

THE YOUNG DIVER

MEDICAL LINE

By Dr. Maida Taylor

Intellectual,
Mental And
Emotional
Readiness To
Dive

Just as the rate of development, growth and maturity varies greatly, the age at which a young person, male or female, takes up sport diving is not uniform. One must weigh and balance a complex set of psychological, intellectual and physical factors to determine when to start training for this wonderful, but sometimes risky endeavor. Hopefully, this discussion will help define the physical and mental maturity required for youngsters to begin scuba diving. These guidelines apply to boys as well as girls. The physical limitation discussed herein pose a larger obstacle for girls, because of their generally lower weight, smaller body mass and shorter stature than boys of the same age.

Preparation for the sport requires the physical strength and skill to maneuver on and under the water, and the "smarts" to comprehend the danger of diving on compressed air. Before trying SCUBA, youngsters can learn a comprehensive set of skills that minimize risks. To dive safely, a person should possess good judgment, must act responsibly, and be attentive at all times. Diving safely requires attention to detail and respect for rules, traits that may be slow to develop in some teens.

Drowning and compressed gas accidents including air embolism and decompression sickness constitute the core of dangerous and lethal events in diving. Before taking up diving, an individual must have the ability to understand the hazards of the marine environment, and the dynamics and physics of compressed gases. Introduction to the ecology of the underwater world also helps the novice diver to move carefully in this fragile world. If a child does not have the maturity or intellectual tools to master these ideas, delay diving instruction.

Discussion of the laws of compressed gas, and explanation the kind of physical damage done by gas embolism or decompression sickness may provoke a great deal of anxiety in some youngsters. Even adult diving students report feelings of fear and trepidation after hearing about diving accident injuries. One has to impart this kind of information to the student diver, despite the fear that may be evoked. Tables, gauges, meters and profile all have no meaning if you do not understand



their utility. The entire science of diving has evolved to assure safety and to avoid injury. The young diver must have the maturity and judgment to be able to see safety instruction as a caution, rather than as a threat. The immature youth may become so fixated on the dangers of diving that anticipation of the underwater experience becomes a nightmare. Educational introduction to the open ocean should strive to balance positive images against the negative aspects and dangers. Early teens may not be able perceive the pros and cons in proportion. Rather than provoke undue fears in a timid, immature child, diving instruction perhaps should be delayed until greater maturity is evident.

The academic level of intellect necessary to understand gas dynamics probably develops at around the age that chemistry and

physics instruction begins in high school. Most students can comprehend the physical science aspects of diving by the age of 16 or 17. A gifted and mature teen may possess these abilities sooner; but as a rule, age 16 is a good time to start instruction in most cases.

One of the most important issues in considering mental readiness to begin SCUBA diving is motivation. When teaching adult diving classes, we often see a wife who takes up diving to please her husband, even though she is afraid of the water. Many young women think that diving will be a great place to meet men. Situations like these represent disasters in the making. A pushy parent who drags a teenage child to the beach for an open water dive is committing a form of child abuse. Jefferson Davis, in his lectures on diving safety, always warned diving doctors and instructors to be on the lookout the “dragooned” diver; the person pushed, prodded or coerced into taking up the sport. Problem parents exist who force their children to participate in sports not for the child’s benefit, but for the parents vicarious satisfaction. The stereotypic example is that of a man dragging his son into something the boy is not ready for or not interested in. More and more, educators and teachers demand that girls to have equal opportunity in the class room and on the sporting field. Parents are trying harder to treat girls equitably and are trying to avoid “sexist” limitations their activities, opportunities and achievements. A girl-child now is as likely as a boy to be “dragooned” into diving. A young

woman may be told that she must take up diving in the interest of family togetherness, even if she is not interested in the sport. The person responsible for assessing readiness to dive must measure the sincerity of the level of interest of the novice diver. Instructors need to determine where the motivation resides: from within or from outside. Unless the interest in diving comes from a strong personal interest, scuba training is completely inappropriate activity for a young person. (see diving instructors, buddies and parents section below)

Physical Maturity and Size for Diving

Diving equipment is bulky, heavy and complicated. In order to use equipment safely and to be comfortable, diving requires a minimum skeletal and body mass. Most dive rental shops stock a mid to upper range of sizes of suits and vests, not well tailored to a smaller body size. For comfort as well as safety, experts feel that a diver should weigh at least 45 kg. (108 lb.) and measure at least 150 cm. (60 inches or 5 feet) in height. Custom gear has become available for smaller divers for many years, and can be adapted to teens and children. Custom gear is, however, expensive, and most families are reluctant to spend money on special equipment before determining if a novice diver really takes to the sport.

