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The use of aquatic therapy for children with neuromuscular disorders

Chris Hydukovich
University of North Dakota

Troy Schmitz
University of North Dakota

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## ABSTRACT

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ABSTRACT

Purpose
The purpose of this literature was to determine the effects aquatic intervention has on children suffering from neuromuscular disorders compared to that of traditional land-based physical and occupational therapy services.

Method
A literature search was conducted using PubMed, OT search, AJOT online, CINAHL, the Mayo Clinic Triage, and various occupational therapy textbooks regarding the use of aquatic therapy in a neuromuscular population. Information was extracted from this literature to generate educational material for parents of child receiving aquatic occupational therapy.

Results
A review of literature presented cerebral palsy as the main neuromuscular disorder of study associated with aquatic therapy. Focus of aquatic therapy aimed at increasing such areas as range of motion, functional mobility, normal movement patterns, and feelings of self worth. A majority of the research found aquatic therapy to be viable and effective intervention method. From the outcome based literature reviewed by the authors, parental education material was developed for the purpose of assisting parents to understand the use, benefits, and outcomes of aquatic therapy for their child. The education literature focused on assisting parents in understanding what occupational therapy is and how it relates to aquatic therapy. With this, the education material prepares the parent and/or child for engagement in aquatic therapy and increases parental insight into the therapeutic processes and outcomes expected from aquatic therapy intervention.

Conclusion
The use of aquatic therapy as an occupation-based treatment method is advantageous for children suffering from neuromuscular disorders for a variety of reasons. Increasing range of motion, an ability to engage in basic activities of daily living, and an improved self image are all outcomes that can be achieved through the use of aquatic occupational therapy. This user-friendly patient education material will promote parental understanding of the benefits and outcomes aquatic occupational therapy can provide for their children that traditional, land-based therapy may not.
CHAPTER I

Introduction

The core components of occupational therapy that make the profession unique are the client-centered approach to intervention and the implementation of a client’s meaningful occupations into the therapeutic process. The profession of occupational therapy focuses on the functional components of occupations by assisting people in performing daily activities that are important to them, “regardless of their impairment, disability, or handicap” (Neistadt and Crepeau, 1998, p. 5). With this being stated, it is at times difficult to keep occupation at the core of occupational therapy services, especially in a pediatric population. Parham and Primeau (1997) described play as the main occupation of children. If a child is suffering from a disability, play has the potential to diminish. Keeping play central to the intervention process can be difficult for therapists because it is not easy to use play as a vehicle for therapeutic outcomes. With this being stated, it remains essential to keep play at the core of occupational therapy to assure pediatric patients are able to find meaning and value in the therapeutic experience. Using aquatic therapy for the treatment of children who suffer from one or more disabilities is a potential solution to this “occupational-intervention dilemma”.

The National Center of Physical Activity and Disability (NCPAD) (2006) defines aquatic therapy as “the use of water and specifically designed activity by qualified personnel to aid in the restoration, extension, maintenance, and quality of function for those who have acute, transient, or chronic disabilities, syndromes or diseases” (PII 1).
Occupational therapists who implement aquatic interventions utilize specific skills in treatment interventions to assist in the prevention of dysfunction and reversal of pathological progression. Aquatic therapy is delivered to enhance performance in daily life activities to those individuals suffering with disabilities which potentially limit participation in valued occupations. One such example is children suffering from neuromuscular disorders such as cerebral palsy. Delivering therapy in an aquatic setting has the potential to be therapeutic in a number of ways while still allowing children to engage in meaningful play, therefore making the intervention occupation-based. Additionally, traditional land-based treatments have the potential to cause discomfort and/or pain in children suffering from some forms of neuromuscular disorders. This can turn occupational therapy into a negative experience for the child. Aquatic therapy has the potential to solve this issue as well. Because of warm water’s effect on the body, aquatic therapy is often a more comfortable alternative to traditional intervention techniques.

The purpose of this scholarly project then is to identify the best methods of delivering aquatic therapy interventions and to improve the overall functional abilities of children suffering from neuromuscular disorders. In order to do so, a user friendly guide to delivering aquatic interventions will be generated to assist occupational therapists practicing in an aquatic setting. The guide to therapy will focus specifically on deficits common to children suffering from neuromuscular disorders. Along with this, education material will be generated to assist the parent’s of children receiving aquatic therapy to better understand the components and benefits of aquatic occupational therapy. It will be designed to answer common questions parents may have about aquatic occupational
therapy as well as to reduce the level of concern parents may have about their child engaging in aquatic occupational therapy.

Disability, impairment, and handicap illustrate an individual’s loss or abnormality in the physical structure of functioning (World Health Organization, 2007). When a child is born with a congenital abnormality, they often have difficulty performing the activities they desire and need for survival and living a meaningful life. Therefore, occupational therapy intervention is often required to address these difficulties or deficits. For the purpose of this scholarly project, occupational therapy intervention approaches implemented through the use of aquatic therapy as defined by the American Occupational Therapy Association (2002) will include establish/restore, modify, and maintain. The establish/restore approach is designed to establish or restore abilities that have been impaired but are necessary for functioning. This approach will assist children with neuromuscular disorders to improve such things as pain, range of motion, functional mobility, and ADL performance. The intervention approach of maintain assists clients in preserving functional skills that have been developed through the use of therapy. This approach is in line with the establish/restore approach and assumes that without maintenance, performance could potentially decrease and consequently negatively affect a child’s functioning and health. The maintain approach is significant in children with neuromuscular disorders as a worsening in symptomology often occurs without some type of therapeutic intervention.

The following chapters of this scholarly project will include a review of pertinent literature which will allow the reader to get a better understanding of what type of research has been performed in relation to aquatic therapy. Additional information is
provided regarding what cerebral palsy is and what types of traditional interventions have been utilized by therapists in contrast to aquatic therapy. The following chapter will have a synopsis of the process of the product development. Part one of the product is parental education material for parents with children who may benefit from aquatic therapy. The product focuses on identifying what aquatic occupational therapy is and what it can offer to their children that land-based interventions may not. Part two of the product is a user friendly guide to delivering aquatic occupational therapy to children with neuromuscular disorders. Its intent is to assist therapists in developing and implementing an aquatic therapy treatment plan that keeps play at the core of therapy while still allowing therapists to focus on areas of deficits limiting functioning. The final chapter will include a summary and a conclusion in regards to the scholarly project, its purpose, its limitations, and recommendations for future considerations.
CHAPTER II
Review of Literature

Background of Cerebral Palsy

It is worth noting that in this review of literature nearly all aquatic intervention-based articles and research used the diagnosis of cerebral palsy (CP) as their intended population of interest. Therefore, it is of significant importance to describe cerebral palsy, how this disorder presents itself, and the major limitations found in children and adolescents suffering from cerebral palsy.

Bax (as cited in Hoares, Wasiak, Imms, and Carey, 2007) stated that cerebral palsy refers to “a group of disorders of the development of movement and posture, causing activity limitations, that are attributed to non-progressive disturbances...” that occurred during the development of the fetal or infant brain (p. 2). Although there are additional variables that coincide with CP, the most commonly seen disorders are of postural and movement deficits. Additional disorders often accompanying CP include visual/auditory deficits, cognitive impairments, learning disabilities, oral motor issues, postural problems, and behavioral disorders (Merrill and Mulligan, 2003).

Children with cerebral palsy constitute a large percentage of pediatric patients who receive occupational therapy services. Through the implementation of occupational therapy, patients can increase upper body functions, master basic activities of daily living (ADL’s) such as basic self cares, increase their overall level of functional independence, and increase self esteem and feelings of self worth (National Institute of Neurological
Disorders and Stroke, 2007). Research has indicated that nearly three of every 1,000 children born have a diagnosis of cerebral palsy (Rogers, 2005). This has resulted in nearly 5,000 new diagnoses of CP each year. There are several conditions associated with CP that result in the interference with a child’s ability to interact within their environment. Cerebral palsy disrupts the way the child receives input from the environment through sensory reception and processing of received information. This in turn results in the many difficulties children with cerebral palsy face daily.

The symptoms of cerebral palsy which create difficulty in maintaining functional independence vary widely based upon the type of CP diagnosed. Classifications of cerebral palsy include spastic type, pure athetosis, athetosis with spasticity or tonic spasms, choreoathetosis, flaccid type, and ataxic type (Rogers, 2005). Each of these diagnoses affects children with CP in a different manner. CP can also be further specified by the type and location of a child’s abnormalities (National Institute of Neurological Disorders and Stroke, 2007). These forms of cerebral palsy include quadriplegia, diplegia, and hemiplegia (Rogers, 2005).

