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The Role of the Occupational Therapist on the Neuro-Rehabilitation Team

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Occupational Therapy

Occupational therapy is defined as "a health and rehabilitation profession that assists individuals of all ages who have had an injury, illness, cognitive impairment, mental illness, developmental, learning, or physical disability to maximize their independence" (AOTA). An occupational therapist's goal is to maximize a person's independence in all aspects of daily functioning. Various performance areas such as activities of daily living, work and productive activities, as well as play and leisure activities, guide the practice of occupational therapy. Treatment sessions focus on engaging individuals in meaningful and purposeful activities in order to assist them in achieving their goals so they reach their optimal level of independence, productivity, and satisfaction. This allows the individual to have a sense of increased self-efficacy, autonomy, purpose, competence, and especially wholeness.

Occupational Therapy and Acquired Brain Injury (ABI)

Occupational therapists play a pivotal role in the evaluation and treatment of an individual who has sustained a brain injury. The focus is to approach the individual's care in a holistic manner. This involves interviewing the individual as well as family, in order to thoroughly understand his or her medical, vocational, social, and emotional history. An occupational therapist will utilize the information obtained to guide the treatment program and more accurately evaluate the individual's level of impairment in the various performance areas.

Individuals with ABI may demonstrate various types of impairments that may or may not be consistent with their diagnosis. It is obvious when a person has a knee replacement that they will probably present with lower extremity weakness, pain, and impaired range of motion. When a person has sustained a brain injury, there may be various parts of the brain that were affected in a more subtle way, that were not reflected in the diagnosis. For example, when a person has hydrocephalus

as a complication to an original focal injury, the pressure may exert a diffuse effect on the brain and produce functional impairments that were unexpected based on the primary diagnosis.

Occupational therapists that work with brain-injured individuals must be proficient in assessing how physical, cognitive, and behavioral impairments affect the various activities of daily living (ADLs). An activity analysis of each task is performed and is often used to guide the rehabilitation process.

Evaluation and Treatment

The evaluation is initiated by a thorough clinical interview, which should include open-ended questioning regarding social, medical, and vocational history, physical and social environment, as well as family and self-assessment of the individual's current level of functioning. The results will provide the therapist with a global picture of the person's former functioning, current insight, and awareness of limitations. It is extremely important to note the individual's level of insight (see Chapter 14). If it is impaired, safety may be of significant concern. For example, if an individual reports he has no physical deficits, yet through observation he or she clearly has a hemiparesis, this individual may attempt to stand without assistance. In order to assess the level of insight fully, the therapist will compare the individual's self-assessment of functioning with therapist observation, family report, and objective findings.

Following the interview, standardized assessments are utilized, in order to quantify deficits objectively. These include tests of motor, perceptual, attention, and executive functions. The interpretation of both the interview and formal test results facilitate the generation of a problem list. A treatment plan and short- and long-term goals are formulated with the survivor's input. When appropriate, the survivor's family will also participate in goal formation. In the brain injury arena, evaluation and treatment are closely connected. As the individual progresses, the therapist must continue to assess, analyze, and appropriately gauge the treatment plan. He/she does so by continually re-assessing an individual's insight and abilities across a hierarchy of tasks and by assessing the strategies that an individual uses when faced with a problem (Toglia, 1994). The next section will describe specific areas addressed by the occupational therapist in evaluating and treating an individual with acquired brain injury.

Upper Extremity Function

Evaluation of the upper extremity requires a comprehensive examination of an individual's range of motion, strength, tone, endurance, coordination (gross motor and fine motor), and sensation. The evaluation is completed through observation of an individual completing various tasks as well as through standardized testing, including goniometry and manual muscle testing. An accurate assessment of these areas is crucial in assisting the individual to develop the skills necessary to increase independence with all functional tasks. While traditional

TABLE 12.1. Recovery stages of the upper extremities

Arm	Hand
1. Flaccidity—no voluntary movement	1. Flaccidity
2. Synergies developing—flexion usually develops before extension (may be a weak associated reaction or voluntary contraction with or without joint motion); spasticity developing	2. Little or no active finger flexion
3. Beginning voluntary movement, but only in synergy; increased spasticity, which may become marked	3. Mass grasp or hook grasp; no voluntary finger extension or release
4. Some movements deviating from synergy: a. hand behind body b. arm to forward-horizontal position c. pronation-supination with elbow flexed to 90 degrees; spasticity decreasing	4. Lateral prehension with release by thumb movement; semivoluntary finger extension (small range of motion)
5. Independence from basic synergies: a. arm to side-horizontal position b. arm forward and overhead c. pronation-supination with elbow fully extended; spasticity waning	5. Palmar prehension; cylindrical and spherical grasp (awkward) Voluntary mass finger extension (variable range of motion)
6. Isolated joint movements freely performed with near normal coordination; spasticity minimal	6. All types of prehension (improved skill) Voluntary finger extension (full range of motion); individual finger movements

evaluation methods such as range of motion testing, manual muscle testing and dynamometer measurements can be helpful, it is often more appropriate and useful to utilize a qualitative, functional and descriptive approach to describing and assessing the hemiparetic upper extremity. Functional approaches for evaluating active range of motion (AROM) could include asking the individual to put on and button a shirt or to reach for items overhead. In addition, Brunnstrom (1970) provides a useful stepwise paradigm with which to describe the upper extremity (see Table 12.1).

Range of Motion (ROM)

Scapular active and passive ROM (A/PROM) is the first area assessed. If limitations are present, then safe and functional movement of the entire limb will be affected. This is because the scapular-humeral rhythm is a 2:1 ratio. For example, if the individual's upper extremity moves to 180 degrees of shoulder flexion, the humerus moves through 120 degrees and the scapula 60 degrees (Davis, 1996). If this scapular-humeral rhythm is compromised, the individual is at risk for developing joint pain and trauma (i.e., bicep tendonitis). Treatment for limited scapular ROM involves the use of modalities, such as heat and ultrasound, and passive as well as active assistive range-of-motion exercises.

