Occupational Therapy in Neuro-Oncology Acute Care and the Role of Mirror Visual Feedback: A Doctoral Capstone Project

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Author Note

No conflicts of interest to disclose.

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Acknowledgments

To begin, the author would also like to express sincere appreciation to her parents (Scott and Shelly Davis) and grandparents (Phil and Carol Davis), who have provided an unmatched example of hard work and resilience. The author is also extremely grateful for the continued support and encouragement provided by her significant other, Cole Foutty.

The Indiana University Occupational Therapy program has allowed the author to reach many professional goals and gain skills that have prepared her for a fulfilling career in healthcare. The author is thankful for the knowledge and guidance that her professors have shared. The implementation of this project would not have been possible without the staff members at the capstone site. The site mentor's collaborative approach to mentorship and clear passion for the field have been a true gift to the author.

Abstract

This paper explains a Doctoral Capstone Experience (DCE) completed by an occupational therapy student at a level I trauma center in Columbus, Ohio. The site referenced throughout the paper is a large teaching hospital and a comprehensive cancer center. The capstone student's primary objective was to gain advanced clinical skills in the area of neuro-oncologic rehabilitation. While doing so, the student also researched mirror visual feedback and trialed the use of this intervention with the neuro-oncology population. To improve the quality of the site, the student advocated for the purchase of additional mirror therapy resources and provided education to the staff therapists. The student delivered an in-service presentation and created an infographic regarding evidence supporting mirror visual feedback and practical tips for application. The student measured the effectiveness of the education with a pre-survey and post-survey. Participants' average responses to survey questions related to knowledge and confidence increased, suggesting that the education had a positive impact on the site. The overall results of the capstone indicate that occupational therapy has a strong role in neuro-oncologic acute rehabilitation and that while there is a need for additional evidence, mirror visual feedback may be a beneficial intervention for this patient population. The completion of the project resulted in additional mirror resources, access to sustainable educational materials, and a guide for incoming clinical students to reference when working with neuro patients.

Keywords: neuro-oncology, mirror visual feedback, hemiparesis, postural control, visuospatial awareness, occupational therapy, acute care

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There are over one million new diagnoses of cancer each year in the United States (Ng et al., 2017). At the capstone site, occupational therapists provide rehabilitation services to patients experiencing acute medical conditions who also have oncologic histories. While this hospital is among the nation's best facilities for cancer care, therapists feel that there is a missed opportunity to utilize creative, evidence-based interventions for patients with neurological deficits. Emerging research suggests that mirror visual feedback could offer great benefits to individuals with hemiparesis, decreased postural control, and unilateral neglect.

There is currently limited research regarding occupational therapy's role in acute neuro-oncologic care. Mirror visual feedback is an effective component of traditional neurorehabilitation, yet existing research does not frequently allude to its use in the context of oncology. If the site does not examine functional outcomes related to mirror therapy, it may be overlooking an innovative way to promote improved occupational performance and meaningful participation for this vulnerable population.

Therefore, the purpose of this capstone project is for the student to gain advanced clinical skills in the neuro-oncology practice area while trialing mirror visual feedback interventions when appropriate. The student also aims to educate the rehabilitation staff members on the appropriate usage of mirror visual feedback and expand available resources through collaboration with management.

Needs Assessment

The site is located in Columbus, Ohio, which has an estimated total population of 898, 553 residents (United States Census Bureau, 2021). The site is one of the largest cancer hospitals

in the United States, and it features an emergency department, acute care department, and several operating rooms. After a formal agreement was made between the site and Indiana University, interviews and literature reviews were completed to better understand the state of the community. The overall purpose of this needs assessment was to determine the potential needs of the site, identify causes that could be contributing to these challenges, and develop a plan that promotes improvement by addressing the gaps.

Description of Interview

Before the interview, the student explored the site's website to gain a basic understanding of the setting and researched the demographics of Columbus. The student was additionally provided with the opportunity to shadow in the site's neuro-oncology unit for three days due to a fieldwork placement at the same hospital. Finally, a preliminary search of the literature was conducted to determine occupational therapy's role in oncologic care and neurorehabilitation.

The student participated in an initial meeting with the site mentor, who has been an occupational therapist (OT) at the site for nearly five years. The meeting took place in-person on July 27, 2021, for approximately 45 minutes. The purpose of the meeting was to learn more about the neuro-oncology unit, introduce the general aim of a capstone project, and ask about the site's current needs. Specific questions were posed to identify which types of diagnoses are seen most frequently and to clarify how a student's skills could contribute to the success of the organization (see Appendix A for list of questions).

Reasoning

The capstone student gleaned information about geographic location, the hospital environment, and the specific operations of the rehabilitation department. This process was critical because environment can have a profound effect on how people engage meaningfully in

daily activities. In addition, understanding the patient population and common diagnoses painted a clearer picture of which performance skills need to be addressed in treatment. Lastly, the interview questions were intentionally designed to understand how neuro-oncologic rehabilitation differs from traditional neurorehabilitation.

Analysis of Interview Results

The site mentor explained that her primary focus is neuro-based care, while she also sees several ear/nose/throat (ENT) patients as a part of her caseload. She reports that many of the common diagnoses she sees include glioblastoma, metastatic cancer that has spread to the brain, cerebral vascular accident (CVA), and post-surgical patients recovering from craniotomies, craniectomies, and cranioplasties. In this setting, many of the deficits are related to basic mobility, activities of daily living (ADL), and cognitive functions (such as attention, memory, sequencing, and spatial awareness). Addressing psychosocial components and implementing family training is often important due to the terminal nature of some brain cancers.

During the interview, the site mentor also shared that many patients with brain tumors experience unilateral weakness, postural leaning, and impaired visuospatial awareness. With these common deficits in mind, she would like to utilize the capstone student's skills to explore the efficacy of mirror visual feedback with the neuro-oncologic patient population and further the staff's education on this topic. She discussed her desire to monitor whether incorporating a full-length mirror into interventions could improve posture, visuospatial awareness, or upper extremity coordination. Finally, she emphasized the importance of completing this intervention in a functional, occupation-based manner by simulating ADL tasks with the mirror present.

Gap Analysis and Literature Review

Due to the medical acuity of this setting and high standards related to patient care, the site mentor has been unable to dedicate extensive time to trialing novel interventions with oncology patients who experience unilateral weakness, visuospatial deficits, and impaired posture. She and other members of the acute rehabilitation team agreed that evaluating the effects of mirror visual feedback (in conjunction with functional tasks) would be useful. In addition to lack of time to explore this intervention, she stated that the department's resources are limited to only a few mirror boxes intended for upper extremity use. Through the results of this capstone project, she planned to demonstrate to management the need for additional resources, including a full-length, portable mirror that is accessible to all therapists.