Quadriplegia is the most severe form of CP as all limbs are affected by the disorder. This classification of CP usually presents with abnormal posture of the head/neck and extremities. It is often accompanied by moderate to severe cognitive impairment and those diagnosed with quadriplegic CP have difficulty functioning without a high level of assistance. Diplegia refers to CP affecting two extremities, either both legs or both arms. Cognition is usually unaffected and often these children display a moderate to high level of functional independence. Hemiplegic cerebral palsy occurs when the affected limb or limbs are on one side of the body. The affected extremity(s) are usually
smaller than functional or “normal” extremities and physical developmental delays are often present. Speech is also affected, however intelligence is usually intact (National Institute of Neurological Disorders and Stroke, 2007). Each of these types of cerebral palsy has their own symptomology. However, a number of symptoms of cerebral palsy are visible across the various types of the disorder.

Some of the common problematic features of CP include fine motor deficits, balance impairments, decreased range of motion, difficult functional mobility, and uncontrollable body movements. Typically children with CP present impairments in their inability to maintain normal postures because of the lack of muscle co-activation and the development of abnormal movement patterns (Rogers, 2005). Many of these conditions listed above have direct consequences of how the child can interact with and within their environment. When adapting to their environment children tend to implement postural and movement patterns resulting in deformities. That is, they begin to right their own posture to make their interaction in the environment more meaningful. Many deformities begin to develop due to these adjustments without the proper alignment and positioning from a therapist (Rogers, 2005). With these symptoms, other deficits are also noticeable in children diagnosed with CP.

Problems in eating can be associated with abnormal oral motor abilities or the position of which the child is sitting while eating. According too Avery-Smith (2002), “children with CP can have deficits of bolus formation and transit delayed swallow reflexes, pharyngeal immobility, esophageal disease, and aspiration” (p. 1094-1095). These deficits will coincide with the way the child’s head, neck, and limbs are position during the phases of swallowing. Appropriately positioning a child with CP will
maximize symmetrical skeletal alignment, prepare the child for positioning in order to
eat, provide support to free hands, and maximize access to the environment (Avery-
Smith, 2002). With many of these disabling factors present in children suffering from
cerebral palsy, many face psychosocial deficits as well.

A lack of social skills and decreased interpersonal interaction in children suffering
from cerebral palsy result from isolation from their peers secondary to motor problems,
cognitive impairments, and sensory deficits. Therefore, it is important to incorporate
emotional support systems with children at a young age to limit these inadequacies they
may feel as a result of their illness (Merrill and Mulligan, 2003). Having adequate social
interactions is imperative to the development of a support system and the success the
child will have when emotional support is needed or engagement with others is sought.

Land-based Treatment Methods for Neuromuscular Disorders

Although this review of literature is intended to explore the types and benefits of
aquatic therapy for children with neuromuscular disorders, it is important to first
recognize the various treatment techniques implemented to treat cerebral palsy outside of
the aquatic therapy realm. This will lead to a better understanding of some aquatic-based
intervention strategies and methods described later in the text.

Neurodevelopmental treatment approach. The neurodevelopmental treatment
(NDT) approach focuses on inhibiting abnormal movement patterns and promoting
normal movement. The NDT approach has been a core therapeutic technique used by
occupational therapists in the treatment of cerebral palsy adolescents (National Institute
of Neurological Disorders and Stroke, 2007). This approach aims at increasing the child’s
potential to improve motor capability and to reduce musculoskeletal deficits. The NDT
approach also focuses on particular sensorimotor components such as muscle tone, reflexes, movement patterns, postural control, sensation, and perception (Butler and Darrah, 2001). In order to decrease the effects cerebral palsy has on adolescents, therapists implement NDT techniques to achieve normalized tone, decrease abnormal reflex patterns, and increased motion of the limbs. According to Tsorlakis et al. (2004), children suffering with cerebral palsy are described as having a non-progressive disorder, but not necessarily an unchanging disorder. Literature suggests the main impairment with individuals with some forms of CP is gross motor dysfunction (Tsorlakis, 2004). With the use of NDT as a treatment intervention, children with CP have shown signs of improvement in their stability, positioning, and gross motor movements. With the research that has been done with NDT and children suffering from CP, research suggests NDT is an effective method of treating the disorder. However, skepticism continues to exist surrounding the NDT technique as experts have stated no strong evidence exists that supports the technique (National Institute of Neurological Disorders and Stroke, 2007).

**Progressive resistance exercise and aerobic exercise.** Land-based exercise programs have often been the intervention method of choice for treating children with neuromuscular disorders. Progressive resistance exercise (PRE) is one form of land-based treatment methods for children with neuromuscular disorders. Kelly and Darrah (2005) identified multiple research studies which implemented PRE programs of 6 – 10 weeks duration with no notable differences between studies in relation to length of time. Research studies identified by the authors using pretest and posttest measures identified PRE as beneficial for increasing muscle strength of children with CP. Improved walking speed, improved endurance, and perceived physical appearance were also significant
outcomes from the identified studies. The use of PRE prevents atrophy of palsied musculature not often moved and therefore decreases the severity of contractures of affected limbs (National Institute of Neurological Disorders and Stroke, 2007).

Land-based aerobic exercise has also been an intervention method chosen by therapists in the treatment of children with neuromuscular disorders. Of the identified articles of Kelly and Darrah (2005), significant outcome reports by therapists were increased maximal heart rate, increased aerobic capacity, and a decrease in the amount of oxygen consumed as related to the level of workload in children with CP.

Related research has been done on the use of land-based intervention techniques with children suffering from fibromyalgia. Children with this disorder often display symptoms of pain, sleep disturbances, morning stiffness, fatigue, anxiety and depressive symptoms (Redondo et al., 2004). Due to the pain and poor physical abilities seen in individuals with fibromyalgia, it is not difficult to understand why research is being done to seek effective treatment. Research has found that by focusing on exercise based treatment methods for children with fibromyalgia, therapists have been able to achieve sufficient and effective improvements. In their research, Redondo et al. used one kilogram weights for the use of the upper extremity strengthening and two kilogram weights for lower limb strengthening to improve muscle endurance and tolerance to physical activity (Redondo et al., 2004). This approach can be modified to the individual’s age and ability to manipulate weight poundage.

As the amount of research increases, results appear to be favorable for the use of land-based and progressive resistive exercising. With this being said, it has been noted that little research exists with children who are non-ambulatory and suffer from CP. It is
of importance to note that an aquatic setting may better serve these non-ambulatory children. As evidence-based treatment becomes increasingly important, presenting statistical evidence will become vital to appropriately treat these non-ambulatory children.

*Cognitive-behavior therapy.* In addition to much of the land-based treatment methods used for treating children and adults with fibromyalgia, the use of cognitive-behavior therapy (CBT) has been implemented to further assist patients in coping with the disorder effectively. It is the belief of some clinicians and researchers that the use of CBT can allow patients with neurological disorders to reduce their perceived pain, increase self efficacy, and implement strategies to manage chronic pain (Redondo et al., 2004). This is particularly important to individuals with fibromyalgia due to the chronic pain, lack of sleep, and the emotional impact of being in some respects physically unable to perform aspects of their daily routines. Clinicians can apply these techniques to help the patient cope with chronic pain, be informed about their illness or disease, discover methods to cope with daily living activities, increase sleep and rest, and prevent relapse of symptomology. It is important to understand that CBT is not limited to the above diagnoses, but can be applied to a wide variety of individuals impacted emotionally and cognitively by their disease or disorder (Redondo et al., 2004). Post-treatment research results indicated that with the use of CBT in conjunction with land-based aerobic exercise/physical activity, patients can improve their overall performance and endurance during increased levels of activity. The patients can also reduce negative perception of the way they feel and see themselves as a part of society.
**Constraint induced movement therapy.** Constraint-induced movement therapy (CIMT) has recently been identified as a possible land-based intervention technique for the treatment of children with hemiplegic cerebral palsy. This therapy restricts the movement of the intact limb for a continuous period of time, thereby promoting the use of the affected limb (Hoare et al., 2007). This method has also been implemented in adults suffering from hemiparesis following a cerebral vascular accident (CVA). This technique has demonstrated excellent return of use in affected extremities within this CVA population. Hoare et al. (2007) conducted a systematic review of literature in which three articles were identified as fitting for the review of literature. Of the three articles reviewed, two demonstrated statistically significant outcomes based upon hand use, bimanual performance, ability to perform self-cares independently, and WeeFIM scores. The third article also saw improvements their groups of adolescents receiving CIMT but scores were not identified as statistically significant.