Passive and active goniometric measurements are taken for both upper extremities. If either passive or active ROM is not within functional limits, further evaluation is done in order to find the source of the problem. An example of a physical

anomaly that causes both limited active and passive ROM with a hard-end feel is heterotopic ossification. This problem may require medical/surgical intervention and aggressive ranging of the extremity during treatment.

Glenohumeral subluxation is a common cause of pain in the hemiplegic shoulder that has low or mixed tone. With proper positioning and careful joint-approximated ROM, pain and/or impingement should not occur. It is the occupational therapist's responsibility to educate the individual, family, and other caregivers (e.g., nursing staff) about the precautions of ranging the upper extremity with a subluxed shoulder (Ikai et al., 1998; Shepherd & Carr, 1998). Slings can be used to support the affected upper extremity from soft tissue damage, or to allow for stability during ambulation and transfers. Other supportive methods include resting the hand in the individual's pocket, or on a handbag that is worn across the chest, or resting the arm on the tabletop surface or an armboard when seated. This support can be helpful, especially if the weight of the flaccid side appears to be affecting the individual's balance during ambulation. If a sling is used, caution should be taken to ensure that the individual does not remain in it for extended periods of time, as it positions the upper extremity in an internally rotated and flexed position. This positioning simulates the natural synergy pattern, and if the arm remains positioned as such, soft tissue contracture may result. Further, the sling should only be worn when in a standing position. Proper training in the use of a sling is needed to decrease the risk of improper application and contracture due to prolonged use (Zorowitz et al., 1995; Shepherd & Carr, 1998).

Muscle Strength and Tone

Manual muscle testing is used to assess the strength of both upper extremities. The OT utilizes this information to determine the areas that will cause limitations during performance of functional tasks, and the results will guide the treatment protocol for retraining the upper extremity. Specific treatment techniques derive from a variety of frames of reference, as summarized by Trombly (1997). The biomechanical model emphasizes educating the individual on various ROM and strengthening exercises, while utilizing equipment such as weight cuffs, dumbbells, and theraband. The neurodevelopmental-motor learning model focuses on utilizing normal movement patterns and other facilitatory and inhibitory techniques. The rehabilitative model stresses the use of compensatory strategy training and the use of adaptive equipment to improve the individual's ability to participate in functional tasks efficiently and without pain.

While each model presents its own theoretical framework regarding treatment, many therapists utilize dynamic and integrated approaches. Rood (as cited in Trombly, 1997a,b), for example, advocates the normalization of muscle tone by utilizing various sensory inputs (i.e., vibration, fast brushing, tapping, and prolonged stretch) to facilitate and inhibit motor responses and reflexes. The Neurodevelopmental Treatment (NDT) or Bobath (1990) treatment approach utilizes trunk stabilization and weight-bearing as building blocks for more distal action. Kabat's Proprioceptive Neuromuscular facilitation approach (1951)

advocates the use of specific diagonal movements to facilitate the development of motor control.

The evaluation of muscle tone and tone management is another critical component for reeducating a hemiparetic upper extremity. Tone refers to the state of muscle contraction at rest and can be determined by its resistance to stretch (Jacobs & Jacobs, 2001). Most of the time, after the initial acute phase of the injury, a hemiparetic extremity has mixed tone. As the tone begins to return, it usually starts proximal to the body. For example, the scapula and the pectoralis muscles may be the first to increase in tone. When this is the case, the upper extremity will internally rotate and adduct from the force of the tone. If the individual is not positioned properly, this can lead to contractures, pain, and limited range of motion. The occupational therapist will identify and continually evaluate how increased tone and pain is limiting the individual's function (Gillen, 1998).

Once tone is identified more distally, the evaluation of splinting needs is completed. If a therapist has determined that a splint is required, a prescription from the physician will be requested. Splinting is done to assist in normalization of tone, decrease the risk of contractures, increase or maintain PROM, prevent skin breakdown, and keep the UE in a functional position. Some common splints used for this purpose are resting hand splint, stretch splint (i.e., dynasplint for the elbow), wrist cock-up and thumb opposition splint (Davis, 1996; Duncan, 1989). The splints are fabricated and then modified as the individual's functional movement and tone change, with the goal of totally removing the splint. Once the splint is fabricated, a splint-wearing schedule is provided for the individual and/or caregivers to ensure proper use of the splint. It is also important to note that if an individual's wrist and hand is flaccid (low tone), a splint will not ensure the integrity of the musculature in the hand. Without tone, the muscles will atrophy with or without a splint.

There is some question regarding the effectiveness of splinting the hemiplegic hand. Lanin (2003) performed a meta-analysis regarding the efficacy of splinting in adults following stroke. Based on this review of the literature, the author concluded that there was no difference between the conditions of providing an aggressive PROM program alone versus providing an aggressive PROM program in conjunction with splinting. However, it was noted that many of the clinical protocols included PROM programs which may be above and beyond the feasible constraints of clinical therapy programs. Thus, the evidence was inconclusive as to whether splinting might provide an adjunct when therapy time is limited.

Treatment for tone management focuses on regulation through the use of neuroreeducation techniques such as facilitory or inhibitory techniques, proprioceptive neuromuscular facilitation techniques, and functional tasks to increase ROM, strength, and endurance. Both the individual and all of the individual's caregivers must be educated on the proper positioning and handling of the upper extremity. Incorporating weight bearing of the involved extremity while the individual performs self-care tasks will facilitate both the normalization of tone and promote awareness of the involved extremity. Communication between the physiatrist and the occupational therapist is also crucial in the area of tone management. The physician will utilize the feedback from the occupational therapist to assist in

determining whether medications and/or injections should be used for decreasing the amount of tone in the involved extremity.

MA was a 18-year-old male involved in a rollover motor vehicle accident as an unrestrained passenger. His injuries included a right subarachnoid hemorrhage, left subdural hematoma with shearing injury. He also suffered bilateral pulmonary contusions with one reported seizure. He had a PEG tube placed for nutritional supplement, and required the support of a ventilator. He remained in a coma for approximately 6 weeks, and during that time developed severe contractures in bilateral upper and lower extremities. He was medically treated for the contractures and high tone with oral medications and responded well. The initial occupational therapy evaluation during his acute inpatient rehabilitation stay showed that all areas of self-care and functional mobility required maximal assistance of another person. The range of motion in his shoulders was within functional limits, but the range of motion in his elbows, wrists, and fingers was severely impaired and affected by his increased flexor tone.

