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A Visual Teaching Aid for a Pediatric Aquatic Physical Therapy Program

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University of North Dakota

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A VISUAL TEACHING AID FOR A PEDIATRIC AQUATIC PHYSICAL THERAPY PROGRAM

by

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Bachelor of Science, Colorado State University, 1994
Bachelor of Science in Physical Therapy
University of North Dakota, 1996

An Independent Study
Submitted to the Graduate Faculty of the
Department of Physical Therapy
School of Medicine
University of North Dakota
in partial fulfillment of the requirements
for the degree of
Master of Physical Therapy

Grand Forks, North Dakota
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1997
This Independent Study, submitted by Saundi Wilson in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Faculty Preceptor)

(Graduate School Advisor)

(Chairperson, Physical Therapy)
PERMISSION

Title A Visual Teaching Aid for a Pediatric Aquatic Physical Therapy Program

Department Physical Therapy

Degree Master of Physical Therapy

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Von for loving me enough to let me follow my dreams. I love you.

And, most importantly, I want to thank our Lord and Savior for continually blessing my life in so many ways and bringing me through each and every hardship.

Rejoice in the Lord always, again I will say rejoice. Let all men know your forbearance. The Lord is at hand. Have no anxiety about anything, but in everything by prayer and supplication with thanksgiving let your request be made known to God. And the peace of God, which passes all understanding, will keep your hearts and your minds in Christ Jesus.

Philippians 4:4-7
ABSTRACT

Aquatic therapy is quickly becoming a popular form of treatment in pediatric physical therapy. The unique properties of water allow children with disabilities to exercise and experience movement that they are often unable to experience on land. Despite the numerous benefits of aquatic therapy, few resources are available which visually demonstrate suggestions for the use of this form of treatment. A visual teaching aid would provide students and professionals in physical therapy with exposure to aquatic therapy treatment techniques with a pediatric population.

The purpose of this study will be to research and review the literature regarding aquatic therapy and create a video to provide a visual teaching aid to familiarize physical therapy students and professionals with pediatric aquatic therapy and provide techniques and exercises that can be utilized to treat children with disabilities. Techniques and exercises will be demonstrated with children who have disabilities and with children who do not have disabilities. All sessions with the children will take place in Grand Forks, North Dakota, under the direction of a physical therapist from the Child Evaluation and Treatment Program (CETP) or a University of North Dakota physical therapy faculty member. A dialog of instructions, benefits, precautions, progressions, and
variations will accompany each technique and/or exercise. By actually observing the treatment on a pediatric patient in the therapeutic pool, the students and professionals will be able to understand and apply the knowledge and techniques in their own therapeutic programs.
CHAPTER I

INTRODUCTION

Aquatic therapy is not new to the realm of pediatric physical therapy. Sources as early as the Bible mention the benefits people have attained using water as a treatment technique. As a young boy, Franklin D. Roosevelt used warm water treatment as therapy for polio in the early parts of this century.¹ Today, pediatric aquatic therapy is used to treat a variety of conditions from spasticity in a child with cerebral palsy to gait training with a child who has spina bifida.² Children with disabilities can experience active, independent movement in the water that they would not be able to experience on land.³

Aquatic physical therapy consists of supervised one-on-one, hands-on, individualized and group sessions for restoring normal function.⁴,⁵ These sessions are used for reinforcing normal movement patterns, range of motion, and strength through manual applications in a variety of positions in the water. Aquatic physical therapy represents a broad group of treatment techniques that demand action or interaction by the patient; require neuromuscular and skeletal performance; and relate specifically to the patient’s physical impairment, disability, and projected treatment goals.⁴
The therapist must utilize the unique properties of water to create a specialized plan of treatment for each patient. Properties, such as buoyancy, surface tension, cohesion, viscosity and streamlining, can be manipulated by the therapist in order to produce a wide variety of exercise levels and challenges for the patient. Hydrostatic pressure directs blood flow from the distal extremities to the heart and thus reduces swelling. The warmth of the water relaxes musculature and reduces spasticity, while causing physiological increases such as heart rate, respiratory rate, and metabolic rate. All of the properties of water combine to provide an optimal therapeutic experience for the patient.

Aquatic physical therapy can benefit children with disabilities in a variety of ways. Tone and range of motion can be improved through specific therapeutic techniques. Strength is facilitated at various levels, from trace to normal, and in a number of different positions. Many children benefit from vestibular stimulation, coordination, and gait training in the water. The pool is also an excellent place to teach breathing techniques to children with respiratory problems. Children with disabilities who participate in aquatic therapy often experience gains in psychological and psychosocial development as well. Aquatic therapy is an important therapeutic technique in pediatric physical therapy.

Children with certain diagnosis, disorders, or situations should not participate in aquatic therapy. Any general contraindication to aquatic therapy would apply, including infections, uncontrolled seizures, or excessive fear.
The majority of patients can participate in aquatic therapy; however, safety precautions must be followed with each and every patient. The disadvantages of aquatic therapy are administrative and therapeutic in nature, and are generally outweighed by the many benefits that the children who participate receive.

Despite the numerous benefits of pediatric aquatic therapy, few resources are available which visually demonstrate suggestions for the use of this form of treatment. Accreditation standards for physical therapy and physical therapist assistants fail to specify aquatic physical therapy as a requirement for curricula content. Of all the professional programs that do view aquatic therapy as "required coursework," 93% include the technique as part of a class rather than an entire class. Ninety-four percent of the material presented in these classes about aquatic therapy is in lecture format. A visual teaching aid would provide students and professionals in physical therapy with exposure to aquatic therapy treatment techniques with a pediatric population.

The purpose of this study is to research and review the literature regarding aquatic physical therapy and create a video to provide a visual teaching aid to familiarize physical therapy students and professionals with pediatric aquatic therapy and provide techniques and exercises that can be utilized to treat children with disabilities. By actually observing the treatment on a pediatric patient in the therapeutic pool on video, the students and
professionals will be able to understand and apply the knowledge and techniques in their own therapeutic programs.
CHAPTER II

PROPERTIES OF WATER

Water, in its natural form, has a number of characteristics that contribute to the therapeutic benefits of aquatic therapy. One such characteristic is buoyancy, which is defined as the upward thrust of water acting on a body that creates an apparent decrease in the weight of a body when immersed.\(^6\) Another is hydrostatic pressure, the fluid pressure exerted on all surface areas of an immersed body at rest, which aids in the reduction of swelling.\(^6,10\) The characteristics of surface tension, cohesion, and viscosity of water all impact the amount of resistance produced during therapeutic exercise. The warmth of the water is also an important.\(^6,7\) The temperature of a therapeutic pool is generally set between 92° and 98°, a temperature that produces a number of physiological effects for the patient during therapy. In order to truly understand the benefits of aquatic therapy, one must be introduced to the properties of water. Each of these properties will be described in the following paragraphs.

Buoyancy

Weight relief of a body due to buoyancy is one of the main advantages of aquatic therapy.\(^7\) According to Archimedes's Principle, when a body is fully or partially immersed in water at rest, it experiences an upward thrust equal to the
weight of the water that it displaces. This upward thrust decreases the amount of weight that the patient bears through each joint and allows for a greater freedom of pain free movement. A person who is immersed in the water up to his neck will experience a body weight which is nine-tenths of his body weight when out of the water. This reduction of body weight is beneficial to patients with arthritis who have extreme pain with weight bearing during exercise on land. In the water, patients can often walk and perform strengthening exercise pain free because of decreased stress on the affected joints. Buoyancy also aids in walking by increasing the patient's stability while standing. If patients fall off vertical while standing immersed in the water, buoyancy will help them to regain a vertical position, thus discouraging and preventing falls. This prevention assists in teaching proper walking patterns to children with decreased balance reactions. The counteraction of gravity due to buoyancy enables patients to exercise in ways they cannot on land.

Buoyancy can be utilized in pool treatments in a variety of ways. Exercise progression involves the use of buoyancy in assisting motion, as support, and as resistance to active movement. When using buoyancy in assistive exercise, the positions for resistive and assistive exercise are always opposite in water compared to land. This is because buoyancy gives assistance to upward motion while gravity gives assistance to downward motion. An example of an assistive exercise in the water for increasing hip flexion would be to have the
patient stand immersed in the water and allow buoyancy to assist in bringing the knee towards the chest.

The effect of buoyancy is greatest when the body segment is horizontal and diminishes as the segment approaches vertical because the cross-sectional area of the body part is greatest while in the horizontal position. When the patient is raising his arm from his side to above his head, the assistance of the water due to buoyancy will be the greatest when the arm is out at a 90° angle to his body. A long lever arm results in a position which permits the most assistance from buoyancy. When re-educating weak muscles, the therapist can progress the patient from a long lever arm when the patient is weakest to a shorter lever arm as the patient gets stronger. Instructing the patient to keep his arm straight and fully extended during the exercise will increase the amount of support from the water during abduction exercises. When a limb is positioned parallel to the surface of the water and the limb is moving in a horizontal direction, the influence of buoyancy on the exercise movement is neutralized. This position is ideal for assessing and testing joint movement and muscle power in the pool since minimal movements can be detected by the therapist.