The student researcher conducted a review of available literature to examine the role of occupational therapy in neuro-oncology and to determine the potential use of mirror visual feedback as an effective intervention for this population. Various databases were explored using search terms such as cancer, oncology, neuro-oncology, brain cancer, acute care, mirror therapy, mirror visual feedback, posture, hemiparesis, and occupational therapy. To ensure the most accurate information, the student researcher primarily investigated articles that were published within the last five to ten years. The synthesis of this evidence was used to inform the objectives for the capstone project in neuro-acute care at a cancer hospital in Columbus, Ohio.

Comprehensive Cancer Care

Despite the rising number of people diagnosed with cancer, extensive research efforts and advances in medicine have led to improvements in the quality of comprehensive cancer care over the last several decades. In fact, the 5-year survival rate for all cancers increased from 49% (1975-1977) to 67% (2006-2012) (Ng et al., 2017). Cancer care typically involves many different

disciplines and settings due to the evolving nature of the disease, various treatment options, and the potential for long-lasting complications that persist well into survivorship.

A study conducted by Ng et al. (2017) examined patient-reported usefulness of acute care cancer rehabilitation (including physical, occupational, and speech therapies). The results indicated that patients agreed or strongly agreed that rehabilitation helped to improve physical function, independence, ability to complete self-care tasks, hope, mood, anxiety, and spirituality (Ng et al., 2017). Similar evidence suggests that improved physical ability to complete functional tasks is also associated with an overall higher quality of life (Brekke et al., 2019). These positive effects demonstrate the need for rehabilitation services in hospital settings.

Role of Occupational Therapy in General Oncology

Cancer's impact on total body function often leads to an impaired ability to participate in valued life activities. Evidence suggests that occupational therapy is a helpful service for cancer patients due to its ability to promote improved fatigue, neuropathy, lymphedema, cognition, upper extremity function, and balance (Pergolotti et al., 2016). In a scoping review, occupational therapists were additionally found to be involved in oncology care in the following ways: return to work, quality of life, pain management, psychosocial support, equipment prescription, home assessment, ADL tasks, and leisure engagement (Wallis et al., 2020).

Role of Occupational Therapy in Neuro-Oncology

According to He-Strocchio and Longpré (2016), occupational therapy interventions for patients with brain-related cancers can be preventative, restorative, supportive, and palliative. One preliminary study related to post-surgical neuro-oncology rehabilitation states that "significant improvements were noted in motor function, cognition, and ADL function" (Yu et al., 2019). Depending on the location of the brain tumor, deficits and approaches to treatment

may vary. A descriptive study conducted by Campbell et al. (2009) assessed the impact of occupational therapy for post-craniotomy patients with various tumor locations. Of 65 patients involved in the study, 54% received transfer training, 50% received ADL training, and 34% received specific cognitive interventions. Cognitive interventions were most frequently directed in the following ways: attention and concentration (frontal lobe); sequencing and naming (parietal lobe); memory re-training, naming, sequencing, and visual-perceptual tasks (temporal lobe); problem-solving (occipital lobe); balance (cerebellar) (Campbell et al., 2009).

One of the most common physical symptoms of brain cancer targeted by occupational therapy interventions is hemiparesis (also known as unilateral weakness). According to Amidei et al. (2015), approximately 26-47% of patients with a brain tumor experienced incidences of hemiparesis or hemiplegia. When hemiparesis is present, it is also common for the patient to experience unilateral spatial neglect. According to Van Vleet et al. (2020), common clinical interventions for neglect include "therapist-administered 'top-down; self-cueing strategies (eg, 'look left') that typically rely on adequate recall of the behavioral strategy (an approach that might not be conducive for patients with deficit awareness issues)." However, the overall outcomes of this randomized controlled clinical trial suggest that more effective interventions for this deficit are goal-directed, conducted in a functional/natural environment, and focused on gaining both tonic and phasic attention through multi-sensory approaches (Van Vleet et al., 2020).

The most common anatomic areas associated with unilateral weakness include the frontal lobe, primary motor cortex, thalamus, internal capsule, and brainstem (Amidei et al., 2015). Spatial awareness can often be related to these same areas, as well as the parietal lobe (Van Vleet et al., 2020). This information suggests that, in order to combat unilateral weakness and promote

improved functional participation, occupational therapy interventions for this population should target these areas of the brain. Likewise, interventions should account for appropriate cognitive load and promote attention through various types of feedback.

Mirror Visual Feedback Interventions

A systematic review by Deconinck et al. (2015) states that mirror visual feedback, "a phenomenon where movement of one limb is perceived as movement of the other limb, has the capacity to alleviate phantom limb pain or promote motor recovery of the upper limbs after stroke." Most often, the use of the term "mirror therapy" or "mirror visual feedback" is synonymous with this definition and consists of placing a small mirror in a mid-sagittal position to mimic bilateral upper extremity movements. However, there is also emerging information that suggests mirror therapy can be performed differently by facing a full-length mirror.

Using a full-length mirror may be useful for addressing hemiparesis deficits that exist beyond the upper extremity, like balance and posture. A study conducted by In et al. (2016), aimed to examine the effects of mirror visual feedback on static standing balance in post-CVA patients using three visual conditions (eyes closed, eyes open, and full-length mirror feedback). The results show that there were significant differences in lateral (left-to-right) control (In et al., 2016). Using additional visual supports, such as a vertical line placed down the center of the full-length mirror, may further enhance the patient's ability to activate muscle groups and bear weight through the affected side (Pak & Lee, 2020).

Neural Mechanisms

The neurobiological mechanism of mirror visual feedback is thought to be related to the brain's mirror neuron system. Mirror neurons are unique because they become excitatory both when a person themselves executes a movement or is touched, as well as when the person simply

observes another individual executing a movement or being touched (Ramachandran & Altschuler, 2009). These neurons create the same condition in the brain, regardless of whether the action is experienced first-hand or is being observed. Self-observation via visual feedback (such as by watching oneself in a video or in the mirror) may allow these neurons to fire and promote increased movement of hemiparetic limbs (Son & Kim, 2018).

Various studies from Deconinck et al. (2015) also suggest that mirror visual feedback activates neural areas associated with attention and cognitive control (including dorsolateral prefrontal cortex, posterior cingulate cortex, primary and secondary sensory cortices, and precuneus). Additionally, the intervention likely excites the ipsilateral primary motor cortex that is connected to the affected upper extremity while encouraging increased projections from the contralateral primary motor cortex over time. (Deconinck et al., 2015).

