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A Literature Review and Introductory Pediatric Aquatic Therapy Manual

Dena Wright

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A LITERATURE REVIEW AND INTRODUCTORY PEDIATRIC AQUATIC THERAPY MANUAL

by

Dena Noel Wright
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
May
1997
This Independent Study, submitted by Dena N. Wright 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.

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PERMISSION

Title A Literature Review and Introductory Pediatric Aquatic Therapy Manual

Department Physical Therapy

Degree Master of Physical Therapy

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Signature Dena Wright
Date Dec. 12, 1996
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“Trust in the Lord with all your heart, and lean not on your own understanding; In all your ways acknowledge Him, and He shall direct your paths”. Proverbs 3:5-6
ABSTRACT

Aquatic therapy continues to grow as an acceptable and often times preferable means of achieving therapeutic goals across a variety of patient populations: pediatric to geriatric, orthopedic to neurologic. The unique properties of water allow people to exercise and to recover in a safe and relaxing environment that promotes similar goals to those on land. However, land exercises can not simply be performed in water due to the water's unique properties. Similarly, exercises for adults do not work as effectively for children. Many physical therapy programs across the nation provide only minimal instruction on aquatic or pediatric therapy as a part of the core curriculum.

The purpose of this literature review and the accompanying manual are to provide a review of the unique characteristics of water and to introduce pediatric aquatic activities to physical therapy professionals and students. The review of literature focuses on the physical properties of water, thermal considerations, advantages of aquatic therapy, and precautions. The manual includes a variety of recreational and therapeutic activities to be utilized by a physical therapist in a therapeutic pool. The activities are categorized based upon their primary therapeutic objective.

The result of this project is an overview of aquatic therapy and the properties of water. In addition, the beginning aquatic physical therapist and physical therapy student are provided with ideas to facilitate their own creativity in designing individual pediatric aquatic therapy treatment plans.
CHAPTER 1
INTRODUCTION

Water has been used as a source of therapy since the days of Hippocrates (460-375 BC). Schools of thought have changed slightly over the years, but the same principles of water still exist today. In the early years, most treatments consisted of nonvigorous activity in baths or spas. It wasn’t until after World War I, World War II, and the polio epidemic that people began practicing aquatic therapy as we know it today. 1,2

Children can benefit greatly from participation in pool activities. 4-14 Depending upon children’s needs and abilities, physical as well as emotional progress can be gained either from a recreational, therapeutic, or integrated pool program. 5 Benefits gained by children include increased metabolic endurance, increased activity endurance, and improved psychological status. 2,4,10,15

Physical therapy treatment techniques used on land are often capable of being adapted for use in water. However, the many properties of water, including the antigravity effects as well as the warm temperatures of a therapeutic pool, make aquatic physical therapy an advantageous environment in which to achieve therapeutic goals. 16 The buoyancy of the water allows positioning of the children that is not possible on land and the warmth of the pool provides an environment for relaxation. 17
The literature available regarding aquatic therapy is limited;\textsuperscript{5} however, the literature specifically on pediatric aquatic therapy remains even more sparse. It is not feasible to simply apply an adult aquatic therapy program to children. The activities must be modified in most cases to maintain the interest and motivation of the children. The pediatric programs must also account for the developmental differences between adults and children. Often times games are used during therapy which tend to provide an environment where the therapeutic objectives are disguised and the pressures to perform are eliminated, thus stimulating the children’s curiosity, creativity, and motivation to learn.

As the scope of physical therapy continues to broaden, there appears to be a demand placed on the academic programs to squeeze more information into the curriculum.\textsuperscript{18} It is unrealistic to expect each physical therapy and physical therapist assistant program to thoroughly address all areas of physical therapy. Cherry and Knutson\textsuperscript{19} reported that 93% - 99% of entry-level physical therapy programs surveyed required some content covering child development, pediatric disorders, and management of pediatric conditions with the majority of time spent on child development. Although normal child development is essential to understanding abnormal development, the same study reported a dissatisfaction in the lack of time spent on management of pediatric disorders. Morris and Jackson\textsuperscript{18} reported that aquatic physical therapy is not an essential component for curricular content for PT and PTA accreditation. Morris and Jackson discovered however, that while not deemed essential by the Commission on Accreditation in Physical Therapy Education, many entry level PT and PTA programs included general principles of aquatic physical therapy as a portion of their curriculums.
In contrast, they found that many accredited programs did not introduce aquatic physical therapy at all. The literature supports that more pediatric and aquatic physical therapy content is being included in entry level physical therapy and physical therapy assistant programs than has been included in the past.\textsuperscript{18-21} However, similar to other topics covered, the information is introductory due to limited time and the vast number of essential physical therapy content topics.\textsuperscript{5,18,19} The implementation of pediatric aquatic therapy programs is made more difficult due to the limited amount of practical knowledge and skills achieved in pediatrics and aquatic therapy during physical therapy school.\textsuperscript{5} Therefore, physical therapy students and professionals must utilize other means of obtaining the necessary education. The availability of this manual will provide therapy students and professionals alike with a quick reference tool to deliver methods of pediatric aquatic physical therapy. The opportunities for gaining advanced knowledge in areas such as pediatric physical therapy or aquatic physical therapy follow graduation day in the form of clinical experience, continuing education, postentry level degrees, or certified specialization.\textsuperscript{19-21}

There appears to be a small variety of literature available outlining various pediatric aquatic therapy and adapted swimming models.\textsuperscript{4,5,7-14,22} Those published tend to be diagnosis specific. However, the activities in this manual are designed to be used for a wide variety of children, comprehended easily, and are intended to guide the beginning instructor into developing her own creative activities.

The purpose of this manual is to provide physical therapy students and physical therapy professionals with an educational and reference tool consisting of general pediatric aquatic therapy techniques and concepts. This manual may prove to be a
valuable teaching and learning instrument because of the brief yet thorough introduction to the physical properties of water and to the physical and psychological benefits of aquatic therapy. In addition, the water activities are easy to learn, easy to instruct, and easy to follow.
CHAPTER 2

OVERVIEW OF AQUATIC THERAPY

Water is a unique medium due to the many physical properties of water which are unlike anything available on land. A brief description of the most useful properties of water, such as the properties of relative density, turbulence, buoyancy, friction, and hydrostatic pressure are included in the following paragraphs.

Relative Density

Archimede’s principle states that a particular amount of fluid is displaced when an object is immersed into a fluid medium.\textsuperscript{1,3,4,23} The amount of dispersion is dependent upon the relative densities of each of the two substances. The relative density or specific gravity of water is one.\textsuperscript{14,23} Anything that is placed into water that has a relative density less than one will float. Anything that has a relative density greater than one will sink.

Young children have an average relative density of 0.86.\textsuperscript{1} As one moves into adolescence and early adulthood, more muscle mass is gained and the relative density increases to 0.97. As people progress in age, the body has less muscle mass and more adipose tissue, which is less dense than muscle, and the body’s relative density returns to 0.86. People will therefore experience periods throughout the life cycle where the body more easily floats. Each individual’s ability to float will vary depending upon the ratio of fat to bone and lean body tissue as well as the amount of air in the lungs.\textsuperscript{2}
Turbulence

Turbulence is another important property of water that can be described as the disturbance of the water one experiences as motion occurs. The slower the motion through the water is, the more even the turbulence. Quicker movement through the water will create a greater disturbance and a more uneven distribution of waves. Any movement in the water will cause some degree of turbulence; therefore, those people working with unsupported children in the pool must be aware of the motion created so as not to cause the children to unintentionally lose their balance. However, the turbulence may be used to challenge children’s balance skills as well as their muscle strength.

Friction

The increased amount of friction experienced while submerged in water is highly beneficial. The friction in water is 790 times greater than that of the air. This allows time for one to adjust his position as a loss of balance occurs. The fact that water will “catch” a person as he begins to fall helps a patient build confidence in the water and attempt more challenging feats than when on land. The increased amount of skin friction with the water also allows the water to be used as a “resisting” force. Strengthening of weak muscles occurs as the body moves through the water. The quicker the movement, the more resistance is experienced.

Buoyancy

The metacenter principle is experienced as two forces act upon the body in water: a downward force, gravity, and an upward force, buoyancy. This phenomenon is also known as Archimede’s principle: the amount of upward thrust is equal to the amount of fluid displaced by a partially or completely submerged body. These two forces must
be equal for the body to maintain a balanced alignment. If the body becomes off center, for example, a limb is lifted out of the water while in a supine position, the two forces are no longer equal and the body immediately undergoes a rotational force until it is once again realigned so that the two forces are equivalent.

The center of buoyancy is unique for every individual. Once the body is immersed, the center of buoyancy is found when the body is balanced using the least amount of work. Buoyancy has the greatest effect on bodies parallel to the water’s surface. The more vertical a body becomes in water, the lesser the effects of buoyancy.

Buoyancy may be used to assist, stabilize, or resist movement. The assistive property of buoyancy allows the body to move more easily through the water. Difficulties with movement may be due to weak muscles, increased muscle tone or spasticity, or orthopedic restrictions. The resistive property of buoyancy allows for strengthening muscles and increasing muscle tone because of the friction principle of water and the turbulence created with movement. Using the surrounding water as a means of support allows people to be aided in sitting, standing, and other functional activities granted the turbulence is kept to a minimum. In short, buoyancy will assist movement approaching the water’s surface and resist movement away from the water’s surface. As the body is gently moved in a horizontal plane through the water, buoyancy and gravity “cancel” one another and the body remains supported.

**Hydrostatic Pressure**

Pascal’s law states that the fluid pressure is equal at any horizontal level, but it increases with depth. The hydrostatic pressure is directly proportional to the depth of the body in water. The hydrostatic pressure of the surrounding water provides sensory
input for increased proprioception. The pressure also aids by improving coordination and minimizing athetoid movements when the activity is performed well below the water’s surface. The improved movement is possible due to an increase in sensory input and water’s friction property which helps to support the extremities when they’re “free in space”. In addition, the varying pressure has an effect similar to a compression device on edema or other body fluids with the greatest amount of pressure in the deepest water. It is important to note that respiration is also affected by the hydrostatic pressure. If patients become short of breath or feel that they can not “catch their breath”, they should be removed from the water or moved at least to a level that exposes the chest. This will enable them to breathe without the constriction imposed by the surrounding water.

