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An Occupational Therapist's Guide for Rehabilitative Driving with Traumatic Brain Injured Clients

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An Occupational therapist's Guide for Rehabilitative Driving
with Traumatic Brain Injured Clients

by

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This Scholarly Project Paper, submitted by Josiah Hadsall in partial fulfillment of the requirement for the Degree of Master's of Occupational Therapy from the University of North Dakota, has been read by the Faculty Advisor under whom the work has been done and is hereby approved.

Faculty Advisor

Date

PERMISSION

An Occupational Therapist's Guide for Rehabilitative Driving with Brain Injured Clients

Department Occupational Therapy

Degree Master's of Occupational Therapy

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ABSTRACT

Traumatic brain injuries are devastating occurrence accounting for nearly 10 million injuries occurring each year, with 2 million of those occurring in the United States. As these individuals progress through rehabilitation and begin to acquire independence once again, they look for opportunities to reintegrate within the communities which they live. Driving has been identified as a monumental stage of rehabilitation and is a key way to experience the community for individuals after a traumatic brain injury. This scholarly project was conducted to help occupational therapists addressing driving rehabilitation with traumatic brain injured clients and help ease some of the problems that inexperienced occupational therapists face with rehabilitative driving.

The problems that have been addressed include the limited information that is available to inexperienced occupational therapists as they deal with rehabilitative driving. Rehabilitative driving is an emerging field in occupational therapy. Many therapists will not address driving on a fulltime basis and may not have driving specializations. This guide will help those that are limited with inexperience approach driving concerns with traumatic brain injured clients.

A comprehensive literature review was conducted to support the outcome of the developed product. This research suggests that rehabilitative driving resources are needed to increase and support the evidence base on driving. The development of additional

resources will provide increased access to rehabilitative driving for inexperienced occupational therapists. As the literature review progressed, it also became evident that traumatic brain injured clients are in need of rehabilitative driving services specific to their diagnosis.

Significant findings throughout the literature review include deficits currently being addressed by occupational therapists are similar to needs related to driving, clients view driving as a monumental stage in recovery, and occupational therapists are in need of increased guidelines and resources to meet driving needs for their traumatic brain injured clients. To help aid in the resolution of these findings a product has been developed that specifically addresses driving concerns of traumatic brain injured clients. Included in this product are tools and resources to aid in the stress experienced by inexperienced occupational therapists addressing rehabilitative driving. Specific evaluation tools have been developed to evaluate both on and off-road evaluations. The off-road evaluation tool is a semi-structured interview that addresses specific details related to driving and the history of the clients driving experiences. The on-road evaluation provides a checklist that will aid in the behind-the-wheel driving assessment.

CHAPTER I

INTRODUCTION

With over 10 million injuries occurring each year and over 2 million of those occurring in the United States it is necessary for traumatic brain injury (TBI) survivors to get appropriate care. Traumatic brain injuries occur at all ages, with the ages of 15 to 24 being the most at risk due to lifestyle and activity involvement. Brain injury risk and prevalence also increases after the age of 60 (Family Caregiver Alliance, 1998). Freedoms and privileges such as driving become a major topic of discussion at the landmark age of 16. Individuals at the age of 16 fall in the middle of the prevalent ages for sustaining a TBI. “For the young person, driving is a right of passage and a route to increased freedom and social standing within society” (Brooks & Hawley, 2005, p. 165). At this point it is necessary to discuss occupational freedoms and aiding individuals to mobilize within the community.

Driving has been determined as one of the most important instrumental activities of daily living that is linked to independence and social interaction throughout the community experience (Brooks & Hawley, 2005; Stav, Pierce, Wheatley, & Davis, 2005). Clients who have suffered traumatic brain injuries view the return to driving as the crowning moment in their rehabilitation. Driving is a source of freedom which allows for social interactions and access to public facilities independently. Driving has been

categorized by the American Occupational Therapy Association [AOTA] (2002) as an aspect of community mobility. As patients with traumatic brain injury realize that they may not drive again or will have that freedom temporarily revoked may feel like they have lost a sense of who they are. Rehabilitative programs that focus on driving and integrating community mobility back into traumatic brain injury survivors lives can help redefine injured individuals and give back a sense of their previous lives and freedoms.

As occupational therapy practitioners take on the role and responsibility of rehabilitative driving they need some guidance and protocols to follow to ensure quality care and safe rehabilitation for all clients. This project focuses on the development of a guide that will give therapists a basic outline for rehabilitative driving protocols and the tools necessary for conducting safe and appropriate rehabilitation when working with traumatic brain injured clients. Developing a guide for occupational therapists will not only benefit therapists, but will ensure that clients receive the essential components and appropriate care related to driving rehabilitation.

The main concern is that occupational therapists new to driver rehabilitation are at a loss when it comes to gathering information for successful and appropriate outcomes when dealing with driving issues of traumatic brain injured clients (Davis, 2003; Korner-Bitensky, Bitensky, Sofer, Man-Son-Hing, & Gelinas, 2006) With a guide that focuses on driving, therapists can eliminate the stress behind the research involved and locating the starting point of treatment. This guide is designed to build upon evidence-based research

and give occupational therapists the needed direction. It will be accessible to therapists as a tool to practice and document outcomes of driver rehabilitation. The product will also be used to promote and encourage increased involvement with the growing interest in driving rehabilitation.

All individuals who are physically fit and possess the cognitive abilities that are required for driving deserve the chance to drive again. Facilities that incorporate driving programs into their existing services can utilize this guide that is being developed as a starting point and referral guide. Included in this guide are references to evaluations, treatment options, and driving recommendations. It is necessary at this point in time for occupational therapists to step up, take the lead in driver rehabilitation, and set guidelines and protocols for meeting client's needs.

Chapter II provides a comprehensive review of the literature addressing driving and the effects of traumatic brain injuries on driving. The general role of the occupational therapist when dealing with traumatic brain injuries and the specific role of driver rehabilitation is discussed in this literature review. Evaluations related to traumatic brain injury and driving are described. Chapter III describes the methodology in developing the product. An overview of the product can be found in the Chapter IV with the complete guide found in the appendix. Chapter V includes the summary and recommendations for implementation and future research.

CHAPTER II

LITERATURE REVIEW

According to the Family Caregiver Alliance (1998) over 10 million traumatic brain injuries (TBI) occur each year resulting in hospitalization or death. In the United States an average of 2 million TBIs occur annually including 1.1 million emergency room visits, 300,000 hospitalizations, and 56,000 deaths. It has been determined that national data surveys have underestimated the extent of these figures. It is reported that males are twice as likely to sustain a TBI as females. Individuals between the ages of 15 and 24 have a greater risk of sustaining a TBI due to lifestyle choices. Risk of TBI also increases after the age of 60. It is estimated that approximately 62 out of every 100,000 adults over the age of 15 are TBI survivors living in our communities and suffering from accident related impairments (Family Caregiver Alliance, 1998).

With demographics such as this it is important to keep in mind the general safety of the community in which these individuals live in. With the appropriate care and facilitation these individuals can once again function in our communities as productive citizens with a purpose to life. Many aspects and occupations of life come to an abrupt end when an unexpected injury occurs. Many of these individuals reintegrate into our communities without the proper treatment and specialized care. One activity that is often neglected in treatment and rehabilitation is that of driving. “Many individuals see the ability to drive again as a crucial index of recovery. Stopping driving is associated

with lost social activities and depression, even when other forms of transportation are easily accessible,” (Hawley, 2001, p. 761). This issue of driver rehabilitation is one of the top emerging fields in occupational therapy for the new millennium (American Occupational Therapy Association [AOTA], 2000) and requires our attention. With the proper tools and education occupational therapists are qualified to provide driving rehabilitation. This literature review describes demographics, treatment and recovery of clients, the general and specific role of occupational therapists, screening tools, driving programs, and evidence to support the need for occupational therapists in driving rehabilitation.

The most common causes of brain injury include falls, motor vehicle accidents, assaults, and sporting or recreational injuries. Falls account for 28% of injuries, motor vehicle accidents produce 20% of injuries, being struck by or against something or someone including sport-related injuries 19%, and assaults account for 11%. The other 22% of causes varies from suicide attempts to unknown causes (Langlois, Rutland-Brown, & Wald, 2006).

There are two common categories of injury when referring to TBI, a focal contusion and diffuse axonal damage. According to Pulaski (2003, p. 776):

A focal contusion is a bruising of the brain as a result of a blow to the head. This can occur, for example, from a fight or sports injury. Diffuse axonal damage results from twisting, tearing, or stretching of the axons of the nerve fibers throughout the brain. This primarily

occurs because velocity, when the brain and body are moving forward at a certain speed and are suddenly stopped short. This causes the brain to bounce back and forth within the skull, leading to diffuse damage. This may also be called a shearing injury. This type of injury can occur in motor vehicle accident or a fall greater than the person's own height.

In many cases clients experience both focal and diffuse damage in certain accidents.

One example of this would be a car crash when an individual hits their head on the steering wheel (focal), and suffers damage from the force of velocity (diffuse).

Another way to describe brain injuries is to categorize them as primary or direct and secondary injuries (Book, 2005). With primary or direct injuries the damage is caused by impact. Secondary injuries are caused by subsequent swelling, infection, or cerebral hypoxia. Direct brain injuries include diffuse axonal injury and focal lesions related to laceration. Secondary injuries are often linked to concussion, infection, and hypoxic brain injury (Book, 2005).