There is existing research which explores the efficacy of mirror visual feedback for post-CVA patients, showing that this intervention may improve upper extremity motor function, posture, balance, and ability to complete ADL tasks (Theime et al., 2018). Neuro-oncology patients often experience similar symptoms of unilateral weakness, postural lean, and visuospatial neglect that resemble classic CVA deficits. Furthermore, because mirror visual feedback is suspected to activate the primary motor cortex and other frontal lobe areas (where many tumors that cause hemiparesis exist), this intervention is appropriate to test and may successfully be applied to cancer patients.

Guiding Models

The Model of Human Occupation (MOHO) is useful for this capstone project because it gives insight into what motivates the patient to engage, and it considers the feedback provided from actions as part of a dynamic system (Kielhofner & Burke, 1980). When visual feedback is

introduced into the context of occupation (such as in the case of using a mirror), it could affect the patient's performance skills and drive to participate. Knowing what motivates clients and understanding the impact of roles and routines can inform appropriate interventions for patients receiving acute care rehabilitation services.

A qualitative study conducted by Bowyer et al. (2020) examined the effects of post-professional group training for MOHO with occupational therapists at a large cancer hospital. Therapists identified an improvement in client-centered practice through the application of MOHO and found that using this model as a guide for clinical reasoning allowed them to "re-envision" their patients from an occupation-based lens in a setting that often relies heavily on a medical model of care (Bowyer et al., 2020).

Lastly, since this capstone project relates to patients with neurological deficits, it is important to consider the benefits of the Neuro-Occupation Model. The basis of this model is that humans are influenced by their nervous systems, and it considers the "conflation of the brain, context, and occupation" through a self-organizing approach (Derakshanrad et al., 2020). Evidence suggests that this model allows for occupational therapists to create opportunities for clients to engage in self-determined occupations and therefore increase overall life participation (Derakshanrad et al., 2020).

Project Plan and Process

Plan

The capstone student collaborated with faculty and site mentors to develop a plan that fit the needs of the site and aligned with the values of the Indiana University Occupational Therapy (IUOT) program. The primary purpose of the project was to gain advanced clinical skills in the neuro-oncology acute rehabilitation practice area. To implement this portion of the project, the

plan included providing treatment for neuro patients four days per week during the 14-week experience. In addition, the plan was to explore the use of mirror visual feedback with this population and educate staff members on this intervention. To evaluate the effectiveness of this education, the student planned to collect data from a pre/post-survey. One day per week, the student allowed time off-site to research these topics and investigate other resources.

Goals

The curricular threads of the IUOT program include socially responsive healthcare, critical inquiry and reflective practice, and leadership and advocacy. The capstone student and mentor collaborated to create the following Student Learning Objectives with these curricular threads in mind:

- **Student Learning Objective (SLO) 1: Socially Responsive Healthcare**
    - The student will demonstrate the ability to provide equitable care for patients from various cultural and socioeconomic backgrounds to promote occupational justice for diverse populations.
- **SLO 2: Critical Inquiry and Reflective Practice**
    - The student will demonstrate the ability to apply evidence-based decision making in order to create goals and implement appropriate, occupation-based interventions for patients with neurological deficits.
- **SLO 3: Leadership and Advocacy**
    - The student will demonstrate the ability to advocate for patients by partnering with other members of the healthcare team (including management) to address opportunities for quality improvement and/or the purchase of additional resources.

Goals and objectives for the doctoral capstone project include:

- **Project Goal 1:** The student will collaborate with the site to implement a project that allows for the development of advanced clinical skills and addresses the site's current needs.
    - **Objective 1:** The student will conduct a needs assessment to determine the current "gaps" that exist at the site and to examine potential changes that could benefit patient care.
    - **Objective 2:** The student will conduct a literature review to better understand the population and to identify evidence-based interventions for patients with neurological deficits.
    - **Objective 3:** The student will apply knowledge from the needs assessment and literature review to develop a project plan that aims to improve evidence-based patient care while applying advanced practice skills related to neuro-oncology.
- **Project Goal 2:** The student will provide comprehensive care for patients experiencing hemiparesis and will evaluate the effectiveness of mirror visual feedback interventions.
    - **Objective 1:** The student will evaluate patients to better understand the diagnosis/condition and to identify the potential presence of unilateral weakness/hemiparesis.
    - **Objective 2:** The student will assess deficits related to neuro-motor systems and develop goals which aim to increase independence and facilitate functional participation.
    - **Objective 3:** The student will utilize mirror visual feedback to address hemiparesis (when appropriate) for the purpose of evaluating the effectiveness of this intervention for patients with neuro-oncologic histories.

- **Project Goal 3:** The student will develop a method to examine the outcomes of the capstone project and analyze how these results may affect the site's future patient care procedures.
    - **Objective 1:** The student will research various outcome measures and select a tool/assessment that is applicable to the population and project purpose.
    - **Objective 2:** The student will utilize the selected outcome measure to assess the effectiveness of the project and interpret the meaning of the results.
    - **Objective 3:** The student will evaluate how the outcomes may inform the site's future patient care practices and whether the results may translate to other areas of occupational therapy practice.

Process

The initial stages of the project (Weeks 1-2) were focused on orienting to the site, understanding the population, and continuing the needs assessment. Due to the student's prior experience at the site for a Level IIA fieldwork placement, becoming familiar with the site required less time. However, the student was required to shadow to gain insight into the common neurological deficits and learn to work with medically complex patients in the neurocritical care unit (similar to intensive care). On off-site days, the student spent time reviewing resources from previous anatomy and neurological foundations courses through IUOT.

In the following stages (Weeks 3-5), the capstone student progressed to evaluating and treating 3-6 neuro patients per day, four days per week. The student practiced assessments and interventions related to cognition, coordination, balance, positioning, and delirium and continued to collaborate with staff members, including daily co-treatments with a Board-Certified Clinical

Specialist in Oncologic Physical Therapy with specialized training in neurological and vestibular conditions.

Items were gathered for trialing mirror visual feedback, including an affordable, full-length mirror with an easel stand to use prior to the hospital's purchase of additional resources. The student began trialing basic mirror visual feedback interventions and learning how to determine when a patient was appropriate. The literature review was updated to include more details about specific neural mechanisms.

