

Chapter 10

Aquatic Strategies in Musculoskeletal Pain

Joseph T. Alleva, MD,
Thomas H. Hudgins, MD,
Marty Biondi, PT

At the conclusion of this chapter, the reader will be able to:

1. Provide a comprehensive and safe aquatic exercise progression to treat conditions of the ankle, knee, and shoulder.
2. Justify aquatic therapy intervention using both aquatic principles and the body's physiological response to exercise in the explanation.
3. Provide efficient therapeutic intervention for lower extremity strength acquisition using aquatic therapy techniques.

GENERAL PRINCIPLES

Hydrostatic pressure refers to the pressure a fluid creates on an immersed object. It varies with the density of the fluid as well as with the depth of the immersed object. It is a valuable property to exploit for an injured joint. It allows control of joint effusion and provides a source of constant proprioceptive feedback for a particular joint.¹ Consequently, range of motion may improve. From a cardiovascular standpoint, hydrostatic pressure increases preload to the heart and therefore increases cardiac output and the work of breathing.^{2,3}

Buoyancy is an upward thrust equal to the weight of fluid displaced by any object. Athletes who have a weight-bearing restriction as a result of injury or surgery will find this invaluable. Immersion to the symphysis pubis will off-load approximately 40% of a patient's body weight, to the umbilicus approximately 50%, and to the zypoid approximately 60%.⁴

Viscosity is the resistance of fluid flow and, more specifically, the friction between molecules of the liquid that forces them to adhere to each other as well as to the surface of the body moving through it. Turbulent flow refers to the rotary motion of fluid that takes place behind the body as it moves through liquid. The turbulent flow tends to drag the body backward as it attempts to move forward. Turbulent flow depends on multiple factors including size, shape, and speed of the object moving. These properties each provide varying degrees of resistance essential to conditioning and strengthening. This effect can be further amplified by using aquatic devices such as fins and floats.