A combination of the above properties allows all children to experience greater freedom of movement in the water than on land. The sense of weightlessness experienced in water is due to the lateral pressure of the water coupled with the effects of buoyancy. Children with disabilities will likely be able to accomplish maneuvers with ease in the water that are difficult, if not impossible, to achieve on land. Often times, the pool experience is the only time that children who require the use of wheelchairs, braces, or assistive devices can have the freedom and independence of movement that children without disabilities feel. This can have a significant positive impact on children’s morale, self esteem, and self confidence. In addition, the experience allows children a time to become more aware of their bodies in space and how parts of the body move and work together under more “normal” circumstances.
Methods and Progression Options

The Bad Ragaz Ring Method (pronounced Bod Rugoz) was developed over a number of years in Switzerland as a form of active exercise in water. Initially the techniques did not take into account the physical properties of water, but rather, were slightly adapted land exercises. By 1957, the Bad Ragaz techniques were modified with the activities performed as the patient lay in water supported by floatable rings at the neck, pelvis, and ankles. The exercises consisted of active resisted or stabilization activities. Eventually proprioceptive neuromuscular facilitation (PNF) patterns were incorporated as part of the Bad Ragaz techniques. Today, this method is used as a form of muscle reeducation including strengthening, elongation, relaxation, and tone inhibition. The properties of water (buoyancy, turbulence, hydrostatic pressure) are used to properly perform a program of progressive resistance. In general, Bad Ragaz uses spiral and diagonal patterns in mass movements that are characteristic of normal movement patterns, similar to PNF movement patterns. The therapist facilitating the techniques should stand in waist deep water (Ts_11 level) for the most optimal body mechanics. This will ensure the therapist’s stability without causing a strain on her body during the activities.

It is necessary to progress the children as they demonstrate the ability to correctly perform activities. Progression may be accomplished in many ways. Moving from deeper water to shallower water requires the child to work against the force of gravity. It creates more weight bearing through the lower extremities. However, turbulence has a greater effect on balance when the body is immersed in deeper water than when in shallow water. Movements may begin slowly and progress by faster motions through the
The addition of paddles or webbed gloves for the upper extremities or non-aerodynamic devices made for the feet are further progression from speed or streamlining. As mentioned above, buoyancy may be used to first assist movement toward the water’s surface followed by supporting the body during movement (motion parallel to the water’s surface) and finally resist motion away from the water’s surface. Activity that uses symmetrical movement is easier than asymmetrical or unilateral movements. Also, initially the arms may be used to assist with balance. As the child becomes more comfortable and is able to balance in various developmental positions against turbulence, the child should begin to use his upper extremities to catch, throw, and reach. The progression techniques mentioned may be used in any combination: increase the speed of movement with the addition of webbed gloves.

**Thermal Considerations**

A patient’s thermoregulatory system must be sufficient to accommodate to elevated water temperatures especially when the majority of the body is submerged or there is an increased amount of exertion through exercise activity. The natural mechanisms of body temperature control such as conduction, convection, radiation, and evaporation, are less effective or lost when the body is immersed in water. Only the area above water is able to dissipate heat.

A child’s body temperature is less stable than the adult’s. Especially young children’s temperatures will respond more quickly and more drastically to an increase or decrease in temperature. Often children do not appear to be fatigued. The therapist working with the child in the pool must monitor the child’s behavior and alertness as well as limit the time spent in the pool in spite of the appearance that the child is not fatigued.
It is undesirable for one to reach a level of fatigue. Fatigue will appear more quickly when the temperature of the pool is high and when the child is more active. Vital signs as well as other indicators such as excessive flushing of the face, may be monitored as red flags to change the activity or to remove the child from the pool.

Numerous opinions exist as to the optimal temperature of a therapy pool. A range of temperatures from 89 to 98 degrees Fahrenheit were cited in the literature. Palmar indicated that all of the desired effects, muscle relaxation, decrease in pain due to muscle spasm, increased circulation, and removal of metabolic wastes for example, can be achieved in temperatures 89.3 - 92.6 degrees Fahrenheit. Palmar also stated that temperatures less than 89.3 degrees cause unwanted muscle tension inhibiting relaxation. Similarly, Franchimont et al determined temperatures greater than 95 degrees lead to undesirable effects such as alterations in the cardiovascular system and excessive fatigue for both the therapist and the patient. All things considered, Reid-Campion concluded temperatures ranging from 89.6 - 93.2 degrees suit the majority of the population while minimizing the risk of fatigue and unfavorable effects to the patient and the therapist.

The literature also contains varying opinions regarding the optimal duration of a single therapy session in the pool. Davis and Harrison stated that the duration should not exceed 30 minutes while the optimal range is 20 - 30 minutes. Duffield stated that the average treatment time is 20 minutes, but that great variation exists among people’s tolerance, ranging between 5 and 45 minutes. One commonality exists among all of the authors reviewed: the duration of each therapy session should take into account the age, size, physical condition, and activity level of each person, as well as the humidity of the room and the temperature of the water.
Advantages of Aquatic Therapy

Multiple therapeutic effects may result from the use of a warm water pool for the purposes of aquatic therapy. Most of the effects can be classified as either physiological or psychological. The physiological effects include an increase in blood flow, tissue extensibility, peripheral nerve conduction velocity, respiratory rate, general metabolic rate, and motor nerve activity. A decrease in pain, joint stiffness, and muscle spasm are all possible occurrences resulting from the physiological effects. Psychological effects of aquatic therapy include, but are not limited to, an increase in the children’s self-concept, self-esteem, and self-confidence due to the “freeing” nature of water. Group activities in water provide opportunities to enhance children’s socialization skills, to concentrate on tasks, and to possibly participate for longer periods of time than during an individual therapy session. A group setting advocates a supportive environment and allows for peer teaching opportunities. These effects, combined with the physical properties of water, provide the opportunities for the multiple potential benefits of aquatic therapy: an increase in range of motion, muscle strength, tolerance and endurance to physical activity, motivation, and proprioceptive input. Other potential benefits include improvement in balance and coordination, elimination of full weight bearing, and opportunity for muscle reeducation. The water itself, as well as the acoustics of the pool area, will also provide sensory stimulation. The affected senses include visual, auditory, vestibular, tactile, and proprioception.

Precautions

Many of what were once considered to be absolute contra-indications for aquatic therapy or pool usage have now become possible contra-indications or cautions. The
therapist must use her own discretion when determining each of the following possible contra-indications. Children with epilepsy or seizure disorders may participate in aquatic therapy as long as the seizures are controlled and the condition is made known to the people working with the children. Problems with blood pressure or cardiac conditions do not automatically eliminate the use of aquatic therapy. Various precautions, however, must be taken including consistent monitoring of vital signs and careful supervision of the activity level and the temperature of the water. Open wounds must be considered on an individual basis. If the wound may be adequately covered so there is no exchange of body fluids with the water, it is acceptable for the child to enter the pool in most instances. Hydrophobia is another precaution for aquatic therapy. A therapist or parent may attempt to familiarize a child with the water if the child will allow. Introducing a child to the pool must be done by a person with whom the child has complete trust and at the child’s own pace. Incontinence of urine and feces is considered only as a precaution by some authors. Incontinence of urine may be dealt with prior to pool entry by use of catheterization or waste elimination monitoring. In cases where “accidents” may occur, the circulating chlorine in the pool will disinfect the water. Persons in the pool at this time are at no more greater risk than if the time were spent in a public swimming pool. It is undesirable and uncommon to allow children with unpredictable fecal incontinence into the pool, however, upon occasion it may be unavoidable and should be dealt with as such. In most cases, contamination is not likely if solid waste elimination is monitored or evacuated prior to entering the pool. Other authors contend that unpredictable bowel elimination should not be tolerated.
Authors\textsuperscript{2,3,15,23} of aquatic therapy literature do agree that skin conditions and other infections are definite contra-indications for aquatic therapy. Tinea pedis is the most commonly occurring skin infection affecting children; ringworm is quite common in children as well.\textsuperscript{3} Bacterial growth thrives in a warm water environment; therefore all infections, including water-borne infections, should be regarded as contra-indications. Typhoid, cholera, and dysentery are all examples of water-borne infections.

Additional consideration is necessary for children with one or more of the following: swallowing difficulties, visual impairment, decreased sensation, decreased perception, and impulsive tendencies.\textsuperscript{16} As logic would imply, any children that do not feel well or exhibit a fever should not be subjected to a warm water pool.\textsuperscript{3}
CHAPTER 3
ABOUT THE MANUAL

This manual contains a large variety of aquatic techniques for children that provide both recreational and therapeutic benefits. Benefits include strength building, enhanced flexibility through stretching and range of motion, endurance training, perceptual stimulation, improved respiratory capacity and control, psychological gains, balance promotion, three dimensional activity, and rotational control. In addition to this manual, a video has been produced that covers a number of the aquatic activities described. The video may be used in addition to the written form or as an alternative learning method for these activities.

The aquatic therapy activities contained in this manual were selected based upon several factors: general application, ease of understanding, ease of teaching, and application to children. These activities are meant to encompass a broad range of areas. They are not intended for any specific diagnosis although cerebral palsy, juvenile rheumatoid arthritis, spina bifida, muscular dystrophy, and cystic fibrosis are mentioned as indications for various exercises simply as guidelines. These activities are by no means all inclusive. Each treatment technique may be modified to fit each individual’s needs. Aquatic therapy treatment techniques are only limited by the therapist’s own creativity.

