The Temporomandibular Joint and Related Orofacial Disorders

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2

General Anatomy

To become or remain competent in the treatment of TMD complaints, the clinician needs a basic understanding of head and neck anatomy. Knowledge of the general morphology makes basic examination of the TMJ region easier. Physical evaluation provides an appraisal of patient-related information with an anticipated therapeutic outcome.

The review in this chapter is not meant to be an all-encompassing textbook of anatomy. Bits of morphology are described to help the clinician visualize clinical problems. Key anatomic landmarks are presented as points of reference for enhancing interpretation of physical findings.

General Description of the TMJ

The temporomandibular joint is located just anterior to the tragus of the ear. The joint is considered an articulation between the base of the skull and the condyle of the mandible. The articular surface of the skull is the squamous part of the temporal bone. This bone has a concavity, the *articular (glenoid) fossa* and a convexity, the *articular tubercle (eminence).*

The *condyle* of the healthy mandible is convex on surfaces that bear force. It is widest mediolaterally and roundish anteroposteriorly. Deviation in form (DIF) is common in young adults.

Unlike the articular surfaces of most other joints, the articular surfaces of the TMJ are covered with dense fibrous connective tissue instead of hyaline cartilage. Occasionally cartilage cells occur within this tissue; then, the surface is termed *fibrocartilage.* The surfaces are nonvascularized and noninnervated. The cartilage accommodates compressive force.

An *articular capsule* lies beneath the skin and encloses the lateral surface of the joint. The circular fibers are attached superiorly and medially to the articular fossa and extend to the eminence and the neck of the condyle. The *lateral (temporomandibular) ligament* is anterior to the capsule and reinforces the joint laterally. Collagenous fibers are arranged obliquely in the lateral part of the ligament and horizontally in the medial part. No comparable reinforcement occurs along the medial surface of the joint. Capsular tissue is highly vascular and innervated.

The TMJ is a *synovial* joint. The soft tissue between the articular surfaces contains two synovial compartments. The superior compartment is largest and contiguous with the fossa. The inferior compartment is smallest and reinforced by diskal attachments. The superior

compartment extends more anteriorly than the lower compartment. These compartments contain fluid that has both lubricating and nutritional functions.

These compartments are divided by an *articular disk,* composed of dense fibroelastic connective tissue. The disk encloses the superior surface of the condyle when the jaws are closed. It fuses to the capsule and the lateral pterygoid muscle anteriorly, joins the capsule mediolaterally, and attaches to loose vascular connective tissue posteriorly.

The disk is divided into an *anterior band,* an *intermediate zone,* and a *posterior band.* The anterior band has fibers interspersed with fibers of the lateral pterygoid muscle. The intermediate zone is the thinnest part of the disk. During jaw opening, it forms the articulating surface between the condyle and fossa. The posterior band is the thickest and joints the posterior attachment, often termed the *bilaminar zone (retrodiskal pad).*

Although the disk lacks neural tissue, finely branched fibers innervate the collateral diskal ligaments that attach the disk to the medial and lateral poles of the condyle, the retrodiskal tissue, and the posterior wall of the capsule. The condyle articulates with the disk to form a separate joint, often termed the *disk-condyle complex.* This complex articulates with the temporal bone to form a sliding joint.

The disk often is inappropriately termed a *meniscus,* a term that better applies to the crescent-shaped disk of fibrocartilage attached to the superior articular surface of the tibia. One side of the meniscus of the knee joint attaches to the articular surface, and the other two sides extend into the joint, ending in a free edge. The disk of the TMJ does not fit this description.

Significance: The disk is an active structure that maintains contact of the joint surfaces with the mandible at rest, at intercuspation, and during function. Although innervated with somatic and visceral afferent (including nociceptive) fibers, retrodiskal tissue has no proprioceptive capability. Inflammation may develop within the tissue if it is injured by excessive condylar force.

