Developmental Changes in Muscular Strength

As muscle mass increases throughout preadolescence and adolescence, there is an increase in muscular strength. In fact, the growth curves for strength are similar to those for body muscle mass. In boys, peak gains in strength typically occur about 1.2 years after peak height velocity and 0.8 years after peak weight velocity, with body weight being the clearer indicator. This pattern suggests that during periods of rapid growth, muscle increases first in mass and later in its ability to express strength (15). In girls, peak gains in strength also typically occur after peak height velocity, although there is more individual variation in the relationship of strength to height and body weight for girls than for boys (95). Although the strength of boys and girls is essentially equal during preadolescence, hormonal differences during puberty are responsible for an acceleration in the strength development of boys and a continuation at approximately the same rate in the strength development of girls as during the preadolescent years. On average, peak strength is usually attained by age 20 in untrained women and between the ages of 20 and 30 in untrained men.

An important factor related to the expression of muscular strength in children is the development of the nervous system. If myelination of nerve fibers is absent or incomplete, fast reactions and skilled movements cannot be successfully performed, and high levels of strength and power are impossible. As the nervous system develops, children improve their performance in skills that require balance, agility, strength, and power. Since the myelination of many motor nerves is incomplete until sexual maturation, children should not be expected to respond to training in the same way or reach the same skill level as adults until they reach neural maturity (86).

Because physiological functions are more closely related to biological age than to chronological age, at any given time an early-maturing child probably has an advantage in measures of absolute strength when compared with a later-maturing child of the same sex who has less muscle mass. In general, the body type of early-maturing youngsters tends to be mesomorphic (muscular and broader shoulders) or endomorphic (rounder and broader hips), whereas late maturers tend to be ectomorphic (slender and tall) (figure 7.1). Clearly, physical differences in body proportions can affect the execution of resistance exercises. For example, short arms and a large chest cavity are an advantage in bench presses, whereas long legs and a long torso are a disadvantage in squats. These factors have implications for strength and conditioning professionals who are attempting to standardize fitness tests or develop a resistance training program for a group of boys and girls who vary greatly in physical size. The reasons for individualized training programs should be explained to all participants, and special encouragement should be offered to late maturers who may be smaller and weaker than chronological-age peers with more biological maturity and therefore greater height and strength. Although late maturers tend to catch up to the early maturers as they proceed through adolescence, young athletes should realize that many factors—including motivation, coaching, and ability—contribute to success in sport.