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The Cranial Nerve Exam: Effectiveness of Peer-to-Peer Teaching and Experiential Learning in Speech-Language Pathology Graduate Students

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The Cranial Nerve Exam: Effectiveness of Peer-to-Peer Teaching and Experiential Learning in Speech-Language Pathology Graduate Students

Abstract

This study sought to determine if speech-language pathology graduate students found peer-to-peer teaching and experiential learning beneficial in learning how to assess the cranial nerves. Graduate students in a motor speech disorders course completed an in-class cranial nerve examination in which they either portrayed clinicians or patients. Student groups utilized a reflective practice approach by teaching their peers how to assess the cranial nerves. Intensive practice sessions were offered almost daily for two weeks prior to the exam. Thirty-seven students completed an online survey about their knowledge and confidence in assessing cranial nerves and identifying diagnoses before starting the training for the exam; 36 participants completed the same survey post-exam training. Students reported feeling more confident and less anxious in evaluating the cranial nerves, assessing damages, and identifying diagnoses. This preliminary study indicates peer-to-peer teaching could be an effective strategy for learning how to evaluate cranial nerves.

Keywords

Reflective learning, Peer-to-peer teaching, Experiential learning, Adult neurogenics

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Instructors incorporate different teaching methods to enhance college students' learning and prepare them for their careers. Reflective practice, also known as reflective thinking, reflective learning, and experiential learning, seeks to have students learn via experience and self-directed learning (Cadorin et al., 2015; Caty et al., 2014; Haddock, 1997). Reflective learning, which is the terminology that will be used throughout the majority of this paper, leads to students learning how to problem-solve, develop critical thinking skills, collaborate with others, learn through doing, remain flexible, and improve decision making (Cadorin et al., 2016; Dube & Ducharme, 2015; Tillard et al., 2018).

Reflective learning can be an effective teaching method and can include activities such as practice groups that involve case studies, data, and scenarios; reflective journaling; and questionnaires (Baxter & Gray, 2001; Caty et al., 2014; Dube & Ducharme, 2015; Dunn & Musolino, 2011; Haddock, 1997; Knecht-Sabres, 2010; Tillard et al., 2018). Reflective learning is being used with medical, occupational therapy (OT), and speech-language pathology (SLP) students (Cadorin et al., 2016; Caty et al., 2014; Dube & Ducharme, 2015; Knecht-Sabres, 2010; Tillard et al., 2018; Visconti, 2010). OT and SLP students report reflective learning improved their skills and self-perception of their skills, including being able to more accurately plan for evaluations and treatments sessions while simultaneously balancing their evidence-based sessions with the hopes of patient and family members; students also reported they had better clinical reasoning skills and greater knowledge of resources (Burda & Hageman, 2015; Knecht-Sabres, 2010; Tillard et al., 2018; Visconti, 2010). Tillard et al. (2018) had SLP students participate in reflective practice groups while completing clinical aspects of their degree. Reflective practice sessions were 45-60 minutes long for 12 weeks; trained Clinical Educators were facilitators. A pre/post-test was administered before and after the 12-week period. Students reported reflective practice was a good use of time and increased their engagement. They believed they made positive contributions to their peers' learning and that these positive changes in perception were maintained for six weeks.

Problem-based learning (PBL) can be used as a reflective learning approach. A pure PBL approach requires students solely teach themselves the course content when given complex patient cases and scenarios to address; tutors may facilitate the process, however, they may not have expertise in the course content (Edens, 2000; M. Rose, personal communication, April 26, 2004; Whitehill et al., 2014). A hybrid PBL approach is when lectures are provided by the course instructors while students also get into groups to independently work through complex patient cases (Burda & Hageman, 2015). As part of the PBL process, students are taught to evaluate what they do not know, and what they need to find out; they then take the time and responsibility to learn new information (Burda & Hageman, 2015; Dunn & Musolino, 2011). PBL is being used in SLP programs (Burda & Hageman, 2015; Visconti, 2010; Whitehill et al., 2014) with the goal to strengthen students' comprehension of learning topics embedded in a problem (Whitehill et al., 2014). SLP graduate students in hybrid PBL courses as part of their curriculum are given increasingly complex patient cases to work through over the course of the semester (Burda & Hageman, 2015). Additional circumstances are included as part of the patient cases (e.g., legal and ethical concerns regarding a patient who unexpectedly dies in a hospital). Students assigned to semester-long groups work through these cases and give presentations regarding treatment approaches and other pertinent issues (e.g., role play rounds with other disciplines, deal with family members who disagree with SLP recommendations; Burda & Hageman, 2015). Reflective practice, including PBL, can be time-consuming (Burda & Hageman, 2015; Tillard et al., 2018),

especially initially, leading students to feel overwhelmed, and they can be frustrated when trying to coordinate group schedules (Burda & Hageman, 2015). Despite these concerns, students tend to state that the benefits outweigh the challenges, they retain more information, and their communication and critical thinking skills have improved (Burda & Hageman, 2015).