According to Pulaski (2003) symptoms of a brain injury can include single to multiple symptoms. Symptoms may be long-term or life-long depending on the severity and location of the injury. Symptoms may include motor disturbances which cause abnormal tone, resulting in hemiplegia, paraplegia, triplegia, or quadriplegia (Pulaski, 2003). Other symptoms include limited range of motion (ROM), decreased postural control, reduced motor control, sensory issues, and cognitive impairments. If issues are not addressed in early stages of rehabilitation they can lead to lifelong disabilities.

Other symptoms that can be the most devastating are those of the cognitive nature. Cognitive impairments may include organizational skills, timing and orientation, attention span, long and short-term memory, and the ability to sequence (Book, 2005; Pulaski, 2003). Clients with brain injury may also lack the ability to problem-solve and make decisions. The skill to acquire and retain new information may also be impaired. Another deficit that may arise is the lack of visual perceptual skills and the ability to depict spatial relations, position in space, depth perception, and figure ground. Problems with language and speech may also inhibit the client's ability to interact socially and express themselves. Problems such as language and speech can also be related to increased stress associated with brain injuries (Tomberg, Toomela, Pulver, & Tikk, 2005). Also causing problems for many TBI survivors is the ability to interpret emotions and properly portray emotions in a socially correct manner. Some specific symptoms and impairment are specific to location of the trauma. It is the occupational therapist's job to determine which occupational areas have been affected by the location of the lesion. Once occupational therapists have determined what the deficits are, they can then base treatment on the specific occupational deficits (Pulaski, 2003).

There are many settings in which care for patients with TBI occur; patients first start their rehabilitation in hospital intensive care units and acute rehab settings. "Rehabilitation goals after traumatic brain injury are improving function, increasing the level of independence as high as possible, preventing complications and providing

an acceptable environment to the patient,” (Irdesel, Aydiner, & Akgoz, 2007, p. 6). The rehabilitation team will vary from setting to setting as well. Most commonly found on these teams are the following; physicians, psychologists, occupational therapists, physical therapists, nurses, social workers, and speech language pathologists (AOTA, 1999).

During the acute phase of rehabilitation there can be multiple complications which can lead to increased delays in functional recovery. These complications may include contracture development, pressure wounds, and deep vein thrombosis. In many instances these complications can be life threatening and interfere with the patient’s rehabilitation. According to Irdesel et al. (2007), early rehabilitation decreases the frequency of these complications and helps to bring complications under control with more ease and less time. Radomski (2002) reports many patients are discharged early from inpatient care due to lack of funding and do not reach all their therapeutic goals. Therefore goals may overlap as clients progress to different settings.

Goals for recovery and treatment vary from each setting. As patients progress to different rehabilitation facilities throughout their recovery, goals and the focus of therapy change, meeting the demands as the client progresses and reaches his or her potential. In a rehabilitation hospital the client focus is centered towards functional independence with tasks such as activities of daily living (ADL) and rediscovery of

self. A client may stay in a facility such as this for an extended time period based on the level injury and rate of recovery (Radomski, 2002).

After reaching their client's potential and goals set for a rehabilitation hospital, therapists may find it appropriate for the client to continue with therapy services in an outpatient setting. In a setting such as this a client would continue to work on increasing independence in various activities. The occupational therapist would continue to help the client rediscover hobbies, increase social participation, and organize life to an independent state. At this point other issues would also be addressed, such as community mobility and driving if appropriate (Radomski, 2002). Community mobility has been defined by the American Occupational Therapy Association as moving one's self in the community through various modes of public or private transportation, including driving (AOTA, 2002). Community mobility and driving fall in the category of instrumental activities of daily living (IADL). IADLs are described in the Occupational Therapy Practice Framework as "activities that are oriented toward interacting with the environment and that are often complex and generally optional in nature" (AOTA, 2002, p. 620). When addressing these IADLs the therapist needs to address the safety of the client and those involved in the client's participation in community mobility. Community mobility facilitates increased social participation and a sense of independence for the client. Increasing social participation is a key component of therapy when working with brain injured clients (Radomski, 2002).

The general role of occupational therapy in treating a brain injured client is to provide occupational therapy services that are client-centered and provide the individual with the best possible care that will result in increased function and quality of life (Pulaski, 2003). The first step is to provide a thorough evaluation. Evaluations occur in every setting and provide the therapist with a starting point for treatment planning and setting goals that are appropriate with the client. The assessment may include; daily living skills, range of motion, gross-motor coordination, hand function, endurance, sensory processing, perceptual skills, problem solving skills, and social interactions (Pulaski, 2003). Assessments specific to driving will be discussed at a later point in this literature review.

Specific assessment instruments are numerous and vary from facility to facility. At this point there is not a specific evaluation that has been established for driving. According to French and Hanson (1999) it is determined by the individual facility what evaluations are conducted. Occupational therapists typically research specific assessments and treatment options for clients and try to keep driving evaluations centered on the client's specific needs. Treatment areas that occupational therapists will address include the following; self-care, productivity, leisure, sensorimotor, cognitive functioning, visual perceptual, psychosocial issues, and environmental adaptations. It is also the general responsibility of the occupational therapist to follow all precautions set forth by the physician. It is the responsibility of the occupational therapist to provide safety guidelines when addressing functional

activity and completing daily routines with injured clients (AOTA, 1999). The overall role of the occupational therapist is an evaluator, advocate, service provider, and role model for TBI patients, their families, and significant others.

The general role of the occupational therapist when addressing driving and community mobility is the following: evaluating specific client needs, individualizing treatment through client centered practice, and discharging through evidence based and safe referrals for potential driving clients. Helping to ensure the safety of individuals who are passengers, for example wheelchair lifts and helping establish public transportation adaptations is another role of the occupational therapist (Brooks & Hawley, 2005; Davis, 2003; French & Hanson, 1999; Korner-Bitensky, Bitensky, Sofer, Man-Son-Hing, & Gelinas, 2006). Safety is the first concern that occupational therapists address in rehabilitative driving. Community mobility will also be addressed by the occupational therapist including walking, riding a bike, and gaining independence throughout the community. Planning out community mobility and individualizing with clients will increase independence and make roadways safer for all (Stav, Pierce, Wheatley, & Davis, 2005).

Occupational therapists also evaluate, educate, and train individuals with different disabilities including brain injuries how to acquire a driver's license for the first time. Many TBI survivors are young adults who may have been injured before the legal driving age. At this point the occupational therapist can help these

individuals through evaluation, education, and behind the wheel training, in order to acquire a license. Occupational therapists will train and evaluate drivers that have had a license revoked due to impairment or injury to regain their license as well. Another objective that occupational therapists participate in is to help individuals who have temporarily lost or permanently lost their license due to age, injury, or impairment find alternative modes of transportation that will ensure safety to all those involved (Stav et al., 2005).

In settings where individuals with TBI are a target population the occupational therapist will need to make adjustments for rehabilitation accordingly. “Rehabilitative occupational therapists need to weave client’s goals for driving into the fabric of the intervention,” (Davis, 2003, p. 15). Various roles will be played out by the occupational therapist; evaluations, interventions, education, and safety are all addressed in therapy. Different evaluations and interventions include on and off-road evaluations, visual tests, cognition evaluations, motor planning activities and evaluations, and behind-the-wheel training (Stav et al., 2005).

As more and more occupational therapists take on the role of driving rehabilitation therapist, more education and training is expected. As roles progress occupational therapists will require more specialized training that focuses on skill and encounter increased quality of treatment will higher expectations (Davis, 2003). As occupational therapists take on the task of rehabilitative driving three categories

emerge. The first category being the occupational therapy generalist, second the occupational therapist with advanced training, and third the certified driving rehabilitation specialist.

“All occupational therapists, across all practice areas, may have clients whose disability affects driving or the potential to drive,” (Davis, 2003, p. 16). Various factors including muscle, movement, general function, visual deficits and performance skills such as strength, coordination, and organization can affect driving. These sub-skills of driving are addressed in multiple settings of practice. Davis again states that the occupational therapy generalist responsibilities encompass the task of asking clients the importance of driving in their everyday function. At this point it is appropriate for the occupational therapist to address and set goals for driving.

Occupational therapists with advanced training take on a more involved role when it comes to driving. “Therapists at this level can evaluate the integration of and train clients in specific sub-skills associated with driving. Therapy interventions can be tailored to restore or modify performance skills, performance patterns, or activity demands that could affect driving” (Davis, 2003). Once a therapist has advanced training they are then qualified in setting standards for their facilities for addressing driving.

The third role is that of the certified driving rehabilitation specialist (CDRS). In this role the occupational therapist has many responsibilities. According to Davis (2003, p. 17):

Occupational therapists at this level require broad, expansive knowledge of driving components such as assessments, driver education, novice driver education, equipment prescription, installation, and training. These therapists are able to establish protocols to determine driving competence and appropriate training as well as provide information and counseling for pursuing transportation alternatives.

Some therapists may avoid driving evaluation due to the fear of deciding competency in clients and being held responsible. At this point it is the CDRS's responsibility to evaluate and make clinical judgments of competency.

The rehabilitation of injured clients who wish to gain a driver's license is a long and strenuous process. Initially the occupational therapist may begin with a general strengthening program. According to French and Hanson (1999), range of motion (ROM), manual muscle testing (MMT), grip strength, and pinch strength may all be used as measuring tools for motor abilities. Also included in the data gathered by French and Hanson was the use of a basic coordination screenings and sensation testing to gather data about the patient's physical abilities or deficits. Another way that therapists can test motor functioning is through a series of reaction time testing. One way of testing this is through an assessment called the Brake Reaction Timer (Korner-Bitensky et al., 2006). According to these authors, a survey that was

conducted in 2003 showed that 73% of driver screens included the Brake Reaction Timer as a measurement tool for reaction time. As therapy focuses on strengthening using these tools to measure can help therapists track progress. Reaching goals in this area is essential to maintain safety while addressing driving.