Finally, buoyancy can also be used as resistance to movement. Resistance increases with a longer lever arm and decreases as the limb moves closer to vertical. Patients can use the water to resist exercise by pushing down against the buoyancy. For example, the patient can strengthen the triceps by straightening the arm from a bent elbow position and pushing the water down.
Resistance can be further increased by adding flotation devices to the limb that the patient is exercising. Adding flotation rings to a child's wrists makes all downward motions of the arm more difficult to perform in the water because he must push against both the buoyancy of the water and the support of the rings. Buoyancy is an asset to aquatic therapy because it allows for a wide variety of therapeutic techniques and exercise programs to be implemented on a number of different patient types.

Hydrostatic Pressure

The second characteristic of water that benefits patients in aquatic therapy is hydrostatic pressure. Hydrostatic pressure can be described as the fluid pressure exerted on all surface areas of an immersed body at rest. The pressure is directly proportional to the depth of the body part below the surface. The hydrostatic pressure increases as the depth of the water increases. A patient standing in water at chest level will have a greater amount of hydrostatic pressure applied to the ankles than to the hips. The pressure gradient that is produced by the water encourages the return of fluids from the extremities towards the heart. This is very beneficial to patients whose joints become swollen and painful when exercising on land. By exercising in the water, they can offset the tendency for blood to pool in the lower portion of the body.

Surface Tension, Cohesion, Viscosity

Surface tension, cohesion, and viscosity contribute to the resistance provided during aquatic exercise. Water molecules have a greater tendency
to hold together on the surface of the water, thus a greater resistance can be encountered if the patient is encouraged to perform exercise against the surface tension of the water. Cohesion is defined as the tendency of water molecules to adhere to each other, while viscosity is the property of a liquid to resist motion within it. As the cohesion between the water molecules increases, the viscosity of the water increases. The viscosity of water provides resistance to all motion including motion that is assisted by buoyancy. However, viscosity has a much less noticeable effect than buoyancy on the patient's movement in the water. Resistance can also be increased by increasing the speed at which the patient moves the body, or part of the body, through the water. Further resistance to movement is produced when the patient repeatedly changes the direction of motion creating waves and turbulence.

Streamlining

Another characteristic that influences resistance is streamlining. Streamlined objects have less resistance from water than nonstreamlined because the water "flows" over a streamlined object with greater ease and speed. The edge of the hand is more streamlined than the palmar surface, so a patient can increase the resistance to an exercise by facing the palm of the hand in the direction of the movement. By adding special gloves to the hand that create a "webbing" between the fingers, even more resistance to movement can be facilitated. Streamlining also plays a role in gait activities. As a person walks through the water, an area of negative pressure called a wake is created behind
him. The wake is an area of less resistance and is often used for gait training by having a patient walk behind a therapist where the resistance is lower. Resistance of the water can be manipulated by the therapist, through positioning and aquatic equipment, to create different exercise levels for the patient.

**Warmth**

The final property of water utilized in aquatic therapy is warmth. The temperature of a therapeutic pool is usually between 92° and 98° Fahrenheit. This temperature produces many physiological effects for the patient, such as an increase in heart rate, respiratory rate, and general metabolic rate. An increased flow of blood to the superficial tissues and muscles allows for easier and stronger contractions of the muscle fibers. As muscles are warmed by the blood circulating through them, there is a decrease in sensitivity of sensory nerve endings which leads to general muscle relaxation and reduction of spasticity. On land, the patients who require a heat modality often perform exercises before or after receiving the modality. In the pool, the patients exercise and receive the therapeutic warmth of the water at the same time. The muscles become less fatigued in pool therapy than when they receive two separate treatments on land.

The properties of water all combine to provide an optimal therapeutic experience for the patient. Buoyancy, surface tension, cohesion, and viscosity can be utilized to provide a wide range of exercise levels and opportunities. Hydrostatic pressure reduces swelling by directing blood flow in a proximal...
direction toward the heart.\textsuperscript{6-10} Finally, the temperature of the water relaxes spastic muscles and provides increased blood flow for optimal contraction of weaker musculature.\textsuperscript{6,7,10} The benefits of aquatic therapy depend on the ability of the therapist to utilize the properties of water in order to provide optimal treatment for the patient.
CHAPTER III

BENEFITS AND CONTRAINDICATIONS OF AQUATIC THERAPY

Aquatic therapy is quickly becoming a popular treatment method in patient care and rehabilitation.\textsuperscript{1-4,9,10,15,16} A number of studies\textsuperscript{1-4,11-14,16-20} have been published about the benefits and drawbacks of using aquatic therapy as a therapeutic tool. Concern for patient safety is reported as a potential drawback of this treatment technique.\textsuperscript{3,7,10-13,16} However, the literature supports aquatic therapy as an effective physical therapy treatment technique when facilitated by a physical therapist. Patients with specific diagnoses or disorders that are contraindicated for aquatic therapy treatment should not participate in an aquatic therapy program. The benefits achieved through aquatic therapy are reported to outweigh the drawbacks that might occur.\textsuperscript{2}

Benefits

Advantages of water over land—Due to the unique properties of water, aquatic therapy is able to offer a totally different, often superior, environment than any on-land therapy.\textsuperscript{21} The absence of active movement can contribute significantly to delayed physical and mental development in children with disabilities.\textsuperscript{3} Children need active, not just passive, movement in order to develop perceptual and visual motor skills. Because of physical limitations, it is
often difficult for children with disabilities to experience active independent movement on land. However, the therapeutic pool, through warmth and buoyancy, enables the child to enjoy a greater range of activity. Water also provides the possibility of voluntary movement at an earlier time in the patient's progression than any other method of treatment. Patients are able to perform fine gradation of movement with less energy than is needed on land. Aquatic therapy may be more effective than on-land therapy because the child is often more cooperative in the pool setting. The pool environment provides children with tactile stimulation, a feeling of weightlessness, and a freedom of movement that they cannot experience in any other medium. The water allows perceptual training to be achieved through visual, aural, temperate, and tactile means.

Specific treatment techniques that are not possible in the therapeutic gym setting can be easily achieved in the therapeutic pool. The water provides a medium that allows for a variety of positioning techniques for patients with neurological disorders such as those with spinal cord injuries. A patient with little volitional control can be more easily maneuvered by the physical therapist while in the water. In the therapeutic pool, there is potential for exercise in three dimensions which cannot be done on land. The physical therapist can easily adjust the intensity, resistance, and progression of exercise to patient tolerance. Water can provide sensory stimulation that allows for increased patient awareness of affected part of the body or desensitization of a hypersensitive part of the body through tactile and temperature pathways. A
therapist can decrease neglect, the inability to perceive a part of the body affected by the neurological injury, in a patient with hemiplegia through water games, turbulence, and floatation devices. A variety of treatments can be performed more effectively in the water.

Effect on Tone—Tone refers to the elasticity, length, and quality of fibers of a muscle; both high and low tone can be treated in the pool.\textsuperscript{1,8,11-13,16} Aquatic therapy is a proven method of relaxation and tone reduction in spastic and contracted muscles\textsuperscript{1,8,11,12,16} (see Appendix A). The use of warm water can be combined with proper handling of the child to inhibit abnormal patterns of movement and provide an optimal means for reducing hypertonus in the spastic child.\textsuperscript{13} By resisting buoyancy, the uncontrolled and wide-ranging movements of the patient with an athetoid or low tone disorder may be minimized and movements of a more functional nature may be facilitated\textsuperscript{13} (see Appendix A). Sweeney\textsuperscript{13} found that both infants with high tone and infants with low tone showed improvements after participation in an aquatic therapy program.

Effect on Range of Motion—Range of motion and stretching are also successfully administered in the therapy pool.\textsuperscript{1,7-12} The warmth of the water and the tone reduction discussed above promotes increased flexibility for the patient.\textsuperscript{1,10} Gentle stretching of soft tissue is often less painful and more effective in the therapeutic pool than when applied in the gravity-affected setting because of hydrodynamic effects achieved through warmth, buoyancy, and tone reduction.\textsuperscript{7-10} Because of complete immersion, lower extremity range of motion
is especially effective in the water and can be administered using the same techniques as on land. By limiting and/or decreasing spasticity, even for short periods of time, a carry-over to functional improvements in range of motion is seen over long periods of time. With little power and good range of motion, carefully graded progression of re-education using buoyancy can be achieved in the water. When generalized muscle relaxation and decreased pain is achieved through tone reduction and range of motion, movement is more easily facilitated (see Appendix A).