When comparing the size, shape and physiology of pre-adolescent girls to those of adult women, distinct differences emerge. Though few

good studies exist, girls seem to incur a higher oxygen expenditure when walking or running than women do. This means that girls generate more metabolic heat and burn more energy than adult women during weight bearing exercise. Girls typically have a larger surface area to body mass ratio, thereby presenting a larger surface area to the environment for heat exchange. Thus, girls get colder more quickly than women do under similar environmental conditions. These characteristics, in combination with higher rates of peripheral blood flow in children, put pre-adolescent and early adolescent females at an increase risk of cold stress. In open water swims in water 20.3 degrees C, girls age 8 evidenced a 2.5-3 degree decline in core temperature, while girls age 16 to 19 showed little thermal stress. A poorly fitting wet suit is a great hazard. The adults on the dive will assume that the suit is protecting the new initiate. Since children get cold faster and lose heat more rapidly to the environment, the adults in the dive party may not understand or even vaguely perceive the youngster being at risk. A bad wet suit is almost worse than no wet suit for the young diver. Children need greater thermal protection than adults do. As most divers know, being cold ruins many otherwise delightful dives. Diving becomes a chore and a punishment rather than a pleasure. Early negative experiences for a young diver may dampen any future enthusiasm and enjoyment diving in the inexperienced and fledgling diver. The family diving adventures everyone has planned and anticipated will be over before they

start. Poor fit gear also predisposes to accidents. It may be better to put off the diving experience for a young person, rather than provide a bad experience if no suitable equipment is available.

In terms of adolescent physical growth and development, girls reach 95% of their height by the time of their first menstrual cycle, usually at age 12 1/2 to 13. The phase of most rapid change in height occurs approximately 6 months before the start of menstrual periods. Girls then undergo a phase of rapid weight gain, and most attain adult size and body mass by age 14-15. When looking at factors that affect athletic performance, strength and aerobic capacity all increase during adolescent growth and development. According to studies of trained teenage athletes, these performance parameters level off and then plateau between age 13 and 15, and little gain

occurs in physical performance later in adolescence. In other words, if a girl has reached puberty and has had periods for 6-12 months, she has completed most of her physical growth. Since most girls age 14-15 have essentially reach full physical size, strength and athletic potential, they possess the physical maturity to start diving. Girls who mature early will have more muscle mass and larger bone mass than girls who mature later, and may take up diving sooner, if they possess the mental and intellectual facility to do so. Remember, however, that girls have only 2/3 of the total body mass and muscle mass that boys have at the same age, and need to have training tailored specifically for them, taking into account their size, strength and body mass limitation.

Special Equipment Problems for Children and Teens

Most diving accidents occur due to human error. Diving equipment occasionally causes or contributes to accidents risk. The equipment used in diving to avoid *cold stress* and to assist in *buoyancy control* pose special problems for the person of smaller stature.

Cold represents a special threat for children and women. Children possess a larger surface area relative to total body mass, and lose heat much more quickly than adults. Women also have a larger relative surface area to mass than men, and have less muscle mass that also is a significant source of body insulation along with fat. Girls prior to puberty have less fat and muscle, and are very vulnerable to cold stress. Even in later teen years, after growth in height is over, continued maturation includes accumulating more fat and adding more muscle. Adolescents and children by virtue of their smaller size possess a smaller blood volume and lower total body water. Smaller blood and plasma volume predispose to dehydration which in turn increases the risk of hypothermia. Teens who dive need to be especially aware of how cold they feel. Instructors or parents should be very deliberate and remind teens to drink lots of fluids, Adults in charge and teens should recognize their exercise tolerance and limits. Cold and dehydration both contribute to increase rates of decompression sickness. Teens would appear to be a group

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particularly vulnerable to the combined adverse effects of these two diving perils.

Custom wet suits do not obviate all the difficulties encountered by smaller divers. In most climates except extreme tropical waters, divers wear wet suits or dive skins for protection from hypothermia and as a physical barrier against stinging ocean life forms. Most new divers learn to deal with changes in suit and tank buoyancy through the operation of a buoyancy compensator. The smaller diver may find that a suit makes her *very* buoyant on the surface. To compensate, she has to add a relatively larger amount of weighting than larger, denser divers use. As she descends, and the neoprene of the suit is compressed, the gas trapped in the suit that provides the flotation decreases. The weights then start to pull her down, often faster than she realizes. Divers need excellent skills to manage these rapid changes in buoyancy.

Similarly, at the end of the dive, as it empties, the tank becomes buoyant. An empty tank on a small person may exert a very profound positive pull to the surface, and as ascent continues, the air used in the buoyancy compensator also expands. Unaware of these changes, the diver risks a rapid, poorly controlled ascent. Air embolism may occur on surfacing, and if the dive was deep or long, decompression sickness may develop. In summary, the small diver is at risk for dropping too deep and too fast at the start, and at risk for coming up too fast at the end of a dive.

