Key Terms
Traumatic brain injury (TBI)
Open brain injury
Closed brain injury
Primary damage
Diffuse axonal injury (DAI)
Secondary damage
Posttraumatic amnesia (PTA)
Decorticate posturing
Decerebrate posturing
Postural deficits
Impaired initiation
Disinhibition
Emotional lability
Sensory regulation treatment
Pelvic alignment

Chapter Objectives
After studying this chapter, the student or practitioner will be able to do the following:

1. Define traumatic brain injury and identify its common causes.
2. Describe the range of clinical symptoms seen in the traumatic brain injury population.
3. Discuss the impact of posttraumatic amnesia on function.
5. Identify how functional assessments are used with clients with traumatic brain injury.
6. Describe the principles of a seating program.
7. Explain the purpose of sensory regulation and how it is used in treatment of a client with traumatic brain injury who is functioning at a lower level.
8. Identify the problems of occupational functioning most likely affected by traumatic brain injury.
9. Identify treatment activities for clients with traumatic brain injury at each level of the Rancho Los Amigos Level of Cognitive Functioning.
10. Describe the role of the family and significant others in the recovery process of the client with traumatic brain injury.
11. Explain the purpose of a behavior management program.
12. Explain how posttraumatic vision syndrome, perceptual dysfunction, and cognitive dysfunction impact function.
13. Identify and describe appropriate adaptive and compensatory treatments for specific deficits caused by traumatic brain injury.

Traumatic brain injury (TBI) results from a penetrating (open) or nonpenetrating (closed) injury to the brain. Survivors of TBI may show a variety of problems. Despite numerous commonly experienced diagnoses, no two clients present with exactly the same symptoms. Some brain injuries cause immediate death, whereas others result in mild damage. One TBI client may emerge from coma, respond inconsistently and nonreactively to painful stimuli (as presented when tested by a physician), and eventually require assistance the remainder of his or her life. Another may be able to complete all activities of daily living (ADL) but have problems performing instrumental activities of daily living (IADL), work tasks, and leisure activities without structure, cues, or assistance; this client will have to make the necessary adjustments. The range of disability after a TBI is more diverse than in other central nervous system dysfunction. TBI is a life-altering experience that causes physical, cognitive, behavioral, and emotional changes.

This chapter will present a brief overview of the incidence, pathophysiology, medical/surgical management, and evaluation of severity of TBI. The occupational therapy (OT) evaluation, as performed by the occupational therapist, will be discussed briefly. The focus of this chapter will be on interventions in which the occupational therapy assistant (OTA) might be expected to participate. Changes in client factors—such as physical, cognitive, behavioral, visual, perceptual, functional, and psychosocial functions—will be presented in more detail to help the reader to differentiate clients functioning at a lower level from those functioning at an intermediate to advanced level (Table 26-1).
Table 26-1  Levels of Cognitive Functioning

<table>
<thead>
<tr>
<th>Level of Cognitive Function</th>
<th>Characteristics</th>
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| I.  No Response: Total Assistance | Appears to be in a deep sleep  
Completely unresponsive to any stimuli presented |
| II.  Generalized Response: Total Assistance | Reacts inconsistently and nonpurposefully to stimuli in a nonspecific manner  
Responses are limited in nature and are often the same regardless of stimulus presented  
Responses may be physiological changes, gross body movements, and/or vocalization  
Earliest response may be to deep pain  
Responses are likely to be delayed |
| III.  Localized Response: Total Assistance | Reacts specifically but inconsistently to stimuli  
Responses are directly related to the type of stimulus presented in the environment, such as head turning toward a sound  
Withdrawal of extremity and/or vocalization when presented with a painful stimulus  
May follow simple commands in a delayed and inconsistent manner, such as closing eyes or squeezing or extending an extremity  
Responds to auditory and visual stimuli (in the visual fields at near distances)  
After external stimulus is removed, client may lie quietly and may also show a vague awareness of self and body by responding to discomfort by pulling at nasogastric tube or catheter  
May show bias by responding to some persons (especially family, friends) but not to others |
| IV.  Confused-Agitated: Maximal Assistance | Heightened state of activity with severely decreased ability to process information  
Detached from the present and responds primarily to own internal confusion  
Behavior is often bizarre and nonpurposeful relative to immediate environment  
May cry out or scream out of proportion to stimuli even after removal, show aggressive behavior, attempt to remove restraints or tubes, or crawl out of bed in a purposeful manner  
Lack of discrimination between persons or objects  
Unable to cooperate directly with treatment effort  
Verbalization is often incoherent and/or inappropriate to the environment  
Confabulation may be present; patient may be euphoric or hostile  
Attention is very short; selective attention is often minimal at best  
Lack of awareness of present events  
Lacks short-term recall but may react to past events  
Needs maximum assistance to perform basic self-care (feeding, dressing)  
If not disabled physically, the client may be able to perform motor activities as in sitting, reaching, and ambulating as part of agitated state, but not purposefully on request  
May show mood shifts from euphoric to agitated without any relationship to environmental events |
| V.  Confused-Inappropriate, Nonagitated: Maximal Assistance | Appears alert  
Able to respond to simple commands fairly consistently  
Responses are nonpurposeful and random in more complex situations and with less structure  
May be agitated, but not on an internal basis (as in Level IV) but rather as a result of external stimuli—and usually out of proportion to the stimulus  
Gross attention to the environment but is highly distractible  
Lacks ability to focus attention on a specific task without frequent redirection back to it  
With structure, the client may be able to converse on a social, automatic level for short periods of time  
Verbalization is often inappropriate; confabulation may be triggered by present events  
Memory is severely impaired, with confusion of past and present in reaction to ongoing activity  
Lacks initiation of functional tasks and often shows inappropriate use of objects without external direction  
May be able to perform previously learned tasks when structured but cannot learn new information  
Responds best to self, body, comfort—and often family members  
Usually can perform self-care activities with assistance and may accomplish feeding with maximum supervision  
May wander off either randomly or with vague intention of “going home” |
### Table 26-1 Levels of Cognitive Functioning—Cont’d

<table>
<thead>
<tr>
<th>Level of Cognitive Function</th>
<th>Characteristics</th>
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| VI. Confused-Appropriate:  | Goal-directed behavior but depends on external input for direction  
| Moderate Assistance       | Response to discomfort is appropriate and the client tolerates unpleasant stimuli (e.g., nasogastric tube) when need is explained  
|                            | Follows simple directions consistently and shows carryover for relearned tasks (such as self-care)  
|                            | Needs less supervision with familiar tasks (old learning)  
|                            | Shows little or no carryover for new learning  
|                            | Responses may be incorrect because of memory problems, but they are appropriate to the situation  
|                            | Responses may be delayed  
|                            | Decreased ability to process information with little or no anticipation or prediction of events  
|                            | More depth and detail in past memories than recent memory  
|                            | Beginning awareness of situation by realizing an answer is unknown  
|                            | No longer wanders and is inconsistently oriented to time and place  
|                            | Selective attention to tasks may be impaired, especially with difficult tasks and in unstructured settings, but is now functional for common daily activities (30 minutes with structure)  
|                            | Shows at least vague recognition of some staff and has increased awareness of self, family, and basic needs (such as food), again in an appropriate manner as in contrast to Level V |
| VII. Automatic-Appropriate:| Appears appropriate and oriented within hospital and home settings  
| Minimal Assistance for    | Completes daily routine automatically but often does so in an almost robotic way  
| Daily Living Skills       | Minimal to absent confusion but has shallow recall of what has been done  
|                            | Shows increased awareness of self, body, family, foods, people, and interaction in the environment  
|                            | Superficial awareness of but lacks insight into his condition, demonstrates decreased judgment and problem-solving, lacks realistic planning for the future  
|                            | Shows carryover for new learning but at a decreased rate  
|                            | Requires at least minimal supervision for learning and for safety purposes  
|                            | Independent in self-care activities and supervised in home and community skills for safety  
|                            | With structure, can initiate tasks in social and recreational activities of interest  
|                            | Unaware of needs and feelings of others  
|                            | Oppositional/uncooperative  
|                            | Judgment remains impaired, such that client cannot drive a car  
|                            | Unable to recognize inappropriate behavior in social interactions  
| VIII. Purposeful and     | Alert and oriented  
| Appropriate:              | Recalls and integrates past and recent events  
| Standby Assistance        | Completes familiar tasks in a distracting environment for 1 hour  
|                            | Aware of and responsive to culture  
|                            | Shows carryover for new learning if acceptable to life role and needs no supervision after activities are learned  
|                            | Within physical capabilities, client is independent in home and community activities, including driving  
|                            | Vocational rehabilitation to determine ability to return as a contributor to society (perhaps in a new capacity) is indicated  
|                            | Shows continued impairments in comparison to previous level of function in abilities, reasoning, tolerance for stress, judgment in emergencies, or unusual circumstances  
|                            | Irritable  
|                            | Argumentative  
|                            | Self-centered  
|                            | Depressed  
|                            | Social, emotional, and intellectual capacities may continue to be decreased but are functional for society  
|                            | Recognizes and corrects inappropriate behavior in social interactions but needs standby assistance to make corrections  

Continued
PART VII  Clinical Applications

Statistics

Incidence

In the United States, there are over 5.3 million survivors of traumatic brain injury.29 Over 1.5 million persons sustain a TBI every year, and 75% of these are mild TBI.29 The number of fatal and severe TBIs has been declining, a trend that is attributed to decreased incidence of drunk driving; increased use of seatbelts, airbags, and motorcycle helmets; and increased public education on prevention of TBI.37 However, the increased use of airbags and the extreme velocity in which they are deployed have increased the incidence of mild TBI. Consider the case of Mr. B. His injuries likely would have been much less serious if he had been wearing his seatbelt at the time of impact. Clients with mild TBI may have other diagnoses such as bruising, fractures, or other complications attributable to injuries at the time of the TBI. Because mild TBI can be underreported, the OTA who is familiar with the signs and symptoms should report any questionable observations to the occupational therapist for further review by the physician.