Effects on Strength—Aquatic therapy is an excellent way to facilitate muscle strength and motor control of the trunk, neck, and extremities. Extremity strengthening is achieved in water using similar techniques prescribed in the therapy gym; however, limb, trunk mobilization, and strengthening are often more rewarding in the water than on land because the child is able to accomplish more independently (see Appendix A). Muscles with less than anti-gravity strength can perform progressive resistive exercises better underwater because muscles can contract more easily and strongly in warm water. There may be no fixed resting position in the water so there is more fixative effort required by the body musculature. More synergists and fixators are required to stabilize the body in the water during exercise with resulting mild generalized and almost continuous exercise. For example, the child's trunk must be stabilized, fixators, so that he can control the movements of the extremities, synergists, through the water while swimming.
The pool is also a good place to start lumbar stabilization techniques because the buoyancy allows for the negation of partial or total body weight. The decrease in load on the spine caused by the water allows the trunk muscles to stabilize. Buoyancy also helps to provide trunk stabilization so limb movement is easier. The therapist can increase the difficulty of the trunk exercise by decreasing the depth of the water (see Appendix A). The patient who is deconditioned often cannot initially stabilize his trunk on land because his muscles cannot accommodate to the load on the spine. Aquatic stabilization exercises serve as building blocks for later stabilization exercises on land.

Effects on Coordination—Aquatic therapy makes it possible to achieve a slow, controlled movement even without normal strength of the musculature. The buoyancy of the water causes an apparent loss of weight of the limbs and enables the patient to have coordinated movement using weakened muscles, an event impossible on land. The water retards ataxic movement and allows the patient to experience the sensation of a more normal movement pattern. Proprioception can be improved by allowing the patient to see and feel the movement through the water (see Appendix A).

Effect on Gait—The therapy pool is an excellent setting for pre-gait and gait activities to help patients learn skills needed during ambulation on land. Pre-gait activities, such as early standing, are designed to promote stability and balance. The patient with impaired balance and equilibrium difficulties benefits from the support of the water around the trunk. This support provides
security and retards loss of balance, allowing the patient more time to react to shift in the center of gravity. Gait re-education in the pool should precede re-education on land. A correct pattern of walking and good posture should be emphasized and are easily corrected. In the water, there is significantly less stress placed on the joints of the lower extremity, providing the opportunity to include exercises and activities designed to improve the individual's ability to ambulate (see Appendix A).

Effect on Respiratory Disorders—Patients with respiratory disorders can benefit from aquatic therapy. Correct breathing control and oral motor control can be achieved through breath holding and blowing bubbles activities (see Appendix A). The water pressure on the abdomen wall encourages deep respiration and increases vital capacity.

Effect on Psychological and Psychosocial Development—Aquatic therapy has important psychological effects on the patient as well. Aquatic therapy can provide the patient with a greater sense of comfort and safety due to the fact that there is a decreased chance of injury from exercises performed under water. Many of the same tasks that are achievable in the pool are threatening to the patient on land. Activities in the pool are often easier for the patient to perform so they are rewarded with a sense of accomplishment earlier than they would be on land. Aquatic therapy provides a challenge while allowing the patient to feel safe and comfortable in the therapeutic environment.
Motivational and therapeutic properties of water can create a stimulating learning environment for the child with even the most severe disability. The water provides a sense of freedom and relaxation for a child whose life is somewhat limited physically. The aquatic therapy session becomes an opportunity for comfort and even play which is an important step in a child's socialization. As the child develops the ability to move and enjoy the activities in the water, he begins to improve self-awareness and self-esteem. The achievement of skills and voluntary movement foster an increased sense of independence, morale, and accomplishment. Studies show that aquatic therapy has stimulated participation and increased interest span. Infants participating in an aquatic program showed improvements in feeding behaviors and levels of alertness following the therapy session. Immersion combined with activity seemed to have a tranquilizing effect for hyperactive and anxious patients. The physical and emotional independence achieved through participation in a continuous aquatic program may not only be improved during the pool time but over the long term as well. Aquatic therapy has a variety of benefits that contribute to the patients' overall physical and emotional well-being.

Parental Involvement—The parents are a part of the therapy process and should be included in the therapy sessions as much as possible. In on-land therapy, the parents tend to watch and only sporadically converse with the physical therapist during their child's treatment sessions. In pool therapy, it is easier to facilitate parental involvement because the parents are “forced” to get
wet and participate in therapeutic games and activities\textsuperscript{16} (see Appendix A). Parents report that the child is often easier to handle and/or is able to move actively, with less restriction, on his own for one to two hours after aquatic therapy.\textsuperscript{16}

**Contraindications, Safety, and Disadvantages**

**Contraindications and Precautions**—The disadvantages and contraindications of aquatic therapy are few. The majority of research in this area is concerned with safety issues and patients for whom hydrotherapy is contraindicated. Patients with the following diagnoses or disorders should not participate in an aquatic therapy program: fever, cardiac failure, infectious or contagious disorders, open wounds, excessive fear of water, uncontrolled seizures, and uncontrolled blood pressure.\textsuperscript{3,10,13} A patient who cannot tolerate inpatient treatment should not participate.\textsuperscript{16} Although the following patients are allowed to participate in an aquatic therapy program, proper caution must be used with those who have a mild fear of water, controlled cardiac disorders, and controlled hypertension.\textsuperscript{7,11} In order to participate in aquatic therapy, the patient should be able to tolerate at least one-half hour of gym therapy.\textsuperscript{12} Patients with decreased sensation should have their skin, that could have scraped along the bottom of the pool, checked before and after treatment.

**Safety Issues**—Safety is an important issue in aquatic therapy. In order to prevent infection, the pool and surrounding area should be cleaned regularly.\textsuperscript{7} Proper chlorinating is also required. To prevent falls outside the pool, the
surface should be kept rough and dry with no running allowed in the pool area. The patient should always be instructed to enter the pool slowly because a mild rise in blood pressure may occur on entry. The physical therapist should always be standing close by. If the patient is unable to walk into the pool, another method of entry would be used (see Appendix A). In most cases, a period of adjustment to the water involving water play will be needed; time should be allotted for this\textsuperscript{16} (see Appendix A). The patient should never be left alone at any time during the treatment\textsuperscript{10}. The physical therapist should watch for signs of fatigue and adjust the treatment accordingly. The patient should be cautioned about overstressing joints, such as fingers used to grasp the sides of the pool or the edge of a kickboard. To avoid chilling after therapy, proper towels or bath blankets should be wrapped around the patient\textsuperscript{7}. The post-pool shower should gradually change in temperature from pool temperature to room temperature. The patient should stay indoors at room temperature for 20 minutes, especially if it is cold outside. The patient should be reminded to drink liquids to avoid dehydration.

Administrative Disadvantages—The disadvantages of aquatic therapy involve both administrative and therapeutic concerns. It is often difficult to have full access to a therapeutic pool\textsuperscript{7}. If a pool is available, there is often a limit to the amount of treatment time allotted for each therapist or patient. Work in the pool is hard and can lead to a thermal disability if the patient's status is not monitored carefully\textsuperscript{8}. 
Therapeutic Disadvantages—In the pool, it is often difficult for patients to fixate or stabilize a proximal joint in order to move a distal joint. If this condition is left unchecked, poor isolation of movement can occur. If there is improper stabilization during exercise, muscle incoordination may be increased and faulty movement patterns may develop. Patients appear to have a reduced sense of stretch in the water so it is important that the physical therapist not stretch too vigorously. When placing a patient with spasticity in a supine floating position, the therapist must support the head and neck to prevent extensor thrust. The front crawl stroke may tend to facilitate abnormal postural reflex patterns such as asymmetrical tonic neck reflex (ATNR). The flutter kick may promote extensor hypertonus and adduction of the lower extremities. The therapist must be mindful of the disadvantages and take precautions to prevent negative effects on patient care.

Woods reported gains in strength, endurance, cardiopulmonary function, and normalization of movement patterns in patients who participated in an aquatic therapy program. Although there are some important safety issues and precautions that must be taken into account, therapists can creatively utilize the unique properties of water to reduce tone; increase strength and coordination; re-educate gait patterns; and improve the breathing techniques, functional independence, and self-esteem of the patient in the development of a successful aquatic therapy program.
CHAPTER IV

PRODUCTION OF THE VIDEO

The purpose of this study was to research and review the literature regarding aquatic therapy and create a video to provide a visual teaching aid to familiarize physical therapy students and professionals with pediatric aquatic therapy and provide techniques and exercises that can be utilized to treat children with disabilities. Prior to producing the video, several aspects of aquatic therapy were researched, including properties of water, benefits, contraindications, treatment techniques, and exercises.

The techniques and exercises that were demonstrated in the video were developed by the administrators of the project. Each exercise was chosen because of its ease of application and relevance to pediatric physical therapy. The following areas of therapy were addressed: tone facilitation and reduction, range of motion, trunk and extremity strengthening, balance and equilibrium reactions, gait training, vestibular stimulation, and games (see Appendix A). The techniques and exercises were reviewed by a pediatric physical therapist at the Child Evaluation and Treatment Program (CETP) in Grand Forks, North Dakota, and by a University of North Dakota Physical Therapy (UNDPT) faculty advisor.
A contract was created between the administrators of the project, the CETP physical therapist, the UNDPT faculty advisor, and the director of the rehabilitation hospital where the taping would take place (see Appendix B). The contract outlined the responsibilities of each of the parties involved, equipment to be used, and permission for use of the therapeutic pool. The administrators of the project planned to observe and interact with each child involved in the project during at least one regularly scheduled physical therapy treatment session at CETP. The purpose of this interaction was to familiarize the child with the designers and maximize the child’s comfort throughout the production.