Once motor functioning has been addressed the occupational therapist will then focus on visual deficits if present. “Functional mobility is severely affected by visual field deficits. Patients present with slower gait, shorter strides, anticipation of movements, shoe gazing, and tactile strategies such as trailing a wall with their finger during ambulation,” (Gutman & Schonfeld, 2005, p. 32). Clients with visual impairments may not be appropriate for driving unless these problems are properly addressed in therapy. In a study conducted by Brooks and Hawley (2005), nearly 29% of brain injured clients who attempt a return to driving have vision-related impairments. Visual problems may include visual spacing, visual scanning, depth perception, unilateral neglect, visual recognition, visual response, and visual memory (Leon-Carrion, Dominguez-Morales, & Barroso Y Martin, 2005). Therapy may include; patching or occlusion, scanning devices and activities, using sensory techniques with vision, such as touching what is seen, training patients in use of prescribed optical devices, neglect training, perceptual activities, driving simulators, and evaluation of outcomes (Quintana, 2003).

Cognitive retraining is essential for a client to return to driving. According to Giles (2003), cognitive retraining may include cognitive therapy, problem-solving training, coping skills training, and other approaches. According to Radomski and Davis (2002), cognitive therapy may include changing the context, establishing habits, establishing behavioral routines, acquiring compensatory skills, establishing habits, and developing strategies for accomplishing goals. As therapists help clients reach optimal cognitive skills, clients then who have shown a level of competency and that have passed a neuropsychological exam may then prepare them for behind-the-wheel testing or training, also called on-road evaluating (Lundqvist, 2001).

As more occupational therapists take on the role of driving rehabilitator there will be more demands for continuing education and skilled training. As a driving expert the role of the occupational therapist is very demanding. The first step that an occupational therapist will take when driving questions are presented is to conduct a formal evaluation. Although no standardized assessment is available for therapists, an evaluation of driving capabilities is essential. More licensing bodies are requiring that a skilled occupational therapist carry out a functional driving evaluation for clients with TBI as they request an opportunity to return to driving (Korner-Bitensky et al., 2006).

Evaluations are an essential part of driver rehabilitation. Results of these evaluations provide data that allows a therapist to make clinical judgments regarding

the safety and skills an individual needs for driving. At this point it is critical to discuss evaluations, standardized and non-standardized. According to Korner-Bitensky et al., (2006), the Brake Reaction Timer (BRT), Trail Making Test Part A and Part B, and the Motor-Free Visual Perception test (MVPT) are the most common standardized off-road evaluations that are being utilized by therapists. The most common on-road evaluation is a non-standardized driving evaluation (Korner-Bitensky et al., 2006). Research shows that assessment usage varies greatly from professional to professional. According to this same research it is also noted that occupational therapists should take a great interest in driving and establish guidelines and training to ensure evidence-based evaluations that are consistent across the profession (Korner-Bitensky et al., 2006).

The Brake Reaction Timer is the most commonly used standardized evaluation when assessing TBI clients that wish to return to driving (Korner-Bitensky et al., 2006). This assessment was developed by American Automobile Association (AAA) and was used to measure the amount of time that it would take to react to a stimulus (Florida Atlantic University, n.d.). The reaction timer has been modified and adapted since it was first introduced. The Stationary Simple Reaction Timer that is produced through Vericom Computers Inc. is the most recent and commonly used reaction timer. This assessment has a pedal component and a monitor. The pedal and program are connected to a monitor, as the client is visually stimulated they are timed

on how long it takes to push the pedal after seeing the stimulus (Vericom Computers Inc., n.d.).

The second most common evaluation for driver rehabilitation is the Trail Making Test Part A and B (Korner-Bitensky et al., 2006). The Trail Making Test is an assessment that is made up of two parts. The first part (A) is designed to assess visual spatial abilities, and the second part (B) is designed to assess executive function and mental flexibility (Bowie & Harvey, 2006). Part A requires the client to connect randomly placed numbers on a sheet of paper as quickly as they can. Part B combines both letters and numbers and requires the client to alternate between numbers and letters (1-A-2-B-3-C), (Hashimoto et al., 2006). This test can help determine visual search ability and motor skills, it has also been determined through various research and studies to be a reliable predictor of driving functions (Bowie & Harvey, 2006). Alternate versions of the Trail Making Test have been created to broaden the applicability of the test across different age ranges and to accommodate for verbal confusion and remove any obstacles (Bowie & Harvey, 2006).

The third most common assessment that has been determined to predict driving abilities is the Motor-Free Visual Perception test (MVPT). In various research publications one of the most commonly utilized assessment tools was the MVPT; this was used specifically with traumatic brain injured clients when addressing driver rehabilitation (Bouillon, Mazer, & Gelinas, 2006; French & Hanson, 1999; Korner-

Bitensky et al., 2006). This test is in its 3rd edition and is comprised of multiple test plates; each template has drawn pictures on them. The client is given directions and responds verbally or by pointing to the correct answer. There are five categories that can be tested with the MVPT, they include; spatial relationships, visual discrimination, figure ground, visual closure, and visual memory. The MVPT is the preferred tool for assessment when dealing with brain injuries because it eliminates confusing variables (Asher, 2007).

The Mini-Mental State exam is a commonly used evaluation tool that is also utilized with rehabilitative driving and brain injuries. According to Korner-Bitensky et al. (2006) the Mini Mental State exam is the most commonly used cognitive measure for assessing TBI clients that wish to drive again. This evaluation is easy to use and requires little time to administer, thus making it a practical evaluation for occupational therapists. This classical evaluation can be used at any point throughout the initial examination and throughout treatment to monitor client's progress. This assessment is a questionnaire that consists of 11 questions in five various categories. Categories include orientation, memory, attention, calculation, recall, and language (oral and written instructions) (Asher, 2007).

Driving simulators are the primary tool used for preparing clients for on-road evaluations. Research conducted by Lew et al. (2005) has shown that driving simulators can predict driving abilities or problems that may not be present in an on-

road evaluation. Long-term difficulties with driving are more likely to show in the driving simulator evaluation than they do in an on-road evaluation. The Systems Technology Incorporated (STI version 8.16) which was used in this research is equipped with a PC with a 21 inch monitor, two speakers, a table mounted steering wheel, accelerator pedal, and brake pedal (Lew et al., 2005). The software that comes with this specific tool is equipped with various visual scenes and sound. The system is programmable and can be altered for increased difficulty. Driving simulators can be very costly and cannot duplicate actual driving situations. Another downfall of driving simulators is that they cannot reproduce unexpected dangers of driving such as weather and other natural risks. They can however be very useful in predicting various outcomes and provide the occupational therapist with client tendencies and habits related to driving (Lew et al., 2005).

After a client has passed all off-road evaluations that the occupational therapist has assigned, the client is then ready for an on-road evaluation. These evaluations are non-standardized and require a great deal of clinical reasoning on the occupational therapist's behalf. "On-road driving evaluations assess shortcomings in ability to drive at an operational level, i.e., difficulties to carry out intended actions," (Schanke & Sundet, 2000, p. 114). Behind-the-wheel tests are still not a part of all facilities established procedure when assessing potential drivers. These evaluations can be costly with a high liability and are not easy for hospitals and rehabilitation centers to establish (Tamietto et al., 2006).

According to Marshall, Man-Son-Hing, Molnar, Hunt, and Finestone, (2005) when assessing a client during a behind-the-wheel test it is not the physical abilities such as turning the wheel and operating controls that determines pass or fail. Pass or fail is determined by the client's cognitive abilities such as scanning of the environment and attention span. Physical abilities are tested and mastered in the clinic through preparatory activities long before on-road evaluation. These researchers also stated that elements of driving such as anticipation of hazards and environmental awareness should be considered components of on-road driving assessments (Marshall et al., 2005). On-road driving evaluation assessments are not recommended for occupational therapists who have not expanded their knowledge and received advanced training. Occupational therapists have to keep in mind the general safety of the client, themselves, and the community when conducting on-road evaluations (Davis, 2003).

Behind-the-wheel assessments can be conducted in two different ways. The first is in a closed-course. These courses are usually available through driving schools or public safety departments. These courses can include parking tests, staying within the lines, and observing signs and speed limits (Coleman et al., 2002). Closed-course driving examinations have typically yielded little or no information about real-life driving behaviors that are portrayed on public roads and lack real world experiences (Pietrapiana et al., 2005).

The other type of behind-the-wheel driving assessments is the open-course driving examination. This type of evaluation provides a clearer indication of driving fitness. This evaluation of driving abilities is typically conducted on a set route established by the occupational therapist that allows the client to experience various driving and traffic conditions. The downfall to open-course driving evaluations is that they are not standardized and do not show reliability (Coleman et al., 2002). This same downfall is associated with all on-road evaluations of driving. Although researchers are aware of this downfall they still see fit to perform on-road evaluations to simulate real-life experiences.

Driving programs across the country vary and have different standards throughout various facilities. Driver programs are most commonly affiliated with established organizations such as hospitals, rehabilitation facilities, outpatient rehabilitation centers, vocational rehabilitation centers, and private practices (French & Hanson, 1999). Evaluations, treatment, and recommendations all differ from each facility. Many driving programs base their protocols on things such as funding, referral sources, and dominating diagnosis. The research that French and Hanson (1999) conducted showed that 87% of programs conducted behind-the-wheel evaluations.

