The Head and Neck Anatomy

8

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Abstract

The head consists of skull bones, mimic muscles, brain and many nerves, and blood vessels. All the functions we perform with our five senses such as sight, hearing, smell, touch, and taste take place in the head region. In addition, emotions are expressed thanks to the facial muscles. One of the most essential functions performed in the head area is speech. Speech is a fundamental human characteristic that enables communication and social engagement. The only movable bone in the head is the mandible. The movement of the head is mostly owing to its articulation with the neck. It acts as a bridge between the body and the head. Due to their proximity and directly linked functions, the head and neck regions are mentioned together. The head and neck areas are crucial to swallowing function. Therefore, the head provides the realization of many intertwined vital functions with both the contractile and noncontractile structures it contains in the head and neck region. In this chapter, the anatomy of the head and neck region, the muscles it contains, and evidence-based exercises for these muscles will be explained.

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8.1 Noncontractile Structures in the Head and Neck Region

8.1.1 Head Bones

The skeletal system consists of bones, joints, and cartilage structures associated with them. Bone structures not only provide the body structure but also form a support surface for the soft tissue. The bones of the skull consist of cranial bones and facial bones. The cranial bones protect the brain by surrounding it. Through the cavities in the skull, blood vessels and nerves can pass. The facial bones form the face and provide support for functions such as chewing, speaking, and breathing. The head bones are given in the table (Table 8.1).

There are 22 bones in the human skull, excluding the middle ear bones. Except for the mandible, all other bones are immobile. Thanks to the temporomandibular joint it forms with the tempo-

Table 8.1 Head bones

Cranial bones	Facial bones
• Occipital (single) • Frontal (single) • Sphenoid (single) • Ethmoid (single) • Parietal (paired) • Temporal (paired)	• Vomer (single) • Mandible (single) • Lacrimal (paired) • Nasal (paired) • Inferior nasal conchal (paired) • Zygomatic bones (paired) • Maxillae (paired)

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ral and the mandible bones are mobile. The skull also articulates with the vertebral column in the neck region. When viewed from above, the skull displays a single piece of the frontal bone in the front, two connected pieces of parietal bone on the sides, and a single piece of the temporal bone in the back. The junction of bone structures is called a suture. Laterally, the sphenoid and ethmoid bones can be seen. In the anterior part of the skull are the facial bones, including the maxilla, mandible, and zygomatic bone (Fig. 8.1). The maxillary bone comprises the upper jaw. The mandible is the lower jaw. Several facial bones are shared by one or more soft tissues. An anomaly in the facial bone also affects many soft tissues.

In the lower part of the skull are the foramen and the hard palate. The hard palate forms the floor of the nasal cavity and the roof of the mouth. The foramen provides a passageway for the cranial nerves that innervate the blood vessels supplying the head and neck. The mandibular branch of the nervus trigeminalis (V) passes through the foramen ovale. The internal carotid artery and the sympathetic carotid plexus pass through the carotid canal. Just behind the styloid process is the stylomastoid foramen, where the N. facialis (VII) emerges from the skull to the face. The jugular foramen, placed medial to the styloid process, allows the internal jugular vein, the N. glossopharyngeus (IX), the N. vagus (X), and the N. accessorius to pass through (XI). The spinal cord, vertebral arteries, and nerve accessory (XI) go via the foramen magnum, the largest clearance in the lower view (Fig. 8.2).

8.1.2 Temporomandibular Joint (TMJ)

Ginglymoarthrodial diarthrosis formed between the mandible and the temporal bone is a joint. The

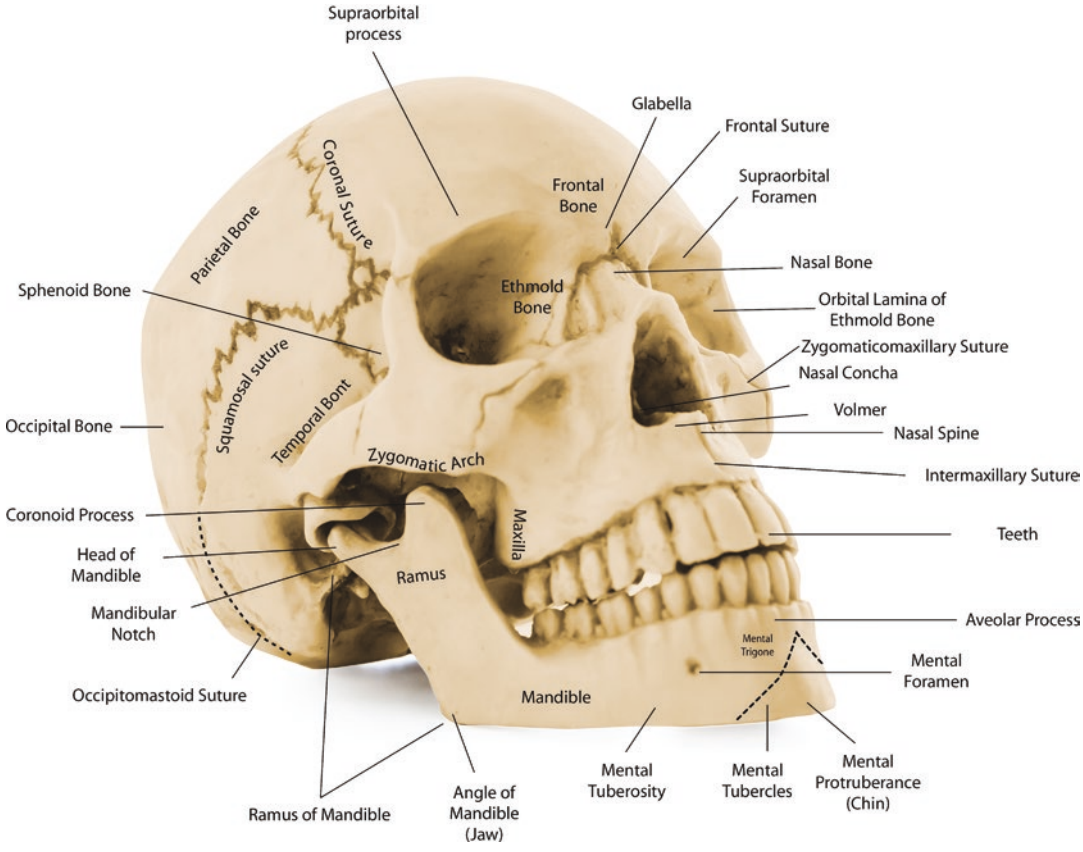


Fig. 8.1 Frontal and lateral view of the skull (Quality Stock Arts/Shutterstock.com)