From this research it can be determined that CIMT is viable treatment method for treating hemiplegic CP. With this noted, it would be beneficial for further research to be conducted using CIMT and aquatic therapy in conjunction with one another to assess the possibility of aquatic therapy further adding to a child’s ability to improve range of motion of an affected limb.

**Origins of Aquatic Therapy**

Over the past decade, the use of aquatic therapy and aquatic exercise has become increasingly popular secondary to its effects on the body’s physiological responses (Darby and Yaekle, 2000). Along with this, additional psychological and psychosocial improvements have been found to increase through the use of aquatic therapy, especially
in a pediatric and adolescent population with notable disabilities (Getz, Hutzler, and Vermeer, 2006). These effects, along with multiple others have made aquatic therapy a viable and effective treatment for children with various neuromuscular impairments and disorders.

The use of aquatic therapy in a pediatric population has been considered a relatively new form of intervention for treating a pediatric population, and more specifically for children with neuromuscular or neuromotor impairments such as cerebral palsy. Early literature associated with aquatic therapy often focused on using it as an adjunct to other therapies and rehabilitative modalities. In their annotated bibliography on aquatic therapy in a pediatric population, Dumas and Francesconi (2001) identified the first literature associated with aquatic therapy beginning in 1965 in which books, pamphlets, and journal articles were identified associated with the use of aquatic intervention. Harris (1978) identified play as the main occupation of children and focused on providing a means of assisting children in engaging in meaningful occupations while simultaneously promoting proper movement patterns and facilitating improved muscle tonicity. The author’s implemented aquatic program consisted of combining the use of the neurodevelopmental treatment approach (NDT) and swimming as a means of providing meaningful occupation while facilitating improving physical conditions of children with cerebral palsy. In the proposed method aquatic intervention, the author identified the breast stroke and elementary back stroke as the swimming strokes of choice to implement secondary to their symmetry, an important concept within the principles of NDT. These strokes also promoted abduction, midline placement of the head, and were thought to discourage asymmetrical movements. A relaxation skills phase was also
implemented to promote decreased spasticity in muscle tone. To further increase the
effectiveness of the program, three different guides for intervention were developed for
the different classifications of CP (Harris, 1978).

In 1983, Sweeney (as cited in Dumas and Franscesconi, 2001) implemented NDT
principles in her study regarding the use of aquatic therapy in an infant population.
Techniques such as midline head positioning, proximal hand placement, and graded
movement were implemented in order to increase movement and function in the infants.
Reported results included improved muscle tone, improved feeding behavior,
preservation of joint integrity, and increased visual and auditory orientation (Dumas and
Franscesconi, 2001). Little research combining aquatic therapy and NDT principles has
been performed since Sweeney’s research. Literature has provided no reasoning for this
halt in research, however. And while some techniques used during the formative years of
aquatic therapy are no longer implemented, others used years ago can still be seen today.

Dumas and Franscesconi (2001) researched articles from 1979 to 1999 in a
pediatric population with neuromuscular and musculoskeletal disorders. These studies
consisted of experimental designs, case reports and clinical practices. The early
practicing of aquatic therapy identified in Dumas and Franscesconi’s research consisted
of similar intervention techniques found in aquatic therapy today. One example of this is
demonstrated in Peganoff’s (1984) study in which therapists used swimming techniques
to increase upper extremity range of motion (ROM), spontaneous use of upper
extremities, as well as other motor planning and coordination skills necessary to increase
the functional capacity of a child with cerebral palsy (CP). The single case report also
revealed an increase in the child’s self image as well as her ability to independently complete ADL tasks.

Attermeier (1983) also implemented aquatic therapy techniques in line with today’s practice during her case report on child suffering from mild neurological dysfunction. In the research, techniques such as supported standing, assisted ambulation, and tiptoe standing were implemented to assist the child in achieving independent ambulation within the age/gender norms. Abnormal movements were also decreased secondary to the use of aquatic therapy (Attermeier, 1983).

Benefits of Aquatic Interventions

The positive effects of aquatic therapy and aquatic exercise programs are widely recognized in the medical profession. Performing therapy in an aquatic setting has become increasingly popular amongst therapists in recent years because of the multiple benefits it possesses that land-based therapies cannot provide (Dumas and Franscesconi, 2001). Recently there has been more emphasis placed on using aquatics with children who are suffering from a wide variety of disabilities. However, insufficient research has been performed on the benefits of aquatic therapy and its effectiveness in a pediatric population (Dumas and Franscesconi, 2001). Nevertheless, there are many benefits of using aquatics as a therapy tool in replacement of standard traditional treatment methods that have been used in the past to treat disabled children.

In the literature of Kelly and Darrah (2005), the authors discussed the many assets of aquatic therapy and aquatic exercise. These assets include reducing the influence of gravity secondary to the buoyancy capabilities of water, an ability to more easily adapt exercises that may prove to be difficult in land-based settings, and an increased reduction
on the loading of joints. The use of water during therapy is also useful because of its ability to reduce the strain on unstable joints that is often symptomatic of children who have cerebral palsy. By reducing the tension and loading on joints, water allows for a smoother, gentler motion that can help increase motion while reducing pain or discomfort associated with the motion (Kelly and Darrah, 2005). Yet another benefit of aquatic therapy is its ability to reduce muscle tone when water temperatures reach levels of 30 degrees Celsius or higher. A reduction in muscle tone in turn allows for increased movement in children who suffer from neuromotor or neuromuscular disorders. This allows for a higher performance in daily living skills (Getz, et al., 2006).

Aquatic therapy has also been found to be beneficial in infant and toddler populations. In their research, McManus and Kotelchuck (2007) demonstrated that aquatic therapy significantly increases the functional mobility of infants and toddlers compared to those infants who did not participate in aquatic therapy rehabilitation. Intervention strategies used to improve the functional mobility of infants and toddlers in the study included gait training, standing play, dynamic balance activities, and resistive play with weighted toys and water currents (McManus and Kotelchuck, 2007). The research then concluded that those infants who participate in aquatic therapy in conjunction with home-based early intervention are likely to achieve greater functional mobility than their peers of whom did not participate in aquatic intervention programming.

In a case study of a child with spastic right hemiparesis, Peganoff (1984) implemented the use of aquatic therapy attempting to increase range of motion, promote the functional use of the right upper extremity, and increase the child’s balance.
Following the eight week aquatic program, the child of study demonstrated increased shoulder flexion of 15 degrees and shoulder abduction of 10 degrees. With this, it was found that the patient was spontaneously crossing midline and using the affected upper extremity without encouragement from the therapist. Spontaneous use of the arm was most notably seen while the patient performed simple activity of daily living (ADL) tasks within her home. Improvements in balance and coordination were also observed and attributed partially to an increased internal awareness of positioning and movement patterns (Peganoff, 1984).

Dorval, Tetreault, and Caron (1996) focused their research on the impact of group aquatic intervention programming for adolescents with cerebral palsy between the ages 10 and 17. Research was conducted over 12 months with three periods of testing including baseline, pre-intervention, and post-intervention. 20 adolescents were included in the study and subsequently divided into two groups; a conventional aquatic intervention group and an experimental group. Each group received 10 intervention sessions differing in programming based upon which group each child was enrolled. The authors identified the major difference in interventions between groups as “planning of global and specific objectives for the experimental group classes” (Dorval et al., p. 247).

Testing indicated the groups were similar at the time baseline measures were recorded based on type of CP, symptomology, and deficits related to functional ability.

Results of the research displayed significant improvements in each group related to the participant’s level of functional independence post-intervention. A more significant increase was noted in the experimental group at the post-intervention testing. However, this difference was not statistically significant. It was then concluded that all groups
perceived aquatic intervention as a positive experience related to self-esteem and level of functional independence. The final results displayed no statistically significant differences between trial groups based on intervention outcomes pre-test to post-test. Instead results indicated the type of aquatic programming appeared to be less important than the interventions being carried out in an aquatic setting itself (Dorval et al., 1996). This was demonstrated by significant increases in the functional capacity of both groups from the initial testing prior to interventions and the post-testing measurements recorded.