Peer-to-peer learning (i.e., peer learning) and peer-to-peer teaching are other ways that reflective learning can be used (Stigmar, 2016). No consensus exists on the definitions of peer-to-peer learning or peer-to-peer teaching, and researchers use such terminology interchangeably (Dawson et al., 2014; Stigmar, 2016). Irrespective of the specific vocabulary used, in essence, peers facilitate each other's learning (Stigmar, 2016). Thus, peer-to-peer teaching has individuals learn new information and then teach this information to their peers (Burda & Hageman, 2015; Pawson et al., 2006). Peer-to-peer learning can take place in many forms, including when a pure or hybrid PBL approach is utilized (Burda & Hageman, 2015). It can also take place when students are learning new clinical skills and allows peers to provide support to each other when learning self-awareness and professional practice skills (Dube & Ducharme, 2015). Baxter and Gray (2001) evaluated the effectiveness of reflective practice on SLP students' clinical education. Peer learning was paired with deep learning in which students were given client case notes and encouraged to problem solve and think independently in terms of what they might do with a client. Students reported being more self-directed and active in their learning and felt both supported, yet not dependent on a teacher's presence (Baxter & Gray, 2001).

Learning to evaluate the cranial nerves is a way reflective learning and peer-to-peer teaching can be implemented in SLP courses. SLP students must be knowledgeable about the cranial nerves due to the patients they will see, and identifying the cause of neurologically-related symptoms helps clinicians formulate treatment plans (Hannibal, 2017). However, little research has been found which details if, and how, SLP graduate students are trained in how to carry out a cranial nerve exam. This can present some challenges since there is the expectation that students will need to perform such exams on patients in their future jobs (Carnaby, 2012). Thus, more information is needed to help inform instructors on how to best incorporate innovative practices into their courses (Kamper et al., 2021). Specifically, this study addressed the following research questions:

1. Do SLP students report having greater knowledge and confidence in evaluating the cranial nerves after having participated in peer-to-peer teaching?
2. Do students in their first semester of graduate school (i.e., G1s) report having greater knowledge and confidence in evaluating the cranial nerves after having participated in peer-to-peer teaching?
3. Do students in their second semester of graduate school (i.e., G2s) report having greater knowledge and confidence in evaluating the cranial nerves after having participated in peer-to-peer teaching?

Methods

Participants. Participants were classified based on their corresponding cohorts and included first-semester graduate students (i.e., G1s) and second-semester graduate students (i.e., G2s) attending the University of Northern Iowa (UNI) (IRB Protocol #19-0154). All were enrolled in the Motor Speech Disorders course during the Fall 2019 semester. During this particular semester, 45 students were enrolled in the course. Students were divided into three semester-long groups; each of the three groups had 5 G2s and 10 G1s. Participants provided informed consent prior to

completing the survey instrument described below. A total of 37 participants completed an online pre-cranial nerve training exam survey; 36 completed the online post-cranial nerve training exam survey. Of the G1 students, 26 completed the pre-cranial nerve training survey and 25 completed the post-cranial nerve training survey. Eleven G2 students completed both the pre-and post-cranial nerve exam training survey.

Survey Instrument. The investigators developed the survey using Tillard et al.'s (2018) questionnaire as a guide. The survey's aim was to understand students' familiarity, knowledge, and confidence in assessing the cranial nerves and how these perspectives evolved over the course of two weeks. Responses included a Likert rating scale with the anchor points of (1) strongly disagree, to (5) strongly agree. Students also described the benefits and challenges with reflective learning. The same survey was used pre- and post-cranial nerve exam training (Appendix A) with the training and evaluation process described below. The online survey link was sent out to the Motor Speech Disorders class via email at the beginning of the first day of class, prior to any preparation for the cranial nerve examination, and the week following the completion of the exam. In order to avoid any possible coercion, the survey link was sent out by the departmental coordinator (not the class instructor) to students. The instructor was also not present while the student research team members read aloud the research script.

Cranial Nerve Training and Examination Procedure. At UNI, graduate students complete an experiential cranial nerve examination in the Motor Speech Disorders course in the fall semester and the Aphasia course in the spring. Historically, this exam takes place the third week of each semester. All 12 cranial nerves are evaluated; some are evaluated as a group (i.e., III, IV, and VI are evaluated as one group, as is IX, X, and XI). Alternating motion rates (AMRs), sequential motion rates (SMRs), maximum phonation time (MPT), and suck, snout, and palmomental reflexes are evaluated as part of cranial nerve I, because the instructor (i.e., first author) judged this cranial nerve to be too easy to evaluate alone. In the working world, SLPs evaluate cranial nerves that pertain to their scope of practice; however, the instructor believed it important that students have basic knowledge of how all cranial nerves are evaluated in order to strengthen their understanding when reading future patients' case histories.

At UNI, a hybrid PBL approach is utilized (Burda & Hageman, 2015). As part of UNI's Motor Speech Disorders and Aphasia classes, each student is placed into one of three peer-to-peer teaching groups on the first day of class. Groups are generally divided up alphabetically to include a relatively equal number of G1s and G2s. G2s are expected to teach the G1s the expectations and knowledge of the cranial nerve examination as the G2s completed the exam in the previous semester. G2s provide G1s with a script (see Appendix B) and a chart explaining information (see Appendix C; e.g., damage, diagnosis, symptoms) needed to accurately complete the exam. The script outlines what should be said when evaluating each nerve, what functions are being tested, what questions to ask the patient, and instructions for the mock patient when being evaluated, based on possible diagnoses. G1s and G2s use this script to study and better understand each cranial nerve. Daily group study sessions are set up by the graduate students that span a two-week period and last 2-4 hours per day. Each student meets for 2-3 hours per day. Up to four hours are allotted per day to accommodate students' varying schedules due to class and clinic responsibilities. G2s take turns training the G1s in 2-3 hour blocks with independent outside studying expected. Initially, the G2s model how the clinician conducts the examination for each cranial nerve. Then, G2s encourage G1s to practice being the clinician while evaluating the various

cranial nerves. Overall, students tend to spend an average of 40 hours learning and studying for the exam.