Another previously unrecognized and unreported risk for young divers relates directly to physical size and body conformation and buoyancy control. Early adolescent males and females have narrower hips than adults do. When you look at the conformation of a child, chest, waist and hip measurements are all very similar. In later adolescence, change in conformation with deposition of fat and growth of the hips provides a nice seating for a weight belt. As stated above, adolescent girls, because of their lighter bones and smaller muscle mass often need a lot of weight to offset the very buoyant effect of a full wet suit. During descent, suit volume reduces providing less flotation and the compressed material reduces the diameter of the waist and hip of the suit. The weight belt loosens and can inadvertently slip down over the hips and fall toward the feet. A young and relatively inexperienced diver, who is preoccupied with adding air to a buoyancy compensator as she “gets heavy” deeper on descent, suddenly realizes that her weight belt is slipping off. Worse still, she may find that the weight belt has dropped off

completely, and now she suddenly is uncontrollably buoyant. Though no statistics are available, this type of buoyancy control crisis may be implicated in diving accidents in young girls or boys. One also might wonder how many times an unexpected circumstance like this leads to a double diving accident involving a parent and child. In later adolescence, when growth nears completion, and the body contour,


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composition and mass reach true adult measures, suit and gear problems and risk will lessen.

Adolescents should receive special training in advanced buoyancy control techniques if they are to dive at all. This issue takes us neatly to the matter of who should teach the teen to dive and who should be buddied with teenagers.

Diving instructors, diving buddies and parents

In order to develop confidence, teens who start diving should train with other adolescents. If all the persons in a class have the same basic intellectual, physical and experience level, they will attain a more balanced perspective of their relative strengths and weaknesses, skills and deficits, than they will in a class with a wider mix of students. Instructors can measure performance against other students of similar size and ability. The class progresses at a speed appropriate for age with teens learning some tasks and skills more quickly than adults and others more slowly. If the didactic material in the diving manuals seems too difficult, a teen may be less embarrassing to say so in a group of peers. When adults are present, particularly if the adults are the parents, a teen may feel inhibited about confessing that he or she does not understand the materials. No one wants to hold back the rest of the class.

All teen classes are not widely available and mixed age classes are the norm. Instructors should try to extend special consideration to see that teens have their concerns and

needs addressed in a positive and reinforcing manner.

Diving instructors tend to be a pretty athletic, tough, "macho" group. Like athletic coaches, they are often demanding and occasionally harsh, and may even humiliate members of class in order to improve performance. Athletic coaches are notorious for using such provocative techniques. Teenagers who are members of sports teams may not find this kind of teaching unusual. Other teens experience great pain when humiliation and embarrassment are used as goads. They may give up on diving even before they "get their feet wet." Browbeating and insults damage self-esteem, and do not promote learning in teens or adults.

Try to find a certified instructor knowledgeable about teens, one with a supportive style. An instructor also should have a working knowledge of the physical and anatomic differences between adults and teens, between males and females, which may affect diving performance. A good instructor will tailor training to insure that the performance demands are appropriate and realistic for the age and size of the students. A good instructor should be tough enough to train hard, but fair enough to recognize and acknowledge limitations. The same may be said for any instructor of novice divers of any age.

Just as instructors can intimidate student divers, parents sometimes are guilty of pushing their children too hard for their own ego gratification and needs. Though

guardianship of minor children resides with their parents, the father and mother may not be objective enough to determine if and when a teenager is ready for diving. The final decision resides with the diver instructor. After a few classes, the instructor reserves the right to say that a particular child is not ready for the sport. Parents should respect the judgment of the instructor in this matter. The opinion is based on many years of experience teaching this sport.

The schedule of instruction and training in the dive course must be strictly adhered to, and parents should not try to modify or skip parts of the planned curriculum. A zealous over enthusiastic parent can do great harm by trying to act as "the instructor." In a previous life, I taught swimming to preschool children. We developed a specific, progressive teaching plan to orient toddlers to the water. After a great week in the water, a child often returned on Monday morning fearful and regressed. Often, parents tried to teach their kids the swim with well intentioned, but often awkward, unplanned, and sometimes dangerous techniques. An ambitious parent often ruined several days of learning by throwing a kid into the deep end of the family pool, hoping he or she would swim. The child however rapidly learned to hate and fear the water. Parents should not be the dive instructor for their own children. As with driver's education, a professional teacher, with a well-planned curriculum and good teaching skills, can better serve a student's needs for order, patience and objectivity. Any adult who is contemplating teaching their own

child to dive, should try to teach their own child to drive first.