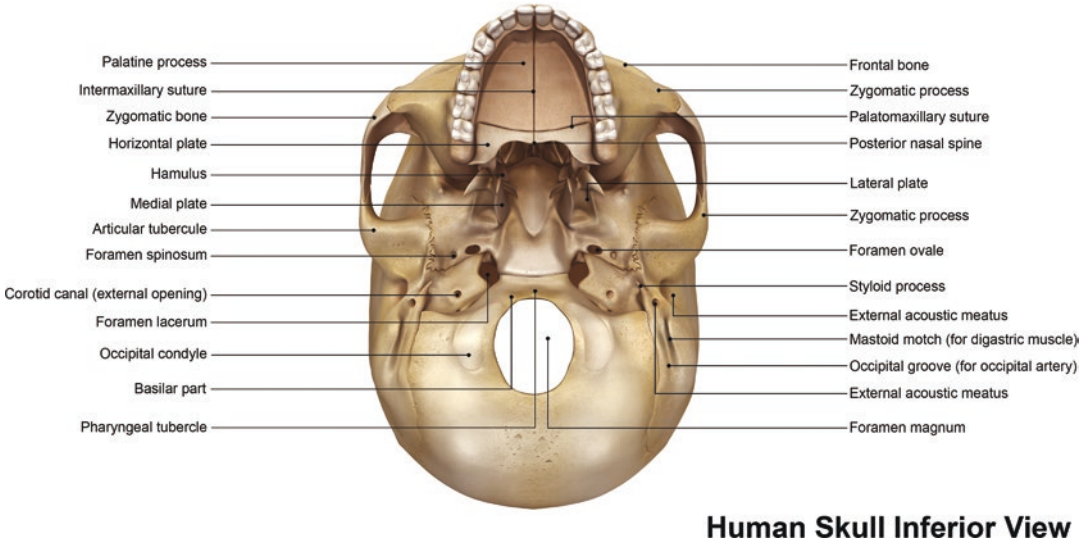


Fig. 8.2 Inferior view of the skull (sciencepics/Shutterstock.com)

TMJ consists of the joint capsule, articular disc, synovial fluid, and several ligaments. The temporal bone forms the cranial surface of the TMJ. The area of temporal bone where the condyle of the mandible articulates is known as the glenoid fossa. The articular disc is placed slightly below the glenoid fossa and covers the condyle of the mandible. It has a biconcave or oval shape. The anterior part of the disc contacts the joint capsule, articular eminence, condyle, and lateral pterygoid muscle. The margins of the cartilaginous disc surround the joint and partially fuse with the fibrous capsule. The joint disc facilitates and regulates the joint's mobility during movement.

Three main ligaments connect the joint to the cranium: the temporomandibular, stylomandibular, and sphenomandibular ligaments. The temporomandibular ligament supports the lateral joint capsule and is regarded as the main connector for the joint. This ligament prevents the mandible from moving backward excessively. The stylomandibular ligament prevents excessive protrusion of the mandibula. The primary function of the sphenomandibular ligament is to hinder excessive translation of the TMJ condyle after the mouth is opened 10°. The other two ligaments tighten when the mandible protrudes, preventing excessive movement (Fig. 8.3). These bonds direct the forces on the TMJ and form proprioceptive afferents. Furthermore, joint capsule receptors, masticatory muscles, skin receptors, and periodontal ligaments contribute to joint proprioception.

During the opening of the mandible, the joint undergoes two fundamental motions: rotation and translation. The first movement of the joint, a 20–25 mm rotation, is followed by translation, which refers to the forward sliding of the joint. A mouth opening of 40–50 mm is considered normal. Trismus refers to the pathology of opening fewer than 35 mm. The TMJ is involved in many functions such as sucking, chewing, swallowing, speaking, breathing, and facial expressions.

8.1.3 Neck Bones

The cervical vertebrae consist of 7 vertebrae located between the skull and the thoracic vertebrae. There are transverse foramens on either side of the vertebral foramen. The vertebral artery passes through these transverse foramens. The first (atlas) and second (axis) cervical vertebrae are specifically defined because of their proximity to the skull and their unusual anatomy. The

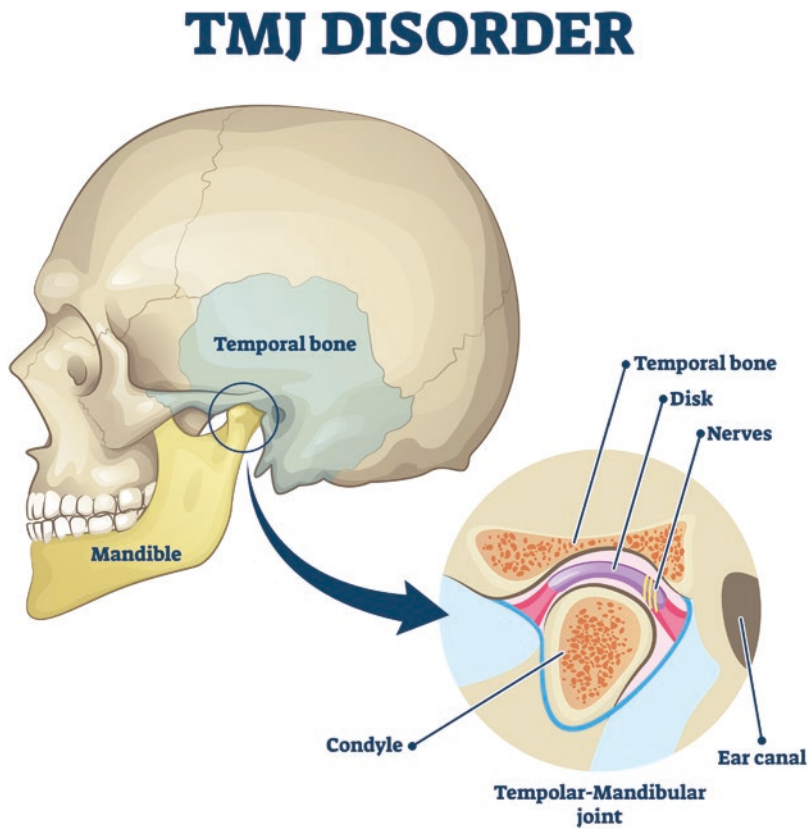


Fig. 8.3 Temporomandibular joint (VectorMine/Shutterstock.com)

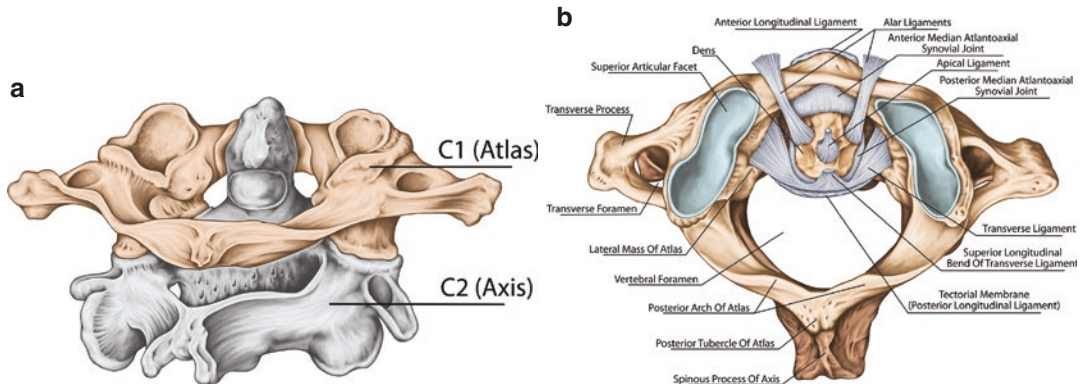


Fig. 8.4 (**a**, **b**) Atlantoaxial joint (stihii for both/Shutterstock.com)

atlas is in the form of an irregular ring connected by a short anterior arch and a longer posterior arch. The axis has a vertical projection called the dens anteriorly. The dens articulates with the anterior arch of the atlas (Fig. 8.4).