The performance skills of children who engage in aquatic therapy have been documented as increased in multiple studies. However, the enhancement of performance skills of children with cerebral palsy is not aquatic therapy’s only benefit. A reduction in pain levels has also been achieved through the use of aquatic therapy. Pain is improved through the use of aquatic therapy because of the relaxation capabilities water can possess assuming its temperature level is correct (Aquatic Therapy and Rehab Institute, 2007). Effective water temperature levels have been consistently described throughout a number of studies on the effects of aquatic exercise and aquatic therapy. The optimal temperature range has been identified as 30-33 degrees Celsius, which equates to approximately 86 degrees Fahrenheit (Takken, van der Net, Kuis, and Helders, 2003). Improvements in pain can also be achieved secondary to the reduction of body weight due to water’s buoyancy. Decreasing fatigued musculature leading to increased discomfort and pain within muscles and joints has also been reported when therapy is conducted in water (Aquatic Therapy and Rehab Institute, 2007). The use of aquatic therapy has been found to increase the vital capacities of its participants as well.
Hutzler et al. (1998) described the respiratory function of some children suffering from CP as comparable to that of children diagnosed with muscular dystrophy (MD). Through the implementation of aquatic therapy, a significant reduction in the respiratory function of children suffering from CP can be achieved, comparable to that of normal children (Hutzler et al., 1998). Darby and Yaekle (2000) also demonstrated the positive effects aquatic interventions can have on heart rate and oxygen consumption. Research has found statistically significant evidence supporting the use of aquatic interventions over land-based exercising to increase the vital capacity of participants. Resting heart rate and diastolic blood pressure were found to be significantly less when standing in chest deep water. Heart rate, systolic blood pressure, and diastolic blood pressure all were found to be statistically significantly less post-exercise than that of the same land-based exercises. Similar results were found for oxygen consumption when measured post-exercise in both settings (Darby and Yaekle, 2000). This research then demonstrates the effectiveness an aquatic setting can have on the vital capacities of those who participate in interventions in this therapeutic setting. With this being stated, an improvement in the performance of physical skills and the overall physical condition of children with CP is not the only benefit generated from the use of aquatic therapy within a child-aged population.

In their systematic review of literature, Getz et al. (2006) found multiple studies in which occupational therapists noted improvements in children’s interpersonal interactions, their ability to communicate, and their overall self-esteem. In their survey study on the effects of aquatic therapy used in an autism population, Vonder-Hulls, Walker, and Powell (2006) found that the use of aquatics in children with autism ages
four to ten increased social skills such as making eye contact and maintaining eye contact. The researchers also found that children with autism who participate in aquatic therapy tended to have increases in seeking out extracurricular activities, initiating play, and controlling their impulses. All the therapists in the surveys indicated enjoyment from their patients while participating in the aquatic activities. The perception of the children by others then seemed to improve because of the use of aquatic therapy and exercise (Vonder-Hulls et al., 2006). In a case study on the use of aquatic therapy to treat a child with spastic-hemiparesis cerebral palsy, Peganoff (1984) found the most notable result from the use of aquatic therapy as an increase in the child’s self-image. The patient eliminated apprehension related to participation in aquatic therapy and altered her focus to her personal strengths promoting a positive style of thought. This research is of significant importance to children with neuromuscular disorders as a decreased self image, a low level of social skills, and limited social participation are often identified as inhibitors to engagement in purposeful and meaningful activity for children with these disorders (Getz et al., 2006).

Importance of Parental Education

To achieve true client compliance and to develop a trusting client-therapist relationship, a client must be knowledgeable and informed of all that is occurring or is about to occur in the therapeutic process. Informed clients are often more likely to comply with treatment plans and intervention strategies and are less likely to experience complications related to this (Bastable, 2006). The process of educating clients in a pediatric situation becomes increasingly difficult due to a number of factors, however. Such things as age, diagnoses, and ability to communicate are just a few reasons why
patient education typically is not aimed at children who are receiving therapy services. Instead, education materials must be designed towards their adult caregivers who are more readily able to understand information related to the child’s diagnosis and the course of therapy and are more suited to make important medical decisions. When parents are unfamiliar with certain types of therapies or the reasons for these therapies, anxiety can often occur (Bastable, 2006). This is one thing education materials have the potential to alleviate.

Wilken and Isaacson (2005) focused their literature on the education of caregivers providing care to those of a geriatric population. Although the geriatric population is quite different than a pediatric population, caregivers of both endure many of the same physical and psychological stressors. And although these caregivers are very invested in the treatment and care of those who they are providing care to, they do not often receive education materials that will facilitate their understanding of treatments or strategies to increase the efficacy of the care they are providing (Wilken and Isaacson, 2005). Along with this, educational materials have the ability to empower the care giver. Empowerment allows the caregivers to view themselves as competent and confident when making medical decisions and discussing the medical situation of their loved one. Empowerment also leads to a reduction in stress and burnout experienced by many of those who provide care to someone suffering from one or more disabilities (Wilken and Isaacson, 2005). With this being stated, patient education materials are often difficult to understand and/or use, often resulting in the disuse of otherwise beneficial education materials (Aldridge, 2004).
In his literature associated with the readability and usability of patient education material, Aldridge (2004) stated the average American-adult is able to read at an eighth grade level. However, it was also noted that most patient education materials were written at a 12th grade level or higher. This often results in the disuse of patient education materials. To simplify education materials and thereby promote the use of such materials, Aldridge (2004) identified a number of strategies to increase the readability of education materials. Taking such steps as highlighting important elements of the material, writing in a larger text, bulleting important aspects of education materials, and using graphics and pictures to augment the text are strategies that effectively increase the readability and usability of education materials (Aldridge, 2004).

Other important aspects on educating adults exist as well. Because adults of a parenting age tend to be problem-centered and self-directed learners, education materials should be focused on what is important to the adult learner. Along with this, writing educational materials at a level of readability that allows the adult to critically analyze its content will also promote the use of received educational materials (Bastable and Dart, 2006). Therefore, when using adult learning strategies, it is effective to organize materials in an understandable and identifiable manner. Along with this, a motivational component must exist to make the educational material meaningful to the learner. This is most easily accomplished by narrowing educational material strictly to the subject the learner is most invested in (Bastable and Dart, 2006). Appropriately designed and understandable education materials ultimately improve the overall care of clients. Implementing simple strategies to increase patient understanding ultimately increases the overall level of patient care and the final outcome from the therapy process.
Future Considerations

There continues to be a pressing need for more research on aquatic therapy. While some literature exists, there is a need for a more definitive answer on the best ways to conduct aquatic therapy for children suffering from neuromuscular disorders that an aquatics setting can serve. Nearly all research reviewed found positive results in all areas studied. However, not all results were reported with statistical significance and much of the literature contains very little evidence-based data. This indicates that while improvements will occur, there may not be enough objective evidence present for third party payers to cover the costs of aquatic therapy. This is a cause for concern due to the fact that it appears the use of aquatic therapy is beneficial. It is also a technique that children enjoy, making the use of aquatic therapy purposeful and meaningful to the children, a core component for occupational therapists working in a pediatric setting. To eliminate such a technique could be a potential setback for any population of clients who seem to benefit from the use of aquatic therapy.
CHAPTER III

Methodology

The practice of aquatic therapy can be considered a relatively new therapeutic intervention compared to that of long standing traditional methods of physical disability interventions. For the parents of children receiving aquatic therapy, many questions and concerns arise during the process of aquatic therapy. Due to the nature of their child’s disability, many parents fear for their child’s safety in an aquatic setting. Also, many parents are not aware of water’s positive impact on the rehabilitation process. However, multiple works of study have found water to be a very therapeutic environment for the treatment of children and adolescents with neuromuscular disorders. Because of this, it is of the utmost importance that therapists relay to parents the positive effects of aquatic therapy and the many benefits of conducting therapy in water. This is the primary aim of the parental education material generated in this scholarly project.