By the end of the first week, G1s are encouraged to independently evaluate all 12 cranial nerves without the script. Next, the possible damages and/or diagnoses related to each cranial nerve are taught. G1s learn how to diagnose damages (e.g., look at the client and know that right facial droop represents possible right lower motor neuron [LMN] damage) and how to present damages as a mock client (e.g., tongue out to the left and evidencing fasciculations represents possible left LMN damage to the hypoglossal nerve). Lastly, additional possible diagnoses are taught (e.g., Parkinson's disease, left neglect). G2s act out the diagnoses, and teach the G1s student-developed "tricks and tells" to remember the specific disorder. For example, the patient presents with possible bilateral LMN damage to cranial nerve XII by sticking their tongue out slightly while moving it as though it has fasciculations. This is a "tell" to the clinician that it is bilateral LMN damage. Towards the end of the two-week period, study sessions consist of combining all learned material and practicing until everyone feels comfortable. Occasionally, G2s may present slightly different ways on how to evaluate the same cranial nerve. In such instances, G2s discuss these differences and arrive at an agreed-upon procedure for evaluating a nerve. They consult with the course professor, as needed; however, in general, G2s are independent in their teaching of the material.

On exam day, each group generally has 45 minutes to complete the cranial nerve exam, which operates as such: the instructor randomly calls two students with one assigned the client role and the other the clinician role. The clinician assesses only one cranial nerve or one group of cranial nerves (i.e., III, IV, VI; IX, X, XI). The client randomly draws which nerve will be assessed. The client and professor leave the room and go into the hallway, where the client is given corresponding cranial nerve damage (e.g., unilateral lower motor damage; bilateral upper motor damage) and/or possible diagnoses (e.g., malingering, Huntington's disease). The client may utilize props (e.g., red stickers to represent shingles, walker) and is given some time to prepare for their portrayal of the assigned diagnosis. Meanwhile, the clinician stays in the classroom and has the opportunity to run through the specific cranial nerve evaluation (e.g., cranial nerve VIII: check hearing and balance) prior to the client's return. At the end of the evaluation, the clinician must state the associated damage/diagnosis that was presented for that specific cranial nerve. This process continues until all students have completed the exam.

Results

Descriptive Statistics. Descriptive statistics were conducted on survey questions 3-8 and are included in Table 1 and in Table 2 (see below). In general, all students had higher scores on post-cranial nerve exam training surveys, with the exception of the survey item regarding anxiety level, in which students as a whole reported lower scores (i.e., lower anxiety) post-training (see Table 1).

Inferential Statistics. A series of paired t-tests were conducted to determine if pre-post training survey responses were significantly different. For G1s, the following statistically significant differences occurred on: Question 3 (t (24) = -12.00, $p \leq .0001$); Question 4 (t (24) = -7.61, $p \leq .0001$); Question 5 (t (24) = -7.45, $p \leq .0001$); Question 6 (t (23) = -10.40, $p \leq .0001$); and Question 7 (t (24) = 6.02, $p \leq .0001$). No statistically significant differences occurred pre- and post-training on Question 8 (t (24) = -1.41, $p \geq .17$) (See Table 3).

For G2s, the following statistically significant differences occurred on: Question 3 (t (10) = -6.71,

$p \leq .0001$); Question 5 (t (10) = -2.89, $p \leq .02$); Question 6 (t (10) = -4.28, $p \leq .002$). No statistically significant differences occurred pre- and post-cranial nerve exam training on: Question 4 (t (10) = -2.06, $p \geq .07$); Question 7 (t (10) = 1.99, $p \geq .07$); or Question 8 (t (10) = -1.94, $p \geq .08$) (See Table 4). An additional single t-test conducted revealed that G2s' pre- training scores were significantly higher than G1s' pre-training scores on Question 7 (t (25) = 39.95, $p \leq .001$), indicating G2s were less anxious than their G1 counterparts prior to the onset of peer-to-peer training. Overall, students had lower scores on the post-cranial nerve examination training survey item pertaining to anxiety levels; all other items generally had significantly higher mean scores.

Table 1

Mean Scores on Pre- and Post-Cranial Nerve Examination Training Survey Responses: All students

Question Number	**Question Description**	**Pre-Training Responses** (n = 37)		**Post-Training Responses** (n = 36)	
		M	*SD*	*M*	*SD*
3	**Effectively describe diagnoses**	2.78	1.20	4.64	0.49
4	**Identify possible lesions/etiologies**	3.14	1.23	4.58	0.50
5	**Confidence in ability to assess cranial nerves**	2.97	1.42	4.53	0.61
6	**Confidence in ability to teach cranial nerves***	2.56	1.34	4.47	0.65
7	**Anxiety about performing the Cranial Nerve Exam**	3.95	1.18	2.69	0.98
8	**Positive effect on academic knowledge and clinical skills**	4.54	0.56	4.78	0.42

Note: *36 participants responded to this item pre-cranial nerve examination versus 37 participants.