The children photographed for this book were selected with the help of the physical therapy staff of United Hospital’s Child Evaluation and Treatment Program in
Grand Forks, North Dakota. They were chosen based on their parents’ and their own willingness to participate in the production of this manual as well as their ability to cooperate and to tolerate a variety of activities and people involved.

Each participating family was initially contacted by the child’s primary therapist. The families were then provided with a consent form which described the purpose of this project, the people involved, any risks and potential benefits, and the level of involvement expected from their children. The families were informed regarding how the pictures would be used in the manual and the accompanying video. Also included in the consent form, were the safety measures that were expected to be followed by the physical therapy students including: the presence of a licensed physical therapist at all times during the filming, adequate competency demonstration by the physical therapy students, and an ample adjustment period between the child and the PT students. (Appendix C)

Many children’s activities that occur in a pool environment can be considered recreational. This is an important aspect that may greatly improve the morale of the children. Confidence is usually gained once the children accomplish a skill in the water that is difficult or impossible on land. The suggested activities described in this manual are geared toward a therapeutic program, however, the activities are designed to be enjoyable to most children. Some of the primary therapeutic objectives are strengthening of weak muscles, reducing increased tone, increasing range of motion, improving respiratory function, enhancing balance reactions, and developing functional skills. This does not imply, however, that there is no recreational content to these activities. For the benefit of the children, it is hoped that the users of this manual recognize recreational components of water activity that are easily incorporated into activities without losing
sight of the therapeutic goal. When possible, activities should be turned into games with
the emphasis on active participation, acquisition of socialization skills, and enhancement
of the children’s psychological health. In addition, the teaching of water safety skills and
components of swimming strokes should be a part of the aquatic therapy program.11,12
When working with children, it will be important to build games, fun, and opportunities
for success into each aquatic therapy session.5 Keeping this in mind will improve the
likelihood of providing the children with the motivation necessary for continued progress.

In order to most effectively use this manual, therapists must first have a good
understanding of the children’s skill levels, strengths and weaknesses, motivational
factors, needs, and primary objectives. These are all aspects of the children that will
become more clear as therapists begin working with the children in the water and
developing a level of comfort between the therapist and the children. In addition, the
children’s medical and family histories should be known. It would also be necessary to
have an understanding of child development and children’s disabilities.

Appendix A includes all of the aquatic activities provided in the manual. It is
divided into sections based upon general objectives. The section headings include
activities for range of motion, activities to reduce tone, activities to facilitate tone,
activities for trunk strengthening, activities to facilitate upper and lower extremity
strengthening, activities to promote respiratory function, activities performed underwater,
activities for vestibular stimulation, activities to facilitate balance and equilibrium
reactions, activities to facilitate gait, and game activities to incorporate various treatment
options. Within each of the sections, are a variety of activities to help satisfy the
objective. The rationale, precautions, suggested equipment, procedure, progression,
variations, and potential benefits are described for each activity in an easy-to-read bulleted form. Pictorial illustrations of children performing the activities are also included.
CHAPTER 4

CONCLUSION

Physical therapy in a therapeutic pool setting provides opportunities for experiences that, due to physical limitations, may not be possible on land. In addition, many physiological and psychological benefits are possible as a result of the therapeutic temperatures of the water, the physical properties of water, and the motivational factors resulting from the recreational component of aquatic activity.

The purpose of this project was to provide an overview of the physical properties of water, the benefits of aquatic therapy, and the precautions of aquatic therapy as they pertain to pediatrics. In addition it was purported that an easy-to-use manual be constructed consisting of general pediatric aquatic therapy techniques and concepts that would benefit physical therapy students, professionals, and instructors. The intended purposes of this project have been achieved to some degree.

The available literature on pediatric aquatic therapy is quite limited. Therefore, the majority of the activities in chapter four derived from personal past experiences of play with children, conversations with physical therapists, or observation of pediatric aquatic physical therapy sessions. Because of the limited amount of available literature specific to pediatric aquatic therapy, the rationale, equipment suggestions, progression, variations, and benefits were adapted from basic principles of adult aquatic therapy.
therapy and learned material acquired from formal physical therapy education.\cite{1,3,4,8,18,23,25,26,28,29,30,31,32}

However, all components of the manual were affirmed for validity and application through peer reviews by professionals with pediatric and aquatic therapy backgrounds.\cite{30,31}

The limited amount of literature found specific to pediatric aquatic therapy techniques was primarily applicable to large groups of children.\cite{2,10} The large group activities do not always allow an adequate amount of hands-on therapy time to ensure therapeutic goals are being met. Other literature was primarily based on the Halliwick Method, a method used describing the general shape of the body in water: either “stick”, “triangle”, or “ball” with the “ball” being the most stable.\cite{4,10} The remaining literature found that pertains to aquatics and children was primarily of recreational nature including learning how to swim but without the physical therapy component.\cite{8,11,12,33}

From personal experience, it is believed that the current physical therapy curriculum does not adequately meet the educational or application needs of those students desiring a formal introduction of aquatic physical therapy techniques for adults or pediatrics. The physiological responses of the body in therapeutic cold and warm temperatures are addressed in detail, but limited in application of aquatic pool activities. Further research is indicated, possibly in the form of a survey, to determine whether or not students and/or practicing professionals feel there is a need for more extensive education in physical therapy schools on pediatrics and/or aquatic therapy in a pool setting. Currently, at least one study has concluded that aquatic courses involving physical, occupational, and recreational therapy students might contribute to a greater application of aquatic sources to children with disabilities.\cite{7}
This project may serve as a guideline for future studies or products of research such as textbooks and other teaching aids. There are many additional possibilities of activities for pediatric aquatic physical therapy. The ideas generated for this manual were restricted by the author’s limited amount of clinical experience in the area of pediatric aquatic therapy. Another limitation of this project includes the lack of readily available resources specific to pediatric aquatic physical therapy needed to support personal discoveries. Furthermore, limited time was also considered a problem in order to produce the ideal product.

It is the author’s hope that this pediatric aquatic physical therapy literature review and manual will be made available to and used by interested future physical therapy students, faculty, and clinical instructors as a tool to generate creativity for treatment approaches in pediatrics.
Appendix A
Aquatic Therapy Safety
Contraindications for Aquatic Pool Therapy

- Fever
- Cardiac dysfunction
- Infections or contagious diseases
- Open wounds that are unable to be securely covered
- Uncontrolled seizures
- Uncontrolled blood pressure
- Respiratory dysfunction
- When in doubt or in question, consult with the referring physician prior to the initiation of aquatic therapy
General Pool Precautions

Children who may participate in aquatic physical therapy, but may require additional monitoring or special care:

- Children who display signs of general anxiety, stranger anxiety, or fear of water
- Children who are unable to swim
- Children with controlled cardiac or hypertension disorders
- Children with a controlled known seizure disorder
- Children with decreased sensation or proprioception
- Children with diminished or absent vision or hearing
- Children who are unpredictable, impulsive
- Children with spina bifida and a latex allergy: must be aware of the toys, swim suits, and equipment used
- Children with swallowing disorders
- Children with stomas for a feeding tube, colostomy bag, or tracheostomy sight
- Children who are incontinent of bowel and/or bladder: work therapy around the child’s bowel program, catheterize prior to pool entry, or take the child to the restroom prior to pool entry
- Children unable to verbally communicate
Pool Entry

♦ Precautions: Wet and slippery surfaces, uncooperative or unwilling child

♦ Equipment: Stairs with handrails, lifts, ladders, ramps

♦ Procedure: The child should always enter the pool slowly and carefully. A physical therapist, another healthcare professional, or aide under the direction of the therapist should always be positioned beside or near the child upon entry.

♦ Progression and Variations: Pool entry should begin with the child being carried in or handed to the therapist in the pool by another adult. Other options include walking into the pool using the stairs, climbing down the ladder, and jumping into the water from the side of the pool to the therapist. A lift, either hydraulic chair or hoyer lift, may be used if the child is very involved and too big to carry into the pool.

♦ Application: Safe entry into the pool
Introduction to the Water

♦ **Equipment:** Stairs, toys, pouring toys or cups, sponges, squirt toys

♦ **Precautions:** General pool, never leave the child alone

♦ **Procedure:** The child may sit on the edge of the pool or on the top step and dangle his feet in the water. The therapist may also hold the child on her lap and use her hands to gradually and gently wet the child. Encourage the child to use his own hands to play in the water.

♦ **Progression:** If the child is sitting on the therapist’s lap, gradually move to the next step down or to a bench while the child is preoccupied with a toy.

♦ **Variations:** The child may be handed to the therapist from the side. The therapist should maintain a lot of contact with the child. Eventually, decrease the amount of physical contact and allow floatation equipment to support the child. If the child continues to show signs of anxiety or fear, request that the parent attend the first few sessions of aquatic therapy until the child becomes more comfortable. Often times, it is helpful to ask a parent to go into the water with the child the first few sessions. The parent can then be taught ways to handle the child in water. On the contrary, if the child continues to cry for “Mom” and Mom is present, more may be accomplished in Mom’s absence.

♦ **Application:** Fearful child or parent, beginning the session, developing a rapport between the child and the therapist
Activities for Range of Motion: Upper and Lower Extremities
Upper and Lower Extremity Range of Motion

**Rationale:** Water's buoyancy assists movement towards water's surface, warmth of water relaxes muscles, increases tissue extensibility, and decreases pain preparing the body for range of motion and stretching.

**Equipment:** Bench, stairs, various toys
**Precautions:**
- Decreased perception to stretching, over fatigue of child

**Active assistive shoulder flexion and extension**

- **Procedure:** Begin ROM/stretching at the proximal joints and move distally. Depending upon the child’s size and level of functioning, ROM and stretching can be performed sitting, supine, prone (ex. hip flexor stretch), or standing. The therapist can passively move the joints through the ROM as on land, use the buoyancy of the water to actively assist the child to range the extremity toward the water’s surface, or have the child actively move the joints through the available range while the therapist provides overpressure to stretch the limited ranges.
  - Encourage proper breathing throughout the ROM activity. This will further relax the child and aid in the ROM and stretching.