The creation of the parental education material has two primary purposes. First, by educating parents on what aquatic occupational therapy is and how it can help their child, the parents will become less apprehensive towards aquatic therapy interventions. Secondly, by presenting the parents with education material, the therapist is empowering the parents and facilitating their belief in the positive effect aquatic therapy can have on their child. These two principles will allow therapists to gain the trust and support of the parents which is essential in establishing rapport. This will ultimately facilitate a positive interventional experience for the pediatric client.
Along with the generation of the parental education material, a user friendly guide to the delivery of aquatic interventions was developed to assists therapists in the development and delivery of the aquatic occupational therapy treatment plan. For some occupational therapists who deliver aquatic therapy interventions, the treatment of children and adolescents is not within their main scope of practice. Along with this, the treatment of children with neuromuscular disorders adds to the difficulty in delivery services secondary to wide ranging disabilities such as abnormal muscle tone and abnormal movement patterns. The main focus of the therapy guide is to provide aquatic occupational therapists with intervention methods that focus on rehabilitation and are consistent with the goals they have created for their client. Along with this, the therapy guide offers interventions that allow children to engage in play activities during the course of the intervention process. This allows for the generation of a new context of which the pediatric client can engage in purposeful and meaningful play. Keeping the intervention meaningful is at the heart of this therapy guide as this is what makes aquatic occupational therapy unique in the treatment of a pediatric population.

The production of the parental education material began following an extensive review of literature associated with pediatric aquatic therapy. During the search, an emphasis was placed on aquatic therapy, occupational therapy, and neuromuscular disorders. Articles not containing the above criteria were also accepted if appropriate. Obtained articles and other texts then served as the primary sources of information of which composed the educational materials.

Determining the main points of focus of the parental education material was largely decided upon by the authors. Also, any articles addressing parental issues and/or
concerns were reviewed. When identifying what areas were most essential for inclusion, the authors focused on presenting information to the readers that would increase their knowledge base about aquatic therapy while simultaneously answering questions about any parental concerns. In theory, this is the method that would best facilitate a decrease in the anxiety level of parents associated with engaging their child in aquatic occupational therapy.

The Cognitive Learning Theory served as the theory that grounded the principle design of the education material developed for parents who have children receiving aquatic occupational therapy. This learning theory was chosen as it focuses intrinsically on the learner. It has the ability to change or further develop the “learners’ perceptions, thoughts, memory, and way of processing and structuring information” (Braungart and Braungart, 2006, p. 43). According to the cognitive learning theory, an individual must change their perceptions and thoughts and form new understanding and insights into learned information. The learner is largely responsible for directing and organizing the information into a new understanding.

The information processing cognitive approach was also beneficial in the development of the parental educational material. The cognitive approach emphasizes how information is perceived, understood, and stored into long and short term memory (Braungart and Braungart, 2006, p. 43). Information processing is particularly important to therapists as it is of the utmost importance for individuals to be able to store and recall the pertinent information that is provided to them by healthcare workers. This facilitates a therapeutic relationship and acknowledges an individuals right to be informed about the therapy process. By organizing information in a meaningful way, the parental education
material facilitates this information processing by adding structure to the learning process and assisting the learner to store the information in a structured and organized way that will facilitate an increased ability to extract and recall the learned materials.

A final important principle of the cognitive learning theory is its focus on the gestalt perspective. This principle emphasizes the importance of perception in learning. The basic gestalt principle is that “people strive for simplicity, balance, and familiarity in organizing information” (Braungart and Braungart, 2006, p. 44). The gestalt principle suggests that it is impossible for learners to pay attention to all of their surroundings, and instead must attend to certain features of a learning experience. Using the gestalt perspective in the construction of the education material allowed for only the most pertinent information regarding aquatic occupational therapy to be included in the education material. This will facilitate a greater parental understanding of aquatic occupational therapy as the educational material only contains information of significant importance. This reduces the possibility of non-use of the education material due frustration associated with the content of the educational materials.

Following the production of the parental education material, a user friendly guide to delivering aquatic occupational therapy interventions to children with neuromuscular disorders was developed. To generate the guide to aquatic therapy, much of the same literature used to develop the parental education material was utilized. The authors began an extensive review of the literature, identifying therapeutic techniques utilized within research articles that were reported as successful and/or statistically significant. Along with this, interventions that focused on implementing play and creating meaning and purpose to therapy were also interventions of focus. From this critique, therapeutic
interventions were then selected for inclusion into the guide to aquatic occupational therapy.

To make the therapy guide user friendly and easy to use, only the most common focuses of intervention for children with neuromuscular disorders were included in the guide. Deficits that may be more patient specific or uncommon were left off the guide to aquatic occupational therapy to prevent clutter and confusion. To determine which disabilities and deficits should be the focus of the therapy guide, the authors again reviewed pertinent literature and focused on the disabilities/deficits most often targeted in research studies. These targeted areas for interventions then served as the headings in the guide to aquatic therapy. Information extracted from key references served as the therapeutic interventions listed under each targeted area. Finally, example goals were generated to assist the therapist in generating the treatment plan while keeping interventions consistent with goal areas. However, the goals are only examples and their intended purpose is to provide examples to therapists to facilitate goals with functional outcomes.

The model selected to guide the approach to aquatic occupational therapy and the parameters to its best method of delivery as related to occupational therapy was the Ecological Model of Human Performance. Winnie Dunn, the main author and promoter of the Ecological Model, designed it as a method for occupational therapists to follow which focuses on the major components of task performance (Dunn, Brown, and Youngstrom, 2003). There are four main components which make up the Ecological Model of Human Performance. They include context, task, person, and performance. The Ecological model is a framework that considers the relationships among the person, task,
and context and how the dynamic interactions between these three impact the performance of the individual (Dunn et al., 2003). Performance of a task occurs when an individual engages in the tasks within their environment. These tasks can be limited by an individual’s variables, such as their skills, abilities, motivation, and contextual barriers (Dunn et al., 2003). Children who have a neuromuscular disorder may have difficulty effectively performing meaningful tasks or engaging in a task that is motivating or desired within their environment. With the use of aquatic occupational therapy, the child will be able to work towards these goals through the use of interventions focused towards play, meaning, and motivation.

The Ecological Model is ideal to follow in order to develop and identify the patient’s needs and what they feel are purposeful, productive and meaningful occupations. Participation that is meaningful and purposeful to the patient will improve physical conditions and wellness, ultimately improving a child’s functional performance. This model is in line with aquatic occupational therapy because it focuses on the interaction between the individual and their environment in order to define which activity produces a meaningful effect to each individual. This will ultimately lead to an increase in a child’s overall ability for the performance of meaningful tasks such as play.

In the Ecological Model, Dunn et. al (2003) stated context can be considered the surroundings of one’s environment and the environmental conditions that affect task performance. In this scholarly project, the authors use the principles of the Ecological Model to create a context in which children can engage in a meaningful occupation. While this may stray slightly from the foundations of the origins of the model, it still promotes a new physical context in which children can engage in meaningful play in an
environment supportive of a disabled child’s physical demands. The context of an aquatic environment has the potential to enable children in performing play tasks due to its ability to adapt and modify movements and mobility. Also, an aquatics environment in a rehabilitation facility can be transitioned into the community where the child can continue his/her new occupation outside of a therapeutic pool.

Furthermore, this model uses the five different intervention approaches identified in the Occupational Therapy Practice Framework. These intervention approaches including establish/restore, adapt/modify, alter, prevent, and create (American Occupational Therapy Association, 2002). The focus of these interventions is to meet the needs necessary for an individual to accomplish successful task performance. The Ecological Model of Human Performance will adapt well into the therapeutic interventions being used with the patient population described above. This model does not focus on disability, but instead focuses its understanding on causative factors limiting an individual’s task performance. The Ecological Model can be adapted and transferred from a rehabilitation setting into a community facility leading to skills transfer while keeping the physical context similar. This has the potential to ultimately lead to engagement in meaningful occupation in a physical context valued by the individual.
CHAPTER IV

Product

The products of this scholarly project were clearly focused on two main populations. The first population of focus was parents or guardians of children preparing to engage in aquatic therapy. The second population of focus was occupational therapists who practice in an aquatic setting and deliver therapy services to children suffering from neuromuscular disorders. These two populations were identified as critical to address for a number of reasons.

The primary reason the authors felt the need to develop a product aimed at a parental population was to educate the parents about aquatic occupational therapy and the many benefits it has for their child. By educating the parents of children suffering from neuromuscular disorders, the therapist has the ability to decrease any anxiety or concerns parents may have regarding their child’s engagement in aquatic therapy. This education and reduction in anxiety then has the potential to empower the parent to become an active learner and participant in the aquatic interventional process. This will lead to the establishment of good rapport while simultaneously fostering a trusting relationship between the therapist and the client and client’s family.

