



Using elliptical exercise machine for treatment of injury and cross training

There is consensus that elliptical exercise machines are comparable to treadmill running in terms of providing adequate stimulus for improving aerobic capacity, weight control, and health benefits (Mier 2006).

Despite its popularity, as a clinician I find elliptical the exercise machines a bit of a conundrum to understand; because there is very little biomechanical or physiologic evidence either supporting or refuting claims of manufactures and exercise gurus.



A study by A.L. Batte (2003) investigating the physiologic parameters of using the elliptical exercise machine concluded that a level of perceived exertion scale was lower than expected relative to energy expended when running or biking. The inference from this study is that you can burn more calories for less effort compared to other forms of aerobic type exercise. A study by M. Egana (2004) contradicted the previous study and concluded that for a given level of perceived exertion (effort) energy expenditure was the same between treadmill, stair-climber, and elliptical exercise machine. C.M. Mier (2006) concluded that manufacturer's estimates of energy expenditure (level of resistance) will over estimate the actual energy expenditure using elliptical exercise machine. Skepticism regarding manufacture's claims is wise.

There are very few scientific studies, and the studies that are available are of poor quality. The studies available do not report whether they calibrated the elliptical exercise machine used in their study. If the machine is not reliable, the results of the study are questionable. There are a wide variety of types of elliptical exercise machines available, some incorporate arm movement some do not.

There is a large amount of high quality research comparing energy expenditure between running, biking, and swimming. There is consensus that for a given distance of running at a given level of perceived exertion or heart rate, it requires 3 to 4 times the distance of biking to expend a similar amount of energy. For a given distance of swimming it requires 4 times the distance of running to achieve similar energy expenditure. There is no credible data available to begin to suggest equivalencies between elliptical exercise and running.

Potentially the most useful study (Lu, TW 2007) looked at joint motion and joint forces using elliptical exercise machine and compared to walking on level ground. The study has some faults such as there were only 15 subjects, male only, information was not provided about the experience and skill the subjects had with this relatively novel form of exercise, and the particular elliptical machine only used the legs, and did not use arm movement. Despite the short comings this study provided unique insight to the idea of using elliptical exercise machine for cross training, and the treatment of lower extremity injuries.

The conclusions of the study were that joint movements and joint forces with elliptical exercise were different than level walking. Impact forces (shock) are significantly lower using elliptical in comparison to walking. The forces across the hip and knee joint are significantly greater using elliptical in comparison to walking.

Examining the specific data in the study using the elliptical exercise machine, the knee tends to stay relatively flexed (bent) whereas when walking there are two points in the cycle when the knee is straight. Using the elliptical exercise machine at the end of the back stroke there is a larger amount of force placed on the ball of the feet when compared to walking when the foot is at the end of the step.

It seem reasonable that there are some injuries for which the elliptical exercise machine would have very positive benefits, some injuries which the elliptical exercise machine would be harmful, and some injuries for which the elliptical exercise machine would be indifferent. Using the joint movement and force data from the study by Lu and clinical experience some inferences can be made regarding using elliptical exercise machine for treatment of lower extremity injuries.

Diagnosis for which elliptical exercise machine **would be** beneficial:

- Patella Femoral Arthralgia (knee pain)
- Chondromalacia Patella (knee pain)

- IT band syndrome (lateral knee pain)
- Stress fracture in the lower leg

Diagnosis for which elliptical exercise machine **would not** be beneficial:

- Piriformis syndrome (hip/buttock pain)
- Patellar tendonitis (knee pain)
- Metatarsalgia (pain on the ball of the foot)
- Big toe pain (sesmoiditis, hallux valgus, arthritis, bunion)

Diagnosis for which benefits of elliptical exercises is **uncertain**:

- Low back pain, sciatica
- Heel pain (plantar fasciitis, tarsal tunnel)
- Degenerative joint disease (arthritis) of the hip and knee

The data from the study by Lu concludes the elliptical exercise machine places relatively greater demand on the hip, thigh, and calf muscles compared to walking; therefore it may be beneficial as a cross training exercise as strong powerful hip, thigh, and calf muscles are considered important to prevent injury and improve performance for competitive runners. What continues to be uncertain is whether an elliptical exercise machine would be better than a bicycle as a form of cross training for competitive runners. I did not find any studies comparing the biomechanics of elliptical exercise to bicycling.

When a runner is deciding whether to use, and how to use an elliptical exercise machine as a means of cross training 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 any thing". Have your running partner use the new fangled elliptical machine and with a high level of curiosity and attention to detail, see if he/she likes it and has a positive or negative response.