**Suggestion:** To encourage active range of motion, provide toys for the child to play with, play Simon Says, have the child throw balls one or two-handed overhead, or provide water pouring toys for supination and pronation. Provide toys of any kind to distract the child while performing passive lower extremity ROM and to maintain the interest of the child.
**Progression:** Passive ROM ➔ Active Assisted ROM ➔ Active ROM ➔ Resisted ROM (can be accomplished in any plane by increasing the speed of the motion)

*Active shoulder motion and forearm supination and pronation*

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*Passive lower extremity ROM with mind distraction*
**Benefits:** Increased tissue extensibility, increased ROM, decreased pain, decreased tone/spasticity, increased relaxation, improved ROM, prevention of contractures, muscle elongation with end-range stretching, greater preparation of body tissues for increased activity, movement dissociation, strengthening with AROM and resisted ROM.
Activities to Reduce Tone
Floatation in Supine

♦ Rationale: Buoyancy of water supports body

♦ Procedure: With therapist positioned at child’s side, assist child in positioning into supine. Therapist must provide maximal manual contact to gain child’s trust and to allow child to relax in this position.

Instruct child to look up at the ceiling. The therapist may ask questions regarding the color or shapes of tiles on the ceiling to encourage a head-back position. The child should be encouraged to breathe deeply in and out to promote relaxation.

♦ Progression:
  • Reduce manual contacts.
  • Provide arm and ankle floats to allow child to float independently from therapist.
  • Remove floats for independent floating.

♦ Variations:
  • Gently move child through the water in supine floating position but not enough to require child to contract muscles against the water’s turbulence. Tell the child, “We’re going for a boat ride,” as you move around the pool.
  • Practice breathing techniques during the activity.
  • Use music or tell stories to help the child relax.

♦ Benefits: Tone reduction, relaxation, respiratory control through concentration on breathing, preparation for other activities
Lateral Trunk Flexion (Bad Ragaz)

♦ Rationale: Gentle rhythmic motion inhibits high tone, warm water decreases tone, buoyancy assists movement and helps support body thereby decreasing muscle contraction, pool allows motion in all planes

♦ Equipment: Appropriate floatation devices: head support primarily

♦ Procedure: Child is positioned in supine with hips abduction and slightly externally rotated. PT stands between child's lower extremities with handhold on pelvis or proximal thigh. Slowly and gently swing child from side to side allowing the ipsilateral trunk soft tissues to elongate. Pause before reversing direction to allow turbulence to decrease. Child may need to close eyes if cannot tolerate the visual input or if unable to relax with the visual input.

To maintain lumbar flexion, PT may lift left side of pelvis while sidebending right and lift right side of pelvis while sidebending left (hips move in same direction as lifted side of pelvis). Instruct child to relax and to concentrate on breathing deeply in and out.

♦ Progression: Eliminate pause before reversing direction.

♦ Variations:
  • Perform listening to relaxing music.
  • Change speed, direction, and rhythm.
  • Practice breathing techniques.

♦ Benefits: Tone reduction, vestibular stimulation, trunk elongation

Precautions:
Decreased perception to stretch, water over child's face

Contraindications:
Spinal fusion, rods in the back
Pelvic and Trunk Rotation
(Bad Ragaz)

♦ **Rationale:** Rhythmic rotation aids in breaking up tone, warm water promotes a decrease in tone.

♦ **Precautions:** General pool

♦ **Equipment:** Appropriate floatation devices, a floatable head support may be needed

♦ **Procedure:** With child positioned in supine, PT stands between child’s lower extremities with handhold on the pelvis. Gently rock the child’s pelvis by pushing alternating anterior superior iliac spine (ASIS) downward into the water. If resistance is felt from the child, instruct the child to allow the PT to perform the movement.

♦ **Variations:**
  - The therapist may sing a song or make soothing noises to the rhythm of the movement.
  - With a small child or highly involved child, place the child’s head on the therapist’s shoulder or chest while in supine and maintain the same handhold.

♦ **Benefits:** Tone reduction, relaxation, dissociation of trunk and pelvis.
Activities to Facilitate Tone
Passive Prone on Elbows

Equipment: Kickboard or floatation device with straps

Procedure: Place child prone on floatation device supported on elbows. Straps may be necessary to help stabilize the child on the floatation device and to “free up” the therapist’s hands. Rhythmically glide the child through the water while applying pressure through the child’s shoulders to encourage weight bearing through the scapula and upper extremities.

Precautions:
Swallowing water due to dysphagia or poor oral control

Progression:
- Encourage weight shifting and equilibrium reactions by tipping the floatation device slightly.
- Move the child through the water more quickly.

Variations: The child may place face or mouth in the water to blow bubbles for respiratory support.

Benefits: UE strengthening, scapula stabilization, head and trunk control, head and trunk extension, balance, vestibular stimulation, respiratory control, trunk elongation
Upper Extremity Ball Push

♦ Rationale: A downward motion goes against water's buoyancy principle, therefore requiring strength and controlled movement to succeed. Motion parallel to the water's surface allows both gravity and buoyancy to act simultaneously, thereby "cancelling" each other and making horizontal movement easier than downward vertical movement.

♦ Equipment: Ball or large toy that floats and a bench

♦ Procedure: The child sits on a bench or stands in chest to shoulder level water. The child then pushes the ball out in front of him against the resistance of the water.

♦ Progression:
  • Push the ball down under the water against the water's buoyancy
  • Increase the surface area of the ball

♦ Variations:
  • Use a kickboard in place of a ball.
  • Perform the activity in time to music.
  • Have child push the ball toward the therapist in varying directions.
  • The child may jump up and push the ball in a downward direction.
  • Push a toy boat underwater and hold until all the bubbles stop.

♦ Benefits: Increase tone, scapular stabilization, UE strengthening, improved grip strength, improved hand and finger ROM, trunk stabilization, encouragement of proximal motor return

Precautions:

If the ball is too difficult to hold under water when pushed down, the ball may pop up and hit the child in the face or splash water in the face unexpectedly.
Lower Extremity Weight Bearing

♦ Rationale: Preparation and/or progression to standing and ambulation activities

♦ Precautions: General pool

♦ Equipment: Bench, parallel bars, steps with a railing

♦ Procedure: Place the child in a position with adequate base of support. The therapist puts pressure down through the child’s shoulders and/or pelvis to facilitate weight bearing bilaterally.
Pediatric Aquatic Therapy

• Progression:
  • Sitting with pressure through the knees ⇒ half-kneeling ⇒ standing
  • Physical contact assistance from therapist ⇒ independence
  • As depth of water decreases, weight bearing through the joints increases
  • Create turbulence around the child

• Variations:
  • Add UE activities to maintain child’s attention and to challenge balance.
  • Incorporate various positioning into games such as Simon Says.

• Benefits: Facilitate proximal motor return, increase tone through the lower extremities, increase proprioception, promote upright posture, muscle elongation of antigravity muscles, improve balance
Activities for Trunk Strengthening
Stiff as a Board

♦ **Rationale:** Contractions promoted via water's turbulence

♦ **Equipment:** Appropriate floatation devices to support head, pelvis, and/or lower extremities

♦ **Procedure:** Therapist stands in waist to chest deep water positioned between child’s lower extremities. Manual contacts are on child’s pelvis or proximal thighs. The child should maintain a static position while the therapist moves the child around the pool at various speeds and direction. Instruct the child to be “stiff as a board”.

♦ **Progression:**
  - Increase speed.
  - Change direction randomly.
  - Increase lever arm (a more distal handhold).

♦ **Variations:**
  - This activity may also be done with therapist standing at the child’s head and manual contacts near the scapulae.
  - Make motorboat sounds.
  - Move to the rhythm of an upbeat song.

♦ **Benefits:** Trunk strengthening, particularly abdominal and oblique muscles, co-contraction of trunk musculature, increase tone in trunk region

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**Precautions:**

Over fatigue of child, painful acute conditions, excessive speed may wash water over child’s face, depth of water: waist deep for therapist allows ideal body mechanics and control, therapist’s timing: important during change of direction

**Contraindications:**

Upper motor neuron lesions: this technique may lead to an abnormal increase in tone
**Rationale:** Water provides additional resistance as the legs move in a faster motion both toward the upper body and back into hip extension.

**Equipment:** Overhead bars or pegs to hold on to, ladder steps or railing.

**Procedure:** The child holds on to overhead pegs or bars or railings beside the child. The legs should not touch the floor of the pool. The child then pulls his legs toward him into hip flexion with the emphasis on an abdominal contraction. The therapist may need to stroke or palpate the abdominals to facilitate the abdominal muscles instead of the hip flexors. The child’s knees may be in extension or flexion.

**Progression:**
- Begin with the knees in flexion ➔ knees in extension
- Physical assistance from the therapist ➔ independent
- Increase the speed
- Add ankle weights
- Increase the arc of motion

**Variations:**
- Perform in supported supine
- Pull the legs up in a diagonal to involve the abdominal obliques

**Benefits:** Trunk and abdominal strengthening.

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**Precautions:**
- Inducing excessive tone with overexertion.
Trunk and Abdominal Strengthening in Floating (Bad Ragaz)

♦ **Rationale:** Water provides resistance for muscle strengthening, moving in opposite direction of turbulence requires active muscle contraction

♦ **Equipment:** Floatation devices to support head, pelvis, and LE

♦ **Procedure:** The therapist’s and child’s positions will vary depending upon the area of the child’s body targeted for activity. The therapist stabilizes the pelvis while the child moves the upper body in various planes and directions or the therapist stabilizes the upper body while the child moves the lower body.

