



Elliptical Exercise Machine – What do we know?

For quite some time as a clinician I find making recommendations regarding the use of elliptical exercise machine a bit challenging because there is very little and often conflicting biomechanical or physiologic evidence regarding the use of this equipment.

An investigation by Lu in 2007 measured the forces across the joints in the lower extremity in a small group of young healthy males while using a particular elliptical machine. Data showed when using an elliptical machine the knee stays relatively flexed (bent); whereas when walking the knee straightens at two points in the gait cycle. Using the elliptical machine at the end of the back stroke there is a larger amount of force on the ball of the foot when compared to the same position during walking. There are smaller vertical pedal reaction forces and loading rates during use of elliptical machine compared to ground reaction forces of walking, and the elliptical machine places relatively greater demand on the hip, thigh, and calf muscles compared to walking. A limitation of this study is that it examined only one particular elliptical machine, and there is a wide variety of designs among elliptical machines. The question remains are the results applicable to different elliptical machines?

A more recent investigation by Burnfield in 2010 looked at the kinematics (joint movements) and EMG (electrical activity of muscles) in the lower extremity of health adults' (male and female age range from 19 to 75) while using four different elliptical machines (SportsArt; Life Fitness; Octane; and True). The overall conclusions were that the SportsArt elliptical machine best simulated the movement of walking. The results across all machines showed significantly greater flexion of the trunk, pelvis, hip, and knee during elliptical training compared to walking. During elliptical training gluteus maximus muscle and thigh muscles activity was greater than walking and calf and shin muscle activity was less than walking.

The data from these two studies provide a little guidance in answering two common questions. One question is an elliptical machine good for a runner to use to cross train?

Assuming the mechanics of running are similar to walking the result of these two studies provide some direction to answering this question. Motions on the elliptical machine have similar movements to walking. Of the four machines tested the SportsArt elliptical machine appears to most closely simulate walking movements. The ground reaction forces are less using an elliptical machine compared to walking. The amount of motion in the lower extremities in the direction of flexion is greater using an elliptical machine compared to walking. The pressure on the ball of the foot is greater using an elliptical machine compared to walking. There is greater demand of the hip and thigh muscles using the elliptical machine compared to walking. There is less demand on the foot and ankle muscles using the elliptical machine compared to walking.

Another common question is an elliptical machine good for an injured runner to use to maintain cardio-respiratory fitness while recovering from an injury? Given the above observations injuries which an elliptical machine should be beneficial include: patella femoral arthralgia; chondromalacia of the patella; IT band syndrome, stress fracture, shin splints; Achilles tendonopathy; heel pain (plantar fasciosis); and low back pain which is aggravated by movement in the direction of extension (spinal stenosis). Injuries which an elliptical machine would not be beneficial include: buttock pain; hip/groin pain; patellar tendonitis; metatarsalgia (pain on the ball of the foot); low back pain aggravated by movement of the spine in direction of flexion (disc problem).

Often the cure for a problem is cause of the problem, or visa versa the cause of the problem can be the cure. Given the above list of injuries which would benefit from using the elliptical machine, depending on the circumstances use of the elliptical machine could actually aggravate the injury. For example, if you have a problem about the hip and the hip muscles are relatively weak for example piriformis syndrome, using the elliptical machine would place a significant demand on the piriformis muscle so you may want to avoid the elliptical machine in favor of a bicycle. However if you have weak hip muscles using an elliptical machine in a progressive manner can challenge and strengthen the hip muscles to help alleviate the problem. A healthcare profession can help provide specific guidance for your particular problem.

Elliptical exercise machines are readily available. Our understanding of the mechanics of using elliptical machines to simulate walking/running, and in the management of lower extremities is limited to very few studies with a limited number of subjects.

When deciding whether to use, and how to use an elliptical exercise machine there is little information to guide us. As it is with similar situations of uncertainty, you don't know until you give it a try. You could take the approach of the classic TV commercial for Life Cereal "Give it to Mikey, he'll eat anything". One idea is have your running buddy use the new fangled elliptical machine with a high level of curiosity and attention to detail, see if he/she likes it and than make your choice.