,4,45).

It might be challenging to pinpoint the causes of persistent or deteriorating pain due to the complexity of chronic neck discomfort. For functional tasks, the combination of the proprioceptive, vestibular, and visual systems helps to maintain static and dynamic balance. Neck pain recurrence and somatosensory system abnormalities can be brought on by kinesiophobia and catastrophic behaviors. A complete evaluation is necessary since these changes may change the cervical afferent input to the higher centers, impacting cervical proprioception. Previous research has demonstrated that CNP persons may find it challenging or impossible to perform functional tasks. Additionally, kinesiophobia can

worsen their functional limitations, which can decrease their quality of life. Kinesiophobia may cause functional capacity to deteriorate as a result of avoiding physical activity, which can result in impaired mobility and chronic pain (4,45).

According to reports, psychological aspects are crucial to the chronicization process. One of them is increased discomfort and anxiety of movement, which might result in re-injury. Reduced physical fitness, avoidance of exercise, functional impairment, disuse, and depression are some long-term impacts (35,45).

There are 5 questionnaires mentioned in the literature that are used to assess pain-related fear (35):

1. Fear of Pain Questionnaire (FPQ)
2. Pain Anxiety Symptoms Scale (PASS)
3. Fear-Avoidance Beliefs Questionnaire (FABQ)
4. Fear-Avoidance of Pain Scale (FAPS)
5. Tampa Scale for Kinesiophobia (TSK)

It is stated that all these questionnaires have weak aspects of their psychometric properties and validity and reliability. TSK is seen as the best available questionnaire measuring kinesiophobia. The TSK is the earliest scale that Miller et al. developed to assess a patient's subjectively perceived kinesiophobia in 1991 (35,44).

3. MATERIALS AND METHODS

3.1. Individuals

Our research looked at how kinesiophobia, proprioception, pain, and quality of life compared in people with non-specific acute and chronic neck pain. In this study, non-specific acute and chronic neck pain served as the dependent variables. The study's independent variables were kinesiophobia, proprioception, and pain. This research is cross-sectional and observational.

52 patients, 26 with acute and 26 with chronic non-specific neck pain, who applied to Yeditepe University Hospital in Istanbul participated in this study.

Our investigation was authorized by the Yeditepe University Non-Interventional Clinical Research Ethics Committee at the meeting on January 27, 2022, with application number 201212132 and decision number 10. This was in accordance with the ethics committee application submitted prior to the study. After getting the appropriate internal authorizations and the ethical committee's approval, the research was launched.

Patients who applied to the Yeditepe University Koşuyolu Hospital outpatient clinic and were diagnosed with non-specific neck pain were invited to the study. The risks within the study procedures were explained in detail to the participants in accordance with the Declaration of Helsinki. They voluntarily participated in the study by signing consent forms. A copy of the Informed Consent Form was given to the participant. The patients were divided into two groups as acute and chronic according to the duration of their neck pain. The same evaluations were made for both patient groups. After the diagnosis was made by the doctor, evaluations were made at the Physiotherapy and Rehabilitation Clinic on the same day and no further visits were required for the patient.

Based on the sample size, pre- and post-joint position sense values obtained from existing studies with similar test and survey applications, the number of patients to be included in each group was found to be 26 as a result of the power analysis performed with 5% margin of error and 80% reliability. Calculated using Gpower 3.1.9.2 software. Since there will be two groups as patients with acute or chronic neck pain in the study, 52 cases will be included in the study (46).

1. experiencing acute neck pain for less than six weeks and chronic neck pain for at least three months (2),
2. between the ages of 18 and 55, and
3. having effective communication and comprehension skills.

Pregnancy, any history of cervical spine trauma or surgery, congenital cervical deformity, and a diagnosis of fibromyalgia, neurological conditions, rheumatoid arthritis, radiculopathy, or vestibular impairment that would characterize neck pain as specific were the exclusion criteria for the patients (having a definite pathoanatomical origin).

All individuals participating in the study were informed in writing and verbally about the purpose of the study, the duration of the study, the applications to be carried out, the effects of the applications, the problems that may be encountered, the expectations, the forms used and the purposes, and an "Informed Consent Form" will be received from the individuals that they agreed to participate in the study.

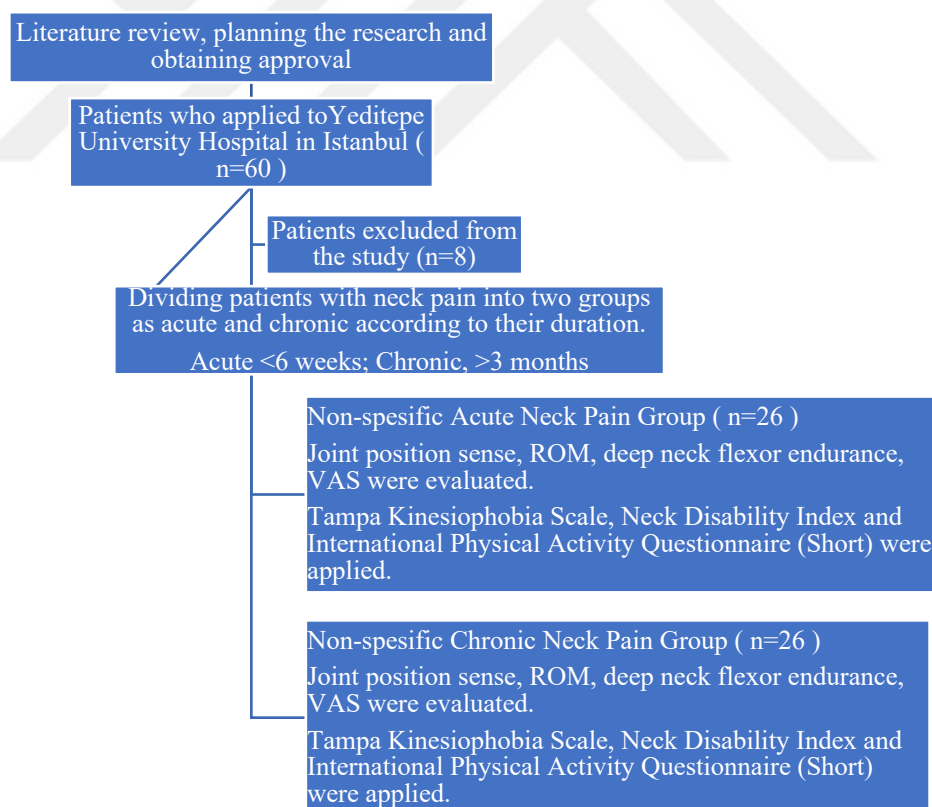


Figure 2.25. Flowchart

3.2. Evaluation Methods

3.2.1. Demographic information

To collect informations about participants' age, height, body weight, body mass index (BMI), educational status, occupation, diagnosis and duration of the disease etc. 'Demographic Information Form' assessed.

3.2.2. Pain evaluation

The patients' intensity of pain was assessed using the Visual Analogue Scale (VAS). On a scale of 1 to 10, patients will be asked to rate their pain during the day, at rest, and at night. A score of "0" denotes no discomfort, whereas a score of "10" denotes excruciating pain. The specified locations will be measured in millimeters and documented (47).

3.2.3. Range of motion measurement

Six directions of the neck joint motions of the study subjects will be measured: flexion, extension, lateral flexion (right and left), and rotation (right and left). The iPhone software G-Pro (Goniometer-Pro), which is deemed to be sufficiently valid and reliable, will be used to assess the active craniocervical range of motion (ACCROM) in individuals with non-specific neck discomfort. The participants were advised to sit upright on a chair with a padded backrest supporting the thoracic spine, their feet flat on the ground, and their arms comfortably positioned on the armrests beside them in order to assess active flexion, extension, and lateral flexion using the G-Pro app. The participant was firmly fastened to the chair across the shoulders with an inelastic belt to decrease the impact of the thoracic spine. The external auditory meatus was placed above the center of the phone to assess the active range of neck flexion and extension (ROM). The craniocervical was then invited to travel through its complete range of motion by the participants. By pressing the iPhone screen after making sure that the measurement was complete, the angles were recorded. One of the application's axes was placed with the occipital protuberance, and the application's center was parallel to the C7 spinous process. The patients were told to flex their right and left sides to their full capacity from this position. The movement was assessed in the supine position because using the app to track active craniocervical rotation while sitting was challenging. The nose served as one of the app's axes, while the top of the head served as its center. From this position, the participants were instructed to rotate as far to the right and left as they could. The angles of rotation were then measured and recorded (27).

3.2.4. The joint position sense evaluation

The head repositioning test and target angle tests, which are extensively used in the literature and are believed to be reliable and valid, were utilized to assess the joint position sense of the participants tested within the scope of the study (12,18). Deviations from the target angle during testing were determined using the G-Pro app, which was reported to be sufficiently accurate, reliable, and valid (27). Assessments were conducted as outlined in the literature: while seated in a regular chair, with the hips and knees bent at a 90-degree angle, and with the eyes closed (12). The tests were conducted after alerting the evaluated individuals of the tests to be administered and after the trial session had been used. People were urged to learn this position by placing their heads in the neutral position during the head repositioning test. After learning the reference position, the participants were instructed to move their heads into the maximum flexion position as quickly as they pleased and to keep it there for 5 seconds. People were then instructed to put their heads back in the reference position. The angle between the reference position and the end position was measured in the sagittal plane (12).



Figure 3.1. Head Repositioning Test

In the 30° neck flexion and 20° neck extension postures, target angle tests were carried out on the subjects to gauge their perception of joint position. Subjects were asked to keep this position in mind after their heads were brought from the neutral position to the target angle by the evaluator in the sitting position and with their eyes closed. After individuals learned the target position, their heads were placed in the neutral position. Individuals were then asked to bring their heads to the target angle. In the sagittal plane, the angle difference between the desired angle and the end location was measured. The

measurements were averaged over the three tests, which were conducted with a 20-second gap between each (12,48).



Figure 3.2. 30° Neck Flexion Target Angle Test



Figure 3.3. 20° neck extension target angle test

3.2.5. Evaluation of the cervical deep flexor muscle endurance

The subjects' cervical deep flexor muscle endurance was assessed while they were lying on their backs with their arms by their sides. The subject was instructed to tuck his chin in and look at his chest level. The length of time it can remain in this position, with its head raised around 2.5 cm, is measured in seconds (29). A stopwatch was used to time how long it took to maintain the position in seconds, and the test was run once. Before starting the test, the participants were informed that the test would be terminated in case of loss of chin tuck position, sudden/serious increase in pain and the person's unwillingness to continue the test. The physiotherapist showed how to do the test practically. The trial period was kept as short as possible in order not to cause fatigue/pain in the person (29,36).



Figure 3.4. Cervical deep flexor muscle endurance test

3.2.6. Neck disability evaluation

It has been demonstrated that the Turkish version of the Neck Disability Index (NDI) is a simple, dependable, and valid tool for measuring pain brought on by acute and chronic neck diseases, as well as limitation in everyday activities. The extent of pain-related disability in the patient group with both acute and chronic neck pain was evaluated using the Neck Disability Index (NDI), which is said to be valid and reliable. The ten topics that make up NDI include pain intensity, personal care, lifting, reading, headache, attention, working, driving, sleeping, and recreation. Participants in the study were asked to rate each title on a scale of 0 (no disability) to 5 (total disability). The overall score is between 0 (no disability) and 50. (complete disability) (49).