Exploring the need for driver rehabilitation programs is in high demand with the growing elderly population and the increasing TBI population that integrate

throughout out communities. Occupational therapists are qualified to establish these programs. They first need to explore and establish a need for a program in their geographical area. Contacting such organizations and individuals as AAA, local physicians, eye-care practitioners, public transportation agencies, and other community contacts can help occupational therapists establish programs and have support from community referral sources (Pierce, 2005).

According to Schultheis, Matheis, Nead, and DeLuca (2002), individuals who complete a driving evaluation program have minimal difficulties returning to the role of a driver. These authors also reported that up to 78% of TBI survivors attempt to return to driving following their accident. With over 1 million TBIs occurring each year occupational therapists and rehabilitation facilities need to prepare themselves to respond to this demand of driving. With the training that is available and the education that occupational therapists have qualifies them to address driving as an instrumental activity of daily living. In many cases returning to driving is noted as a final step in recovery. Driving has become important in our society and is related to social freedom and the independence an individual can obtain. Driving has been linked to work transportation, shopping, and receiving healthcare (Rapport, Hanks, & Bryer, 2006). As more TBI survivors look towards occupational therapists to guide them in the process of regaining a driver's license, it becomes the occupational therapist's responsibility to acquire the knowledge to safely guide them through this procedure.

Other considerations when treating TBI clients that have goals of driving again include family involvement, community barriers, laws and regulations depending on location, and social aspects of driving (Stav et al., 2005). Not all TBI survivors will be appropriate for assessments focused on driving. Occupational therapists have the responsibility to determine who is appropriate for assessment and should take responsibility for addressing community mobility. Referral sources will vary and fluctuate based on the different community settings available in the area. Occupational therapists who do not evaluate drivers on a daily or weekly basis should stay current in evaluation practices and treatment associated with driving to ensure the best care for TBI survivors who wish to drive again. Therapists who are certified in driving should set standards and become mentors for those who have not yet had experience in driving rehabilitation (Davis, 2003; Stav et al., 2005).

The purpose of this project is to create a manual that would guide occupational therapists along as they embark on the task of driver rehabilitation. The goal is to ease the stress involved in planning and acquiring adequate evaluation and treatment tools when addressing driving needs of TBI clients. The finished product is designed for occupational therapists who do not have advanced driver rehabilitation training but are wanting to evaluate driving readiness as an IADL. Therapists that are already addressing and evaluating areas such as cognition, strength, fine motor control, gross motor control, and visual perception are already equipped with the resources to begin driver rehabilitation practices. Occupational therapists are well

qualified and trained in community mobility techniques and maximizing IADL functioning in all populations. Therefore occupational therapists are appropriate to lead the way with driver rehabilitation and help set new standards in community mobility and driving.

To aid in the development of this project and to help explain the relationship between driving, the individual, and the environment, the Canadian Model of Occupational Performance was utilized. This model describes how the person, occupation, and environment all work together to produce what is called occupational performance. Occupational performance is described as “the ability to choose, organize, and satisfactorily perform meaningful occupations that are culturally defined and age-appropriate for looking after one’s self, enjoying life, and contributing to the social and economic fabric of a community,” (Law et al., 1997, p. 30).

This model has two focuses, the first being occupational performance and the second being client-centered practice. Client-centered practice is the focus on the activity and the relationship that the client has with that activity (Kielhofner, 2004). With both of these concepts being utilized the issue of spirituality arises. Spirituality can be related to driving as meaning is derived from the driving experience. Spirituality has to do with meaning, purpose, and connectedness to one’s environment (Kielhofner, 2004). Driving is a meaningful occupation for many TBI survivors and

gives the client a connected feeling throughout the community. With therapy focusing on a return to driving, this can make therapy very client-centered and help address the spiritual needs of the client. Using the Canadian Model of Occupational Performance enhances the effectiveness of the product and gives evidence to its theory base. Chapter III describes the methodology that was used to develop the product following the Canadian Model of Occupational Performance.

CHAPTER III

METHODOLOGY

After intense research and article reviews, the author comprised a comprehensive literature review that supports and gives reason for the outlined product. After developing the literature review a conclusion was made that there was a need for the development of a product that can guide occupational therapists in the field of rehabilitative driving.

The literature suggests that rehabilitative driving resources are needed to further the evidence-base and access for material related to driving. Another discovery made was the need for recommendations of resources and options for those that do not meet the fitness required to drive.

The development of the product focused on evaluation tools needed for effective and comprehensive assessments. The product also emphasized the importance of on-road driving tests and the safety concerns that should be addressed. The intention overall of the product was to ease the stress involved in gathering materials and to guide therapists that do not have experience in rehabilitative driving methods. Occupational therapists new to driving rehabilitation take on a great challenge and are faced with the pressure of ensuring client safety and client satisfaction. The development of this guide has created a tool that can help ensure the needs of the client and the therapist. Chapter IV provides an introduction and summary of the product. It includes information and resources regarding the purpose of driving, the evaluation tools needed, and the specific recommendations that can be made for clients.

CHAPTER IV

PRODUCT

Traumatic Brain Injury (TBI) survivors are entitled to move throughout the community and interact with the environment. Driving is a key element in reconnecting with TBI survivor's surroundings. Individuals that are capable of meeting the driving requirements and needed skills should have an opportunity to drive again. As occupational therapists move forward with new and innovative treatment techniques, rehabilitative driving can not be ignored. This resource brings together information related to driving and the steps needed to provide a guide to direct rehabilitative driving.

This product includes information on the national resources, evaluation process, and recommendations for community mobility. More specifically this guide takes a client-centered approach at driving rehabilitation and helps occupational therapists with limited experience have a starting point for guiding TBI survivors to drive again. In addition multiple resources are cited to provide a large resource base for occupational therapists to reference when further information is needed.

The completed guide can be located in the Appendix. Chapter V summarizes the process of the development, the limitations of this project, and recommendations for future action.

CHAPTER V

SUMMARY

The literature review provided an overview of the needs and benefits of rehabilitative driving for TBI clients. As the process of the scholarly project progressed it became apparent that driver rehabilitation has not been fully accessible to all occupational therapists. Occupational therapists who are not experienced in driving rehabilitation need resources to guide them through the process of evaluating clients for driving. Based on the literature review a guide was developed to lead occupational therapists in the right direction with rehabilitative driving.

Limitations of the study

One limitation with this specific study was the lack of occupational therapy based organizations that are actively addressing rehabilitative driving. The organizations that have addressed driving are limited by the fact that rehabilitative driving is a new and emerging field that is being addressed by occupational therapists.

Another limitation of this study was the broad range of acceptable evaluation tools. The author had to limit the number of evaluations utilized so that a new practicing therapist would not feel overwhelmed. The limited resources were included at the discretion of the author.

Recommendations for future action

Many traumatic brain injured clients have a desire to drive; however making the choice to drive can be difficult for individuals and families. With the help of occupational therapists individuals and families can decrease the anxiety involved with driving decisions. As this guide is implemented it should be incorporated with continuing education opportunities and further knowledge in the field of driving. This is a starting point only. Experienced driving experts should take an interest in the development of more intense guidelines and standards.

To continue with the reliability and validity of this product, qualitative and quantitative studies regarding the outcomes of the guide should be conducted. Further research and investigation should also be addressed regarding the evaluation tools and the correlation that they have with driving.

The guide produced for this project will be made available upon request. The users of the guide will be asked for feedback and recommendations for use of the resource. The feedback from the users will be applied to further the effectiveness of the product and make driving more accessible to all occupational therapy practitioners and their clients.

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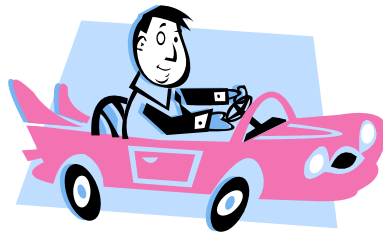
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Appendix

An Occupational Therapist's Guide for Rehabilitative Driving with Traumatic Brain Injured Clients



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Master of Occupational Therapy

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Introduction

Community mobility and transportation are essential components of socialization

and interaction with the environment. Driving, one aspect of community mobility contributes to the environment and socialization experience. Losing community mobility and driving abilities can lead to depression, isolation, and loneliness (Stav, Pierce, Wheatley, & Davis, 2005). Occupational therapists are responsible for guiding and directing individuals in all aspects of community mobility.

The environment, the occupation, and the individual all comprise critical aspects of driving. As individuals make their way throughout the community they can increase interaction and socialization opportunities. The Canadian Model of Occupational Performance has been utilized to enhance the development of the product and incorporate the environment, occupation, and the person (Kielhofner, 2004). The use of this model when addressing driving needs can provide the therapist with the tools to address all areas of concern.

With many traumatic brain injuries the concept of meaning becomes an issue. The Canadian model provides evidence and support to address this concern and provide the client with motivation and meaning related to community mobility. When a therapist is equipped with the proper tools needed to address driving concerns and focuses on the particular needs of the client results in client-centered practice (Kielhofner, 2004). Client-centered practice has been effective in meeting the needs and challenges with a variety of client populations. The purpose of this guide is two fold: The first purpose is to help occupational therapists find a starting point when addressing rehabilitative driving. The second purpose is to document the efficacy of driving rehabilitation with clients diagnosed with traumatic brain injury. The following material includes resources

occupational therapists can utilize to increase awareness and find more choices when addressing driving. The key national organizations addressing driver relates issues are identified. Selected evaluation tools are described to set baseline for clients and to determine readiness for further evaluation regarding driving. Treatment options and resources for driver rehabilitation are described as well as options for clients who are not able to return to driving.