Mechanics of the Healthy Joint

The joint is a bilateral articulation. The right and left joint function as a single unit. Because of the capability of free movement, it is classified as a *diarthroidal* joint. Both hinge (ginglymus, rotation) and *gliding* (arthroidal, translatory) motions are possible. The hinge action relates to the disk-condyle complex; the gliding action, to the disk-temporal bone. Also, the joint is capable of *bodily* (side) movement.

There are close relations among the appearance of the disk, the shape of the synovial compartments, and the location of the condyle. Often, the thick posterior band may locate superior to the condyle when the jaws are closed. Yet the disk conforms to the shape of the fossa and is not restricted to this superior position.

Movement involving the joints has been divided into different phases, namely the *occlusal, retruded opening, early protrusive, late protrusive, early closing,* and *retruded closing* phases. Recently, more detail has been illustrated.

The *occlusal* phase involves a static jaw position with the teeth in maximum intercuspation. The posterior band occupies the deepest part of the mandibular fossa. The intermediate zone and anterior band lie between the condyle and posterior slope of the eminence.

In the *retruded opening* phase, the condyle rotates and moves 5 to 6 mm inferior to the intermediate zone, which now becomes the articulating surface. The medial pole of the condyle moves anterosuperiorly, and the lateral pole moves posteroinferiorly. The shape of the inferior compartment changes the most. The movement continues with opening to about 18 mm.

In the *early protrusive opening* phase, the condyle moves inferiorly and anteriorly approximately 6 to 9 mm beneath the intermediate zone. The movement stretches the bilaminar zone. More space develops posteriorly as the condyle translates anteriorly. This change shifts the posterior band posteriorly.

In the *late protrusive opening* phase, the condyle moves inferiorly and anteriorly beneath the anterior band. More space develops in the superior compartment posteriorly than in the inferior compartment during rotation. Blood enters spaces of the posterior attachment.

The superior retrodiskal lamina contains elastic connective tissue. Apparently, during forward translation the lamina exerts posterior traction on the disk. This action limits anterior dislocation of the disk.

In the *early closing* phase, the condyle translates posteriorly, about 6 to 9 mm, to the intermediate zone. There is simultaneous reduction of space posteriorly in the superior compartment.

In the *retrusive closing* phase, the condyle rotates superiorly but remains inferior to the posterior band. This movement reduces the space in the inferior compartment, tightens the mandibular attachment, and forces blood from the posterior attachment. The condyle returns near the occlusal phase.

The width of the disk space is inconstant and changes with interarticular pressure. Disk space widens if the pressure is low (ie, during empty mouth movements). It narrows when pressure is high (ie, during maximal intercuspation of the teeth).

The *limitations* of specific ligaments and the lateral pterygoid muscle restrict movements of the condyle. The attachment of the lateral ligament at the lateral pole prevents condylar displacement posteriorly away from the eminence. Side shifting of the mandible is passively restricted. This movement also is controlled by activity of the lateral pterygoid muscle on the contralateral side of the mandible. Other prominent ligaments, including the

stylomandibular and sphenomandibular ligaments, play little role in the mechanics of movement.

During opening phases, the superior head of the lateral pterygoid muscle is inactive. In one study, the superior head was inserted at the pterygoid fovea of the medial condyle in 70% of 26 human cadaveric joints. Accessory fibers terminate under the foot of the disk. They join the anterior ligament and insert at the condyle. The foot of the anterior part of the disk joins the capsule. This arrangement indicates that the superior head has little role in movement of the disk. The superior head is active during closing, assisting the elevator muscles in seating the condyle and the disk anterosuperiorly against the eminence.

The inferior head of the lateral pterygoid contracts during the early phase of closure. Electromyographic studies show that it is inactive near initial tooth contact.

Significance: The TMJ is considered a compound joint; the disk acts as an intermediate nonossified structure between the temporal bone and the condyle. The attachment of the superior lateral pterygoid muscle to the anterior part of the disk prevents the disk from dislocating posteriorly. The specific events concerning anterior displacement are unclear.