3.2.7. Fear of movement evaluation

It was established that the Turkish version of the Tampa Kinesiophobia Scale is appropriate for use in academic research after it was discovered to have high test-retest reliability in patients with neck problems. The Turkish version of the Tampa Kinesiophobia Scale (TSK) used to evaluate the fear of movement of the individuals included in the study. TSK consists of 17 questions. In this scale, there are four alternative answers to each question graded according to the On a Likert scale, 1 indicates "Strongly Disagree," 2 "Disagree," 3 "Agree," and 4 "Strongly Agree." The overall score is between 17 and 68. A high TSK score denotes a high level of movement anxiety. In our study, we employed the questionnaire that Ylmaz et al. translated into Turkish (44).

3.2.8. Physical activity level evaluation

The International Physical Activity Questionnaire-short form [International Physical Activity Questionnaire (IPAQ)] is used to assess physical activity level. Regarding tet-retest reliability and validity, it was discovered that the Turkish version of the IPAQ was nearly identical to the original English form. The study proved the accuracy and validity of the Turkish short and long forms of the IPAQ in measuring physical activity. This questionnaire, whose validity and reliability in Turkish has been shown, consists of 7 questions and the activity level of the person is calculated by asking whether heavy, moderate and light physical activity has been done and how long. According to the survey, walking accounts for 3,3 MET, moderate physical activity 4,0 MET, light physical activity 1,5 MET, and intense physical activity 8,0 MET of metabolic equivalent of task (MET). By averaging the MET values over time (min) and frequency, one may determine the total MET value (day). The total score is obtained by adding the multiplied values. Weekly MET value is defined as low physical activity if it is below 600, medium physical activity if it is between 601-3000, and high physical activity if it is above 3,000 (50).

3.3. Statistical Analysis

The number of patients to be included in each group was found to be 26 as a result of the power analysis carried out with a 5% margin of error and an 80% reliability. This was based on the sample size, pre- and post-joint position sense values obtained from previous studies with comparable test and survey applications. software Gpower 3.1.9.2 was used to calculate. Since there had to be two groups of patients with either acute or chronic neck pain, 52 persons were enrolled in the study (46). The study's data were statistically analyzed using the SPSS 20.0 program. Using both visual (histograms and probability graphs) and analytical methods (Kolmogorov Smirnov / Shapiro-Wilk tests), the conformance of the variables to the normal distribution was assessed. Demographic data, range of motion, endurance test, physical activity level, joint position sense, neck disability index, fear of movement, parameters of the scores evaluated by descriptive analysis and given as mean (mean) $\pm$ standard deviation (SD). Mann-Whitney U. analysis of non-normally distributed data and Independent Groups T analysis of regularly distributed data. Spearman's correlation test and the Mann-Whitney U test are used to compare results. Results are considered statistically significant when the P value is less than 0.05.

4. RESULTS

The study included 60 patients with non-specific chronic and acute neck discomfort. Due to their failure to meet the inclusion criteria, 8 of these patients were excluded. As a result, statistical analysis was performed on the data of the 52 research participants.

4.1. Demographic Information

The study's chronic neck pain and acute neck pain groups were found to have similar age, height, body weight, and BMI values. In 4.1, a table containing the individuals' demographic data is provided.

Table 4.1. Demographic Information of Individuals Included in the Study

Demographic Information	Chronic Neck Pain Group X $\pm$ SS	Acute Neck Pain Group X $\pm$ SS	p
Age	35.58 $\pm$ 10.238	35.08 $\pm$ 10.877	0.769
Height	168.38 $\pm$ 9.157	172.23 $\pm$ 8.86	0.080
Body Weight	65.42 $\pm$ 9.659	71.54 $\pm$ 14.84	0.135
BMI	23.04 $\pm$ 2.423	23.90 $\pm$ 3.40	0.410

*p<0.05, N: The number of participants, X: Mean, SS: Standard deviation, BMI: Body mass index

Table 4.2. Gender Information of Patients

Gender	Acute Neck Pain Group Percent (n=26)	Chronic Neck Pain Group Percent (n=26)
Female	57,7	76,9
Male	42,3	23,1

Female participants made up 67.3% of the study's participants. Patients in the chronic neck pain group made up 76.9% of participants, while those in the acute group made up 57.7% of participants.

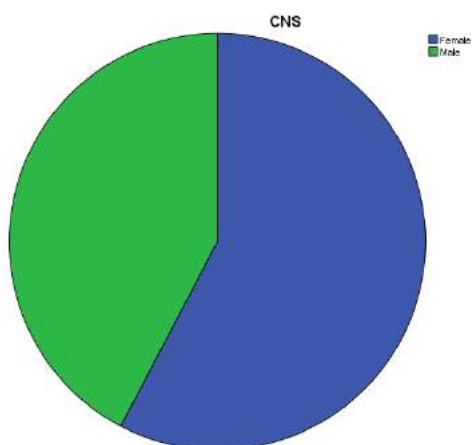


Figure 4.1. Acute Group Neck Pain Pie Chart

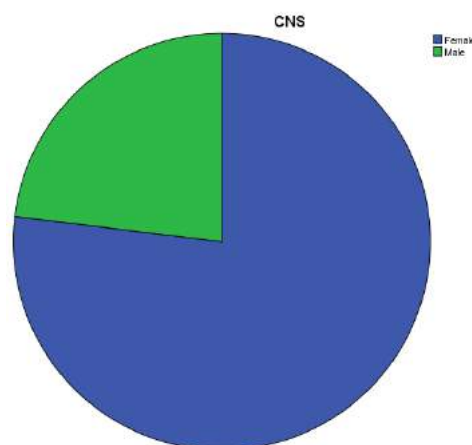


Figure 4.2. Chronic Group Neck Pain Pie Chart

4.2. Findings Related to the Assessment of Pain Severity of Individuals

Information on the pain severity of individuals is shown in Table 4.3.

Tablo 4.3. Finding on the Evaluation of Neck Pain in Individuals

	Chronic Neck Pain Group X ± SS	Acute Neck Pain Group X ± SS	p
VAS rest	3.58±2.301	5.35±2.244	0.012
VAS activity	6.27±1.756	7.15±1.736	0.062
VAS night	3.50±2.860	4.81±2.857	0.095

*p<0.05; VAS, Visual Analog Scale

It was found that people with acute neck pain experienced more severe rest discomfort than people with chronic neck pain, although activity and nighttime pain were of comparable intensity.

4.3. Findings Related to the Evaluation of Range of Motion

The ranges of motion for the neck in the chronic neck pain group and the acute neck pain group were found to be comparable in flexion, extension, right lateral flexion, and left lateral flexion. In contrast to the group with chronic neck pain, those with acute neck discomfort had less range of motion in both the right and left cervical rotations. Table 4.4 displays details on the measures of each person's range of motion.

Tablo 4.4. Range of Motion Evaluation Results of The Groups

ROM	Chronic Neck Pain Group X ± SS	Acute Neck Pain Group X ± SS	p
Flexion (°)	57.65±12.59	52.23±16.73	0.278
Extension (°)	51.62±14.32	47.23±16.88	0.368
Lateral Flexion Right (°)	41.08±7.27	37.85±11.57	0.337
Lateral Flexion Left (°)	42.77±9.36	39.54±11.03	0.348
Rotation Right (°)	73.50±8.54	65.08±16.86	0.048
Rotation Left (°)	74.50±10.29	62.69±19.84	0.033

*p<0.05

4.4. Findings Related to the Evaluation of Individuals' Joint Position Sense

When the results of the joint position sense test of study participants with chronic and acute neck pain were examined, it was discovered that the errors of the head repositioning test were comparable. Likewise, the results of the target angle test in 30° flexion and target angle test in 20° extension were similar in these two groups. The table regarding the Cervical Joint Position Sense Error values of the individuals is given in 4.5.

Table 4.5. Joint Position Sense Measurement Results of the Groups

Join Position Sense Test		Chronic Neck Pain Group X ± SS	Acute Neck Pain Group X ± SS	p
Head Repositioning Test Error	Ext.	2.20 ±1.63	2.89 ±2.11	0.267
	Flex.	2.71±2.21	2.98±2.38	0.640
Target Head Positioning Test Error	30° flex.	4.40±2.95	4.04±3.26	0.399
	20° ekst.	3.55±2.43	2.47±1.42	0.137

*p<0.05

4.5. Findings Related to Fear of Movement, Level of Neck Disability, Physical Activity Questionnaire Evaluation

Table 4.6. Statistical Analysis Results of TSK, NDI and IPAQ of the Groups

	ChronicNeckPainGroup X ± SS	AcuteNeckPainGroup X ± SS	p
TSK	42.46 ± 4.483	39.96 ± 4.228	0.072
NDI	13.15 ± 5.304	15 ± 5.899	0.344
IPAQ	1079.23 ± 1391.744	1428.23 ± 1945.365	0.431

*p<0.05; TSK, Tampa Scale of Kinesiophobia; NDI, Neck Disability Index; IPAQ, International Physical Activity Questionnaire

Patients with acute and chronic neck pain were shown to have similar TSK, NDI, and IPAQ scores. The information on the TSK, NDI, IPAQ scores of the individuals is shown in table 4.6.

4.6. Findings Related to Deep Cervical Flexor Muscle Endurance of Individuals

Patients with chronic neck pain were shown to have higher deep neck flexor endurance (DNFE) than those with acute neck pain. Information on deep neck flexor endurance of individuals is shown in table 4.7.

Table 4.7. Findings Related to Deep Cervical Flexor Muscle Endurance Assessments of Individuals

	Chronic Neck Pain Group X ± SS	Acute Neck Pain Group X ± SS	p
DNFE (sec.)	11.15±4.961	7.46±6.250	0.004

*p<0,05

4.7. Findings related to the classification of people with acute neck pain by the Neck Disability Index in terms of VAS, ROM, Proprioception, Kinesiophobia, Physical Activity Level, and Deep Neck Flexor Muscle Endurance

The neck disability index was used to group members of the acute neck pain group together. The VAS scores between the groups classified as mild and moderate did not differ significantly. Table 4.8 displays the evaluations' findings.

Table 4.8. Results of the Classification of the Neck Disability Index for Evaluating Neck Pain in People with Acute Neck Pain

VAS	Acute Neck Pain Group NDI-Mild $\bar{X} \pm SS$	Acute Neck Pain Group NDI-Moderate $\bar{X} \pm SS$	p
VASret	5.36 $\pm$ 2.292	5.33 $\pm$ 2.89	1.000
VASactivity	7.55 $\pm$ 1.809	6.87 $\pm$ 1.685	0.277
VASnight	4.00 $\pm$ 2.966	5.40 $\pm$ 2.720	0.273

*p<0,05

In the group of patients with acute neck discomfort, there was no discernible difference between ROM values for patients categorized as mild and moderate. Table 4.9 displays the findings of these analyses.

Table 4.9. Findings on the Classification of the Neck Disability Index When Evaluating Range of Motion in People with Acute Neck Pain

ROM	Acute Neck Pain Group NDI-Mild $\bar{X} \pm SS$	Acute Neck Pain Group NDI-Moderate $\bar{X} \pm SS$	p
Flexion (°)	47.27 $\pm$ 19.152	55.87 $\pm$ 14.307	0.272
Extension (°)	47.64 $\pm$ 20.612	46.93 $\pm$ 14.340	0.677
Lateral Flexion Right (°)	39.18 $\pm$ 15.510	36.87 $\pm$ 8.052	0.464
Lateral Flexion Left (°)	39.00 $\pm$ 13.349	39.93 $\pm$ 9.468	0.694
Rotation Right (°)	60.36 $\pm$ 21.435	68.53 $\pm$ 12.217	0.496
Rotation Left (°)	58.55 $\pm$ 22.147	65.73 $\pm$ 18.152	0.298

*p<0,05

Table 4.10 shows the correlation between head repositioning and target angle tests in individuals with mild and moderate acute neck pain.