CASE STUDY

Mr. B.: A Client Functioning at Low Level

Mr. B. is a 19-year-old right-handed male who was involved in a motor vehicle accident (MVA) in which he was sitting without a seatbelt in the front passenger seat. The car was hit on the passenger side by a delivery truck that ran a stop sign. Both the driver and the passenger airbags deployed. Mr. B. had a positive loss of consciousness and began seizing at the scene of the accident. The EMT noted decerebrate posturing. Mr. B. had no previous medical problems and was not on any medications. He was immediately transported to the intensive care unit (ICU) of a level I trauma medical center, where he was evaluated as having sustained a Grade III head trauma. A computed tomography scan of the head showed bilateral intraventricular hemorrhage with multiple shear lesions. The Glasgow Coma Scale score was 6. Within 24 hours, Mr. B. underwent emergency surgery or ventriculostomy (insertion of tube through skull into brain) to reduce brain swelling. A Foley catheter was placed, and a bowel management program (using medications) was initiated.
CASE STUDY

Mr. B.: A Client Functioning at Low Level—cont’d

Two days after the accident, Mr. B. underwent a craniotomy for evacuation of a right frontal lobe subdural hematoma. A tracheostomy tube and parenteral nutrition tube were placed within a few days after the injury. Mr. B. stayed in the ICU for the next 3 weeks. He was unconscious for 14 days and awoke from the coma one week prior to being transferred to the rehabilitation unit. On awaking from coma, Mr. B. responded to pain and showed some purposeful movement of his nondominant left upper extremity (UE) but could not follow commands or verbalize at all. His eyes were open during his wake cycle, but he did not visually attend or track. His sleep patterns were abnormal. Increased tone was noted in both UEs (right greater than the left). There was no movement of his right extremities, and the UE showed flexor patterning. Right hemiparesis was present. Medications were prescribed to prevent seizures, reduce spasticity, regulate the wake/sleep cycle, reduce gastric discomfort, and increase alertness. When medically stable, Mr. B. was transferred to the inpatient rehabilitation program. The last week before transfer, the ICU physical therapist initiated a program to get Mr. B. out of bed and sitting in a bedside chair with a high back, leg rests, tilted seat, and lapboard. Mr. B. required maximal assist of two persons to transfer from the bed to the chair and back. Postural control and static sitting balance were fair to poor, and dynamic sitting balance was very poor. Mr. B. began verbalizing (answering simple questions) and moving his left upper and lower extremities (LEs) purposefully. Mr. B. was wearing a helmet at all times that he was out of bed. Dysphagia prevented him from eating or drinking anything by mouth. He appeared to be drooling because he had difficulty swallowing his saliva at times. All feeding supplements, fluids, and medications were being given through the feeding tube.

Initial Occupational Therapy Evaluation

The occupational therapist completed an initial evaluation, obtaining the following information:

Mr. B. lives in a two-story home with his parents and his 16-year-old sister. At the time of the injury, he was enrolled in his second semester at a local community college, where he was majoring in criminal justice, but he withdrew because he could not complete the semester. In the fall, he had achieved a B+ average, completing 12 credits. He has no history of learning disabilities or academic difficulties. He worked 12 hours most weekends at a local restaurant as a short-order cook and was completely independent in all self-care, laundry, cooking, and money management.

Mr. B. now requires maximal assistance with all self-care skills and functional mobility. The speech-language pathologist and the respiratory therapist worked with Mr. B. to improve his ability to breathe normally without using the tracheostomy tube. Through oral-motor and swallowing training by the speech-language pathologist, Mr. B. has progressed to eating pureed foods but still cannot drink fluids by mouth. All nutritional needs are met through tube feedings. The only self-care task the client could perform was to wash his face using his left hand with moderate assistance from the clinician. He continues to use the Foley catheter for bladder management and is on a bowel program.

Mr. B. has been wearing corrective lenses for distance since he was 10 years old. His glasses were broken in the MVA, but the family brought to the hospital a second pair with an up-to-date prescription. Every time staff or family has tried to put his glasses on him, he has become agitated and removed them. Mr. B. can visually attend about 10 to 15 seconds and track objects for 10 to 15 seconds.

Mr. B. has reduced active and passive range of motion (ROM) of the right UE and LE due to paresis and spasticity. He has full functional use of the left extremities, has some movement of the right lower extremity, and lacks functional use of the right UE. Sensory and perceptual testing could not be performed fully because of his limited cognition and inability to communicate and participate in objective testing. From observation, Mr. B. seems to have reduced tactile sensation of the right side and pain with passive ROM of the right UE. Cognitively, Mr. B. is at a Level IV on the Ranchos Los Amigos Scale. Posttraumatic amnesia (PTA) seems to be resolving. The client requires 24-hour supervision for safety.

Outpatient Therapy

After several weeks of therapy as an inpatient, Mr. B. made such significant progress that he was referred for outpatient OT 5 days a week through the same hospital rehabilitation program. His seizures are now controlled, and the tracheostomy, gastric tube, and catheter have been removed. Mr. B. eats primarily fluids and softer foods, completes basic hygiene and uses a shower chair and hose for bathing, grooms himself, feeds himself with occasional spills, and dresses with minimal assistance to put on his right ankle foot orthosis (AFO) and right shoe. He walks with a hemi-cane and requires minimal to standby assistance. He needs moderate verbal and visual reminders to wear his helmet at all times that he is out of bed, especially when ambulating. Both parents provide assistance as needed. Mr. B.’s mother has stopped working so that she can take care of her son.

Mr. B. is bowel and bladder continent. He has minimal to moderate spasticity of his right trunk and LE. Mr. B. now wears his glasses at all times. He is currently participating in a serial casting program to increase passive ROM of his right elbow. He still has no functional use of his right (dominant) extremity, with moderate spasticity. Visual tracking is impaired, and visual processing speed is slowed. Perceptual deficits include visual agnosia, reduced ability to recognize faces, right-left discrimination deficits, impaired figure-ground, topographical disorientation, and depth perception deficits. Language problems include auditory processing deficits and impaired word finding. Mr. B. has improved to a Level VI on the Ranchos Los Amigos scale and still requires supervision at home. Mr. B. wants to be able “take care of [himself] without help, go back to school, and drive a car again.”
The leading causes of TBI are motor vehicle accidents (MVAs) and falls. Recent statistics show that TBI occurs three times more often in men than in women.\textsuperscript{13} The risk is greater among children 4 to 5 years old, adolescent and young adult males 15 to 24 years old, adults over age 75, and people who have had previous brain injuries.\textsuperscript{29} Most individuals who experience a TBI are of a lower socioeconomic status and are single. A high percentage of persons with TBI have a history of drug and alcohol abuse or a psychiatric history,\textsuperscript{24} and two-thirds of the persons with TBI have measurable alcohol levels at the time of the injury.\textsuperscript{13} Research indicates that women with TBI tend to recover better than men do.\textsuperscript{17} Prognosis for older persons who are injured is about the same as for younger persons with similar injuries, but recovery for persons injured in midlife is the least favorable.\textsuperscript{17} Mortality is higher for adults in MVA and falls. Recent statistics show that TBI occurs three times more often in men than in women.\textsuperscript{13} The risk is greater among children 4 to 5 years old, adolescent and young adult males 15 to 24 years old, adults over age 75, and people who have had previous brain injuries.\textsuperscript{29} Most individuals who experience a TBI are of a lower socioeconomic status and are single. A high percentage of persons with TBI have a history of drug and alcohol abuse or a psychiatric history,\textsuperscript{24} and two-thirds of the persons with TBI have measurable alcohol levels at the time of the injury.\textsuperscript{13} Research indicates that women with TBI tend to recover better than men do.\textsuperscript{17} Prognosis for older persons who are injured is about the same as for younger persons with similar injuries, but recovery for persons injured in midlife is the least favorable.\textsuperscript{17} Mortality is higher for adults in MVA and falls.

### Pathophysiology

An open brain injury typically is caused by direct trauma to the head by an object that penetrates the skull and brain. Examples are bullets and fragments, pieces from exploding objects, and other flying projectiles. A closed brain injury occurs when acceleration, deceleration, and rotational forces are applied to the head and cause brain tissue to shear (tear apart). Closed brain injuries often result from MVAs and falls. In both types of injuries, damage can be caused by coup (the direct hit on the head) and contrecoup (the result of the brain moving inside the skull from the coup impact).

### Primary Damage

Primary damage occurs at the time of trauma and is caused by localized contusions that result in diffuse axonal injury (DAI). Contusions (bruises) occur in the frontal and temporal regions when the brain slides and strikes the rough skull. They are usually bilateral, but severity is asymmetrical. Most damage occurs at the site of the first hit. Localized contusions may also be found under areas of depressed skull fracture.\textsuperscript{5}

DAI results from stretching and shearing forces that occur in the tissues of the brain and can affect any brain structure. The corpus callosum and the brain stem are the most commonly affected areas.\textsuperscript{1,2} DAI causes widespread brain damage. Damage may be severe enough to induce a coma or so mild that only a concussion or brief loss of consciousness results. Both Mr. B. and Mrs. R. in the case studies sustained closed brain injuries caused by being thrown around in their car upon impact. Both had coup and contrecoup injuries. Mr. B.’s coup injury caused a subdural hematoma, which required a craniotomy for evacuation of the large blood clot to save his life, and Mrs. R. had a laceration that required stitches to close. However, because the impact of the crash was on Mr. B.’s side of the car and he was not wearing a seatbelt, he experienced a much more significant injury than Mrs. R. did.

### CASE STUDY

**Mrs. R.: A Client Functioning at a High Level**

Mrs. R., a 36-year-old schoolteacher, was the driver of a car involved in a motor vehicle accident (MVA). She was wearing a seatbelt at the time of the crash. A truck ran a stop sign and struck the car on the passenger side, injuring her nephew, Mr. B. Mrs. R. sustained a deep laceration over her left eye and briefly lost consciousness. She was transported to the emergency room at a local hospital, where she received 10 stitches for the laceration and complained of a severe headache, dizziness, and neck pain. Her head and neck X-rays and the computer tomography scan of her head were negative. Mrs. R. has a history of allergies and uses prescribed medication as needed. At the emergency room, she was diagnosed with a concussion and whiplash and discharged to home, with recommendations to rest. However, she chose to visit the hospital where her nephew was hospitalized. Initially, she was not allowed in the ICU to visit him, but spent several hours sitting with her sister, brother-in-law, niece, and other family members. When her headache, neck pain, and dizziness became severe, she went home. She woke up the next day with a severe headache, light sensitivity, fatigue, severe neck and upper back pain, numerous body aches, dizziness, and difficulty attending and concentrating. She stayed home for the next 10 days, leaving her house only to visit her injured nephew and see her doctor, who diagnosed concussion, sleep disturbance, and cervical muscular strain. She was prescribed medication for pain and sleep, and physical therapy.

She “felt better” after taking medications and attending six physical therapy sessions and decided to return to work as a fourth-grade teacher. She noticed immediately that the fluorescent lights and noises in the school were difficult to tolerate. By the end of the first day, she was so exhausted that she had to call her husband for a ride home. She ate a quick meal and slept for 14 hours. Her experience for the remainder of the week was similar, and she chose to find a quiet area in the school to rest in the dark as many times as she could to get through the day. She also noticed she had difficulties with focusing, remembering, organizing her schedule, thinking of words to say, sleeping at night, and sitting or standing comfortably for more than 30 minutes. Without provocation, she would burst into tears. She stopped performing all household management tasks,
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CASE STUDY

Mrs. R.: A Client Functioning at a High Level—cont’d

exercising, and leisure reading at home and then could perform slightly better at work. Mrs. R. continued to teach for the next 4 weeks but was always exhausted, had difficulty performing home management chores, made several errors in bill paying, and began falling farther and farther behind in keeping up with her schoolwork. At work and at home, she isolated herself socially, except to visit her nephew in the hospital 3 times a week.

