The Association between Agitation and Dysphagia Diet Levels of Persons with Traumatic Brain Injury

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By

Kimberly Tarnoff

The Ohio State University

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Project Advisors: Michelle Bourgeois, Ph.D., Department of Speech and Hearing Science

Jennifer Bogner, Ph.D., Department of Physical Medicine and Rehabilitation

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THESIS TITLE: The Association between changing Agitation levels and Dysphagia Diet levels in Persons with Traumatic Brain Injury.

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Printed or typed name:	**Signature**:
Michelle S. Bourgeois Project Advisor	[signature] Project Advisor
Jennifer M Brello	[signature]
Rebecca McCauley Departmental Representative	[signature] Departmental Representative
Jennifer Bogner Honors Representative	[signature] Honors Representative

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Abstract

Agitation after a traumatic brain injury (TBI) can have a major impact on the rehabilitation process. Agitation can also impact one's ability to swallow correctly (dysphagia.) A decrease in cognitive function and behavioral control that characterizes agitation may interfere with the understanding of the normal swallowing process: the procedures and maneuvers, and the sensation and awareness of the bolus. This loss of cognitive ability may require a modification to the patient's diet. The purpose of this study was to determine the association between agitation after a traumatic brain injury and diet restrictions. The methods included reviewing archived data from the TBI Practice-Based Evidence Study held at The Dodd Hall Rehabilitation Hospital at The Ohio State University. Data from ten patients were analyzed. The patients' agitation levels from three time segments per day were plotted against their diet consistency. Data points from the patients' FIM™ Cognitive scores were also plotted to show the patients' cognitive progression. A range of patterns were observed, suggesting that therapists may have made diet levels less restricted due to a variety of factors, such as an improvement with the physical structures related to the swallowing process. The results of this study can help inform clinicians about the recovery process of patients with traumatic brain injury.

Introduction and Literature Review

A traumatic brain injury (TBI) is a potential consequence of extreme physical force to the brain. The most frequent causes of TBI are falls, motor vehicle-traffic accidents, being struck by/ or against someone or something, or assaults (U.S. Department of Health and Human Services Centers for Disease Control and Prevention, 2010). The U.S. Department of Health and Human Services Centers for Disease Control and Prevention (2010) estimates that there are 1.7 million TBIs that occur in the United States per year. Of the 1.7 million, 80.7% were seen in the emergency room, 16.3% were hospitalized, and 3.0% resulted in death. TBI accounts for 30.5% of fall the injury-related deaths. Such an injury disrupts the normal brain function through inefficient operation of nerve cells, as nerve cells are not able to send vital cues and information to each other. Some symptoms that result from neuronal damage include a decrease in cognition, reduced language ability, emotional control problems, and swallowing deficits, all of which are basic and essential skills for daily living.

Dysphagia, difficulty swallowing correctly, is not an uncommon result of a traumatic brain injury. About 41.6% of patients who enter an acute rehabilitation hospital experience swallowing inefficiencies. Dysphagia may be the result of physiological, cognitive and/or behavioral impairments (O'Neil, 2002). A decrease in cognitive function and behavioral control may interfere with the understanding of swallowing procedures and maneuvers; sensation and awareness of the bolus may be diminished (Logemann, 1998). Consequences of dysphagia may include aspiration, where the bolus penetrates into the lungs and can cause choking, and sometimes death. If a patient has frequent episodes of aspiration, aspiration pneumonia can arise.

Depending on the severity of one's swallow impairment, one's diet will need to be adjusted to a consistency that can be safely swallowed. Such alterations include a diet restricted to one of five different consistency levels: NPO (No Food by Mouth), Mechanical-Pureed diet Mechanical-Altered, Mechanical-Advanced, Mechanical-Soft, or Regular (Everything Speech, 2011). Changes in these various diet levels are some of the many modifications that a Speech- Language Pathologist (SLP) directs a patient to use to swallow safely during the recovery period. While diet levels usually become less restricted during rehabilitation (moving from NPO in acute care to increasingly less restricted diets in rehabilitation), if diet level were to become more restricted the level of agitation could potentially increase if the change is not well tolerated.

Agitated behavior arises often during the recovery period of a traumatic brain injury (Corrigan, 1989). Agitation is “an excess of one or more behaviors that occurs during an altered state of consciousness” (Bogner & Corrigan, 1995). Examples of agitated behaviors include disinhibited movement, restlessness, wandering, irritability, and aggressiveness (Levin & Grossman, 1978). During inpatient rehabilitation related to TBI, agitation usually occurs in about one-third of patients. By definition, agitation occurs during a state of decreased cognitive functioning; in regard to TBI, the state of decreased function is termed “post-traumatic amnesia.” Research suggests that if agitation is present in a patient, it is often associated with limited participation in therapy, difficulty achieving functional goals, and prolonged duration of in-patient rehabilitation (Nott, 2010). Therefore, reducing the level of agitation is needed to improve the efficiency and effectiveness of the rehabilitation process.

In addition to the physical structures not functioning correctly, or as a result of cognitive changes, a patient’s irritable, restless state of emotion may heighten the dysphagia. This loss of emotional control can cause problems such as eating and drinking too much and/ or too fast. Dietary safety strategies must/should be carefully and accurately followed. However, if the person is too agitated, he/she may not be capable of following the essential instructions. This can then delay recovery time, as "studies have found a correlation between recovery of functional oral feeding and improvement in cognitive status" (Terre & Mearin, 2007). In this study, the Ranchos Los Amigos Cognitive Function Scale (RLCF) was used to evaluate cognitive functioning in patients who experienced a TBI. The RLCF rates the cognitive status from 1 (no response) to 8 (purposeful, appropriate). Depending on the patient's scores, they were split into 3 groups: Group 1 had RLCF scores of 2-3; Group 2 had RLCF scores of 4-5; and Group 3 had scores of 8. It was concluded that there is a correlation between cognitive abnormality from a TBI and the presence of a swallowing impairment. The most severe group, Group 1 had a significant dysfunction in the oral phase (80%) and 62.5% had difficulties in the pharyngeal phase. Group 2 and Group 3 showed one third of the patients having difficulty in the oral phase, and half in the pharyngeal phase (2007).