Disk-Condyle Derangement

Alteration in the healthy disk-condyle relation leads to the appearance of joint sounds. Different configurations and positions of the disk account for sounds during movement. In *disk displacement with reduction,* the condyle may be either slightly delayed or blocked by the disk during forward movement. Usually, the disk is displaced anteromedially. The accounts for the hesitation or "hang" on opening. Ultimately, the disk self-reduces.

With reduction, the displacement lasts through rotation. The disk reduces posteriorly as the condyle translates. This shift in disk position and configuration results in noise.

Different kinds of sounds have been identified. A click is a distinct sound of brief duration with a clear beginning and an end. Fine crepitus is a fine grating sound that is continuous over a longer period of opening or closing. Coarse crepitus is a continuous noise over a longer period of time consistent with bone grinding on bone.

Clicking that occurs on opening and on closing is termed *reciprocal clicking.* This may be divided into reproducible reciprocal clicking, reproducible opening clicking, and reproducible closing clicking, based on presentation of sounds following two or more opening and closing movement.

In *disk displacement without reduction,* the blocked disk persists. Hence, no reduction occurs. The condition is termed a *closed lock.* Without reduction, the posterior band is more anteriorly positioned with respect to the condyle than normal. Because no translation occurs, no noise results.

Several conclusions have been made about joint sounds from electromyography of the lateral pterygoid muscle. Apparently, the superior head hyperfunctions during the final closing sound, and the inferior head hyperfunctions during the opening sound. Presumably, closing

sounds result from the contact between an anteriorly moving disk and a posterosuperiorly moving condyle. The hyperfunctional inferior head pulls the condyle anteriorly to contact the anterior band of the disk or the posterior slope of the eminence.

Progressive Joint Derangement

The anatomic, clinical, and radiologic evidence is ambiguous about a sequence heading to progressive dysfunction of the joint.

Argument for Progression

Otherwise healthy disks become displaced leading to reduction followed by a period of nonreduction. This progression has been described from combined dissection of joints and arthrography.

The sequence proceeds as follows. The posterior band thickens, compressing the inferior compartment, which increases the space anteriorly. The intermediate zone lies inferior to the eminence. After more derangement, the shape of the anterior band diminishes and the superior compartment narrows. The posterior attachment thins initially, becomes denser from adaptation, then may perforate laterally. Once perforation occurs, bony changes may follow. Progressive and regressive remodeling occurs in the condyle and the eminence. If severe, the articular surfaces become osteoarthrotic. Crepitus results from friction of articular surfaces against one another.

Other clinical and arthroscopic findings confirm some of these changes. Arthroscopy showed osteoarthrosis was more frequently present in the temporal connective tissue than in the disk. Reciprocal clicking was common in joints with slight or no osteoarthrosis. Crepitation correlated with advanced and not an early phase of osteoarthrosis. Lateral joint soreness correlated with synovitis. Posterior joint soreness was uncommon. When present, it was associated with lateral joint soreness.

Argument Against Progression

Evidence is lacking to support certain assumptions involving progression. Studies of dissected human cadaveric joints showed that anterior displacement was rare and may be a normal variant. The condyle does not force the disk anteriorly, and perforations of the posterior attachment are rare.

Significance: A criticism of the argument for progression is that small groups of patients with joint disease have been studied. In the absence of widespread muscular tenderness, persistent soreness along the lateral surface of the joint likely means synovitis. If the joint remains tender to palpation, chronic inflammation is probable.

Muscles

The anatomy of major head and neck muscles is reviewed because muscular complaints may be referred to the TMJs. Because of their involvement in mandibular movement, the muscles of mastication are emphasized.

Masticatory

The *masseter* is divided into two hears. The superficial head originates on the anterior zygomatic arch and inserts on the angle and the ramus. The deep head originates from the posterior part of the zygoma and inserts on the ramus and the coronoid process.