During the middle stages of the project (Weeks 6-8), the capstone mentor assisted the student with releasing a pre-survey via email to approximately 25 staff members (physical therapists, occupational therapists, physical therapy assistants, and occupational therapy assistants). Also, further collaboration occurred with management to demonstrate the need for mirror therapy resources, including a portable full-length rehab-grade mirror and two mirror boxes. The student began integrating additional visual supports inspired by the literature review (using resources such as dry erase markers, tape, and magnets).

Midterm feedback was provided by the capstone mentor, and the student created goals related to improving clinical skills in the neurocritical care unit. By Week 9, the student was evaluating and treating 6-9 neuro patients per day, four days a week. This level of clinical involvement continued throughout the duration of the project. Weeks 10-11 included finalizing the education materials (including an infographic) intended to increase staff knowledge and confidence. The student shared these materials and delivered an informational presentation on the first day of Week 12 (March 28, 2022). A post-survey was delivered to the same group of therapists that completed the original pre-survey and received education to ensure reliability of results.

The final stages of the experiential portion of the project (Weeks 12-14), involved analyzing the results of the pre-survey and post-survey to measure changes and examine the effectiveness of the education provided. The student continued treating patients with advanced clinical skills and developed a brief introductory packet of tips for future fieldwork students. This resource was intended to provide helpful tips for working with highly complex neurological patients in the acute care setting. The capstone student spent time finalizing the capstone report and planning for the presentation. The final presentation was delivered on May 6, 2022, at Indiana University-Purdue University (Indianapolis).

Implementation

The capstone student gained advanced clinical skills through the ability to manage a caseload of oncology patients with acute neurological conditions (increasing to 6-9 patients per day by Weeks 9-14). The student received continued guidance from the site mentor, researched available literature, and implemented various evidence-based assessments and interventions (SLO #2). As further evidence of learning, the capstone student created a packet of tips for incoming students to reference when working with this patient population (Appendix E). During this clinical experience, the capstone student treated many incarcerated individuals and learned to navigate other social and ethical dilemmas, including domestic violence, substance use, and homelessness (SLO #1).

When appropriate, the capstone student conducted mirror therapy interventions as part of treatment sessions. The capstone student documented 10 separate case studies of patients who trialed mirror visual feedback at the site. Although this sample size is relatively small, time was limited to only 14 weeks, with the initial portion of the capstone being dedicated to orientation and collecting the supplies necessary for this intervention. While the patients' detailed medical

histories must be kept private for confidentiality, the student synthesized the most common diagnoses and organized the outcomes into themes. The student collaborated with management to advocate for patients and encourage the purchase of additional mirror therapy resources (SLO #3).

Internal Review Board (IRB) approval was gained on September 22, 2021. The project was approved with the categorization of "Non-Human Subjects Research." The participants for the educational component of the project were rehabilitation staff members (physical therapists, occupational therapists, physical therapy assistants, and occupational therapy assistants).

The student created a survey to examine the level of knowledge and confidence that staff therapists had about mirror visual feedback at baseline (Appendix B). Before formally releasing the survey, the student sought guidance from the IUOT research coordinator to create a survey with clear wording and avoid leading participants toward specific answers. The survey utilized a Likert-scale format, with "1" indicating "Strongly Disagree" and "5" indicating "Strongly Agree." A final question was included to gain consent and to inform participants of the intended use of the results.

The survey was sent via email to 25 therapists. Although participation was encouraged, it was not required by the organization. Recruitment included casual, in-person networking with therapists and other stakeholders (including management) to explain the purpose of the capstone project. A brief description was also included within the email containing the survey link. The pre-survey was released before the in-service to better understand gaps in knowledge and confidence. To promote accuracy of responses, only those who attended the in-service filled out the post-survey. However, all therapists, regardless of in-service attendance, were provided with access to the corresponding infographic.

The initial plan of creating an in-depth binder of mirror visual feedback evidence and resources was adjusted to better fit the needs of the staff. Following discussion with the site mentor and other stakeholders, the student elected to create a simple, easy-to-read infographic. Due to the fast-paced nature of acute care, staff members agreed they would be more likely to utilize this brief synthesis of practical tips rather than a long-form document. The infographic can be found in Appendix C. Also, a smart phrase tool was developed in Epic and shared with staff to promote ease of documentation and inclusion of relevant measures.

The in-service lasted for a total of approximately 45 minutes during the lunch hour on Monday, March 28, 2022. The capstone student delivered information in a lecture-style format and prompted questions to encourage dynamic discussion. Attendees were instructed to follow along with the infographic. This was provided in print format, and a QR code was offered as an alternative method to reach the infographic in digital format. A sign-in sheet was utilized to ensure that those attending the in-service had filled out the pre-survey. After the presentation concluded, the student sent out a link to the individuals in attendance with the post-survey to assess the effectiveness of the education.

Evaluation

Of the 25 people the link was delivered to, 20 responded to the pre-survey. Of these 20 individuals, 14 were able to attend the in-service on March 28, 2022. Limitations were related to therapists being out sick, having other mandatory meetings, or being in the middle of a treatment session with a patient. There were 14 responses collected for the post-survey. A table of results can be found in Appendix D.

The pre-survey and post-survey contained identical questions to maintain consistency and were both delivered via Qualtrics (Appendix B). The average results across the pre-survey

questions fell within the ranges of 1.83 to 3.43, with a combined average of 2.64 (SD = 0.51). This indicates that the average participant felt neutral or somewhat disagreed with the survey statements, which were all related to knowledge and confidence with utilizing mirror visual feedback. The range of average responses across all ten post-survey questions was 4.42 to 4.83, with a combined average of 4.62 (SD = 0.15), meaning that the average participant somewhat or strongly agreed with the survey statements

The primary difference between the pre-survey and post-survey was an increase in the combined and individual average responses. There was an increase of 1.98 in the combined average responses across all ten questions. The average increase for individual questions ranged from 0.66 to 3, with a combined average of 1.87 (SD = 0.67). These statistics suggest that after attending the educational in-service and being provided with the infographic, participants were more likely to elect a survey answer that corresponded with an increased level of confidence, understanding, and ability to utilize mirror therapy in this practice setting.

The questions with the lowest pre-survey ratings were #4, #6, #7, and #9. These questions were related to location of mirror therapy resources at the site, types of additional visual supports, self-reported confidence in using this intervention, and how to document progress appropriately. The student intentionally aimed to address these weak areas with the infographic and in-service presentation. In the post-survey, these questions had the top four highest increases in average participant response compared to the pre-survey, which suggests that the student was able to effectively communicate information to impact the identified gaps.

The student performed t-tests using the data, and all ten questions resulted in a p-value of less than 0.05. This indicates 95% confidence in stating that the results are statistically

significant. However, it is important to note that a small sample size and a decreased participation rate for the post-survey may impact the true statistical significance of the results.