Located at the level of the third cervical vertebral, anterior–superior to the thyroid cartilage, the hyoid bone does not articulate with any structure. Many muscles such as the suprahyoid and infrahyoid muscles connect to the hyoid. The

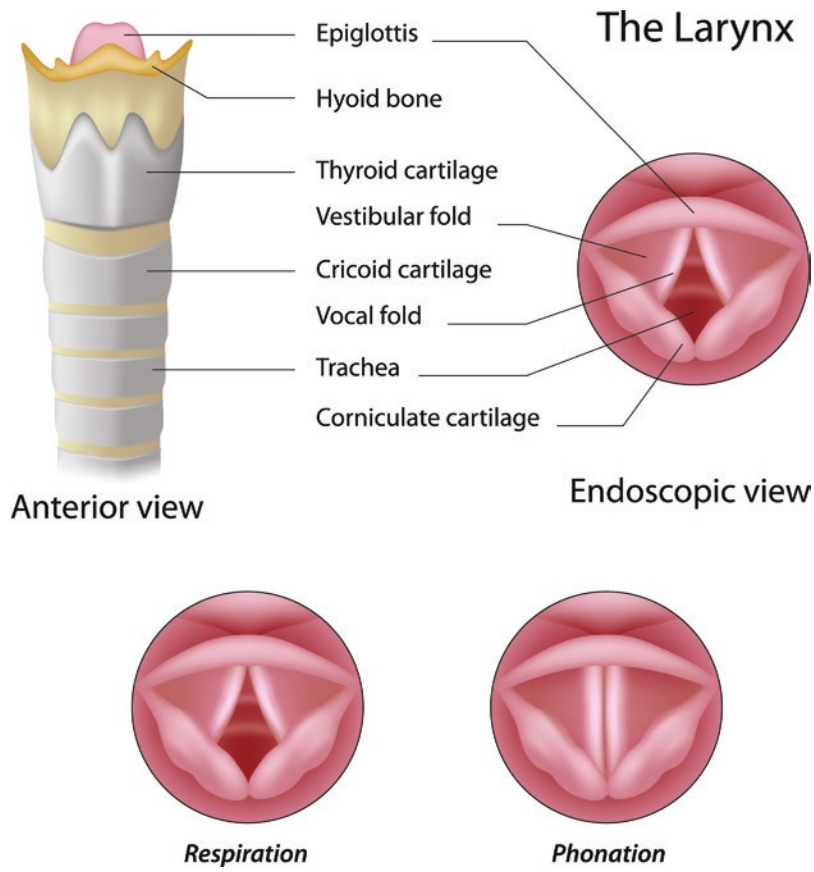


Fig. 8.5 Larynx (Alila Medical Media/ Shutterstock.com)

hyoid bone with its connected muscles forms the base of the tongue. It takes part in functions such as swallowing, chewing, speaking, and breathing. The hyoid bone may rise and fall in response to muscle contraction and function. The epiglottis is the cartilage structure at the base of the tongue. This structure forms the root of the tongue and the anatomical cavity called the vallecula. It undergoes retroflexion with the effect of gravity during swallowing. The movement of the epiglottis is facilitated by the elevation of the larynx, its contact with the base of the tongue, and the weight and movement of food passing over it. Epiglottis movement helps to close the airway during swallowing. Vocal cords are responsible for primary phonation. During swallowing, it abducts and closes the airway (Fig. 8.5).

8.2 Contractile Structures in the Head and Neck Region

Muscles contract and relax by innervation of the corresponding nerves. They cause movement of soft tissue or bones along with contraction. It is essential to understand where the muscle starts and where it ends. Origin is often connected to the structure that moves the least. The opposite end of the muscle, the insertion, is the more movable part. Generally, when the muscle contracts, it moves from the insertion to the origin. The head and neck region are divided into six main groups based on their functions: mimic muscles, chewing muscles, tongue muscles, hyoid muscles and pharynx muscles, and cervical muscles. The muscles of the ear, eye, and nose are not included.

8.2.1 Mimic Muscles

Mimic muscles are the muscles humans use to express themselves and their emotions (Fig. 8.6). These muscles also contribute to the functions of speaking, chewing, and swallowing. Innervation of all mimic muscles is provided by N. facialis (VII). Both halves of the face are innervated separately. Mimic muscles are given in the table (Table 8.2). The sensation of the face is received by the branches of the trigeminal nerve and cervical plexus.

8.2.2 Chewing Muscles

The chewing muscles consist of four muscles attached to the mandible: M. masseter, M. temporalis, M. pterygoideus medialis, and M. pterygoideus lateralis (Fig. 8.7). The masseter is the strongest of the chewing muscles. The temporomandibular joint enables mandibular movements while chewing (TMJ). Therefore, pathologies of these muscles may be related to TMJ dysfunctions. The table below lists the chewing muscles (Table 8.3).

8.2.3 Hyoid Muscles

The hyoid muscles attach to the hyoid bone and assist functions such as chewing, swallowing, and speaking. The muscles are divided into two based on the way they are attached to the hyoid bone from above or below: suprahyoid and infrahyoid. During swallowing, the suprahyoid muscles are primarily responsible for elevating the hyolarynx. By closing the airway in this manner, safe swallowing is maintained. The infrahyoid muscles, on the other hand, operate as a suspension during hyoid movement, ensuring smooth and fluent movement. Additionally, when the hyoid bone is fixed, the suprahyoid muscles also act as mouth opening. The hyoid muscles and their innervations are given in the table (Table 8.4).