National Organizations and Programs

Driving rehabilitation is an uprising industry in the occupational therapy world. There are not many organizations that are specific to rehabilitative driving. There are however many organizations that can be referenced to give guidance and support to occupational therapy practice pertaining to driving. The following organizations and programs are some well known and accredited institutes that can lead therapists in the right direction and provide answers. The organizations and programs listed are from national traffic and safety organizations to brain injured specific programs. Included in this list is the American Occupational Therapy Association, which is leading the way in promoting and providing evidence for emerging practice areas including driver rehabilitation. The last organization listed is the accredited organization to certify qualified individuals as driving experts. As rehabilitative driving is addressed it should be noted that the list is not a limiting factor, but a start to further an occupational therapist's research.

National Highway Traffic Safety Administration (NHTSA)

- The NHTSA is a government based agency that focuses on traffic safety, vehicles and equipment, laws, regulations, and guidance, and vehicle safety research. This organization can be utilized to maintain legality and stay up to date on critical issues and legislation regarding driving and traffic safety.
 - Contact Information
 - NHTSA Headquarters
1200 New Jersey Avenue
West Building
Washington, DC 20590
 - Phone: 1-888-327-4236
 - Web Address: <http://www.nhtsa.dot.gov/>

Advocates for Highway and Auto Safety

- This organization is an alliance of health professionals, consumers, safety groups, and insurance companies working together to make roads safer for all people.

This group encourages the adaption and use of state and national laws regarding driver safety. This alliance has resources available for individuals to become educated in laws and give opportunities for people to take action in establishing and upholding driving laws.

- Contact Information

- Advocates for highway and Auto Safety

750 First St, NE

Suite 901

Washington, DC 20002

- Phone: 1-202-408-1711
- Email: advocates@saferoads.org
- Web Address: <http://www.saferoads.org/index.htm>

National Institute for Driver Behavior (NIDB)

- The NIDB is a foundation focus on reducing behaviors related to risks to help reduce driving accidents. The NIDB is user friendly and has many programs that can further knowledge in driver safety. This program is geared towards school and work settings and focuses on identifying standards for low risk driver performance habits. Another goal of this organization is to partner with other organizations to achieve common goals and make road-ways safer. By developing a structured outline this program gears itself towards driver safety and future safe drivers.

- Contact Information

- National Institute of Driver Behavior

- P.O. Box 98

- Cheshire, CT 06410

- Web Address: <http://www.nidb.org/>

Brian Injury Association of America

- This organization is the leading association for brain injury survivors, families, and professionals. This organization has over 40 state charters that provide education and resources to anyone searching for answers related to brain injuries. Local organizations that are associated with this organization can help with resources and locating the necessary tools to properly treat brain injured clients. The national association can link individuals to local and state organizations to make tools more accessible.

- Contact Information

- Brain Injury Association of America

1608 Spring Hill Road, Suite 110

Vienna, VA 22182

- Phone: 1-703-761-0750
- Web Address: <http://www.biausa.org/index.html>

Brain Injury Resource Foundation

- This organization is a branch of the Georgia Brain Injury Association and has been developed to give resources to anyone starting life again after a brain injury. This foundation has multiple resources related to driving after a brain injury. This organization not only focuses on informing and preventing injury, but provides a resource base for those that have already sustained an injury and need guidance. Specifically this organization has a large resource base of driving after brain injury and how to acquire licensure.

- Contact Information

- Brain Injury Resource Foundation

1441 Clifton Rd Ne #114-A

Atlanta GA, 30322

- Web Address:

http://www.birf.info/home/library/transport/trans_drive_ot.html

American Occupational Therapy Association (AOTA)

- AOTA is the national governing body for occupational therapy. AOTA is focused on maintaining quality delivery of occupational services, promoting the profession, and improving patient access to healthcare. This occupational therapy based organization is a forefront entity in promoting new and emerging practice areas. This organization produces multiple publications that have addressed rehabilitative driving and community mobility. As a member of this association access is granted to all publications. With access to all publications therapists can retrieve and reference numerous driving and community mobility articles and further their knowledge in therapy. Another benefit offered through this association is the continuing education opportunities related to driving offered at various times and locations.

- Contact Information:

- The American Occupational Therapy Association, Inc
4720 Montgomery Lane
PO Box 31220
Bethesda, MD 20824-1220
- Phone: 1-800-377-8555
- Web Address: www.aota.org

The Association for Driver Rehabilitation Specialists

- This association is the standard for driving specialists. Certification is acquired through the Association for Driving Rehabilitation Specialists. The website provided by this foundation can be a helpful tool for any therapists interested in furthering driver rehabilitation skills and gaining further education and training. Utilizing the Certified Driver Rehabilitation Specialist directory, therapists can locate and network with certified individuals in their region to better serve brain injured patients.

- Contact Information

- ADED

8601 Six Forks Road, Suite 400

Raleigh, NC 27615

- Phone: 1-919-529-1830
- Web Address:
<http://www.aded.net/i4a/pages/index.cfm?pageid=1>

Evaluation

Initial Evaluation

The initial evaluation should be conducted in a quiet environment that is distraction free. Traumatic Brain Injured clients can be easily sidetracked and therefore quality information in this part of the evaluation may not be gathered if distractions occur. Other components of the evaluation may be conducted in various environments to gather distractibility information related to driving. The following section describes some of the tools that can be used to provide baseline data in evaluating a client's readiness for resuming driving. Due to the nature of driving and the connection it has with the environment, the individual, and the task (driving), one of the assessments utilized in the evaluation process is the Canadian Occupational Performance Measure.

This evaluation tool is directly linked to the Canadian Model of Occupational Performance. The Canadian Model specifically describes the environment, the person, and the task and relates it to the overall performance of the client (Kielhofner, 2004). Another focus of this Model is to make occupational therapy practice client-centered. With specific goals such as driving and helping clients develop meaning with community mobility and their ability to move throughout their environment makes this model and evaluation tool a perfect fit.

Other evaluation processes that will be discussed in this section are the on and off-road evaluation processes. On-road evaluation practices are based on standardized testing. These tests are numerous and can be used at the user's discretion. There are multiple standardized testing tools available to occupational therapists and many can meet the needs for driver evaluations (French & Hanson, 1999; Korner-Bitensky,

Bitensky, Sofer, Man-Son-Hing, & Gelinas, 2006). This manual will make recommendations and provide users with information regarding specific evaluations. This guide is not setting limits, but making suggestions for therapists new to driving rehabilitation and providing a starting point for evaluation.

As a part of the initial evaluation a tool has been developed for this product to specifically address driving needs for traumatic brain injured clients. The full Initial Evaluation Worksheet for Rehabilitative Driving with Traumatic Brain Injured Clients can be found in the Appendix of this product. Some of the points addressed in this evaluation tool are as follows:

- Medical History
- Current Medical Status Including Medications
- Problem Individuals are Experiencing (dizziness, seizures, etc.)
- Activities of Daily Living Status
- Instrumental Activities of Daily Living Status
- Range of Motion Testing
- Manual Muscle Testing and Grip Strength
- Driving History
- Preferences and Adaptations Utilized

Canadian Occupational Performance Measure (COPM)

The Canadian Occupational Performance Measure (COPM) is a standardized evaluation that was developed in 1990. This assessment focuses on assisting the client and therapist to recognize limitations in self-care, productivity, and leisure (Kielhofner, 2004). The usage of this assessment with driving focuses on the productivity and leisure aspects related to driving. Self-care is also an issue with community mobility and the individual's ability to make appointments and obtain the necessary items for taking care of personal needs. This assessment lets the individual identify what is important to them and how they rate it. The client-centered aspect of this evaluation makes it non-threatening to the client and allows them to specifically identify what they see as a problem area (Law et al., 1990). This is significant in the sense that it allows a client to specifically identify driving or community mobility as a problem area without a therapist probing and influencing a client's decisions.

The COPM includes a semi-structured interview that focuses on identifying problem areas. After the client identifies the problem areas they are prompted to rate the importance of these problem areas on a 1 to 10 scale. Once they have identified all problem areas, they are then asked to identify the top five problems. They are then asked to identify again on a 1 to 10 scale for each problem the level they are currently performing at and the satisfaction they have with this performance (Law et al., 1990). After all the data is gathered the occupational therapist then calculates the score based on a formula provided with the evaluation. This assessment can be used to track progress

over time. This evaluation is set up to re-evaluate multiple times giving the therapist a tracking tool and providing the client with a feedback method to track improvement in performance.

Off-Road Standardized Evaluations

The following assessments have been chosen because of the information gathered in the literature review. The reliability and validity have also been reviewed by the author. Multiple assessment tools have been considered, it should be noted that other evaluations may be used that are not listed in this guide. The author has chosen the following evaluation tools to help occupational therapists who do not have knowledge in assessing driver fitness experience ease in the transition to new practice areas such as driving. Standardized evaluations are the most reliable and many facilities may have assessments available to access making the evaluation process easier for the occupational therapist (Korner-Bitensky et al., 2006). The assessment tools are categorized into cognitive, perception, vision, and physical ability. Each evaluation is listed with a short description, the required materials for administration, the authors if available, and the source to locate the evaluation.