The children were selected for the project according to their physical, mental, and emotional abilities and how they related to the chosen exercises of the project. The physical therapist at CETP made the initial contact with the families. A cover letter and consent form with a pre-addressed, stamped envelope were distributed to the parents of the children selected (see Appendix C). The cover letter and consent form included a brief description of the project, estimated dates for taping sessions, a description of possible risks, a statement granting permission from the parent, and an invitation to attend the taping sessions. Once the consent forms were received by the administrators, the families were contacted to schedule taping sessions.

The taping sessions took place on two weekends in October so as not to interfere with the children’s regularly scheduled treatment sessions. A fellow classmate served as the videographer and a UNDPT faculty advisor supervised
at all times. Each child’s taping session lasted approximately one hour. The number of techniques or exercises that were demonstrated within that hour varied for each child. Specific techniques and exercises were selected for each child based on the child’s diagnosis, functional level, and personal preference of favorite activities. No re-taping sessions were needed.

The script for the video was written and placed on Power Point slides that were inserted into the video (see Appendix A). The slides consisted of aquatic safety issues and a description of each exercise demonstrated in the video. There are a few slides that were not accompanied by a taped demonstration because the activity described was very common and did not require a visual demonstration. The slide contained applications, equipment needed, and precautions for each exercise. The procedure, progression, and variations of the exercise were verbally described during the visual demonstration of the exercise.

The techniques and exercises were rearranged in the order of the slides by one of the designers using two VHS recorders. The Power Point slides were then copied from a computer disc onto a high eight video (see Appendix A). Take 1 Video Productions, a professional editing company, combined the video of slides with the video of the techniques and exercises and recorded the audio voice over of the script. The editing took a total of five hours. Copies of the video were distributed to the two administrators, CETP physical therapist, and
the UNDPT faculty advisor. The families and the children who participated in the video were invited to view the video upon its completion.
CHAPTER V
CONCLUSION

Pediatric aquatic therapy is used to treat a variety of conditions from spasticity in a child with cerebral palsy to gait training with a child with spina bifida.² Despite its popularity, few resources exist which visually demonstrate suggestions for a pediatric aquatic therapy program.⁵ A visual teaching aid will provide physical therapy students and professionals with exposure to aquatic therapy treatment techniques and exercises with a pediatric population.

The properties of water combine to provide an optimal therapeutic experience for the child. Properties such as buoyancy, surface tension, cohesion, viscosity, and streamlining can be utilized by the therapist to create an appropriate exercise level for the patient through assistance or resistance to motion.⁶⁻⁹ Hydrostatic pressure effects the patient's circulation by encouraging blood flow from the extremities towards the heart.⁶⁻¹⁰ The warmth of the water can produce many beneficial physiological effects for the patient that can lead to increased relaxation and decreased tone.⁶,⁷,¹⁰ The physical therapist must utilize the properties of water to create a specialized plan of treatment for each patient.

The literature supports aquatic therapy as an effective and beneficial treatment technique in pediatric physical therapy.⁶,⁷ Tone, range of motion, and
strength can be improved through a specialized aquatic therapy techniques and exercises.\textsuperscript{1,7,8,11-13,18} Children can receive training in more advanced areas such as vestibular stimulation, balance activities, and gait training.\textsuperscript{8,9,11,15} Breathing activities for children with respiratory difficulties are especially effective in the pool setting.\textsuperscript{1,7,16} Children with disabilities who participate in aquatic therapy often experience gains in psychological and psychosocial development as well.\textsuperscript{1,2,8,9,11,12,16} Aquatic therapy has a variety of benefits that contribute to the patient's overall physical, mental, and emotional well being.

Despite the many benefits to aquatic therapy, the physical therapist must be mindful of the contraindications, precautions, and disadvantages to prevent negative effects on patient care. Contraindications and precautions to aquatic therapy include any diagnosis or disorder that would endanger the health of the patient or the health of others in the pool, such as uncontrolled seizures, infections, or excessive fear of water.\textsuperscript{3,10,13} The safety of the patient should be a priority at all times.\textsuperscript{7,10,16} The disadvantages of aquatic therapy are few and are generally outweighed by the many benefits that children who participate receive.

A video was created to provide a visual teaching aid and to familiarize physical therapy students and professionals with pediatric aquatic therapy. The video demonstrated a variety of techniques and exercises that can be used to treat children with disabilities. The techniques and exercises were selected based on their ease of application and relevance to pediatric physical therapy. The video will be used as a visual teaching aid in the classroom to introduce
physical therapy students to the realm of aquatic therapy while familiarizing them to how children with disabilities function in a pool setting. It could also be utilized in a clinical setting to suggest new ideas for treatment, refresh old techniques and exercises, and/or train physical therapy professionals in the art of pediatric aquatic therapy. Additional techniques and exercises could be added to the video in the future after the administrators gain more clinical experience in the realm of pediatric aquatic physical therapy. By observing the treatment techniques and exercises on pediatric patients, the students and professionals will be able to understand and apply the knowledge to their own therapeutic programs.
PEDIATRIC AQUATIC PHYSICAL THERAPY

Saundi Wilson
Dena Wright
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AQUATIC THERAPY
SAFETY
Contraindications to Aquatic Therapy

- Children who may not participate in aquatic therapy are those with:
  - fever
  - cardiac failure
  - infections/contagious disease/open wounds
  - uncontrolled seizures
  - uncontrolled blood pressure
  - any questions should be cleared w/ physician
General Pool Precautions

• Children who are able to participate in aquatic therapy, but require special care
  – Those who can’t swim or have an extreme fear of water
  – Those with controlled cardiac or hypertension disorders
  – Those with decreased sensation
  – Those who are unpredictable
  – Children w/ Spina Bifida are contraindicated from using any equipment with latex
Pool Entry

- Application: Safe entry into the pool
- Equipment: Stairs with handrails & ladders
- Precaution: Wet & slippery surfaces & uncooperative child

Procedure: The child should always enter the pool slowly and carefully. A PT, another health care professional, or the parent should always be directly beside the child.

Progression & Variations: A smaller or child or one with more involvement may enter the pool by being carried or handed into the pool by an adult. Children who are able can walk into the pool via the stairs or climb down a ladder. Jumping into the pool from the side to a PT or other adult may be another option for some children.
Introduction to the Water

- Application: Fearful child or parent, begin treatment & develop rapport with PT
- Equipment: Stairs, toys, pouring toys, sponges & squirt toys
- Precaution: General pool

Procedure: The child may start by sitting on the side of pool or on the top step of the stairs and dangle his/her feet into the water. The child can also be held on the PT’s lap. Encourage water play with sponges and squirting and/or pouring toys. Begin by wetting the PT and progress to wetting the child. Progression: Move slowly down the steps or transfer to a bench in the water. Progress to deeper water as the child feels comfortable.

Variations: Sometimes the child is handed in from the side to the PT. The PT can start by holding the child close to his/her body at first and then progress to less contact with the PT. the child can also start in an inner tube w/ the PT holding on. Above toys can be used with this method as well.
ACTIVITIES TO FACILITATE TONE
Passive Prone on Elbows

• Application: UE strengthening, scapula stabilization, head and trunk control and extension, balance, vestibular stimulation & breathing exercises
• Equipment: Kickboard or floatation device with straps
• Precaution: General pool safety

Procedure: Place the child in a prone position on a floatation device supported by on elbows. Straps may be needed to help stabilize the child on the floatation device and to “free up the PT’s hands. Rhythmically glide the child through the water while putting pressure on the child’s shoulders to encourage weight bearing through the scapula and upper extremities.

Progression: Encourage weight shifting and equilibrium reactions by tipping the floatation device. Move the child faster through the water.

Variations: The child can place his/her face in the water and work on breathing techniques as well.
Upper Extremity Ball Push

- Application: Increase tone, scapular stabilization, UE strengthening, grip strength, hand & finger ROM, Trunk stabilization & encouragement of proximal motor return
- Equipment: Ball or large toy that floats & a bench
- Precaution: General pool

Procedure: The child can sit on a bench or stand in shoulder level water. The child is then instructed to push the ball out in front of him/her against resistance.

Progression: Push the ball down under water against buoyancy. Increase surface area of the ball.

Variations: Do the activity to music. Have the child push the ball out to reach PT’s hand in various planes of movement. Have the child jump up and push ball down into the water.
Lower Extremity Weight Bearing

• Application: Facilitate proximal motor return, increase tone, increase proprioception, promote upright posture, prevent contractures & balance

• Equipment: Padded bench, parallel bars, & steps with a railing

• Precaution: General pool

Procedure: Place the child in a position with an adequate base of support. The PT then puts pressure down through shoulders and/or pelvis and hips to facilitate weight bearing, bilaterally.