Table 4.10. Results of the Evaluation of Joint Position Sense Measurements in People with Acute Neck Pain According to the Classification of the Neck Disability Index

Join Position Sense Test		Acute Neck Pain Group NDI-Mild X ± SS	Acute Neck Pain Group NDI-Moderate X ± SS	p
Head Repositioning Test Error	Ext.	2.058±2.405	3.506±1.711	0.011
	Flex.	2.997±2.245	2.974±2.568	0.917
Target Head Positioning Test Error	30° Flex.	3.300±1.524	4.597±4.081	0.794
	20° Ekst.	2.452±1.470	2.485±1.446	0.876

*p<0,05

It was reported that among patients with acute neck pain who were categorized as having mild and moderate pain, the moderate pain group's fear of movement values were statistically higher than those in the mild pain group. Table 4.11 displays the results of the assessments of movement phobia, neck disability index, and physical activity questionnaire scores.

Table 4.11. Findings on the Kinesiophobia, Neck Disability Index and Physical Activity Level Scores in Individuals with Acute Neck Pain According to Neck Disability Index Classification

	Acute Neck Pain Group NDI-Mild X ± SS	Acute Neck Pain Group NDI-Moderate X ± SS	p
TSK	38.9±3.506	41.33±4.287	0.049
NDI	9.00±2.324	19.40±3.043	0.000
IPAQ	2179,18±2683.936	877.53±918.997	0.203

*p<0.05; TSK, Tampa Scale of Kinesiophobia; NDI, Neck Disability Index; IPAQ, International Physical Activity Questionnaire

Table 4.12 shows the correlation between deep neck flexor muscle endurance assessments in patients with mild and moderate acute neck pain.

Table 4.12. Findings on Measuring Deep Neck Flexor Muscle Endurance in People with Acute Neck Pain According to the Classification of the Neck Disability Index

	Acute Neck Pain Group NDI-Mild X ± SS	Acute Neck Pain Group NDI-Moderate X ± SS	p
DNFE (sec.)	10.45±7.954	5.27±3.515	0.072

*p<0,05

4.8. Findings from the Neck Disability Index Classification of People with Chronic Neck Pain: Evaluation of VAS, ROM, Proprioception, Kinesiophobia, Physical Activity Level, and Deep Neck Flexor Muscle Endurance

Table 4.13 shows the correlation between the VAS scores of patients with mild and moderate chronic neck pain.

Table 4.13. Findings on the Classification of Neck Disability Index for Neck Pain in People with Chronic Neck Pain

VAS	Chronic Neck Pain Group NDI-Mild X ± SS	Chronic Neck Pain Group NDI-Moderate X ± SS	p
VAS ret	2.88±2.088	4.89±2.205	0.043
VAS activity	5.88±1.495	7.00±2.062	0.139
VAS night	2.53±1.908	5.33±3.536	0.049

*p<0,05

In the group of patients with chronic neck pain, there was no discernible difference between ROM values for patients categorized as mild and moderate. Table 4.14 presents the findings of these analyses.

Table 4.14. Findings on the Classification of the Neck Disability Index for the Evaluation of Range of Motion in People with Chronic Neck Pain

ROM	Chronic Neck Pain Group NDI-Mild X ± SS	Chronic Neck Pain Group NDI-Moderate X ± SS	p
Flexion (°)	58.06±11.377	58.89±15.358	0.914
Extension (°)	53.12±10.154	48.78±20.523	0.432
Lateral Flexion Right (°)	42.00±6.699	39.33±8.396	0.445
Lateral Flexion Left (°)	42.24±6.260	43.78±13.917	0.379
Rotation Right (°)	72.24±9.284	75.89±6.772	0.286
Rotation Left (°)	74.65±11.656	74.22±7.694	0.785

*p<0.05

Table 4.15 shows the correlation between head repositioning and target angle tests in individuals with mild and severe chronic neck pain.

Table 4.15. Results on the Evaluation of Joint Position Sense Measurements in People with Chronic Neck Pain According to the Classification of the Neck Disability Index

Join Position Sense Test		Chronic Neck Pain Group NDI-Mild X ± SS	Chronic Neck Pain Group NDI-Moderate X ± SS	p
Head Repositioning Test Error	Ext.	2.290±1.844	2.034±1.216	0.892
	Flex.	2.801±2.370	2.553±2.020	0.914
Target Head Positioning Test Error	30° Flex.	4.191±2.925	4.804±3.157	0.705
	20° Ekst.	3.504±2.702	3.663±1.964	0.552

*p<0.05

The fear of movement values in the groups of patients with mild and moderate chronic neck pain were shown to be significantly higher than those in the mild pain group. Table 4.16 shows the results of the assessments of movement fear, neck disability index, and physical activity questionnaire scores.

Table 4.16. Results on the Kinesiophobia, Neck Disability Index, and Physical Activity Level Scores in People with Chronic Neck Pain, According to the Classification of the Neck Disability Index

	Chronic Neck Pain Group NDI-Mild X ± SS	Chronic Neck Pain Group NDI-Moderate X ± SS	p
TSK	40.59±3.063	46.00±4.743	0.010
NDI	9.76±2.562	19.56±2.068	0.000
IPAQ	1013.94±1205.042	1202.56±1767.07	0.449

*p<0.01*p<0.05; TSK, Tampa Scale of Kinesiophobia; NDI, Neck Disability Index; IPAQ, International Physical Activity Questionnaire

Table 4.17 shows the correlation between deep neck flexor muscle endurance measurements in the group of patients with chronic neck pain who are classified as mild and moderate.

Table 4.17. Findings on Evaluating Deep Neck Flexor Muscle Endurance in People with Acute Neck Pain According to the Classification of the Neck Disability Index

	Chronic Neck Pain Group NDI-Mild X ± SS	Chronic Neck Pain Group NDI-Moderate X ± SS	p
DNFE (sec.)	12.18±5.468	9.22±3.270	0.289

*p<0,05

4.9. Correlation Analysis Results of Evaluated Parameters

Vas night scores were observed to significantly increase in correlation with increases in Vas rest scores in patients with acute neck pain (p<0.05) Proprioception and kinesiophobia scores did not significantly correlate with VAS scores. In individuals with acute neck pain, table 4.18 shows the correlation between VAS scores and ROM, proprioception, kinesiophobia, neck disability level, physical activity, and deep flexor muscle endurance.

Table 4.18. Results of the Correlation Analysis between the Vas and the Range of Motion, Proprioception, Kinesiophobia, Neck Disability Index, Physical Activity, and Flexor Muscle Endurance in Patients with Acute Neck Pain (Correlation coefficient 'r' values are provided in the table.)

ROM	VAS rest	VAS activity	VAS night
Flexion (°)	-0.032	-0.261	-0.132
Extension (°)	0.295	-0.437*	-0.060
Lateral Flexion Right (°)	0.188	-0.228	-0.114
Lateral Flexion Left (°)	0.277	-0.384	-0.035
Rotation Right (°)	-0.029	-0.326	-0.062
Rotation Left (°)	0.199	0.299	0.169
JOINT POSITION SENSE			
Head Repositioning Ext.	-0.045	-0.255	-0.112
Flex.	0.088	0.162	-0.098
Target Head Positioning 30° flex.	0.143	0.085	0.086
20° ekst.	0.309	0.059	0.167
QUESTIONNAIRES			
TSK score	0.248	-0.039	0.304
NDI score	-0.003	-0.235	0.105
IPAQ score	-0.174	0.225	-0.046
DNFE (sec.)	0.050	-400*	-0.056
**p<0,01; *p<0,05			

When the VAS resting score increased, the VAS night and VAS activity scores also increased in the correlation study of individuals with chronic neck pain ($p<0.01$). While proprioception tests and VAS scores did not significantly correlate, a significant rise in the correlation between kinesiophobia scores and VAS rest and night scores was observed ($p<0.01$). In individuals with chronic neck pain, table 4.19 shows the correlation between VAS scores and ROM, proprioception, kinesiophobia, neck disability level, physical activity, and flexor muscle endurance.

Table 4.19. Results of Correlation Analysis Between Vas and Rom, Proprioception, Kinesiophobia, Neck Disability Level, Physical Activity, and Flexor Muscle Endurance in Patients with Chronic Neck Pain Are Shown in The Table (Correlation coefficient 'r' values are provided.)

ROM	VAS rest	VAS activity	VAS night
Flexion (°)	-0.157	-0.031	-0.292
Extension (°)	-0.039	-0.114	-0.126
Lateral Flexion Right (°)	-0.333	-0.116	-0.291
Lateral Flexion Left (°)	-0.187	-0.125	-0.298
Rotation Right (°)	0.055	-0.117	-0.114
Rotation Left (°)	0.021	-0.160	-0.036
JOINT POSITION SENSE			
Head Repositioning	0.051	0.158	0.067
Ext.			
Flex.	-0.202	-0.289	0.109
Target Head Positioning	-0.088	0.044	-0.073
30° flex.			
20° ekst.	-0.064	-0.021	-0.149
QUESTIONNAIRES			
TSK score	0.782**	0.376	0.660**
NDI score	0.488*	0.323	0.394*
IPAQ score	0.106	0.432*	0.072
DNFE (sec.)	-0.373	-0.343	-0.203

**p<0,01; *p<0,05

In the head repositioning test that was conducted while moving from extension to neutral, a statistically significant positive correlation was observed between the error score and the rise in flexion angle. A significant positive correlation was found with the increase between the error score in the head repositioning test performed while coming from the extension to the neutral and the level of neck disability. In patients with acute neck pain, table 4.20 shows the correlation between proprioception error scores and VAS, ROM, kinesiophobia, neck disability level, physical activity, and deep flexor muscle endurance.

Table 4.20. Results of the Correlation Analysis between Proprioception and Vas, Rom, Kinesiophobia, Neck Disability Level, Physical Activity, and Flexor Muscle Endurance in Patients with Acute Neck Pain Are Shown in the Table (Correlation coefficient 'r' values are provided.)

	Head Repositioning		Target Head Positioning	
VAS	Ext.	Flex.	30° flex.	20°ekst.
VAS rest	-0.045	0.088	0.143	0.309
VAS activity	-0.255	0.162	0.085	0.059
VAS night	-0.098	-0.112	0.086	0.167
JOINT POSITION SENSE				
Head Repositioning Ext.	1.000	-0.029	0.338	-0.253
Flex.	-0.029	1.000	-0.173	0.034
Target Head Positioning 30° flex.	0.338	-0.173	1.000	0.000
20°ekst.	-0.253	0.034	0.000	1.000
ROM				
Flexion (°)	0.461*	0.119	0.134	-0.056
Extension (°)	0.114	-0.087	0.335	0.222
Lateral Flexion Right (°)	0.176	0.055	0.175	0.115
Lateral Flexion Left (°)	0.266	-0.214	0.281	0.064
Rotation Right (°)	0.366	0.015	0.321	0.077
Rotation Left (°)	0.153	-0.068	0.333	-0.058
QUESTIONNAIRES				
TSK score	0.079	-0.199	-0.153	-0.046
NDI score	0.532**	-0.221	0.156	0.034
IPAQ score	-0.161	0.114	-0.284	0.163
DNFE (sec.)	-0.041	-0.135	0.107	-0.168
**p<0,01; *p<0,05				

In patients with chronic neck pain, table 4.21 shows the correlation between proprioception error scores and VAS, ROM, kinesiophobia, neck disability level, physical activity, and deep flexor muscle endurance.