Occupational therapy treatment sessions focused on increasing MA's independence with both self-care and functional mobility (transfer status). Passive range of motion with prolonged stretch was performed to maintain joint integrity and prevent soft tissue contracture. Resistive exercise was performed within the available range of motion. Adaptive equipment and techniques were taught, such as the use of built-up utensils for self-feeding and the use of enlarged grips for other self-care items such as combs and toothbrushes. In addition, naturalistic modifications in dressing were taught (such as the use of overhead versus button down shirts).

The occupational therapist collaborated with the physiatrist to monitor the effects of tone medications. Over time, the tone decreased in MA's lower extremities, which had a significant positive impact on his transfers. Over the course of months (encompassing acute, subacute, and outpatient rehabilitation) he became able to walk with supervision for safety and without the use of an assistive device. The range of motion increased in his upper extremities, which improved his self-care status. He was able to dress and groom himself with some adaptations (i.e., shoes that did not require tying).

Recently, a technique known as constraint induced movement therapy (CIMT; Taub & Uswatte, 2000) has received a great deal of clinical attention. This approach involves restraining the nonaffected upper extremity for distinct periods of time, thereby forcing the individual to use his/her paretic arm/hand for functional activities (e.g., reaching for a spoon). It is based on the principle of learned non-use; that is, the individual with hemiparesis instinctively learns to compensate for the impairment of the hemiparetic upper extremity by utilizing the non-affected hand. This non-use is adaptive in the sense that it allows for completion of ADLs in a one-handed manner. However non-use becomes maladaptive when the affected upper extremity begins to recover, but the habit of not using the affected arm (learned non-use) precludes the use of the affected arm during functional tasks. While early research protocols (reviewed by Taub & Uswatte, 2000) involved long hours of constraint (90% of waking hours) and therapy time (6 hours daily, 5 days per week), modified protocols more representative of clinically feasible conditions have been developed (e.g., 5 hours constraint daily, with 30 minutes of OT and PT, three times per week). Results of these modified protocols (Page et al., 2002a,b;

Ploughman & Corbett, 2004) have been shown to demonstrate positive results as well, including increased hand use and maintenance of these gains over time.

Coordination

Coordination refers to the ability of muscle groups to complete a timely, smooth pattern and sequence of motion through proprioceptive sensory feedback. Ataxia is a specific type of coordination impairment, often caused by cerebellar lesions, which inhibits smooth or coordinated gross movements. Evaluation of gross and fine motor control is completed through naturalistic observation as well as standardized testing. Naturalistic evaluation may include observing the way the individual dons/doffs clothing, reaches for an object on a shelf or signs his/her name. Functional assessment of coordination is done using similar methods used to test range of motion, and specialized tests of fine motor coordination (e.g., Purdue Pegboard Test, 9-Hole Peg Test; as cited in Mathiowetz & Haugen, 1997). Treatment of coordination deficits should focus on the functional goals of the individual and can include remedial approaches such as therapeutic exercise, so that the strength of the muscles might overcome the intensity of the tremor or incoordination. Compensatory treatment strategies include bearing weight throughout the upper extremities during self-care and other functional tasks, or weighting the affected upper extremity or adaptive equipment (e.g., use of weighted utensils while eating). The weight increases proprioceptive feedback to the brain and can decrease the intensity of the resultant tremor. It is important to note that the type and amount of weight that is effective varies from individual to individual.

Sensation

The evaluation and treatment of sensory deficits is important to ensure a person's safety while completing ADL tasks; sensation also plays an important role in coordination of movements (Gowland & Gambarotto, 1994). Touch, taste, smell, and vision are each evaluated by the occupational therapist (hearing is evaluated by the speech-language pathologist). The sense of touch (including ability to sense pain, pressure, and temperature) is often affected in a person with hemiplegia/hemiparesis, and can have a major impact on safety (e.g., individuals may not be able to sense the water temperature in the shower or feel pain if they get their affected arm wedged in a doorway while propelling their wheelchair). Taste and smell are senses that often get overlooked when evaluating an individual with acquired brain injury (Zasler et al., 1992), but changes in these sensations are important to identify, as they can impact other areas of functioning (e.g., appetite). Vision evaluation is discussed in detail in Chapter 8, and OTs often work collaboratively with neuro-optometrists in the treatment of individuals with visual impairments. Treatment sessions focus on normalizing an individual's sensation through sensory reeducation techniques and/or teaching adaptive techniques to ensure safety during completion of functional tasks.

Self-Care

Self-care is the core component of basic activities of daily living (BADLs). The American Occupational Therapy Association lists self-care as one of its major performance areas. These activities include bathing, toileting, grooming, dressing, feeding, medication management and general hygiene. Naturalistic observation is the most appropriate method of evaluating independence in self-care. When performing an ADL evaluation, the therapist must carefully assess the level of assistance that the individual requires. In many traditional practice areas, the impediment to full participation in self-care is based on a physical deficit. When working in the brain injury arena, however, it is the interplay of physical, visual perceptual, behavioral, emotional, and cognitive deficits that truly impacts the performance of self-care (Mercier et al., 2001).

When initiating a self-care assessment, individuals may be asked to pick out their clothes and identify what items they need for bathing and grooming. It is noted whether or not they initiate this task immediately, require repeated cues, or need the task broken down into smaller components. Ability to sequence the task properly, time management, and initiation of compensatory strategies are also assessed. It is noted whether patients ignore one side of their body or forget how to use basic self-care items. Upon evaluation, it is important to play as passive a role as possible, in order to assess how an individual would perform each task as if the therapist was not there.

