



## Engineering Explosive Athletic Performance: The S-Force Performance Trainer

### Designed to Enhance Drive-Phase Acceleration

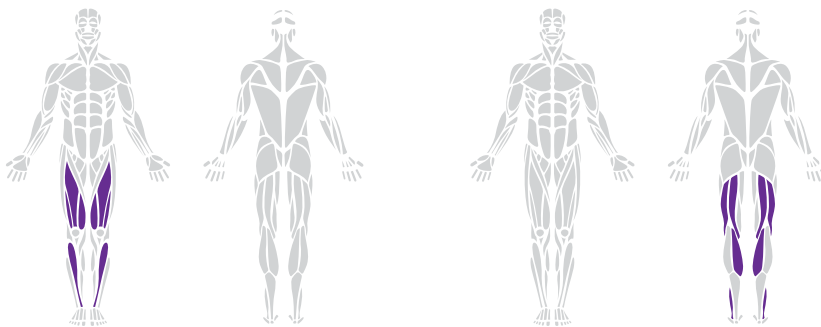
When our industrial designers and product engineers teamed up to develop the S-Force Performance Trainer, the aim was to create a new-to-market training tool that could help athletes of all kinds improve their acceleration in the drive phase of sprinting. Now that the product has made the leap from sketchbooks and computer models to athletic training facilities, Matrix commissioned an in-depth study conducted by a professional biomechanics consultant to authenticate the benefits of our design. Leveraging scientifically validated testing procedures, the biomechanics consultant confirmed that the S-Force Performance Trainer provides significantly increased muscle activation in the muscles essential to the drive phase of sprinting, helping to effectively build strength in these muscles and increase athletic acceleration.

### Validating Superior Design

Our study of the S-Force Performance Trainer's benefits included seven subjects, four males and three females, all of whom were healthy adults that engaged in physical activity three to five times per week. Each subject had electromyography (EMG) sensors put on muscles on their right leg, plus one sensor on their heel to act as an accelerometer to determine heel strike. Specifically, the EMG sensors measured the activity of the shin, calf, quad and hamstring muscle groups while the subject sprinted on the S-Force Performance Trainer. The subject sprinted in both the upright and acceleration positions and at resistance levels of 2, 3 and 4. To account for the differences between subjects, we measured each subject's maximum voluntary contraction for each muscle group after the sprint. With this data as a baseline, we could then compare muscle activation based on percentage of activation rather than pure muscular power.

### Muscle Activation: Acceleration vs Upright Positions

The first muscle activation comparison was between the two grip positions, referred to as the acceleration position and the upright position. Both positions were found to have benefits when it comes to building the muscles essential to the drive phase of sprinting. The acceleration position provided a statistically significant increase in muscle activation in the shin and quad muscle groups. The upright position, on the other hand, provided a statistically significant increase in muscle activation in the calf and hamstring muscle groups. The study proves that simply by providing the two distinct grip positions, working out on the S-Force Performance Trainer can help athletes augment the muscles essential to explosive acceleration in the drive phase of sprinting. Yet the S-Force goes even further by providing multiple levels of magnetic resistance.



Acceleration Position

Upright Position



### **Muscle Activation: Varying Resistance Levels**

The S-Force Performance Trainer's unique design includes a smooth, quiet magnetic resistance system that automatically increases resistance the harder the athlete works, creating challenging progressive workouts. Our study demonstrates that different muscle groups essential to the drive phase of sprinting are activated more strongly at different levels of resistance. From resistance levels 2 to 3, the shin, calf and hamstring muscle groups showed a statistically significant increase in muscle activation. From resistance levels 3 to 4, the shin, calf and hamstring muscle groups showed an even greater statistically significant increase in muscle activation. This supports the hypothesis that more resistance helps build even more explosive acceleration in the drive-phase of the sprint.

### **Maximizing Drive-Phase Acceleration**

The study shows that the S-Force Performance Trainer is highly effective in activating the muscles essential to the drive phase of sprinting, thereby building the strength athletes need for explosive athletic performance. In conclusion:

- The acceleration position increases muscle activation and builds strength in the anterior leg muscles (shin and quad muscle groups)
- The upright position increases muscle activation and builds strength in the posterior leg muscles (calf and hamstring muscle groups)
- Increasing magnetic resistance increases muscle activation and builds strength in the shin, calf and hamstring muscle, with the increase in muscle activation proportionate to the level of magnetic resistance

### **References**

1. Hintermeister RA, O'Connor DD, Dillman CJ, Suplizio CL, Lange GW, and Steadman JR. Muscle activity in slalom and giant slalom skiing. *Medicine and Science in Sports and Exercise*: 315-322, 1994.
2. Swanson SC and Caldwell GE. An integrated biomechanical analysis of high speed incline and level treadmill running. *Medicine and Science in Sports and Exercise*: 1146- 1155, 1999.