Mr. R. noticed that his wife was more irritable, less focused, unable to converse for more than a few minutes, emotional at times, got up often during the night because she could not sleep, kept all the lights off, stopped watching television, bumped into objects in the home, and dropped things. Mrs. R. was referred to a neuropsychiatrist, who diagnosed a mild TBI, posttraumatic headache, posttraumatic concussion syndrome, posttraumatic vision syndrome, depression, disorder of initiating and maintaining sleep, fatigue, and sensory hypersensitivity. The doctor confirmed the previous diagnosis of whiplash. He prescribed medications for headache pain, fatigue, depression, alertness, and sleep and recommended that Mrs. R. take a 3-month leave of absence from work, effective immediately. He also referred Mrs. R. to OT and speech-language pathology for evaluation and treatment.

Occupational Therapy Evaluation

Mrs. R. is independent in self-care but became dizzy when she closed her eyes in the shower. The therapist recommended a shower chair for safety.

Mrs. R. is no longer independent in instrumental activities of daily living; she relies on her husband and other help. Her husband, Mr. R., works long hours as a mechanical engineer and always has been responsible for home repairs and yard work. He has taken over all of the cooking, grocery shopping, laundry, light cleaning, and bill paying. The family hired a cleaning service for the deep cleaning every 2 weeks. Despite using more prepared foods, Mrs. R. still has difficulty getting meals and makes errors in timing of different foods, overcooking foods, and leaving the oven on after using it. She becomes distracted easily and often does not complete tasks such as laundry without reminders from her husband. She forgets when to take medications and no longer follows her daily planner, instead requiring reminders from her husband. Mrs. R. is easily fatigued and takes a 2- to 3-hour nap each afternoon.

Mrs. R. has eye misalignment, reduced visual tracking, reduced convergence, impaired depth perception, double vision, and impaired saccades, causing reading problems. She does not wear corrective lenses. She avoids driving at night or in heavy traffic or inclement weather, and she tries to drive only on local familiar roads, but she gets lost about twice a week. Her husband has been very supportive about the problems associated with her injury and the accident in which her nephew was seriously injured, but feels considerable stress.

Mrs. R.’s goals are to regain all of her previous roles: fulltime worker, volunteer at her church choir, family member, home maintainer, friend, religious participant, and hobbyist. She has been rated Level VIII on the Ranchos Los Amigos Scale. She is highly motivated to participate in OT and “go back to my old life, when everything was easy to do.”

Secondary Damage

Secondary damage can occur immediately after the injury, or hours or days later. Secondary effects can be life-threatening and include intracranial hematomas, cerebral edema, raised intracranial pressure, hydrocephalus, intracranial infection, and posttraumatic seizures. Widespread brain damage can result from secondary damage. Early diagnosis and medical treatment of secondary changes during the acute phase of the injury help minimize neurological dysfunction and reduce the risk of further brain damage. After a significant rise in intracranial pressure, Mr. B. underwent a ventriculostomy to reduce pressure on the brain and to limit the risk of further brain damage. Again, Mr. B’s injuries were more severe than Mrs. R’s; his head moved around much more in the car because he was not restrained by a seatbelt. The airbag blocked him from going forward but did not limit movement in other directions.

Medical and Surgical Management

The priorities in the medical and surgical management of the person with a TBI are to minimize effects of the immediate injury and prevent secondary complications. When the brain-injured person arrives at the hospital emergency room, the medical team first addresses life-threatening injuries and works to stabilize the individual medically. For severely injured individuals, this process may take hours to days. The person with a severe TBI may experience many crises and receive emergency treatment for shock or respiratory arrest. The medical team evaluates the client to assess for other injuries, such as spinal and soft tissue injuries, fractures, wounds, and/or internal injuries. Suctioning, intubation, or a tracheostomy may be required for a blocked or damaged airway. The person may require stitches or immobilization such as splints, a cervical collar, a halo vest, casts, or traction. A craniotomy, performed by a neurosurgeon, may be needed to decrease rising intracranial pressure and bleeding.

Mrs. R.’s injury was mild; she was medically stable when she arrived at the emergency room. Her most serious medical problem was her forehead wound, which required stitches. Mr. B.’s severe injuries required several medical interventions. Despite the introduction of a tube to drain fluid off his brain, Mr. B. required a craniotomy, in which a portion of his skull bone was removed and saved for future replacement. With an open area of the brain, Mr. B. needed to wear a protective helmet at all times that he was out of bed to prevent damage.
to the brain in case of a fall. Because of memory deficits, Mr. B. needed verbal and visual reminders to use it as prescribed.

Initial nutritional needs are usually treated with intravenous fluids. For unconscious clients or persons who cannot take in food orally in sufficient quantity, a nasogastric tube is inserted through the nose into the stomach. If the problem continues, a gastrostomy tube may be placed surgically in the stomach. The client receives nutrients through these tubes until he or she can consume sufficient calories or fluids orally. Mr. B. could not take in any food or fluids by mouth initially because of his light coma nor later, after awakening, because of dysphagia. As he recovered and received speech-language pathology treatment, he progressed to foods with softer textures.

A person with urinary incontinence may require catheterization. To assist the individual in eliminating the bowels, the physician usually prescribes stool softeners to prevent impaction. Later in the rehabilitation phase, when elimination functions start to return, a bowel and bladder program is initiated. After the initial evaluation and treatment (management in the emergency room and operating room), the client is usually transferred to the ICU. In the ICU the client is monitored for response to treatment and for possible complications. The clinical neurological status is frequently reassessed. When medically stable, the client is usually transferred to the acute care neurological service or to a rehabilitation unit.

**Occupational Therapy in the Intensive Care Unit**

Because of the ongoing evaluations and rapid changes, the occupational therapist normally provides OT for the client with TBI in the ICU. The OTA may be asked to carry out interventions for ROM, facilitating responses to stimuli, practicing basic hygiene skills such as washing the face, family education, etc. OT goals in the ICU include the following:

- Establishing a bed and wheelchair positioning program
- Establishing a sitting program if possible
- Preventing contractures
- Increasing endurance
- Establishing a baseline cognitive status
- Educating the family
- Facilitating client participation in basic ADL

The occupational therapist may be involved in recommending positioning equipment, to be ordered or fabricated especially for the individual client. A client with an open brain injury or craniotomy defect greater than 5 cm by 5 cm typically requires a helmet when he or she is out of bed to protect the open skull from further brain injury.

**Severity of Injury**

**Posttraumatic Amnesia**

The spectrum of deficits from TBI varies and can be characterized as severe, moderate, or mild. Although no absolute measure of severity of TBI exists, some measures are indexed by duration and depth of coma and length of posttraumatic amnesia (PTA). Over 70% of persons with acquired brain injury will experience PTA of 28 days or greater, as was true for Mr. B. Longer periods of PTA are associated with lower level of cognitive and motor ability. Medical centers may have their own systems to rate the level of severity (such as the Grade III head trauma rating for Mr. B.). Regardless of the level of injury, the most significant recovery usually occurs during the first two years, especially the first 6 months; however, neurological recovery can continue for years.

One of the most accurate predictors in determining the severity of the diffuse brain damage is the duration of PTA. When a person with a severe TBI comes out of coma, PTA can last from a few days to months. Individuals with PTA are disoriented and inattentive. They have significant difficulty learning new information and have impaired (episodic) memory for daily activities or events. They do not remember events occurring since their injury and may be confused and agitated. The injured person cannot store or retrieve new information; they cannot remember daily occurrences such as what he had for breakfast, who came to visit that day, the day of the week, etc. Safety is also a concern because of poor awareness and impulsivity.

**Functional Assessment**

A number of assessment scales are used with persons with TBI for clinical evaluation, program evaluation, prediction of outcome, and to produce data for clinical research. Upon admission to the hospital for TBI, most people are rated with the standardized Glasgow Coma Scale (GCS) to measure their level of consciousness. The GCS is divided into categories of eye opening, best motor response, and verbal response; 15 items, in total, are scored. A score of 13 to 15 indicates mild impairment, 9 to 12 moderate impairment, and under 8 severe impairment. Mr. B. had a GCS score of 6.

Other scales and objective measures such as the Disability Rating Scale, the Functional Independence Measure, the Community Integration Questionnaire, and observational assessments such as the Rancho Los Amigos Scale of Cognitive Functioning (see Table 26-1) are used to evaluate TBI. The occupational therapist might participate with the team in using these assessments, and the OTA should be familiar with the scale(s) used at the facility.

After a TBI, recovery occurs along a continuum from comatose (at one end of the spectrum) to fully functional in all situations. The original version of the Rancho Los Amigos Scale of Cognitive Functioning divided recovery into eight stages; the revised version added two more stages. In addition to identifying cognitive deficits and skills, the Rancho Los Amigos Scale also includes behavioral and functional deficits and skills occurring at the various stages of recovery. Becoming familiar with these stages will prove useful to the clinician as he or she seeks to recognize and understand the various characteristics of recovery from TBI. The information is also useful for educating caregivers and families.
In addition to the assessments discussed above, the occupational therapist assesses performance in areas of occupation, performance skills, performance patterns, contexts, activity demands, and client factors.\(^3\)\(^,\)\(^3\)\(^9\) Despite the considerable difference between Mr. B. and Mrs. R. in the severity of their TBIs, both have experienced changes in their ability to perform customary and valued occupations. Mr. B. demonstrates deficits in all areas of performance skills; Mrs. R., despite her higher level of function, also shows diminished performance skills. Both clients have deficits in performance patterns (habits, routines and roles).\(^3\)\(^) Mr. B. requires much more assistance to participate in his occupations, whereas Mrs. R. has changed her habits to accommodate her brain injury (e.g., staying at home and performing fewer chores). She has given up her work role temporarily and has reduced most other roles because her symptoms such as headache, sensory sensitivity, low endurance, and executive dysfunction interfere with her ability to participate.

The occupational therapist also assesses performance in the contexts of each client’s life, which includes: cultural (beliefs, activity patterns), physical (environment), social, personal (age, gender, socioeconomic status, educational status), spiritual, temporal (stage of life, time of year, duration of problems), and virtual (computers, radio).\(^3\) At the time of the accident, Mr. B. was a young adult who was just starting his college education, living at home and still financially dependent on his parents. He had not established himself as an independent mature adult. Therefore some of the skills he needs to learn will be new and challenging. He will require lengthy rehabilitation, with emphasis on basic self-care training and performance skills first. The occupational therapist identifies the activity demands (tools and materials used in tasks, space demands and physical environment, social demands, sequencing and timing, motor skills required and body parts used in the task)\(^3\) and adapts them to promote success for the client. For example, the occupational therapist might observe Mr. B. eating to determine why he spills his food. Perhaps he is using his non-dominant left hand and could benefit from further practice in improving coordination.

