Fascial Planes of the Head and Neck

The entire body is enclosed in a large envelope, the skin. The organs, glands, muscles, blood vessels, and other structures are enclosed in individual envelopes deep to the skin. These deep envelopes are composed of fibrous connective tissue.

Connective Tissue

The connective tissues are all the connecting and supporting tissues in the body. Even bone and cartilage are considered connective tissues. These tissues may be classified according to the texture or character of the intercellular matrix.

The *intercellular matrix* is the material or substance that comprises the bulk of the tissue and serves to bind the entire mass into a unit. It is found between the connective tissue cells and incorporates them into the tissue as a whole.

The matrix in bone is tough and fibrous. It is made rigid by the presence of mineral salts. The matrix in cartilage is also firm, but it is more elastic. Cartilage tolerates compression well and is therefore frequently found between articulating bones, where it serves as a cushion.

Fibrous connective tissue is another type of connective tissue. It can also be further classified according to its texture. This texture depends on the type of microscopic fibers and substance comprising the matrix. Tendons and ligaments are made of *dense fibrous* connective tissue, which exhibits a great tensile strength.

*Loose fibrous* connective tissue has a strong binding power also, but it is more loosely interwoven. Between the fibers of the matrix are interstices that are filled with tissue fluid or ground substance. Loose fibrous connective tissue is found in various degrees of denseness, and its tensile strength is somewhat less than that of dense fibrous connective tissue.

The capsules of joints and the capsules of some glands and organs are strong and closely woven structures. They are composed of a type of fibrous connective tissue known as *fibroelastic tissue*. *Fibroareolar* or *areolar* connective tissue implies that the tissue is *loosely* woven, fairly weak, and friable.

Fibrous tissue cells are called *fibroblasts*. They are widely separated except in *adipose tissue* where the cells are clumped together, and each cell contains a large glob of fat. The *buccal fat pad* is a mass of adipose tissue, lying superficial to the buccinator muscle at the anterior border of the masseter muscle.
Fascia

Other than the specifically organized structures, tendons, and ligaments, the fibrous connective tissue envelopes are called fascia. The fascia of the head and neck may be divided into superficial fascia and deep fascia.

Superficial Fascia

The superficial fascia covers the entire body and lies just under the skin. It is composed of two layers. The outer layer contains varying amounts of fat. A thin membrane serves as the inner layer which has a large amount of elastic fibers. The superficial fascia attaches the skin to the deep fascia which covers and invests the structures lying deep to the skin. Although the superficial fascia attaches to the deep fascia, it glides freely over the deep fascia in most areas, producing the characteristic movability of the skin. In areas where the skin is movable, the superficial and deep fascia can be separated by blunt dissection, using a probing finger or blunt instrument. Thus, the interspace between these two levels of fascia is a potential cleft or space.

The muscles of facial expression are invested in the superficial fascia. Under the superficial fascia of the face and scalp, no deep fascia is found. The superficial fascia of the face and scalp is continuous with the superficial fascia of the neck, the superficial cervical fascia.

Deep Fascia

In the head and neck region, the deep fascia begins at the anterior border of the masseter muscle and is attached to the superior temporal and nuchal lines. The deep fascia is found only posterior and inferior to these margins.

The geography of the deep fascia is quite complex and intricate. Once it is learned and understood, however, it is both interesting and fascinating. What makes the topic confusing, occasionally, is the use of contradictory nomenclature. One author may define a term in one manner, and another may use a different definition for the same term. An attempt will be made in the following discussion to keep the material well organized and to maintain a continuity of nomenclature.

The key to understanding is organization. With a knowledge of the deep fascia of the head and neck, the astute clinician has a clear understanding of the relations of the various anatomic structures therein.

Deep Fascia of the Jaws

Although the deep fascia is absent in the face and scalp, it is considered to be represented by the periosteum of the skull and facial bones. More posteriorly, deep fascia is present, and it invests the muscles of mastication.

A sheet of deep fascia, the temporal fascia, covers the temporalis muscle. This fascia attaches to the superior temporal line, covers the temporalis muscle, and passes inferiorly to
the zygomatic arch. Superiorly, the temporal fascia and fibers of origin of the temporalis muscle blend into a firm aponeurosis. An aponeurosis is a fibrous connective tissue which is extremely dense and firm; it appears as a flat tendon.