Progression: Sitting with pressure through the knees, half-kneeling, kneeling, standing. Start with support from PT then progress to independence. As the depth of the water decreases, the amount of weight born through the joints increases.

Variations: Add UE activities to maintain child’s attention. Use different positions during games like Simon Says.
ACTIVITIES TO REDUCE TONE
**Floatation in Supine**

- **Application:** Relaxation, tone reduction & elementary swimming skill
- **Equipment:** Floatation devices to adequately support child
- **Precaution:** General pool & children unable to be positioned entirely within the horizontal plane will tend to rotate to one side

**Procedure:** The PT stands at the child’s side providing maximal manual contact to gain the child’s trust and allow the child to relax. The child lies supine in the water supported with floatation devices or by the PT.

**Progression:** Decrease the amount of support from floatation devices and/or PT. Progress to Bad Ragaz techniques.

**Variations:** Work on breathing techniques with the child. Use music or tell stories to help relax the child.
Bad Ragaz Techniques for Relaxation

Application: Decrease in tone/spasticity, dissociation of trunk & pelvis, elongation of trunk soft tissues, vestibular stimulation, calm hyperactive child & cerebral palsy

- Equipment: Floatation devices to adequately support child in the floating position

- Precaution: General pool, decreased perception to stretch, water over child’s face

Procedure: The child is positioned in supine with the hips in abduction and slight ER. 1) The PT stands between child’s LE with a hand hold on the child’s pelvis. The PT gently rocks the child’s pelvis by alternatingly pushing both ASIS’s downwardly into the water. 2) PT assumes same position or stands at the child’s head with a hand hold at the child's scapulae. Slowly swing child from side to side through the water. The child may need to close eyes if he/she cannot tolerate visual input.

Progression: Pause before reversing direction to monitor turbulence and resistance. Eliminate or shorten pause to progress.

ACTIVITIES TO FACILITATE RANGE OF MOTION
Upper Extremity Range of Motion

- Application: Increase ROM, increase tissue extensibility, decrease pain, contractures, decrease tone/spasticity & relaxation
- Equipment: Bench, stairs & toys
- Precaution: General pool & decreased perception to stretch

Procedure: Similar to land. The child sits in chest level water on a step, a bench or on the PT’s lap. The PT performs PROM. The buoyancy of the water is used for AAROM. The child can play games and reach for toys with AROM. Buoyancy can also be used to resist ROM by instructing the child to push against it.

Progression: PROM-AAROM-AROM-RROM

Variations: ROM can be done in standing or floating supine as well. A kickboard or other floatation device can also be used in AAROM. The child can play Simon Says, perform pouring activities, or UE strengthening activities.
### Lower Extremity Range of Motion

- **Application:** Increase ROM, decrease contractures, increase tissue extensibility, decrease pain, decrease tone/spasticity & relaxation
- **Equipment:** Bench, stairs, toys & floatation devices
- **Precaution:** General pool & decreased perception to stretch

**Procedure:** Similar to land. The child sits in chest level water on a step, a bench or the PT’s lap. The PT performs PROM. The buoyancy of the water is used for AAROM. The child can play games for AROM. Buoyancy can also be used to resist ROM by pushing against it. Toys can be used to occupy the child while performing LE PROM.

**Progression:** PROM-AAROM-AROM-RROM

**Variations:** ROM can be done in standing or floating supine as well. Child can play Simon Says or perform LE strengthening activities.
ACTIVITIES TO FACILITATE TRUNK STRENGTHENING
Trunk Stability

- Application: Trunk strengthening, increase tone, co-contraction of trunk musculature, orthopedic conditions, JRA & MD
- Equipment: Floatation devices to support head, pelvis and/or LE
- Precaution: General pool, inability to perceive stretch, over fatigue, painful, acute conditions & water may wash over child’s face

Procedure: The PT stands in waist to chest level water positioned between child’s LEs with manual contact at the child’s pelvis. The child is instructed to maintain a static position while PT moves the child through the water. Tell the child to be “stiff as a log”.

Progression: Increase speed, change direction randomly, add turbulence & increase lever arm by moving hand hold distally. Progress to trunk strengthening in floating.

Variation: Make motor boat sounds. Move to the rhythm of an upbeat song.
Trunk Strengthening in Floating Position

- **Application:** Trunk strengthening in different planes, especially abdominals, increase tone, orthopedic conditions, MD & JRA
- **Equipment:** Floatation devices to support head, pelvis & LE
- **Precaution:** General pool, over fatigue, painful, acute conditions & valsalva maneuver

Procedure: The PT’s position will vary depending on what area of the child’s body is the focus of the activity. The PT stabilizes the child’s pelvis while the child moves the upper body or the PT stabilizes the upper body while the child moves the lower body.

Progression: Move the support from the PT more distally, add weights, increase the number of repetitions, etc....

Variations: 1) With the PT at the child’s pelvis, The child partially sits up and reaches across body to get toy floating in water.(abdominal obliques)

2) With the PT positioned at the child’s pelvis, the child pretends he/she is a tree blowing in the wind as he/she moves self through the water. (lateral trunk flexion)
ACTIVITIES TO FACILITATE UPPER EXTREMITY STRENGTHENING
Making Waves

• Application: UE strengthening and ROM, balance, bilateral coordination

• Equipment: Objects to increase resistance of water (webbed gloves, flat toys, etc.)

• Precaution: General pool

Procedure: Have the child stand in chest level water and abduct and adduct his/her arms against the resistance of the water. The PT may need to stabilize child’s trunk.

Progression: Sitting, half-kneeling, kneeling, and standing. Increasing the depth of the water increases the resistance to arm motion. Decreasing the depth of the water increases difficulty for balance.

Variations: Have a contest to create the biggest wake. Have the child spin around in the water while moving his/her arms for added vestibular input.
Throwing and Catching

- Application: UE strengthening & ROM, sitting and standing balance, bilateral coordination, pelvic anterior/posterior mobility, trunk stability, hand-eye coordination, over-head activity, socialization skills & muscular dystrophy
- Equipment: Balls, all sizes, rings & a bench
- Precaution: General pool & ATNR

Procedure: The child sits on a firm stable surface in the pool with the UEs above the water. The child plays by throwing and catching the ball. The PT may need to help stabilize trunk.

Progression: the child moves from sitting to half-kneeling, to kneeling, to standing. Progress to less support from PT for stabilization.

Variation: The child may throw the rings that he/she will then dive for. The child throws a ball at a target or through a hoop. Use The throwing and catching in keep away game. The child can also shoot baskets or play volleyball if age appropriate. This activity is excellent for parental and/or peer involvement.
Pull Ups

- Application: UE strengthening, scapular/trunk strengthening & bilateral overhead activity
- Equipment: Pull up bar or aquatic exercise station
- Precaution: General pool & shoulder joint laxity or hypermobility

Procedure: The PT raises the child up to grasp the bar or handles of the aquatic exercise device. The child slowly raises self up out of the water and then lowers self back into the water.

Progression: Decrease the help of buoyancy by decreasing the depth of the water. The PT can attach weights to child's legs to add difficulty.

Variations: Change the child's’ hand positions to focus on specific back and UE muscles.
Triceps Dips

- Application: UE strengthening, weight bearing & ROM, bilateral coordination, balance, & proprioceptive stimulation
- Equipment: Parallel bars, ankle weights
- Precaution: General pool, shoulder instability & unequal strength bilaterally

Procedure: The child stands in the parallel bars with one hand on each side of the bars. The child raises self up out of water into full elbow extension and slowly lowers self back into water. The child may have to bend knees to keep the LEs from reaching the pool floor and hindering movement.

Progression: Increase difficulty by decreasing the depth of water. Add ankle weights to child's ankles. Increase the number of repetitions.

Variations: Have the child do dips with legs straight out in front of him/her. Practice counting or do to music.
Parallel Bar Push-ups

- Application: UE & trunk strengthening, coordination, trunk and pelvic stability, UE weight bearing, neck and trunk extension & proprioception
- Equipment: Parallel bars
- Precaution: General pool, shoulder instability & unequal strength bilaterally

Procedure: Have the child stand outside the parallel bars with both hands gripping one bar. Position the child so that his/her feet are far enough away to encourage bending of the arms and not the hips. The child slowly lowers his/her chest to touch the bar and back up keeping the body straight.

Progression: Increase difficulty by decreasing the depth of the water. Increase the number of repetitions.

Variations: Add respiratory activities. Practice counting or do to music.
Push/Pull Kickboard Through Water

- Application: UE strengthening, abdominal strengthening, trunk stabilization, trunk rotation, balance, bilateral coordination & crossing mid-line
- Equipment: Kickboard or other toy that can be used to resist movement through the water
- Precaution: General pool & valsalva maneuver

Procedure: The child sits or stands in chest deep water. The child holds onto the edge of the kickboard and pushes the flat side of the kickboard away from the body then pulls it back towards the body. The PT may need to provide support to prevent the child from falling backwards.