Mrs. R. has established herself in many roles, particularly at her work. However, she has not been able to maintain any habits, roles, or routines consistently. She will require intervention to reestablish roles, beginning preferably with those in the home, a familiar environment, which should help her feel more comfortable and less fatigued. Finally, the occupational therapist assesses client factors, which include body functions and body structures.\(^3\)\(^,\)\(^3\)\(^9\) Body functions that would be addressed in OT include mental functions (affective, cognitive, perceptual); sensory functions and pain; neuromusculoskeletal and movement-related functions; cardiovascular, hematological (vascular), immunological; and respiratory function; and skin and related structures.\(^3\)\(^,\)\(^1\)\(^9\) OT practitioners should be aware of body structures, including the structures of the nervous system, the ears, and eyes, and those structures related to movement, etc.\(^3\)\(^,\)\(^1\)\(^9\) Mr. B. has deficits in all body functions as listed; Mrs. R.’s problems are mostly related to cognitive and mental functions. The remainder of this chapter will explore OT treatment options in relevant areas for Mr. B. and Mrs. R.

**Clinical Picture of Persons with Traumatic Brain Injury**

The person with a TBI can show a variety of symptoms manifested in many different ways, depending on the type, severity, and location of the injury. The client may have severe limitations in most of the areas listed below or the client may have very subtle deficits, evident only in high-level, complex activities. The following section involves the motor performance skills section and body functions.

**Neuromuscular Status**

The neuromuscular deficits experienced by clients after TBI can vary from severe motor involvement (of the trunk or of one to all four extremities) to minimally impaired coordination and muscle strength and full isolated voluntary control. Most clients who require OT will exhibit deficits in one or more of the following areas: primitive reflexes, muscle tone, postural stability, motor control, ROM, strength, sensation, and endurance.

**Abnormal Reflexes**

Common reflexes exhibited in severely brain-injured adults are the asymmetrical tonic neck reflex and the symmetrical tonic neck reflex. Treatment focuses on inhibiting these brain stem reflexes and facilitating normal movement patterns. Mr. B. demonstrated patterning of the right side (flexion of the UE and extension of the LE) and did not recover right UE movement. The occupational therapist would facilitate normal movement patterns of the neck, trunk, left extremities, and right LE.

**Abnormal Muscle Tone**

When muscle tone is affected by the TBI, it varies from hypotonicity (flaccidity) to hypertonicity (spasticity) and can affect all skeletal muscles of the head, neck, trunk, and extremities. When muscles are flaccid, the resistance to passive movement is diminished, and the stretch reflexes are dampened. The affected body part may appear floppy and will require support to prevent subluxation. Mr. B. has increased tone or spasticity of his right side. Although his LE motor function improved enough to allow him to ambulate with an AFO and semi-cane, his right UE remained nonfunctional, causing him to change his hand dominance. The spasticity was severe enough to cause a contracture of his right elbow, requiring serial casting.

Spasticity may range from minimal to severe and increases the risk for joint contractures.

The client in coma may develop **decorticate posturing** (sustained contraction and posturing of both UEs in flexion and the trunk and both LEs in extension) or **decerebrate posturing** (sustained contraction and posturing of the trunk and extremities in extension) in the first days or weeks after injury. These postures may diminish over time when the client makes a neurological recovery. Mr. B. demonstrated decerebrate
posturing at the scene of the accident, which resolved over the next few weeks.

Spasticity will fluctuate with changes in the client’s position, volitional movement, or medication. Infections or illness, pain, an overfilled bladder, impaction of the bowels, or resistance to the affected or unaffected muscles on the opposite side can increase spasticity. OT intervention for abnormal muscle tone begins with proper positioning and maintenance of full active and passive ROM to prevent contractures. Long-term consequences of severe spasticity include reduced ability to perform ADL, difficulty in maintaining proper bed or sitting positioning, reduced functional mobility (difficulty with transfers, gait deviations), reduced speech and breath control, painful spasms, contractures,27 and increased risk for skin breakdown.

**Muscle Weakness**

After a TBI, muscle weakness or below-average muscle strength can be mild to severe. When muscle weakness is present in the head, neck, and trunk, the client may have difficulty with head control or posture while sitting. If weakness is present in both UEs, deficits in gross and fine motor control or coordination will be present. Mr. B. has right hemiparesis, thus suggesting that he will demonstrate problems with motor control.

**Postural Dysfunction**

*Postural deficits* result from imbalanced muscle tone; delayed or absent righting reactions; impaired motor control; and deficits in vision, cognition, and perception. Abnormal postures frequently exhibited in adults with moderate to severe TBI include the following:

- **Head/neck:** Forward flexion or hyperextension
- **Scapula:** Humeral depression with protraction, retraction, or downward rotation
- **UEs:** Possible bilateral or unilateral involvement; typically have elbow flexion, humeral adduction and internal rotation, forearm pronation, and flexion of wrist and fingers
- **Trunk:** Kyphosis, scoliosis, loss of lordosis
- **Pelvis:** Posterior pelvic tilt and pelvic obliquity
- **LEs:** Hip adduction, knee flexion, planter flexion, and inversion; if in a persistent vegetative state, may have severe extensor spasms

Mr. B. initially demonstrated postural deficits, which were addressed through adaptations when he first began to sit upright. With recovery he gained more postural control as well as control of his left extremities and right LE sufficient to allow him to ambulate with devices and assistance.

**Impaired Motor Control and Motor Speed**

Motor control allows for smooth purposeful movements of body parts during functional tasks. Impairment in voluntary motor control in all of the extremities (quadriparesis) results from an imbalance in muscle tone and muscle weakness. It is not uncommon for only one side of the body to be involved, thus causing hemiparesis, such as occurred with Mr. B. Loss of motor control leads to deficits in head and trunk control, sitting and standing balance, reaching, bending, stooping, and functional ambulation; these functions are necessary for performing both basic and advanced ADL. Many persons with TBI experience reduced gross and fine motor speed. Both Mr. B. and Mrs. R. show slowed motor speed while performing functional tasks.

**Ataxia**

Ataxia is abnormal movement and disordered muscle tone seen in clients with TBI due to damage to the cerebellum or to the sensory pathways. Ataxia can affect movements of the head, neck, and trunk but usually affects the extremities. The client with ataxia has lost the ability to make small, minute adjustments that allow for smooth coordination of movements. Shakiness and incoordination cause problems in fine motor tasks such as writing, fastening, or eating.

**Limitations of Joint Motion**

Loss of active and passive ROM is a common problem. Interventions for loss of ROM vary depending on the cause; the occupational therapist should determine the cause of the loss of ROM before the OTA begins treatment.

Mr. B. has lost active and passive ROM of his nonfunctional right UE, which did not respond either to daily ROM exercises or to medication to reduce spasticity. As a result, he continues to require serial casting of the elbow until maximum ROM is achieved. He may require additional splinting to be worn as much as possible to maintain gains; once gains are established, he can reduce hours of wear to only when sleeping.

**Sensory Changes**

Persons with TBI may experience dulling or a loss of the following: light touch sensation, sharp or dull discrimination, proprioception, kinesthesia, or stereognosis of the extremities. Cranial nerve involvement may cause loss of pain and light touch sensation in the face and impaired senses of taste and smell. Mr. B. demonstrated reduced tactile sensation, or hyposensitivity, of the right side. Treatment focuses on increasing his awareness of the lack of protective sensation. For example, Mr. B. should learn to check water temperature with his left hand and check the skin under the AFO for any problems. Mrs. R. has a different sensory problem; she is hypersensitive to noise and visual input. She compensates by isolating herself, keeping all overhead lights off at home, and wearing earplugs when she is with other people in the community.

**Decreased Functional Endurance**

Decreased endurance usually results from the TBI but may also arise from deconditioning from prolonged bed rest or medical complications such as urinary tract infections. OT intervention includes a graded program to gradually increase the client’s ability to sit up and actively participate. Despite significant differences in the severity of their injuries, Mr. B.
and Mrs. R. both have problems with low endurance and fatigue. Although she is participating less in home management, social, and community roles, and no longer working, Mrs. R. still takes a 2 to 3 hour nap every day. Both Mr. B. and Mrs. R. have sleep issues that contribute to fatigue.

Dysphagia

The OT practitioner often works in conjunction with the speech-language pathologist to treat persons with dysphagia. Clients with TBI may have dysphagia in any of the four stages of swallowing: oral preparatory, oral, pharyngeal, and esophageal. Typically, more than one abnormality in swallowing is observed. For example, a client with swallowing problems and a dietary restriction of “no thin liquids” may try to take a drink from the water fountain in the hospital, even though it is contraindicated; this behavior is not unusual in clients with impulsivity and lack of insight. Clients with dysphagia who can eat may choke often and thus necessitate suctioning; they also may drool saliva because they cannot swallow it effectively or may hold food particles in their mouth after eating. Clients with dysphagia who are NPO may also drool or experience dry mouth. Such clients will usually have oral hygiene problems.

It is important for families and significant others to understand the dietary restrictions to assist the client in following a dietary program safely and effectively. Some clients lack the cognitive capacity to understand fully their difficulties with feeding and the restrictions needed to prevent choking, aspiration, or aspiration pneumonia. Mr. B. has progressed significantly in eating (i.e., moving from NPO and tube feedings to eating soft foods). He may find it difficult to adhere to his dietary restrictions when discharged to home, especially because his medically restricted diet differs from his peers (i.e., he cannot eat potato chips, chicken wings, tacos, etc. and cannot drink thin liquids such as soft drinks, water, or coffee).

Visual Function

TBI may significantly impact a previously intact visual system. Visual problems that result from a TBI include eye misalignment, double vision, blurring of vision, inability to smoothly adjust from near to far vision, jerky eye movements, poor tracking (inability to follow objects), field defects (ability to see only part of an image), reduced blink rate, and incomplete eyelid closure.

Many persons with TBI have posttraumatic vision syndrome (PTVS), which affects visual acuity, oculomotor control (eye coordination), binocular vision (eye teaming), and the coordination between the focal (detail oriented) and ambient (peripheral) aspects of the visual and balance systems. Symptoms of PTVS include double vision, reduced gaze stability (perceiving stationary objects as moving), poor attention and concentration, poor visual memory, glare sensitivity, impaired balance, and loss of coordination and postural control. PTVS causes problems with reading, functional mobility, and visual efficiency. Mr. B. shows some aspects of PTVS; Mrs. R. shows many more visual problems affecting her function. For example, she no longer enjoys reading. Visual impairments will impair functional performance, depending on the type, severity, and interrelation with deficits in other areas. The occupational therapist evaluates for visual impairment as the result of TBI and recommends referral to a vision specialist for a complete evaluation (see Chapter 23). PTVS and other visual deficits caused by TBI respond to vision rehabilitation, which comprises remedial exercises as well as instruction in and use of compensatory strategies, devices, and modification of the environment. A behavioral optometrist in the College of Vision Development (COVD) most often provides visual therapy in the form of remedial exercises; some occupational therapists are specially trained in this area of functioning (see Chapter 23). The OT practitioner more generally provides interventions for compensation and environmental adaptation.

