



# Cranial Nerves for Swallowing Disorders

What they do, how to assess them, and how they can help to determine your treatment.

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## CN V (5) – Trigeminal Nerve

### What it does:

**Sensory:** controls all somatosensation (touch, pain, and temperature) from the face and anterior 2/3 of the tongue

**Motor:** controls all motor movement for the:

- Mylohyoid and anterior belly of the digastric (suprahyoid muscles, laryngeal ELEVATORS)
- TENSOR veli palatini (does NOT tense the velum, it opens the eustachian tube)
- 4 Muscles Of Mastication (masseter, temporalis, medial and lateral pterygoids).

Mnemonic device to remember: MY TENSORS DIG ANTS 4 MOM

MYlohyoid + TENSOR veli palatini + DIGastric (ANTerior) + 4 Muscles Of Mastication (masseter, temporalis, medial and lateral pterygoids) (Thanks Wikipedia!)

### How do you assess it?

- Suprahyoid muscles:
  - Gently touch the patient's hyoid bone, ask them to swallow, and feel for hyolaryngeal elevation. Very minimal to no elevation can indicate an impairment here, but it is a very rough guide.
  - Put your hand under their jaw and ask them to tense their lower jaw muscles to feel for the ability to tense the floor of the mouth, hence roughly assessing the mylohyoid.
- Muscles of mastication:
  - Have the patient clench their cheeks, if you feel the bulging at the jawline, Yahtzee!
  - After clenching of the teeth, have them open their jaw, if there is a deficit, the jaw will deviate to the weak side.

### How can this guide your treatment?

If ANY of these deficits are present, then you know you have some sort of motor trigeminal nerve (CNV3) involvement going on. Some potential deficits include:

- The oral phase with poor mastication, oral transfer with poor stabilization of the floor of the mouth.
- The pharyngeal phase with decreased hyolaryngeal excursion (big predictor of dysphagia!)

If you know you have an injury to one side or the other, allow that to tailor your treatment. Perhaps a head turn, or head rotation to the weak side will allow for the unaffected, stronger side to lead the way. You also can try the Mendlesohn, Shaker, or CTAR (barring any contraindications) since the patient may have some difficulty with hyolaryngeal excursion. Other possibilities include EMST and NMES.

## CN VII (7) – Facial Nerve

### What it does:

**Sensory:** TASTE to the anterior 2/3 of the tongue (back to the circumvallate papillae)

**Motor:** controls all motor movement for the:

- Face: including several muscles of facial expression, oral acceptance (i.e. orbicularis oris), and pocketing prevention (buccinator).
- Stylohyoid and posterior belly of the digastric (considered hyoid elevators, but they elevate and RETRACT the hyoid, so aren't nearly as important as the muscles that protract the hyoid and give us hyolaryngeal excursion.)
- Submandibular and sublingual salivary glands - if you have a patient presenting with a dry mouth, you know the facial nerve may be in play.

## How do you assess it?

- If you notice a facial droop to one side or the other, you know that the patient has facial nerve involvement and to which side.
  - If you're suspecting an upper motor neuron (UMN) lesion, the lower side of the face on the opposite side (contralateral) will be affected.
  - If you have a (lower motor neuron) lesion, both the upper and lower sides of the face on the same side (ipsilateral) as the lesion will be affected.
- Have the patient pretend to blow out some candles to assess the orbicularis oris.
- Puff out their cheeks assessing the buccinator which helps to prevent pocketing.

## How can this guide your treatment?

Some potential deficits in the oral phase could include poor bolus formation, poor oral acceptance, anterior spillage and pocketing. Possible treatment strategies may be exercises to lingual, labial, or mandibular musculature, IOPI, or NMES in the facial placement.

## CN IX (9) – Glossopharyngeal Nerve

### What it does:

#### Sensory:

- Touch, pain, temperature, and TASTE from the POSTERIOR 1/3 of the tongue.
- Somatosensation (meaning touch, pain and temperature) from the mucosa of the soft palate AND upper pharyngeal mucosa
- Parotid salivary glands

**Motor:** CN IX only provides motor innervation to the stylopharyngeus, which is a laryngeal elevator (because it lifts the entire pharyngeal wall up) and also assists in relaxing and opening of the cricopharyngeus.