Synthesis of Mirror Therapy Trials

The student conducted mirror therapy interventions with a total of ten patients over the course of the capstone experience. The most common primary diagnoses of patients that were appropriate for mirror therapy interventions were CVA, glioblastoma (GBM), or another type of cancerous frontal/parietal lobe tumor. The deficits that frequently served as indicators that a person may benefit from mirror visual feedback were hemiparesis/unilateral weakness, Pusher Syndrome, lateral postural lean, inattention/neglect, decreased visuospatial awareness, and impaired proprioception.

The student only applied this intervention during treatment sessions (after the initial evaluation had been completed). The nature of the patients' clinical presentations resulted in the student utilizing the full-length mirror (or the restroom mirror) rather than a mirror box. The student found that patients required decreased verbal and tactile cues when provided with visual feedback from the mirror. Patients were able to maintain neutral/midline positioning for an increased amount of time and demonstrated a decrease in severity of lateral lean with the mirror present. Lastly, patients were more often able to keep their eyes open, visually attend to the affected side, and participate in functional grooming tasks.

The most useful visual support was a line placed vertically down the center of the mirror. However, patients also responded very well to references related to their own body (such as cues to keep their nose aligned with the middle of the mirror). The student learned that it was extremely important to position the mirror in a way that allowed the therapist to perceive midline from the same angle as the patient when providing prompts to correct.

Discussion and Impact

The capstone project impacted the site by promoting use of an evidence-based, innovative intervention that promotes functional participation for a unique population. Therapists responded positively to the educational in-service. In the post-survey, 100% of participants stated that they "somewhat agreed" or "strongly agreed" that they would choose mirror therapy as an intervention at this time. Prior to the in-service, only 45% of participants chose one of these responses. In the past, management declined requests for additional mirror therapy supplies due to budget and decreased understanding of the need. However, through the benefits demonstrated by this capstone project, they endorsed the value of these resources and were willing to invest in mirrors/mirror boxes.

As described by Amidei et al. (2015), many patients with brain tumors at the clinical site experienced unilateral weakness. Likewise, lesions (mostly due to CVA and tumors) were also frequently connected to spatial neglect deficits (Van Vleet et al., 2020). As suspected, mirror visual feedback interventions were most successful when incorporating visual cues and functional tasks (In et al., 2016). The case study results suggest that utilization of multi-sensory feedback (via the mirror and other supports) was related to improved balance, postural control, visuospatial awareness, and proprioception for this population. Throughout this experience, occupational therapy proved to be a valuable means of increasing meaningful participation and quality of life for cancer patients (both with and without neurological deficits).

The student's ability to develop generalist acute care skills will support a successful career as an entry-level occupational therapist. The capstone experience at a level I trauma center provided an invaluable opportunity to encounter many high-acuity, complex medical conditions.

Furthermore, the student's specialized skills were expanded upon by learning strategies for working with oncology patients and those with neurological conditions.

Limitations of the project included a fluctuating number of patients who were appropriate for mirror visual feedback interventions. Also, within the acute care setting, it is common for patients to only stay a few days or to switch services/primary therapists. Once the student began implementing mirror visual feedback interventions, there was often only one additional session or no subsequent sessions at all, making it difficult to determine the extended, long-term impact. In some instances, patients were not medically stable or did not have appropriate cognitive awareness to participate in interventions.

In addition, there was a relatively small sample size for the survey participants and in-service attendance. The pre-survey was released before the in-service to gain a better understanding of the gaps in knowledge. While this was useful, some of the individuals who filled out the pre-survey were unable to attend the in-service due to illness or other obligations.

Since acute care settings are very fast-paced and the primary purpose of the capstone project was to gain advanced clinical skills, it was at times challenging to find time for working on the research aspect of the mirror visual feedback interventions. To address this barrier, the mentor and student decided after the midterm that they would meet to discuss the case studies once a week and create measurable goals for applying new, evidence-based visual supports to the interventions.

The lack of current literature in this specific practice area was challenging, however, the student found that research related to CVA and general oncology contained principles that transferred to the neuro-oncology population. The completion of this capstone project emphasizes the need for additional studies to be conducted to provide more evidence for the

application of mirror visual feedback with various diagnoses, as well the role of rehabilitation for neuro-oncology patients.

Sustainability

The in-service presentation provided 14 staff members with a basic understanding of mirror visual feedback interventions in the acute care setting and explained where to access resources at the site. For staff members' reference, an infographic was provided (in digital and print format) to ensure that the information could be accessed as needed. The student and site mentor also provided contact information to encourage feedback if any staff members chose to try the intervention in the future.

As explained during the in-service and within the infographic, the student's collaboration with management resulted in the purchase of a rehab-grade, full-length mirror and two additional mirror boxes. These resources, as well as a toolkit of additional visual supports (such as magnets, tape, dry erase markers, etc.), were made available in a designated conference room for all therapists to utilize.

Lastly, the student created a simple packet of tips for incoming clinical students to reference when learning to work with patients who are experiencing neurological conditions. This packet caters to students who benefit from written information to support the verbal feedback that their clinical instruction provides in real-time during evaluation and treatment sessions. The site mentor assisted in uploading this packet for other clinical instructors to access.

Conclusion

The capstone site is a renowned, level I trauma center located in a diverse city. Although the site is at the forefront of comprehensive care, the rehabilitation department was not taking advantage of mirror visual feedback interventions for patients experiencing unilateral weakness,

visuospatial deficits, and impaired postural control. In addition to taking on a full clinical caseload of patients with neurological conditions and oncologic histories, the student trialed mirror visual feedback interventions with a total of ten patients. The student learned to appropriately document progress and how to incorporate additional supports based on available literature.

The student also developed advanced program implementation and leadership skills by delivering an in-service presentation to staff therapists and measuring the effectiveness of education through a pre-survey and post-survey. The results of the survey correlated with an improvement in staff knowledge and confidence regarding mirror visual feedback interventions. Through collaboration with hospital management, the capstone student defended the observed benefits of this intervention and advocated for the purchase of additional rehabilitation resources.

The capstone experience fulfilled the intended purpose of preparing the student to effectively assess and treat in a general acute care setting, while also equipping the student to specialize in addressing high-acuity, neurological and oncology-related conditions. Lastly, the student successfully analyzed current research and created sustainable educational materials to promote effective use of evidence-based interventions by both experienced practitioners and future clinical students.

