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Optimal form running/walking: Should the knee fully extend?

In order to improve my ability to analyze gait, I was curious if individuals who deal with horses had some insight in the process of gait analysis. I interviewed a large animal Veterinarian as well as a noted horse trainer about gait analysis of horse running. Interestingly, both of these horse experts stated it was considered a fault for a horse to have a straight knee at any point in the gait cycle.

For quite a while I have recommend to clients that it is incorrect to have the knee fully extended when the foot strikes the ground. It is better to have the knee slightly bent when the foot strikes the ground. If the knee is fully extended when the foot strikes the ground it causes a braking action slowing progress, and it increases the risk of developing an injury.

What I had not recognized is there is another time when humans run/walk the knee is almost straight, that is, when the foot is coming off the ground. So the question became should the knee be fully extended when the foot comes off the ground. A review of the literature found little in the way of controlled scientific studies to answer this question, but several experts express the opinion that the knee should not be fully extended when the foot comes off the ground.

Jacquelin Perry PhD. author of Gait Analysis Normal and Pathological Function did an extensive review of the scientific literature and concluded subjects vary in the knee posture at initial foot contact between slight hyperextension of the knee (2 to 5 degrees hyperextension) and flexion or bent (5 degrees). Her data examined normal and pathologic gait patterns. Dr. Perry noted when the foot comes off the ground when walking the knee should be flexed or bent about 7 to 10 degrees.

Sherry Brouman PT author of Walk Yourself Well expressed the opinion when walking with locked knees the muscles around your knees get weaker. Your knees should be slightly bend and feel springy when you walk. The knees should be spongy or soft, even when you stand.

Micheal Yessis Phd. author of Explosive Running: Using Science of Kinesiology to Improve Your Performance expresses the opinion a common faulty running technique is a fully extended knee when the foot comes off the ground. His opinion is this can lead to wasted energy expenditure. A fully extended knee likely means the thigh muscles were strongly contracting to get off the ground, when a preferred strategy is to rely on the

resilient properties of the lower leg tendons and muscles to push the heel off the ground and propel you forward.

Nicholas Romanov author of Pose Method of Running states “don’t straighten your leg”, when the foot is coming off the ground. He believes fully straightening the leg accelerates your shin towards the ground in front of the body which creates awful impact on the foot and ankle. Also the longer the foot is stuck to the ground the greater the braking force, the slower you move. He believes that the hamstrings (muscles on the back of the thigh) should be actively lifting the foot off the ground.



The left knee of the young lady is slightly bent when the foot is coming off the ground. This is considered to be desirable running form. The right leg of the young man the knee is fully extended, and this is considered faulty running form. This running illustration applies to walking form as well.

The best way to determine if this is a fault that you do is a video analysis.

Fully extending the knee when the foot comes off the ground could contribute to the development of pain in the front of the hip, knee, or ankle and shin pain.

To correct this fault requires a two prong approach. A musculoskeletal screening examination is in order to determine if the individual has the physical abilities to run with correct form. I would expect the young man in the illustration above with the fully extended knee may have weak calf muscles or long/lax hip flexor muscles. Avoiding stretching the hip flexors, exercises to strengthen the hip flexors and calf muscles would be indicated. Secondly, consciously trying to correct this faulty form and to practice correct form is indicated. Think of lifting the foot off the ground with the muscles on the back of the thigh. Lift your foot off the ground as if you are trying to scrap gum off the bottom of the shoe. Keeping the knee slightly bent when the foot comes off the ground

may decrease stride length, but there are more effective ways to increase ones stride length such as high knee lift during the swing phase.

Walking and running with a fully straightened knee is considered faulty form. A slight amount of bend in the knee when the foot strikes the ground and when the foot comes off the ground is desirable.