Perceptual Function

The ability to accurately perceive sensory information and respond to people and objects within the environment is necessary for successful, independent function. Depending on the nature and extent of damage in TBI, impairment may involve visual, tactile, body scheme, language, and motor functions (see Chapter 24). Clients may experience impairments in the following areas: visual agnosia (inability to recognize objects by sight), impaired left/right discrimination, impaired figure-ground, reduced topographical orientation (spatial orientation), impaired depth perception, tactile agnosia (astereognosis or inability to recognize objects by touch), impaired body scheme (reduced ability to identify body parts), left unilateral neglect (reduced perception of left space), apraxia (impaired motor planning), and others. These deficits may affect the client’s ability to interpret sensory information accurately and interact with objects, tools, or people in the environment successfully. Mr. B. has several perceptual problems, and Mrs. R. shows impaired topographical orientation.

Cognitive Function

Varying degrees of cognitive deficits may result from TBI and include disorientation, decreased levels of attention, reduced concentration, impaired memory, impaired initiation, diminished safety awareness, decreased ability to accurately process information, and difficulty with executive functions and abstract reasoning.

Disorientation

For clients at a lower level of function, disorientation to varying degrees often occurs in relation to person, place, time, and situation (circumstance). The person appears confused and may need frequent basic reorientation through verbal and visual
cues until basic orientation improves consistently. Families and significant others can benefit from learning how to provide reorientation cues. Initially the information should be presented in a matter of fact tone by reminding the client with TBI of the basic orientation information; the clinician should avoid asking the person to answer questions repeatedly because doing so may lead to frustration, reduced cooperation, or agitation. The reorientation process can take from weeks to months. For some persons with TBI, disorientation may be permanent.

**Reduced Attention and Concentration**
The client with a TBI often has deficits in the ability to attend to relevant tasks and sustain attention for the time needed to complete the task. TBI often leads to difficulty attending in the presence of any type of distraction, internal or external. Lower level clients are often distracted by somatic (bodily) concerns, such as discomfort associated with catheterization or intravenous tubing, pain, or urinary urges. These distractions may cause them to try to remove the tubes any time they can reach the appliances. Such clients require soft restraints to limit UE use and 24-hour supervision to avoid injury. Clients with reduced attention and concentration will also have difficulty attending to tasks in a distracting environment because of a reduced ability to mask out irrelevant sounds or visual information. The OT practitioner must select relevant activities with the client to maximize attention and concentration. Both Mr. B. and Mrs. R. have reduced attention spans but have different reactions. Mr. B. is more easily distracted; Mrs. R. is more easily overwhelmed, fatigued, and likely to develop a severe headache.

**Impaired Initiation**
Impaired initiation—or difficulty in beginning the first actions, steps, or stages of a task—can significantly impact the ability to function. Reduced initiation is not synonymous with impaired motivation. Persons with initiation problems may often sit because they are unsure of the first step in tasks and generally benefit from external written or verbal cues to get going. When they come to a stopping point they may get stuck again and require more cues to continue with the task. Both Mr. B. and Mrs. R. show reduced initiation. Mr. B. requires more structure and moderate verbal cues to initiate most tasks; Mrs. B. needs to have a set schedule with long rest breaks between each brief activity.

**Impaired Memory**
Several types of memory impairment exist and range from the inability to recall a few words just heard (immediate memory), to forgetting what happened in the last treatment session (short-term memory), to forgetting events that occurred 24 hours ago or years before the injury (long-term memory). Memory loss contributes to confusion and is manifested in the inability to learn and carry over new tasks. At times, the client cannot remember personal information accurately or completely; therefore the OT practitioner must seek other sources of information, such as family members.

Establishing a routine using a meaningful cueing system can help the client become more functional. For example, clients who can no longer read words would be better served by an ADL cue sheet with pictures of their own supplies or even of themselves performing tasks such as combing their hair. Mr. B. has more difficulty with new learning and carry-over, and benefits from lowered expectations, which can be graded up as he succeeds. He could use a one-page daily checklist of his schedule and chores to check off as he finishes each task. He should always wear a large-face watch, which is easier to use.

Mrs. R. could benefit from a few assistive devices, such as a main schedule board at home posted in an obvious place, a checklist for chores, and a daily planner that is easier for her to use than the one she used prior to her injury. A sign could be posted with the day the housecleaning services comes and with all the dates for the next 3 months to help remind her when they will return. Color coding, streamlining information, and using checklists and a visual format with spaces designed so as not to overwhelm might be useful for Mrs. R. The OT practitioner would recommend that both Mr. B. and Mrs. R. set up well-marked areas in their home for belongings to be stored specifically in those locations (e.g., a tray for keys, another for the daily planner, etc.).

**Decreased Safety Awareness**
Unsafe behaviors exhibited by some persons with TBI may result from impulsiveness, decreased insight into deficits, impaired judgment, or a combination of all of these. Disorientation and impaired memory can contribute to the client’s inability to recognize limitations for specific situations or analyze consequences of actions. Such clients will require 24-hour supervision for safety. Mr. B. has some safety issues and requires supervision to prevent injury. The OT practitioner could work with the client and the family to help them modify his home environment to maximize safety. For example, they might consider installing railings on all stairs, unplugging kitchen appliances, or removing controls from the stovetop. Safety compensations for Mrs. R. might include showering on a tub seat to avoid falls and avoiding performing potentially dangerous tasks (such as using kitchen appliances) when she is fatigued.

**Delayed Processing of Information**
Difficulty with processing visual and auditory information within a normal time frame results in slowed or delayed processing speed. The delay may be a few seconds or minutes. Clients who need more time to respond may seem as if they have additional deficits. Therefore the clinician should allow the client sufficient time to respond during treatment. Both Mr. B. and Mrs. R. have delayed processing. Mr. B. has a delay in auditory processing and other language deficits and would benefit more from visual and tactile, rather than auditory, cues. Mrs. R. has difficulty integrating information, especially when it is presented quickly, such as in an automated telephone menu.
Impaired Executive Functions and Abstract Reasoning

Executive functioning is a prerequisite to functioning in adult roles and is key to setting goals, planning, and effectively completing tasks. This requires high-level problem solving, reasoning, and judgment. Clients with brain injuries tend to view situations in concrete terms, interpreting all information at the most literal level. Functional independence, including appropriate social skills and successful return to work, demands mastery and control of executive functions.19 Clients with executive dysfunction usually require assistance or supervision to function.

Mr. B. shows concrete thinking, reduced thought flexibility, and reduced abstract reasoning. Therapy would focus on maximizing his ability to perform functional tasks first and then progressing perhaps to school-related tasks such as introductory college-level mathematics. Mrs. R. has been unsuccessful to varying degrees in home management, work and leisure, and IADL such as money management and medication management, largely because of executive dysfunction. She has compensated by discontinuing or significantly reducing her participation in her daily roles. The OT practitioner would first determine Mrs. R.’s priorities regarding the tasks to which she wishes to return first. Treatment sessions would be graded to increase her ability to participate without becoming overwhelmed by sensation or frustrated or developing a headache. One example might be reinitiating reading, one of her valued leisure pursuits, using large-print books.

Behavioral Function

Behavioral impairments often occur during recovery from a TBI and can challenge both the treatment staff and the families. Behavioral management is a key element of rehabilitation after a TBI. Teamwork is essential because inexperienced individuals who lack prior knowledge of the behavioral problems and the planned strategies may unintentionally reinforce the client’s undesirable behavior.

Common behaviors seen in persons after a TBI include lowered frustration tolerance, agitation, combativeness, disinhibition, emotional lability, and refusal to cooperate. After a TBI, some individuals have a reduced ability to tolerate frustration and may act out when challenged. Graded programming that presents the person with tasks that can be accomplished with assistance or cues based on the person’s specific needs will help reduce frustration levels. The client who cannot filter distractions, is sensitive to sensory information, or is asked to perform beyond his or her present capability may become agitated in a noisy, visually active environment. An agitated client may become verbally abusive or combative and kick, bite, grab, or spit. These behaviors may be directed at the person the client perceives as the source of agitation or toward others in the environment. Clinicians should be aware of which clients are more easily prone to agitation and should select a treatment environment that will help reduce this problem. Although combative behavior may occur in isolation, some clients go through a period of combative behavior that lasts for weeks or months. In such cases, a consistent behavior management program must be immediately established and enforced by those who interact with the client. The program would include procedures to limit undesirable behaviors and increase desirable behaviors while ensuring the client’s safety. This phase can be especially difficult for family members and significant others, who will require encouragement and support.

A client with disinhibition lacks proper social awareness of the environmental requirements and consequently acts inappropriately. Disinhibited behaviors include urinating in public, removing clothing, taking food off others’ trays, shouting obscenities, and making indiscriminate sexual advances to staff members or clients.

Emotional lability is the display of exaggerated and sometimes inappropriate emotional responses to situations. The client reacts by weeping or laughing uncontrollably and may later feel embarrassed.

Lack of cooperation by clients with TBI is often misinterpreted as deliberate. Cognitive and behavioral deficits often impair the person’s ability to understand the purpose of therapeutic tasks, which may lead to refusal to participate. The cognitive and behavioral aspects of a TBI are complex and interrelated, and the behavior exhibited by the client after a TBI correlates significantly with the level of cognitive function.

Both case study clients demonstrate behavioral problems related to cognitive deficits. Mr. B. has reduced insight and pragmatics (strategies for getting things done) and could participate in group games that stress the necessary skills and that provide for positive feedback and constructive criticism. Mrs. R. can be irritable and frustrated when she is overwhelmed, so the OT practitioner must be careful in planning short, successful treatment activities that Mrs. R. finds relevant and that help her feel productive.

Psychosocial Factors

Professional counseling can be invaluable in helping persons with TBI and their family members cope with the numerous changes caused by the injury. Many persons with TBI initially deny their symptoms, which can be considered a coping mechanism, given the serious nature of the losses sustained. Denial becomes dysfunctional when it lasts for more than 2 years.14 Anger follows denial: the client’s anger may be directed at the health care workers or family14 and can become stressful for family members. As emotional recovery progresses, the client uses bargaining as a strategy and becomes more cooperative and motivated in therapy.14 Next, the client may show depression, believing that hope is lost.14 He or she may experience genuine grieving for the losses resulting from the TBI. The final stage is acceptance, in which the client accepts the residual skills and limitations and is willing to work toward a life with all of these changes.14 Clients may move back and forth through these stages and may seem to be involved with
several at once. The grieving and depression stage can be especially profound. Mrs. R. with her depression and lowered self-confidence has withdrawn from the community and her family and is not ready to participate in a group activity with other clients. She would do better with one-on-one treatment with the OT practitioner to create and pursue a plan to improve her functional performance.

One of the strongest predictors of success in rehabilitation after a TBI is social support. Family, friends, and significant others are integral to the rehabilitation process, especially in the beginning stages, because they may be better able to elicit a response from the client than are the health care team members. In addition, they often serve as sources of information regarding the injured person’s pre-injury roles, habits, values, preferences, and coping style.