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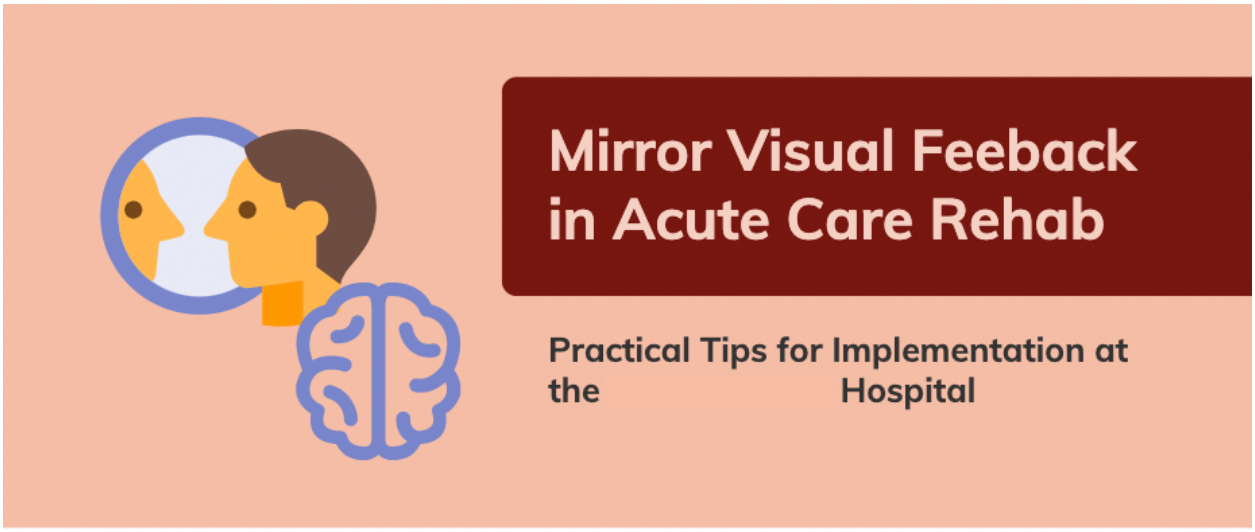
Appendix A

1. How do geographic location and surrounding culture impact this site?
2. Who makes up the majority of your patient population?
3. What are the primary diagnoses that you see in this setting?
4. What are some current needs of your facility?
5. How do you imagine a capstone student contributing to the success of your organization?
6. Do you feel that your setting differs from traditional neurorehabilitation?
7. How do you typically address psychosocial elements/mental health in this setting?
8. Do you explore family training with many patients?
9. How does being in acute care at a Level I trauma center affect your daily work?
10. Are there any specific areas of ongoing research that you find intriguing and wish you had more time to explore?

Appendix B

1. I understand the scientific evidence behind using mirror visual feedback.
2. I understand how to determine whether a patient is appropriate for mirror therapy interventions.
3. I understand the differences between using a mirror box and a full-length mirror.
4. I know where to access mirror therapy resources.
5. I can articulate the value of mirror visual feedback to patients/families.
6. I am aware of additional visual supports that can be applied to mirror therapy interventions.
7. I am confident in my ability to utilize mirror visual feedback independently in the acute care setting.
8. I feel comfortable using mirror visual feedback during co-treatments (PT/OT).
9. I understand how to document/monitor progress when using mirror visual feedback.
10. At this time, I would choose to use mirror visual feedback as an intervention.
11. I understand that the anonymous results of this survey (pre and post) may be reported in a doctoral student capstone project paper/presentation.

Appendix C


Mirror Visual Feeback in Acute Care Rehab
Practical Tips for Implementation at the Hospital
Full Length v.s. Mirror Box
• Mirror boxes are typically utilized for UE rehabilitation. The mirror is placed in a midsagittal plane, and the reflection of the unaffected side simulates movement of the affected side.
• Full-length mirrors are sometimes used in a similar fashion for LE rehabilitation.
• Emerging literature suggests self-observation with full-length mirrors or video feedback to address deficits that exist beyond only UE or LE (posture, balance, visual attention).
Intended Population
• Traditionally used post-amputation, post-CVA, or with complex regional pain syndrome
• Limited research regarding use with cancer population but evidence suggests that it may be beneficial
• Useful for patients with unilateral weakness; typically on neuro-oncology or neuro-surgery service
Snapshot of Evidence
Approximately 26-47% of patients with a brain tumor experience unilateral weakness; CVA is also common within this population
Using a full-length mirror for visual feedback may improve lateral postural control, especially on unstable surfaces
Adding a vertical line to signify midline has been shown to further activate muscles and promote weight-bearing on the affected side
Mirror neurons are thought to be involved in this process, as well as the primary motor cortex/other frontal lobe areas

Intervention Basics

Why Should I Use a Full-Length Mirror?

- "Proximal stability before distal mobility"
- Beneficial for patients who cannot ambulate to the bathroom
- Creates more functional opportunities for participation when completing grooming tasks at edge of bed
- May assist with general orientation to hospital/circumstances
- Improve proprioception and ability to self-correct posture with less invasive cues from therapist

Who is Appropriate?

- The patient should be oriented to self, follow simple commands, and visually attend for at least brief periods of time.
- Patients with severely impaired vision (double vision, significant blurriness, blindness, etc.) may not be able to participate. However, this intervention can be useful for introducing compensatory techniques to patients with neglect/inattention or visual field cuts.

Implementation + Visual Supports

The intervention can be adapted for sitting edge of bed or standing. If the patient has significantly decreased awareness, it is important that the therapist is positioned in a way that allows them to perceive midline from the same angle that the patient does.

Reminders:

- Be mindful of the fact that many people have not seen themselves post-surgery
- Check to ensure that patients have eye glasses if needed

Cues For Midline

- Adding a vertical line in the middle of the mirror (dry erase market or tape)
- Adding a vertical line to the patient's gown (soft tape or string)
- Referencing the patient's facial features (nose)

Dynamic Reaching

- Adding magnetic strip to midline of mirror and reaching to place small magnets along line
- Tracing a path (created with tape or marker on the mirror) with finger
- Crossing midline when reaching

Where to Find Materials

Full-Length Mirror/Boxes

At this time, there is an affordable, full-length mirror with an easel stand available in the conference room on 21. The mirror has a small timer on the front for easy progress monitoring.

A larger, rehab-grade mirror with wheels and small mirror boxes have been ordered and will be available soon.

Additional Resources

A toolkit can also be found in the conference room on 21. This contains supplies that assist with additional visual supports (such as dry erase markers, ruler, magnetic strips, small magnets, and sticky notes.)

We want your feedback! If you try this intervention and have ideas for modifying resources, let us know.