♦ **Progression:**
  - Move the therapist handhold more distally.
  - Add weights.
  - Increase number of repetitions.
  - Isometrically hold the contraction in the shortened position.
  - Increase speed.
  - Vary the planes of movement.
Variations:

- With the therapist providing support at the child’s pelvis, the child partially sits up and reaches across or to the same side of his body to pick up a toy (upper abdominals and obliques).
- Once the child has performed the abdominal curl to retrieve a toy or ball, instruct him to reach the arm up overhead and to slam dunk the object into the basketball hoop located superior to the child’s head (latissimus dorsi stretch and trunk rotation).
- With the therapist providing static support at the child’s pelvis, the child initiates the movement through a concentric lateral flexion contraction pretending to be a tree blowing in the wind (lateral trunk flexion).
- With manual contacts at the child’s pelvis or proximal thighs, the therapist sways the child’s body side to side. Instruct the child to bend his trunk in the same direction as the movement (lateral trunk flexion against water’s turbulence).
- While stabilizing the child’s distal lower extremity(ies), instruct the child to make waves by bending and straightening the legs (hip flexor, hamstring, and gluteus maximus strengthening).
- With the therapist positioned at the child’s head providing support near the scapulae, the child raises and lowers the LEs curling up into a ball beginning at the toes (lower abdominals).

Benefits: Trunk strengthening: upper and lower abdominals and internal and external obliques, trunk tone facilitation

Precautions:

Over fatigue; painful, acute conditions; valsalva maneuver
Activities to Facilitate Upper Extremity Strengthening
Sponge Squeeze

♦ Precautions: General pool

♦ Equipment: Sponges of varying sizes and shapes, containers to fill with water

♦ Procedure: Allow the child to choose one or two sponges. Using one or two hands, instruct the child to fill the sponge with water by putting it underwater and then to squeeze the water out above the surface. The child may also do this activity with a sponge in each hand.

♦ Progression: Use larger sponges or two in each hand.

♦ Variations:
  • Allow the child to empty the sponges into containers and to see which one is filled first.
  • Use variable shaped and colored sponges and practice shape and color recognition.
  • Perform in a variety of positions: sitting, kneeling, half-kneeling, standing.
  • Use squirting toys in place of a sponge to have a water fight between the child and the therapist, a parent, or peer.

♦ Benefits: Use associated reactions to strengthen the weaker or nondominant hand, hand-eye coordination, bilateral coordination
Making Waves

♦ Precautions: General pool

♦ Equipment: Objects used to increase the resistance of the water: webbed gloves, paddles, flat toys

♦ Procedure: Have the child stand in waist to chest-level water with the arms abducted. Instruct the child to make waves by holding the arms out and twisting the body. Some children will have difficulty dissociating upper extremity movement and will horizontally adduct both arms followed by horizontal abduction of both arms. This is acceptable for strengthening the trunk and the upper body, but does not provide a rotational component. If necessary, the therapist must demonstrate the activity as she intends for it to be performed keeping the overall goal or purpose in mind. The therapist may need to stabilize the child’s trunk if the child is unable to maintain his balance with the additional forces and turbulence acting upon him.

♦ Progression:
  • Performed in sitting, half-kneeling, kneeling and/or standing.
  • Waves may initially be performed at the water’s surface (will see splashing) waves underwater (no splashing).
  • Increase the depth of the water to challenge the child’s balance from additional turbulence.
  • Increasing the depth of the water will require the child to have more of his arm in the water thereby requiring more strength to make waves.
  • Decrease the depth of the water to challenge the child’s balance form additional gravitational forces.
  • Increase the speed and amplitude of movement.

♦ Variations:
  • Have a contest to determine who makes the biggest wake.
  • Have the child spin or move in a circle with the arms abducted to create the waves.

♦ Benefits: UE strengthening, UE ROM, balance, bilateral coordination, UE dissociation, trunk rotation, trunk strengthening and stabilization through co-contraction of the trunk musculature, vestibular stimulation
Triceps Dips

♦ **Equipment:** Parallel bars, ankle weights

♦ **Procedure:** The child stands in the parallel bars with one hand on each bar. The child raises and lowers self in and out of the water with elbow extension followed by slow and controlled elbow flexion. Depending upon the child's height and the depth of the water, the child may need to flex the legs at the knees to keep the feet from touching the bottom of the pool during the activity. Encourage the child to exhale each time he raises himself out of the water.

**Precautions:**

Shoulder instability, asymmetrical upper extremity strength

♦ **Progression:**
  - Decrease the depth of the water allowing greater effects from gravity.
  - Add ankle weights.
  - Increase the number of repetitions.
  - Isometrically hold the position out of the water. Do not allow the child to “hang” on the shoulder ligaments.

♦ **Variations:**
  - Perform the dips with the child’s legs out in front of him to add quadriceps and abdominal contractions.
  - Practice counting out loud. This can be educational, but will also prevent the child from holding his breath during the exercise.
  - Perform to music to encourage rhythm or to provide motivation.

♦ **Benefits:** UE strengthening, weight bearing, and ROM, bilateral coordination, balance, proprioceptive input, respiratory control
Parallel Bar Push Ups

- **Equipment:** Parallel bars or side of pool

- **Procedure:** Have the child stand outside of the parallel bars with both hands gripping the bar shoulder width apart. Position the child so that his feet are far enough away to require elbow and shoulder flexion instead of hip flexion. The child slowly lowers his chest to touch the bar keeping the neck in neutral or slight extension. The child then raises self through elbow extension all the while keeping the back and hips straight if possible. Encourage exhalation with elbow extension.

- **Progression:**
  - Decrease the depth of the water.
  - Increase the number of repetitions.

- **Variations:**
  - Practice counting out loud. This can be educational, but will also prevent the child from holding his breath during the exercise.
  - Perform to music to encourage rhythm or to provide motivation.

- **Benefits:** UE strengthening, weight bearing, and ROM, trunk strengthening, trunk and pelvic stability, neck and trunk extension, proprioceptive input, respiratory control

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**Precautions:**
Shoulder instability, asymmetrical upper extremity strength, bumping face or teeth on parallel bars with uncontrolled movement - may pad bar with towel or floatation device
Pull Ups

♦ Precautions: Shoulder joint laxity or hypermobility

♦ Equipment: Pull up bar or aquatic workout station

♦ Procedure: The therapist may need to assist the child in reaching the pull up handles initially. The child then slowly and controlled raises and lowers self in and out of the water.

♦ Progression:
  • Decrease the depth of water.
  • Increase the number of repetitions.
  • Attach ankle weights.

♦ Variations:
  • Change hand positions to target a specific back, shoulder, or arm muscle.
  • Hold the position at the top for a specific amount of time.

♦ Benefits: UE strengthening, scapular strengthening, trunk strengthening, overhead activity, shoulder range of motion
Pushing and Pulling the Kickboard

♦ Precautions: Valsalva maneuver

♦ Equipment: Kickboard or another toy that is easily held and provides resistance, bench

♦ Procedure: Child sits or stands in waist to chest deep water. The child then 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 therapist may need to provide support to prevent the child from falling backward. If this activity is performed in sitting, the therapist may also have to provide cues or aid in keeping the child’s legs positioned in flexion.

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

♦ Variations: The child holds the kickboard horizontally in front of him 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. The child then changes directions and pushes out and across with the stabilizing arm.

♦ Benefits: UE strengthening, abdominal strengthening, trunk stabilization, improved balance, bilateral coordination, crossing midline
Throwing and Catching

♦ Precautions: ATNR

♦ Equipment: Balls - all sizes, rings, bench

♦ Procedure: Child sits on firm stable surface in the pool with UEs above water. The child plays throw and catches the ball. The therapist may need to stabilize the trunk.

♦ Progression:
  • Sitting ⇒ half-kneeling ⇒ kneeling ⇒ standing
  • Assisted stabilization ⇒ independent stabilization
**Variations:**
- Throw the ball at a target or through a hoop.
- Shoot baskets.
- Play volleyball.
- Throw rings that the child will later retrieve.
- Include parent involvement.

**Benefits:** UE strengthening, AROM, challenged balance, bilateral coordination, pelvic anterior/posterior mobility, hand-eye coordination, overhead activity, socialization skill acquisition, overhead activity
Activities to Facilitate Lower Extremity Strengthening
Pediatric Aquatic Therapy

Lower Extremity
Push Off

♦ Equipment: Side of pool, kickboard, floatation device

♦ Procedure: Holding on to the side of the pool, the child places both feet firmly against the pool’s wall. The child may be supported in an inflatable ring or without any floatation device depending upon abilities. Both knees and hips will be fully flexed. The child then pushes off of the wall through extension of the LEs propelling self backward toward the pool’s center.

Precautions:
Water splashing over child’s face, extensor synergy

♦ Progression:
• Two feet ⇒ one foot
• Decrease assistance from the therapist

♦ Variation:
• Child holds kickboard horizontally in front of himself and then pushes off of the kickboard instead of the wall.
• Use an inflatable ring around children who can not swim.

♦ Benefits: LE strengthening, weight bearing through the lower extremities, proprioceptive input, use as a closed-chain activity

Proprioceptive input:
Approximation of lower extremities
Plyometrics

♦ Equipment: Steps, bench, hoola-hoop

♦ Procedure: Instruct the child to jump up and down in the water. Child may also jump across the length of the pool and back.

♦ Progression:
  • Increase the depth of the water to challenge balance and to increase resistance.
  • Begin first by holding on to a rail or with therapist’s assistance ⇒ independence.
  • Increase speed, increase height of jump.

♦ Variations:
  • Jump up and down forward/backward and side to side on small step and progress to a taller bench.
  • Jump in and out of a hoola-hoop, front to back and side to side.
  • Hop on one foot with the above variations.

♦ Benefits: LE strengthening, weight bearing through the LE, proprioceptive input, improve balance, improve coordination, cardiovascular workout

Precautions:
Decreased sensation and proprioception of lower extremities - use aqua socks

Above: hopping on one foot across the width of the pool
Right: bilateral jumping on and off bench
Kicking Activities

- **Equipment:** Side of pool, kickboard, inflatable ring or inner tube

- **Procedure:** The child is placed in an inflatable ring or holds onto the poolside or kickboard. The therapist then instructs the child to propel self forward using various kicking techniques.