The principal purpose for the generation of the aquatic occupational therapy guide to intervention was to use water as a treatment modality while simultaneously stressing the importance of keeping occupation at the core of aquatic occupational therapy. As mentioned above, it is the job of occupational therapists to assure occupation is kept at
the heart of therapy. Using play as a vehicle for interventions can also alter a child’s perception of therapy. Instead of viewing therapy as something they are receiving because they are different than other children their age, the child will perceive the therapeutic experience as enjoyable and meaningful. This will improve the patient’s feelings of purpose and increase the value placed on the therapeutic intervention.

For occupational therapists delivering aquatic therapy, the guide to therapy offers possible aquatic intervention strategies that enable the therapist to focus on certain deficits while keeping occupation central to the interventions. With example goals provided as well as listed interventions targeting common deficits in children with neuromuscular disorders, the therapy guide has the potential to be used as a resource that will assist the therapist in developing and implementing the treatment plan for their client. In the end, it is hoped that a more structured treatment plan will lead to the most effective interventions possible, therefore decreasing pathological progression of disease and increasing the functional capacity of children receiving aquatic occupational therapy.
Aquatic Therapy

For My Child
WHAT IS OCCUPATIONAL THERAPY?
Occupational Therapy is a medical profession that assists clients in achieving their highest level of independence in life roles by helping them to participate in life activities they find meaningful and have identified as important.

WHAT IS AQUATIC THERAPY?
Aquatic Therapy is the use of water and specifically designed activity by qualified personnel to aid in the restoration, extension, maintenance, and quality of function for those who have acute, transient, or chronic disabilities, syndromes or diseases. (National Center of Physical Activity and Disability)

OCCUPATIONAL THERAPY THROUGH THE USE OF AQUATIC INTERVENTION
Occupational therapists are unique in the fact that they focus on client’s occupations, or activities of everyday life that are important and meaningful to clients, and use these occupations through the course of the therapy process. When occupational therapists implement the use of aquatic therapy for your child, they are able to provide the child with a chance to engage in play, the main occupation of children. Play is also used as a means of treatment for the child to meet identified goal areas.

This can be achieved by:
- Using weighted toys
- Using swimming techniques which the child enjoys
- Involvement with other children during aquatic therapy
- Allowing the child to play while engaged in a therapeutic task
WHAT CAN AQUATIC THERAPY PROVIDE MY CHILD THAT LAND-BASED TREATMENT CANNOT?

- Reduces the influence of gravity due to water’s buoyancy
- More easily able to adapt therapies in an aquatic setting due to the ability for the therapist to move the child in the water
- Ability to reduce strain on unstable joints
- Reduces tension and loading on joints
- Allows for smoother, gentler motion that can help increase motion
- Reduction in muscle tone secondary to warm water’s effects
- Reduces pain and discomfort associated with movement
- Water temperature can reduce tonicity of muscles
- Increases ability to be functionally mobile

(Kelly and Darrah, 2005)
**Areas Aquatic Therapy Can Help Improve**

- Muscle weakness  
  - Limited motion
- Poor endurance  
  - Limited mobility
- Pain  
  - Incoordination
- Cardio/Respiratory deconditioning  
  - Neurological disorders
- Abnormal muscle tone  
  - Balance deficits
- Postural control

**Possible Reasons to Avoid Aquatic Therapy**

- Fever  
  - Infectious disease
- Open wounds  
  - Contagious rash
- Allergies to pool chemicals  
  - Urinary infections
- Uncontrolled blood pressure  
  - Vital capacity less than 1400

*(Integrated Physical Therapy Services)*
OUTCOMES FROM AQUATIC THERAPY

• Increased joint Range of Motion (ROM)
  (Getz, Hutzler, and Vermeer, 2006)

• Increased ability to use the upper extremities resulting in ability to:
  ▪ Self feed
  ▪ Perform basic self cares
  ▪ Engage in play activities
  ▪ Communicate more effectively
  (Peganoff, 1984)

• Improved balance when still and during movement
• Increased functional mobility including walking and crawling
  (McManus and Kotelchuck, 2007)

• Increased engagement/interaction in play with others
• Improved coordination
• Reduction in musculature and joint pain post-therapy
• Increased vital capacity including:
  ▪ Decreased resting heart rate
  ▪ Improved respiratory function
  ▪ More stable blood pressure
  (Darby and Yaekle, 2000)

• Improved self image
• Improved self esteem
  (Getz, Hutzler, and Vermeer, 2006)
WHAT TO BRING TO AQUATIC THERAPY
Arrive to your first day of therapy in street clothes. Bring your child’s swimming suit (and yours if desired) to aquatic occupational therapy. Changing rooms are available on location to dress into your swimming attire. If your child would like to bring extra clothing to wear in the pool such as a t-shirt, that is acceptable.

WHAT TO EXPECT FROM AQUATIC THERAPY
Aquatic therapy provides a therapeutic environment for your child which promotes your child’s ability to engage in play and meaningful activity while still being involved in therapy that targets improvements in areas of deficits.

Pool conditions will vary depending upon the facility your child receives aquatic therapy. However, most pools have a variety of characteristics in common. These characteristics include:
• A pool temperature of 30° – 33° Celsius, or 86° – 91.4° Fahrenheit.
• A zero depth pool, or a pool with easy access from steps, ladders, a chair lift, or a hoist
• Platforms to decrease water depth which usually is 4-5 feet at its deepest point
• Poolside grab bars and floatation devices to decrease your child’s apprehension associated with water
WHAT IF MY CHILD CANNOT SWIM?

A therapist will be present at all times to assure your child’s safety is never in jeopardy. The therapist will maintain constant contact with your child to assure proper safety is maintained. With this, a number of assistive devices assist your child in performing successfully in an aquatic environment. These devices include but are not limited to:

- Life jackets
- Flotation devices such as noodles
- Chair lifts
- Rollup bands
- Kickboards

Also, the parent has the option to join the therapist and child in the water if it will provide additional comfort with the therapy process.
OTHER THERAPIES YOUR CHILD MAY RECEIVE OTHER THAN AQUATIC OCCUPATIONAL THERAPY

- Physical Therapy
  - Conductive Education
  - Patterning
  - Progressive Resistive Exercising (PRE)
  - Aerobic Exercising
- Occupational Therapy
  - Neurodevelopmental Treatment (NDT)
  - Progressive Resistive Exercising (PRE)
  - Sensory Integration
  - ADL Training
- Recreational Therapies
  - Used more often for mildly impaired children and focuses on non-physical improvements (i.e. communication skills)
- Speech and Language Therapy
  - Speech therapists assist children in learning how to communicate and help to decrease drooling and increase a child’s ability to self feed
- Pharmaceutical Treatment
  - Medication used to address problems such as muscle tonicity and pain
**AQUATIC THERAPY SUCCESS STORY**

Travis was born in Texas. He could not move. The doctors advised his mom not to pick him up or nurse him as he was to die within the week, and it would be uncomfortable if mother had formed an attachment. Mom was a former Marine Corps Sergeant. She had her own ideas about Travis and made the hospital care for him. As the state wished to institutionalize him, she eventually had to fight to keep her own son.

By two months, Travis had been diagnosed with Spinal Muscular Atrophy, a form of muscular dystrophy. He was given another two years to live. Four months later, at the request of his physical therapist, Travis entered the Paso Robles (CA) Early Intervention Adapted Aquatics Program (E.I.A.A.) under the direction of Dick Smith.

By two years old, Travis could walk in shoulder deep water and scoot about on his buttocks on land. By age four, Travis competed in his first Special Olympic Area Swim Meet by swimming both freestyle and backstroke. At age five, he took his first steps on land, using lower leg braces. By six, he was walking all over the place. Today, he is self-caring. Take Smith's advice about Travis. "If you get the chance, don't play cards with him. He's good."

If Travis had been institutionalized, the costs would have been phenomenal. First, Travis would have been a dependent, not independent, person. That cost is immeasurable. Second, the state of Texas would have foot the bill for the care of Travis. At an estimated $80,000 per year, Texas would be out about $960,000 for the 12 years of care (so far) for Travis; this cost would obviously escalate for each additional year of care. So what made the difference in Travis' story? Dick Smith believes it was early intervention adapted aquatics and a committed family. Smith is an Adapted Aquatics Faculty instructor and a member of the Aquatic Council of the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD). Although Smith is not a
therapist, his years of working with children in the pool have given him an experience base from which PT’s and OT’s may learn.