In order to provide the best possible care to persons with a TBI and a related dysphagia, it is important to understand the many factors that contribute to their recovery. Therefore, the purpose of this study was to evaluate the association between changing agitation levels and dysphagia diet levels after a traumatic brain injury.

Methods

Participants

The database of the Practice-Based Evidence Study (Horn, Corrigan, Seel, Dijkers, 2013), a longitudinal study of the outcome of rehabilitation intervention at the inpatient Dodd Hall Rehabilitation Hospital of the Ohio State University Wexner Medical Center, was reviewed to identify patients who had a TBI that resulted in documented agitation and dysphagia. From the database of 274 patients admitted from 2008-2009, the 10 patients with the most agitation based on scores from the Agitated Behavior Scale (ABS) (Bogner, 2000) who also had documented changes in diet consistencies were selected for in depth review. Only patients who had data on agitation and diet levels that overlapped 75% of the data collection period were included. Demographic information, including age, race, gender, cause of injury, and length of stay in rehabilitation were extracted; Table 1 displays this information.

Table 1. Demographic data for persons with TBI, dysphagia, and agitation.

Subject Number	Age	Race	Gender	Total Days in Rehabilitation	Cause of Injury	Mean ABS Score
1	19	White	Male	16	MVA	40
2	69	White	Male	27	MVA	43
3	21	White	Male	49	MVA	44.3
4	30	White	Male	29	MVA	45.3
5	35	White	Male	27	MVA	46
6	53	African American	Male	30	Fall	38.3
7	69	White	Male	37	Violence	38.3
8	46	White	Male	43	MVA	38
9	41	White	Female	36	MVA	32
10	40	African American	Male	40	Miscellaneous	31.3

MVA- Motor Vechicle Accident

Measures

In addition to demographic data, scores from a variety of measures to document the course of rehabilitation for each patient were extracted from the Practice-Based Evidence database (Horn, Corrigan, Seel, Dijkers, 2013). The variables of interest for this study included the cognition scores from the Functional Independence Measure (FIM™) (Rehab Measures, 2013), the Agitated Behavior Scale (Bogner, 2000), and Diet consistency (Everything Speech, 2011).

A patient's cognitive functioning was determined using the Functional Independence Measures (FIM™) (Rehab Measures, 2013). The FIM™ score measures the severity of a patient's disability and denotes how independent he/she is. There are 18 items that are rated: 13 motor tasks and 5 cognitive tasks. These tasks are scored based on a 7- point scale that ranges from total assistance to total dependence. Specifically in this study, only the scores of the cognitive tasks were extracted. These cognitive assessments included tasks related to comprehension, expression, social interaction, problem solving, and memory. The total scores from each category were added together to create a FIM™ Cognitive score. This test was done once a week for the duration of the patient's stay.

Agitation was determined using the Agitated Behavior Scale (Bogner, 2000). The ABS assesses the nature and extent of agitation during the acute phase of recovery from an acquired brain injury; it provides feedback about the patients' agitation during their rehabilitation period. The ABS consists of 14 different behaviors. The 14 items are ranked 1 through 4. A score of 1 represents that the behavior is not present, while 4 denotes that the behavior substantially interferes with functioning and cannot be redirected. Staff members administer the ABS at the end of each shift: three times per day, or every eight hours. There are three levels of agitation: mild, having a score of 22-27, moderate level includes a total of 28-34, and severe, which tallies to a score of 35 and higher. A patient is considered agitated if he/she has score that is greater than 21 at least three times in a 48 hour period (Bogner, 2000).

Diet consistency levels included: 0.NPO: No food is allowed by mouth. The patient is fed through a feeding tube or a trachestomy; 1. Mechanical- Puree: Consists of a very cohesive diet, pudding-like, requiring little chewing ability; 2. Mechanical- Altered: Involves cohesive and moist semisolid foods with some chewing; 3. Mechanical Advanced / 4. Mechanical Soft: Soft foods that require more chewing; or 5. Regular: There are no restrictions; all types of food are allowed (Everything Speech, 2011).

Procedures

When a patient was admitted to Dodd Rehabilitation Hospital due to a TBI diagnosis, bedside and clinical evaluations were performed by a SLP to determine if the patient needed to be on a restricted diet. Through a bedside evaluation, the SLP judged if the patient was able to accurately and appropriately get the food into the mouth, was able to clear the spoon using his/her lips, eat at a safe pace, inhibit impulsive behavior, and was cognitively able to remember to chew or swallow. If the patient exhibited a lack of chewing, a SLP needs to determine if it was because of a sensory deficit, such as not being able to feel the food, or a motor deficit, such as weak muscles. A clinical evaluation may then be conducted by radiology personnel using a video x-ray procedure, the Modified Barium Swallow, or fiberoptic endoscopy, to visualize the patient's swallow and look for aspiration. (Kundo, n.d).

When the SLP reviewed the radiology report, she or he determined what level of diet the person required for safe swallowing. Depending on the severity of the dysphasia, the patient would be prescribed a restricted diet. Such restrictions included a diet restricted to one of five different consistency levels: NPO (No Food by Mouth), Mechanical-Pureed diet, Mechanical-Altered, Mechanical-Advanced, Mechanical-Soft, or Regular (Everything Speech, 2011).

The Practice-based Evidence study database was made available in the form of an Excel Spreadsheet. The Excel Spreadsheet consisted of each patient's start and end date for each diet level, and dysphagia diet consistency. Out of the 274 patients, 152 were documented as having a diet restriction for solid foods. Not all 152 patients experienced all four irregular diet consistency levels, but they were on at least one during their stay. The 122 patients that were consistently on a regular diet were not considered to be part of this study.