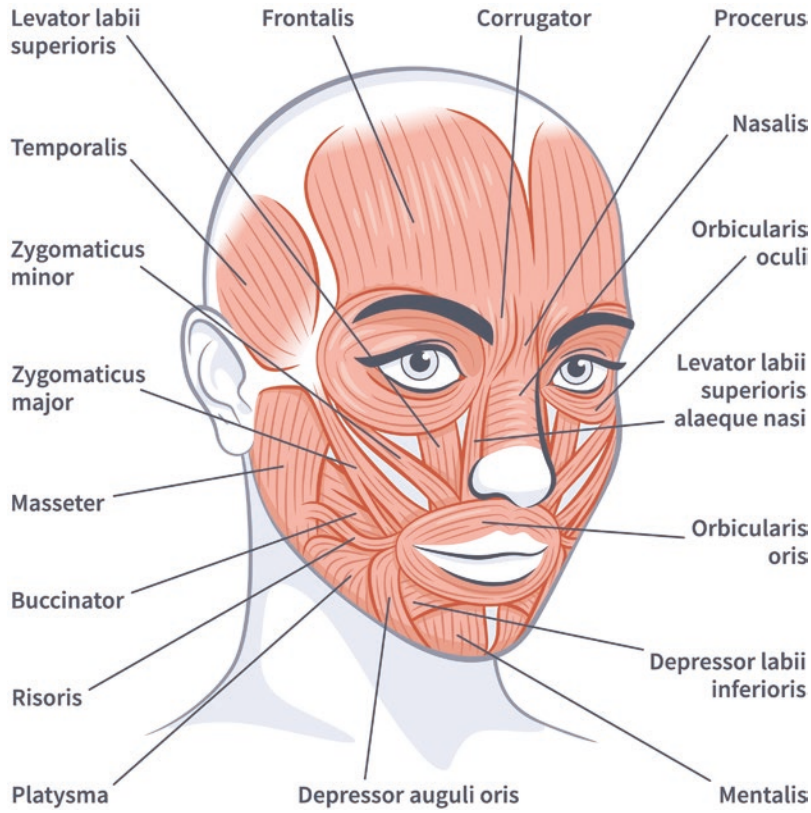


Fig. 8.6 Mimic muscles (ORLY Design/ Shutterstock.com)

Table 8.2 Mimic muscles

Muscle	Function	Sensation
Mentalis	Depression and outward movement of the lower lip, wrinkling of chin skin	It expresses emotions such as sadness and doubt
Platysma	It depresses the mandible and the rim of the mouth It stretches the lower face and anterior neck area	It helps to express many emotions such as fear and surprise
Frontalis	Primary eyebrow elevation	It serves to raise an eyebrow during the confusion. It works vertically and creates horizontal lines on the forehead
Corrugator	It pulls eyebrows down and inward	It is the main muscle that expresses pain. It creates vertical ridges on the nose when the eyebrows are frowned upon (vertical ridges)
Procerus	It pulls eyebrows down	It creates horizontal wrinkles on the nose as it ends in the skin on the nasal bridge
Buccinator	It pushes the cheeks into the oral cavity	It enables blowing. It helps regulate intraoral pressure
Orbicularis oris	It closes and shrinks lips	It allows moving the lips, blowing, and kissing while speaking
Orbicularis oculi	It consists of three parts. The largest part is responsible for eye closure. Its upper part is called the depressor supercilii. It helps to pull the eyebrows down	It is used for voluntary tight eye closure, bringing the eyebrows slightly closer together and pulling them down
Risorius	It pulls the corner of the mouth laterally	It helps with expressions such as smiles and grins
Levator labii superioris	It elevates the upper lip	It allows the emergence of maxillary teeth. It is used to express emotions such as smiling and arrogance
Levator anguli oris	It elevates the corner of the mouth	It helps to smile
Depressor anguli oris	It depresses the corner of the mouth	It allows the expression of emotions such as sadness and anger
Depressor labii inferioris	It depresses the lower lip	It allows the expression of emotions such as sadness
Zygomaticus major	It elevates the corner of the mouth posterior-superiorly	It helps to smile
Zygomaticus minor	It elevates the upper lip	It allows the emergence of maxillary teeth. It is used to express emotions such as smiling and arrogance

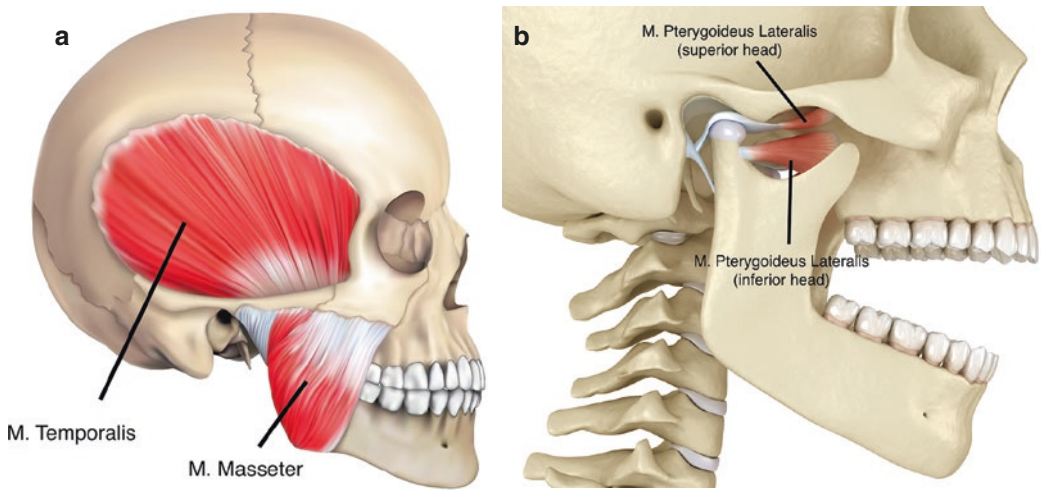


Fig. 8.7 (**a**, **b**) Chewing muscles (RuMax/Shutterstock.com) (**a**), (Alex Mit/Shutterstock.com) (**b**)

Table 8.3 Chewing muscles

Muscle	Origin-insertion	Function
Masseter	**Origin:** Maxilla, inferior zygomatic arch **Insertion:** Lateral surface of mandibular ramus	Elevation of the mandible Superficial fibers: Mandible protrusion
Temporalis	**Origin:** Temporal fossa **Insertion:** Coronoid process of the mandible	Anterior and middle fibers: Mandible elevation Posterior fibers: Mandible retraction
Pterygoideus lateralis	**Origin:** Superior part: Infratemporal part of the greater wing of the sphenoid bone Inferior part: Lateral surface of the sphenoid bone **Insertion:** Superior part: Temporomandibular joint capsule Inferior part: Mandibular condyle	Mandible depression Superior part: Stabilizing the condyle and disc during elevation
Pterygoideus medialis	**Origin:** Medial surface of the maxilla and sphenoid bone **Insertion:** Medial aspect of mandibular ramus	Mandible elevation and protrusion

Table 8.4 Hyoid muscles

Muscle		Origin	Insertion	Innervation
Suprahyoid muscles	Mylohyoid	Mandibula	Hyoid bone	By the mylohyoid nerve of the mandibular branch of the trigeminal nerve
	Digastric	**Anterior belly:** Intermediate tendon **Posterior belly:** Mastoid notch of the temporal bone	**Anterior belly:** Medial surface of the mandible **Posterior belly:** Intermediate tendon	**Anterior belly:** By the mylohyoid nerve of the mandibular branch of the trigeminal nerve **Posterior belly:** By the posterior digastric nerve, a branch of the facial nerve
	Geniohyoid	Mandibula	Hyoid bone	First cervical nerve, led by the hypoglossal nerve
	Stylohyoid	Styloid process of the temporal bone	Hyoid bone	By the stylohyoid, a branch of the facial nerve
Infrahyoid muscles	Omohyoid	Scapula	Hyoid bone	Second and third cervical nerve
	Sternohyoid	Posterior and superior aspects of the sternum	Hyoid bone	Second and third cervical nerve
	Thyrohyoid	Thyroid cartilage	Hyoid bone	Second and third cervical nerve
	Sternothyroid	Posterior aspect of the sternum	Thyroid cartilage	Second and third cervical nerve

8.2.4 Tongue Muscles

The tongue is a thick mass of voluntary muscles coated by a mucosal membrane and attached to the floor of the mouth by the lingual frenum. It performs intricate functions during speech, chewing, and swallowing. Two types of muscles make up the tongue: the extrinsic and intrinsic tongue muscles. Intrinsic muscles are placed inside the tongue, whereas extrinsic muscles are located outside. The insertions of the extrinsic muscles are located inside the tongue. In terms of their direction, intrinsic tongue muscles are classified as superior longitudinal, inferior longitudinal, vertical, and transverse. The contraction of these muscles changes the shape of the tongue. Extrinsic muscles attach the tongue to bony structures and move the tongue (Table 8.5). All tongue muscles are innervated by the hypoglossal nerve.