Table 4.21. Results of the Correlation Analysis between Proprioception and Vas, Rom, Kinesiophobia, Neck Disability Level, Physical Activity, and Flexor Muscle Endurance in Patients with Chronic Neck Pain Are Shown in the Table (Correlation coefficient 'r' values are provided.)

	Head Repositioning		Target Head Positioning	
	Ext.	Flex.	30° flex.	20° ekst.
VAS rest	0.051	-0.202	-0.088	-0.064
VAS activity	0.158	-0.289	0.044	-0.021
VAS night	0.067	0.109	-0.073	-0.149
JOINT POSITION SENSE				
Head Repositioning	1.000	0.262	0.147	0.320
Ext.				
Flex.	0.262	1.000	-0.017	0.304
Target Head Positioning	0.147	-0.017	1.000	0.357
30° flex.				
20° ekst.	0.320	0.304	0.357	1.000
ROM				
Flexion (°)	0.240	0.026	0.449*	0.103
Extension (°)	0.137	0.323	-0.255	-0.080
Lateral Flexion Right (°)	0.359	0.353	0.017	0.083
Lateral Flexion Left (°)	0.039	0.081	-0.130	-0.301
Rotation Right (°)	0.102	0.325	-0.454*	0.254
Rotation Left (°)	-0.084	0.492*	-0.420*	0.177
QUESTIONNAIRES				
TSK score	-0.223	-0.376	-0.115	-0.026
NDI score	-0.057	-0.216	-0.185	-0.111
IPAQ score	0.087	0.195	-0.108	0.106
DNFE (sec.)	0.238	0.206	-0.096	0.061

**p<0,01; *p<0,05

When the kinesiophobia score increased in patients with acute neck pain, there was also a significant rise in the disability level score, according to the correlation analysis. Table 4.22 shows the correlations between kinesiophobia, the neck disability

level, physical activity and VAS, ROM, proprioception, and the endurance of the flexor muscles in individuals with acute neck pain.

Table 4.22. Results of Correlation Analysis between Kinesiophobia, the Neck Disability Level, Physical Activity and Vas, Rom, Proprioception, and Flexor Muscle Endurance in Patients with Acute Neck Pain Are Shown in the Table (Correlation coefficient 'r' values are provided.)

VAS	TSK score	NDI score	IPAQ score
VAS rest	0.248	-0.003	-0.174
VAS activity	-0.039	-0.235	0.225
VAS night	0.304	0.105	-0.046
ROM			
Flexion (°)	0.115	0.265	-0.318
Extension (°)	-0.165	0.032	-0.430*
Lateral Flexion Right (°)	-0.164	-0.067	-0.134
Lateral Flexion Left (°)	-0.062	0.259	-0.174
Rotation Right (°)	0.055	0.131	-0.368
Rotation Left (°)	0.173	0.225	-0.379
JOINT POSITION SENSE			
Head Repositioning	0.079	0.532**	-0.161
Ext.			
Flex.	-0.199	-0.221	0.114
Target Head Positioning	-0.153	0.156	-0.284
30°flex.			
20°ekst.	-0.046	0.034	0.163
QUESTIONNAIRES			
TSK score	1.000	0.451*	-0.351
NDI score	0.451*	1.000	-0.247
IPAQ score	-0.351	-0.247	1.000
DNFE (sec.)	-0.084	-0.326	-0.170
**p<0,01; *p<0,05			

The correlations between kinesiophobia, neck disability level, physical activity and VAS, ROM, proprioception, and deep neck flexor muscle endurance in patients with chronic neck pain are shown in Table 4.23.

Table 4.23. Results of the correlation analysis between kinesiophobia, the neck disability level, physical activity and VAS, ROM, proprioception, and flexor muscle endurance in patients with chronic neck pain are shown in the table (correlation coefficient 'r' values are provided).



Table 4.23. Results of the Correlation Analysis between Kinesiophobia, The Neck Disability Level, Physical Activity and Vas, Rom, Proprioception, and Flexor Muscle Endurance in Patients with Chronic Neck Pain Are Shown in the Table (Correlation coefficient 'r' values are provided.)

VAS	TSK score	NDI score	IPAQ score
VAS rest	0.782**	0.488*	0.106
VAS activity	0.376	0.323	0.432*
VAS night	0.660**	0.394*	0.072
ROM			
Flexion (°)	-0.283	-0.159	-0.140
Extension (°)	-0.213	-0.220	0.405*
Lateral Flexion Right (°)	-0.576**	-0.266	0.268
Lateral Flexion Left (°)	-0.320	-0.167	0.165
Rotation Right (°)	0.116	0.216	0.122
Rotation Left (°)	-0.019	0.041	0.107
JOINT POSITION SENSE			
Head Repositioning Ext.	-0.223	-0.057	0.087
Flex.	-0.376	-0.216	0.195
Target Head Positioning 30°flex.	-0.115	-0.185	-0.108
20°ekst.	-0.026	-0.111	0.106
QUESTIONNAIRES			
TSK score	1.000	0.542**	-0.095
NDI score	0.542**	1.000	-0.237
IPAQ score	-0.095	-0.237	1.000
DNFE (sec.)	-0.303	-0.318	0.029

**p<0,01; *p<0,05

In individuals with acute neck pain, a correlation between ROM scores and VAS, ROM, proprioception, kinesiophobia, neck disability level, physical activity, and deep neck flexor muscle endurance is shown in table 4.24.

Table 4.24. Results of Correlation Analysis between Range of Motion and Kinesiophobia, Neck Disability Index, Physical Activity and Vas, Proprioception, and Deep Neck Flexor Muscle Endurance in Patients with Acute Neck Pain Are Shown in the Table (correlation coefficient 'r' values are given.)

VAS	Flexion (°)	Extension (°)	Lateral Flexion Right (°)	Lateral Flexion Left (°)	Rotation Right (°)	Rotation Left (°)
VAS rest	-0.032	0.295	0.188	0.277	-0.029	0.199
VAS activity	-0.261	-0.437*	-0.228	-0.384	-0.326	-0.299
VAS night	-0.132	-0.060	-0.114	-0.035	-0.062	0.169
ROM						
Flexion (°)		0.283	0.633**	0.264	0.395*	0.223
Extension (°)	0.283		0.678**	0.743**	0.573**	0.595**
Lateral Flexion Right (°)	0.633**	0.678**		0.700**	0.470*	0.382
Lateral Flexion Left (°)	0.264	0.743**	0.700**		0.428*	0.540**
Rotation Right (°)	0.395*	0.573**	0.470*	0.428*		0.724**
Rotation Left (°)	0.223	0.595**	0.382	0.540**	0.724**	
JOINT POSITION SENSE						
Head Repositioning Ext.	0.461*	0.114	0.176	0.266	0.366	0.153
Flex.	0.119	-0.087	0.055	-0.214	0.015	-0.068
TargetHeadPositioning 30° flex.	0.134	0.335	0.175	0.281	0.321	0.333
20° ekst.	-0.056	0.222	0.115	0.064	0.077	-0.058
QUESTIONNAIRES						
TSK score	0.115	-0.165	-0.164	-0.062	0.055	0.173
NDI score	0.265	0.032	-0.067	0.259	0.131	0.225
IPAQ score	-0.318	-0.430*	-0.134	-0.174	-0.368	-0.379
DNFE (sec.)	0.238	0.310	0.297	0.034	0.075	0.022

**p<0,01; *p<0,05

According to table 4.25, there is a correlation between ROM scores and VAS, ROM, proprioception, kinesiophobia, neck disability level, physical activity, and deep neck flexor muscle endurance in individuals who have chronic neck pain.



Table 4.25. Results of Correlation Analysis Between Range of Motion and Kinesiophobia, Neck Disability Level, Physical Activity and Vas, Proprioception, and Deep Neck Flexor Muscle Endurance in Patients with Chronic Neck Pain (Correlation coefficient 'r' values are provided in the table.)

VAS	Flexion (°)	Extension (°)	Lateral Flexion Right (°)	Lateral Flexion Left (°)	Rotation Right (°)	Rotation Left (°)
VAS rest	-0.157	-0.039	-0.333	-0.187	0.055	0.021
VAS activity	-0.031	-0.114	-0.116	-0.125	-0.117	-0.160
VAS night	-0.292	-0.126	-0.291	-0.298	-0.114	-0.036
ROM						
Flexion (°)		0.108	0.505**	0.208	-0.136	-0.374
Extension (°)	0.108		0.469*	0.556**	0.563**	0.195
Lateral Flexion Right (°)	0.505**	0.469*		0.530**	0.183	-0.050
Lateral Flexion Left (°)	0.208	0.556**	0.530**		0.317	0.200
Rotation Right (°)	-0.136	0.563**	0.183	0.317		0.652**
Rotation Left (°)	-0.374	0.195	-0.050	0.200	0.652**	
JOINT POSITION SENSE						
Head Repositioning Ext.	0.240	0.137	0.359	0.039	0.102	-0.084
Flex.	0.026	0.323	0.353	0.081	0.325	0.492*
Target Head Positioning 30°flex.	0.449*	-0.255	0.017	-0.130	-0.454*	-0.420*
20°ext.	0.103	-0.080	0.083	-0.301	0.254	0.177
QUESTIONNAIRES						
TSK score	-0.283	-0.213	-0.576**	-0.320	0.116	-0.019
NDI score	-0.159	-0.220	-0.266	-0.167	0.216	0.041
IPAQ score	-0.140	0.405*	0.268	0.165	0.122	0.107
DNFE (sec.)	-0.044	0.564**	0.286	0.452*	0.306	0.033

**p<0,01; *p<0,05

The correlation relationship deep flexor muscle endurance scores and kinesiophobia, neck disability level and physical activity level in patients with acute neck pain is shown in table 4.26.

Table 4.26. Results of the Correlation Analysis between Deep Flexor Muscle Endurance and Kinesiophobia, Neck Disability Level, and Physical Activity Score in Patients with Acute Neck Pain Are Shown in the Table (Correlation coefficient 'r' values are provided.)

	TSK score	NDI score	IPAQ score
DNFE (sec.)	-0.084	-0.326	-0.170

**p<0,01; *p<0,05

In individuals with chronic neck pain, the correlation between deep flexor muscle endurance scores, kinesiophobia, neck disability level, and physical activity level is shown in table 4.27.

Table 4.27. Results of the Correlation Analysis between Deep Flexor Muscle Endurance, Kinesiophobia, Neck Disability Level, and Physical Activity Score in Patients with Chronic Neck Pain Are Shown in the Table (Correlation coefficient 'r' values are provided.)