Never let an uncertified minor child dive in the family pool with tanks just for fun. Such an act is misguided and dangerous. Gas bubbles change most in size in the last 1-2 metres of ascent to the surface, and lethal embolism can occur even in shallow backyard swimming pools. Never allow a child, free swimmer, or novice diver to take a single breath of compressed gas while free diving from the surface to a diver on the bottom of a pool. Even adults forget when free diving that a breath taken from a tank at the bottom of the pool is a breath of compressed gas. Experienced divers have made this error, taking a breath, swimming back up while breath holding, and dying on the surface. Too many diving accident reports include tragic stories of a parent diving with a child, and one or both of them drowning. A parent, out of a sense of duty, with inadequate skills, air or judgment, may panic in an effort to rescue a child in trouble and both may be lost. Conversely, a child, witnessing a parent in trouble, and despite inadequate training and strength, tries intervene. Parent-child diving teams hold the potential for a massive family tragedy almost too awful to imagine. If an accident occurs, and one member of the duo survives, the residual shame and guilt are almost unthinkable and unbearable to consider, not unlike the death of a child in an auto accident with the parent driving or visa versa.

Teens often will heed the advice and counsel of adults in authority, but not their parents. This lack of regard for parental advice is an appropriate testing of limits and an attempt at separation, a normal component of adolescent psychological development. Such defiance, however, compromises communication between parent and child. Clearly, this kind of behavior enhances the risks of diving if parent

buddying of parent and child should be omitted, or reserved for very experienced divers only

Alternatives to diving and activities to prepare for diving

For teens who are too small to use dive equipment comfortably, or who are too young to understand the basics of the gas laws, several options exist to provide preliminary conditioning and training for diving.

Teens will greatly benefit from practicing and perfecting their swimming skills in open water. Swimming in waves and currents differs dramatically from being in a pool. Getting used to the splash and surge of open water decreases the tendency to panic in rough water, and builds confidence. Pool swimming is good too, since working in less buoyant fresh water strengthens muscles and promotes flotation skills. Underwater swimming helps develop breathe control and endurance. Swimming with fins aids in becoming an efficient diver later.

Snorkeling offers a great transition to diving for youngsters. The environment and its sights and inhabitants become familiar with no risk of gas accident. Teens, while snorkeling, learn to identify marine life, gaining an appreciation of the beauty of the plants and animals in the sea. They also learn how to avoid marine hazards like coral and stinging coelenterates on ropes and lines, and to move gently in the delicate



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and child are paired as buddies. When families are diving together, have the diver master or instructor define the dive plans and profiles. Allowing a third party to define the limits avoids issue of parent-child conflict.

Do not dive alone with your child unless you are an advanced and experienced diver. Always have a qualified instructor as part of your diving group for the first year or two of diving as a family. This advice probably should be followed until the minor child is over age 18. With the alternatives proposed below, there is no reason a family cannot share an ocean oriented vacation with young teens. To insure that the experience is safe and memorable, one-to-one

ecosystem of the ocean. And as we all know, when your tanks are empty and your dive day is done, snorkeling is a wonderful way to get more out of a dive trip. Other skills to practice while snorkeling include surface diving, breathe hold diving, and swimming with snorkel only without a mask. Any good general diving instruction book will have a discussion of these basic snorkeling skills in its section on "watermanship."

Youths who become proficient at snorkeling may then advance and practice skills for diving using all the regulation dive equipment except tanks. In wet suits, with buoyancy compensators, weight belts and snorkels, the incipient diver starts to learn buoyancy control, surface diving, gear positioning for comfort and safety, without the risks inherent in SCUBA. In fact, learning to work well with all the diving equipment in place except tanks provides a bedrock of skills that making SCUBA seem easy. The danger in SCUBA diving is that it seems so easy. The impression that diving is easy is just the thing that makes it so dangerous.

Good skills, good training and good judgment reduce the hidden dangers inherent in sport diving for anyone at any age. If any question exists about the mental or physical readiness of a teenager, please delay scuba diving until confidence and competence are readily apparent. Better to regret saying no and deal with a youngster's disappointment,

than experience the trauma of an open water diving accident.

After a teenager evidences good diving skills and has logged an adequate number of dives, family members may then set out together sharing the adventure of the open ocean. As parents and children age and mature, diving can continue to be a family adventure, providing time together while appreciating the ocean's richness, nature's underwater artistry, and each other. □

REFERENCES

Available on request.

ABOUT THE AUTHOR

Maida Taylor MD MPH FACOG is a board certified ob gyn and has been practicing medicine and diving since 1975. She authored the chapter in Bove's and Davis' text Diving Medicine on women and diving, and teaches several diving medicine course each year. Her interests center on the interactions and influences of hormones, menstruation, menopause and pregnancy on fitness, and how hormonal changes affect diving performance. Her current area of interest is how low estrogen states may affect the incidence and severity of decompression illness.

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