Table 8.5 Tongue muscles

Extrinsic muscles	Function
Styloglossus muscle	It pulls the tongue back, moves it up and back
Genioglossus muscle	Different parts of the muscle can protrude the tongue from the oral cavity or press parts of the tongue surface
Hyoglossus muscle	It depresses the tongue

8.2.5 Pharyngeal Muscles

The pharynx is the region bounded by the oral cavity anteriorly and the nasal cavity superiorly, extending to the upper sphincter of the esophagus. It establishes a passageway for both breathing and swallowing. It has three components: the nasopharynx, oropharynx, and laryngopharynx. The pharynx consists of the stylopharyngeus, salpingopharyngeus, soft palate muscles, and pharyngeal structures. Stylopharyngeus, salpingopharyngeus, and palatopharyngeus are laryngopharyngeal elevators. The stylopharyngeus begins from the styloid portion of the temporal bone and extends longitudinally and terminates at the pharyngeal wall. It is innervated by the glossopharyngeal nerve.

Pharyngeal structures compose the posterior and lateral pharyngeal walls. These structures consist of three parts upper, middle, and lower parts. Pharyngeal structures elevate the pharynx and larynx and create pharyngeal pressure to deliver nutrients to the esophagus. They are innervated by the pharyngeal plexus. As a continuation of the hard palate, the roof of the mouth is formed by the five pairs of soft palate muscles. Additionally, these structures are connected to the tongue. All muscles are involved in speaking and swallowing. The tensor veli palatini muscle is innervated by the mandibular branch of the trigeminal nerve, while all other soft palate muscles are innervated by the pharyngeal plexus (Fig. 8.8). Soft palate muscles are given in the table (Table 8.6). The pharyngeal plexus innervates the pharyngeal muscles. These muscles are formed by the pharyngeal plexus vagus and glossopharyngeal nerve branches. The glossopharyngeal nerve receives the sensation in the plexus, while the vagus performs its motor innervation. Only the stylopharyngeus is innervated by the glossopharyngeal nerve.

8.2.6 Cervical Muscles

The cervical muscles are responsible for the mobility and stability of the neck. M. trapezius and M. sternocleidomasteideus are the largest and most superficial muscles (Fig. 8.9). Cervical muscles are given in the table (Table 8.7).

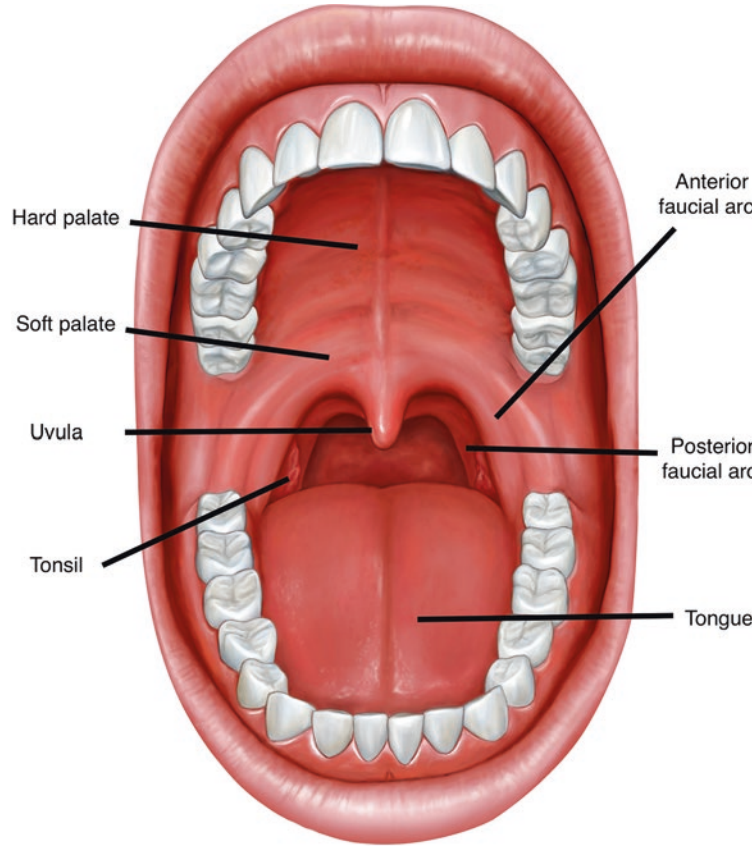


Fig. 8.8 Anterior faucial arch (Andrea Danti/Shutterstock.com)

Table 8.6 Soft palate muscles

Muscle	Function
Palatoglossus (it forms the anterior faucial arch)	It elevates and angles the tongue towards the soft palate, and depresses the soft palate towards the tongue, forming the sphincter that separates the oral cavity from the pharynx
Palatopharyngeus (it forms the posterior faucial arch)	It moves the palate posterior-inferiorly and the posterior pharyngeal wall anterior-superiorly to close the nasopharynx
Levator veli palatini	It elevates the soft palate
Tensor veli palatini	It slightly depresses the soft palate
Muscle of the uvula	It closes the nasopharynx

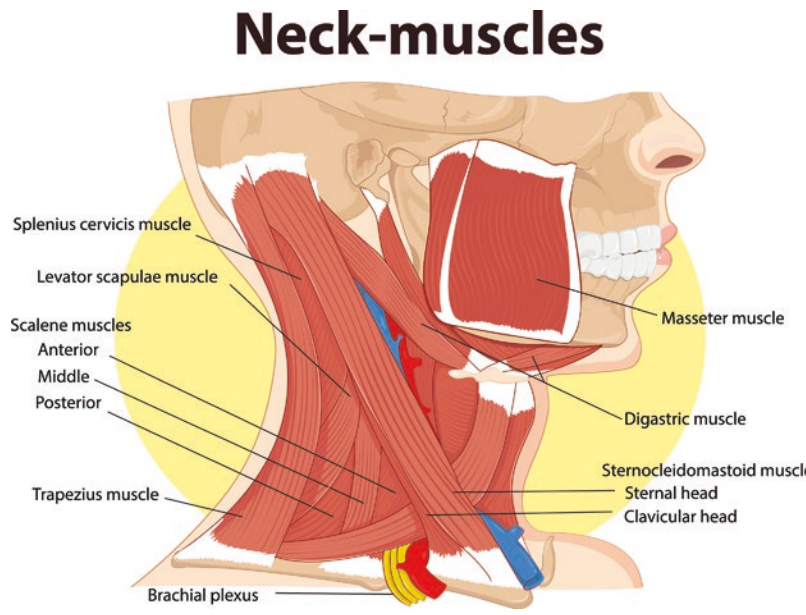


Fig. 8.9 Cervical muscles (Mister_X/Shutterstock.com)