	TSK score	NDI score	IPAQ score
DNFE (sec.)	-0.303	-0.318	0.029

**p<0,01; *p<0,05

5. DISCUSSION AND CONCLUSION

Our study's goals were to discover kinesiophobia and proprioceptive impairment in individuals with acute and chronic neck pain, as well as to research into the relationships between these problems and pain, quality of life, and proprioception. Additionally, the results of these evaluations were assessed with relation to the degree of neck disability, level of physical activity, deep flexor muscle endurance, and range of motion (ROM) of the cervical area. 52 people participated in the research, 26 of whom had chronic neck pain and 26 of whom had acute neck pain. When the collected data were subjected to proper statistical analysis, it was observed that there was no statistically significant difference in proprioception between the groups with acute and chronic neck pain. It was observed that the mean fear of movement scores of those with chronic neck pain were higher than those with acute neck pain. However, this difference is not statistically significant. We classified individuals in acute and chronic pain groups as mild and moderate according to their neck disability index scores. In the group of individuals with acute neck pain, we found that those with moderate pain scored significantly higher on the fear of movement score than those with mild pain. In those with chronic neck pain, the findings were similar between those with mild and moderate pain. The VAS rest scores were found to be statistically greater than those in the chronic neck pain group, despite the fact that the VAS activity and VAS night scores of the individuals in the acute neck pain group were similar to those in the individuals with chronic neck pain. It has been observed that persons with chronic neck pain have statistically higher right and left rotation angles than those with acute neck pain. Both groups' other neck flexion and extension ranges were similar. When the neck disability index scores and physical activity levels were compared between the people with acute and chronic neck pain, there was no statistically significant difference. Statistics have indicated that people with acute neck pain have lesser deep flexor muscle endurance than people with chronic neck pain. In patients with acute neck pain, there was only a significant relationship between the neck flexion angle and moving the head from extension to neutral. However, it was found that in patients with chronic neck pain, error values in the target angle test increased as the range of motion of the right and left rotation joints decreased. In individuals with both acute and chronic neck pain, we found a statistically significant correlation between fear of movement and the level of neck disability. We observed that the level of neck disability increased in both groups as the fear of movement increased. Additionally, a statistically

significant relationship was established between the increase in fear of movement scores and the vas night and vas rest scores among individuals who had chronic neck pain. Additionally, it was found in the correlation tests performed on the individuals in the chronic neck pain group that the scores for the neck disability index and fear of movement statistically increased when the vas night and vas rest pain scores increased.

In the literature, it has been reported that middle-aged women are more likely than younger ones to experience neck pain. Neck discomfort incidence increased in the middle-aged groups, with maximum at ages 40 to 49 and ages 35 to 44, respectively.^{2,25} According to a study by Viikari-Juntura et al., the risk of neck pain increases after the ages of 35 for women and 45 for males, increases with age until the ages of 45 and 54, and then marginally declines as people become older (51). The majority of the individuals in our study who had neck pain were female, and it was calculated that their mean age was similar with the age ranges where the risk of neck pain increased. In our study, 76.9% of those with chronic neck pain and 57.7% of those with acute neck pain were female patients, which is consistent with the literature. Similar to the literature, the peak age for neck pain in these two groups is between 35 and 44 years of age (25). Women predominated in the group with chronic neck pain, in line with the literature, and although they still made up the majority in this group with acute neck pain, the difference was noticeably less. We were unable to find any information about the incidence of acute neck pain according to gender or age, despite the fact that there have been numerous research on how the incidence of chronic neck pain varies by gender and age. The majority of studies on acute neck pain in the literature focused with post-traumatic or whiplash injuries. Participants in this study who had acute neck pain had nonspecific acute neck pain. In this study, we found that the group of individuals suffering from chronic neck pain was significantly more dispersed than the group of people with nonspecific acute neck pain. The incidence of acute neck pain according to gender may be equivalent in men and women, or it may be higher in men than in women, when the number of people with acute neck pain reaches a certain level. According to a study that looked at the most recent statistics on the epidemiology and trends of neck pain, there is some indication that demographic factors like age and gender may have an impact on the prevalence and progression of neck pain, but further research is required (52). Evaluating the prevalence of acute neck pain in persons that isn't caused by whiplash is difficult because prevalence studies typically don't distinguish between this and other types of neck pain. Based on the

point prevalence reported by Cote et al., we hypothesize that 10% of the population has acute neck pain that is not related to whiplash at any given time (53).

Parazza et al. stated that there was no significant difference in VAS scores between individuals with acute/subacute and chronic pain, however, they showed that the individuals with chronic pain had a significantly higher level of disability (54). In our study, there was no significant difference between those with acute and chronic neck pain in terms of level of disability, but the acute group had a higher level of disability than the chronic group. Although participants in this study reported higher VAS activity and VAS night scores than participants in chronic pain, this difference was not statistically significant. Additionally, compared to people with chronic neck pain, people with acute pain had VAS resting scores that were considerably higher. When individuals suffering from chronic neck pain were classified based on their level of neck disability, the moderately disabled people had considerably higher VAS rest and night scores than the mildly disabled people, but there was no significant difference in the VAS activity scores. There was no significant difference in VAS scores between mild and moderate individuals when acute neck pain sufferers were grouped according to their level of neck disability.

When the literature is reviewed, the majority of research focusing at the association between fear of movement and the level of pain and disability have shown a relationship, similarly to the group with chronic neck pain in our study. Based on the analysis of cross-sectional research, Luque-Suarez et al. published a systematic review in 2019 that found a higher degree of fear of movement was correlated with a greater level of pain severity and disability in individuals suffering from chronic neck pain (55). In patients with mechanical chronic neckpain, Saavedra-Hernandez et al. found a significant correlation between disability and fear of movement (56). In their study conducted in 2012, Howell et al. similarly found a significant correlation between NDI and TSK in individuals with chronic neck pain, but they were unable to find a significant relationship between TSK and cervical range of motion (57). The group with acute neck pain in our study found no correlation between TKS and neck range of motion. Other neck ROMs and TSK were not correlated with the chronic neck pain group, with the exception of the right lateral flexion angle. Higher TSK scores for fear of movement were correlated with higher NDI scores in the Johansen et al. Research (58). In the research published by Bulhes et al. in 2019, it was found that psychometric characteristics, such as fear of movement, were correlated to the presence of pain in patients with nonspecific chronic

neck pain and contributed to the pain's elevation (59). Demirbükten et al. observed in another study that in people with chronic neck pain, there was no correlation between fear of movement and pain (43). In our study, we found similar correlations with the literature in the chronic neck pain group. The NDI and VAS scores dramatically rise along with the Tampa scores of those with chronic neck pain, with the exception of the VAS activity score. In our study, there was no correlation between Tampa scores and VAS scores, however there was a positive correlation between Tampa scores and NDI scores in the nonspecific acute neck pain group. Individuals with moderate Tampa scores scored considerably higher than those with mild when people with acute and chronic neck pain were classified into the neck disability index among themselves. The Tampa scores of the individuals in the chronic neck pain group were higher than the Tampa scores of the people in the acute neck pain group, but the difference between these two groups was not statistically significant, according to our analysis of the acute and chronic neck pain groups. There are very few studies on people with nonspecific acute neck pain in the literature. As a result, no data about the fear of movement and its correlation with other variables in individuals suffering from non-specific acute neck pain could be gathered. Gonçalves and Silva's studies indicated that in patients with idiopathic chronic neck pain, the fear of movement increases as the joint position sense decreases, despite the fact that there are few and small studies investigating the relationship between fear of movement and joint position sense in the literature (60). Similar to this, Zgören et al. found that in individuals with chronic neck pain, as the sense of joint position decreases, the fear of movement increases (61).

In their study that investigated the correlation between kinesiophobia and physical activity in individuals suffering from chronic neck pain, Demirbükten et al. did not find a correlation between kinesiophobia and neck pain. It was shown in the same study that there was no correlation between the level of physical activity and pain intensity (43).

In this study, neither kinesiophobia nor the level of physical activity was significantly correlated with the presence of either chronic pain or acute pain. There was no association between the pain score and anything other than VAS activity and amount of physical activity in patients with chronic neck pain. It has been demonstrated that in people with chronic neck pain, the VAS activity score rises significantly when their level of physical activity rises. In people with acute neck pain, there was no correlation between VAS scores and activity level that was statistically significant.

The people's increased fear of movement increases their psychological perception of pain and makes them more likely to avoid performing that action. Thus, the person avoids movement and exercise, this orientation causes an increase in pain and disability in the person. This leads to a worsening of the person's functional status. That's why it's extremely important to identify and prepare to treat your fear of movement (62).

In the study by Reddy et al., it was found that cervical joint position errors were considerably higher in all areas compared to asymptomatic individuals in individuals with nonspecific chronic neck pain (63).

According to research by Portelli et al., individuals with neck pain had head repositioning accuracy that was worse than that of the healthy group in all directions of motion (64).

The study was not sufficiently populated with participants, according to Chen and Treleaven, who found no differences in the sense of joint position between the group with chronic neck pain and the control group in terms of joint position sense (65).

In their study of 20 older adults with chronic neck pain and 20 elderly people without neck pain, Uthairakul et al. performed the joint position sense error test. The study's findings are shown along with the error values that were acquired after the extension and right- and left-rotation motions. It was showed that the calculated three different error values were higher in the neck pain group than in the pain-free group. The joint position sense error values between the groups, however, were not found to be statistically significant (66).

In one study, three different joint position sense tests were used, including head repositioning and two different target angle tests. The finding showed that in all three tests, people with chronic neck pain made more errors than the asymptomatic control group. The joint position sense test error rates in individuals with chronic neck pain have also been demonstrated to be unrelated to outcomes such as pain, disability, fear of movement, anxiety, depression, and quality of life (12).

In individuals with chronic neck pain, Asiri et al. discovered a strong correlation between fear of movement and joint position errors, with the exception of flexion

direction. Additionally, they showed in this research that in people with chronic neck pain, there is a strong correlation between fear of movement and pain intensity (45).

Another randomized control study discovered that proprioceptive training using a gaze direction recognition exercise in conjunction with conventional physical therapy was more effective than standard physical therapy for people with chronic neck pain in terms of reducing neck disability and improving balance than the former (67).

Another study found no relationship between the findings of the joint position sense evaluation and the neck disability index, the kinesiophobia, or VAS scores in individuals with chronic pain (12).

In this study, four different joint position sense tests, two different head repositioning tests and two different target angle tests, were used to evaluate the proprioceptive sense of individuals. According to our findings, there is no significant difference between the error rates of individuals suffering from chronic neck pain and those with acute neck pain in any of the four tests.

Our findings also show that there is no correlation between the joint position sensing test error rates in individuals suffering from chronic neck pain with the intensity of pain, movement fear, or physical activity of the individuals. In our study, we found no correlation between the levels of neck disability in individuals suffering from chronic neck pain and the error rates in the other three position sense tests. However, we did find a significant correlation between the error rates in the extension to neutral head repositioning test and the level of neck disability in individuals suffering from chronic neck pain.

Similar to these findings, our findings in patients with acute neck pain indicate that there is no correlation between the joint position sense test's error rates and the individuals' levels of pain, disability, fear of movement, or physical activity. We did not come across any evaluations of joint position sense in people with nonspecific acute neck pain when we searched the literature.

We did not compare the joint position sense test error rates between groups of people with acute and chronic neck pain and a control group, in opposed to research in the literature, because our control group was not asymptomatic. As a result, we aimed to

contribute to more effective planning of referrals and rehabilitation for people with acute and chronic neck pain. Therefore, we wanted to observe the individuals with acute and chronic pain and found effective factors that play a role in the chronicity of pain in non-specific neck pain in this study.

In both asymptomatic and individuals suffering from chronic neck pain, Amiri Arimi et al. investigated the correlation between cervical joint position errors and the strength and size of the neck flexor muscles. They showed that, in opposed to the asymptomatic group, the chronic neck pain group had reduced muscle strength and size, but that there was no correlation between joint positioning errors and any of these parameters (46).