It was verified whether the 152 patients that were on a restricted diet had ABS data available. Forty-three patients did not have information relating to agitation. Since the ABS is administered to all patients at risk for agitation, it can be assumed that patients without ABS scores were not agitated. Therefore, 109 patients were left available to analyze. These 109 possible patients were organized into a separate Excel Spreadsheet. The Excel Spreadsheet organized the ABS data by the date and time of each assessment with the corresponding scores. Out of 109 patients with ABS information, 48 of them were considered agitated. A patient was considered agitated if they had a score greater than 21 on three out of six consecutive assessments. Not every patient had three agitation scores for each day. The missing data may have been due to agitation not being assessed for a particular day and/ or shift or the data was not transferred to the database. The absent data were taken into account when determining whether a patient was considered agitated. This was accomplished by inserting extra columns in the data where a particular test should have been completed. With the missing data included, it was determined whether the patient was agitated.

The ABS data from the 48 patients were copied into a separate spreadsheet. To find the highest agitation levels, the three highest agitation scores for each patient were averaged and ranked among each other. The total range of the agitation means was 23-46. The ten patients with the highest agitation scores were selected. Scores ranged from 39.3-46. However, five of those patients did not have a 75% overlap of ABS scores and diet consistency information. Therefore, they could not be included in the analysis. The ten patients who were chosen were the most agitated, with documentation of being on an irregular diet that also contained nearly a full set of data. The average scores of those ten patients ranged from 31.3-46.

An Excel spreadsheet was compiled that organized each patient's data according to the Day Number, ABS Score Shift 1, ABS Score Shift 2, ABS Score Shift 3, Diet Consistency, and Cognitive FIM™ scores. A graph was created plotting the agitation scores of all three shifts against their diet consistency. That graph was further separated into three graphs that only included one ABS shift score for the patient's diet modifications. Each time the diet would be modified the graph was split. Trend lines demonstrate the overall pattern of agitation during the particular diet level.

These individual shifts were used to evaluate if there was an association between agitation levels and diet consistency.

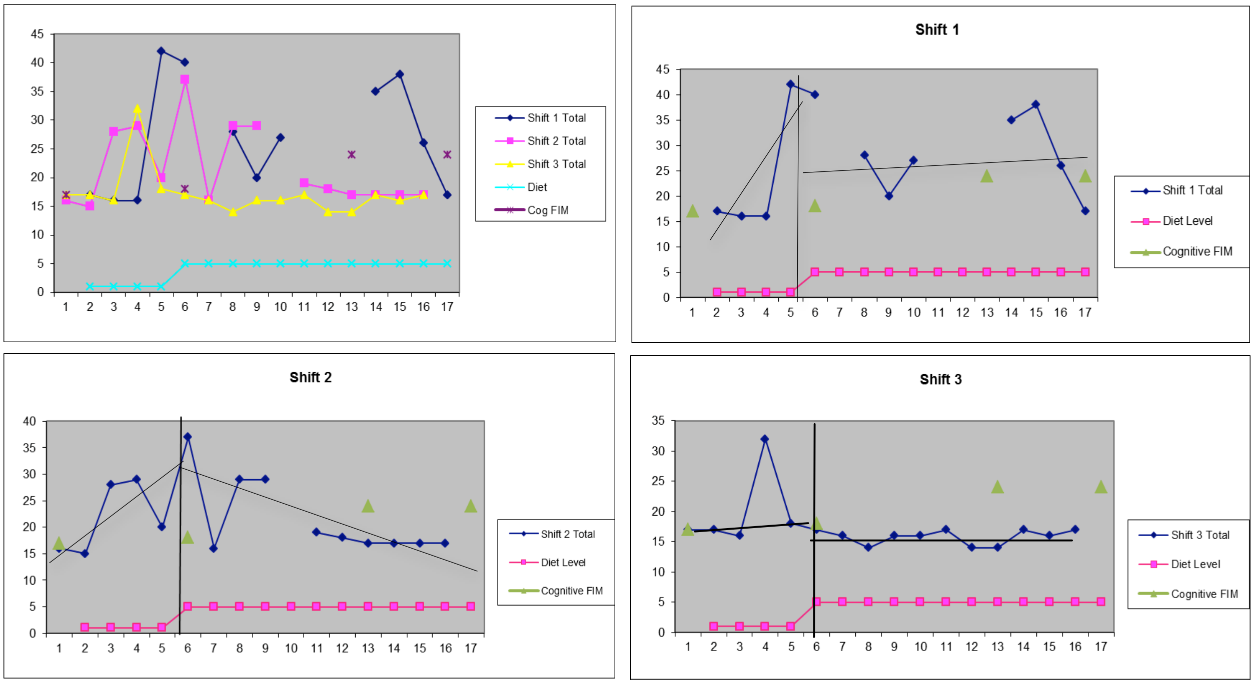
Data Analysis

The data was analyzed by looking at the trend lines for agitation, cognition, and diet levels for each patient. The general trend could have either been that agitation and cognition increased, decreased, or did not change throughout the patient's length of stay. These two variables could have alterations that paralleled each other, or ones without any consistent relationship. It was then determined whether the diet level became more or less restricted, or if there was no diet change in correspondence to when the agitation and/ or cognition altered.