Retraining of self-care skills may involve the use of compensatory strategies such as one-handed dressing techniques. These techniques may need to be broken down into smaller components and/or explained with simple one-step commands. The level and type of compensatory strategy training must be matched to the specific cognitive deficits. This is one of the challenges of thorough functional neuro-rehabilitation. The therapist must consider the impact that each deficit has on the performance of each self-care task.

AJ is a 63-year old male who sustained a right-sided CVA. The CVA resulted in left-sided hemiparesis, and a marked left inattention. After hospital discharge and a 2-week stay in acute rehabilitation, AJ was transferred to a subacute brain injury unit for continued comprehensive rehabilitation. OT evaluated him in his room while performing his morning self-care. It was found that he needed maximal assistance transferring out of bed and into a wheelchair, onto a toilet and into the shower. He was only able to dress his strong side and was unable to dress the paretic side. He needed assistance with grooming and it was noted that when brushing his teeth, combing his hair, and shaving, he ignored his affected right side. Problems identified included left-side hemiparesis, decreased functional mobility (i.e., transfer skills), decreased attention to the left side, decreased basic self-care (i.e., dressing, grooming, etc). Short-term goals (to be achieved within 1–2 weeks) included being able to groom left side of face during oral care with minimum assistance and moderate verbal and visual cues, being able to don an overhead shirt using hemi-dressing techniques with moderate assistance and maximum cues, and being able to transfer from wheelchair to bed with moderate assistance. Long-term goals (to be achieved by discharge) included being able to perform all grooming tasks while seated at a sink with supervision for setup only, being able to don overhead shirt with supervision for setup only, being able to perform

functional transfers (i.e., tub, bed, toilet) with contact guard assistance and being able to perform bathing with distant supervision for safety.

Treatment focused on upper and lower body dressing as well as grooming. AJ was seen in his room prior to the start of his day, in order to simulate his natural routine. He was trained on the use of compensatory strategies to effectively dress his hemiparetic side (e.g., dressing the weaker side first). Grooming tasks were performed at wheelchair level since decreased balance impacted his safety. One-handed techniques were taught for opening containers (such as toothpaste, shave cream). In order to improve his attention and awareness to his affected side, verbal and visual cues were utilized. The therapist first provided verbal cues (e.g., "did you get the left side" [of your face]), then progressed to visual cues as he was unable to internalize the strategy in order to self-cue. A sign reading, "Remember to check your left side" was placed on the mirror, which he was then able to follow in order to complete the task without assistance of another person.

After 5 weeks of comprehensive inpatient neuro-rehabilitation (including 2 weeks at an acute level followed by an additional 3 weeks on the subacute brain injury unit), AJ was independent enough to return home at a level of modified independence (extra time, visual cues) with his ADLs and began outpatient therapy to address home management and community re-integration skills.

Functional Mobility

The resultant hemiparesis and/or balance deficits that often accompany ABI affect not only a person's self-care ability, but also the individual's ability to move from place to place, or *functional mobility.* An individual's functional mobility must be thoroughly assessed in order to ensure proper wheelchair positioning, access to the environment, access to adaptive equipment, safety, and maximization of independence. This assessment includes evaluation of bed, toilet, and shower/tub transfers. Postural and trunk control, sitting and standing balance, and ability to navigate an environment with or without an assistive device will also be assessed. While evaluating functional mobility, the therapist will also take note of the automatic use or non-use of both appropriate and ineffective/unsafe compensatory strategies.

For wheelchair management, occupational therapists work with physical therapists and durable medical equipment providers to select an appropriate seating system. Because cognition is key to safety awareness, consideration of cognitive deficits plays a major role in the selection of a seating system. Evaluation of the individual's abilities and deficits determine whether a manual or electric wheelchair may be required, and a specialized wheelchair evaluation may be needed (Pesperin, 1998). The physical evaluation for wheelchair positioning begins proximally and progresses distally. The individual's physical height and weight determine the size of the wheelchair. The therapist should aim for a near 90-degree angle at the hips. This is achieved by adjusting a number of variables (Pesprin, 1998).

Cushion choice is based on an evaluation of the individual's weight, hip angle, and pelvic tilt, ability to weight-shift and relieve pressure, and any incontinence issues. Wedges may be used to assist in proper pelvic positioning. Placement of lateral supports may be needed to assist in maintaining proper trunk alignment

because of decreased tone. The backrest will assist in hip angle and trunk alignment. Careful choice of armrests is especially important for the hemiparetic individual. Removable armrests assist in safety with transfers. Attaching a half-arm board or full lapboard to the armrest of the wheelchair promotes attention to the weaker side, as well as ensuring the arm does not get injured when the individual is not attending to it. Adjustable height armrests allow the therapist to position the elbow at ninety degrees and the scapula in a neutral position. This preventative measure may help the individual to avoid developing adhesive capsulitis and/or impingement syndromes. A wedge may also be placed on the lapboard to assist in edema management. Leg rests should be considered when one or both lower extremities are unable to assist in propulsion of the wheelchair. It is important that the supported leg(s) maintain a 90-degree angle at the ankle and the knee. Ideally, leg rests should be removable in order to increase safety with transfers, and should be able to elevate if the vascular system is compromised. The therapist may consider placement of a lap/seat belt, and/or chest and trunk straps for safety for individuals with impulsivity and/or decreased safety awareness. They can also be used to assist with the hip angle, and to prevent slipping out of the chair in individuals with poor postural control.

Once a seating system is chosen and properly fit to the individual, it is essential that the occupational therapist work with the individual on transfer training. Transferring refers to the ability to move from surface to surface (i.e., from wheelchair to bed or from bed to commode). The therapist takes into consideration the home setup and discharge environment, and ultimately focuses on transfers in the most naturalistic setup possible. Transfer options and/or devices include stand-pivot technique, use of a sliding board or mechanical (e.g., hoyer) lift. It is the goal of the OT to discharge the patient utilizing the least restrictive, yet safest transfer method.