- **Progression:**
  - Decrease support and/or assistance of therapist.
  - Begin younger children or highly involved children in an inflatable ring because of increased stability and support (in addition to therapist assistance).
  - Inflatable ring or side of pool ➔ kickboard.

- **Variations:**
  - Flutter kick, frog-legged kick, abduction and adduction propulsion, knee flexion and extension with the hip in neutral, dorsiflexion and plantarflexion
  - Encourage kicking by turning the activity into a race or relay game.
  - Kick across the pool in prone and return in supine.

- **Benefits:** LE strengthening, LE ROM, bilateral coordination, improved endurance, sensory integration, lower extremity dissociation

**Precautions:**
Flutter kick may promote extensor hypertonus

Promotes cervical flexion or neutral in supine;
Promotes cervical extension in prone
Activities to Promote Respiratory Function
Motorboat

♦ **Equipment:** Inflatable ring, floatation device

♦ **Procedure:** With the child positioned in prone supported either by the therapist or floatation equipment, encourage the child to place his mouth or face in the water and pretend to be a motorboat by exhaling through the mouth and making noise. Instruct the child to exhale completely. The therapist should move the child about in the pool when the “motor” is running.

**Precautions:**

Hyperventilation may result if the child breathes too rapidly or shallow, inhaling water, water entering the nostrils as the bubbles are blown, valsalva maneuver

♦ **Progression:**
  - Increase the time the “motor” is running.
  - Place only the mouth in the water ➔ mouth and nose ➔ face ➔ head.
  - Therapist-propelled ➔ self-propelled by kicking or using UEs.

♦ **Variations:** The child may be in prone position with an inflatable ring around the trunk. The child should be encouraged to kick while the “motor” is running to self-propel the “boat”.

♦ **Benefits:** Chest expansion, controlled breathing, diaphragmatic breathing, facial muscle strengthening, oral motor control

Use prone positioning to encourage cervical extension:
Use an upright position (partial prone, sitting, or standing) to encourage cervical flexion
**Blowing Bubbles**

**Equipment:** Drinking straw

**Procedure:** The child may perform this activity in a variety of positions depending upon the therapist’s goals. Following therapist demonstration, the child should be encouraged to take a deep breath inward, place his mouth in the water, and fully exhale through the mouth to create bubbles.

**Progression:**
- Blow bubbles first in cupped hands at the water’s surface underwater.
- Increase the duration of the bubble blowing promoting controlled exhalation.
- Blow bigger bubbles with forceful exhalation.

**Variations:**
- Create a contest between the therapist and the child to determine who can blow bubbles the longest.
- Blow the bubbles through a straw.

**Benefits:** Chest expansion, controlled breathing, diaphragmatic breathing, facial muscle strengthening, oral motor control, cervical flexion if performed from an upright position, motivational

**Precautions:**

Hyperventilation may result if the child breathes too rapidly or shallow; inhaling water, water entering the nostrils as the bubbles are blown, valsalva maneuver

Unknown to the child, the therapist is providing approximation through the pelvis and lower extremities for proprioceptive input
Sailboating

♦ **Equipment:** Balloons (contraindicated if latex allergy), ping-pong ball, toy boat; drinking straw, inflatable tube

♦ **Procedure:** Provide the child with a lightweight, floatable object. Encourage deep breathing. Following a full inspiration, instruct the child to blow the floating object across the water.

♦ **Progression:**
  - Increase the size or weight of the toy being blown across the water.
  - Increase the distance the child is required to move the object, either in one expiration or in total.
  - Eliminate the therapist assistance in balance, etc. Place child in positions that are challenging i.e. within inflatable ring where the child is responsible for propelling forward.

♦ **Variations:**
  - Use this activity as a part of an obstacle course.
  - Turn the activity into a race across the pool.
  - Exhale through a straw to move the object.

♦ **Benefits:** Chest expansion, controlled breathing, diaphragmatic breathing, facial muscle strengthening, oral motor control, cervical flexion if performed from an upright position

**Precautions:**

Hyperventilation may result if the child breathes too rapidly or shallow, inhaling water, water entering the nostrils as the bubbles are blown, valsava maneuver
Activities Performed Underwater
Somersaults

♦ **Rationale:** Underwater activity promotes breath control and chest expansion, water's resistance provides general strengthening and endurance during propulsion

♦ **Equipment:** Funnoodle®, bar, or rope to somersault around; may perform without equipment

♦ **Procedure:** In obstruction-free zone, allow child to spin around rope, bar, or Funnoodle®. Therapist must use judgment as to how much assistance to provide child.

♦ **Progression:**
  - Perform somersaults in open water.
  - Perform backward somersaults.

♦ **Benefits:** Sensory integration, perceptual/visual/spatial stimulation, respiratory control, it's fun and challenging

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May need to progress child to a full somersault by practicing components of the activity initially.

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**Precautions:**

Light refraction on water may distort depth perception; requires adequate depth of water; must be free from obstructions such as wall or floor

**Contraindications:**

Lack of voluntary breath control, children with a recent history of aspiration
Swimming Through the Hoop

♦ Rationale: Underwater activity promotes breath control and chest expansion, water’s resistance provides general strengthening during propulsion

♦ Equipment: Hoop, parallel bars

Precautions:
Light refraction on water may distort depth perception and images underwater

Contraindications:
Lack of voluntary breath control, children with a recent history of aspiration

♦ Procedure: The therapist holds the hoop in the water and instructs the child to swim through the hoop.

♦ Progression:
  • Begin the activity with the hoop only halfway in the water so that the child may swim at the surface initially. Gradually increase the depth of the hoop.
  • Vary the angle (plane) of the hoop.

♦ Variations:
  • A toy or spot on the wall may be the goal to grasp or touch once through the hoop.
  • An alternate method is to have child swim through the therapist’s legs or under the parallel bars.

♦ Benefits: Sensory integration, perceptual/spatial/vestibular stimulation, hand-eye coordination, general endurance and strength improvement, respiratory control
Pediatric Aquatic Therapy

Fishing and Diving

♦ Rationale: Water allows for movement through multiple planes, holding breath underwater encourages chest expansion and breath control, muscle strengthening and overall endurance promoted by swimming through water's resistance, grasping object within limited time frame enhances eye-hand coordination.

Precautions:
Light refraction in water may distort depth perception and images of objects underwater.

Contraindications:
Lack of voluntary breath control, children with frequent incidence of aspiration.

Equipment: Sinkable rings and toys of various size, shape and color.

Procedure: The child or therapist should allow toys to sink to the bottom of the pool. The child swims underwater to retrieve the sunken object(s). Child may prefer to use goggles.

Progression:
- Increase the depth of water.
- Decrease the size of the retrievable object.

Variations:
- Incorporate this activity with others to create an obstacle course.
- Include multiple areas of learning: request the retrieval of a particular color or shape.
- Request that a specific number of rings/objects be picked at one time.
- Arrange the rings in a line and ask the child to run his arm through the rings to scoop them up.

Benefits: Sensory integration, perceptual/spatial/vestibular stimulation, hand-eye coordination, general endurance and strength improvement, respiratory control.

Increase the number of rings or objects recovered as respiratory capacity improves.

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Activities for Vestibular Stimulation
Bobbing

♦ Rationale: Movement in various planes affords vestibular stimulation, pushing off of wall and floor provides proprioceptive input, bobbing with parts of face underwater promotes breath control, movement in and out of water provides tactile stimulation

♦ Equipment: None

Precautions:
Swallowing difficulties, fear of putting head underwater, respiratory dysfunction

♦ Procedure:
Passive: Therapist holds child’s trunk and rhythmically raises and lowers child in water.

Active: Child holds onto poolside or ladder and rhythmically raises and lowers self in water or child uses LEs to propel self up and down in the water.

♦ Progression:
• Whether active or passive, begin bobbing with the face out of the water. Progress to lowering chin ➔ mouth ➔ nose ➔ head.
• Instruct the child to blow bubbles each time his face is underwater.

♦ Benefits: Improved respiratory control, pool/water introduction for fearful child, sensory integration, vestibular stimulation
Swinging Through the Water

♦ **Rationale:** Water affords movement through multiple planes

♦ **Precautions:** General pool

♦ **Equipment:** Inflatable ring

♦ **Procedure:** Child may be placed in a variety of positions including prone (play like a motorboat or airplane), supine, or horizontal. In supine, child’s head may be placed on the therapist’s shoulder while the therapist supports the child at the pelvis or waist and walks backward. In any of the above positions, the therapist should move the child about in the water at varying speeds and directions.

  • *Note:* This activity is similar to the Spinning activity. Use this activity with highly involved children or small children who demonstrate greater comfort with increased physical contact.

♦ **Progression:**
  • Increase speed.
  • Abruptly change direction.

♦ **Benefits:** Vestibular stimulation, cervical and trunk extension when performed in prone, cervical and trunk flexion when performed in supine, head righting on body

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increased vestibular input with random changes in speed and direction
Spinning

♦ **Rationale:** Water allows motion in all planes

♦ **Equipment:** Inner tube, other floatation device

♦ **Procedure:** Position child in the middle of an appropriately sized inner tube. Child may sit in the tube or hang with the feet through the center of the tube. The therapist may need to assist the child in holding onto the inner tube. Therapist may push, pull, rock, or spin the child in the tube to provide vestibular challenges. The child may prefer to close his eyes initially to limit the visual input.

♦ **Progression:**
  - Increase the speed.
  - Encourage child to keep the eyes open.
  - Randomly change speed and direction.
  - Encourage child to use own arms and legs to spin and to propel self.

♦ **Benefits:** Vestibular stimulation, sensory integration, increased tone

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**Precautions:**

Inappropriately sized inner tubes, do not use inner tubes containing latex with children diagnosed with spina bifida due to latex allergy
Dancing

♦ **Rationale:** Water allows movement in various planes, water slows falling

♦ **Precautions:** General Pool

♦ **Equipment:** Music, possibly floatation devices

♦ **Procedure:** Move child in all planes of motion in time to the music. If child is able, encourage him to dance by himself. Child may use floatation equipment and move to the music independently.