Cognitive Off-Road Evaluations

Mini Mental State Examination (MMSE)

- **Authors:** Marshall F. Folstein, Susan E. Folstein, and Paul R. McHugh
- **Population:** Adults with psychiatric, neurological, and general medical conditions.
- **Description:** Providing a short and simple evaluation the MMSE provides a quantitative measure of cognitive functioning. This tool can be utilized as a routine measurement for performance levels and mental status. Using a question and answer format, the administrator orally delivers questions to client. There are 11 questions that address five areas of cognition: orientation, registration (memory), attention, and calculation, recall, and language (following oral and written instructions). This assessment is the most commonly used cognitive evaluation when addressing driver rehabilitation within the United States.
- **Time Required:** 5-10 minutes
- **Materials for Administration:** The questionnaire, a watch, pencil, and four sheets of blank white paper.
- **Reliability and Validity:** Test and re-test reliability for a 24 hour interval was 0.887, over a 28 day interval with clinically stable patients it was 0.98. To demonstrate validity the MMSE has been correlated with the Wechsler Adult Intelligence Scale. Reliability and validity have been demonstrated in psychiatric, neurological, and other general medical populations.

- **Source:**

Folstein, M.F., Folstein, S.E., & McHugh, P.R. (1975). Mini-Mental State: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12, 189-198.

- **References:**

Cooke, D.M. & Kline, N.F. (2007). Cognitive Assessments. In I.E. Asher (Ed.). *Occupational therapy assessment tools: An annotated index* (3rd ed.). Bethesda, MD: AOTA.

Folstein, M.F., Folstein, S.E., & McHugh, P.R. (1975). Mini-Mental State: A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, 12, 189-198.

Nilsson, F.M. (2007). Mini Mental State Examination (MMSE) - probably one of the most cited papers in health science. *Acta Psychiatrica Scandinavica*, 116, 156–157.

Trail Making Test Part (TMT) Part A and B

- **Authors:** Ralph M. Reitan & Deborah Wolfson (1985). The TMT was originally part of the Army Individual Test Battery developed by Ralph M. Reitan in 1958.
- **Population:** Adults with neurological deficits related to cognitive flexibility and executive functioning. Alternate forms have been created to adapt the TMT across a broader population.
- **Description:** The TMT is a simple evaluation that tests the speed of processing, sequence alternation, cognitive flexibility, visual search, motor performance, and executive functioning. The TMT consists of two parts, part A and part B. Part A is a series of encircled numbers that descend on the paper in random order, the client is to connect the numbers in numerical order as quickly and accurately as possible number 1 through 25. Part B is set up in the same format except it alternates between numbers and a corresponding letter. For example 1-A, 2-B, 3-C, and so on. The patient is required to complete through the number 13 and the letter L.
- **Time Required:** 5-10 minutes
- **Materials for Administration:** The evaluation sheets with the encircled numbers or letters, a pencil, and a timer.
- **Reliability and Validity:** Reliability ratings for the TMT vary from 0.78 to 0.92. It is stated that the reliability is related to the practice effects of the TMT. Practitioners can vary the reliability with different practices of the administration. Shorter intervals have shown a larger practice effect such as 6 weeks, but year

long interval in interrater reliability has shown little to no practice effects on reliability. To demonstrate validity the TMT has been used with and correlated to the Wisconsin Card Sorting Test. The test has exact words to follow in italicized form to ensure validity of testing.

- **Source:**

Army Individual Test Battery. (1944). *Manual of directions and scoring*.
Washington, DC: War Department, Adjutant General's Office.

Reitan, R. M. (1992). *Trail making test: Manual for administration and scoring*.
Tucson, AZ: Reitan Neuropsychology Laboratory.

- **References:**

Bowie, C.R. & Harvey, P.D. (2006). Administration and interpretation of the Trail Making Test. *Nature Protocols*, 1, 2277-2281.

Perianez, J.A., Rios-Lago, M., Rodriguez-Sanchez, J.M., Adrover-Roig, D., Sanchez-Cubillo, I., Crespo-Facorro, B., Quemada, J.I., & Barcelo, F. (2007). Trail Making Test in traumatic brain injury, schizophrenia, and normal aging: Sample comparisons and normative data. *Archives of Clinical Neuropsychology*, 22, 433-447.

Reitan, R. M. (1992). *Trail making test: Manual for administration and scoring*.
Tucson, AZ: Reitan Neuropsychology Laboratory.

Perceptual Off-Road Evaluations

Motor-Free Visual Perception Test, 3rd Edition (MVPT-3)

- **Authors:** Ronald P. Colarusso and Donald D. Hammill.
- **Population:** Children and adults ages 3 to 95 years old.
- **Description:** The MVPT-3 was developed to provide a speedy and straightforward assessment of visual perception that does not require the subject to create motor movements. This evaluation can be utilized in screening, diagnosing, and research. The MVPT is comprised of 65 test pages. 1 through 40 are designed for ages children aged 4 to 10, and items 41 to 65 are designed for ages 10 and above. The MVPT tests five categories of visual perception. These areas include spatial relationships, visual discrimination, figure ground, visual closure, and visual memory. The evaluation does not require that the participant speak, they may point to the correct answer if they chose to. There is another form of the MVPT that allows the individual to vertically view the test (MVPT-V). This format is designed to accompany individuals with spatial deficits associated with hemifield visual neglect or abnormal visual saccades. The MVPT is one of the most common utilized evaluation tools associated with driving.
- **Time Required:** Approximately 25 minutes
- **Materials for Administration:** MVPT-3 templates, manual, scoring sheets, and a pencil.

- **Reliability and Validity:** Using Cronbach's coefficient alpha to identify the internal consistency the MVPT showed 0.86 to 0.90 reliability across different ages. The test-retest reliability was 0.87 to 0.92. The validity was established through the literature review, item trial and analysis. The MVPT-3 also correlated well with other visual perceptual tests.

- **Source:**

Academic Therapy Publications
20 Commercial Blvd.
Novato, CA 94949
Tel.: 800-422-7249
Email: sales@academictherapy.com
Web site: www.academictherapy.com

- **References:**

Brown, T. & Jackel, A.L. (2007). Perceptual Assessments. In I.E. Asher (Ed.),
Occupational therapy assessment tools: An annotated index (3rd ed.).
Bethesda, MD: AOTA.

Korner-Bitensky, N., Bitensky, J., Sofer, S., Man-Son-Hing, M., & Gelinas, I.
(2006). Driving evaluation practices of clinicians working in the United
States and Canada. *American Journal of Occupational Therapy*, 60, 428-
434.

Clock Test (CT) or Clock Drawing Test (CDT)

- **Authors:** Holly Tuokko, Thomas Hadjistavropoulos, Jo Ann Miller, Annette Horton, and Lynn Beattie.
- **Population:** Older adults that have neurological or perceptual deficits. This test was originally designed for ages 65 to 85 years old.
- **Description:** To measure impairment the CT was designed to screen the visuospatial and constructional disabilities of the population. The CT consists of three parts, the first is clock drawing, clock setting (draw a specific time), and clock reading. The clock drawing consists of the individual drawing a clock on a blank sheet of paper. A score of up to 10 is derived from the individual's drawing based on placement of hands and numbers. The CT is equipped with specific scoring criteria; any score below 10 is associated with some sort of perceptual deficit.
- **Time Required:** 10 minutes total
- **Materials for Administration:** The CT manual, scoring forms, a blank sheet of paper, and a pencil.
- **Reliability and Validity:** Test-retest reliability was 0.78 after 12 weeks. Interrater reliability was 0.97. Validity was observed through factor analysis, concurrent validity was based on correlation with the Mini-Mental State, the

Mattis Dementia Rating Scale, and the Global Impression of Neuropsychological Impairment Scale.

- **Sources:**

Multi-Health Systems, Inc.
3770 Victoria Park Avenue
Toronto, ON M2H 3M6 Canada
Tel.: 800-268-6011, 416-492-2627
Email: customerservice@mhs.com
Web site: www.mhs.com

- **References:**

Brown, T. & Jackel, A.L. (2007). Perceptual Assessments. In I.E. Asher (Ed.),
Occupational therapy assessment tools: An annotated index (3rd ed.).
Bethesda, MD: AOTA.

Straus, S.H. (2007). Use of the automatic clock drawing test to rapidly screen for
cognitive impairments in older adults, drivers, and the physically
impaired. *Journal of the American Geriatrics Society*, 55, 310-311.

Visual Off-Road Evaluations

Automated Visual Testers

- **Titmus*i*500**
 - **Manufacturer:** Titmus Premium Vision Screening.
 - **Population:** The Titmus*i*500 series is designed to fit all ages and accommodate for all people regardless of literacy or age.
 - **Description:** The Titmus*i*500 is an automated visual test designed to fit all people. The Titmus is equipped with built-in screening software, electronic scoring of test results, and many features for ease and comfort of testing. This visual tester incorporates a touch screen that allows for easy access to information and test results and a walk through process for the client. With a new fluorescent lighting technology the Titmus*i*500 can produce a very close replica of actual daylight. This automated visual tester can screen for natural line of sight, far and near vision, depth perception, binocularity of both eyes, acuity of both eyes, acuity of individual eyes, and other related screening templates. The Titmus also can test the night vision of an individual for night driving conditions. The results can then be compared to a variety of job settings. This is helpful if the client also has goals of returning to work and driving is their mode of transportation.