Table 8.7 Cervical muscles

Muscle	Origin-insertion	Function	Innervation
Sternocleidomastoideus (SCM)	**Origin:** The medial part of the clavicle and the superior-lateral surface of the sternum **Insertion:** Mastoid process of the temporal bone	When contracted unilaterally, the head lateral flexes to the same side and rotates to the opposite side	XI. Cranial nerve
Trapezius	**Origin:** External surface of the occipital bone and the posterior midline of the cervical and thoracic regions **Insertion:** Lateral third of clavicle and scapula	Cervical fibers elevate the shoulder.	XI. Cranial nerve C3–C4
Scalene muscles	**Origin:** Transverse protrusion of cervical vertebrae (process) **Insertion:** The superior surface of the first and second costae	Neck flexion with bilateral contraction Lateral flexion (ipsilateral) and rotation (contralateral) with unilateral contraction Neck lateral flexion Elevation of costae	C4–C8
Longus colli	**Origin:** C3–C5 transverse tubercle Anterior of C5–T3 body **Insertion:** Anterior of C2–C6 body	Neck flexion when contracted bilaterally Neck lateral flexion and neck rotation when contracted unilaterally (contralateral)	C2–C7
Longus capitis	**Origin:** C3–C6 transverse processes **Insertion:** Basilar part of the occipital bone	Neck flexion when contracted bilaterally Neck rotation when contracted unilaterally (ipsilateral)	C1–3
Rectus capitis anterior	**Origin:** Anterior surface of the atlas bone **Insertion:** Basilar part of the occipital bone	Neck flexion when contracted bilaterally Neck rotation when contracted unilaterally (ipsilateral)	C1–2

(continued)

Table 8.7 (continued)

Muscle	Origin-insertion	Function	Innervation
Rectus capitis lateralis	**Origin:** Superior surface of the atlas bone **Insertion:** Jugular process of the occipital bone	Lateral flexion of the neck when contracted unilaterally (ipsilateral)	C1–2
Semispinalis capitis	**Origin:** Transverse processes of the upper thoracic vertebrae **Insertion:** Occipital bone	**Bilateral contraction:** Head neck extension **unilateral contraction:** Lateral flexion, head and neck rotation (contralateral)	Cervical and thoracic spinal nerves
Semispinalis cervicis	**Origin:** Transverse processes of the upper thoracic vertebrae **Insertion:** Spinous processes of C2–C4 vertebrae	**Bilateral contraction:** Head neck extension **Unilateral contraction:** Lateral flexion, head and neck rotation (contralateral)	Cervical and thoracic spinal nerves
Splenius capitis	**Origin:** C7–T3 spinous process, inferior part of the ligamentum nuchae **Insertion:** Temporal bone mastoid process and lateral part of the nuchal line of the occiput	**Bilateral contraction:** Neck extension **Unilateral contraction:** Head and neck lateral flexion and rotation	Cervical spinal nerve
Splenius cervicis	**Origin:** T3–T6 spinous processes **Insertion:** C1–C3 transverse processes	**Bilateral contraction:** Head neck extension **Unilateral contraction:** Head and neck lateral flexion and rotation	Cervical spinal nerve
Levator scapula	**Origin:** C1–C4 transverse processes **Insertion:** Superior of the medial scapula	**Bilateral contraction:** Neck extension with fixed scapula elevation, adduction, rotation, insertion **Unilateral contraction:** Neck lateral flexion and rotation (ipsilateral) while insertion is fixed	N. dorsalis scapula (C5), cervical spinal nerves (C3–C4)
Rectus capitis posterior major	**Origin:** Spinous process of atlas **Insertion:** Inferior lateral part of the nuchal line of the occiput	**Bilateral contraction:** Head extension **Unilateral contraction:** Head rotation (ipsilateral)	Suboccipital nerve (C1 posterior ramus)
Rectus capitis posterior minor	**Origin:** Tubercle of the posterior arch of the atlas **Insertion:** Inferior medial part of occiput nuchal line	**Bilateral contraction:** Head extension	Suboccipital nerve (C1 posterior ramus)
Obliquus capitis superior	**Origin:** Transverse process of atlas **Insertion:** Occiput	**Bilateral contraction:** Head extension **Unilateral contraction:** Head lateral flexion (ipsilateral)	Suboccipital nerve (C1 posterior ramus)
Obliquus capitis inferior	**Origin:** Spinous process of the axis **Insertion:** Transverse process of atlas	**Bilateral contraction:** Head extension **Unilateral contraction:** Head rotation (ipsilateral)	Suboccipital nerve (C1 posterior ramus)

8.3 Neural Structures in Head and Neck Region

There are 12 separately defined cranial nerve pairs in the head and neck region. They innervate all striated and smooth muscles of the head and receive sensation. In addition, they are responsible for the sensations of sight, smell, and hearing, as well as structures such as the salivary and lacrimal glands. Cranial nerves and their functions are given in Chap. 5.

8.4 Movements in the Head and Neck Region

Knowing the movements of the head and neck region enables clinicians in the evaluation and treatment of very common diseases such as cervical disc herniation, headache, temporomandibular joint problems, and swallowing disorders.

8.4.1 Movements of the Head

Movements of the head are shown in Table 8.8.

8.4.2 Movements of the Temporomandibular Joint (TMJ)

The temporomandibular joint (TMJ) slides and rotates in front of each ear and consists of the mandible and the temporal bone. The TMJs along with several muscles allow the mandible to move up and down, side to side, and forward and back. When the mandible and the joints are properly aligned, smooth muscle actions, such as chewing, talking, and swallowing, can take place. When muscles, ligaments, the disk of the TMJ, and jaw and temporal bones are not aligned, several problems may occur. Movements of the temporomandibular joint are shown in Table 8.9.