Table 2

Mean Scores on Pre- and Post-Cranial Nerve Examination Training Survey Responses: G1s and G2s

Item Number*	G1s Pre-Training[a]		G1s Post-Training[b]		G2s Pre-Training[c]		G2s Post-Training[d]	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Question 3	2.23	0.99	4.52	0.51	4.09	0.30	4.91	0.30
Question 4	2.73	1.15	4.52	0.51	4.09	0.83	4.73	0.47
Question 5	2.35	1.20	4.36	0.64	4.45	0.52	4.91	0.30
Question 6**	1.96	1.10	4.28	0.68	3.91	0.70	4.91	0.30
Question 7	4.27	1.04	2.88	0.97	3.18	1.17	2.27	0.90
Question 8	4.50	0.58	4.72	0.46	4.64	0.50	4.91	0.30

Note: See Table 1 to see an abbreviated content of the question item. **25 participants completed Question 6. [a]*n*=26; [b]*n*=25; [c]*n*=11; [d]*n*=11

Table 3

T-Test Results for Pre- and Post-Cranial Nerve Examination Training Survey Responses: G1s

Pairs of Pre- and Post- Items	*t*	*df*	*p*
Question 3	-12.00	24	0.0001
Question 4	-7.61	24	0.0001
Question 5	-7.45	24	0.0001
Question 6	-10.40	23	0.0001
Question 7	6.02	24	0.0001
Question 8	-1.41	24	0.17

Table 4

T-Test Results for Pre- and Post-Cranial Nerve Examination Training Survey Responses: G2s

Pairs of Pre- and Post- Items	*t*	*df*	*p*
Question 3	-6.71	10	0.0001
Question 4	-2.06	10	0.07
Question 5	-2.89	10	0.02
Question 6	-4.28	10	0.002
Question 7	1.99	10	0.07
Question 8	-1.94	10	0.08

Discussion

Findings of the Current Study. Speech-language pathologists are expected to perform cranial nerve exams on their patients in order to develop appropriate treatment plans that best meet the needs of their patients (Carnaby, 2012; Hannibal, 2017), yet little published research exists focusing on how SLP students can be trained in order to carry out such evaluations. One recent study employed the use of spaced retrieval when asking graduate SLP students to recall cranial nerve knowledge (e.g., name, body part innervated, function, type) (Johnson et al., 2019). While students improved their knowledge of the cranial nerves, they provided written responses on a survey and did not actually conduct cranial nerve examinations on each other (Johnson et al., 2019). Results of the current study indicated participants had several statistically significant differences on survey items pre- vs. post-completion of the cranial nerve examination training. Specifically, after participating in intensive peer-to-peer teaching, students reported more extensive knowledge and confidence in evaluating cranial nerve function, greater abilities in identifying and explaining underlying diagnoses and etiologies and in teaching their peers how to assess the cranial nerves. This data is similar to other studies reporting that peer-to-peer teaching and reflective learning can be beneficial for introducing students to new concepts and helping them to learn through experiences (Haddock, 1997; Tillard et al., 2018).

Students reported significantly lower anxiety levels after completing the exam. The majority of the participants were in their first semester of graduate school and had not previously experienced the cranial nerve examination. While examining the results of the G2s, no statistically significant differences were noted on the survey items pertaining to identifying lesions/etiologies and anxiety level. Since the G2s had previously completed the exam during Spring 2019, it is logical to assume that they were more comfortable identifying underlying causes of cranial nerve damage and less anxious compared to the students entering their first semester of the graduate program. As Knecht-Sabres (2010) noted, participating in experiential learning can allow students to have greater self-perception in their ability to carry out various professional tasks, including assessments.

The only instance in which survey scores were not significantly different pre-and post-cranial nerve examination training was on survey item #8. This item asked individuals about the impact of peer-to-peer teaching and experiential learning on their academic knowledge and clinical skills. As part of the information students provided on what they did and did not like about this approach to studying for the examination, students liked that the peer-to-peer teaching pertained to real life situations. Therefore, lack of significant differences on this item are not entirely unanticipated as Hannibal (2017) noted the importance of SLPs possessing knowledge of the cranial nerves. Providing experiences that mimic the real world as best as possible can help SLP students learn necessary and practical skills and information (Caty et al., 2014; Hannibal, 2017). It is also plausible the students had experience with peer-to-peer teaching or experiential learning prior to taking the survey, though no specific data was collected on this specific topic. Students also reported that while the short, intense study time was stressful and difficult to coordinate study schedules, peer-to-peer teaching improved their collaboration and time management skills, which are abilities SLP need. These responses are similar to prior studies by Burda and Hageman (2015) and Knecht-Sabres (2010).

Overall, researchers have reported positive outcomes when incorporating reflective learning in their courses (Baxter & Gray, 2001; Burda & Hageman, 2015; Dube & Ducharme 2015; Dunn & Musolino, 2011; Haddock, 1997; Tillard et al., 2018; Visconti, 2010). This study indicates that graduate students had enhanced confidence and self-perception of their clinical abilities when evaluating the cranial nerves after participating in peer-to-peer teaching and experiential learning.

Limitations and Future Research. The limitations encountered in this study should be taken into consideration. The survey used for this study did not undergo any psychometric testing. In addition, the survey tool developed by Tillard et al. (2018), which was used as a guide for the current study's survey tool, was developed as a "fit-for-purpose questionnaire" (p. 5), and has not been reported to have undergone psychometric testing. Thus, neither have been validated for use. Further research could include a more detailed, psychometrically validated survey.