- **Source:**

690 HP Way

Chester, VA 23836

Phone: 800-446-1802

Email: info@titmus.com

Web site: www.titmusiseries.com

- **Reference:**

Sperian, Titmus *i* Series (n.d.). Retrieved November 5, 2007, from

<http://www.titmus.com/series/i500%20TNO%20Brochure%20120106.pdf>.

Babirad, J. (2002). Driver evaluation and vehicle modification. In D.A.

Olson, F. DeRuyter (Eds). *Clinician's guide to assistive technology*. Philadelphia: Mosby, Inc.

- **Keystone VS-V Medical (with Glare Test) Tester**

- **Manufacturer:** Keystone View.
- **Population:** The Medical model of the Keystone View Tester is geared towards the adult population with medical issues resulting in vision impairment.
- **Description:** The Keystone VS-V Medical Tester is an automated vision tester that has been programmed for medical specific needs. The Keystone Tester is equipped with the Dark Adaption Exam which makes is reimbursable by Medicare and some insurance companies. It is also equipped with templates to test contrast sensitivity, acuity, color perception, depth perception, eye coordination, and glare recovery. The templates that this automated tester is set up with make it an ideal vision tester when addressing driving.
- **Source:**

2200 Dickerson Road

Reno, NV 89503

Phone: 866-5746360

E-mail: sales@keystoneview.com

Web site: www.keystoneview.com

○ **Resource:**

Keystone View, VS-V GT Medical Vision Screener (2003). Retrieved

November 5, 2007, from

<http://www.keystoneview.com/?p=pv&id=258>.

Babirad, J. (2002). Driver evaluation and vehicle modification. In D.A.

Olson, F. DeRuyter (Eds). *Clinician's guide to assistive*

technology. Philadelphia: Mosby, Inc.

Visual Field Deficit Screening Tool

- **Procedure for Practice**

- **Equipment**

- Eye patch
 - Interesting target mounted on stick

- **Setup**

- Patient seated directly opposite of the examiner, approximately 20 inches apart from eye to eye.
 - Distraction free background behind examiner.

- **Procedure**

- Patch the left eye of the patient and close or patch your own right eye.
 - Instruct patient to look at you left eye and tell him you will be moving a target in from the side and the patient is to tell you when they first see the target.
 - Move target in from various angles; begin at 12 o'clock then 2, 4, 6, 8, and 10.
 - Compare the patient's answers to what you viewed.
 - Position hands a 3 and 9 o'clock so that you can just see your fingers. Ask the patient how many fingers you are holding up.
 - Patch the patient's right eye and close or patch your own left eye. Repeat the previous four steps.
 - A problem is indicated if the patient cannot see the target when he does not see both fingers simultaneously.

- **Reference:**

Scheiman, M. (1997). *Understanding and Managing Vision Deficits: A Guide for Occupational Therapists*. Thorofare, NJ: Slack.

Smooth Pursuits and Visual Tracking Screening Tool

- **Procedure for Practice**
 - **Equipment**
 - A small interesting target
 - **Setup**
 - Seat the patient directly in front of the examiner.
 - Hold target about 16 inches from the patient's eyes.
 - **Procedure:**
 - Do not give directions to patient regarding head movements.
 - Tell the patient to watch the target and do not take their eyes off of it.
 - Move the target clockwise 2 rotations and counter clockwise 2 rotations.
 - Observe
 - Number of rotations the patient completes.
 - Ability to maintain fixation, that is the number of times the patient has to refixate.
 - Movement of the body and head.
- **Reference:**

Scheiman, M. (1997). *Understanding and Managing Vision Deficits: A Guide for Occupational Therapists*. Thorofare, NJ: Slack.

Saccades Screening Tool

- **Procedure for Practice**

- **Equipment**

- Two targets (tongue depressors with one red and one green circle on the end)

- **Setup**

- Patient is to be seated directly in front of the examiner.

- **Procedure**

- Hold wands approximately 16 inches from the face, separate the wands by about 8 inches.
 - To do not give directions regarding head movements.
 - Tell the patient to look at the red dot when you say red. Tell patient to look at the green dot when you say green.
 - Then tell the patient to look from one target to the other for a total of 10 fixations, 5 fixations on each color.
 - Observe.
 - Ability to complete the 10 fixations.
 - Accuracy of eye movements (look for overshooting or undershooting the targets).
 - Look for movement of the head during activity.

- **Reference:**

Scheiman, M. (1997). *Understanding and Managing Vision Deficits: A Guide for Occupational Therapists*. Thorofare, NJ: Slack.

Physical Ability Evaluations

Stationary Simple Reaction Timer by Vericom Computers (Brake Reaction Timer)

- **Population:** This evaluation is appropriate with anyone that is of legal age to drive. It may also be utilized with those that are studying for testing. The brake reaction timer has been used by agencies from AAA to rehabilitation centers.
- **Description:** The Stationary Simple Reaction Timer is a brake reaction timer computer program that has been set up to record the time it takes for the individual to react by pressing a break pedal when stimulated by an on screen stimulus. This specific reaction timer is equipped with the reaction time software, digital driving scene, the steering wheel, throttle foot pedal, and a brake foot pedal. The client is seated in front of a desk with the steering wheel mounted onto the desk and the pedals placed under their feet. The software is installed and creates a digital scene that provides obstacles and required reactions to avoid failure. When a reaction is recorded the computer keeps a record of the time that each response took. This company has also created a mobile reaction timer that is installed into a vehicle with a dash mounted sensor that produces a light when the driver needs to respond. This product can be effective for a more realistic experience, but may be a threat to the safety of all who are involved. Therefore the Stationary Simple Reaction Timer is suggested to safely and accurately gather the need reaction time data. The Stationary Simple Reaction Timer is priced at \$395.00 for all the pedals, steering wheel, and software.

- **Source:**

Vericom Computers, Inc

14320 James Road

Suite 200

Rogers, MN 55374

Phone: 800-533-5547

E-mail: vericom@vericomcomputers.com

Web site: www.vericomcomputers.com

- **Reference:**

Vericom Computers Inc., Stationary Simple Reaction Timer. (n.d.). Retrieved

October 2, 2007, from

<http://www.vericomcomputers.com/StatReactionTimer.htm>

Motor Assessment Scale (MAS)

- **Authors:** Janet H. Carr and Roberta B. Shepherd
- **Population:** Stroke patients are the targeted population. This assessment can also be utilized with other neurological populations including traumatic brain injuries.
- **Description:** The MAS quantitatively measures the motor recovery of stroke victims by having them perform functional tasks. The MAS consists of one item that measures general muscle tone and eight items that measure motor function: supine to sitting at side of bed, balanced sitting, sitting to standing, walking, upper-arm function, hand movements, and advanced hand activities. Items can be scored on a 0 to 6 scale with 6 being optimal performance. Items on this assessment can be administered in any order. This assessment is good for viewing many deficits. Balance and dizziness can be viewed as the patient performs gross motor functional activities. These items are closely related to driving and should be noted throughout this assessment.
- **Time Required:** 15-30 minutes
- **Materials for Administration:** The administrator will need the rating scale, a pencil, low and wide plinth, stopwatch, polystyrene cup, jellybeans, teacups, rubber ball, stool, and a comb, pen with a top, table, dessert spoon, water, paper, and cylinder.
- **Reliability and Validity:** The assessment was videotaped to determine reliability. On a 4 week interval reliability by a single rater was ranged 0.87 to 1.00 with the

average correlation being 0.98. Concurrent validity was determined by correlating this assessment with the Fugl-Meyer Assessment. It was determined that walking was the biggest predictor of change from rehabilitation admission to discharge.

- **Source:**

Carr, J.H., Shepherd, R.B., Nordholm, L., & Lynne, D. (1985). Investigation of a new motor assessment scale for stroke patients. *Physical Therapy*, 65, 175-180.

- **References**

Amini, D.A. (2007). Motor Assessments. In I.E. Asher (Ed), Occupational therapy assessment tools: An annotated index (3rd ed.). Bethesda, MD: AOTA.

On-Road Evaluation

On-Road Evaluation

The on-road evaluation process may be the most difficult for a therapist that is new to driver rehabilitation (Marshall, Man-Son-Hing, Hunt, & Finestone, 2005). There is a great deal of liability involved with on-road assessments. Traumatic brain injured clients are known to lack consistency with their behaviors. Introducing a car and the actual driving aspect of the evaluation can cause an unexpected amount of stress and anxiety on the client. It is very important the occupational therapist be aware of any difficulties that the individual may be experiencing with this part of the assessment.

Safety

Safety is the first concern for driver rehabilitation. It is the occupational therapist's responsibility to ensure safety for all those involved in the driving evaluation. The use of inappropriate driving evaluation practices may compromise the safety of the community (French & Hanson, 1999). Occupational therapists that take on this responsibility need to familiarize themselves with traffic laws and regulations. The therapist needs to be aware of mistakes and point them out the driver if they are putting anyone in danger. Driving tests should be stopped immediately if accident or possible accidents may occur. If a client is not performing well and is putting the community in danger the therapist should stop the evaluation and drive the car back to the starting point.

Choosing a Route

The route should be mapped out by the occupational therapist before the on-road evaluation is to take place. The occupational therapist needs to consider the time of day and the weather conditions. School zones should be avoided on the first trial of driving for safety purposes. The route should progress from the simplest to the more difficult situations (quiet streets to busy highways). It is suggested that a car be used that has been adapted for on-road evaluations. Equipped cars may include a set of pedals on the passenger side that allows the passenger or therapist to brake or accelerate the vehicle.