The *medial pterygoid* arises from the medial surface of the lateral pterygoid plate and from the lateral surface of the palatine bone. Fibers run posteroinferiorly, inserting on the medial surface of the ramus and the angle.

The *lateral pterygoid* has two heads. The superior head originates on the infratemporal surface of the greater wing of the sphenoid bone. Nearly horizontal fibers insert at the pterygoid fovea of the medial condyle. The inferior head arises from the lateral surface of the lateral pterygoid plate and inclines superiorly as fibers run posterolaterally inserting into the pterygoid fovea.

The *temporalis* arises from the frontal and parietal bones inferior to the superior temporal line. Fibers converge into a tendinous band, which then divides into two parts. A superficial group of fibers inserts on the superolateral surface of the coronoid process. Deeper, larger fibers form a band along the inner coronoid process extending inferiorly to the anterior border of the ramus.

Suprahyoid

The suprahyoids are accessory muscles located superior to the hyoid bone. They act during depression of the mandible or assist with elevation of the hyoid bone.

The *digastric* has two bellies. The anterior belly originates near the mandibular symphysis and inserts on the hyoid bone. The posterior belly originates on the mastoid notch and inserts on the hyoid bone. The anterior belly assists in depression of the mandible and the posterior belly in retrusion (or retraction).

The *geniohyoid* originates near the inner surface of the mandibular symphysis and inserts at the hyoid bone. The muscle assists in drawing the hyoid bone anteriorly.

The *mylohyoid* is inferior to the tongue and inserts at the body of the hyoid bone. This muscle assists in elevating the floor of the mouth.

The *stylohyoid* is located at the styloid process and inserts at the body of the hyoid bone. This muscle pulls the hyoid posterosuperiorly.

Infrahyoid

The infrahyoids are accessory muscles located inferior to the hyoid bone. They act during depression of the hyoid bone or elevation of the larynx.

The *sternothyroid* originates on the manubrium of the sternum and inserts at the thyroid cartilage.

The *thyrohyoid* originates on the thyroid cartilage and inserts on the hyoid bone.

The *omohyoid* originates on the superior part of the scapula and inserts at the lateral border of the hyoid bone.

The *sternohyoid* originates on the manubrium of the sternum and inserts on the body of the hyoid bone.

Muscles Moving the Scalp, Head, and Shoulders

Several muscles are responsible for movements of the scalp, head, and shoulders.

The *frontalis* is the anterior half of the epicranius muscle. It originates on the galea aponeurotica, a tendinous sheath, and inserts into the skin along the orbit and the nose.

The *occipitalis* is the posterior half of the epicranius muscle. It originates at the occipital bone and the mastoid part of the temporal bone and inserts at the galea aponeurotica.

The *sternocleidomastoid* has two origins, the sternum and the clavicle. Both heads insert at the mastoid process and occipital bone.

The *splenius* muscle is divided into two parts. The capitis originates near the seventh cervical vertebra and inserts at the mastoid process and occipital bone. The cervicis joins at the first three cervical vertebrae. Inferior to the splenius is the semispinalis capitis.

The *trapezius* is a triangular muscle that originates at the occipital bone and inserts at the acromion and spine of scapula.

The *levator scapulae* originates at the fourth and fifth cervical vertebrae and inserts at the scapula.

The major and minor heads of the *rhomboids* originate along the first cervical vertebra and extend to the fifth thoracic vertebra.

Significance: Specific head and neck muscles need to be identified appropriately by location. This facilitates correct palpation and, ultimately, treatment as required.

Arteries

The main blood supply to the *TMJs* is derived from the external carotid artery. The maxillary artery branches from it by way of the infratemporal fossa at the neck of the mandible. A lesser branch, the masseteric artery supplies the posterior attachment. The superficial temporal artery, which ascends through the parotid gland, also serves the joint.