Some clients may have a history of psychiatric or emotional problems, which may be worsened by the injury. Other clients may experience new psychiatric or emotional problems as a result of the injury. Some of these problems, such as reactive depression, are associated with normal reactions to the losses associated with the TBI, whereas other conditions are organic or caused by the injury (e.g., lability, reduced frustration tolerance, increased anxiety). Understanding the client’s previous methods of coping can assist in the selection of treatment activities. For example, a client may have listened to certain types of music to relax and may benefit from continuing to use favorite songs to relax in treatment. Psychiatric or emotional problems worsened or caused by the TBI generally are responsive to medical and psychiatric treatment. Mrs. R. could benefit from assistance in determining what sensory experiences she can tolerate and which ones would be relaxing for her.

It is often difficult for family members and friends to experience changes in the loved one’s performance and behavior. No matter how cognizant of the disability the family and the client are, it does disrupt the family structure. Many family members serve as primary caregiver for the client with a TBI, which can be stressful. Often, clients and their caregivers seek counseling to help them cope with the enormity of the situation. The OT practitioner instructs the client and the caregivers how to assist the client, while minimizing burnout by locating resources to provide transportation, respite care, psychological support, or professional services. Moreover, clients and caregivers choose to participate in groups offered through the local rehabilitation hospital or the state Brain Injury Association. Both Mr. B. and Mrs. R.’s families have been stressed and challenged by the severity of Mr. B.’s injury and by the fact that Mrs. R. was injured as well. The OT practitioner would work with the specialists on the team (such as the psychologist or the social worker) in providing a therapeutic, successful, and productive environment for progressing toward their long-term goals.

**Occupational Therapy Evaluation**

The occupational therapist performs OT evaluations for a TBI adult. The therapist’s findings establish a baseline for treatment. The OTA is responsible for reading and familiarizing himself or herself with the OT findings, as stated in the evaluation.

**Treatment of Clients with Severe Traumatic Brain Injury**

OT treatment for the person with a severe TBI or for a client with a low-level injury (levels I to III; see Case Study: Mrs. R.) aims to increase the person’s level of overall responsiveness and awareness through structured graded programming, divided into simple steps. Adequate time must be allowed for a response because low arousal causes delays in processing information.

Treatment at this stage can be broken down into six areas: sensory regulation, bed positioning, wheelchair positioning, use of positioning devices and casting and splinting, dysphagia management, and family and caregiver training. Although the treatments occur simultaneously to optimize the person’s progress, the OT clinician must coordinate treatment with the rest of the team so as not to overwhelm the client. This type of OT program was provided to Mr. B. when he was an inpatient in acute care and in acute rehabilitation.

**General Principles**

Heinemann et al. describe three stages of recovery with the Rancho Los Amigos Level of Cognitive Functioning Scale; these stages are useful for guiding OT treatment planning (see Table 26-1).

1. **Stage 1—Coma**, corresponds to Rancho Los Amigos levels I to III. The OT practitioner focuses on sensorimotor and cognitive functions, using sensory stimulation and reality orientation.
2. **Stage 2—Confusion/Increasingly Goal-Directed**, involves levels IV-VI. The OT clinician minimizes environmental overstimulation and repeatedly instructs the client in simple goal-directed functional tasks.
3. **Stage 3—Cognitive-Behavioral Rehabilitation**, addresses levels VII and VIII. Therapy focuses on higher-level tasks in home management, work and leisure, and compensatory strategies to work around the remaining deficits.

From the beginning, OT treatment focuses on the client’s goals for occupational participation in all life roles. Criteria for discharge from OT for clients with TBI may include the following:

- Goals have been met
- The client has reached a plateau in therapy
- The client cannot participate in treatment because of other complications
- Skilled OT services are no longer required or the client no longer wishes to participate

Some persons with TBI may return to therapy during a major life transition such as having a child, starting a new job, or losing a loved one because they need additional structure and assistance to work through the transition.
Sensory Regulation Program

For the client who does not respond to pain, touch, sound, or sight or who shows only a generalized response to pain, the goal of treatment is to increase his or her level of awareness through arousal via controlled sensory input.

Sensory regulation treatment incorporates visual, auditory, tactile, and other stimuli into specific functional and familiar tasks such as rolling in bed. The client is engaged actively to maximize the benefit. The program is multisensory and meaningful, and the treatments are usually brief (initially about 10 minutes) and incorporate both sides of the body. The modalities are common everyday tasks such as hygiene, bed mobility, or using the nurse call bell. The clinician continually observes the client during the activity and documents any changes in behavior, such as head turning in response to sounds, visual attention and tracking, vocalizations, and following commands.

Bed Positioning

The person with a TBI may not be able to reposition the body spontaneously to relieve pressure as other people do regularly while sleeping. Bed positioning is important because the person with a TBI initially spends most of the time in bed. Although the person may have special mattresses or bed positioning options designed to distribute weight and maximize positioning for comfort, the goal of OT is to develop a turning and sitting program to reduce risk for development of pressure sores. If possible, the client would be rotated through different positions: supine, on the right side, on the left side, prone (if possible). Bolsters, pillows, or splints are used as needed, whether the person is awake and asleep. The practitioner must be aware of the presence of medical devices and appliances, which may interfere with the client’s ability to achieve certain positions. For example, a person with a tracheostomy cannot lie prone.

The person should change positions every 2 hours to avoid constant prolonged pressure on any area. For safety the bedrails should always be up while the person is lying in bed. When positioning the client, the clinician should avoid pressure on bony prominences and other vulnerable areas that are more prone to skin breakdown. These include earlobes, shoulder blades (scapulas), elbows, hips, ankles, and heels. Thinner persons are at higher risk for developing pressure areas over bony prominences, but individuals of all sizes are at risk for decubitus ulcers if they are not turned regularly, especially when there is a loss of sensation. Persons with severe TBI may require maximal assistance of at least two people to turn. When the person is awake, sitting up supported in bed can be added as another position. If the client does not regain the ability to change position during sleep spontaneously, he or she will require a permanent turning program.

Wheelchair Positioning Program

Proper seated positioning of the client with TBI reduces the incidence of skin breakdown and contractures, facilitates normal tone, encourages use of cognitive skills and social interaction, improves behavior, and enhances safety. Medical benefits accrue from sitting upright; they include improved respiratory function and circulation, reduced risk for blood clots in the lower extremities, and reduced isolation. The occupational therapist assesses the client for factors (such as paralysis, weakness, spasticity, or loss of sensation) that would influence the choice of special positioning devices or customized seating. Special attention should be paid to the presence of medical appliances that might interfere with equipment (e.g., a gastrostomy tube cannot be used with certain designs of seatbelts).

The client with a TBI who can sit in a wheelchair is more mobile and can explore and interact with the environment and receive services in other areas of the health care facility. Persons who have been on bed rest for an extended time will require a graded program to move from lying supine to sitting erect. If the person gets up too quickly, blood pressure may drop too much and cause the individual to become dizzy, lose consciousness, and fall.

The occupational therapist establishes the initial seating and positioning program, often in conjunction with other health care team members, such as the nurse and the physical therapist. The OTA carries out the daily implementation of the program. Effective seating and positioning requires trunk stability, a stable base of support at the pelvis, maintaining

Figure 26-1 Improved posture and trunk alignment is achieved with positioning devices.
the trunk in midline, and holding the head erect in order for the person to use the UEs in functional activities (Figure 26-1).

**Graded Seating Program**
The person with the TBI begins with sitting upright in bed with the head at the end of the bed and all rails up. As the client becomes comfortable sitting upright, the amount of time the client spends in this position is increased as tolerated. After each sitting session the skin should be checked for reddened pressure areas, and positioning equipment should be adapted if needed. Some lower-level individuals who do not have trunk stability and head control to sit upright may be unable to sit in bed and will require transfer to a wheelchair with a high reclining back with head support. For a client who can progress to sitting in a wheelchair, proper positioning should target postural deficits and facilitate postural alignment through choice of the wheelchair design and positioning devices. Often, the client can be positioned using commercially made equipment, but the occupational therapist or OTA may need to fabricate or adapt seating devices. The following are guidelines to consider.

**Pelvis**
Wheelchair positioning begins with pelvic alignment because poor hip positioning causes poor head and trunk alignment and influences tone throughout the body, especially the extremities. A solid seat insert can be placed on the seat of the wheelchair underneath the client to facilitate a neutral to slight anterior tilt of the pelvis. An insert that is slightly wedged (with the downward slope pointing toward the back of the wheelchair) can be used to flex the hips to help inhibit extensor tone in the hips and LEs. This position can help prevent the client from sliding forward out of the wheelchair. A lumbar support may maintain a natural curve in the spine. A variety of wheelchair cushion choices distribute weight to reduce pressure areas and position the client. A seatbelt angled across the pelvis will help to maintain the hips back up against the back of the wheelchair, the desired position.

**Trunk**
Positioning the trunk occurs next after the pelvis is properly positioned. The goal is to support the client while sitting to allow the person to sit at midline, while being able to use the UEs without losing balance. A solid back insert or solid contoured back is placed behind the client’s back to facilitate a more erect posture of the back. Lateral trunk supports can be used to eliminate leaning to either side; a chest strap or crossed chest straps will decrease leaning forward, pull back the shoulders, and allow for chest expansion. Custom-made trunk support systems may be ordered by the physician and fabricated by an orthotist for clients with severe positioning problems.

**Head**
For clients with minimal or no active head control, achieving an upright midline head position can be difficult. Most head control devices employ static positioning. The head is kept from falling forward by a forehead strap. Caution must always be taken to avoid overstressing the cervical area or giving excessive resistance to spastic neck muscles. Reclining the patient back will eliminate this problem but also will reduce weight bearing through the trunk and pelvis and limit visual interaction with the environment.

An alternative to static head positioning is dynamic head positioning. The advantages of a dynamic device are that it places the head in good alignment on the trunk and distributes pressure equally. It also allows the client to begin initiating head movements actively (Figure 26-2).

**Lower Extremities**
Calf supports attached to elevating leg rests can provide additional support for the LEs. Thigh pads placed along the lateral aspect of the thigh may be used to decrease LE adduction. An abductor wedge may be placed between the LEs to eliminate abduction. Proper footwear (e.g., high top athletic shoes) can serve to help position the feet correctly. Use of a foot wedge placed on top of the foot plate under the feet can prevent plantar flexion contractures for one or both feet. Some clients may require calf or toe straps to help them maintain the LEs on the footrests.

**Upper Extremities**
A lap tray is often used to help support the UEs on a level surface. The UEs should be positioned with the shoulders in slight flexion and external rotation, the elbows in slight flexion, and the wrists and fingers in a functional position. Some clients may benefit from use of a support such as an arm trough or hemi-board for only one UE. Wedges can be used to elevate the affected UE, if needed, to manage edema.
Wheelchair positioning involves constant reevaluation and adaptation of equipment to meet the changing needs of the client. The OTA may be involved in this aspect of treatment as long as he or she is under the close supervision of the occupational therapist.