Balance is another essential skill for safe mobility and ADL completion. It is affected by decreased trunk stability, strength, proprioceptive/kinesthetic awareness, and may also be affected by vestibular system dysfunction. It is imperative that the occupational and physical therapists collaborate when evaluating and treating balance dysfunction. It is often during ADL activity that deficits in balance are demonstrated and pose the greatest safety risk. The physical therapist, for example, might perform balance testing, and might challenge the individual by ambulating with him/her on a variety of surfaces. In this setting, the individual is often focused on his or her balance as the product of the treatment. However, when an individual is involved in an activity such as morning care, or in an IADL such as cooking, the individual's primary focus is often the activity, and not the component area of balance, and he/she may become less safe in terms of balance when involved in a functional activity. It is therefore the responsibility of the OT to help the individual recognize the functional impact of his or her balance deficits, and provide compensatory strategies in the natural environment. A comprehensive evaluation of the individual's static and dynamic balance while seated and standing helps to identify the supervision or assistance level that may be required during functional tasks (Gowland & Gabaretto, 1994; Alley, 2001; LePostollec, 2000). An individual may

need an assistive device (e.g., cane) to help increase balance during ADLs. Some individuals may benefit from specialized vestibular retraining (see Chapter 11).

In summary, treatment of mobility deficits requires a multi-faceted approach including remedial techniques (e.g., strength, endurance training, tone management) and use of compensatory strategies and/or adaptive equipment (e.g., weight-bearing for ataxia, lapboards, sliding boards).

Cognitive Skills

ABI can lead to individuals experiencing a wide variety of cognitive deficits, as described below. While many disciplines evaluate and treat cognitive dysfunction (i.e., speech language pathology, neuropsychology), occupational therapy's unique role is in the interplay between cognition and activities of daily living. For example, it is the OT's role to assess memory in terms of how it is affecting the individual's daily functioning—Is the individual forgetting to take his medicine? Is he/she forgetting appointments? Is he/she forgetting to use the compensatory strategies that he/she learned in therapy the previous day? Correspondingly, the OT develops functional goals in reference to cognition. The individual might be taught to use a pill organizer or daily planner, or to use a set of written instructions and cues when performing new tasks.

Attention

Attention is a complex process that allows a person to take in and react to different stimuli and experiences (Zoltan, 1996). Attention deficits may result in problems with nearly any activity throughout an individual's day. There are five distinguishable levels of attention: focused, sustained, selective, alternating, or divided. Deficits in any of these areas can impact a brain injury survivor's ability to perform both basic and complex ADLs and can be a focus of OT treatment. Focused attention is the ability to perceive individual pieces of information. Sustained attention is a person's ability to concentrate while completing a task within a closed environment. A person experiencing difficulty with sustained attention may have problems with such activities as reading a book or having a conversation. Selective attention is a person's ability to concentrate despite the presence of distractions. Individuals demonstrating difficulties with selective attention may find they cannot concentrate with external distractions such as people walking in and out of a room or background noise (e.g., television or radio). An individual may also find it difficult to concentrate with internal distractions such as pain or anxiety. Alternating attention requires a person to shift focus or concentration from one thing to the next. For example, an individual may be preparing food in the kitchen when the phone rings. In order to answer the phone and participate in the conversation the individual must be able to shift attention to the new task at hand. Once the phone call is completed, the individual must successfully shift attention back to where he or she left off in meal preparation. Deficits in alternating attention may pose a safety risk. Finally, divided attention is the ability to multitask or devote attention to several different things at the same time. This is the most complex level

of attention, but also the level that we use most frequently in life. For example, divided attention is required to drive a car. One must be able to accelerate or brake, while controlling the steering wheel, paying attention to the traffic, anticipating traffic lights or stop signs, using the rearview and side mirror, and perhaps even changing the radio station.

One evidence-based approach to the remediation of attention is a structured approach known as Attention Process Training (Sohlberg & Mateer, 1987). In this model, tasks are presented hierarchically, with more complex tasks presented only after the individual has mastered more basic levels/tasks. Stimuli can be presented auditorily or visually. Time-pressure management training (Fasotti et al., 2000), which teaches survivors to compensate for slowed processing speed and cognitive overload, is another technique that has been shown to improve attentional abilities. More functional approaches to improve attention include the use of structured tasks with a focus on challenging attention skills in order to facilitate generalization to ADLs (Novack et al., 1996). For example, a therapist might introduce the relearning of a self-care task such as upper body dressing in a quiet room with the curtain drawn and door closed, with the only stimulus being the individual's shirt. As the individual progresses, however, the therapist might introduce additional, more naturally occurring distractions, such as hallway noise, or sounds on television. To challenge the individual even further, the therapist might ask him/her to execute the dressing task while discussing discharge plans or verbally discussing his/her day's schedule with the therapist.

Executive Functions

Executive functions are high-level cortical skills that allow us to plan, organize, and execute complex activities. These skills include initiation, organization, sequencing, problem-solving, follow-through, self-monitoring, and time management. Impairments in executive functions are common, particularly in ABI survivors with frontal lobe injury, and affect performance with all productive activity including home, community, work, or school-based activities (Grafman & Litvan, 1999).

Initiation is the cognitive process of beginning any given task or action. Initiation deficits can range from mild to severe, but nonetheless require intervention. Severe deficits can manifest in even the simplest tasks like those seen in an individual's morning routine. Activities such as putting on one's shirt may require verbal and/or physical cues in order to begin the action of putting an arm through the sleeve. In other cases, poor initiation might itself manifest as the tendency to remain quiet and nonparticipatory in a group discussion unless asked a direct question. Once directly addressed or given prompts, the survivor with initiation deficits may be well able to engage in the conversation at hand.

Organization and follow-through require the individual to conceptualize the whole task and generate the appropriate sequence of steps necessary to complete it successfully. An example would be the common household task of cooking. In order to plan a hot meal with several dishes, one must plan, organize and prepare accordingly, correctly sequencing and anticipating how long each dish will take.

As with all OT treatment, executive function deficits are best treated from a holistic, person-centered, and performance-based approach. The therapist and individual will collaborate to identify a task, usually home- or community related, and determine, in a stepwise fashion, the components and sequence of the activity. The OT will provide structured cueing to help the individual to arrive at an appropriate plan. The therapist will also provide compensatory strategy training, such as list making, task segmentation, or the use of timers and calendars. There is evidence for the efficacy of various approaches to the rehabilitation of executive function deficits, including structured problem-solving training techniques such as goal management training (Levine et al., 2000).