Table 8.8 Movements of the head

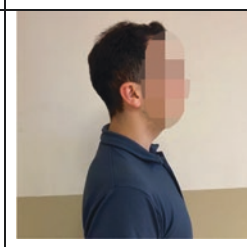
MOVEMENT	
Cervical neutral position (anterior view): The gravity line passes through the midline of the head. There is no lateral flexion or rotation.	
Cervical neutral position (lateral view): The gravity line passes through the earlobe. 20-35° cervical lordosis (C2-C7 Cobb Angle) is regarded normal.	
Cervical rotation (left): The head turns to the left	

Table 8.8 (continued)

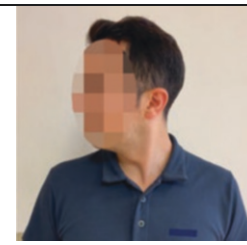
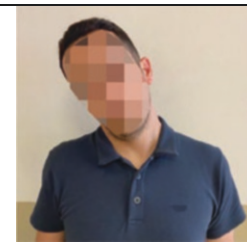
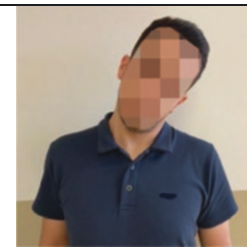
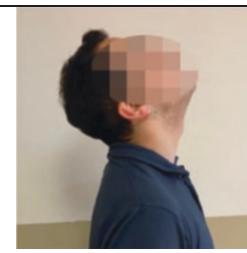
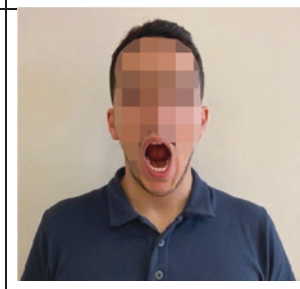
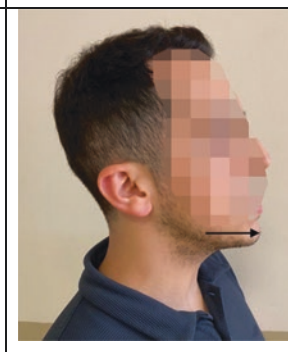
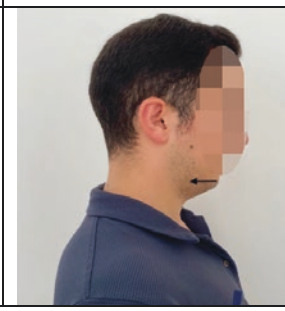
Cervical rotation (right): The head turns to the right	
Cervical lateral flexion (right): The head tips to the right side or touches an ear to the right shoulder	
Cervical lateral flexion (left): The head tips to the left side or touches an ear to the left shoulder	
Cervical flexion: The head bends forward towards the chest	
Cervical extension: The head bends forward-backward with the face towards the sky	

Table 8.9 Movements of the temporomandibular joint

MOVEMENT	
Mandible depression: Mouth opens with downward movement of the mandible.	
Mandible lateral deviation (right): The mandible is shifted to the right.	
Mandible lateral deviation (left): The mandible is shifted to the left.	
Mandible protrusion: The mandible is pushed forward.	
Mandible Retrusion: The mandible is pulled back.	

8.5 Head and Neck Palpation

The explanations of the anatomic structures of the head and neck and their palpation techniques are given in Table 8.10. In order not to cause/trigger pain, no more than 1.5 kg of pressure should be applied during palpation [painful range (2.0 kg of palpation); pain-free range (0.5 kg and 1.0 kg of palpation)]. Palpation should be performed bilaterally, in a relaxed and seated facing position, with the tip of the finger or by pincer palpation, when no underline bone support is present.

Table 8.10 Palpations of head and neck anatomic structures

ANATOMIC STRUCTURE	PALPATION
Temporalis muscle: The borders of the temporalis muscle were identified by palpation during repetitive clenching. One or two fingers are gently placed on the temple area of the head and the patient/client is asked to clench their teeth.	
Masseter muscle: During palpation, the limits of the muscle are determined by asking the patient to clench their teeth. 2-3 fingers are placed on the patient's/client's cheek and the patient is asked to clench their teeth.	
Digastric muscle: Fingers are placed slightly diagonally under the patient's chin. Attention should be paid to submental lymph nodes.	
Medial pterygoid muscle: After pressing with the fingers from the medial of the patient's mandible ramus to the cranial, the fingers are shifted laterally. It should be ensured that the submandibular lymph nodes are not compressed.	

Table 8.10 (continued)

Lateral pterygoid muscle: The index finger is brought forward between the cheek and teeth of the patient and palpated by applying light pressure in the carinal direction just behind the zygomatic arch. This point can be sensitive and heavy in general. Palpation should be applied gently.	
Sternocleidomastoid muscle (SCM): The patient/client is asked to rotate the head to the opposite side and to make slight lateral flexion, and the muscle is highlighted. The muscle body is palpated lightly by touching it with two fingers or by taking it between the thumb and index fingers.	 
Suboccipital muscles: With the patient lying on his back, the fingers are placed just below the occiput.	
Infrahyoid muscles: 2-3 fingers are placed under the hyoid bone, on the edge of the thyroid and cricoid cartilages, and the patient/client is asked to swallow.	

Table 8.10 (continued)

Hyoid bone: The hyoid bone is located in the midline of the neck, at the base of the mandible, and at the level of the fourth cervical vertebra. The greater cornua on both sides of the hyoid bone are palpated with the thumb and index finger.	
Thyroid cartilage: It is easily palpated just below the hyoid bone. It is shield-shaped and has prominent laryngeal prominence in males (known as Adam's apple)	
Thyroid (up) and cricoid (down) cartilage: After the thyroid cartilage is palpated, cricoid cartilage just below it can be palpated. It surrounds the trachea with its ring-shaped shape.	

8.6 Evidence-Based Exercises for the Head and Neck Region

Head and neck problems are common among people. It is often confused with the vertebral column and shoulder–arm complex problems, and so, neglected. The head/neck, one of the five kinetic chain checkpoints (head/neck, shoulders, lumbo–pelvic–hip complex, knees, and feet/ankles) is affected by and influences all movements of the other kinetic chain points. Evidence-based exercises for the head and neck region are shown in Table 8.11. Hyoid and hyolaryngeal mobilizations, Masako maneuver, and head lift exercises should be performed while lying on the back, while others should be performed in a sitting position.

Table 8.11 Evidence-based exercises for the head and neck region

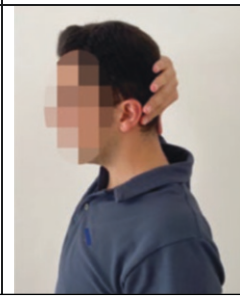
EXERCISE	
Cervical extensors stretch: One hand is placed behind the head. The head is tilted forward until you feel a stretch in the back of the neck. After the head is held at the endpoint for 15-30 seconds, it is taken to the starting position. This is repeated for the other side.	
Cervical lateral flexors stretch: The right hand is placed on the left side of the head. The head is tilted to the right until tension is felt on the left side of the neck. After holding the head for 15-30 seconds at the endpoint, it is taken to the starting position. This is repeated for the other side.	
Sternocleidomastoid (SCM) muscle stretch: The right hand is placed on the left side of the head. The head is brought into left rotation-right lateral flexion until tension is felt in the SCM muscle. After holding the head for 15-30 seconds at the endpoint, it is taken to the starting position. This is repeated for the other side.	
Isometric extension: One hand is placed behind the head. While holding the hand steady, press the head towards the palm for 10-30 seconds. It is repeated 3-5 times.	