**Splinting and Casting**

Splinting is used to properly position a body part or support a part for the client to use it functionally. Casting is used to increase passive ROM when high muscle tone and contractures (or possible contractures) are present. The goals of splinting and casting are to reduce abnormal tone or soft tissue tightness, increase or maintain passive ROM, increase the functional potential of the UE, prevent skin breakdown, and prevent contractures and possible complications.

The most commonly used splint is the stretch splint. This splint places the wrist and fingers in extension and abducts the thumb (Figure 26-3). This splint provides passive stretch to the wrist and hand. A typical splint schedule begins with 2 hours on and 2 hours off, but the wearing schedule depends on the individual client’s needs.

A casting program is implemented when other methods for managing spasticity are ineffective. The most common UE cast is designed to increase elbow extension. Casts can be fabricated out of fiberglass or plaster. Fiberglass is preferred because it is lighter in weight, sets (hardens) more quickly, and is easier to apply than plaster. As with splinting, specialized training and practice in casting are required to attain proficiency.

Serial casting uses a series of casts that gradually stretch out the contracture, increasing passive ROM with each new cast getting slightly closer to the desired end position. Serial casting usually requires at least two clinicians, one to position and hold the extremity and one to apply the cast. Serial casts are generally left on the client for several days and then removed. The patient’s skin is examined for signs of skin breakdown such as redness. If skin integrity is normal, a new cast (closer to the desired ROM) is applied.

Once the desired ROM has been achieved, the last cast is removed, and the edges of both halves of the cast are finished (Figure 26-4). The patient wears the bivalve cast to maintain the ROM. Because Mr. B. is still participating in a serial casting program for his right elbow contracture, he is not a candidate for a bivalve cast until the final one is made.

**Dysphagia**

The patient emerging from coma may have swallowing difficulty and require a feeding evaluation and intervention.
for specifics. The occupational therapist and SLP would work together in developing and implementing a dysphagia program. This area is not appropriate for an entry-level OTA practitioner.

**Caregiver Training**

Education of the caregivers (which may or may not include family members or significant others) begins at the first meeting. Initially, the OT practitioner would explain the role of OT and provide information according to each person’s ability to handle and process it. Caregivers play an essential part in eliciting the client’s responses and can help the client make progress by carrying through with therapy tasks, especially on weekends or holidays. The OT practitioner grades the caregiver education and training so that basic skills are taught first, with more complex skills introduced after the simpler skills are mastered.

The significant changes in the life of the person with a TBI and the impact on the family are important considerations. Because the caregiver provides assistance as well as emotional support, it is easy for caregivers to overlook their own needs. The OT practitioner should encourage the caregiver from the beginning to take time away from the caregiver role to rest and regroup and should reassure the caregiver that he or she need not feel guilty for doing so. Taking personal time will reduce the occurrence of caregiver stress and burnout. To help the caregiver establish a larger group of persons to assist with the caregiver role, the clinician can direct the caregiver to additional resources in the community such as other family members, church members, specialty services such as transportation for persons with TBI, or support groups.

**Treatment of Clients with Moderate to Mild Traumatic Brain Injury**

**Neuromuscular Impairments**

Persons with moderate to minimal injury can experience a variety of motor impairments. Weakness, spasticity, rigidity, soft tissue contractures, primitive reflexes, reduced or lost postural reactions, impaired sensation, and reduced fine motor coordination will affect speed and accuracy of occupational performance. All treatment should be activity- and function-based. Any adjunctive technique, such as neurodevelopmental treatment (NDT), should be followed by a meaningful and functional activity that requires the same movements.

The prerequisites for normal movement include normal postural tone, normal integration of flexor and extensor control (reciprocal innervation), normal proximal stability, and selective (voluntary) movement patterns.20 The common principles of treatment are (1) to progress proximal to distal; (2) to establish symmetrical posture; (3) to integrate both sides of the body into activities; (4) to encourage bilateral weight bearing; and (5) to introduce a normal sensory experience. A variety of treatment approaches—including NDT, proprioceptive neuromuscular facilitation (PNF), myofascial release, and Rood techniques—are used effectively with persons with TBI. Many therapists combine techniques; the occupational therapist should determine the selection and timing of these approaches. These and other such techniques require specialized training including hands-on practice and clinical experience. When the OTA has achieved service competency using these techniques, the OTA may incorporate them into functional training under an occupational therapist’s guidance.

Trunk stability is necessary for effective limb movements. Treatment of postural instability of the trunk should focus on achieving alignment and stimulating muscle responses in the trunk muscles. Alignment will facilitate stability. Once trunk control improves, treatment should progress to activities using the UEs while stabilizing the trunk.

Many clients with mild to moderate TBI have fairly intact motor control. These individuals can ambulate independently (sometimes with assistive devices) and can use both UEs in functional tasks. Closer observation may reveal subtle trunk and UE deficits related to coordination and speed of movement. UE treatment programs are designed to increase scapular stability and improve fine motor control. Activities should focus on improving the client’s accuracy and speed while maintaining good coordination. This goal can be accomplished beginning with the client seated and then progressing to standing. The goal is to achieve dynamic standing balance for all activities in which trunk stability and UE coordination need to be well integrated.

Ataxia is a common problem that interferes with motor control. Ataxia can affect one or all four extremities. The degree to which ataxic movements interfere with function is related to which limb is affected and the severity of the ataxia. In ADL training, the OT practitioner should focus on improving function while maintaining safety. Compensatory techniques such as performing tasks as close the body as possible, performing tasks while seated, leaning on the tabletop with either one or both arms to gain stability, moving the UE while still in contact with a surface, and wearing weights can be useful in reducing the severity of the tremors occurring with movement. Using wrist weights may help improve control during performance of functional tasks, but may not have carryover when the weights are removed. Weighted eating utensils and cups may help the person with ataxia in self-feeding, as long as they can use the equipment safely.

**Vision**

Vision deficits commonly result from TBI. The occupational therapist starts the vision evaluation by getting a complete vision history, which includes whether the client currently uses or needs corrective lenses. In some cases, the glasses may have been broken in the incident that caused the injury. The glasses may be lost, or the prescription not current. Clients who usually use contact lenses, depending on the extent of the injury, may not be able to wear them again and therefore may need to revert back to the use of glasses. For all persons needing corrective lenses, the occupational therapist should recommend a referral to a vision specialist (see Chapter 23).
The occupational therapist designs the treatment plan for vision deficits. Most vision problems are addressed in functional activities. The OT practitioner aims to increase the client’s awareness of impairments, maximize the client’s use of residual vision, and instruct the client in compensatory strategies and how to incorporate them into daily functioning. Providing enlarged print; spacing objects far apart so they are easily seen; increasing the illumination on the task; using contrasting colors (e.g., placing a green toothbrush on a white towel); and marking steps, corners of walls, and table edges with reflective tape are some of the adaptations used for vision impairments. If PTVS is present, the occupational therapist would recommend evaluation and treatment by a vision specialist.

**Perceptual Training**

The two methods of perceptual training are *adaptive* and *remedial*. The adaptive or functional approach is based on the theory that recovery results from the use of intact brain areas to perform adapted functional activities, compensating for lost function. The OT practitioner uses repeated practice in ADL to retrain perceptual skills. This adaptive approach includes increasing the client’s awareness of the perceptual problems, teaching the person how to function with the deficits, and adapting the environment to compensate for deficits.

The remedial approach asserts that the adult brain is sufficiently plastic to repair and reorganize itself after injury. Sensory integration, NDT, and transfer of training techniques are examples of this approach.

Use of functional training in the adaptive approach is appropriate for clients who respond to their environment and situations at a very concrete level and are unable to transfer cognitive-perceptual learning to different situations. A remedial approach works best with clients functioning at a more abstract level. These clients can better carry over a new technique (e.g., one-handed dressing) to other situations.

**Cognitive Retraining**

Cognitive retraining is best accomplished in graded programming through a variety of functional tasks. Persons with TBI perform better in tasks that are familiar to them. Sequencing, for example, can be practiced in a variety of tasks (dressing, assembling a sandwich); clients may participate more willingly because they understand and value the task. Repetition of skills is important for individuals with cognitive deficits.

The OT practitioner determines with the client which functional activities to address first. Activities should be age-appropriate, challenging, and interesting. A computer software and training program is one way to accomplish cognitive training and should be chosen when appropriate for the client. With the increased use of the Internet to search for information, and instantaneous communication through e-mail, instant messaging, and so on, using the computer would be considered a functional task for some clients and therefore should be incorporated into the treatment program.

**Behavioral Management Strategies**

Intervention strategies used to decrease and eliminate problem behaviors are divided into two categories: environmental and interactive.

Environmental alterations use changes in the environment to facilitate appropriate behaviors, inhibit unwanted behaviors, and help to maintain the safety of the client with a TBI. The first step in altering the environment may be to place the client in a quiet, isolated room without a roommate. The television and radio are turned off, and the door is closed, if possible. The walls are painted as simply as possible, and all extra furniture is removed from the room.

Clients who are agitated and unsafe alone may require one-on-one nursing care and a cubicle bed. A cubicle bed substitutes for a standard hospital bed for persons who are extremely agitated and at risk for falling or crawling out of bed. A cubicle bed is a mattress that sits on the floor surrounded by four padded walls. Alarm systems may be needed to monitor the client and prevent unsafe behaviors such as trying to leave the floor.

To interact with the agitated client, the clinician should speak in a calm voice with a soothing matter of fact tone. All communication should be brief to prevent overwhelming the person with details, which might cause frustration and increase confusion. When the person has difficulty initiating tasks, the practitioner should provide tactile cues by physically assisting the client through the beginning of the activity or verbally cueing the client to begin the activity.

Another behavior management technique is diversion. For agitated clients who cannot redirect themselves, the OT clinician can create a diversion, such as changing the subject or creating a harmless physical distraction.

**Self-Care**

ADL retraining improves the client’s functional independence in a familiar and meaningful context. Persons with TBI perform better when tasks are broken down into smaller segments to facilitate learning. Tasks are graded depending on the client’s needs. Approaches such as backward chaining, in which the therapist assists the client with the majority of the activity and the client completes the final step, are one way to grade and modify the activity for the individual client. Another is to organize the steps of the activity sequence into visual and written cues. A self-care program should be structured and consistent, with the client following the same daily routine in the same environment, using the same sequence of steps to accomplish the task. As the client makes improvements, the clinician reduces structure and cues and focuses on improving the client’s ability to complete the task when the routine is disrupted or altered in some way.