Inferiorly, the temporal fascia leaves the temporalis muscle and envelopes the zygomatic arch. Below the arch, the temporal fascia becomes the deep fascia covering the lateral surface of the masseter muscle. It splits to enclose the parotid gland posteriorly; therefore, it is known as the parotideomasseteric fascia. The parotideomasseteric fascia is continuous with the deep cervical fascia below the jaw. It terminates anteriorly at the anterior border of the mandible. That portion of the parotideomasseteric fascia overlying the masseter muscle is known as the masseteric fascia. Over the parotid gland, it is parotid fascia. Posteriorly, as the masseteric fascia becomes the parotid fascia, it splits and envelops the parotid gland. In summary, the temporal fascia, the masseteric fascia, and the parotid fascia are continuous with one another, and they are all continuous with the deep cervical fascia of the neck.

From the pterygoid process, a sheet of deep fascia passes down on the deep surface of the medial pterygoid muscle and attaches to the inferior border and angle of the mandible. This is the pterygoid fascia. This layer of deep fascia is continuous, therefore, with the parotideomasseteric fascia on the lateral surface of the masseter muscle because both attach to the inferior border of the mandible. The pterygoid fascia also covers the medial surface of the medial pterygoid muscle and encircles the lateral pterygoid muscle.

From the above descriptions, we can expect some potential spaces to exist in the area of the muscles of mastication and parotid region. These will be described in the section on the spaces of the face and jaws.

Fascia of the Neck

The fascia below the mandible is referred to as the cervical fascia. It also has a superficial and a deep component. The superficial cervical fascia envelops the platysma muscle. It is continuous with the superficial fascia of the face, which invests the muscles of facial expression.

The deep cervical fascia invests the deeper muscles and organs of the neck. Superiorly it attaches to and splits at the inferior border of the mandible and becomes the parotideomasseteric fascia laterally and the pterygoid fascia medially.

Lower in the neck, the deep cervical fascia has many divisions based on relative anatomic positions. The most superficial layer of the deep cervical fascia is referred to as the investing layer. It surrounds the neck and invests the sternocleidomastoid and the trapezius muscles. This layer is continuous with the deep fascia of the parotid gland and the muscles of mastication. The investing layer is the layer of deep cervical fascia that attaches to and splits at the inferior border of the mandible to become the parotideomasseteric fascia and the pterygoid fascia. Also, it encloses the hyoid bone in the anterior region of the neck.
As noted above, the investing fascia encircles the entire neck. It is attached to the whole length of the inferior border of the mandible. Anteriorly, it blends with the periosteum of the facial bones under the muscles of facial expression. Under the jaw, anteriorly, the investing fascia covers the anterior belly of the digastricus muscle. Also, it encompasses the submandibular salivary gland. On the deep surface of the gland, the investing fascia covers the stylohyoid muscle and posterior belly of the digastricus muscle. Anteriorly, the deep layers of investing fascia split to encircle the suprathyroid muscles and attach to the mandible. Posteriorly, it is attached to the stylohyoid process and tongue. The stylomandibular ligament is merely a deep, dense band of investing fascia extending from the stylohyoid process to the angle of the mandible. The investing fascia fuses with the ligamentum nuchae on the posterior aspect of the neck. Inferiorly, it attaches to the shoulder girdle and sternum. At the superior edge of the sternum in the midline, the investing layer splits and encloses a small amount of loose areolar tissue, the suprasternal space (space of Burns). A prolific anastomosis between the right and left anterior jugular veins occurs in this small space. As in the anterosuperior region of the neck, where the investing layer splits to enclose the suprathyroid muscles below the hyoid bone, the investing fascia envelopes the infrahyoid muscles. Here, however, it is given a separate name, the middle cervical fascia.

Deep and somewhat parallel to the sternocleidomastoideus muscle, the cervical fascia forms a tubular fascial compartment. This is the carotid sheath. It extends from the base of the skull to the root of the neck. The carotid sheath envelops the internal carotid artery superiorly and the common carotid artery inferiorly. Throughout its entire length, the carotid sheath contains the internal jugular vein and the vagus nerve.

The trachea, esophagus, and thyroid gland are enclosed deep to the carotid sheath by another large tube of fascia, the visceral fascia. This deep component of the deep cervical fascia is attached above to the thyroid and cricoid cartilages and pharyngeal tubercle of the occipital bone. It envelops the pharyngeal muscles and also attaches to the pterygomandibular raphe, mandible, and pharyngeal aponeurosis. Inferiorly, it continues into the thorax and blends with the fibrous covering of the heart, the pericardium.

A ribbon of fascia attaches the carotid sheath to the visceral fascia. This is the alar fascia. It extends all the way from the skull to the seventh cervical vertebra.

Posterior to the visceral fascia and deep to the investing fascia and carotid sheath is the vertebral fascia. This is another "tube" of the deep cervical fascia. It encloses the vertebral column and associated muscles. Anterolaterally, it blends with the carotid sheath and alar fascia bilaterally.