Another limitation pertains to the minimal demographic information reported on participants. Socioeconomic status, cultural beliefs, and academic standing of the participants was not obtained. Therefore, it is unknown if such variables would have impacted pre- and post-survey responses. In addition to a lack of demographic information on participants, no survey questions inquired about participants' preferred learning methods. Yet, individuals can have different learning preferences (Brown et al., 2008; Hatami, 2013). For example, the G1s likely had various learning strengths, which could potentially impact the following semester when they teach the incoming group of students, though this is unknown since such information was not obtained. In addition, for the eights students that chose not to participate in the study, it is unknown whether or not this learning style was beneficial to their critical thinking skills and aided in their clinical decision making. Future research could compare students' perceptions of this learning experience with objective measures of learning. Finally, the learning interval was short at only two weeks; however, this encouraged more rigorous studying by the groups involved.

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Appendix A

Survey

1. Are you a: Male/Female/Other-describe

2. Are you a: G1/G2

3. I can effectively explain my reasoning for determining a diagnosis after evaluating cranial nerves.
- Strongly Agree (5) -Agree (4) -Neither Agree or Disagree (3) -Disagree (2) -Strongly Disagree (1)

4. I can identify possible sites of the lesion and/or etiologies based on cranial nerve damage.
- Strongly Agree (5) -Agree (4) -Neither Agree or Disagree (3) -Disagree (2) -Strongly Disagree (1)

5. I have confidence in my abilities to assess cranial nerves.
-Strongly Agree (5) -Agree (4) -Neither Agree or Disagree (3) -Disagree (2) -Strongly Disagree (1)

6. I have confidence in teaching peers on how to assess cranial nerve function.
-Strongly Agree (5) -Agree (4) -Neither Agree or Disagree (3) -Disagree (2) -Strongly Disagree (1)

7. I am anxious about performing a Cranial Nerve Exam.
-Strongly Agree (5) -Agree (4) -Neither Agree or Disagree (3) -Disagree (2) -Strongly Disagree (1)

8. I recognize peer-to-peer teaching, participating in a mock Cranial Nerve Exam, and portraying mock patients positively affects my academic knowledge and clinical skills
-Strongly Agree (5) -Agree (4) -Neither Agree or Disagree (3) -Disagree (2) -Strongly Disagree (1)

9. What do you like about using this approach to study the cranial nerves?

10. What do you not like about using the approach to study cranial nerves?

Appendix B

Script Used During Teaching of and Studying for the Cranial Nerve Examination

Cranial Nerve I: Olfactory, And Also AMRS, SMRs, MPT, and Primitive Reflexes:

Testing: Sense of smell, rate of speech, duration of phonation, and your primitive reflexes

Assessment: Do you have a cold? Are you a smoker? Have you been exposed to any chemicals recently? Have you recently been in an accident or had any trauma?

Ok I'm going to begin by testing your sense of smell

(Test each nostril by having client close their eyes and plug one nostril

Place a vile of a well-known scent under nose)

Do you smell anything? (Each nostril)

(If yes) What do you smell?

Alternating Motion Rates (AMRs): Ok now we're going to test your rate of speech I'm going to give you a sound and I want you to say it as rapidly as you can: puh, puh, puh, tuh, tuh, tuh, kuh, kuh, kuh.

Sequential Motion Rates (SMRs): Now what I'm going to have you do is put all three of those sounds together and again say it as rapidly as you can: puh-tuh-kuh, puh-tuh-kuh, puh-tuh-kuh

(*puh-tuh-kuh is a Sequence)

Maximum Phonation Time: Alright now I want you to say ahhhh for as long as you can and we're going to do that three times: ahhhhh ahhhh ahhh

Primitive Reflexes: Now the last thing I'm going to test is your reflexes: (Swipe finger across top lips. Then Swipe across both palms. Then tap space between nose and top lip on the philtrum.)

Presenting Damages:

Unilateral: client cannot smell on one side: lesion located on the **ipsilateral side**

Bilateral: client cannot smell from either nostril

Hypersensitivity: client can smell everything (refer on to ENT or neurologist but no neurological damage)

Referral: ENT or Neurologist

Cranial Nerve II: Optic

Testing: Vision

Assessment:

Do you normally wear contacts or glasses? If so, please wear them for the exam

Pupillary Light Reflex: (Shine light into eyes one at a time and check the pupils)

Visual Acuity: Please cover one eye and I'm going to give you this chart. Hold it out in front of you at a comfortable distance and read the smallest line you can clearly see.

Ok now we'll do that again for the other eye

Visual Field (4 quadrants): I'm going to have you focus on my nose

(Hold hands up by shoulders) Can you see my hands?

(Drop hands down around midriff area) What about now?

Keep focused on my nose. I'm going to wiggle my fingers and I want you to tell me which side they're wiggling on (Test all four quadrants)

Now I'm going to stand behind you and I want you to say "now" as soon as you see my finger come into your side view (Test both eyes)

Presenting Damages:

Unilateral Partial Damage: Client will be able to see both hands but *the hand on the damaged side will appear blurry*. Client won't see finger or cotton swab until it reaches *midline* on the damaged side. Lesion located on the **ipsilateral side.**

Unilateral Entire Nerve Damage: Client will not be able to see or read anything out of the damaged eye. Lesion located on the **ipsilateral side.**

Bilateral Partial Damage: Can see from damaged eyes but is *blurry* in all tests. Client cannot see finger/cotton swag until midline on either side.