Apraxia

Praxis is the conceiving and planning of a new motor act in response to environmental demands (Jacobs & Jacobs, 2001). A disorder in praxis, or apraxia, is the inability to perform purposeful movements in the absence of physical deficits (Zoltan 1996). *Ideomotor apraxia* is the inability to translate the idea of motion into an actual motor task. It presents as the inability to perform an action on command. The individual may be able to perform the task in a contextually relevant situation but be unable to perform the same task out of context and/or upon command. The individual's performance will improve when actual objects and visual cues are used (Zoltan, 1996). For example, the therapist might say, "Show me how to brush your teeth," and the individual would follow simply by lifting his arm, or with no action at all. However, the same individual, when given a toothbrush, would automatically and instinctively perform the act correctly.

Ideational apraxia is the inability to conceptualize a motor act. It presents as the inability to use tools and objects in appropriate sequence for the appropriate action. Individuals with ideational apraxia, without concurrent language deficits, may be able to articulate the appropriate use of familiar objects and tools, but be unable to produce the motor plan to reach out and grasp the tool. During self-care, this might present as an individual brushing his or her teeth after putting toothpaste on the wrong side of the toothbrush (Zoltan, 1996) or reaching to comb his hair with the toothbrush in hand. It is the job of the occupational therapist to facilitate the relearning of these once familiar tasks. The key to remediation of deficits as a result of apraxia is strategy use and repetition of each functional task until mastery is achieved. The specific steps can be demonstrated by using actual objects with hand-over-hand assistance, when necessary. Visual or verbal cues, or internal/external compensations can be individualized, based on the individual's needs. It has been found that strategy use for treatment of apraxia during ADL retraining is more effective that traditional ADL retraining (Donkervoort et al., 2001).

Visual Perceptual Skills

Vision is a key complex sensorimotor process that allows individuals to adapt successfully to their environment (Zoltan, 1996). Perception is the cognitive process of interpreting the images that the visual system registers. Inaccurate perception of the

visual world leads to inaccurate interaction with the world. Because individuals rely so heavily on visual stimuli to learn and to interact with the world, visual perceptual deficits can lead to widespread functional implications, and often become evident when self-care tasks are observed in an unstructured manner. Common visual perceptual deficits include impaired figure ground and impaired spatial relations. Figure ground refers to the ability to recognize objects and forms in a competing background. Spatial relations refer to the ability to perceive and recognize the way objects relate in space, and to the individual. It includes the ability to recognize when objects are above, below, next to, or in front of other objects (Zoltan, 1996). Manifestations of visual perceptual deficits on ADL activities can include an inability to find the toothpaste in a visually cluttered medicine cabinet, or putting one's arm/leg into the wrong sleeve when donning clothing.

During an initial evaluation, the occupational therapist should identify gross visual and perceptual impairments, and areas which must be further explored. Consultation with the neuropsychologist and referral to a neuro-optometrist can also help identify and clarify the extent and nature of apparent visual perceptual deficits and guide treatment interventions. The observation of the individual during naturalistic, everyday activities (e.g., dressing, grooming) is an essential component of the OT assessment of visual perception.

Occupational therapists use the information from a vision screen and from a full neuro-optometric evaulation to help guide their treatment. For example, if a person is experiencing a visual field loss, treatment would focus on visual scanning techniques in order to help compensate and boost awareness of the full field of vision. A therapist can use a four-corner set up on a placemat or food tray, using stickers to cue the individual to view the entire field, thereby increasing independence with feeding (Hellerstein, 1997). Several recent studies have demonstrated the efficacy of visuospatial rehabilitation and visual scanning training in ABI survivors with visual neglect or other visuospatial deficits (Niemer, 1998; Bailey et al., 2002).

Instrumental Activities of Daily Living (IADLs)

IADLs (also known as work and productive activities) are those activities that are essential for one's full independence in society, beyond basic self-care abilities. The AOTA defines these as acts "oriented toward interacting with the environment that are often complex and generally optional in nature" (Dunn et al., 1994). They include activities such as meal preparation, money management, home management, care of others, and educational and vocational activities. IADLs are contextually and culturally specific and are integral to independent societal functioning. By their complex nature, IADLs involve a number of cognitive skills, including executive functioning.

Meal Preparation

The ability to prepare meals provides the individual with a sense of autonomy and will serve as a factor in discharge planning. Meal preparation requires a variety of

skills, both physical and cognitive, in order to be carried out successfully. Adults with brain injury often demonstrate dysfunction in meal preparation, not only due to physical deficits, but also deficits in cognitive and perceptual skills (Niestadt, 1994). These can include hemiparesis, impaired bilateral arm coordination, impaired standing tolerance/balance, poor visual skills, or reduced sequencing, organizational skills, or safety awareness. It is the goal of the OT accurately to assess the primary limiting factors that prevent the individual from preparing meals and design a treatment plan that addresses these barriers and enables the individual to perform the task successfully. Successful meal preparation may require environment modifications to enhance accessibility. For example, because of reduced ROM, a therapist might put all equipment on easily accessible shelves. In individuals that are hemiparetic, their non-use or lack of use of one side of their body can be compensated for through the use of adaptive equipment, such as a rocker knife, dycem (which keeps objects such as plates from sliding) or plate guard to keep food from falling off a plate. Adaptive techniques are also instrumental for success with meal preparation. These include methods of energy conservation and work simplification. For example, a person can slide a heavy pot along the countertop rather than try to lift it; or do preparation such as chopping at a seated level instead of standing at the counter.