Results

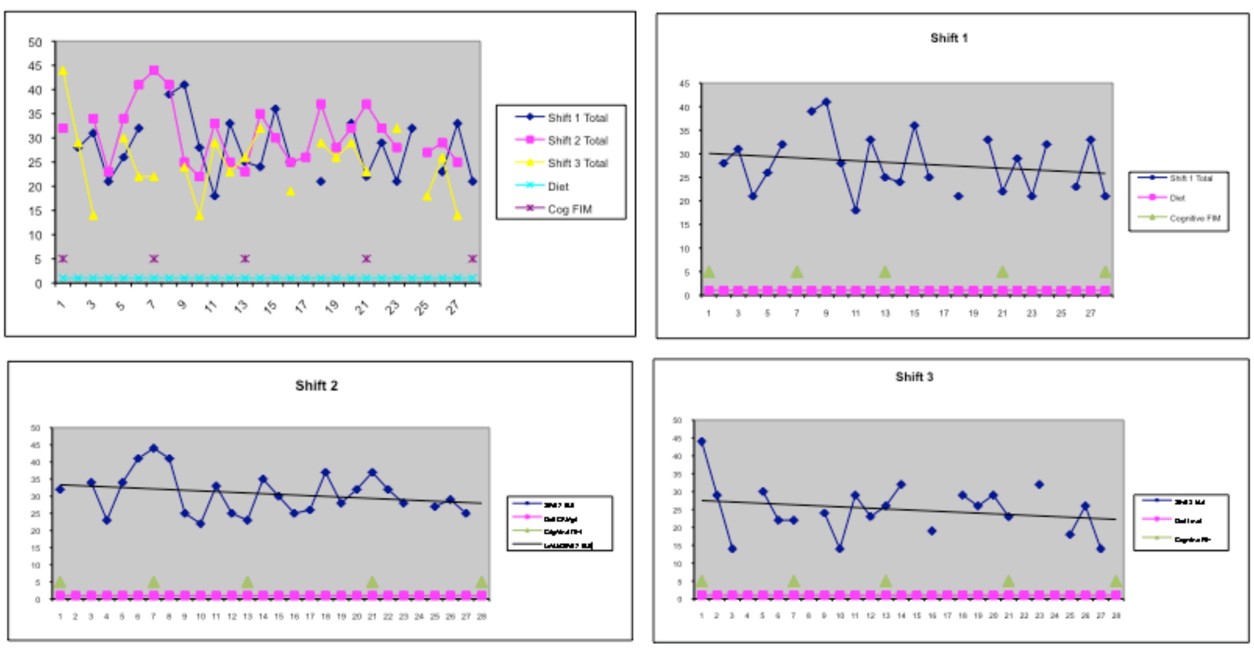
The results of the analysis of cognition, agitation and diet consistency scores are displayed in graphs as follows. Four graphs for each patient display the overall progress of all ABS assessments per shift, diet consistency scores, and FIM™ cognitive status scores. The first graph includes all of the patient's extracted data: the three ABS scores, the diet consistency, and the cognitive progression for the number of days of available data. The three other graphs are dedicated for one ABS shift assessment for the whole patient's length of stay. The diet consistency and cognitive status data are identical for all four graphs for each patient.

Figure 1. ABS, Diet, and FIM scores (overall and per shift) for Patient 1



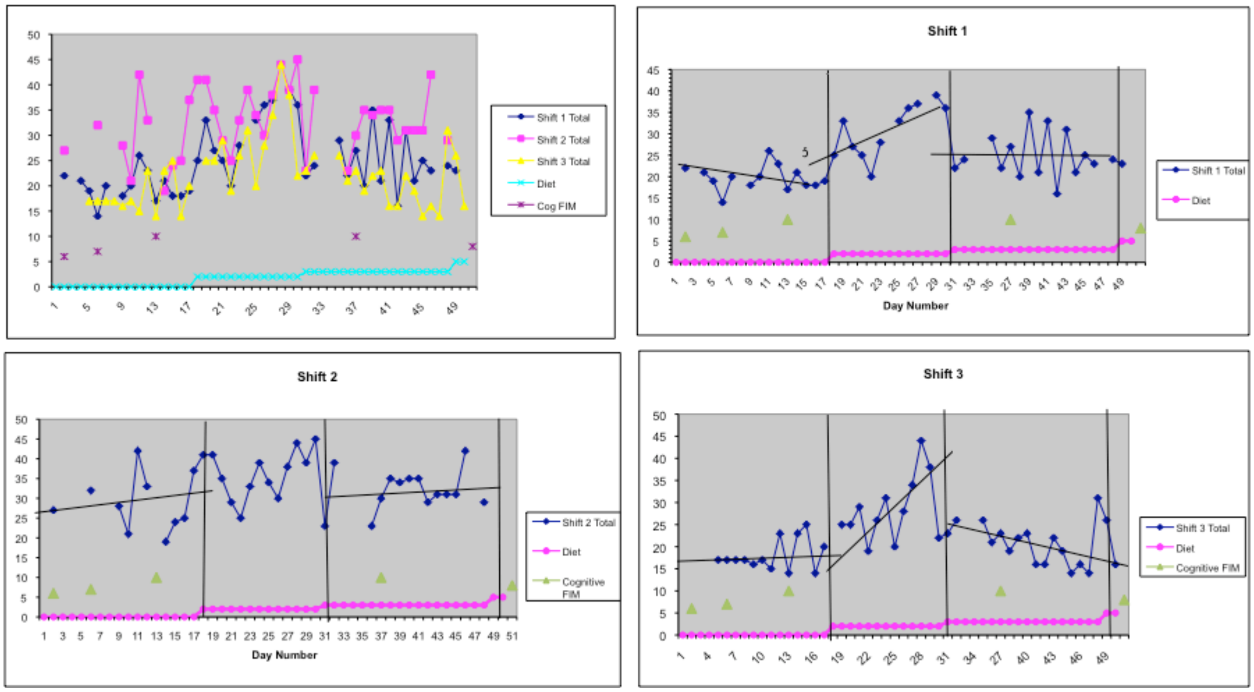
Note: Diet Levels change from 1 to 5.