Fascial Spaces and Clefts

Understanding of the spread of infection is impossible without a clear understanding of fascial clefts or fascial spaces. A fascial cleft may be defined as a place of possible cleavage between two fascial surfaces. It is rich in tissue fluid and poor in fibers. The cleft between the superficial and deep fasciae is a good example. In contrast, a fascial space or compartment is a portion of anatomy that is partially or completely walled off by fascial membranes. The compartment housing the sublingual salivary gland is an example. This
compartment is walled off by the mucous membrane and superficial fascia of the floor of the mouth above. Below, it is walled off by the deep fascia over the mylohyoid muscle. Even though the term *space* is ambiguous, it is in common usage, and it will be used here to imply *cleft* or *compartment*. However, it is more important to remember that these "spaces" are not empty voids. They are only potential spaces.

**Spaces of the Neck**

From the description of the fascia of the neck, we can predict that there are several potential spaces in the neck region. Moreover, the fasciae of the face and jaws are contiguous with those of the neck. The spaces of the face and jaws communicate with the spaces of the neck. It is important to grasp the concept that these "spaces" are defined as having "boundaries", but these "boundaries" are not so well defined and impervious as the boundaries or "walls" limiting the dimensions of rooms in a building. Boundaries limiting fascia spaces often merely help us visualize the anatomic area and are more empirical and academic than impenetrable.

On occasion, these boundaries do physically limit a particular structure and discourage penetration by invading bacteria. An example is the dense fascia overlying the temporalis muscle, or the periosteum surrounding the space of the body of the mandible.

**Lateral Pharyngeal Space**

The lateral pharyngeal space lies high and deep in the neck. Its medial boundary is the visceral fascia overlying the superior constrictor of the pharynx. Since this space is so high, the lateral boundary is the pterygoid fascia and muscles, together with the fascia on the deep surface of the parotid gland. It communicates with the masticator space. The posterior boundary is the apposition of the vertebral and visceral fascia and the alar fascia. Inferiorly, the lateral pharyngeal space is incompletely bounded by the investing fascia of the digastricus muscle, posterior belly, and styloid process. The superior limit of this space is the petrous portion of the temporal bone. Thus, the lateral pharyngeal space extends from the base of the skull to the posterior belly of the digastricus muscle. It contains a section of the carotid sheath. Communications include the submandibular space, masticator space, and retropharyngeal space. Anteriorly, it is bounded by the masticator space and superior constrictor muscle.

**Retropharyngeal Space**

The retropharyngeal space, another potential space, is a midline space extending from the base of the skull to the mediastinum (interior of thorax). It is a potential cleft between the visceral fascia and the vertebral fascia. The anterior boundary is the pharynx, and the posterior boundary is the vertebral column and alar fascia. It may communicate through the alar fascia to the lateral pharyngeal space superiorly and laterally.

**Pretracheal Space**

The pretracheal space lies directly in front of the trachea and is bounded anteriorly by the infrahyoid muscles ("strap muscles"). It is somewhat below the lateral pharyngeal space,
anterior and medial to it, and is limited superiorly by the attachment of the strap muscles to
the thyroid cartilage and hyoid bone. Inferiorly, it communicates with the anterior
mediastinum.

Spaces of the Face and Jaws

It is important to reemphasize that the spaces of the face and jaws communicate
directly or indirectly with those of the neck.

Canine Space

The potential cleft known as the canine space lies deep to the skin and superficial
muscles of the upper lip. The floor is the canine fossa and anterior surface of the maxilla. It
is limited superiorly by the origin of the quadratus labii superioris muscle. The roof is the
skin and muscles of the upper lip.

Buccal Space

The buccal space, the "space" of the cheek, usually contains the buccal fat pad. The
buccinator muscle bounds the space medially, and the skin limits it laterally. Superiorly, it
is bounded by the zygomatic arch and the origin of the masseter muscle. The masseter muscle
also serves as the posterior boundary of this cleft. Inferiorly, the buccal space is bounded by
the mandible. The anterior boundary is the zygomaticus major and depressor anguli oris
muscles.

Masticator Space

The masticator space is a potential cleft enclosed by the parotideomasseteric fascia
laterally and the pterygoid fascia medially. Anteriorly and posteriorly the fascial walls are
closed. At the anterior border of the masseter muscle, the masticator space is limited by the
fusion of the masseteric fascia with the periosteum of the mandible, the superficial fascia, and
the pterygoid fascia. Posterolaterally, the masticator space is bounded by the deep component
of the parotid fascia. Posteromedially, the space is in relation to the lateral pharyngeal space.
Superiorly, the temporal pouches are encountered. However, the zygomatic arch is considered
the incomplete superior boundary. Inferiorly, the fascial walls are closed, since they fuse to
the inferior border of the mandible and become the investing layer of deep cervical fascia.