Smith currently runs his early intervention program with five to eight month old children with either cerebral palsy or muscular dystrophy. The children are referred from a physician, and Smith seeks the input of the child's physical or occupational therapist.

His goals are to improve muscular strength, reduce atrophy, gain use and control of limbs, and maintain activity for as long as possible. His work integrates play with stimuli. Approximately 90% of children have in-water parent participation.

Neither his goals nor games would raise an eyebrow in the therapy world. They are common. The catch? Smith adds water. And it makes a difference.

"The past twenty-four years of teaching special populations has supported my original beliefs on how important warm water and a controlled environment can be," stated Smith. "I've observed results that far exceeded my expectations."

This story is used with the permission of Aquatic Therapy Command Center at www.aquaticnet.com
AQUATIC THERAPY REFERENCES


FACILITY INFORMATION

Facility Name: __________________________________________

Hours: _________________________________________________

Address: ______________________________________________

Phone Number: __________________________________________

Email: _________________________________________________

Primary Aquatic Therapists: _______________________________

_______________________________________________________
Aquatic Occupational Therapy: A User Friendly Guide to Delivering Intervention
(For Children with Neuromuscular Disorders)

Creating an Occupation and a Context: The Center of Aquatic Occupational Therapy

The American Occupational Therapy Association (2002) identifies play as the main occupation of children. It is occupational therapy’s job to engage clients in meaningful occupations and incorporate these occupations into the course of treatment. This should remain the core concept of aquatic occupational therapy as well. The aquatic environment serves as an excellent context for children to engage in meaningful play activity while simultaneously improving many deficits associated with their neuromuscular disorder. Therefore, during the development of your aquatic therapy treatment plan it is essential to assure that the therapeutic activities you will engage your client in are play related and will be meaningful to you client in terms of occupation. Providing meaning to your client will increase task performance leading to an increase in a child’s functional capabilities.

Developing the Aquatic Therapy Treatment Plan:

1. Prioritize the child’s wants and needs as identified by the child and his/her parents
2. Analyze prioritized tasks
3. Evaluate performance of tasks
4. Evaluate the contexts in which occupations are performed
5. Evaluate the child’s variables
6. Develop goals and choose intervention strategies for identified priorities
7. Evaluate the person/task/context match and select achievable goals and reasonable intervention strategies. (Dunn, Brown, & Youngstrom, 2003)
Safety Issues to Address Prior to Engaging Children in Aquatic Therapy:

- Always obtain medical clearance from the primary physician prior to engaging a child in aquatic therapy
- Obtain a list of medications and have a knowledge on the effects of the medicine
- Never encourage a child to work through pain
- Assure water temperature is always within the correct ranges prior to entering the pool
- Always maintain a close proximity with clients to assure safety in the water is maintained at all times
- Check clients for open wounds and other sores that should not be exposed to the aquatic environment
- Monitor blood pressure and pulse rate to assure vitals do not pose any physical dangers
- If needed, assure a parent is available for consult during aquatic therapy to answer any questions the therapist may have

Preparatory Activities:
Children receiving aquatic therapy for the first time often exhibit apprehension in regards to entering a therapeutic pool. Anxiety is often a deterrent to the child experiencing as positive aquatic therapy experience. Keeping aquatic occupational therapy positive and meaningful is essential for the child to perceive aquatic therapy as a meaningful occupation. Keeping the therapeutic experience positive creates a new context in which the child can effectively engage in play while simultaneously improving a multitude of disabilities. The following is a list of preparatory techniques to reduce anxiety and apprehension associated with the aquatic therapy environment:

- Enter the pool slowly and at the child’s pace. If the child demonstrates anxiety or verbalizes the desire to exit the pool, do as the child says and attempt to reenter the pool after the child’s anxiety has decreased.
- The use of music the child has identified as enjoyable has been found to reduce anxiety while being played in the background
- Enter the pool and stay in shallow depths until the child agrees to increasing the depth
- Stretching exercises of targeted muscle groups
- Swimming with floatation devices
- If possible, assist the child in walking or crawling in a comfortable and safe depth of water
Equipment to Enhance Aquatic Interventions:

A large amount of equipment to enhance the experience of aquatic therapy is available to therapists delivering aquatic therapy interventions. These pieces of equipment can be used for the following:

- **Pool entry** (A zero-depth pool is the preferable method for assisting those with disabilities to access the water)
  - Pool deck chair lifts
  - Portable stairs
  - Deck mats to prevent bruising and abrasions
  - Water wheelchairs

- **Pool mobility, staying afloat, and pool safety**
  - Floatation suits
  - Swim belts
  - Foam rafts
  - Water wings
  - Kickboards
  - Water noodles

- **Balance assistance**
  - Balanced bar floats
  - Poolside bars
  - Floatation vests

- **Strengthening and motion**
  - Weighted toys
  - Weighted dumb bells
  - Ankle/wrist weights
  - Webbed gloves
  - Hand paddles
**Range of Motion (ROM) and Joint Contractures:**

**Example Goals:**

1. In order to independently perform self feeding, client will increase ROM from _____ degrees to _____ degrees.
2. Client will increase ROM by _____ degrees in order to independently perform basic self cares such as brushing teeth and combing hair.

**Interventions:**

- Perform activities very slowly during the initial warm-up
- Begin ROM in chest or neck deep water to assure targeted joints are completely submerged in the water
  - This reduces gravity and the strain on muscles
- Stretch joints to the point at which the child verbalizes or displays signs of discomfort with the motion
  - Make the ROM exercises as comfortable as possible
- When possible, implement play into the ROM exercises, this can be done in a number of ways
  - Use weighted toys that can assist in stretching joints
  - Have the child reach for toys at various distances encouraging the child reaching to motions end
- As motion increases, decrease the depth of the pool in which ROM activities are being performed
  - This provides more gravity and weight which equals resistance to targeted motions
- To increase flexibility, muscles must be stressed at least 10% past their resting length
  - Hold in this position for 20-30 seconds

**Therapist’s Notes:**

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
Balance:

Example Goals:
1. Child will maintain sitting balance on floating mat for ___ minutes with moderate assistance in order to increase static sitting balance during play tasks.
2. To increase balance in standing, client will withstand jet pressure for ___ minute(s) with moderate assistance from therapist.

Interventions:
• Place a child on a floating mat for a focus on various balance deficits
  o Maintain mat in static position or move mat to increase difficulty of maintaining balance
  o Keep mat away from sides of pool and in deep enough water that a fall will not result in an injury
• Implement jumping games that incorporate front to back and side to side jumping
• For static standing balance, place child in chest deep water with jet resistance as tolerated
  o Maintain close proximity of child to assure safety is maintained if the child’s balance is lost
• When targeting dynamic standing balance, assist child in straddling a foam noodle
  o When balance is maintained, create turbulence and move the noodle around
  o Encourage child to maintain straddled position for as long as possible

Therapist’s Notes:
Postural Improvement:

Example Goals:

1. In the water, the child will keep his/her head erect for _____ amount of time, with support as needed from the therapist.
2. Client will engage in play task, standing in chest deep water while independently maintaining control of trunk for ____ minutes.

Interventions:

- Contact physician to assure posture problems are not to severe for the child to receive aquatic therapy
- If a home exercise program is being used by the child, implement these techniques in the pool if appropriate
- Allow for the removal of braces during aquatic therapy
- Use swimming strokes that focus on the even development of musculature promoting posture
  - Wide arm sweep breast stroke
  - Double arm back stroke
- Emphasize proper posture and strengthening of both sides of the body
- Adapt swimming strokes as needed to promote postural control
- Place the child in chest to neck deep water while encouraging the child to hold head erect and in midline
  - Place toys in front of child to implement play into the therapy. This will also promote postural control and will assist in establishing midline
  - Decrease depth of water as postural control improves

Therapist’s Notes:
**Strengthening/Resistance Training:**

**Example Goals:**
1. Client will increase strength in upper extremity from __ to __ in order to increase independence in performing basic self cares.
2. Client will perform ____ repetitions of triceps extensions with minimal resting in order to decrease flexion contractures limiting participation in play tasks.