Client Reactions

In this section the focus is on the reaction to the laws and general rule of the road. Client reactions are also associated with the other vehicles on the road and the client's response to various traffic conditions. The occupational therapist should take notes of the driver throughout the evaluation. If the client is not comfortable with the therapist taking physical notes, the therapists should not put them in an uncomfortable situation on the first driving experience and mental notes should be taken. If this occurs it should be noted and recorded that the client did not perform well under pressure.

Physical Abilities

Strength and range of motion are important when driving is addressed. The assessment portion of this guide addressed this important with the Initial Evaluation and Motor Assessment Scale. Drivers need to be fit to perform multiple actions at once. Safety is strongly dependant upon the physical ability of the client.

Results

The results of the on-road evaluation are determined by the occupational therapist. Therapists that are addressing driving fitness need to become familiar with traffic laws and regulations. With a firm knowledge of what is legal and what is safe the occupational therapist can then make a sound decision whether or not the client is fit to drive. The notes of the test should be reviewed and a second on-road evaluation may be conducted to further the correct decision. Consistency is not always evident with traumatic brain injured clients and a second evaluation may help solidify the decision making process. If at anytime anyone was put into a dangerous situation that could have been avoided, it is necessary to fail the driver. If the situation was connected to the client's stage of recovery and further treatment is needed before they are fit to drive then the occupational therapist can address this with the client and their families. Treatment options are available for driver rehabilitation and may help to ensure future safety. Options are not limited to driving alone; rather community mobility and access to public programs may benefit the

client more than driving. These topics will be addressed in more detail in the next section of this guide.

An On-Road Evaluation Checklist has been developed for this guide. The checklist can be located in the appendix.

Recommendations for Non-driving Clients

After a client has been evaluated both off and on the road it is the occupational therapist's judgment that determines the results. When clients are not fit to drive recommendations for other community mobility options then need to be made (Korner-Bitensky et al., 2006). Community mobility is essential for social interaction and increased independence. There are many options to move about the community besides driving. Options are as follows:

➤ Family Support

- Families are a great resource to increase community interaction and help clients regain independence (Irdesel, Aydiner, & Akgoz, 2007). Families can provide transportation through personal modes and by asking outside sources to help in the transportation of the client. Friends fall into this category as well. Often friends are great resources in helping a client regain independence.

➤ Community Transportation

- Many communities have public access transportation. These programs are usually grant funded and are available at a low cost. Many senior citizen programs have transportation available that all community members have access to at low costs. These services will usually provide access to all community members with special circumstances such as TBI. Taxi

services are another community resource. This option is more costly than others but can be utilized when no other options are available. Public bussing is often times available in many communities. This is a great option that allows clients to interact with more people and learn other IADL skills that TBI survivors are focusing on. Other community transportation systems include subways and trains. When community and public options are not available or the client is not comfortable the other suggested options should then be utilized.

➤ **Walking**

- This option can be beneficial to many TBI clients. Walking not only provides transportation but also provides exercise for the client. Many TBI patients suffer from depression and other related problems. The exercise from walking can help decrease symptoms related to these issues. Walking is also helpful with increasing balance. Patients can also benefit from the navigation skills that walking requires. Walking is a very independent activity that allows the individual to move about the community without assistance (Stav et al., 2005).

➤ **Other Modes of Transportation**

- For clients that may not have access to or are not comfortable with the above modes of transportation can select other various modes of transportation. Some of these modes include bike riding, a motorized

scooter, and various other modes. These alternative modes should be carefully discussed with the occupational therapist to ensure safety throughout the community. All modes of transportation should be evaluated for safety and allow the individual to be independent. All of these other modes of transportation have similar concerns as driving. This is important to address and help ensure the safety of the client.

Conclusion

This guide has provided information for any occupational therapist that is interested in the entry levels of rehabilitative driving. There are other available resources for driving rehabilitation. This guide has been developed to give a starting point in the rehabilitation process and evaluating clients for driving and their community mobility methods. The development of this guide has placed emphasis on the Canadian Model of Occupation Performance. With the unique nature of driving this model was chosen because of the emphasis on the environment, the person, and the occupation. Driving is an important component of community mobility; the Canadian model has helped address the aspect of the individual wanting to drive within their environment. The overall intent of this guide is to make rehabilitative driving more accessible and to encourage more occupational therapists to take interest addressing driving issues with clients recovering from traumatic brain injury.

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- Keystone View, (2003). VS-V GT Medical Vision Screener. Retrieved November 5, 2007, from <http://www.keystoneview.com/?p=pv&id=258>.
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- Marshall, S., Man-Son-Hing, M., Molnar, F., Hunt, L., & Finestone, H. (2005). An exploratory study on the predictive elements of passing on-the-road test for disabled persons. *Traffic Injury Prevention*, 6, 235-239.

- Nilsson, F.M. (2007). Mini Mental State Examination (MMSE) - probably one of the most cited papers in health science. *Acta Psychiatrica Scandinavica*, 116, 156–157.
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- Stav, W.B., Pierce, S., Wheatley, C.J., & Davis, E.S. (2005). Driving and community mobility. *The American Journal of Occupational Therapy*, 59, 666-670.
- Straus, S.H. (2007). Use of the automatic clock drawing test to rapidly screen for cognitive impairments in older adults, drivers, and the physically impaired. *Journal of the American Geriatrics Society*, 55, 310-311.
- Vericom Computers Inc., Stationary Simple Reaction Timer. (n.d.). Retrieved October 2, 2007, from <http://www.vericomcomputers.com/StatReactionTimer.htm>.

APPENDIX

Initial Evaluation Worksheet for Rehabilitative Driving with Traumatic Brain Injured Clients

Client:

Diagnosis:

Referral Source:

Date:

Past Medical History:

Current Medical Status Including Medications:

What Problems Are You Experiencing (Dizziness, Seizures, etc.)

Activities of Daily Living Status:

Self Care:_____

Functional Mobility:_____

Sleep and Rest:_____

Instrumental Activities of Daily Living Status:

Health Management:_____

Financial Management:_____

Meal Preparation:_____

Community Mobility:_____

Range of Motion Testing and Manual Muscle Testing for the Upper Extremity			
	Range of Motion	Manual Muscle Testing	Functional
Shoulder Flexion			
Shoulder Abduction			
Horizontal ABD			
Horizontal ADD			
Internal Rotation			
External Rotation			
Elbow Flexion			
Elbow Extension			
Wrist Flexion			
Wrist Extension			

Range of Motion Testing and Manual Muscle Testing for the Lower Extremity			
	Range of Motion	Manual Muscle Testing	Functional
Hip Flexion			
Hip Extension			
Hip ABD			
Hip ADD			
Hip Int Rotation			
Hip Ext Rotation			
Knee Flexion			
Knee Extension			
Plantar Flexion			
Dorsi Flexion			
Inversion			
Eversion			

Grip Strength: Left:_____ Right:_____

Driving History

How many years of driving experience before TBI?

Training or extended education for driving (driver's education)?

How many road violations before TBI?

Have you caused or been involved in any traffic accidents?

How long has it been since you last driven?

Have you attempted to drive since your injury?

What will you do if you are not able to drive?

What other choices are you considering for community mobility?

Preferences or Adaptations Previously Used

Previous Adaptations (extended mirrors, steering knob, cushion or seat pad, etc):

Describe your driving style (defensive, aggressive, etc.)

Visual needs or limitations (glasses, driving restrictions, etc.):

Date of last visual examination:

Other Comments or Added Questions

Therapist's Signature:_____

On-Road Evaluation Checklist

Client:

Diagnosis:

Referral Source:

Date:

General Safety			
Yes	No		Comments
		Can all accessories in the car be accessed without compromising safety (turn signals, lights, radio dials, window controls and other components of a car)?	
		Does the driver check all mirrors before they put the car into drive?	
		Does the client check the “blind spot” before making lane changes or in a parking lot?	
		Is the client driving reckless and not aware of their surroundings?	
		Are all traffic laws being followed and is the client maintaining control of the vehicle?	
		Are the client and the therapist wearing seatbelts?	
		Is the client cued to put on safety belt/does the client cue the therapist to put on belt?	
Choosing a Route			
Yes	No		Comments
		Does the route provide a variety of traffic situations (heavy, moderate, and light traffic)?	
		Does the route provide different roads (highways, side roads, and dirt roads)?	

		Does the route vary the view of the surroundings (city buildings, housing neighborhoods, and country settings)?	
		Does the route cross or intersect various obstacles (bridges, railroad tracks, and intersections)?	
Client Reaction			
Yes	No		Comments
		Does the client stop at all stop signs and lights and allow enough time for vehicles behind to stop at a safe distance?	
		Is the driver aware of and observe all traffic signs (speed limit, merging lanes, yield signs, crosswalks, and stop lights)?	
		Does the driver maintain a safe distance from other vehicles around them throughout the driving exam?	
		Does the driver over correct or react to driving mistakes (swerving, riding the brakes or accelerator, taking hands of the wheel, or flinch to oncoming traffic)?	
		Are the decisions timely and allow for the driver to maintain safety for those around them on the road?	
Physical Ability			
Yes	No		Comments
		Is the driver able to turn the steering wheel at a safe speed and determine how far to turn the wheel?	

		Is the client able to push the brake and acceleration pedals with the correct pressure without creating jerky movements or sudden stops?	
		If the car is equipped with a manual transmission can the client perform all the tasks such as depressing the clutch and shifting at the safe time?	

Summary of Results:

Test Results: Pass or Fail

Recommendations:

Therapist Signature:_____