The *masticatory muscles* are supplied by the maxillary artery. After branching from the external carotid, the maxillary artery divides into six branches. Each branch supplies the muscle of the same name: masseteric, lateral pterygoid, medial pterygoid, anterior and posterior deep temporal, and buccal.

In the region of the *anterior neck,* the facial artery supplies the posterior belly of the digastric muscle. A branch of this artery, the submental artery, supplies the anterior belly. The inferior alveolar artery divides into smaller vessels that supply the mylohyoid, geniohyoid, hyoglossus, and styloglossus muscles.

In the region of the *posterior neck and scalp,* the occipital artery supplies the sternocleidomastoid muscle and thee deep muscles of the posterior neck and scalp. A dorsal branch of the subclavian artery supplies the trapezius, but neighboring sources also participate.

Significance: No definitive relation has been established between TM complaints and vascular disorders, including vascular kinds of headache. Nonetheless, there is still a need to assess the possibility of a relation.

Nerves

The *TMJ* region is innervated by the mandibular branch (V_3) of the trigeminal nerve (V). The main branch is the auriculotemporal nerve from the posterior division of V_3. The masseteric nerve also branches from the anterior division of V_3 to the joint.

The *masticatory muscles* are innervated by the anterior division (V_3) nerve. Numerous branches of the same nerve innervate the masseter, lateral pterygoid, and anterior and deep temporal muscles. A lesser branch arising directly from the mandibular division innervates the medial pterygoid muscle.

In the region of the *anterior neck,* the anterior belly of the digastric and the mylohyoid are supplied by the V_3 division. The posterior belly and the stylohyoid are innervated by the facial nerve. The geniohyoid is innervated by the branch of the first cranial nerve by way of the hypoglossal nerve.

Along with the omohyoid and sternohyoid, the sternothyroid is innervated by the ansa cervicalis, a loop of nerves at the C_1 to C_2 vertebrae. The thyrohyoid is innervated by the C_1 spinal nerve by way of the hypoglossal nerve.

In the region of the *posterior neck and shoulders,* the frontalis and occipitalis muscles are innervated by the facial nerve. Cutaneous branches of C_2 to C_3 divide into the lesser occipital, great auricular, and transverse cervical branches. The greater occipital nerve extends to the scalp branches from C_2.

The spinal accessory nerve supplies the sternocleidomastoid and trapezius muscles. The splenius capitis is innervated by the lateral branches of the middle cervical spinal nerves, the levator scapulae by C_3 to C_4, and the dorsal scapular nerves and rhomboid major and minor by the dorsal scapular nerve.

Significance: Certain nondental and dental disorders with neural origins mimic TMD. Visualization of alternate neural pathways enhances success of physical evaluation of the TMJs.

Larynx and Thyroid Gland

The larynx joins the pharynx superiorly and the trachea inferiorly. It lies ventral to the C_4 to C_6 vertebrae. There are three paired and three unpaired cartilages. The thyroid and the cricoid cartilages are the easiest to palpate.

Bilateral thyroid cartilages unite to form a laryngeal prominence termed the *Adam's apple.* Superior to the thyroid cartilage is the epiglottis, a lid preventing aspiration of substances into the trachea. Inferior to the epiglottis is the hyoid bone. Between the body of the hyoid bone and the thyroid cartilage is a thyrohyoid membrane. Inferior to the thyroid cartilage is the cricoid cartilage that joins the trachea. Lateral to the cricoid cartilage and extending inferiorly along the trachea are the paired lobes of the thyroid gland.

Most muscles of the larynx are innervated by the inferior laryngeal nerve branching from the vagus. An exception is the cricothyroid muscle, which is supplied by the external branch of the superior laryngeal nerve dividing from the vagus.

Significance: This region should be palpated for tenderness or swelling, which may be confused with tenderness of masticatory muscles. Chronic hoarseness suggests inflammation of the vocal folds.