**Interventions:**
- Muscles that require strengthening are typically those that are antagonistic to spastic muscle groups
  - Usually extensor muscles
- Before implementing strengthening techniques, consult with the primary physician to assure it is appropriate for your client. If not properly performed, strengthening may result in:
  - Permanent damage to muscle fibers
  - Extreme fatigue
  - Increased muscle tone
- Children with high tone may benefit from endurance training with a minimal amount of weight and increased repetitions rather than traditional strengthening interventions
- To incorporate resistance training, the following interventions may be of use
  - Have the child wear hand paddles or fins, which will increase resistance while moving through the water
  - Perform movements upon targeted areas with an open hand in place of a closed fist
- Strap on weights and floating bar bells may be implemented for strengthening but used with caution

**Therapist’s Notes:**

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________

_________________________________________________________________
**Functional Mobility:**

*Treatment Time:*
- 30 minutes is appropriate to improve a child’s functional mobility
- Exceeding this time could lead to excessive fatigue

*Example Goals:*
1. Child will use upper and lower extremities to propel him/herself ___ feet in the water with assistance as needed.
2. In order to engage in play activity, client will demonstrate ability to engage in standing play tasks for 5 minutes.

*Interventions:*
- Standing play activities
  - Incorporate dynamic reaching activities at various distances
  - Increase depth of water to increase difficulty of balancing
- Supported functional mobility
  - Therapists supports child as needed
  - Increase forces of buoyancy through water depths to increase difficulty
- Use resistive forces of water jets during standing play and functional mobility
  - Vary forces dependent upon child’s performance
- Sitting activities on floatation devices for postural strengthening of core
  - To increase difficulty, decrease size and density of floatation devices
- In chest deep water, assist child in ambulating targeted distances while encouraging proper movement of lower extremities

*Additional physical therapy for gait training and lower extremity strengthening is supportive of aquatic occupational therapy’s focus on functional mobility*

Therapist’s Notes:

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Reducing Muscle Tone:

Goals:
*Aquatic occupational therapy uses the natural therapeutic effects of water to reduce muscle tone. When writing goals, refer to range of motion section and implement muscle tone into these goals when possible.

Interventions:
- Assure pool temperature does not fall below 86°
  - Normal ranges are usually 86°-92° Fahrenheit, or 30°-33° Celsius
  - Air temperature should be at least 4° higher than the water temperature
- Sudden, involuntary spastic movement may occur when the child is in the pool. To increase the safety of the child, maintain a close proximity to assure the child does not fall off of assistive devices and/or submerge in the water for an extended period of time
- To decrease scissoring of lower extremities, place cushion in between the child’s legs following entry into the pool
- Place child in supine position and laterally sway the child with a rotational motion
  - To assure child’s safety, this technique is best used when two therapists are in the pool
  - If one therapist is performing maneuver, place a flotation device near the swimmers head to prevent submersion
- Avoid fast movements and sudden hands-on/hands-off movements
  - Slow movements and steady touch are more likely to facilitate and/or maintain a reduction in tone
- During play activities, assisting the child in moving the limb may be necessary if the child is unable to voluntarily move limbs

Therapist’s Notes:
Self Esteem/Self Image:

Interventions:
*Self esteem is typically not targeted as a primary intervention but instead is a secondary outcome from aquatic occupational therapy

- Attempt to leave adaptive devices normally used by the child outside of the pool as this will increase the child’s feelings of success
- Engage children in activities that promote success and will allow the child to perform the activity without problem
- If possible, perform therapy with other children receiving aquatic therapy
  - This will promote interpersonal interaction
- Attempt to perform all therapy without pain as this will promote the positive experience of the child
- When appropriate, allow the child to pick the therapeutic activity he/she would like to engage in
- When a crowd is present, such as the child’s parents or other therapists, allow the child to demonstrate learned skills
  - This increases pride and self confidence
- During intervals of the therapy session, ask the child to identify what they have done well or what new skills they have developed

Therapist’s Notes:

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Increasing Vital Capacity:

Example Goals:
1. Child will engage in play task for ___ minutes demonstrating limited labored breathing and fatigue.
2. In order to increase lung capacity, client will hold breath under water for ___ seconds with support from therapist as needed.

Interventions:
- Perform therapy in water temps as listed above as this will allow for easier expansion of the chest wall
- Allow for a longer warm-up period
- Implement use of swimming strokes that promote the stretching of chest muscles and expand the chest region
  - Elementary backstroke
  - Double arm backstroke
  - Inverted breaststroke
- Use of breathing activities will increase vital capacity
  - Holding breath underwater for longer periods of time
  - Blowing bubbles in the water
  - Breathing through the nose with the mouth closed
  - Bobbing techniques to the comfort level of the child
    - Increases rhythmic breathing
    - Increases chest wall elasticity
- Perform as much therapy as possible in chest to neck deep water
- Use activities that promote trunk mobility thus allowing for an increase in a child's vital capacity
- Provide an area for placement of coughed up mucous
- Always provide rest when needed
- Avoid competitive activities with intense activities as this may provoke excessive breathing leading to breathing problems

Therapist’s Notes:
References


CHAPTER V

Summary

Children with neuromuscular disorders will benefit from aquatic occupational therapy physically, psychosocially, and occupationally. The benefits aquatic therapy can provide a child with neuromuscular disorders are unique compared to any other therapy because of the added variables therapeutic water provides. When utilized together, occupational therapy and aquatic therapy can act as a promoter to child development. Although land-based therapy may provide similar benefits to aquatic occupational therapy, aquatic therapy can provide a reduction in high tone musculature, support the human body by providing buoyancy and thereby reducing pressure on the joints, and help alleviate pain. Therefore, if possible and available, aquatic therapy should be offered to their child clients and their families and used when goals can be accomplished more proficiently and with less stress and pain when compared to land-based treatment methods.

In the development of the product for this scholarly project, the authors generated parental education material for parents with children receiving or preparing to receive aquatic therapy. Upon further discussion, the authors found that it would also be equally important to develop a user-friendly guide to aquatic occupational therapy in order to assists therapists in developing, structuring, and delivering effective treatment plans. These products, as presented in Chapter IV, are beneficial to the therapist in order to educate and empower the parents of the child they are treating. This will ultimately foster
a trusting relationship between the child and child's family with the therapist delivering aquatic interventions. Also, the guide to therapy will assist therapists in keeping meaning, value, and occupation at the core of aquatic occupational therapy. The parental education material is found in chapter IV, Product I, for therapists to utilize in order to educate the family. The guide to aquatic occupational therapy is found in chapter IV, product II, and is to be utilized as a guide to delivering effective aquatic therapy interventions.

Limitations

Information researched for this scholarly project is applicable to the domain of occupational therapy, but analyses of the limitations to this scholarly project were taken into consideration. The literature provided in Chapter II encompasses many sources of information from many professional backgrounds conducting research on aquatic therapy. It also provides evidence for the benefits and importance behind the inclusion of occupation in aquatic therapy settings. However evident, the research conducted for aquatic therapy that has been documented and accumulated over the years is limited and comes with limited availability. Some of the research that was conducted on aquatic therapy dates prior to 1995, but has some of the most proficient evidence and research documented to date. Information and research for aquatic therapy is detrimental to its future success and should be developed to keep it current for others who want to implement a program for a facility or a community.

Although many benefits of aquatic therapy are presented in the literature for the application of aquatic therapy and occupation based practice, a gap in the research continues to exist in terms of the combination of the two therapies. Additional quantitative research is needed to increase the evidence supporting the use of aquatic
therapy in general and aquatic occupational therapy more specifically. Quantitative studies would assist those therapists practicing in an aquatic environment to better identify specific strengths and limitations to its use as well as combining aquatic therapy with occupation-based interventions, thereby making aquatic therapy more meaningful. Moreover, quantitative studies can be formulated from the qualitative data to assist in justifying the effectiveness on this approach and help market any changes that may be needed.

*Project Implementation*

Although this project may be useful for some therapists, these products may not fit the style of every aquatic therapy provider or setting/facility. A possible future plan for the products developed in this scholarly project includes the distribution of the products to a number of facilities who deliver aquatic therapy services to a pediatric population. Further research and studies conducted on the products will enhance their effectiveness and assist in the continuing knowledge in the area of aquatic therapy practice. Other future actions may include presentations to local and national associations such as the American Occupational Therapy Association (AOTA), Minnesota Occupational Therapy Association (MOTA), and the North Dakota Occupational Therapy Association (NDOTA). The overall goal of the parental education material and the user-friendly guide to the delivery of aquatic occupational therapy will not only provide assistance to children with neuromuscular disorders through a modern means of therapy, but will also help the parents of children receiving aquatic therapy and therapists practicing in an aquatic environment to understand and implement aquatic therapy as an optional means of therapeutic treatment.
References