  *Note: Music may be added to any activity to promote rhythmic motion, an alert state, or a relaxed state depending upon the music chosen.*

♦ **Variations:** If the dancing is performed passively, attempt to move the child’s upper extremity in multiple planes to improve range of motion.

♦ **Benefits:** Balance, coordination, life activity, vestibular stimulation, crossing midline, upper extremity range of motion, calming effect during introduction to the water, increased tone
Activities to Facilitate Balance and Equilibrium Reactions
Sit and Reach

♦ Precautions: ATNR

♦ Equipment: Toys, objects of interest to the child

♦ Procedure: The child sits on a sturdy bench in chest level water. The therapist places the objects just out of the child’s reach and asks child to reach for the toys or the therapist may initiate play with the child. The objects should be placed all around the child to encourage movement in all directions.

♦ Progression:
  • Decrease the support provided by the therapist.
  • Decrease the depth of water.
  • Increase the surrounding turbulence.
  • Supported sitting ➔ sitting ➔ half-kneeling ➔ kneeling ➔ standing.

♦ Variations:
  • Play games that require the child to reach in one direction and grab an object and then places the object into a container located on the opposite side.
  • Pouring activities may also be used.

♦ Benefits: Enhance balance and equilibrium reactions, improve pelvic/trunk mobility, UE strengthening and ROM, crossing midline, weight shifting, trunk rotation

Whether sitting, kneeling, or standing, the therapist should assist the child to attain good body alignment.
Sitting Balance on a Kickboard

♦ Precautions: Fearful child

♦ Equipment: Kickboard that supports the weight of the child, an additional person to aid in the child's comfort level and to assist with balance.

♦ Procedure: The therapist stabilizes the kickboard as the child sits on it. Straddling the kickboard vertically between the legs is generally easier for most of the children. The child then attempts to balance on the kickboard in the sitting position while the therapist assists by holding onto the kickboard. A second person may be required to help stabilize the child’s trunk with manual contacts at the pelvis.

♦ Progression:
  • The therapist moves and/or tilts the kickboard in various directions.
  • Decrease the amount of support provided from the second person.
  • Allow the child to balance for short periods without the therapist stabilizing the kickboard.
  • The therapist should always remain in close contact with the child.
  • Change the position from a straddled position to a seated position, like sitting on a chair.
  • Eliminate the child’s handhold on the kickboard.
  • Occupy the child’s upper extremities with toys or games such as catching and throwing balls or basketball.

♦ Benefits: Balance and equilibrium reactions; head righting; trunk stabilization; weight shifting in sitting; dissociation of the trunk and the pelvis; trunk elongation; cervical, thoracic, and lumbar extension; lower extremity strengthening via isometrics.

Above: forward and backward tilting facilitates spinal extension and flexion; Right: lateral tilting facilitates trunk elongation.
**Log Rolling**

♦ **Rationale:** Floating is possible when the buoyant force is equal to the weight of the water displaced by the body. Water allows motion in all planes.

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<td>Inability to recover from standing, breathing in or swallowing water</td>
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♦ **Equipment:** Floatation device that will support the child’s weight

♦ **Procedure:** The child begins in supine or prone holding the floatation device against chest. The child may also wear assorted floatation devices. The child then “flips” self over into sidelying and then prone. This is then repeated in the opposite direction. If the child is able to float well without floatation equipment, the child may roll with the aid of the therapist’s manual contacts at the pelvis.

♦ **Progression:**
  - The therapist may need to initiate the movement at first.
  - The child may then progress to rolling without floatation equipment if he can recover to a standing position safely.
  - Improve the continuity of the rolling.

♦ **Benefits:** Rotational control, righting reactions, trunk and abdominal strengthening, head control, vestibular stimulation, trunk and pelvis dissociation

*May be performed with or without the face in the water*
Standing from Floating

♦ Rationale: Floating is possible when the buoyant force is equal to the weight of the water displaced by the body. Water allows motion in all planes.

<table>
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<tr>
<td>Inability to recover from standing, breathing in or swallowing water</td>
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♦ Equipment: None

♦ Procedure: The child assumes a floating position, either supine or prone. The child then transitions to standing by tucking both legs up toward the chest into a “ball”. Standing is complete when both feet are touching the bottom of the pool. The child then returns to a floating position by tucking the legs and curling into a “ball” again. The activity may be repeated multiple times in a row. The therapist may need to assist the child in attaining a curled position and regaining standing balance.

♦ Progression:
  • With a floating device ➔ without a floating device.
  • Decreasing the therapist’s assistance.
  • Increase the number of repetitions.
  • Increase the speed and agility.

♦ Variation: Use with rolling or as a part of an obstacle course.

♦ Benefits: Balance, righting reactions, rotational control, abdominal and trunk strengthening

May be performed with or without the face in the water
Standing on One Foot

♦ Rationale: Viscosity of water helps to slow falling and loss of balance.

♦ Precautions: General pool

♦ Equipment: Parallel bars, sinkable rings and/or balls

♦ Procedure: The child lifts one leg and balances on the opposite leg. Alternate feet. The child may require support from the therapist for trunk stability and balance.

♦ Progression:
  • Parallel bars or wall of pool ➔ independent standing.
  • Increase the level of the water to challenge balance through effects of turbulence.
  • Increase the turbulence.
  • Decrease the depth of the water to challenge balance through the effects of gravity.
  • Decrease the therapist’s assistance.

♦ Variations:
  • The one-footed standing may be incorporated into games such as Simon Says, obstacle courses, or contests with the therapist to determine who can balance on one foot the longest.
  • Instruct the child to pick up the sinkable rings with one foot while balancing on the other. Alternate feet.

♦ Benefits: Improve balance, improve coordination, LE strengthening, weight bearing, proprioceptive input, motor planning, external rotation of the hip when picking up rings with one foot.
Activities to Facilitate Gait
Pre-gait Activities

♦ Rationale: Water’s buoyancy counteracts gravity to unweight the joints. Viscosity of water slows falls when the body becomes off balance.

♦ Equipment: Parallel bars, floatation devices

♦ Procedure: The child stands with support of the therapist through downward pressure at the pelvis. The child then shifts his weight laterally from one foot to the other. Now, with one foot placed in front of the other, the weight is shifted forward and backward over each lower extremity. Alternate the position of the feet.

♦ Progression:
  • Weight shifting beginning in sitting ➞ half-kneeling ➞ standing with support and facilitative input from therapist ➞ standing in parallel bars ➞ standing independently.

♦ Variations:
  • The child may reach to touch or to grab objects from various directions with the UEs while in standing.
  • The child may hold on to a Funnoodle® or other floatation device while weight shifting.

♦ Benefits: Gait training, weight shifting, weight bearing through the LEs, balance, stability, functional activity
Gait Training

♦ Rationale: Water's buoyancy counteracts gravity to unweight the joints. Viscosity of water slows falls when the body becomes off balance.

♦ Equipment: Parallel bars, floatation device

♦ Precautions: Weight bearing status of the child

♦ Procedure: The child stands at one side of the pool and walks to the other side with the support of the therapist at the pelvis. The therapist will need to provide physical and verbal cueing to the child for proper alignment of the body during gait. The therapist may also need to provide support or cueing to control gait speed and quality.

♦ Progression:
  - Parallel bars → support from the therapist → independent.
  - Decrease the depth of the water to challenge balance affected by gravitational forces.
  - Increase the depth of the water to challenge strength via increased resistance.
  - The wake of the therapist can decrease the resistance while the turbulence can increase the resistance.

♦ Variations:
  - Use kickboards or inflatable rings to assist the child with upright positioning and balance.
  - Make up rules or games that require the child to walk on tip toes, walk on heels, walk faster, walk slower, etc.
  - Play “restaurant” or another activity that requires the child to walk back and forth across the pool slowly and controlled. For example, the child must take the customer the cheeseburger being careful not to spill. Then he must take the customer ketchup, then a milkshake, etc. A parent may be the customer.

♦ Benefits: Gait training, balance, weight bearing through the LEs, functional activity
Pediatric Aquatic Therapy

Alternate Gait Activities

♦ Rationale: Water’s buoyancy counteracts gravity to unweight the joints. Viscosity of water slows falls when the body becomes off balance.

♦ Equipment: Parallel bars, flotation device

♦ Procedure:
  • The child stands in the parallel bars or at the side of the pool and side steps back and forth the length of the parallel bars or the width of the pool.
  • Similarly, the child “braids” or “grapevines” across the pool.
  • The child walks around cones or objects set up by the therapist, possibly with the help of the child.

♦ Progression:
  • Parallel bars with support from the therapist with a flotation device independent.
  • Decrease the depth of the water to challenge balance affected by gravitational forces.
  • Increase the depth of the water to challenge strength via increased resistance.
  • The therapist can use a wake to decrease the water’s resistance and provide turbulence to increase the resistance.
  • The child may step on and off the bench or step in preparation for stair climbing.

♦ Variations:
  • Design an obstacle course.
  • Set up races.
  • Perform to music.

♦ Benefits: Gait training, balance, coordination, functional activity

Braiding as an alternate gait activity

Additional options: toe or heel walking, marching, galloping, backward walking, sidestepping, heel-to-toe walking forward and backward

Precautions:

Child’s weight bearing status; “Braiding or grapevines” may encourage a scissored gait pattern for those children who already ambulate with an adducted gait. Have these children do sidestepping instead.
Game Activities to Incorporate Various Treatment Options
Pediatric Aquatic Therapy

Hot Potato

✦ **Equipment:** Ball or other small object that’s able to be tossed

✦ **Procedure:** The therapist or a helper plays music or sings. A ball is tossed amongst those playing the game. When the music stops, whoever has the ball (hot potato) loses that round. Another indicator other than music may be utilized to stop the round such as the lights being turned off or someone yelling stop. The number of rounds to the game will vary depending upon the therapist’s intent.