Table 8.11 (continued)

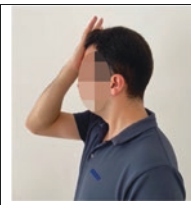
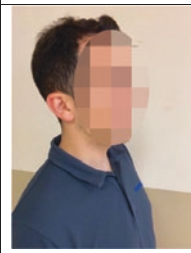
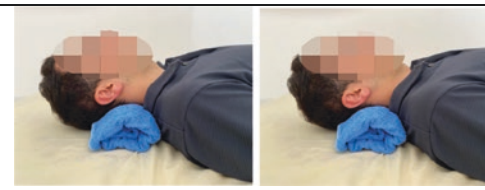
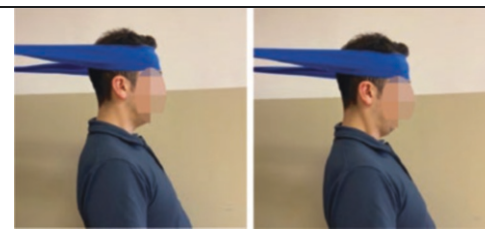
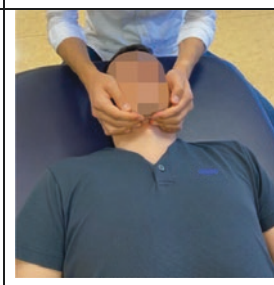
Isometric flexion: A hand is placed on the forehead. While holding the hand steady, press the head towards the palm for 10-30 seconds. It is repeated 3-5 times.	
Isometric lateral flexion: The right hand is placed on the left side of the head. While holding the hand steady, press the head towards the palm for 10-30 seconds. It is repeated 3-5 times.	
Masako maneuver: The patient/client swallows while the tongue is positioned between the teeth. The degree of difficulty can be increased by asking the patient to protrude the tongue more. It is applied by the patient for 3 sets, 8-12 repetitions.	
Proprioceptive neuromuscular facilitation (PNF): The patient is asked to bring his head diagonally against resistance and from left rotation to flexion-right rotation while his mouth is open (concentric contraction). At the end of the movement, the patient maintains the position for 6 seconds (stabilizing contractions). Then, while the patient tries to maintain the head and mouth position, the therapist brings the head back to the starting position (eccentric contraction). 1 set (30 repetitions) every day is repeated 3 days a week. **Head lift exercise:** The patient raises the head in the supine position, looks at the toes, holds the head for 60 seconds, and rests for 60 seconds. It repeats this 3 times (isotonic). Then the patient raises his head 30 times and leaves without holding it (isometric).	   

Table 8.11 (continued)

Chin tuck with a towel: A rolled towel is placed under the neck. The patient is asked to press the towel by making a chin tuck. Three sets are repeated 8-12 times.	
Chin tuck against resistance exercise (CTAR) with a ball: The ball is placed under the chin, and the chin tuck is done towards the ball.	
Elastic band row with chin tuck: The elastic band is attached to a door handle or similar, and the patient grasps the ends. While maintaining the chin tuck, the theraband is pulled by bringing the shoulder from flexion to extension.	
Chin tuck against resistance exercise (CTAR) with an elastic band: The elastic band is placed on the forehead of the patient and the back of the patient is passed. While holding the elastic band taut, the patient is asked to chin tuck.	

Tab. 8.11 (continued)

Hyoid mobilization: palpated the greater cornua on both sides of the hyoid bone with the thumb and index finger. When grabbing hyoid bone, care should be taken not to disturb breathing and compress the carotid arteries. Mobilize left and right at a speed that allows you to move from the end of each side in one second, with a range and intensity of some resistance. This is repeated 4 times for 30 seconds to relax the muscles around the hyoid bone.	
Hyolaryngeal mobilization: The distal phalanges are placed in the submental area and slowly pulled in the superior-anterior direction. Never apply pressure in the posterior direction. It is constantly checked whether there is an uncomfortable situation by looking at the face of the patient. It is applied 15-20 repetitions for 3-5 minutes.	

8.7 Conclusion

All body functions are either directly or indirectly connected to the head and neck. This region is responsible for vital tasks such as feeding, breathing, hearing, speaking, seeing, and smelling. This region is frequently impacted by neurological diseases, head and neck cancers, and head traumas. All other systems are affected by the deterioration of nutrition and respiratory functions in particular. Due to the fact that the physiological actions that occur during swallowing are so distinct, this subject must be studied separately. The head and neck region is highly intricate owing to the presence of hundreds of muscles of different sizes and the connections between the brain and cranial nerves. Thorough knowledge of the anatomy and physiology of this region is essential for the development of a correct and effective rehabilitation program.

Further Reading

Bordoni B, Varacallo M. Anatomy, head and neck, temporomandibular joint. Treasure Island (FL): StatPearls Publishing; 2022.

Brennan PA, Mahadevan V, Evans BT. Clinical head and neck anatomy for surgeons. In: "Chapter 1: The Scalp" and "Chapter 2: Anatomy of the ageing face" and "Chapter 6: Temporal bone, middle ear and mastoid" and "Chapter 9: Oral cavity" and "Chapter 14: Mandible" and "Chapter 16: Infratemporal fossa, pterygopalatine fossa and muscles of mastication" and "Chapter 17: Temporomandibular joint" "Chapter 18: Pharynx" and "Chapter 21: Larynx, trachea and tracheobronchial tree" and "Chapter 24: The Neck"

and “Chapter 27: Cervical spine” and “Chapter 31: Overview of the cranial nerves”. Boca Raton: CRC Press; 2015. p. 3–23.

Fehrenbach MJ, Herring SW. Illustrated anatomy o f the head and neck. In: “Chapter 2: Surface Anatomy” “Chapter 3: Skeletal System” and “Chapter 4: Muscular System” and “Chapter 5: Temporomandibular Joint” and “Chapter 8: Nervous System”. Amsterdam: Elsevier Health Sciences; 2015. p. 11–126.

Gross AR, Paquin JP, Dupont G, Blanchette S, Lalonde P, Cristie T, et al. Exercises for mechanical neck disorders: a Cochrane review update. Manual Ther. 2016;24:25–45.

Kılınç HE, Arslan SS, Demir N, Karaduman A. The effects of different exercise trainings on suprahyoid muscle activation, tongue pressure force and dysphagia limit in healthy subjects. Dysphagia. 2020;35(4):717–24.

Krekeler BN, Rowe LM, Connor NP. Dose in exercise-based dysphagia therapies: a scoping review. Dysphagia. 2021;36(1):1–32.

Martini ML, Neifert SN, Chapman EK, Mroz TE, Rasouli JJ. Cervical spine alignment in the sagittal axis: a review of the best validated measures in clinical practice. Glob Spine J. 2021;11(8):1307–12.

Sayaca C, Arslan SS, Sayaca N, Demir N, Somay G, Kaya D, et al. Is the proprioceptive neuromuscular facilitation technique superior to shaker exercises in swallowing rehabilitation? Eur Arch OtorhinoLaryngol. 2020;277(2):497–504.