Bilateral Entire Nerve Damage: Client is completely blind.

Referral: Optometrist

Cranial Nerve III: Oculomotor, IV: Trochlear, VI: Abducens

Testing: Eye movement

Assessment:

Have you been experiencing any double vision?

Alright, first we're going to take a look at the size of your pupils and check for eyelid droop.

Next, I'm going to shine a light in your eyes to check your pupil dilation.

Ok, now I'm going to have you follow my finger with your eyes (Versions)

(Move finger in an H pattern)

Now I want you to cover one eye, and I'm going to have you follow my finger again (Ductions; Move finger in an H pattern. Repeat for both eyes)

Alright, now I just need you to follow my finger one more time (Convergence)

(Move finger in towards client's nose)

Presenting Damages:

Cranial Nerve III:

Unilateral: Client will have one eye that looks ***outward*** on damaged side, client will not be able to do convergence or H test. Lesion located on **ipsilateral** side

Bilateral: Client will have ***both*** eyes look outward, when checking each eye both will look ***outward***, client will not be able to do convergence or H test

Cranial Nerve IV:

Unilateral: Client will have one eye that looks ***upward***, client will not be able to do convergence or H test. Lesion located on **ipsilateral** side.

Bilateral: Client will have ***both*** eyes look ***upward***, client will **look upward throughout testing**

Cranial Nerve VI:

Unilateral: Client will have **one** eye that looks ***inward*** on damaged side, client will not be able to do convergence or H test. Lesion located on **ipsilateral** side

Bilateral: Client will have **both** eyes look ***inward***, when checking each eye both will look ***inward***. Client will not be able to do convergence or H test.

Cranial Nerve V: Trigeminal

Testing: Feeling in the face and mouth/jaw movement

Assessment:

Have you been experiencing any weakness in your face?

First I'm going to check your corneal reflex (Lightly move finger towards each eye and look for eye blink. *Lack of eye blink indicates damage to ophthalmic branch)

I'm going to check the feeling in your face in the three areas of sensation with a light touch. (Swipe over eyebrows on one side, ask client if they felt it. Repeat on other side, ask the client if the touch felt equal on both sides. Repeat across cheeks and chin)

Now I'm going to do it again with a little bit of a harder touch

Ok, can you open and close your mouth for me. Now wiggle your jaw back & forth

Now bite down for me/clench your teeth (Feel masseter and temporalis muscles)

Now I'm going to try and open your mouth don't let me

Ok, now I want you to open your mouth and I'm going to try and close it, don't let me

Alright now I'm going to try and push your jaw to the side, don't let me, and I'll do it again on the other side

Jaw Jerk Reflex: Have patient slightly open mouth then place your finger on their chin and strike your finger with a reflex hammer

(*If there is a jaw jerk reflex it is said to be positive indicating an UMN lesion)

Presenting Damages:

Sensory:

Ophthalmic:

Unilateral: Cannot feel or blink on one side of forehead **ipsilateral**

Bilateral: Cannot feel or blink on both sides

Maxillary

Unilateral: Cannot feel on one side of cheek **ipsilateral**

Bilateral: Cannot feel on both sides

Mandibular

Unilateral: Cannot feel on one side of the jaw, ipsilateral

Bilateral: Cannot feel on both sides of the jaw

Motor:

Upper Motor Neuron (UMN) Lesion

Unilateral: No jaw deviation, overall jaw weakness, can only slightly resist pressure during open/close/sides tests

One side will be weaker-let clinician know of weakness

SLIGHT jaw reflex

Damage **contralateral** of the lesion

Bilateral: No deviation, jaw hangs slightly open and cannot be closed on its own. Cannot resist pressure. Jaw reflex present and **extreme**.

Lower Motor Neuron (LMN) Lesion

Unilateral: Jaw deviation towards the side of the lesion (weak side) but can resist pressure to the strong side, cannot resist pressure up and down

Bilateral: No deviation, jaw hangs open, cannot be closed, can be pushed to both sides

Cranial Nerve VII: Facial

Testing: Taste and muscle function in the face

Assessment:

Sensory: Alright I'm going to have you close your eyes and stick out your tongue

I'm going to place a taste on the right/left side of your tongue

(*before patient withdraws tongue into the mouth, have them indicate if they taste something before they put their tongue in their mouth)

If yes, what do you taste?

Motor: Okay, I'm going to have you shut your eyes as tightly as possible

(Pull up on patient's eyebrows to see if they can resist pressure)

Now, I need you to open your eyes and raise your eyebrows for me

(Push down on patient's eyebrows to see if they can resist pressure)

Alright, now can you smile really big for me?

Now, pucker your lips and say i-u-i-u-i-u

Now inflate your cheeks for me (Push in on each cheek)

The last thing I need you to do is strain your neck (frog face)

Presenting Damages:

Sensory:

Unilateral: Cannot taste on the side of damage; **ipsilateral**

Bilateral: Cannot taste on either side of tongue

Motor:

UMN Lesion

Unilateral: Can resist eyebrow pressure but not smile and show teeth, pucker lips, inflate cheeks, or strain neck on the **contralateral** side of the lesion.