The clinician should employ techniques that increase functional independence and reinforce normal motor patterns. The occupational therapist might recommend the use of a specific neurophysiological approach that helps to normalize tone and integrate both sides of the body into self-care activities. The clinician would teach the client how to refine
Persons with TBI often have feeding problems, some of which may be too severe for them to take in any fluids or foods orally (NPO). The client who is restricted to NPO initially would have a nasogastric tube; this might later be changed to a gastric tube for all fluid and medication intake. Clients who are NPO are at high risk for choking and aspiration and subsequent aspiration pneumonia if they drink or eat. Individuals with TBI that causes deficits in self-control, insight, safety awareness, and judgment may attempt to drink and eat despite precautions and thus require constant supervision—especially if the client is a silent aspirator and does not show outward signs that he or she has inhaled liquids or foods into the lungs (i.e., choking or holding the throat). Other possible drinking or eating restrictions for persons with TBI include no drinking or eating from a straw, no thin liquids, or only pureed foods. Liquids in the form of ice chips, ice pops, or Jell-O may be the only way these clients can safely take in liquids orally. Clinicians educate clients and caregivers on how to help their injured family member adhere to the restrictions.

In some health care settings the SLP may treat the client with dysphagia and work in conjunction with the occupational therapist. The role of the occupational therapist might be to work with oral motor control, swallowing, safe eating, and the feeding process. The OTA may assist with the eating process if service competency is established. In addition to eating issues, the client with a TBI may have other deficits that interfere with self-feeding such as reduced attention, visual changes, left unilateral neglect, impaired memory, reduced sequencing, impulsivity, one-handedness, sensory deficits, incoordination, etc. The OT practitioner would select the most appropriate nondistracting environment for self-feeding training, such as the client’s room or a quiet area in the dining room. As use of recommended feeding techniques and strategies improves, the client might be able to eat in a more social setting, such as in the dining room with other clients or in the kitchen at home with the family. Because persons with swallowing and other eating problems are at risk for choking, the clinician would make sure that assistance is readily available nearby if needed.

Persons with TBI require a structured consistent feeding routine to reestablish proper and safe eating. Strategies such as introducing one food item at a time, reminding the client to set the utensil down after each bite, and to chew thoroughly and then resume eating help persons with TBI reestablish safe self-feeding. Assistive devices such as a plate guard or a cup with a lid may be useful to increase safe independence in self-feeding, depending on the combination of deficits. Some clients may be on eating restrictions initially and then progress, while others may need to follow restrictions permanently. The OT practitioner should try to incorporate variety in menu planning and suggest how the food can be presented to make it more visually appealing. Impaired taste and smell can reduce appetite, causing some persons to become disinterested in eating. Individuals who continue to receive tube feedings should participate in self-feeding training prior to tube feeding so as to avoid feeling full and thus reducing the appetite. Some clients will be able to take in some liquids or some foods but their intake is insufficient to provide adequate nutrition; thus they require supplemental tube feedings until they can drink and eat enough to sustain themselves. Individuals with permanent changes in their ability to drink or eat the foods to which they are accustomed must learn to cope and accept the alterations in their lifestyle.

### Functional Mobility

Mobility training can be subdivided into bed mobility, transfer training, wheelchair mobility, and functional ambulation. The NDT principles of bilateral involvement, weight bearing, rotation, and tone normalization are used with these activities. The OT practitioner coordinates all programming with the appropriate individuals, the physical therapist, the nurse, and the caregiver. (See Chapter 22 for NDT principles.)

### Bed Mobility, Wheelchair Management, and Functional Ambulation

When the person with TBI begins mobility training, the OT practitioner starts with bed mobility skills of rolling, moving up and down in bed, bridging, moving from a supine to a sitting position, and the reverse. Safety is always stressed throughout all mobility training. Logrolling is more difficult toward the stronger side, because the weaker side may not be able to initiate the roll; thus the client may require more assistance to one side than to the other side. Rolling and moving up and down in bed should be practiced when the bed is in the flattened position, which is easiest for the client. Bed mobility skills are easily adapted according to NDT principles (i.e., the person rolls side to side by putting the stronger leg under the weaker leg, clasps hands, brings the arms up to shoulder height, and initiates the roll). The person may require use of the half bed rails to help in rolling, pushing up, or bridging in bed. Bridging is an important skill because it helps the person manage lower body hygiene and dressing.

When able to sit without complete back support, the person progresses to sitting from supine on the edge of the bed. Because hospital beds may be unusually high, the feet may not touch the floor. In this case the clinician may need to adapt the task by using a sturdy short step stool for the person to place the feet to assist with maintaining balance. Transfer training usually begins with transferring from the bed to and from the wheelchair safely. The amount of assistance and the type of transfer vary with the person. Neuromuscular, visual, visual-perceptual, and cognitive skills dictate the selection of the type of transfer to be used in training. Persons with memory deficits and limited carryover of information would benefit from the same technique and sequence with all persons working with them. If possible, it is preferable for transfers to be practiced by moving to both sides, so that the
client can transfer to either side in other places (e.g., public rest rooms). Some individuals may require the use of a lift, physical assistance of one or more people, use of a sliding board, etc. The NDT approach includes guidelines for transfer training that facilitate the person playing an active role, which helps solidify learning.

All caregivers should be trained to assist the person with TBI in all of the types of transfer required of that person to fulfill home and community roles. After extensive training, practice, and demonstration in proficiency and safety, the treating team approves the caregiver before he or she transfers a client alone. Training alleviates many fears and decreases the chance of failure during the first week at home.

Many persons with TBI who require the use of a wheelchair for functional mobility will use a manual wheelchair. Use of a power wheelchair involves more extensive training. Wheelchair management includes the ability to manage wheelchair parts (e.g., removing foot rests, managing wheel locks, placing a lapboard on and off, etc.) and propelling the wheelchair both indoors and outdoors on different types and levels of surfaces safely. The person learns and practices each skill until it is mastered. Initially, endurance for pushing the wheelchair may be very limited, and with practice increases. Some clients may require gloves to protect the hands from blisters caused by use of the manual wheelchair.

Functional ambulation refers to the patient's ability to walk to complete all activities. The physical therapist assesses the individual's ability to ambulate and provides graded treatment to improve readiness for ambulation using assistive devices as indicated. The OT clinician facilitates carryover of ambulation into ADL such as dressing, preparing a meal, or mopping a floor while using proper technique, devices, and precautions. Some functionally mobile clients can only walk, but others can carry, hold, move, and use items or tools during an activity. The OT clinician might suggest ways for the client to avoid carrying objects in the hands, such as transporting them in an apron, backpack, or rolling cart. The OT practitioner may also teach methods to ambulate safely while performing other daily tasks.

**Group Treatment**

Initially, the person with a TBI will participate in individualized therapy on a one to one basis with the OT clinician. Most therapy programs use group treatment as a supplement to individual treatment; it provides learning experiences not available in individual therapy. Group treatment provides structured socialization in which clients can develop more appropriate communication/interaction and psychosocial skills.

Groups allow persons with brain injuries to get feedback from their peers, which may cause clients to make changes in their behavior.\(^2\)\(^3\)\(^6\)\(^{12}\)\(^{26}\) Group programming for persons with TBI is more successful if it is functionally based. Goals include improving pragmatics, learning appropriate social interaction and behavior, increasing attention and concentration, and working on skills such as counting money, remembering turns, etc. Groups may be facilitated by one discipline but are commonly multidisciplinary. In group treatment, the clinician must understand each client's individual goals, so that the person can achieve optimum value from the experience. Mr. B. could tolerate a group activity for about 30 to 60 minutes, but Mrs. R. would not be able to participate at all because of her sensory sensitivity.

**Home Management**

As the client regains functional skills and independence in ADL such as dressing, feeding, and functional mobility, treatment expands to include IADL. Examples include caring for others, care of pets, financial management, home management, meal preparation and clean-up, safety procedures, emergency responses, shopping, etc.\(^3\)

One must determine the client's interests and previous level of function before initiating interventions in areas of occupation. Some people make only simple meals using, at most, a microwave oven, whereas others prepare elaborate meals. Some clients do not perform any other household activities except making their own beds or doing their personal laundry.

Training is graded to suit the client's functional level. Beginning tasks might include making a cold simple sandwich or a fruit salad. Depending on the client's cognitive status, the clinician may place all food items on the table and have the client verbally review the task before doing it for the first time. At the end of the session, the next day's activities can be discussed. A session such as this requires simple sequencing, organizing, and memory for the task. As the person progresses, the practitioner increases the task demands until the established long-term goal is met.

**Community Reintegration**

In the rehabilitation process, the client with a TBI will reach what appears to be a maximum level of independence or plateau in the protected and structured atmosphere of the hospital. This independence does not necessarily follow over into the community when the person encounters unfamiliar people, situations, and problems. Community reintegration must be included in the OT program before discharge. This process increases the likelihood of successful transfer of training from the rehabilitation setting to the home and community. The OT practitioner can assist the client with TBI in investigating community resources. The Brain Injury Association of America (BIA) has extensive information and links to resources online at www.biausa.org. Each state has a BIA chapter that can provide information, sponsor support groups and other services, and serve as a valuable resource for the brain-injured person and his or her family.

**Home Health**

There are some important differences in OT services provided within the client's home in comparison to other treatment
settings. When the client’s care is moved to his or her home, the relationships between clinician, client, and family necessarily change. The clinician is a consultant as well as an invited guest. Clinicians have less therapeutic control in the home, where the family unit is the key to successful treatment. If the family does not support or agree with the treatment goals, the goals likely will not be accomplished. Establishing client-focused goals with the client and family is important. A central focus of OT for a patient with a TBI is to regain as many home and community roles as possible. It helps if the family shares the client’s goals.

**Summary**

Treatment of the traumatically brain-injured adult requires experience, expertise, and clinical reasoning skills. Most clients have numerous deficits to varying degrees in all areas of performance as well as behavioral and psychosocial issues that may interfere with treatment at times. Because the central goal of OT treatment is to engage the client in occupation, the process is dynamic and interactive. Goals should be interdisciplinary and established to meet the specific needs of each client. Treatment of persons with TBI should be meaningful, functionally based, and incorporate meaningful contexts for each client. Also central to treatment is the role of the caregiver and family, who should be involved in the therapeutic process from the beginning of therapy through discharge.

**Selected Reading Guide Questions**

1. Define TBI.
2. List some of the causes of TBI.
3. Describe the neuromuscular deficits that one might encounter in a low level client with a TBI.
4. Describe the cognitive deficits that might be encountered in a person who has sustained a TBI.
5. Look at the Rancho Los Amigos Scale of Cognitive Functioning, and imagine working with a level VII client. How might the activity of ordering a pizza be graded for a client at this level?
6. Why might a client with a TBI refuse to work on a cooking activity?
7. Describe why and how serial casting is used.
8. How might a figure-ground deficit, a visual field cut, and size discrimination deficit impact an individual’s ability to cook?
9. Why might a TBI patient hit, kick, or bite? What are effective strategies to reduce these behaviors?
10. Explain why functional activities might work better than sequencing cards for client with TBI.
11. Why might a family member of a person with TBI have difficulty accepting the client’s behavior? What can the OT practitioner do to assist the family member?
12. Name an activity that would be a good choice for the first caregiver training session. Why is transfer training not a good choice for this situation?
13. For a client with a TBI who functions at a concrete level, should the OTA pursue an adaptive or remedial approach to perceptual-motor treatment?
14. List two components of a behavior management program.

**References**