Figure2: ABS, Diet, and FIM scores (overall and per shift) for Patient 2



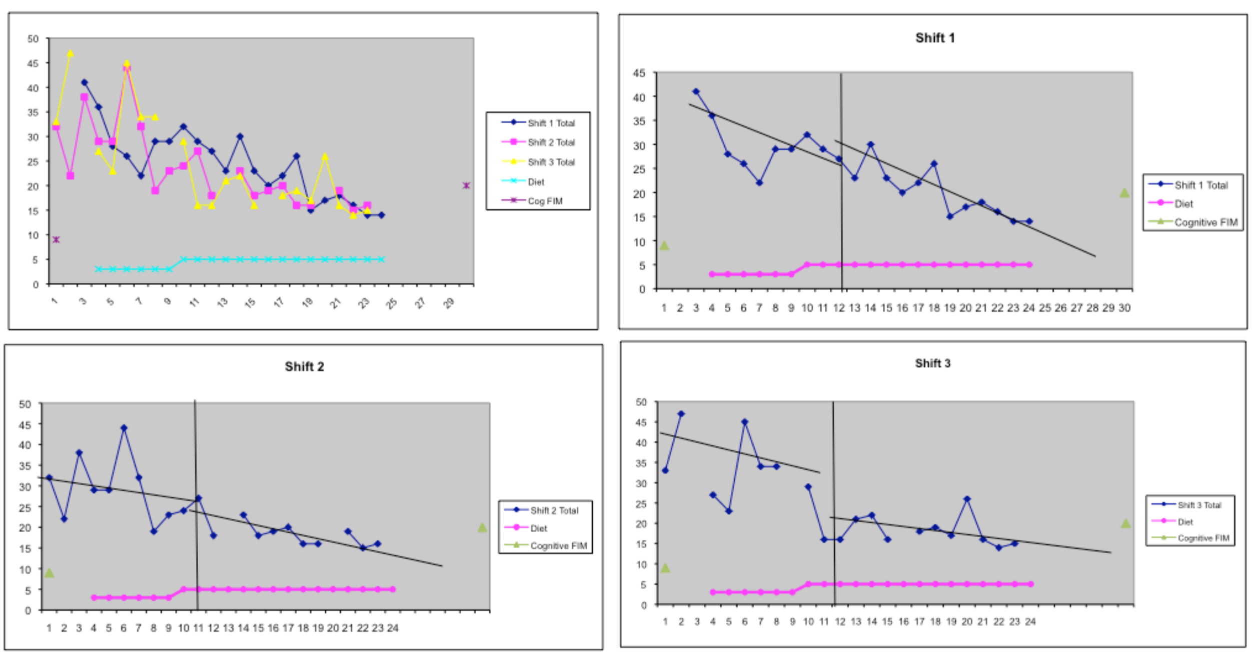
Note: Diet Levels stay at level 1.

Figure 3. ABS, Diet, and FIM scores (overall and per shift) for Patient 3



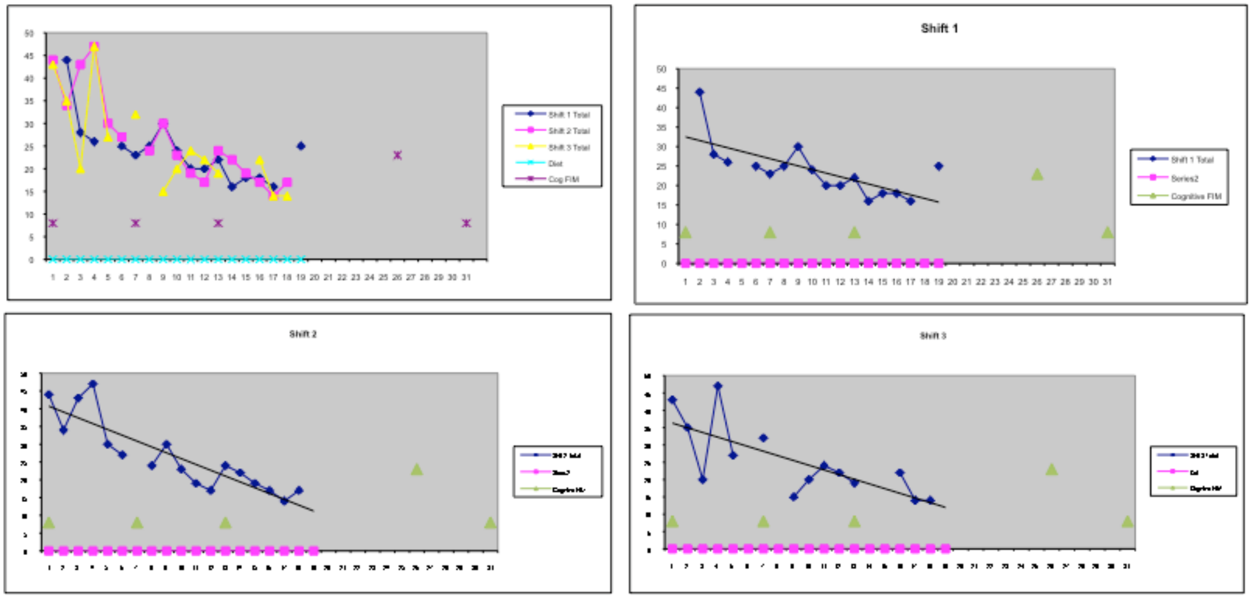
Note: Diet Levels change from 0 to 5.

Figure 4. ABS, Diet, and FIM scores (overall and per shift) for Patient 4



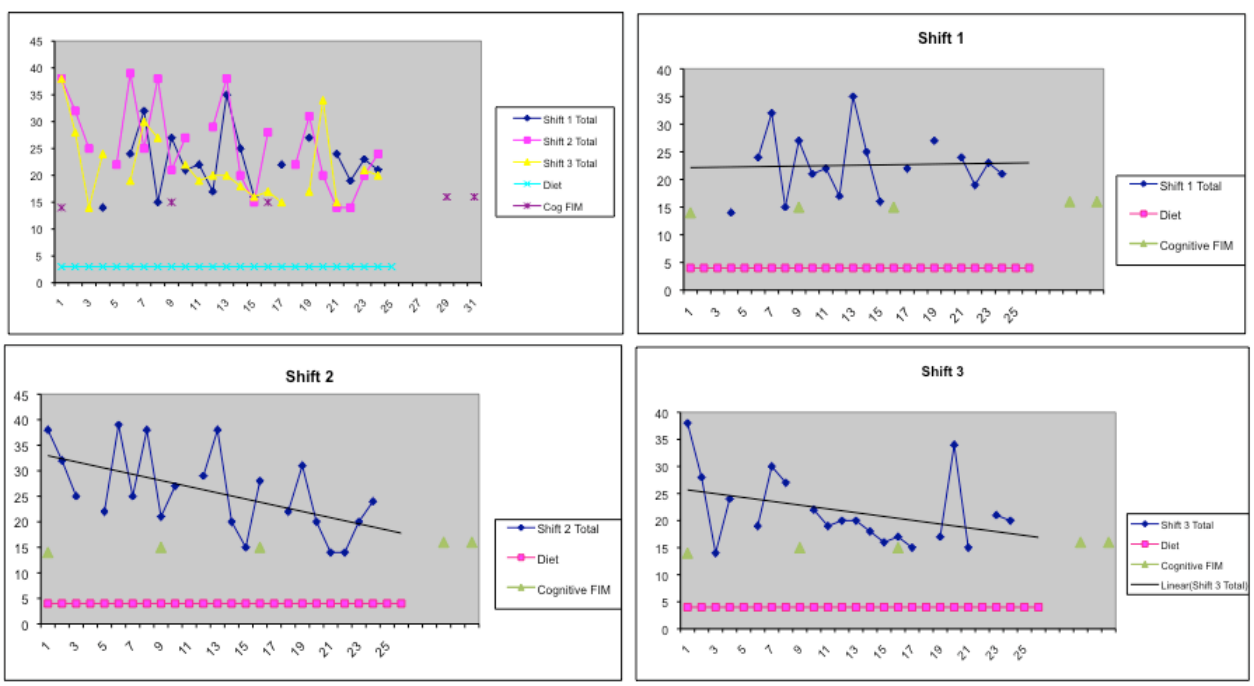
Note: Diet Levels change from 0 to 5.