Progression: The deeper the kickboard is immersed, the greater the resistance to motion.

Variations: The child holds the kickboard horizontally in front of him/her and extends one arm to push the kickboard out to the opposite side of the body while the other arm stabilizes the kickboard close to the body. Then the child switches directions and pushes out and over with the stabilizing arm.
Sponge Squeeze

- Application: Wrist, hand and finger strengthening, hand-eye coordination & bilateral coordination
- Equipment: Sponges of different size and shape
- Precaution: General pool

Procedure: Place a sponge in each of the child’s hands. Instruct him/her to dip the sponge in the water and then bring it above the water to ring it out. The child can also “ring” or twist the sponge with two hands. Have the child squeeze as hard as possible.

Progression: Use bigger sponges or use two sponges in each hand.

Variation: Have the child empty water from the sponge into a container in a contest. Use fun shaped and colored sponges.
ACTIVITIES TO FACILITATE LOWER EXTREMITY STRENGTHENING
LE Kicking Activities

- Application: LE strengthening, LE ROM, bilateral coordination, endurance & tactile stimulation
- Equipment: Side of pool, kickboard and/or inflatable ring
- Precaution: General pool & flutter kick can promote extensor hypertonus

Procedure: The child is placed in an inflatable ring or holds onto the pool side or kickboard. The child is instructed to propel him/her self forward using various kicking techniques.

Progression: Decrease support and/or assistance of the PT. Children who are younger and/or more involved will start out in the inflatable ring b/c of increased stability and support. Holding onto the kickboard is less stable and thus more difficult than holding onto the side of the pool.

Variations: Flutter kick, frog-legged kick, abd/add kick, knee flexion/extension with hip in neutral, DF/PF. Use as a race or a relay game.
LE Push Off

- Application: LE strengthening, weight bearing through LE, proprioception & closed-chain activity
- Equipment: Side of pool, kickboard & floatation device
- Precaution: General pool & water splashing over child’s face

Procedure: The child lies supine with both feet planted firmly against the side wall of the pool. The child bends his/her knees and hips and then extends them to push him/herself backwards through the water.

Progression: Go for using both feet to using one foot at a time. Decrease the assistance from PT.

Variation: The PT holds a kickboard horizontally in front of him/her. The child pushes off of the kickboard rather than the wall.
London Bridges

- Application: LE strengthening, balance, coordination, motor planning & proprioception
- Equipment: Any object to serve as a bridge; a funnoodle or a kickboard
- Precaution: General pool, inhalation of water & water going up child's nose

Procedure: A "bridge" is held in water at an appropriate depth for the child. Instruct the child to bend at the knees and walk under "bridge".

Progression: Lower the "bridge" each time the child passes under it.

Variation: Do a group activity with music. Use as part of an obstacle course.
Plyometrics

- Application: LE strengthening, weight bearing through LE, proprioception, balance & coordination
- Equipment: Steps, bench & hula-hoop
- Precaution: General pool & decreased sensation of LE

Procedure: Instruct the child to jump up and down in the water. The child can also jump across the length of the pool and back.

Progression: Balance difficulty increases as the depth of the water decreases. Resistance increases as the depth of the water increases. The child may start holding onto a railing or the PT and progress to independence.

Variations: 1) The child jumps up and down onto a small step then progress to a taller bench. 2) The child jumps in and out of hula-hoop, front to back and side to side. 3) The child hops on one foot with the above variations.
ACTIVITIES TO FACILITATE BALANCE AND EQUILIBRIUM REACTIONS
Sit and Reach

- **Application:** Balance & equilibrium reactions, pelvic/trunk mobility, UE strength & ROM, crossing mid-line & weight shifting
- **Equipment:** Toys and objects of interest to the child
- **Precaution:** General pool & ATNR

Procedure: The child sits on a sturdy bench in chest level water. The PT places objects just out of the child’s reach and asks the child to reach for them. The objects can be placed all around the child to encourage movement in all directions.

Progression: Decrease support from the PT. Decrease the depth of the water. Increase turbulence. Sit to half-kneeling, to kneeling, to stand.

Variations: Play games where the child reaches out one way to grab an object and then places the object into a container located on the opposite side of the child. Pouring activities can also be used.
Standing on One Foot

• Application: Balance, coordination, LE strengthening, weight bearing, proprioception & motor planning
• Equipment: parallel bars & sinkable rings and/or balls
• Precaution: General pool

Procedure: The child slowly lifts one leg and balances on the opposite leg. Alternate feet. The child may require support from the PT for trunk stability and/or balance.

Progression: Move from parallel bars to independent standing. Difficulty increases as level of the water increases. Increase turbulence. Decrease support from the PT.

Variations: Incorporate into games like Simon Says, an obstacle course or a contest with the PT to see who can balance the longest. Instruct the child to “pick up” sinkable rings with one foot while balancing on the other foot. Alternate feet.
Standing from a Floating Position

- Application: Balance, righting reactions, rotational control & abdominal and trunk strengthening
- Equipment: None
- Precaution: General pool & child’s inability to recover to a standing position safely

Procedure: The child assumes a floating position, either supine or prone. The child then transitions to standing with both feet touching the bottom of the pool. The PT can assist as needed.

Progression: From with a floatation device to without one. Decrease support from the PT. Decrease the depth of the water. Increase the child’s speed and agility.

Variations: Use with rolling activities or as part of an obstacle course.
Rolling with a Floatation Device

• Application: Rotational control, balance, righting reactions, trunk & abdominal strengthening, head control & vestibular stimulation

• Equipment: Floatation device that can support the child’s weight

• Precaution: General pool & if child is unable to recover to a standing position safely

Procedure: The child lies supine and holds floatation device against the chest. The child then “flips” self over into sidelying position and then back into a prone position. Repeat the activity in the opposite direction.

Progression: The PT may need to initiate movement at first. The child can progress to rolling with out a floatation device if he/she can recover to a standing position safely and correctly.

Variations: Use as part of a game like Simon Says.
Sitting Balance on Kickboard

- **Application:** Balance & equilibrium reactions, trunk stabilization, weight shifting in sitting & disassociation of pelvic motion
- **Equipment:** Kickboard that can support weight of child & possible second person to help support child
- **Precaution:** General pool

Procedure: The PT stabilizes a kickboard and the child is placed on it in the sitting position. The child balances in sitting. Another person may be required to help stabilize the child's trunk.

Progression: The PT moves and/or tilts kickboard to encourage equilibrium reactions. Decrease the amount of support from other person. Allow the child to balance for short periods of time without the PT holding onto the kickboard. The PT should remain in close contact with the child at all times.

Variations: Perform to music or have a contest to see how long the child can balance on the kickboard.
ACTIVITIES TO FACILITATE GAIT
Pre-gait Activities

- Application: Gait training, weight shifting, weight bearing through LEs, balance, stability & functional activity
- Equipment: Parallel bars & floatation devices
- Precaution: General pool & weight bearing status of child

Procedure: Have the child stand supported by the PT at the child’s pelvis. 1) The child slowly shifts weight laterally from one foot to the other. 2) The child places one foot in front of the other and shifts weight back and forth over each foot. Alternate legs.

Progression: The child starts by sitting, kneeling, standing in parallel bars, supported by PT or other floatation device, and progresses to independence.

Variations: The child can reach to touch or grab objects with his/her UEs. The child can hold onto a funoodle or other floatation device while weight shifting.
Gait Training

- Application: Gait training, balance, weight bearing through LEs & functional activity
- Equipment: Parallel bars & floatation device
- Precaution: General pool & child’s weight bearing status

Procedure: The child stands at one side of the pool and walks to other side with support from the PT at the child’s pelvis. The PT may need to help support the child and control his/her gait speed and quality.

Progression: The child should start in the parallel bars, move to open water with support from the PT, then support from a floatation device, and progress to walking independently. As the depth of the water decreases, balance difficulty increases. As the depth of the water increases, resistance increases. The wake of PT can decrease the resistance while turbulence can increase the resistance.

Variations: Make rules to encourage the child to walk on tip toes or heels, faster, slower, etc.
Gait Activities

- Application: Gait training, balance, coordination & functional activity
- Equipment: Parallel bars & floatation device
- Precaution: General pool & child’s weight bearing status

Procedure: The child stands and side steps back and forth across the pool. The child weaves or “grape vines” across pool. the child walks around cones or objects.

Progression: The child starts in the parallel bars, moves to support from PT, then support from floatation device, and progress to independence. Increasing the depth of the water makes balance more difficult. Decreasing the depth of the water makes the resistance greater. The PT can use a wake to decrease resistance and turbulence to increase resistance.

Variations: Use as part of an obstacle course, have races with the child, or walk to music.
ACTIVITIES TO FACILITATE VESTIBULAR STIMULATION
Bobbing

- Application: Vestibular stimulation, tactile stimulation, respiratory control, introduction to water & LE strengthening
- Equipment: None
- Precaution: General pool, respiratory disorders & swallowing difficulties,

Procedure: Passive- The PT holds in child in his/her arms and rhythmically raises and lowers the child into the water.