Contents of this space include the masseter muscle, pterygoid muscles,
pterygomandibular space, and space of the body of the mandible. Moreover, the parotid and
lateral pharyngeal spaces communicate with the posterior area of the masticator space.

Temporal Spaces (Pouches)

The temporal spaces (pouches) are two in number, superficial and deep. The
superficial temporal space is between the temporal fascia and the temporalis muscle. Between
the temporalis muscle and the lateral surface of the skull is the deep temporal space. These
spaces are filled with loose areolar tissue. Below the zygomatic arch, both the superficial and
deep pouches communicate with the infratemporal region, pterygopalatine fossa, and masticator space.

**Pterygomandibular Space**

The pterygomandibular space is a deep space containing the inferior alveolar nerve, artery, and vein and confined **within** the masticator space. It is filled with areolar tissue and is the site of injection for dental nerve blocks involving the lower teeth. Posteriorly, it communicates with the lateral pharyngeal space and the parotid gland. The medial boundary is the medial pterygoid muscle, and the lateral boundary is the vertical ramus of the mandible. The **buccopharyngeal curtain** is composed of the fascia, buccinator and superior constrictor muscles, and pterygomandibular raphe; which contribute to the origin of the buccinator and insertion of the superior constrictor muscles. This "curtain" forms the anterior boundary of the pterygomandibular space. Superiorly, the pterygomandibular space communicates with the temporal pouches, but the lateral pterygoid muscle is often considered the superior boundary.

**Space of the Body of the Mandible**

As the investing layer of deep cervical fascia splits at the inferior border of the mandible to form the masticator space, it also forms the space of the body of the mandible. The fascia at the inferior border fuses with bone and periosteum. The **periosteum enveloping the mandible** forms the potential cleft known as the space of the body of the mandible. The space is limited posteriorly by the insertions of the medial pterygoid and masseter muscles. Anteriorly, it is bounded by the attachment of the anterior belly of the digastric muscle. The fusion of fascia and periosteum encloses the space superiorly.

**Parotid Space**

The parotid space is the potential fascial cleft occupied by the parotid gland. It is formed by the splitting of the parotideomasseteric fascia at the posterior border of the masseter muscle. Medially, there is communication with the lateral pharyngeal space. The masticator and pterygomandibular spaces are contiguous with the parotid space.

**Submaxillary spaces**

There are five potential fascial clefts in the submaxillary group: the right and left sublingual spaces, right and left submandibular spaces, and the submental space.

**The Submental Space.** The submental space lies in the midline between the symphysis and the hyoid bone. The right and left anterior digastric muscles bound the space laterally. The floor is the mylohyoid muscle, and the roof is the suprathyroid portion of the superficial layer of cervical fascia. The hyoid bone is considered the posterior boundary. This space contains submental lymph nodes and the origin of the anterior jugular veins.

**Submandibular Space.** Some anatomists refer to this space as the digastric space. It lies lateral and posterior to the submental space. Anteriorly and medially, it is bounded by the anterior belly of the digastric muscle. The posterior belly of the digastric, together with the stylohyoid muscle, bounds the submandibular space posteriorly and medially. The floor is
formed by the mylohyoid and hyoglossus muscles. The roof is skin, platysma muscle, and the superficial layer of cervical fascia. As noted earlier, the investing layer of deep cervical fascia encloses the submandibular gland and the digastricus muscles. The inferior border of the mandible contributes to the lateral and superior boundaries.

The major contents of this space are the submandibular lymph nodes and salivary gland, the facial artery and vein, and the submental artery.

**Sublingual Space.** Above the submandibular spaces are the right and left sublingual spaces. The mylohyoid muscle separates the sublingual space from the submandibular space. However, since the posterior border of the mylohyoid muscle is a free edge, there is easy communication from the sublingual space to the submandibular space.

The roof of the sublingual space is the mucosa of the floor of the mouth. Laterally, it is bounded by the medial surface of the body of the mandible above the mylohyoid line. The geniohyoid and genioglossus muscles form the medial boundary.

The contents of this space include the sublingual salivary gland, the lingual nerve, the hypoglossal nerve, the lingual artery, and the submandibular (Wharton's) duct.