Paranasal Sinuses

The paranasal sinuses are paired air-spaces that communicate with the nasal cavity. Antrums are present in the maxillary, frontal, ethmoid, and sphenoid regions of the skull.

The *maxillary sinus* is the largest of the sinuses. This space occupies nearly two thirds of the maxilla. The superior wall forms most of the orbital floor and the anterolateral wall is bounded by the zygoma especially near the canine fossa. The infratemporal fossa abuts the posterior wall, and the lateral nasal septum abuts the medial wall. Usually the roots of the teeth do not contact the thick wall of the normal cavity. Some roots may be separated by a mucous membrane or thin lamina of bone if the antrum is large. Drainage is variable, occurring mostly through the frontonasal duct in the anterior part of the middle meatus.

Posterior and anterior superior nerves, and sometimes the infraorbital nerve, innervate the antrum.

In the *frontal sinus,* the antrum is located mediosuperior to the orbit. Much variation and septation exists. The frontal bone separates the antrum from the anterior cranial fossa. The roof of the orbit forms the inferior wall. Drainage is mostly into the frontal recess of the nasal cavity, but ostia may open directly into the nose.

Branches from the V_1 division of the trigeminal nerve supply this region.

In the *ethmoid sinus,* the antrum fills the ethmoid bone. Numerous air cells are located posterior to the maxillary sinus and orbit. They drain into the nares anteriorly and posteriorly.

The antrum is innervated by the anterior ethmoidal nerve branching from the nasociliary nerve and, posteriorly, by the maxillary nerve.

The cavity of the *sphenoid sinus* is extremely variable in shape. In some instances, paired cavities may occur in the body of the sphenoid bone. Important boundaries include the middle cranial fossa, the posterior cranial fossa, the nasopharynx inferiorly, the optic nerve, and the cavernous sinus laterally. Drainage is by means of the sphenoethmoidal groove into the lateral nasal wall.

The antrum is innervated by the lateral posterosuperior nasal nerve.

Significance: The frontal sinus is the only paranasal sinus innervated by the trigeminal nerve. Dysfunction of neural origin associated with this sinus may relate to neural dysfunction of the TMJ and vice versa.

The bony floor of the maxillary sinus is thinnest above the roots of the molar teeth. The superior alveolar nerves approximate the lower margin of the maxillary sinus in some cases, making it difficult to determine whether pain emanates from the maxillary teeth or from infection of adjacent sinuses.

Salivary Glands

The proximity of the major salivary glands to the TMJ makes a review of their anatomy worthwhile. Pathology of the glands may mimic symptoms of TMD.

The *parotid glands* are paired glands of irregular triangular shape. Each is divided into three surfaces. The lateral surface is bounded by parotid fascia, tela subcutanea, and skin. The gland passes anteriorly across the lateral surface of the masseter muscle and curves around the posterior border of the ramus just superior to the posterior belly of the digastric muscle. Posteromedially, the surface is adjacent to the sternocleidomastoid and digastric muscles and the mastoid process. Stensen's duct exits into the oral cavity near the maxillary second molar region.

The afferent nerve supply is from the auriculotemporal nerve. The efferent supply is from the glossopharyngeal nerve. Parasympathetic fibers reach the gland by way of the auriculotemporal nerve. The sympathetic fibers probably travel by various arteries from the external carotid plexus.

The *submandibular glands* are paired glands that occupy most of the submandibular triangle. They are bordered by the bellies of the digastric muscle and the inferior border of the mandible. The fascial covering joints the parotid sheath. The thickened fascia between the paired glands forms the stylomandibular ligament. Laterally, the gland abuts with the mandibular branch of the facial nerve and vein. Along the anteromedial surface, it rests on the mylohyoid muscle and nerve and then extends posteriorly to the posterior belly of the digastric muscle, hypoglossal nerve, and sometimes the lingual nerve. The facial artery covers

the superior part of the gland. Wharton's duct terminates at each salivary caruncula lateral to the lingual foramen.