### How do you assess it?

- You can't! There is no way to reliably assess CN IX at the bedside, as there is an extremely high risk of false positives.

### How can this guide your treatment?

If you do know the patient has damage to the motor fibers of CN IX, they may have difficulty moving food through the pharynx due to weak pharyngeal constrictor contraction, possibly leading to failure of opening of the UES/PES. Possible treatment strategies to improve UES opening include the Shaker, Mendlesohn, CTAR, and NMES.

## CN X (10) – Vagus Nerve

### What it does:

#### Sensory:

- Mucous membrane at the valleculae, epiglottis, aryepiglottic folds, and most of the larynx (via the internal branch of the superior laryngeal nerve)
- Mucous membrane below the level of the folds (via the recurrent laryngeal nerve)
- Special sensory taste to the epiglottis
- General sensory to the soft palate, posterior tongue, lower pharynx (beyond where CN IX stops), and the UES

#### Motor:

- The superior, middle, and inferior constrictors
  - The inferior constrictor includes the cricopharyngeus (innervated by the pharyngeal plexus) and is the primary muscle of the UES. It is tonically active, but relaxes during swallowing to open so that the bolus can pass through,

- All of the muscles of the soft palate EXCEPT the tensor veli palatini (which is CN V)
- Salpingopharyngeus
- ALL intrinsic laryngeal muscles (via the L recurrent laryngeal nerve)
- Cricothyroid (via the external branch of the superior laryngeal nerve)

## How do you assess it?

- You are able to assess the vagus nerve at the bedside by inspecting the palate. If it is lower, and less arched, and you have the patient say “aaaaah”, and see a deviation to one side or the other, then you know there is some sort of CN X pharyngeal branch impairment.
- You can also listen to the patient’s voice. By having the patient converse or sustain phonation, listen for changes in vocal quality, pitch, loudness levels, and control.
- These are obviously VERY general techniques that can be used, but if something doesn't seem quite right here, this is a patient that you REALLY MUST pursue an instrumental assessment on.

## How can this guide your treatment?

- Any sort of vagus nerve involvement can lead to reduced laryngeal adduction, and/or poor cough effectiveness leading to aspiration during the swallow, poor UES opening leading to aspiration of residue after the swallow, and any type of sensory impairment of the vagus nerve can lead to the ever dreaded silent aspiration.
- A few exercises that may be beneficial include the Shaker, CTAR, Mendelsohn, supraglottic exercise, super-supraglottic (barring any contraindications), and possibly NMES in the submental placement.
- It is important to NOT recommend compensatory strategies at mealtimes unless you have trialed them under MBSS/FEES first as it can have the opposite effect and propel the bolus in to the laryngeal vestibule.

## CN XII (12) – Hypoglossal Nerve

### What it does:

**Sensory:** NONE! CN XII is the only nerve with solely motor function

**Motor:** All intrinsic and extrinsic tongue muscles (except palatoglossus)

### How do you assess it?

- The hypoglossal nerve is mostly involved with the oral phase. You are able to assess its function at the bedside by having the patient protrude the tongue and push against the cheek. The tongue will deviate to the side that is WEAK.
  - If it is an UMN lesion, weakness is contralateral to the lesion.
  - If this is a LMN lesion, then weakness is ipsilateral to the lesion. Tongue fasciculations are also an indicator of a neurological impairment of LMN only – so loss of bulk, and fasciculations, both suggest LMN.

### How can this guide your treatment?

The hypoglossal nerve is involved in oral pocketing, bolus propulsion, and poor lingual pressure to drive the bolus through the PES/UES. Potential treatment strategies may be exercises to lingual musculature, Masako, Effortful swallow, gargling, super-supraglottic exercises, IOPI, or NMES in the facial placement.

## Ansa Cervicalis

A loop formed at C1-C3 (part of the cervical plexus) contains thyrohyoid and geniohyoid (C1only), sternohyoid, omohyoid, and sternohyoid all considered the infrahyoids or laryngeal depressors.

### Resources:

Corbin-Lewis, K, Liss, J.M., & Sciortino, K.L., 2005, Clinical Anatomy & Physiology of the Swallow Mechanism, Thomson Delmar Learning, Clifton Park, NY

Murray, J., 1999, Manual of Dysphagia Assessment in Adults, Singular Publishing Group, Inc., San Diego