Active- The child holds onto the side of the pool or ladder and raises and lowers self in and out of the water. The child can also jump up and down in the water.

Progression: Passive- The PT holds the child out farther from his/her body and bounces the child in and out of the water.

Active-The child gradually puts his/her chin, nose, and then head under water and bounces back up. Progress by increasing the depth of the water.

Variation: The child can blow bubbles under water. The child can retrieve objects from the bottom of the pool while under water
Inner Tube Play

- Application: Vestibular stimulation, sensory integration & abdominal strengthening
- Equipment: Inflatable ring or inner tube
- Precaution: General pool & intolerance to latex

Procedure: Passive-The child sits or hangs supported by his/her UEs in an innertube while the PT spins and moves the child through the water quickly.

Active- The child hangs in an innertube in the water where he/she can not touch. The child crosses his/her legs and uses them to spin self around in the water.

Progression: From PT assisted to independent. From sitting in the innertube to hanging through the hole supported by UEs. Increase speed and variability.

Variations: Do activity to music.
Swinging Through the Water

- Application: Vestibular stimulation, sensory integration & tactile stimulation
- Equipment: None
- Precaution: General pool

Procedure: The child is held by the PT in a variety of positions (prone, supine, vertical). The PT moves the child through the water with varying speed and direction.

Progression: Increase speed and variability.

Variation: Play games like moor boat or airplane.
Water Dancing

- Application: Vestibular stimulation, balance, coordination, proprioception & socialization
- Equipment: Music & floatation device
- Precaution: General pool

Procedure: Passive- The PT holds the child and moves with him/her through the water to the music.

Active- The child moves self through the water in rhythm to the music. The child may need a floatation device to “dance” independently.

Progression: Increase resistance to movement by increasing the depth of the water. Increase difficulty for balance by decreasing the depth of the water.

Variations: Try line-dancing or square dancing with a group of children.
RESPIRATORY ACTIVITIES
Blowing Bubbles

- **Application:** Controlled breathing, chest expansion, diaphragmatic breathing, facial muscle strength & oral motor control.

- **Equipment:** Drinking straw

- **Precaution:** General pool, hyperventilation, inhaling water, water going up the child’s nose & the valsalva maneuver

Procedure: The child’s position should encourage proper breathing techniques, i.e. no slouched posture. Following the PT’s demonstration, the child will take a deep breath inward, place his/her mouth in the water, and fully exhale through the mouth to create bubbles.

Progression: Blow bubbles first in cupped hands, then at water’s surface, then underwater. Increase exhalation duration. Blow bigger bubbles with forceful exhalation.

Variations: Create a contest between the PT and the child to determine who can blow the longest. Blow through a straw.
Blowing Objects Across the Water’s Surface

Application: Controlled breathing, chest expansion, diaphragmatic breathing, facial muscle strength & oral motor control.

- Equipment: Light toys that float (ping-pong ball, small boats, balloons) & a drinking straw

- Precaution: General pool, hyperventilation, inhaling water, water going up the child’s nose & the valsalva maneuver

Procedure: Place the child in a position to encourage proper breathing techniques. Place floating toys in front of the child and encourage the child to take a deep breath and blow the toys away from him/her.

Progression: Increase the size or weight of the toy. Increase the distance the child is required to propel the toy.

Variations: Have the child blow through a straw. Turn the activity into a race across the pool. Use as part of an obstacle course.
Motor Boat

- Application: Controlled breathing, chest expansion, diaphragmatic breathing, facial muscle strengthening & oral motor control
- Equipment: Floatation device
- Precaution: General pool, hyperventilation, inhaling water, water going up the child’s nose & the Valsalva maneuver

Procedure: The child is placed in the prone position supported by the PT or a floatation device. Encourage the child to place his/her mouth and nose in the water and make a “motor boat” sound while blowing bubbles. The child should aim for a long slow exhalation, coming up for a breath each time. The PT can spin the child around in the water while the “motor” is running.

Progression: Increase the exhalation time. Progress from PT propelled to self propelled by having the child kick and/or use UE strokes. Place only mouth, then mouth and nose, then whole face, then head in the water.

Variations: The child can spin around in circles in an inflatable ring while blowing the “motor”.

GAME ACTIVITIES TO INCORPORATE VARIOUS TREATMENT TECHNIQUES
Hot Potato

- Application: Agility, UE strengthening & ROM, bilateral coordination, crossing mid-line, trunk stability, balance & socialization
- Equipment: Ball or other small tossable object
- Precaution: General pool & child may develop faulty movement patterns if not monitored by PT

Procedure: Same as on land. The players throw the ball back and forth to each other to music. Whoever is holding the ball when the music stops loses that round. Continue play until there is only one person left. He/she is the winner.

Progression: Vary the depth of the water. Progress from sitting, to half-kneeling, to kneeling, to standing. Add rules to make the game more challenging for the child, like you must catch the ball and turn around in a circle before you throw it.

Variations: Add rules. Can be played one-on-one or with a group. Facilitate parental or peer involvement.
**Hokey Pokey**

- **Application:** Coordination, balance, limb disassociation, trunk stability, proprioception, extremity strengthening & ROM & socialization
- **Equipment:** Music
- **Precaution:** General pool & encouragement of faulty movement patterns if not monitored by PT

**Procedure:** Same as on land. The players follow the directions of the song.

**Progression:** The deeper the water the greater the resistance for upper and lower extremity motion. Trunk stability and balance become more difficult as the depth of the water decreases. PT or parent can assist child if he/she is not at cognitive or physical level to play the game without assistance.

**Variations:** Encourage peer and family involvement.
Keep Away

- **Application:** Balance, bilateral overhead activity, jumping, proprioception, hand-eye coordination, motor planning & socialization
- **Equipment:** Ball
- **Precaution:** General pool & development of faulty movement patterns if not monitored by PT

Procedure: Same as on land. The child is placed between the PT and another person. The two outside people play catch over the child’s head and try to “keep the ball away” while the child tries to intercept it.

Progress: Increase balance and coordination difficulty by decreasing the depth of the water. Throw the ball higher and faster to challenge the child.

Variations: Involve peers or parents.
Tag

- Application: Cardiovascular endurance, gait activities and variations, balance, strengthening, disassociation of movement, problem solving & socialization
- Equipment: Possible floatation device
- Precaution: General pool & child’s inability to recover to a standing position safely

Procedure: Same as on land. One person is “it” and he/she chases the other players around the pool. Once a new player is touched or “tagged” he/she is now “it” and must chase everyone else.

Progression: Resistance to motion increases as the depth of the water increases. Add turbulence.

Variations: Make rules to focus the treatment session, such as: the child can only walk on toes or heels or the child must swim under the PT’s legs to “free” him/her self.
Ring Around the Rosie

- Application: Gait, balance, respiratory, vestibular stimulation & socialization
- Equipment: None
- Precaution: General pool, child has a tracheotomy, or has extreme fear of putting face or head under water

Procedure: One-on-one with the PT: The PT holds the child or, if child can stand, holds onto the child's hands and spins around in a circle singing the song. Group: Same as on land but the children may go under water at the end.

Progression: Start by staying above water and progress to chin level, nose level, and progress to going all the way under the water at the end of the song.

Variation: The children could hold onto a funnoodle instead of holding hands.
Simon Says

- Application: Anything the PT wants: ROM, strengthening, motor control, coordination, proprioception, socialization
- Equipment: Possible floatation device & any objects used in the game
- Precaution: General pool

Procedure: Same as on land. One of the players serves as “Simon”, usually the PT and he/she gives the other players specific commands. The other players only have to obey the commands if “Simon” begins the command by saying “Simon Says”. If a player follows a non-Simon command or does not follow a Simon command, he/she is out of the game.

Progression: Progress from total dependence on PT assistance to independence. Alter the depth of the water, the resistance, the turbulence and type of activity to further challenge the child.

Variation: This is a versatile and creative game that can be used to capture the interest of the child while working on a variety of treatments.
Obstacle Course

- Application: Anything the PT wants: agility, strengthening, motor planning, coordination, balance, gait
- Equipment: Anything to complete obstacle course: balls, bench, parallel bars, weighted cones rings, steps, etc..
- Precaution: General pool & development of faulty movement patterns if not monitored by a PT

Procedure: Same as on land. The PT sets up the obstacle course and instructs the child on how to complete it.

Progression: Modify tasks to challenge the child.

Variation: Make it a timed event, or a race against another child, a parent, or the PT.
UNDERWATER GAMES
Diving for Rings

- Application: Perceptual, spacial, and vestibular stimulation, hand-eye coordination, motor planning, overall endurance & strengthening, hypersensitivity, cerebral palsy
- Equipment: Sinkable rings or toys
- Precautions: General pool, ear popping in deeper end of pool, inhaling water, water going up the child’s nose

Procedure: The child or the PT throws rings and allows them to sink to the bottom of an appropriate depth of water for the child. The child swims under the water to achieve the rings.

Progression: Increase the depth of the water. Decrease the size of the retrievable objects. Increase the number of objects retrieved in one dive.