The gland is innervated by the facial nerve. Parasympathetic fibers enter the chorda tympani branch and course with the lingual nerve of the V_3 to the submandibular ganglion. Presynaptic fibers synapse with postganglionic fibers to supply both the submandibular and sublingual glands.

The paired *sublingual glands* lie inferior to the mucosa of the floor of the mouth, superior to the mylohyoid muscle, and between the mandible and the hyoglossus and genioglossus muscles. The lingual nerve lies lateral, inferior, and medial to each gland. Many small ducts open into the oral cavity by way of the sublingual folds. Some anterior ostia join to form Bartholin's duct, which communicates with Wharton's duct and empties into the floor of the mouth.

Significance: The salivary glands may become obstructed or infected. Salivary calculi occur mainly in the submandibular gland (85%) and less often in the parotid gland. Their presence may lead to swelling and pain. There may be insufficient or excess saliva because secretion is exclusively under nervous control.

Most tumors of salivary glands occur in the parotid. Fortunately, few are malignant.

Frey's syndrome, identified by redness and gustatory sweating over the distribution of the auriculotemporal nerve, may be related to parotid trauma or to a complication of parotidectomy. There may be alteration of the parasympathetic fibers that would normally evoke parotid secretion.

Lymph Nodes

Lymph of the head drains into superficial lymph nodes, whereas lymph of the neck drains mainly into deep cervical nodes and less often into superficial nodes. The head and neck are served by groups of nodes named after anatomic regions of the body.

Head

The *retroauricular, anterior auricular,* and *superficial parotid* lymph nodes surround the ear.

The *facial* lymph nodes are scattered along the distribution of the facial artery. Lesser designations are the infraorbital, buccal, and mandibular nodes.

The *occipital* lymph nodes are located at the base of the skull and are associated with the occipital artery.

Neck

Superficial Groups

The *submental* lymph nodes are located inferior to the chin, along the mylohyoid muscle at the junction of the symphysis and the hyoid bone.

The *submandibular* nodes lie near the inferior border of the ramus of the mandible along the submandibular gland.

The *jugular* nodes lie along the external jugular vein at the sternocleidomastoid muscle and abut with the anterior jugular vein.

Deep Groups

The *superior cervical* lymph nodes lie along the internal jugular vein and superior to the omohyoid muscle. Largest of this group is the jugulodigastric node. The jugulo-omohyoid node crosses at the junction of the vein and muscle.

The *inferior cervical* lymph nodes lie along the internal jugular vein and inferior to the omohyoid muscle. Lymph from the superior cervical nodes drains into the inferior cervical nodes or into the jugular trunk leading to the thoracic duct.

The *retropharyngeal* and *parotid* nodes most likely belong to the superior cervical group. The retropharyngeal nodes drain the nose, paranasal sinuses, pharynx, and palate. The parotid nodes drain the external auditory meatus, tympanic cavity, parotid gland, and TMJs.

The *accessory* lymph nodes are members of the posteroinferior deep cervical chain. They lie posterior to the sternocleidomastoid muscle.

The *transverse cervical* nodes lie along the lateral surface of the neck and the trapezius muscle.

The *juxtavisceral* lymph nodes lie along the structures that they drain, including the larynx, trachea, esophagus, and thyroid gland.

Significance: Visualization of location and drainage patterns allows the clinician to discriminate dental-related or sinus infections from TMD complains. The external surface of the TMJ region is drained by superficial anteroauricular nodes. Deeper structures are drained by the deep parotid nodes, which ultimately drain to the deep cervical nodes. Most maxillary anterior teeth drain into the facial nodes, whereas the molars drain into the submandibular nodes. Mandibular teeth drain into the submental or submandibular nodes. Paranasal sinus drainage is by way of the retropharyngeal nodes.