**Clinical Notes**

It is common for infection to occur in the spaces of the face and jaws. The teeth, mouth, nasal cavities, and sinuses all harbor millions of bacteria of many cavities. In the healthy state, these bacteria are in balance. Usually, therefore uncontrolled infection does not occur. However, dental decay, lacerations, trauma, or surgery can cause a disruption in the delicate balance. Infection may result from one or more of the various types of bacteria becoming more active and productive than the rest. Since the spaces of the face and jaws communicate with the spaces of the neck, infection of the face and jaws has great potential for extension to the deep spaces of the neck. This may pose a definite threat to life.

Inflammation of muscle often results in spasm of the muscle. Dental infection, particularly of the molars, often spreads to the masticator space, which envelops the pterygoid muscles (particularly the medial pterygoid) and the masseter muscle. Since this space communicates with the temporalis muscle, it is easy to understand that patients with infected molars often cannot open their jaws. The elevators are in spasm because of the inflammation involving the fascial spaces enclosing them. This spasm of the masticatory muscles with resultant inability to open the jaw is referred to as *trismus*. Trismus, secondary to infected molars, typifies the extension of infection to the masticator space.

Swelling and infection involving the masticator, parotid, or laryngeal spaces are not uncommon. Unchecked, the infection can spread rapidly to contiguous spaces, such as the temporal spaces, and cause a rather severe clinical problem. Infection in the masticator space is usually of dental origin.

A swollen upper lip is typical of infection from maxillary anterior teeth, primarily the cuspids. Such infection usually involves the canine spaces and often spreads to the infraorbital region.
Infections of the lower molars frequently extend to the submandibular space or the sublingual space; those of the upper molars, to the buccal space. Infections of the lower incisors may spread to the submental space.

A knowledge of the various potential spaces of the face and jaws is mandatory to those whose profession centers in the maintenance of health in these areas. The origin and spread of infection can be predicted, prevented, or treated only with such knowledge. Table 9-1 is a consideration of the boundaries and relations of the various potential spaces of the neck, face, and jaws through which infection may spread.

Infection usually spreads from one space to another through lines of least resistance. Therefore, infection of the sublingual space will spread to the submandibular space by taking a path around the free border of the mylohyoid muscle rather than by attempting to perforate through the mylohyoid muscle. Similarly, infection of a maxillary cuspid will perforate the labial bone and involve the canine space rather than perforate the more dense palatal bone and involve the palate.

Infection may not, indeed it often does not, take the line of least resistance. The clinician must be aware of the variability of the course an infectious process may take.

Treatment of infections of the face, jaws, and neck is aimed at control and elimination. Control involves procedures to prevent spread of the infection. Antibiotics and moist heat to the area are common successful therapeutic measures. Elimination involves removing the causative factors and evacuation of pus, if present. Many times control and elimination can be accomplished concurrently. Other times, control must be established before elimination. In still other cases, control is impossible without first eliminating the cause. The approach to treatment of an infection is a clinical judgment, and each case must be treated according to need.

Infection is often complicated by systemic disease, debilitation, and other general factors. Emphasis is made here that it is a patient who is infected - a total human being, not a tooth, a jaw, or a gland. The patient must be treated, not just his jaw. Extraction of an infected tooth from a debilitated, elderly, poorly controlled diabetic is pointless without the concurrent use of fluid and electrolyte therapy, control of diabetes, and reestablishment of nutrition.

It should be noted that the relation of the muscles to the apex of the root of the involved tooth is important in predicting where the infection will localized. But variations are definitely possible.

Swelling may not necessarily mean that pus is present. Cellulitis and extensive edema may exist without pus being formed. An attempt to drain such an area is fruitless. Treatment of such a condition by elimination of the causative factors (in this case, extraction of an infected tooth) and antibiotic therapy may result in resolution of the cellulitis without formation of pus.
If pus does accumulate, however, it must be evacuated. This procedure is known as incision and drainage. Within 24 to 48 hours, the patient will improve. There are specific areas for incision and drainage, depending on the area of localization of the infection.

It cannot be overemphasized that in the treatment of infection, a thorough knowledge of fascial planes and tissue spaces, together with a complete understanding of therapeutic measures, is mandatory. Without such wisdom, infections of the face and jaws can rapidly become a threat to life.

**Ludwig's Angina**

Ludwig's angina is a diffuse, uncontrolled infection of all five submaxillary spaces. Prior to the age of antibiotics, this infection often resulted in death, due to asphyxiation. The clinical picture is one of extensive edema of the oral and pharyngeal region. The floor of the mouth is elevated and with it, the tongue. Spread of the infection to the lateral pharyngeal spaces is common. Treatment is aimed at relief of respiratory obstruction and control of infection. Tracheostomy is often necessary. Aggressive antibiotic therapy, together with drainage of any purulence, is mandatory.