Proprioception differed significantly between the groups of people with chronic neck pain, according to Ghamkhar et al., although there was no correlation between proprioception and neck flexion muscular endurance (68).

When participants in our study with acute and chronic neck pain were evaluated, it was found that those with acute neck pain had much lower muscle endurance than those with chronic neck pain. However, in people with either acute or chronic neck pain, there was no correlation between muscle endurance and joint position errors.

The relationship between kinesthetic cervical sensibility, active joint range of motion, and oculomotor function in people with whiplash injury was investigated in a study conducted using the few studies investigating the relationship between joint position sense and joint range of motion in people with neck pain. A correlation that is positive was found (69).

Özgören et al. showed that in people with chronic neck pain, reduced range of motion had a negative effect on joint position sense. They thought that the reason for this was that the limitation of cervical motion caused physiological and morphological changes in soft tissues and its integration with the central nervous system could not be achieved due to impaired proprioceptive information from muscle spindle, golgi tendon organ, cutaneous and joint receptors (61).

According to the study by Karaağaç, the reduced neck active range of motion, less pain threshold and tolerance, less muscle strength, and loss of proprioception in people

with chronic neck pain may be to responsible for the greater neck disability score they experience compared to people without symptoms (70).

We showed that in individuals suffering from chronic neck pain, decreased right rotation and left rotation range of motion, as well as increased flexion and left rotation, had a negative effect on joint position sense. Furthermore, we showed that increased flexion range of motion was negative to joint position sense in individuals suffering from acute chronic neck pain.

In a systematic review that was published in 2015, it was indicated that variations in study methodology and how tests like joint movement speed were performed may be to responsible for the variable outcomes in joint position error test results in people with neck pain (71). Until now, no information was given about the speed of movement in the studies on the subject. In our study, participants were told to perform the movement at a normal pace without being too fast.

In a systematic review, Vries et al. found that when the head repositioning error test was done with at least 6 repetitions, the error findings were higher in the neck pain group than in the control group (71). In order to avoid test adaptation and memorization effects, and based on the fact that it was done with 3 repetitions in other studies in the literature, the evaluation was performed in our study by taking the average of 3 repetitions during testing. This was done because the test is lengthy and 6 repetitions may make participants less willing to participate in the study.

Hesby et al. found in a systematic review that people with neck pain had less active joint range of motion than those in the control group (72).

When Beltran-Alacreu et al. classified patients with chronic neck pain according to the neck disability score, it was showed that all patients with chronic neck pain had less cervical joint range of motion than the asymptomatic control group (73).

When compared to the control group, individuals with neck pain had less active joint range of motion for rotation, according to Rampazo et al. According to their findings, different assessment techniques may be to responsible for the absence of multidirectional decreased range of motion in neck pain sufferers compared to other studies (74).

De Pauw et al. demonstrated that patients with whiplash-related neck pain only had decreased active range of motion in the direction of flexion and right lateral flexion. This is in contrast to people with nonspecific neck pain (75).

There is a lot of evidence in the literature that individuals with neck pain have less range of motion (76–79).

A motor method to manage pain, preserve cervical stability, and lessen the likelihood of increasing damage to the tissues of the cervical spine is thought to be the restriction of joint range of motion in neck pain patients (80,81).

In this study, the range of motion of those with acute and chronic neck pain was compared. Like other research in the literature, ours lacked a group of participants who were asymptomatic. As a consequence, other than the right rotation range of motion, there was no difference between the groups. In opposed to people with chronic neck pain, those with acute neck pain had a smaller range of motion in the right rotation. According to the neck disability index, it was found that there was no significant different in joint range of motion between people with acute and chronic pain.

With the exception of right lateral flexion, there was no correlation between the Tampa kinesiphobia score and any other joint ranges of motion in individuals with chronic neck pain. It has been reported that increasing fear of movement has a negative impact on right lateral flexion in persons with chronic neck pain.

The tampa kinesiphobia scores and range of motion in the group of individuals with acute neck pain were not significantly correlated in our research. The information we could find on this topic was limited because there aren't many studies in the literature involving people who have non-specific acute neck pain.

Similar to our study, Parazza et al. classified the patients into two groups (acute-subacute, chronic) based on how long they had been experiencing neck pain. They assessed the patients' cervical area muscle endurance. They discovered that the two groups' flexor muscle endurance did not significantly differ from one another (54).

In this study, those with chronic neck pain had significantly stronger cervical flexor muscle endurance than those with acute neck pain. The inclusion of subacute individuals in the comparison group in the study by Parazza et al. made us think that such

a difference might have been created between the results. We observed that some individuals with acute neck pain included in our study could not keep their necks in flexion even for a short time due to severe pain, which may also explain the significant difference. Additionally, there was no significant difference between the groups when people with acute and chronic neck pain were classified as mild and moderate according to their neck disability index.

There was a correlation between pain intensity and cervical flexor muscle endurance in people with neck pain, according to a study investigating the effect of pain intensity on that muscle's endurance (63).

Except for VAS activity, there was no statistically significant difference between VAS scores and neck flexor muscle endurance in this study's participants with acute neck pain. It was found that in people with acute neck pain, an increase in VAS activity score had a negative effect on neck flexor muscle endurance. Pain intensity and muscle endurance were similar in people with chronic neck pain.

Gong et al., in a study investigating whether there is a correlation between deep neck flexor endurance and extension and flexion ranges of motion in college students, indicated that the flexor neck endurance also increased significantly when the extension and extension and flexion ranges of motion increased. In addition, they showed that the level of neck disability decreased when the extension range of motion increased (82).

In this study, when the range of motion of extension and left lateral flexion was increased in people with chronic neck pain, there was a statistically significant increase in flexor muscle endurance. In our investigation, there was no correlation between neck joint range of motion and endurance in people with acute neck pain. The level of neck disability in both groups did not correlate with the neck joint's range of motion.

In a study by Can and Tuna (83), they stated that they could not find a significant difference when they investigated the correlation between healthy people's level of physical activity and neck flexor muscle endurance.

In our study, there was no significant difference between the activity levels of those with acute and chronic neck pain. There was no correlation between physical activity and endurance in people with either acute or chronic neck pain.

Neck pain is a health problem that negatively affects people's quality of life. Pain reduces the functionality of people and prevents their active participation in social life. With the chronicity of pain, both the problems in the musculoskeletal system increase and the neural system is affected. Abnormal afferent input is provided due to chronic pain in the cervical region, which is rich in mechanoreceptors. At the same time, chronic pain causes delayed responses at the cortical level (84). As a result of all these effects, it is understood that chronic neck pain will affect people's life in different ways.

The correlation between pain, kinesophobia, and proprioception in individuals with acute and chronic neck pain is not reported in the literature. This study aimed to evaluate the variables of pain, kinesiophobia, and proprioception, which may contribute to the chronicity of neck pain and limitations on daily activities in people with acute and chronic neck pain, as well as to identify any factors which may act as triggers for pain and activity limitations.

We did not compare the results from the groups of participants with acute and chronic neck pain with a control group, in opposed to research in the literature, because we lacked an asymptomatic control group. As a result, we intended to contribute to more effective planning of referrals and rehabilitation for people with acute and chronic neck pain. Therefore, we wanted to observe the effective factors that play a role in the chronicity of pain in non-specific neck pain in this study.

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7. APPENDICES

7.1. Ethical Committee Approval



T.C.
YEDİTEPE ÜNİVERSİTESİ REKTÖRLÜĞÜ
Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu

Sayı : E.83321821-805.02.03-136
Konu : Etik Kurul Karar Yazısı

Sayın Dr. Öğr. Üyesi Feyza Şule Hantal

Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kuruluna etik onay için başvuru yapılmış olan araştırma önerisinin başlığı, araştırmacılar, başvuru numarası, sunulan belgeler ve toplantı bilgileri aşağıda yer almaktadır. İlgili araştırma önerisi, etik kurulumuz üyeleri tarafından değerlendirilmiş olup, etik ve bilimsel açıdan **UYGUN** olduğuna karar verilmiştir.

Araştırma Başlığı:	Akut ve Kronik Non-Spesifik Boyun Ağrısı Olan Bireylerde Ağrı, Proprioepsiyon ve Kinezyofobi Arasındaki İlişkinin İncelenmesi
Araştırmacılar:	Fzt. Tansu Alemdar, Dr. Öğr. Üyesi Feyza Şule Badıllı Demirbaş
Başvuru Numarası:	202112132

TOPLANTI BİLGİLERİ			
Toplantı Tarihi:	14.01.2022	Toplantı Yeri:	Çevirim içi (Google Meet)

SUNULAN BELGELER	
Islak imzalı başvuru dosyası, CD veya USB belleğe kaydedilmiş başvuru dosyası ve elektronik başvuru	
Araştırma başlığı ve araştırmacıların isimleri	
Başvuru dilekçesi	
Başvuru formu	
Araştırmanın;	
• Niteliği	
• Önemi ve özgün değeri	
• Amaç ve hedefleri	
• Yöntemi	
• Yönetimi	
• Yaygın etkisi	
• Araştırma bütçesi (Mevcutsa)	
• Süresi ve uygunluğu (Zaman cetveli)	
• Kaynakları	

Bu belge, güvenli elektronik imza ile imzalanmıştır.

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Bilgi İçin: Sevgi BAYRAKTAR

Unvan: Uzman Yardımcısı

Telefon No: (0216) 578 00 00 / 6347



Bilgilendirilmiş Gönüllü Olur Formu (yapılan araştırmaya özel olarak hazırlanmış)
Taahhütname-1 Araştırmanın yapılacağı kurumdan izin alma sorumluluğunun araştırmacılara ait olduğuna dair taahhüt
Taahhütname-2 Dünya Tıp Birliği Helsinki Bildirgesinin son versiyonunun ve Sağlık Bakanlığı'nın ilgili tüm kılavuzlarının okunmasına dair taahhüt
Taahhütname-3 Daha önce yapılmış etik kurul başvuruları mevcut olup olmadığına dair taahhüt
Taahhütname-4 Araştırma sırasında araştırma bütçesinde yer almayan ve gönüllünün kendisine veya Sosyal Güvenlik Kurumuna ek yük getirecek hiçbir işlem uygulanmayacağına dair taahhüt
Taahhütname-5 COVID-19 hastalarında tedavi yaklaşımları ve bilimsel araştırmalar genelgesi okunmasına dair taahhüt
Taahhütname-6 Millî Eğitim Bakanlığı Araştırma Uygulama İzinleri konulu yazının okunmasına dair taahhüt
Araştırmacıların her birisine ait özgeçmiş formu
Ek belgeler (Varsa kullanılan ölçek)

Prof. Dr. Didem ÖZDEMİR
ÖZENEN
Başkan

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Üye

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7.2. The Tampa Scale for Kinesiophobia (Tampa Kinezyofobi Ölçeği)

Lütfen, her soruda kendinize en uygun olan kutucuğu işaretleyiniz (her soruda yalnızca bir kutucuğu işaretleyiniz). Teşekkür ederiz.