Figure 5. ABS, Diet, and FIM score (overall and per shift) for Patient 5



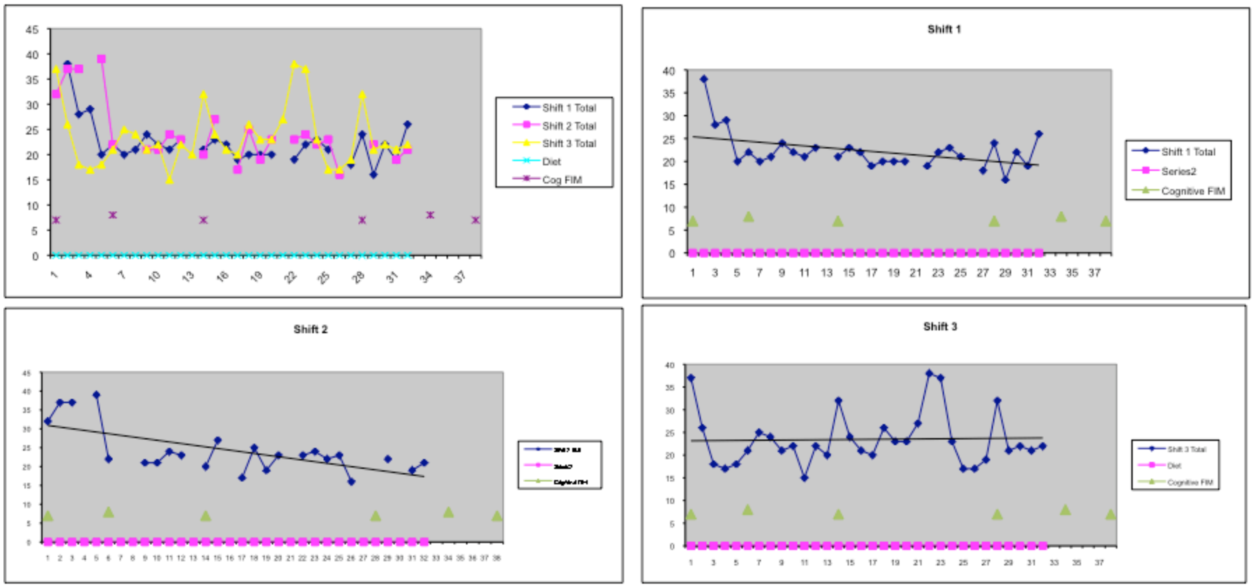
Note: Diet Levels stayed at level 0.

Figure 6. ABS, Diet, and FIM scores (overall and per shift) for Patient 6



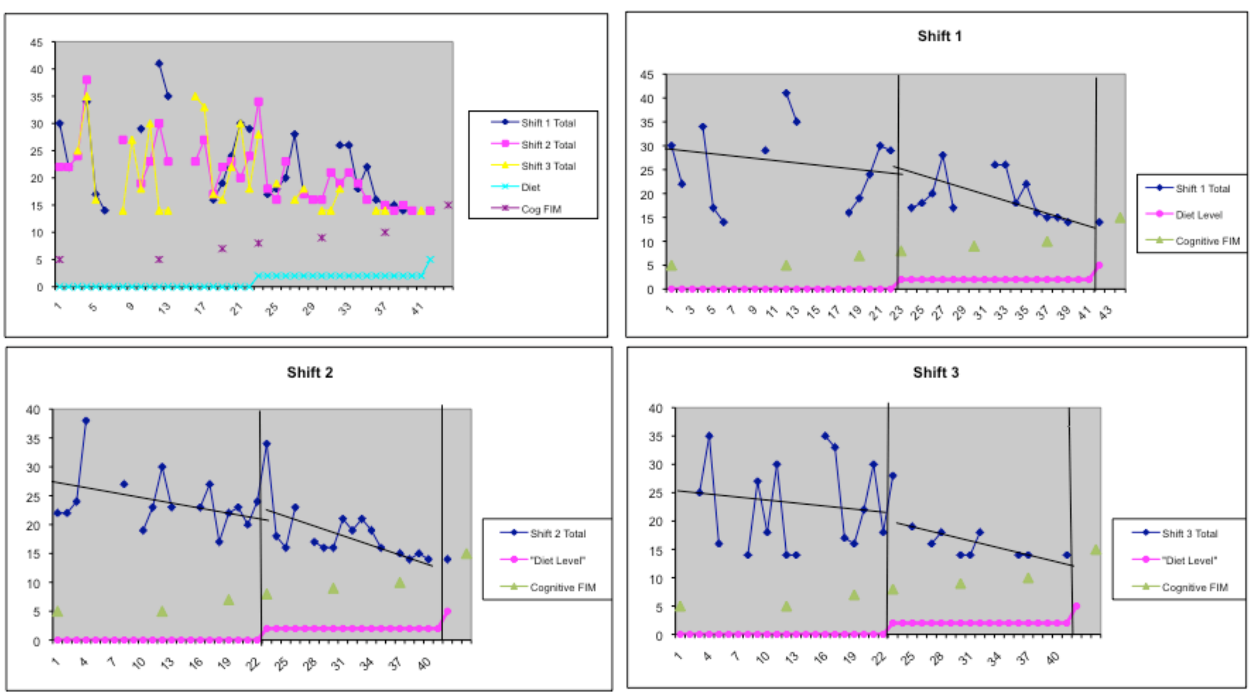
Note: Diet Levels stayed at level 3.