Bilateral: Whole face is paralyzed. Neither eyebrow can resist pressure. Cannot smile or pucker lips and say i-u-i-u-i-u. Cannot inflate cheeks or all air comes out of cheeks; cannot strain the neck. Face is tight and tense. May say "My face feels really tight."

LMN Lesion

Unilateral: Weakness on ½ side of the face. Cannot resist eyebrow pressure, smile or show teeth, pucker lips, or keep air in on the **ipsilateral** side, but can on the opposite side. Cannot strain neck on the damaged side.

Bilateral: **Whole** face is paralyzed. Neither eyebrow can resist pressure. Cannot smile or pucker lips and say i-u-i-u. Cannot inflate cheeks or all air comes out of cheeks; cannot strain the neck. Can say "My face feels really droopy."

Cranial Nerve VIII: Vestibulocochlear

Testing: Hearing and sense of balance

Assessment:

Ok, first I'm going to have you stand up and walk to the door and back

Stay standing and place your arms straight out to the side

Now close your eyes and touch your nose with each pointer finger, one at a time

Auditory Acuity: I'm going to rub my fingers together and I'm going to ask you to tell me when you can hear the rubbing.

Rinne's: I'm going to place this tuning fork beside your right ear. Can you hear anything? Tell me when it stops. (Move to the left side) Can you hear anything? Tell me when it stops. Now I'm going to place a tuning/vibrating fork behind your right ear

(Place vibrating fork on the mastoid process behind the ear)

Can you hear that? Tell me when you no longer hear the sound

(Place tuning fork in the middle of patient's forehead) Can you hear that? Can you hear the sound equally on both sides?

Presenting Damages:

Unilateral**:**

Romberg: Will not be able to touch finger to nose on the side of lesion.

Auditory acuity: Pt. won't be able to hear out of **one** ear

Rinne's: Cannot hear tuning fork on **damaged** side

Weber's: Cannot hear on **damaged** side

Gait: Unbalanced in walking on **one** side.

Lesion located on ipsilateral side

Bilateral:

Romberg: Won't be able to touch finger to nose on both sides

Auditory acuity: Won't be able to hear out of **both** ears

Rinne's: Cannot hear tuning fork on **both** sides

Weber's: Cannot hear tuning fork on **both** sides

Gait: Overall unbalanced

Referral: Audiologist or Neurologist

Cranial Nerve IX: Glossopharyngeal, X: Vagus, XI: Spinal Accessory

Clinician "Tip" To Ensure Evaluating All abilities (taught/learned as a short rhyming song): Swallow, Cough, Coup De Glotte, Gag, Say Ah, Kuh-Kuh-Kuh

Testing: Muscles of the throat, neck, and shoulders

Assessment: Have you noticed any changes in your voice?

Have you had any heart or breathing problems?

Ok, I'm going to place my hands on your throat and I need you to swallow for me

(Note laryngeal elevation)

Can you cough for me?

Alright, now I need you to do a sharp grunt (uh).

Have you previously had a gag reflex? (Use a tongue depressor to elicit gag reflex

by stroking **both** faucial pillars)

Now, can you open your mouth for me and say ah (Look in the patient's mouth,

looking for palatal elevation/symmetry and uvula deviation)

Ok, I'm going to place this mirror under your nose and I need you to say kuh-kuh-kuh (Looking for nasal emissions)

Can you raise your shoulders for me?

I'm going to try and press down on them, don't let me.

Now, I'm going to try and turn your head to the side, don't let me and now the other side.

Presenting Damages:

Cranial Nerve IX:

Unilateral: Client will have difficulty with dry swallow, cough, and coup de glotte. There will be no gag reflex on **damaged** side.

Bilateral: Client will have difficulty with dry swallow, cough, coup de glotte. There will be no gag reflex on **either** side.

Cranial Nerve X:

UMN Lesion

Strangled/tight/harsh voice

LMN Lesion

Pharyngeal Branch: Hypernasal

Recurrent Laryngeal Branch: Breathiness

Superior Laryngeal Branch: Noticeable pitch changes

*If CN IX has unilateral damage CN X will also have unilateral damage; same for bilateral damage

Cranial Nerve XI:

Unilateral: Client cannot raise and resist pressure on one shoulder OR resist head turn on the **same** side of the lesion

Bilateral: Client cannot raise either shoulder OR resist pressure when turning head to either side

Referral: Neurologist

Cranial Nerve XII: Hypoglossal

Testing: Muscles of the tongue

Assessment: Can you stick your tongue out for me?

Alright, can you raise the tip of your tongue up?

Now can you move your tongue from side to side?

(Examine tongue for fasciculations, asymmetry, and atrophy)

Can you move your tongue up into your cheek for me?

I'm going to try and push it out, don't let me

Alright now we're going to do the same thing on the other side

Now I just need you to stick your tongue out for me again and I am going to try and push it to the side, don't let me

Now we'll do the same thing on the other side

Presenting Damages:

UMN Lesion

Unilateral: Tongue will deviate to the **contralateral** side of the lesion. Client can protrude, raise, and move laterally, but the tongue will be weak and slow-moving. Cannot move tongue towards or inside of the cheek **contralateral** to the lesion. Tongue can be pushed further to the side that shows weakness but can resist on side of the lesion.

Bilateral: Tongue is paralyzed; cannot do the test. **No Fasciculations.**

LMN Lesion

Unilateral: Tongue deviates to **ipsilateral** side of the lesion **with fasciculations.** Tongue will be weak during protrusion, raising, and lateral movement. Can put tongue in opposite cheek of lesion and resist. Tongue will not be able to resist pressure on the opposite side of the lesion.