	Kesinlikle katılmıyorum	Katılmıyorum	Katılıyorum	Tamamen katılıyorum
1. Egzersiz yaparsam kendi kendimi sakatlanım diye kaygılanıyorum.	☐	☐	☐	☐
2. Ağrıyla baş etmeye çalışacak olsam, ağrım artar.	☐	☐	☐	☐
3. Ağrımdan dolayı vücudum bana tehlikeli derecede yanlış giden bir şeyler olduğunu söylüyor.	☐	☐	☐	☐
4. Egzersiz yaparsam sanki ağrım hafifleyecekmiş gibi geliyor.	☐	☐	☐	☐
5. İnsanlar benim tıbbi sorunlarımı yeterince ciddiye almıyorlar.	☐	☐	☐	☐
6. Başıma gelen bu olay nedeni ile vücudum hayat boyu risk altında olacak.	☐	☐	☐	☐
7. Ağrının olması her zaman, vücudumu sakatladığım/bir problemim olduğu anlamına gelir.	☐	☐	☐	☐
8. Sırf bazı şeylerin ağrımı artırıyor olması, onların tehlikeli oldukları anlamına gelmez.	☐	☐	☐	☐
9. Kendimi kazara sakatlamaktan korkuyorum.	☐	☐	☐	☐
10. Ağrının artmasını engellemenin en basit ve güvenli yolu gereksiz hareketler yapmaktan kaçınmaktır.	☐	☐	☐	☐
11. Vücudumda tehlike arz eden bir şey olmasaydı, bu kadar çok ağrı hissetmezdim.	☐	☐	☐	☐
12. Ağrıma rağmen, fiziksel olarak aktif olsaydım, durumum daha iyi olurdu.	☐	☐	☐	☐
13. Ağrı, kendimi sakatlamamam için egzersizi ne zaman bırakmam gerektiği konusunda bana sinyal verir.	☐	☐	☐	☐
14. Benim durumumda olan birinin, fiziksel olarak aktif olması pek güvenli değildir.	☐	☐	☐	☐
15. Normal insanların yaptığı her şeyi yapamam, çünkü çok kolay sakatlanırım.	☐	☐	☐	☐
16. Bazı şeyler çok fazla ağrıya neden olsa bile, bunların gerçekte tehlikeli olduklarını düşünmem.	☐	☐	☐	☐
17. Hiç kimse ağrı hissederken egzersiz yapmak zorunda olmamalı.	☐	☐	☐	☐

Tampa Scale for Kinesiophobia

(Miller , Kori and Todd 1991)

1 = strongly disagree

2 = disagree

3 = agree

4 = strongly agree

1. I'm afraid that I might injury myself if I exercise	1	2	3	4
2. If I were to try to overcome it, my pain would increase	1	2	3	4
3. My body is telling me I have something dangerously wrong	1	2	3	4
4. My pain would probably be relieved if I were to exercise	1	2	3	4
5. People aren't taking my medical condition seriously enough	1	2	3	4
6. My accident has put my body at risk for the rest of my life	1	2	3	4
7. Pain always means I have injured my body	1	2	3	4
8. Just because something aggravates my pain does not mean it is dangerous	1	2	3	4
9. I am afraid that I might injure myself accidentally	1	2	3	4
10. Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from worsening	1	2	3	4
11. I wouldn't have this much pain if there weren't something potentially dangerous going on in my body	1	2	3	4
12. Although my condition is painful, I would be better off if I were physically active	1	2	3	4
13. Pain lets me know when to stop exercising so that I don't injure myself	1	2	3	4
14. It's really not safe for a person with a condition like mine to be physically active	1	2	3	4
15. I can't do all the things normal people do because it's too easy for me to get injured	1	2	3	4
16. Even though something is causing me a lot of pain, I don't think it's actually dangerous	1	2	3	4
17. No one should have to exercise when he/she is in pain	1	2	3	4

7.3. Neck Disability Index (Boyun Özürlülük Sorgulama Anketi)

Hastanın Adı Soyadı: _____

Tarih: ____/____/____

Bu sorgulama formu boyun ağrınızın günlük yaşam aktivitelerinizi yerine getirme yeteneklerinizi nasıl etkilediğini anlamamıza yardımcı olacak şekilde tasarlanmıştır. Lütfen her bölümdeki bir kutucuğu işaretleyiniz. Bir bölümde birden çok yanıt kendinize yakın hissetseniz bile, şu anki durumunuza en yakın olan seçeneği işaretleyiniz

Boyunda Ağrı Yoğunluğu A - Şu anda hiç boyun ağrım yok. B - Şu anda çok hafif derecede boyun ağrım var. 1 C - Boyun ağrım orta derecede ve gelip gidiyor. D - Boyun ağrım orta şiddette ve değişkenlik göstermiyor. E - Boyun ağrım şiddetli fakat gelip gidiyor. F - Boyun ağrım şiddetli ve değişkenlik göstermiyor.	Konsantrasyon A - İstediğim zaman dikkatimi hiç zorlanmadan istediğim kadar toplayabiliyorum. B - Hafifçe zorlanarak dikkatimi toplayabiliyorum. 6 C - İstediğim zaman biraz zorlanarak dikkatimi toplayabiliyorum. D - İstediğim zaman epeyce zorlanarak dikkatimi toplayabiliyorum. E - İstediğim zaman dikkatimi toplamakta çok fazla zorlanıyorum. F - Dikkatimi hiç toplayamıyorum..
Kişisel Bakım (giyinme ve temizlenme) A - Ek bir ağrıya neden olmadan kendime bakabiliyorum. B - Kendime normal olarak bakabiliyorum fakat bu ek bir ağrıya neden oluyor. 2 C - Kendi bakımımı yaparken ağrım artıyor, yavaşlıyorum ve dikkatli oluyorum. D - Biraz yardıma ihtiyacım var fakat kişisel bakımımın çoğunu yapabiliyorum. E - Kişisel bakımım ile ilgili işlerin çoğunda her gün yardıma ihtiyacım var. F - Giyinemiyorum. Zorlukla yıkanıyorum ve yataktan çıkıyorum.	İş (Herhangi bir işte çalışmıyorsanız lütfen G seçeneğini işaretleyiniz) A - İstediğim kadar iş yapabilirim. B - Her günlük işlerimi yapabilirim, ama daha fazlasını yapamam. 7 C - Her günlük işlerimin çoğunu yapabilirim, daha fazlasını yapamam. D - Her günlük işlerimi yapamam. E - Herhangi bir işi zorlukla yapabilirim. F - Hiçbir iş yapamam
Yük Kaldırma (boyun ağrınız olmadığı zamanlarda kaldırdığınız ağır yüklerle eşit ağırlıkta) A - Ek bir ağrı hissetmeden ağır yükleri kaldırabiliyorum. B - Ağır yükleri kaldırabiliyorum, fakat ek bir ağrıya neden oluyor. 3 C - Ağır yükleri yerden kaldırmama engel oluyor, fakat yükler, örneğin masa üstü gibi uygun bir yere yerleştirilirse kaldırabiliyorum. D - Ağır ağır yük kaldırmama engel oluyor, fakat hafif ve orta ağırlıktaki yükler örneğin masa üstü gibi uygun bir yere yerleştirilirse kaldırabiliyorum. E - Çok hafif yükleri kaldırabiliyorum. F - Hiçbir şeyi kaldıramıyorum ve taşıyamıyorum.	Araba Kullanma A - Boyun ağrısı hissetmeden araba kullanabiliyorum. B - Boynumda hafif bir ağrı hissi ile istediğim kadar araba kullanabiliyorum. 8 C - Boynumda orta derecede ağrı nedeni ile istediğim kadar araba kullanamıyorum. D - Orta derecede bir boyun ağrısı nedeniyle istediğim kadar araba kullanamıyorum. E - Boynumda şiddetli ağrı nedeniyle güçlükle araba kullanabiliyorum. F - Boyun ağrısı nedeniyle hiç araba kullanamıyorum.
Okuma A - Hiç boyun ağrısı hissetmeden istediğim kadar okuyabiliyorum. B - Hafif bir boyun ağrısı hissederek istediğim kadar okuyabiliyorum. 4 C - Orta derecede boyun ağrısı hissederek istediğim kadar okuyabiliyorum. D - Boynumda orta derecede ağrı nedeniyle istediğim kadar okuyamıyorum. E - Boynumda şiddetli ağrı nedeniyle istediğim kadar okuyamıyorum. F - Boyun ağrısı nedeniyle hiç okuyamıyorum.	Uyku A - Uyku problemim yok. B - Uykum çok hafif bozuk (bir saatten az süreyle biraz bozuk). 9 C - Uykum hafif bozuk (1-2 saat uykusuzluk). D - Uykum orta derecede bozuk (2-3 saat kadar süren uykusuzluk). E - Uykum çok bozuk (3-5 saat süreyle uykusuzluk). F - Uykum tamamen bozuk (5-7 saat süresince uykusuzluktur).
Baş ağrıları A - Hiç baş ağrım yok. B - Sık olmayan hafif baş ağrıları var. 5 C - Orta derecede baş ağrıları var. D - Sık gelen orta derecede baş ağrıları var. E - Sık gelen ağır derecede baş ağrıları var. F - Hemen hemen her zaman baş ağrıları var.	Boş zaman aktiviteleri A - Tüm boş zaman aktivitelerine boynumda ağrı hissetmeden katılabiliyorum. B - Tüm boş zaman aktivitelerine boynumda biraz ağrı hissederek katılabiliyorum. 10 C - Boynumdaki ağrı nedeni ile tüm boş zaman aktivitelerinin bir kısmına katılabiliyorum. D - Boynumdaki ağrı nedeni ile boş zaman aktivitelerinin çok az bir kısmına katılabiliyorum. E - Boynumdaki ağrı nedeni ile boş zaman aktivitelerine hemen hemen hiç katılamıyorum. F - Hiç bir aktiviteye hiç bir şekilde katılamıyorum.

Clinimetric properties of the Turkish translation of a modified neck disability index. Kesiktas NI, Ozcan E, Vernon H BMC Musculoskelet Disord. 2012 Feb

NECK DISABILITY INDEX

THIS QUESTIONNAIRE IS DESIGNED TO HELP US BETTER UNDERSTAND HOW YOUR NECK PAIN AFFECTS YOUR ABILITY TO MANAGE EVERYDAY -LIFE ACTIVITIES. PLEASE MARK IN EACH SECTION THE **ONE BOX** THAT APPLIES TO YOU. ALTHOUGH YOU MAY CONSIDER THAT TWO OF THE STATEMENTS IN ANY ONE SECTION RELATE TO YOU, PLEASE MARK THE BOX THAT **MOST CLOSELY** DESCRIBES YOUR PRESENT -DAY SITUATION.

SECTION 1 - PAIN INTENSITY

- ☐ I have no pain at the moment.
- ☐ The pain is very mild at the moment.
- ☐ The pain is moderate at the moment.
- ☐ The pain is fairly severe at the moment.
- ☐ The pain is very severe at the moment.
- ☐ The pain is the worst imaginable at the moment.

SECTION 2 - PERSONAL CARE

- ☐ I can look after myself normally without causing extra pain.
- ☐ I can look after myself normally, but it causes extra pain.
- ☐ It is painful to look after myself, and I am slow and careful.
- ☐ I need some help but manage most of my personal care.
- ☐ I need help every day in most aspects of self -care.
- ☐ I do not get dressed. I wash with difficulty and stay in bed.

SECTION 3 - LIFTING

- ☐ I can lift heavy weights without causing extra pain.
- ☐ I can lift heavy weights, but it gives me extra pain.
- ☐ Pain prevents me from lifting heavy weights off the floor but I can manage if items are conveniently positioned, ie. on a table.
- ☐ Pain prevents me from lifting heavy weights, but I can manage light weights if they are conveniently positioned.
- ☐ I can lift only very light weights.
- ☐ I cannot lift or carry anything at all.