Variations: Include multiple learning, have the child retrieve a certain color or number. Use as part of an obstacle course.
Swimming Through a Hoop

- **Application:** Breath control, motor planning, perceptual, spacial, and vestibular stimulation, hand-eye coordination, motor planning, overall endurance & strengthening, hypersensitivity & cerebral palsy
- **Equipment:** Large hoop
- **Precaution:** General pool, ear popping in deeper end of pool, inhaling water & water going up the child’s nose

Procedure: The PT holds the hoop under the water and instructs the child to swim through it.

Progression: Begin with the hoop halfway out of the water so the child can swim at the surface, gradually lower the hoop deeper into water. Have the child swim against turbulence.

Variation: Vary the angle or plane of the hoop. Substitute the parallel bars or the PT’s legs if no hoop is available. Use as part of obstacle course.
Somersaults

• Application: Perceptual, visual, spacial, vestibular and proprioceptual stimulation; respiratory control & motor planning
• Equipment: Bar, rope or funoodle
• Precaution: General pool, ear popping in deeper end of pool, inhaling water & water going up the child’s nose

Procedure: The PT holds the child in deep enough water to allow for a flip. Instruct the child to curl up into a ball, tuck the head and hold the nose, if necessary. The PT gently guides the child and assists as needed. In an obstruction free zone, allow the child to spin around bar, rope or Funoodle.

Progression: Decrease the assistance from the PT. Children, who are able, can start from a standing position.

Variations: Instruct the child in performing backward somersaults. Use as part of an obstacle course.
I WOULD LIKE TO THANK ALL OF THE FAMILIES AND CHILDREN WHO GAVE UP THEIR ENERGY AND TIME TO PARTICIPATE IN THIS VIDEO
THANK YOU

- Dena Wright- my partner in crime
- Peg Mohr- Our advisor and shoulder to cry on
- The PTs at CETP- for taking the time to review the exercises
- Kathy Rogers- for filming
- Wanda Weber- for her technical help
- Cheryl Diermeyer- for her editing skills
- The UND faculty- for giving me the chance to learn
- My family- for all of the love and support
- Von- for loving and putting up with all my irate phone calls
- And most importantly, I thank God for blessing me with the ability to relate to His most precious creations, children.
APPENDIX B
Saundi Wilson and Dena Wright will be conducting a physical therapy graduate project for the University of North Dakota. They will be producing a video and manual about a pediatric aquatic therapy program. The video and manual will be used as a visual teaching aid for physical therapy students and professionals.

Saundi and Dena will work closely with the Child Evaluation and Treatment Program (CETP) physical therapists. The therapists will be responsible for recommending families to participate in the project, making initial contact, and passing out the consent forms to the parents. Saundi and Dena will then be responsible for contacting the parents to set up taping sessions that will be convenient for the families and the students. All taping sessions will take place at the Rehab therapy pool. The use of the Rehab therapy pool has been approved by the Physical Therapy Director, Steve Rood. Saundi and Dena will be responsible for scheduling the time in the pool and for any clean-up that is necessary as a result of the project. All video and photographic equipment will be supplied by Saundi and Dena. The aquatic therapy equipment will be borrowed from the Rehab.

Saundi and Dena will attend at least one regularly scheduled therapy session prior to each child's taping session. All techniques and exercises will be reviewed and approved by a CETP therapist. Training sessions, for Saundi and Dena to learn the proper techniques and exercises, will be arranged with the CETP therapist if necessary. It is estimated that no more than two taping sessions will be needed for each child. Saundi and Dena will perform all exercises and techniques for the taping session. The CETP therapist may participate in the video and photographs if she so desires. A CETP therapist or UNDPT faculty member will supervise all taping sessions.

We agree to the above conditions and are looking forward to working together on this project.

Saundi Wilson

Dena Wright

CETP Physical Therapist

UNDPT Faculty Advisor

Steve Rood, Director of PT
Dear Parents,

Hello! My name is Saundi Wilson. My fellow classmate, Dena Wright, and I would like to invite you and your child to participate in a graduate independent study. We are graduate physical therapy students at the University of North Dakota and are producing a video and training manual about pediatric aquatic physical therapy. The video and manual will serve as a visual teaching tool for physical therapy students and professionals.

Physical therapists at the Child Evaluation and Treatment Program (CETP) recommended families to participate in the project. The children that will be selected for the project will be chosen because of their special attributes such as high or low tone and especially for their positive attitude towards aquatic therapy. The children involved in the project will appear on video tape and in photographs in the manual. The name of your child will remain confidential. The video and manual will only be used for educational purposes in the field of physical therapy.

The video and manual will consist of exercises and techniques utilized in aquatic physical therapy. Your child will only participate in those exercises that are approved by the CETP therapist. Dena and I will be administering the exercises and techniques with your child. Either a CETP physical therapist or a UNDPT faculty member will be present during the taping sessions. The taping sessions will take place at the Rehab therapy pool in late September and early October on the afternoons, evenings and weekends that are most convenient for you and your child. It is estimated that no more than two sessions will be needed for each child. You are welcome to attend all taping sessions with your child.

We thank you for taking the time to learn about our project. It should be a fun learning experience for everyone involved. If you and your child are willing to participate in the project, please sign the attached consent form and return it to us in the self-addressed stamped envelope as soon as possible. We will then contact you by phone to set up your child’s taping session. If you are unable to participate in the project, please mail the unsigned consent form in the self-addressed stamped envelope as soon as possible. If you have any questions or concerns please contact Saundi Wilson (777-9780), Dena Wright (777-8542) or our UNDPT faculty advisor, Peg Mohr (777-3689). We are looking forward to hearing from you.

Sincerely,
Saundi Wilson and Dena Wright
Consent Form

Names of project administrators: Saundi Wilson, SPT and Dena Wright, SPT

_____________ has been invited to participate in the production of a video and manual about aquatic physical therapy exercises for children with disabilities. The purpose of the video and manual is to provide a visual teaching aid for physical therapy students and professionals.

The children have been selected according to their physical, mental, and emotional abilities and how they relate to the chosen exercises of the program. Each child will participate in a few of the exercises based on the child's individual needs and the recommendations of the CETP (Child Evaluation and Treatment Program) physical therapists.

Saundi Wilson and Dena Wright will be trained in all of the exercise techniques by a qualified physical therapist. Prior to the taping session, the physical therapy students will observe and interact with your child during at least one regularly scheduled CETP therapy session. The purpose of this interaction will be to familiarize your child with the students and maximize his/her comfort throughout the production. All training and taping sessions will be supervised by a University of North Dakota Physical Therapy faculty member or a CETP physical therapist.

Taping will take place during September and October of 1996 at the Rehab therapeutic pool. In order to ensure privacy and so as not to interfere with your child's regularly scheduled treatment, the majority of the taping sessions will be scheduled in the evenings. A few of the sessions may take place in the daytime if pool availability allows. As the child's parent/guardian, you will work with the physical therapy students to determine the most convenient time for your child's taping session. Re-taping may need to be rescheduled if complications arise.

No discomforts or risks are anticipated beyond those encountered during a regular aquatic physical therapy session. In the unlikely event that this project results in a physical injury, medical treatment will be available including first aid, emergency treatment, and follow-up care as needed. Payment for any such treatments must be provided by you and your third party payer, if any.

The children participating in this project will be recorded on videotape and/or pictured in a written manual. The video and manual will be used as an educational tool in the physical therapy school classroom and as a visual teaching aid for professionals in the physical therapy field. It is possible that your child's diagnosis and/or characteristics of the disorder may be used to provide rationale for the exercises presented. The name of your child will remain confidential and will be disclosed only with your permission.
Your decision whether or not to allow your child to participate in the production of this video and manual will in no way prejudice your relations with the CETP, the University of North Dakota's physical therapy department, or the students involved with this project. You may discontinue your child's participation in this project at any time prior to editing without penalty.

Saundi Wilson and Dena Wright may be reached at 777-9780 or 777-8542 respectively to answer any questions that you have concerning this project. In addition, you are encouraged to ask any questions concerning this project that you may have in the future. The video and manual will be made available to all participating families.

ALL OF MY QUESTIONS HAVE BEEN ANSWERED AND I AM ENCOURAGED TO ASK ANY QUESTIONS THAT I MAY HAVE OF THIS PROJECT IN THE FUTURE. MY SIGNATURE INDICATES THAT I HAVE READ THE ABOVE INFORMATION AND I GIVE PERMISSION FOR ______________________ TO PARTICIPATE IN THIS PROJECT.

Signed:

_________________________________________________________  __________________________
Parent/Guardian                          Date

daytime and evening phone numbers

_________________________________________________________  __________________________
Project Administrator, Saundi Wilson, SPT                          Date

_________________________________________________________  __________________________
Project Administrator, Dena Wright, SPT                          Date

_________________________________________________________  __________________________
CETP Physical Therapist                          Date

_________________________________________________________  __________________________
UNDPT Faculty Member                          Date
REFERENCES


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