Bilateral: Tongue shows **fasciculations.** Tongue can protrude, raise, move laterally. Tongue cannot be put in either cheek or resist pressure from tongue depressor.

*Fasciculations automatically mean LMN lesion. **Referral:** Neurologist

Appendix C

Diagnosis Chart

Diagnosis Name	Nerve it will be paired with	Symptoms to Demonstrate
Parkinson's disease	Any	Shake hands, shuffle feet, take small steps, soft voice, rapid speech rate during AMRs, low volume (i.e., soft and not loud speech), has primitive reflexes
Huntington's disease	Any	Flail arms, twitch shoulders and legs, slow irregular (will have breaks) AMRs, has palmomental reflex
Hypersensitivity-smell	CN I	Extreme sense of smell (ex: notice deodorant, food, breath), extreme reaction to scents
Ptosis	CN III, IV, VI	One eye droops, ask client to hold open; DAMAGE TO CN 3 (innervates the upper eyelid)
Auditory Hallucinations	Any	Hearing things not real -e.g., hearing farm animals
Pseudobulbar affect	Any	Crying, laughing, anger at inappropriate times and that do not match inner emotions
Myasthenia gravis	Any	Voice sounds normal at first and grows progressively quieter - "My voice gets tired quickly. At first my voice is good, the longer I talk, the quieter and worse I get."; Can have hoarse vocal quality

ALS	Any	Has primitive reflexes, decorticate posture - Bulbar Onset ALS: symptoms begin in the face (dysarthria, facial weakness), effortful, hard to make lingual & labial closure AMRS & SMRs - Spinal Onset ALS: curl up hands/arms, symptoms begin with weakness in extremities, short AMRs & SMRs due to breathing, short MPT
Bell's Palsy	CN VII	If CN VII, LMN unilateral Potentially will have impaired hearing on same side (CN VIII), hold face to be droopy, indicate cannot close eye
TIA -transient ischemic stroke, is a mini-stroke	Any	In the middle of testing for short time: Slurred speech, weak arm, droopy face SLP: Call 911, then they will feel better and finish testing.
CVA - cerebrovascular accident	Any	In the middle of testing for short time: Slurred speech, weak arm, droopy face SLP: Call 911 → Patient PASSES OUT ON FLOOR
Stroke to CN X.	CN X	Have breathy sounding voice to mimic vocal fold paralysis. In the middle of test: indicate feel as if not able to adequately get enough air SLP: CALL 911 or for RN or MD
Presbycusis	CN VIII	Can hear but difficult due to age → LET SLP know YOU'RE REALLY OLD
Malingering: say your name is Burda as a "tip" it could be this diagnosis	Any	Inconsistent test results all throughout eval

Ataxia	CN I	Halting, choppy, voice breaks, Slow, slurred, irregular AMRs, SMRS. Speak like drunk, walk like drunk. Say tongue feels too big for mouth
Apraxia of speech	CN I	Irregular SMRs (out of order), slow AMR, INCONSISTENT VOWELS
Aneurysm	Any	Sudden headache, described as "worst headache of your life" SLP: Call 911 & continue test
Heart Attack (myocardial infarction)	Any	Grab chest, shortness of breath, fall to the ground: Call 911 & continue the test
Lyme Disease	Any	Nausea, extreme exhaustion, migraines, sound/light sensitivities, eye pain, tearing, fevers, tremors, forgetfulness, Trigeminal neuralgia
HaNDL Syndrome (Transient Headache and Neurologic Deficits With Cerebrospinal Fluid Lymphocytosis)	Any	Numbness/"shut down" of one whole side of the body. Side feels like its "sleeping" Horrible headaches
Trigeminal neuralgia	CN V	Typically affects only the ipsilateral side. Pain can be fleeting but intense, lasting seconds to minutes, can be triggered by touch, or can be more constant aching/burning. Medication can help, but in some cases can require surgical procedure.
Alcoholism	Any	You had too much booze, you are drunkkkkk! Act drunk

Progressive Supranuclear Palsy	Any	Looking up the whole time, repeats the end parts of words, quiet voice, very slow movements
Acoustic Neuroma	Any	Pressure from a tumor causing hearing loss, ringing in the ear, and unsteadiness
Tourette Syndrome	Any	Uncontrollable repetitive movements or unwanted sounds (tics), such as repeatedly blinking the eyes, and shrugging shoulders. More typical vocal tics include repeating others (echolalia) or repeating oneself (palilalia). Using offensive words (coprolalia) is not generally common
Seizures	Any	Act like you have a seizure. Fall out of chair/wheelchair onto floor (carefully)
Moebius Syndrome	CN VII	Cannot blink or move eyes side to side.
Left Neglect	Any	Ignoring the left side of your body/environment.
Shingles	Any/Typically CN VII	Painful, blistery rash. Can be associated with CN VII if shingles are on face and head
Shadow voices	Any	Hallucinating someone speaking to you, answering questions/talking back and forth; can occur with brain injury.
Foix-Chavary-Marie Syndrome - “Bilateral Opercular Syndrome”	CN V – Trigeminal, Bilateral UMN damage	Jaw hanging open, Anarthria, paralysis of the facial, tongue, pharynx, and masticatory muscles of the mouth that aid in chewing Present since birth