If cognition or visual perceptual skills are the primary deficit, alternative approaches would be used. If basic sequencing and memory are impaired, compensatory techniques such as task segmentation or writing a checklist could be helpful (Niestadt, 1994). For higher-level executive function deficits, treatment might focus on the planning, organization, and execution of a meal with multiple dishes, with treatment broken down across several sessions. One session might focus on choosing a menu, planning and organizing steps to cooking the meal, figuring out the recipe (altering measurements), problem solving through the supplies and equipment needed. A second session could be community-based, involving shopping to purchase required ingredients. A third session would then focus on execution of the meal, and subsequent clean-up. A therapist must consider the individual's level of function, grade the level of the cooking task accordingly, and assist the individual in transferring or generalizing the skills learned in the OT session to his or her home environment. Grading down would necessitate keeping the task simple, such as basic cold items, i.e., making a sandwich. If a therapist graded up, treatment might focus on a more complex hot meal with several dishes. A therapist must assess which level of meal preparation—basic cold snacks to complex hot meals—is appropriate and safe for the individual.

Money Management

Managing finances can be the key to independence for an individual who has sustained a brain injury. As in other areas, money management retraining should occur in a step-by-step, hierarchical fashion. The basis of all money management tasks is the ability to identify coins and currency, assign the appropriate value, and perform addition and subtraction. Once rote recognition and simple calculation is

mastered, the therapist introduces the concept of simple purchasing and making change.

At higher levels, money management includes managing a checkbook, budgeting for household costs, calculating the cost of dining out in a restaurant, and budgeting for leisure/recreational events. As an individual's skills progress, it is important that the therapist grades the activity to meet the challenge of entering the community. Outings to local stores for simple purchases and organizing a bill management system are examples of treatment tasks, which can be used to facilitate the development of routines to assist individuals in performing money management tasks successfully.

Home Evaluations

Home evaluations are an important step for discharge planning from inpatient to home settings. They offer a broader, and sometimes different, insight as to how an individual is able to function/perform in a home and community-based setting. Following a brain injury, while an individual may be able to complete various tasks within the rehabilitation setting; when he or she returns to the home environment, the carryover of the training can be poor (Anemaet & Moffa-Trotter, 1999), or he/she may exhibit reduced safety awareness.

All areas of the home that the individual will be utilizing should be assessed (i.e., entrance to the home, bathroom, kitchen, bedroom, and living room). The evaluation begins with determining how the individual will enter the home. Considerations include whether the individual is able to enter the home safely without the use of adaptive equipment or is able to safely use the adaptive device that he/she has. It is noted if physical adaptations need to be made to the entryway (i.e., addition of a railing or the need for a ramp). The therapist will then observe how the individual performs various tasks within the home (i.e., transfer in and out of the tub/shower, with or without the use of a shower seat/bench, lie down in bed and/or get the milk out of the refrigerator). The therapist will assess the individual's overall safety within the home (i.e., safety while ambulating with an adaptive device; phone accessibility; if rugs should be removed). Cognitive/perceptual awareness (i.e., where the telephone is located) is also a determining factor regarding the level of supervision that will be recommended upon discharge. Physical measurements are taken in order to determine if each aspect of the home is accessible (i.e., measurements of door frames, if a three-in-one commode will fit in the bathroom space available and if the height of shelves and counters are accessible to an individual in a wheelchair). All of the above information enables the therapist to make recommendations for adaptive equipment that may be needed, rearrangement of items in the home, addition or removal of items, and whether or not the individual would be a safety risk for returning to the home environment. The social environment is also observed. The therapist will ideally have the caregiver or significant other present in order to take note of the dynamics between the individual and the person that will be providing assistance, if one is needed. This also facilitates training of the caregiver/family member while the individual is in the home environment.

The therapist may take into account the proximity of neighbors as well as layout and social supports of the community itself. A supportive community with nearby assistance (i.e., neighbors and friends) can be extremely helpful to the survivor as well as the caregiver. In addition, a simply organized neighborhood (e.g., streets with ascending numerical names) may facilitate an individual's independence in community mobility.

Driving Evaluations

For many brain injury survivors, driving is an essential part of their occupational performance (Hopewell, 2002). Occupational therapists contribute to the assessment of an individual's level of functioning and barriers to driving. The evaluation of driving includes a general medical and social history; driving history; assessment of motor, sensory, perceptual, and visual functions; balance; endurance; reaction time; various aspects of cognition; and general ADL and IADL level. Other disciplines assist in the evaluation process as well, such as the speech-language therapist regarding the individual's hearing and communication level and the neuropsychologist for determining the individual's cognitive and emotional functioning (Hawley, 2001). Once the neuro-rehabilitation team determines readiness, a referral can be made for an on-road- assessment.

The information obtained from the driving evaluation enables the occupational therapist to set up a specialized program for each individual. It has been shown that driver-retraining programs increase the ability of brain injury survivors to successfully return to on road driving (Giles, 1994). These programs may include educational sessions on traffic safety and road rules, how to read a map, give and receive directions, physical rehabilitation (strength and balance), visual/perceptual training (e.g., depth perception, peripheral vision), cognitive remediation (attention and memory training), and sensory training (proprioceptive and kinesthetic skills). Education on state laws/regulations re: driving following a change in health status, an on road evaluation and the steps to complete it can be provided (Hawley, 2001). Training sessions may be completed in a classroom setting using paper and pencil tasks, discussions, computer software, and use of a driving simulator, followed by on-road training (Galski et al., 1997). The goal is for the individual to complete the classroom and simulator training and then to complete the on road evaluation (Galski et al., 1992; Galski et al., 1993). Individuals may also require an adaptive equipment evaluation for changes to be made to their car or recommendation for an alternative vehicle (Strank, 1997).

For some ABI survivors, returning to safe driving is not possible. Because driving is often viewed as a strong measure of independence, it is imperative that the occupational therapist facilitates the individual's community independence by exploring additional travel options and engaging in travel training. These options may include various means of public transportation—buses, trains, or some community-based transportation available to individuals with disabilities. Transportation (which, while widespread in metropolitan areas, can be severely limited in more suburban or rural communities), county-subsidized bus service for seniors

or individuals with disabilities, or local community agencies which may provide travel assistance. When appropriate travel options have been determined, travel training can proceed in a stepwise fashion, gradually fading cues and assistance to encourage independence. For example, maps/bus schedules would be obtained and reviewed; then the OT might accompany the individual on several short, routine trips, then shadow the individual, and ultimately progress to generalization of skills to novel, unfamiliar routes.