Figure 7. ABS, Diet, and Cognitive FIM (overall and per shift) for Patient 7



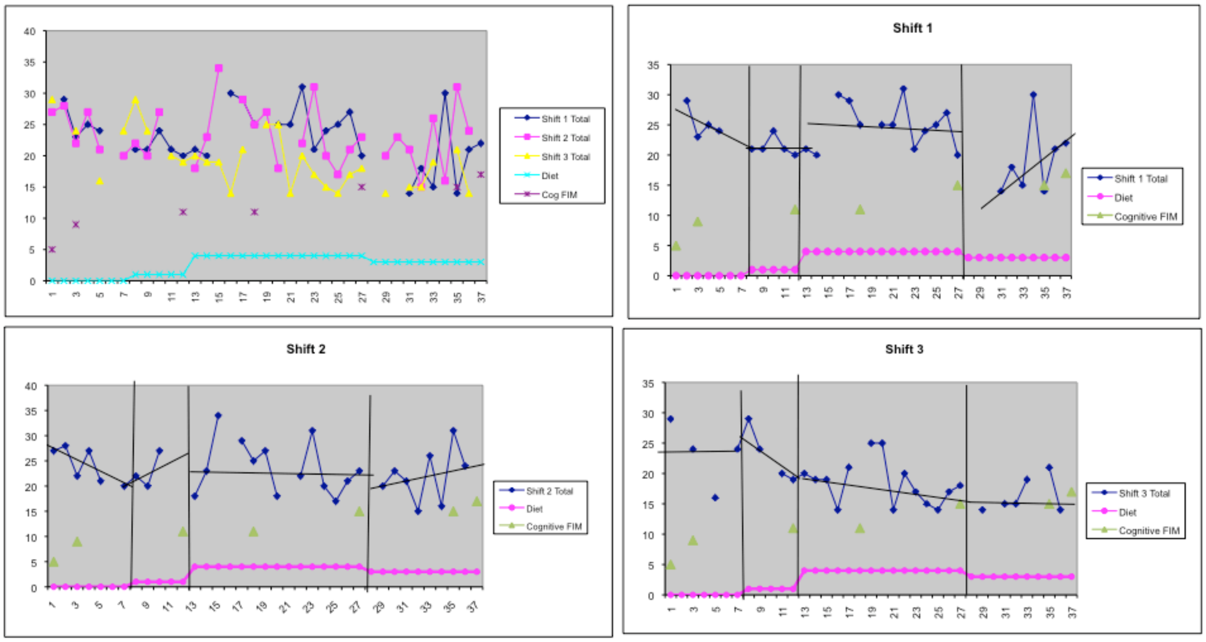
Note: Diet Levels stayed at level 0.

Figure 8. ABS, Diet, and FIM scores (overall and per shift) for Patient 8



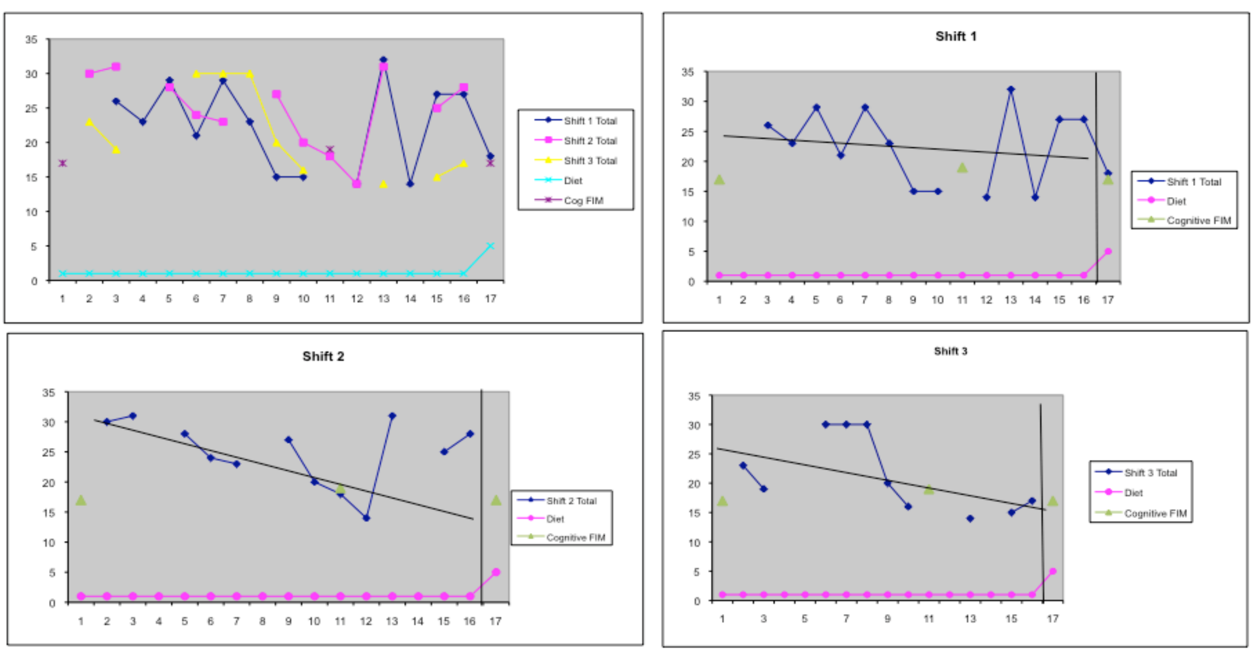
Note: Diet Levels changed from 0 to 5.