Tips for Documentation

.mirrortx

Measurable Outcomes

- Time tolerating sitting EOB/standing
- Quality of sitting/standing balance (poor, fair, good) or level of assistance required
- Estimated degree of lateral postural lean (mild, moderate, severe)
- Number of verbal/tactile cues required for maintaining midline/neutral position

Smart Phrase Available

Pt engaged in mirror visual feedback intervention using full-length mirror (sitting EOB, standing EOB, sitting at armed chair, standing at armed chair) to promote improved posture, balance, strength, proprioception, and visuospatial awareness. Pt with (mild, moderate, severe) postural lean in (left, right, posterior, anterior) direction. Utilized additional visual support to provide cue for midline. Pt able to tolerate (____) seconds/minutes in (sitting, standing) with (poor, fair, good) balance. Dynamic reaching encouraged as able. Pt responding well to (verbal, tactile) cues and demonstrating improved (____) with mirror present.

Helpful Resources

- An OT's Guide to Mirror Therapy (Debra Batistella)
- Noggins & Neurons Podcast

If you would like additional information or have questions, please contact
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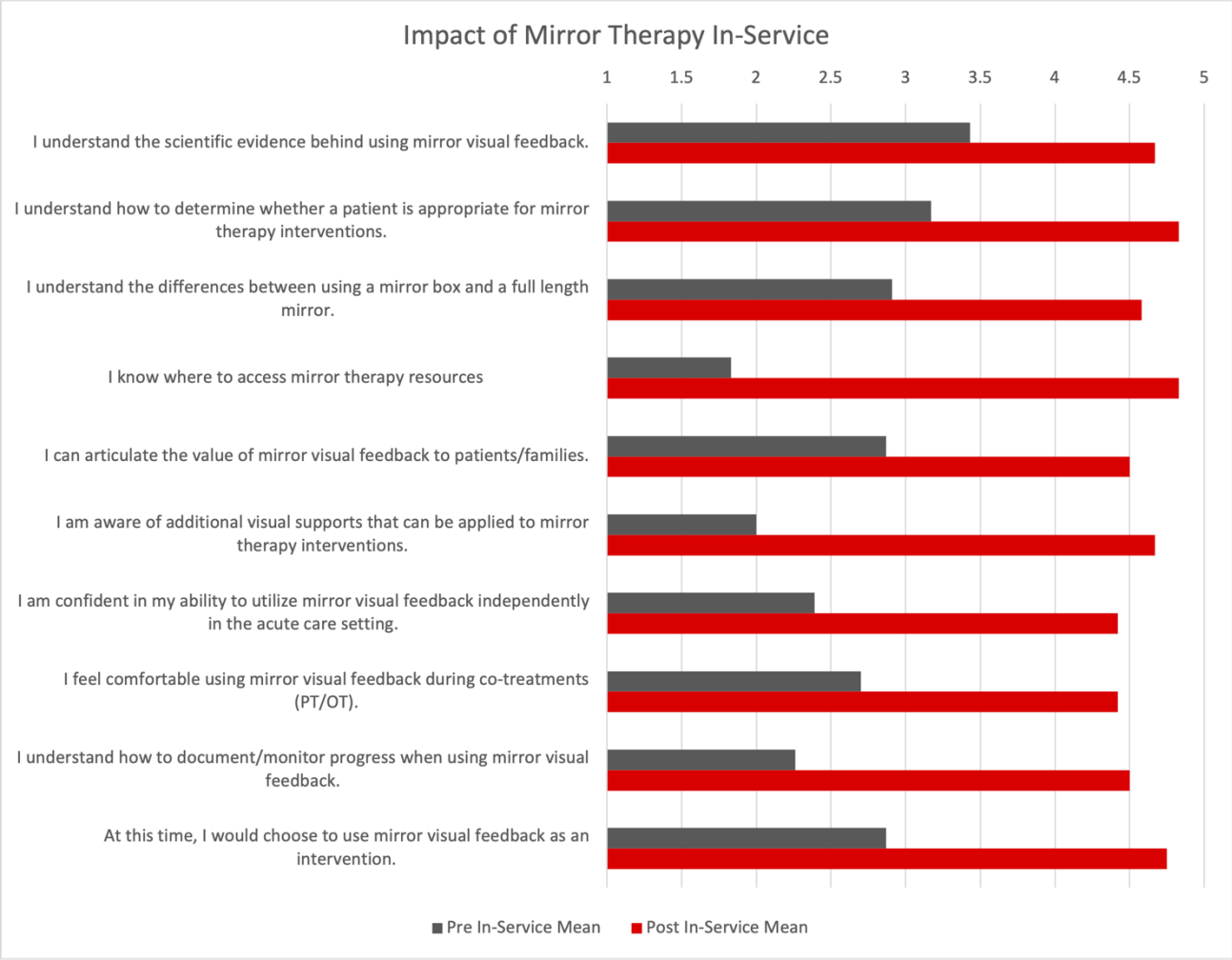
Appendix D



Question Number	Pre-Survey Average	Post-Survey Average	Average Difference
Q1	3.43	4.67	1.24
Q2	3.17	4.83	0.66
Q3	2.91	4.58	1.67
Q4	1.83	4.83	3
Q5	2.87	4.5	1.63
Q6	2	4.67	2.67
Q7	2.39	4.42	2.03
Q8	2.7	4.42	1.72
Q9	2.26	4.5	2.24
Q10	2.87	4.75	1.88
Combined Averages	2.64 (SD = 0.51)	4.62 (SD = 0.15)	1.87 (SD = 0.67)

Appendix E

Cheat Sheet for Working with Neuro Patients

- Orientation/Beginning a Session
  - Can be useful to start with orientation questions to better tailor conversation appropriately
    - Where are you? What is your name? What month and year is it?
  - If the person struggles with orientation questions, try providing choices or asking the question in a Y/N format
    - Are you at Mt Carmel, Ohio State, or Riverside?
    - Are you at home? (Y/N)
    - When providing choices, try to vary the order of the correct answer, as people tend to state the last thing they heard if they are unsure
    - Continue reminding the person of where they are, that they are safe, and that they are at the hospital to get better
- Providing Instructions/Cues
  - Clear, concise, one step at a time
  - Grade commands as you get to know the patient, but start with simple, short phrases
    - If the person is mobile but confused, try very functional phrases rather than breaking down several steps ("Stand up," "Walk," "Grab")
  - Start with verbal cues, increase to tactile cues, then physical prompting/hand over hand if needed
- Fine Motor Assessments
  - Finger opposition (making an "OK" sign, touching index finger to thumb/other digits)