Community Reintegration

Community living skills are an essential component of being a productive participant in society. Successful community integration requires attention to all aspects of functioning, including physical, cognitive, and behavioral. Physically, the individual must demonstrate enough endurance to ambulate community distances, and be able to negotiate curbs and various types of terrain. Cognitively, they must demonstrate awareness of potential safety concerns (e.g., attention to traffic during street crossing) and the ability to self-direct, with or without cues (e.g., be able to follow a list of errands). Behaviorally, they must display the ability to interact appropriately with others (e.g., fellow shoppers, restaurant waiters).

Community-reintegration activities can provide a natural context in which to practice tasks learned or re-learned in the clinic. Occupational therapists will initially address these underlying skills in the clinic environment. However, while these skills might appear to be mastered in this controlled environment, with therapists available to assist and guide, the individual will encounter a very different reality in the community, where the expectations are for self-reliance and the responses of others are unpredictable.

Community reintegration training can be addressed via planning and carrying out of community-based activities. For example, the OT might work with an individual to plan an outing to a local store to purchase self-care items. While this might seem like a simple and straightforward task, it can pose many challenges to the individual with a brain injury. The individual might have to use the yellow pages or Internet to find a local store, and arrange transportation. They might need to prepare a list and create a budget for the items to be purchased. Once in the community, the individual would have to navigate an unfamiliar store, and locate items utilizing signage and other naturally occurring environmental cues. Finally the individual would have to perform the cash transaction ensuring proper change is given and received. All of these complex tasks must be performed in the context of a multi-sensory, highly distracting, often fast-paced environment.

After AJ (see page 222) completed his subacute stay, he continued on with comprehensive outpatient neuro-rehabilitation, including occupational therapy. Upon interview, AJ and his wife described that AJ had been retired, yet very independent and active prior to his stroke. He ran many errands outside of the home, managed his own medical appointments, and was active in several community organizations. He walked 3–4 miles daily, often stopping to purchase a newspaper and socialize with neighbors along his route. Following his stroke, AJ had not resumed these activities and wanted to do so. The neuropsychologist on the team

also shared that AJ's self-esteem was reduced due to the loss of independence and social activity.

Following assessment, the OT identified the following concerns regarding AJ's safety and independence in the community:

1. *Topographical Orientation—did AJ know where he was in relation to his home—even when on previously familiar routes?*
2. *Money Management—Could AJ make simple community purchases ensuring the giving and receipt of proper change?*
3. *Emergency Management—Could AJ define an emergency situation, and did he know how to react in one?*

Treatment commenced in the clinic with the teaching of compensatory strategies for money management. This was done using a graded approach, starting with small dollar amounts. Thus, AJ learned to manage money in the context of purchasing a weekly newspaper.

In consultation with the physical therapist to determine AJ's walking endurance limitations, the OT, AJ, and his wife identified a local store which was both familiar and within a manageable distance. They determined a simple route which was safe, well-marked, and had crosswalks and signals. During clinic-based OT sessions, he practiced crossing streets, utilizing traffic signals and being attentive at corners. As treatment progressed, AJ learned to self-cue and use these safety strategies independently. This was observed both by the OT during treatment sessions, and AJ's wife during weekend activities.

Later, the OT arranged a community visit to AJ's home and community. During his walk to the store, the OT simply shadowed AJ. He completed his purchase and rested on a nearby bench before returning home. For safety, AJ had his mobile phone with him in case something unexpected should happen. Treatment focus then shifted to re-engagement in other community activities.

Pre-Vocational Training

Because vocational expectations for persons who have sustained a brain injury are extremely varied, it is imperative that the occupational therapist help individuals to develop a realistic view of their strengths/skills, weaknesses, and ultimate working potential. Occupational therapists can help individuals realize that a return to productive activity might not mean returning to former competitive employment status. The therapist might encourage individuals to resume or assume the role of homemaker or volunteer, or help develop a structured routine for leisure/avocational activities (e.g., participation in day program, regular exercise routine, and trips to museum/library). When considering an ABI survivor's potential to return to work, it is essential for an OT to develop a comprehensive understanding of the individual's job responsibilities as well as capabilities and limitations. This can be achieved by activity or task analysis (Creighton, 1992). Work simulations can then be developed to teach and reinforce the use of facilitatory/compensatory strategies. These can include using a daily planner to follow a schedule or using written checklists for sequencing and operation of equipment (e.g., computers). Environmental or task modifications (e.g., reorganization of the workspace, structuring/organizing the work day) can allow for successful completion of tasks which would otherwise be too challenging. Familiarity with

vocational rehabilitation resources in the community is essential, and working with community-based vocational counselors, job coaches and employers is often required.

Once MA (see page 220) had met his primary ADL goals, OT treatment focus shifted to helping him develop meaningful participation in the community. Due to ongoing physical and cognitive challenges, MA was not ready to assume gainful employment. Consideration of his interests and residual strengths led to exploration of volunteer opportunities in the local community. Given the nature of his injury (he was a passenger in a motor vehicle operated by an intoxicated driver), MA wanted to share his experiences with his peers and educate them about the dangers of drinking and driving. His OT helped him organize a presentation and contact local schools at which he could speak. MA continues to do these presentations throughout his community, and has enrolled part-time at a community college.

OT as Interdisciplinary Team Players in Neuro-Rehabilitation

The occupational therapist is an integral member of the interdisciplinary team. Through collaboration with other team members, the OT is able to monitor the survivor's functional status from clinic to community. It is essential that close communication be maintained among the different disciplines to help reinforce carryover of learned strategies and to ensure that the individual's treatment plan is well coordinated. The OT focuses on functional abilities and meaningful activities, and incorporates an understanding of physical, cognitive, and behavioral deficits into development of a treatment plan. This plan will enable the brain injury survivor to maximize his/her ability to function during such meaningful activities, at home and in the community.

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