✦ **Progression:**
  - Decrease the depth of the water to challenge balance affected by gravitational forces.
  - Increase the depth of the water to challenge strength via increased resistance.
  - Sit ⇒ half-kneeling ⇒ kneeling ⇒ standing.
  - Add rules to the game i.e. after catching the ball, you must turn around in a circle before throwing it back.

✦ **Variations:**
  - Add rules.
  - Play one-on-one or with a group.
  - Facilitate parental or peer involvement.

✦ **Benefits:** Agility, UE strengthening, UE ROM, bilateral coordination, crossing midline, trunk stability, balance, socialization, hand-eye coordination, motivational

Precautions:
Child may practice/develop faulty movement patterns if not monitored by the therapist.
Ring Around the Rosie

♦ Equipment: None

♦ Procedure: One-on-one with the therapist: the therapist holds the child or, if the child can stand, holds the child’s hands and spins around in a circle singing the song “Ring Around the Rosie”. Group: same as on land, but the children may go underwater when “we all fall down”.

♦ Precautions:
Child’s fear of putting the face underwater

♦ Progression:
• During “we all fall down”, begin by “falling” to neck level ⇝ chin level ⇝ nose level ⇝ completely submerged.

♦ Variations:
• Children can hang on to a Funnoodle® instead of hands.
• Involve peers and parents.
• With a group of three or more, require everyone to sidestep, rotate trunk and walk backwards or forwards, hop on one or two legs, march around the circle.

♦ Benefits: Gait, balance, respiratory control, vestibular stimulation, socialization, parental/peer involvement, LE strengthening, trunk rotation, motivational
London Bridge

♦ Equipment: Kickboard or any object to serve as a bridge

♦ Procedure: The therapist holds up a kickboard or stick-shaped object at a level just below the top of the child’s head. The child then flexes at the knees to walk under the “bridge”. Do not allow the child to fall forward and swim under the board. Tell the child to walk like a duck followed by demonstration by the therapist.

♦ Precautions:

Accidental inhalation of water

♦ Progression:
  - Lower the “bridge” each time the child walks under it requiring greater knee flexion.
  - Walking under the bridge with support next to the wall ➔ walking under the bridge in the middle of the pool.

♦ Variations:
  - Allow the board to go low enough that the child is required to place the chin, mouth, and eventually the head underwater.
  - Create a longer bridge and make the game a timed event singing the song “London Bridge”.
  - The child must be through the bridge before it “falls down”.
  - Use as a group activity.
  - Use as a component of an obstacle course.

♦ Benefits: Quadriceps strengthening, balance, motor planning, proprioceptive input, motivational

Be aware of body alignment and substitution patterns
Hokey Pokey

♦ Equipment: None

♦ Procedure: Perform in the water as the game would be done on land. Encourage the child to sing the words to the song with the therapist if he knows them. Call out the body parts to be “put in” and “put out” that the therapist wishes to range. Encourage “big” movement to facilitate greater range of motion and prolonged unilateral stance.

♦ Progression:
  • Decrease the depth of the water to challenge balance affected by gravitational forces.
  • Increase the depth of the water to challenge strength via increased resistance.
  • When it’s time to “put your whole body in”, encourage the child to jump into and out of the center of the circle.

Precautions:
Child may practice/develop faulty movement patterns if not monitored by the therapist; ATNR

♦ Variations:
  • When it’s time to put “both arms in”, the child can utilize trunk rotation or shoulder circumduction.
  • The therapist, aide, or parent can assist the child by holding him, providing stabilization, or physically moving the body through the motions if he is not at a cognitive or physical level to play the game without assistance.
  • Play with a group of people.

♦ Benefits: Coordination, balance, limb dissociation, trunk stability, trunk rotation, trunk and pelvis dissociation, proprioception, extremity strengthening, extremity ROM, socialization, parent and peer involvement, motivational

Sibling involvement
Obstacle Course

♦ Equipment: Anything to complete an obstacle course: balls, bench, parallel bars, weighted rings, steps, hoola-hoop, inflatable ring; floatation device

♦ Procedure: Same as on land. The therapist, possibly with the help of the child, designs and sets up an obstacle course. The therapist instructs the child on how to properly complete the course. The following are examples of activities to include: diving for rings, alternate gait activities, pull-ups, step-ups, shooting baskets, blowing bubbles, or swimming or stepping through a hoop.

Precautions:
Child may practice/develop faulty movement patterns if not monitored by the therapist.

♦ Progression: Modify the tasks to challenge the child.

♦ Variations:
  • Make the activity a timed event.
  • If more than one person is participating, make the event a race.
  • Involve peers or parents.

♦ Benefits: The possibilities are endless: ROM, strengthening, motor control, coordination, proprioception, and socialization, depending upon the therapist’s goals.
Tag

♦ **Equipment:** Possibly a floatation device, inflatable ring

♦ **Procedure:** Play just as on land. One person is “It” and one or more people are being chased.

♦ **Progression:**
  - Decrease the depth of the water to challenge balance affected by gravitational forces.
  - Increase the depth of the water to challenge strength via increased resistance.
  - Create turbulence to challenge balance.

**Precautions:**

- Child’s inability to recover to a standing position; Child may practice/develop faulty movement patterns if not monitored by the therapist.

♦ **Variations:**
  - Include parent or peer involvement.
  - Create rules to follow i.e. everyone may only walk on their toes or heels, or the child must swim under the therapist’s legs to “free” self.
  - Instead of “It” “tagging” the others, “It” may use a ball to throw at the others causing them to “freeze” if hit.

♦ **Benefits:** Cardiovascular endurance, may incorporate gait activities and variations, balance, general strengthening, dissociation of movement, problem solving, socialization, parent and peer involvement, motivational
Simon Says

◆ **Precautions:** General pool

◆ **Equipment:** Possibly a floatation device, anything required by the therapist’s commands

◆ **Procedure:** Same as on land. This game is a good motivator for children to perform ROM or other activities that they may otherwise show disinterest.

◆ **Progression:**
  - Assistance ➔ independence.
  - Vary depth of water.
  - Vary resistance.
  - Vary turbulence.
  - Alter the type of activity.

◆ **Variation:**
  - Play with a group of people.

◆ **Benefits:** The possibilities are endless: ROM, strengthening, motor control, coordination, proprioception, and socialization, depending upon the therapist’s goals. Simon Says is a versatile and creative game that can be used to add interest to the task at hand or to work on a variety of treatments.
**Keep Away**

**Equipment:** Ball

**Procedure:** Play as on land. Two or more people throw a ball amongst themselves while the person chosen to be in the middle attempts to gain control of the ball.

**Progression:**
- Challenge the child's abilities by making the ball more difficult to attain: throwing the ball higher and faster.
- Decrease the depth of the water to challenge balance from additional gravitational forces.

**Variations:**
- The therapist can take turns with the child being the center person.
- Include parent or peer involvement.
- Encourage the child to get the ball anyway he can: jumping, swimming, reaching really high.

**Benefits:** UE ROM, socialization, LE weight bearing, LE strengthening, balance, hand-eye coordination, trunk and neck extension, unilateral and bilateral reach, motor planning

**Precautions:**
Child may practice/develop faulty movement patterns if not monitored by the therapist.
Appendix B
SUGGESTED EQUIPMENT FOR PEDIATRIC AQUATIC THERAPY

Aquajogger
Aquatic workout station with pull-up bar/handles
Balloons* 
Balls: ping pong ball, beach ball, various sized balls
Barbells
Bench
Cups
Floatable toys of all shapes and sizes
Floating basketball hoop 
Funnoodle®
Hand paddles 
Hoola hoop
Inflatable rings
Inner tubes*
Jugs
Kickboards
Masks, fins, snorkels
Parallel bars
Pitchers
Sponges
Squirt toys: discourage water guns, but rather soft rubber animals that may be squeezed
Stairs
Toy boats: all sizes
U-shaped floatation device for the head
Water wings
Webbed gloves
Weighted rings
Weights
Wind-up toys

*Caution: possibly contains latex. Do not use with children with spina bifida.
Appendix C
THE GRADUATE SCHOOL  
UNIVERSITY OF NORTH DAKOTA OUTLINE

Outline of Independent Study X  Thesis  Dissertation  Project Design  

Student: Dena Noel Wright  Date: September 12, 1996

Proposed Title: A Literature Review and Introductory Pediatric Aquatic Therapy Manual

Anticipated Date of Graduation: May 11, 1997

Description of the nature of the problem/study, the procedure or methodology to be followed, and the proposed results:

Aquatic therapy continues to grow as an acceptable and often times preferable means of achieving therapeutic goals across a variety of patient populations: pediatric to geriatric, orthopedic to neurologic. The unique properties of water allow people to exercise and to recover in a safe and relaxing environment that promotes similar goals to those on land. However, land exercises can not simply be performed in water due to the water's unique properties. Similarly, exercises for adults do not work as effectively for children. Many physical therapy programs across the nation provide only minimal instruction on aquatic or pediatric therapy as a part of the core curriculum.

The purpose of this project is to develop an introductory pediatric aquatic therapy exercise manual for physical therapy students and physical therapy professionals. The procedure being used to complete this project consists of a literature review, selection of basic aquatic therapy activities appropriate for a pediatric population, and illustrations of the procedures through photographs of children performing the exercises. It is hoped that this manual will provide future graduating physical therapy students and beginning pediatric aquatic therapists with ideas for exercise implementation from which they will use their own creativity and experiences to expand and to adapt the exercises to each child.

Signatures of approval as specified in the "Degree requirements" section of the Graduate Bulletin:

[Signature]
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 HAVE BEEN 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
Conditional Contract

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 ___________________________ Date

Dena Wright ___________________________ Date

CETP Physical Therapist ___________________________ Date

UNDPT Faculty Advisor ___________________________ Date

Steve Rood, Director of PT ___________________________ Date
REFERENCES