Figure 9. ABS, Diet, and FIM score (overall and per shift) for Patient 9



Note: Diet Levels changed from 0 to 4, back down to 3.

Figure 10. ABS, Diet, and FIM scores (overall and per shift) for Patient 10



Note: Diet Levels changed from 1 to 5.

The overall changes in agitation, cognition, and diet levels for all patients are summarized in Table 2. As shown, 2 out of the 10 patients (4 and 8) displayed the expected pattern of increased cognition, decreased agitation, and a less restrictive diet. Two patients (1 and 3) did not originally follow the presumed pattern, but eventually did over time. Three patients showed unexpected patterns (5, 9, and 10) and three displayed no overall change (2, 6, and 7).

Table 2. Change in Agitation, Cognitive FIM, and Diet levels for all Patients.

Subject Number	Agitation Level	Cognitive FIM Level	Diet Level
1	↑↓	↑	↑
2	⃠	⃠	⃠
3	↑↓	↑	↑
4	↓	↑	↑
5	↓	⃠	⃠
6	⃠	⃠	⃠
7	⃠	⃠	⃠
8	↓	↑	↑
9	↓	↑	↑↓
10	↓	⃠	↑

↑-Increasing
↓-Decreasing
⃠-No Change

Discussion

The expected pattern of recovery for a person with a TBI who has dysphagia was that as their Cognitive FIM™ score increased, their agitation would decrease, and their diet would become less restricted. This assumption was verified in only 2 of the 10 patients (4 and 8). Some unexpected patterns of recovery were also observed. Patients 1 and 3 portrayed agitation levels increasing, and then decreasing. This could have been due to complications, such as the adverse effects of a medication (e.g. hyponatremia), pain, or another medical problem (Jackson, Mysiw, & Corrigan, 1989). However, both patients eventually continued to follow the expected pattern of increased cognition, decreased agitation, and a less restrictive diet as time went on. Patients 2, 6, and 7 did not experience any improvements in cognition, agitation, or diet level. This may have been due to the severity of the injury, as all 10 patients were categorized in the moderate-severe category. Agitation decreased in Patients 5 and 10 without the corresponding improvement of cognition. However, diet level improved in Patient 10 while it did not change in Patient 5. In Patient 9, the expected pattern was followed, but diet level became more restricted after it had originally decreased.

Agitation is a reflection of the poor self-regulation, decreased arousal, and decreased cognition associated with diffuse axonal injury and damage to the frontal lobe circuitry. Cognitive functioning as measured by the FIM also reflects this damage, but the FIM ratings do not specifically detail the changes in behavior associated with decreased self-regulation. Agitation is not present if there are no impairments in cognitive functioning, but cognition can be impaired without agitation being present. Three of the 10 patients showed a predictable pattern with agitation declining as cognition improved (4,8,9). Patients 1 and 3 showed variable agitation levels when cognition improved. This means that there must be other factors that also influenced the agitation, such as pain. Clinically, it has been observed that sometimes as cognition improves and the patient begins to realize that they are in the hospital, there is a surge of agitation associated with the patient's desire to be discharged prematurely. Due to not having access to the patients' full medical records, it is unknown, specifically, what variables may have provoked the continuation of high agitation levels. Patients 5 and 10 showed agitation decreasing while cognition did not change, which was likely due to pharmacologic treatment that was effective in reducing agitation but not necessarily improving cognition. Patients 2, 6, and 7 did not display any alterations with regards to agitation and cognition status. These unexpected patterns emphasize how each patient recovers, reacts, and responds differently concerning the recovery process of a TBI.

Although agitation occurs differently in each patient, agitation did not increase in 8 of the 10 Patients (2,4,5,6,7,8,9, and 10) throughout their stay at Dodd Hall. Agitation generally occurs relatively early in the recovery process (Ranchos Level IV) and thus is expected to decline during the course of recovery and rehabilitation. The exceptions, Patients 1 and 3, first showed an increase in agitation, however, the agitation started to decrease within a week. Again, this denotes that there may have been an underlying cause for the increase in agitation that was soon resolved that allowed the patients to continue on the expected path of recovery.

Over the course of rehabilitation, half of the patients improved their diet consistency to be less restrictive. Four out of 5 (1,3,4, and 8) improved their diet when cognition increased. Patient 10 was the only one that had an improved diet with no change in cognition. However, the cognitive level was relatively high to begin with. Patients (2, 5, 6, and 7) with no change in diet level also did not have any change in cognition or agitation status. Patient 9 was the only patient where diet level became less restrictive, then more restrictive. Again, due to not having complete medical records, the reason cannot be determined. However, aside from cognitive status, an alteration of the dysphagia diet levels may be a result of an impairment of the physical structures related to the swallowing process, such as muscular weakness or paralysis, or having a tracheostomy. Additionally, Patients 5,6, and 9 showed a cognitive improvement, but diet consistency did not. This may be a result of the SLP taking precautionary measures by not increasing the diet too soon.

However, due to not having sufficient dietary data for Patients 5 and 6, it cannot be confirmed that diet did not become less restricted as cognition improved.

The time of day of when the Cognitive FIM™ scores and dysphagia tests were done varied for each patient and may have impacted the results. If an evaluation was done after a long day of therapy, the patient will most likely be more fatigued as opposed to if the assessment was given earlier in the day.

Conclusion

The relationships between agitation, cognition, and changing diet levels are complex and can be driven by a number of factors. Cognition and agitation are strongly associated constructs, but not equivalent. One can have improved memory, for example, but still have difficulty with behavioral control. Therefore, both cognition and agitation can potentially have an impact on swallowing safety. Yet, therapists also reduce restrictions on a diet based on other un-identified factors, such as an improvement with the physical structures related to the swallowing process.

The results of this study can inform clinicians about various patterns in the recovery process that can be observed in persons recovering from a traumatic brain injury. The possible association between agitation levels and dysphagia diet consistencies shows that there are many intricate variables related to the recovery process of a traumatic brain injury, and that they vary on an individual basis. These results suggest that clinicians should take into consideration all of the individual factors and information relating to a patient’s injury and recovery process before altering one's diet consistency.

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