- Diadochokinesis (both palms down, both palms up, repeat quickly; try alternating with one palm up, one palm down)
- Finger to nose (pt uses index finger to touch their own nose and then touch the therapist's finger, try with both R/L hand)

- Strength Assessments
  - Pay attention to differences between sides (assess for unilateral weakness/hemiparesis)
  - For pts with good ability to follow commands, instruct them to do the following
    - Squeeze your fingers (with both R/L hand)
    - Raise arms toward the ceiling
    - Raise arms out straight in front of themselves (test for ability to push you down/resist movement)
  - If the pt cannot demonstrate AROM, gently move through PROM while protecting joints
  - Be conscious of impairments in tone
    - Flaccidity: decreased tone and no muscle activation (watch for subluxation of shoulder – be very cautious of attempting PROM of shoulder if pt demonstrates flaccidity/subluxation of UE)
    - Spasticity: increased tone/tightness (work through each joint; provide light shaking to break up muscle tone/activate nerves)
- Sensory Assessments
  - Light touch (occlude the pt's eyes and touch parts of UE; have them state whether you are touching them and if so, where)
  - Pain/temperature (try gently using the tip of your fingernail or a pen; a cold/warm washcloth to see if they can distinguish between these sensations)
- Vision Assessments
  - Smooth tracking (instruct pt look at your fingertip and follow with their eyes; if pt is having difficulty, try wiggling your finger to gain more visual attention)

        - Move finger laterally from L to R and then continue creating "H" pattern with finger
        - Watch for nystagmus (beating/jumping of the eyes toward one or both directions)
        - Convergence (bring your finger toward the pt's nose)
    - Double/blurry vision ("How many fingers am I holding up?"; utilize text on name badge or other common items (such as exit sign in hallway) for assessing ability to see clearly
    - Peripheral vision (tested with pt facing straight forward; place pen or other object behind the pt's head, slowly bring toward pt's ear and ask them to let you know when they can see it; repeat on other side)
    - If the person is not able to demonstrate any responses to tracking, use your fingers to create a flicking motion near/toward their eye (concern if the pt has no visual response/does not blink to the 'threat')
    - Be on the lookout for gaze preferences or neglect/inattention (the person may only look toward R/L side; difficulty avoiding obstacles or scanning for items on L/R side)
- <u>Tips for Transfers</u>
    - Unilateral Weakness
        - If the person has unilateral weakness, transfer toward the strong side and/or in a way that allows them to best utilize their stronger extremities and avoid unsafe leaning
            - Ex: If pt is weak on L side, bring chair to pt's R side
            - Ex: If the pt has weak RUE, have the pt reach across their body for the bedrail using their LUE to sit up
    - Supine to Sit
        - For pts requiring significant assist, it is safest for one therapist to be in the front and one to be in the back
        - The therapist in the back may need to get onto the bed (on their knees) and use the pad under the pt's shoulders to shift the trunk into upright position

        - The therapist in the front can manage the legs and use the pad to scoot the person's hips forward into a neutral position with their feet near the floor
    - Sit to Stand
        - If you are unsure of how much support a pt will need to stand, it is safest to do bilateral arm in arm assist (place your arm through their armpit, ask the pt to hold onto your bicep, use your other hand to grasp the gait belt)
        - If the pt has unilateral UE weakness and cannot hold onto your bicep, you can cradle their arm/rest it on top of yours
        - Provide knee/foot blocking for safety (placing your foot horizontally in front of the pt's affected foot or placing your foot in between the pt's knees)
        - When appropriate, consider using the Sara Stedy to promote more functional standing even if the pt is too weak to stand for long periods of time
- <u>More Interventions for Unilateral Weakness/Postural Control</u>
    - Encourage looking at the affected side
    - When sitting EOB, promote bearing weight through the affected extremity by leaning onto forearm (shifting weight from side to side if possible)
        - Watch for Pusher Syndrome (the pt actively pushes toward weak side using their strong UE; causes significant lean)
    - Use tactile cues and mirror visual feedback for midline/neutral positioning
    - Incorporate dynamic reaching when possible
        - Use PNF patterns and bilateral integration/crossing midline
- <u>Positioning</u>
    - Use towels/towel rolls to promote neutral positioning and support the body appropriately (i.e. behind the affected shoulder or near the neck if turned to one side)
    - Pillow under the affected UE to support joints

- Consider placing a rolled-up washcloth into the pt's hand to promote functional positioning and prevent contracture

- Cognitive Awareness
  - Incorporate During Functional Tasks
    - Assess ability to sequence through tasks and identify objects/purpose of objects
    - When appropriate ask color/name of objects
    - Dual tasking: when ambulating in hallway, challenge pt's cognitive load by finding their room number or listing related words (ex. name cities in Ohio or college football teams)
  - Preventing Delirium
    - Point out visual cues in room that remind pt that they are in the hospital
    - Turn on TV/music and leave light on/blinds open at end of session when possible
    - Place call light into pt's hand (even if they have decreased awareness)
- Working in the NCCU
  - When appropriate, make the pt's lines/monitors portable (gather a portable monitor and IV pole from nurses' station)
    - IV pole
      - Bring the IV pole close to the unit
      - Take IV bags off of the hooks first, place them onto the hooks of the IV pole
      - Unplug the IV, unscrew the unit (prepare for it to be heavy), and re-screw it onto the IV pole
      - When finished with session, if pt is in chair, the IV pole can remain as is without transferring the unit back to the original position
    - Portable monitor
      - Turn on portable monitor

- Click “data and pages” on bottom of regular monitor screen
- Click “standby, off unit, prepare for standby”
- Pull grey tab to release from the regular monitor
- Slide the unit into the back of the portable monitor
- When finishing with the session, use the grey tab again to release from portable monitor, place back into regular monitor and click “continue current”

- Lines and equipment to look out for
  - Arterial line (called a-line; measures blood pressure; looks like a clear inflated bag, says “Clear Cuff” on it)
  - EEG (measures seizure activity; gray cord/black bag connected to electrodes)
  - EVD (extra ventricular drain; always check with RN to clamp prior to moving)
    Lumbar drain (also important to check with RN)
  - Ventilator (always ensure that the tubes have enough slack and transfer to sit up toward the side of the vent)
  - Livengood walker (helpful for bringing many monitors/lines when the pt needs an assistive device)
- Precautions
  - Post-crani: no excessive bending over/tipping head forward
  - Post-EEA: no drinking from straw, no blowing nose, sneeze with mouth open, avoid anything strenuous/changing pressure in the head