SECTION 4 - WORK

- ☐ I can do as much work as I want.
- ☐ I can only do my usual work, but no more.
- ☐ I can do most of my usual work, but no more.
- ☐ I can't do my usual work.
- ☐ I can hardly do any work at all.
- ☐ I can't do any work at all.

SECTION 5 - HEADACHES

- ☐ I have no headaches at all.
- ☐ I have slight headaches that come infrequently.
- ☐ I have moderate headaches that come infrequently.
- ☐ I have moderate headaches that come frequently.
- ☐ I have severe headaches that come frequently.
- ☐ I have headaches almost all the time.

SECTION 6 - CONCENTRATION

- ☐ I can concentrate fully without difficulty.
- ☐ I can concentrate fully with slight difficulty.
- ☐ I have a fair degree of difficulty concentrating.
- ☐ I have a lot of difficulty concentrating.
- ☐ I have a great deal of difficulty concentrating.
- ☐ I can't concentrate at all.

SECTION 7 - SLEEPING

- ☐ I have no trouble sleeping.
- ☐ My sleep is slightly disturbed for less than 1 hour.
- ☐ My sleep is mildly disturbed for up to 1-2 hours.
- ☐ My sleep is moderately disturbed for up to 2-3 hours.
- ☐ My sleep is greatly disturbed for up to 3-5 hours.
- ☐ My sleep is completely disturbed for up to 5-7 hours.

SECTION 8 - DRIVING

- ☐ I can drive my car without neck pain.
- ☐ I can drive as long as I want with slight neck pain.
- ☐ I can drive as long as I want with moderate neck pain.
- ☐ I can't drive as long as I want because of moderate neck pain.
- ☐ I can hardly drive at all because of severe neck pain.
- ☐ I can't drive my car at all because of neck pain.

SECTION 9 - READING

- ☐ I can read as much as I want with no neck pain.
- ☐ I can read as much as I want with slight neck pain.
- ☐ I can read as much as I want with moderate neck pain.
- ☐ I can't read as much as I want because of moderate neck pain.
- ☐ I can't read as much as I want because of severe neck pain.
- ☐ I can't read at all.

SECTION 10 - RECREATION

- ☐ I have no neck pain during all recreational activities.
- ☐ I have some neck pain with all recreational activities.
- ☐ I have some neck pain with a few recreational activities.
- ☐ I have neck pain with most recreational activities.
- ☐ I can hardly do recreational activities due to neck pain.
- ☐ I can't do any recreational activities due to neck pain.

7.4. International Physical Activity Questionnaire (Short) (Uluslararası Fiziksel Aktivite Anketi (Kısa))

Hastanın Adı Soyadı: _____ Tarih: ____/____/____

İnsanların günlük yaşayış içinde yaptıkları fiziksel aktiviteler hakkında bilgi edinmek istiyoruz. Aşağıda son 7 gün içinde fiziksel olarak harcanan zaman hakkında sorular bulunmaktadır. Lütfen, kendinizi çok hareketli bir kişi olarak görmesiniz bile her soruyu cevaplayın. Ev ve bahçe işlerinizi, işyerinde yaptığınız aktiviteleri, bir yerden bir yere gitmek için yaptıklarınızı, boş zamanlarınızda yaptığınız egzersiz veya spor gibi aktiviteleri düşünün.

Son 7 gün içinde 10 dakika veya üstünde süren, nefesinizi hızlandıran, kuvvet gerektiren tüm yoğun faaliyetleri göz önünde bulundurun.

1	Son bir hafta içinde kaç gün ağır kaldırma, kazma, aerobik, basketbol, futbol veya hızlı bisiklet çevirme gibi şiddetli bedensel güç gerektiren faaliyetlerden yaptınız?	☐ Şiddetli fiziksel aktivite yapmadım. (3. Soruya Geçiniz )	Haftada _____ gün
2	Bu günlerin birinde şiddetli fiziksel aktivite yaparak genellikle ne kadar zaman harcadınız?	☐ Bilmiyorum/Emin değilim	Günde _____ dakika Günde _____ saat
Geçen bir hafta içinde yaptığınız orta dereceli fiziksel aktiviteleri düşünün. Bunlar 10 dakika veya daha uzun süren, orta derece fiziksel güç gerektiren ve normalden biraz sık nefes almaya neden olan aktivitelerdir.			
3	Son bir hafta içinde kaç gün hafif yük taşıma, normal hızda bisiklet çevirme, halk oyunları, dans, bowling veya tenis gibi orta dereceli bedensel güç gerektiren faaliyetlerden yaptınız? (Yürüme hariç.)	☐ Orta dereceli fiziksel aktivite yapmadım. (5. Soruya Geçiniz )	Haftada _____ gün
4	Bu günlerin birinde orta dereceli fiziksel aktivite yaparak genellikle ne kadar zaman harcadınız?	☐ Bilmiyorum/Emin değilim	Günde _____ dakika Günde _____ saat
Geçen bir hafta içinde yürüyerek geçirdiğiniz zamanı düşünün. Bu; işyerinde, evde, bir yerden bir yere ulaşım amacıyla veya sadece dinlenme, spor, egzersiz veya hobi amacıyla yaptığınız yürüyüş olabilir.			
5	Geçen 7 gün içerisinde, bir seferde en az 10 dakika yürüdüğünüz gün sayısı kaçtır?	☐ Yürümedim. (7. Soruya Geçiniz )	Haftada _____ gün
6	Bu günlerden birinde yürüyerek genellikle ne kadar zaman geçirdiniz?	☐ Bilmiyorum/Emin değilim	Günde _____ dakika Günde _____ saat
Son soru, son bir hafta içinde oturarak geçirdiğiniz zamanlarla ilgilidir. İşte, evde, çalışırken ya da dinlenirken geçirdiğiniz zamanlar dahildir. Bu masanızda, arkadaşınızı ziyaret ederken, okurken, otururken veya yatarak televizyon seyrettiğinizde oturarak geçirdiğiniz zamanları kapsamaktadır.			
7	Son bir hafta içinde günde oturarak ne kadar zaman harcadınız?	☐ Bilmiyorum/Emin değilim	Günde _____ dakika Günde _____ saat

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?
____ **days per week**
☐ No vigorous physical activities ➔ **Skip to question 3**
2. How much time did you usually spend doing **vigorous** physical activities on one of those days?
____ **hours per day**
____ **minutes per day**
☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.
____ **days per week**
☐ No moderate physical activities ➔ **Skip to question 5**
4. How much time did you usually spend doing **moderate** physical activities on one of those days?
____ **hours per day**
____ **minutes per day**
☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?
____ **days per week**
☐ No walking ➔ **Skip to question 7**
6. How much time did you usually spend **walking** on one of those days?
____ **hours per day**
____ **minutes per day**
☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?
____ **hours per day**
____ **minutes per day**
☐ Don't know/Not sure

7. CIRRUCULUM VITAE

Personal Informations

Name	TANSU	Surname	ALEMDAR
Place of Birth			
Nationality			
Email			

Educational Informations

	Name of Institution	Year
Master of Science (MSc)	Yeditepe University Health Science Institute, Sports Physiotherapy and Rehabilitation Department	2019-2022
Bachelor of Science (BSc)	Yeditepe University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation	2012-2017

Work Experience

Physiotherapist	Yeditepe University, Koşuyolu Hospital, Physical Therapy Service	2018-Current
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Language	Reading*	Speaking*	Writing*	KPDS/UD S Score	(17) Score
English	Good	Basic	Basic		72.50

*Very Good, Good, Basic

Computer skills

Program	Ability to use
Microsoft Office	Very Good

Publications / Notices Certificates / Awards

3.Ulusal Fizyoterapi ve Rehabilitasyon Kongresi/Yeditepe Üniversitesi (03.05.2015-05.05.2015)
Kinesio Taping Basic (KT1-2) (12.10.2019-13.10.2019)
Fonksiyonel Bantlama Kursu/Acıbadem Sports (18.11.2017-19.11.2018)
Ön Çapraz Bağ Yaralanması ve Rehabilitasyonu Sempozyumu/Acıbadem Sports (22.10.2019-23.10.2019)
Modifiye Pilates Kursu Matwork Seviye 1 (22.10.2019-23.10.2019)
Trigger Point Treatment in Musculoskeletal Pain (20.10.2018-21.10.2018, Ümit Erkut)
ICH-GCP Hazırlık Kursu E6(R2)- Good Clinical People LTD. (2025)
NS Pharma study Investigator Meeting (in Nice, France) (2020)
Hand Held Dynametry Clinical Evaluator Certification (2022)
Timed Function Tests Clinical Evaluator Certification (2022)
North Star Ambulatory Assessment Clinical Evaluator Certification (2022)
6 Minute Walk Test Clinical Evaluator Certification (2022)
BAYLEY's Motor Function Assesment Clinical Evaluator Certification (2020)
PUL Upper Extremity Motor Function Assesment Clinical Evaluator Certification (2020)
Pulmonary Function Test Training (PFT) (2021)
Chop İntend Upper Extremity Motor Function Assesment Clinical Evaluator Certification (2020)
Hammer Smith Motor Function Assesment Clinical Evaluator Certification (2020-2021)
RP Training for Biogen 23SM201 Study (2021)
Respiratory Inductance Plethysmography (RP) Training for Roche FIREFISH Study (2020)
Revised Upper Limb (RULM) Training Clinical Evaluator Certification (2020-2021)
Motor Function Test (MFM) Training Clinical Evaluator Certification (2020-2021)
Randomized, Double –blind , Placebo Controlled,Multicenter Study to Asses the Efficacy and Safety of Viltolarsen in Ambulant Boys with Duchene Muscular Dystrophy(DMD) (Clinical Evaluator, 2020 – devam ediyor)
An Open-Label study to Assess the Efficacy, Safety,Tolerability and Pharmacokinetics of Multiple Dooses of ISIS396443Delivered Intrathecallyto Subjects with Genetically Diagnosed and Presymptomatic Spinal Muscular Atropy (Clinical Evaluator, 2021-devam ediyor)
A Two-Part Seamless, Multi-Center Randomized, Placebo-Controlled, Doubleblind Study to Investigate the Safety, Tolerability, Pharmacokinetics, Pharmacodynamics and Efficacy Of Risdiplam (RO7034067) in Type 2 and 3 Spinal Muscular Atrophy Patients. (Clinical Evaluator, 2020-devam ediyor)

A Two-Part Seamless, Open-Label, Multi-Center Randomized,, Study to investigate the Safety, Tolerability, Pharmacokinetics, Pharmacodynamics and Efficacy Of Risdiplam (RO7034067) in Infants with Type 1 Spinal Muscular Atrophy (Clinical Evaluator, 2020-devam ediyor)
A Phase 2 Open-label Study to Assess the Safety, Tolerability, and Efficacy of Viltolarsen in Ambulant and Non-Ambulant Boys with Duchenne Muscular Dystrophy (DMD) Compared to Natural History Controls. (Clinical Evaluator, 2021-devam ediyor)
Phase 3, Multicenter, Open-Label Extension Study to Assess the Safety and Efficacy of Viltolarsen in Ambulant Boys with Duchenne Muscular Dystrophy (DMD) . (Clinical Evaluator, 2020-devam ediyor)
Dynamic Neuromuscular Stabilization Yoga Course (DNS Prague School) (24.09.2021-25.09.2021)
Brian Mulligan's Concepts Upper Quadrant (Mulligan Manuel Therapy Concept) (21-23.03.2022)
Brian Mulligan's Concepts Lower Quadrant (Mulligan Manuel Therapy Concept) (9-11.11.2022)