

## Background\*

Physical stamina and strength are important attributes for active-duty military personnel. Full combat gear weighs 35kg, and some specialists regularly handle equipment in excess of 45kg. Lower extremity injuries are frequent with 900 related medical visits per 1000 person-hours<sup>1</sup>. Injury to the knee joint accounts for 49% of musculoskeletal injuries leading to disability<sup>2</sup>. Moreover, individuals who experience a knee injury are 10 times more likely to experience a subsequent knee injury<sup>3</sup> and five times more likely to develop knee osteoarthritis<sup>4</sup>. Spring Loaded knee braces have the potential to protect soldiers against injury, prolong careers and enhance the performance of regular duties by augmenting muscular strength and endurance.

\*This report summarizes findings from an independent research project conducted by the Canadian military.

## Methods

17 Canadian military personnel and one individual with a meniscus injury were recruited to test the knee orthosis' (Levitation®) impact on physical performance. Loaded squat and leg press tests were used to assess the orthosis' impact on physical performance while in high power mode\*. A treadmill test was used to assess the effect of orthosis weight on exercise efficiency while in low power mode\*.

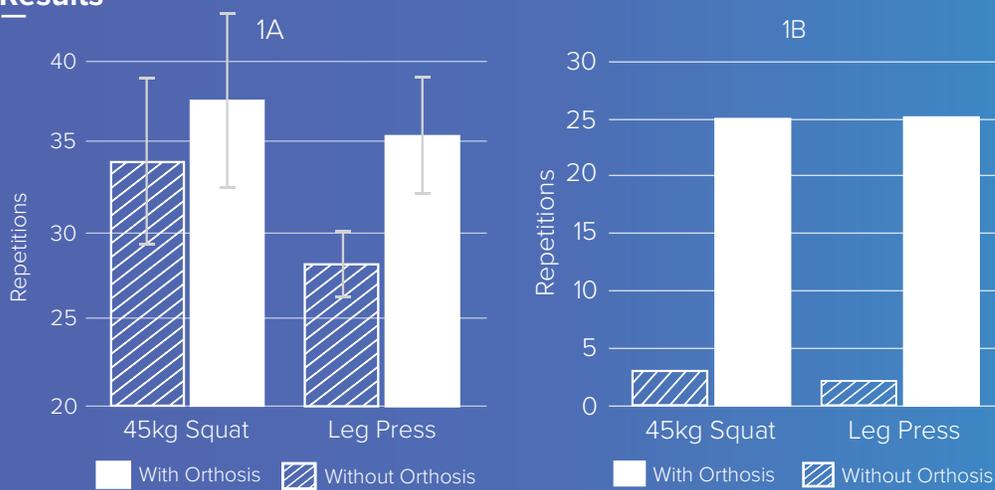
**45kg Squat Test:** As many repetitions as possible with a fixed load of 45kg.

**Leg Press Test:** As many repetitions as possible with a self-selected load that participants perceived as difficult.

**Treadmill Test:** Test duration was 15 minutes with a treadmill speed of 5.5km/h. During the test, the incline increased progressively from 4% to 12%.

\*High Power Mode engages the orthosis' spring mechanism, providing knee extension assistance to the user. Low Power Mode disengages the spring mechanism.

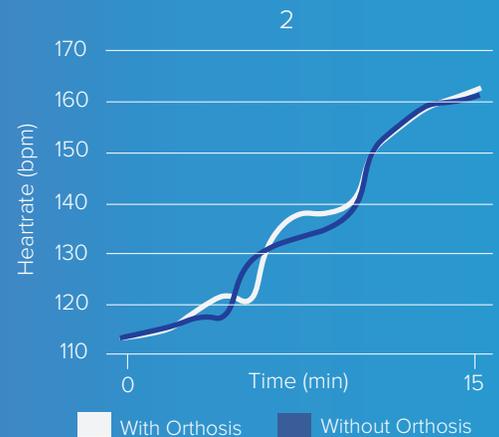
## Results



**Figure 1A:** Group performance averages for maximal leg press and 45kg squat test with and without orthosis. Error bars represent standard error.

**Figure 1B:** Test performance from a single participant with meniscal injury.

**Figure 2:** Heart rate during the treadmill test with and without knee orthosis in low power mode.



## Physical Performance

While wearing the knee orthosis during the 45kg squat test, healthy participants were able to achieve a 10% (Figure 1A) average performance improvement. Similarly, during the leg press test, participants improved in their performance by 26% (Figure 1A). Notably, one participant suffering from a meniscus injury had more than a seven-fold increase in leg press performance and a ten-fold increase in the 45kg squat test (Figure 1B). The injured participant attributed the dramatic improvement in performance to a reduction of joint pain experienced while wearing the orthosis.

During the Treadmill test, heart rate values were similar during the supported and unsupported conditions (Figure 2). Wearing the knee orthosis in low power mode does not appear to incur endurance.

## Conclusion

- 1 Wearing a Spring Loaded knee orthosis resulted in superior performance during resistance exercise.
- 2 Spring Loaded knee braces do not increase the metabolic cost of exercise during aerobic activity.
- 3 Spring Loaded knee orthoses may offer the largest performance improvements to personnel with a knee injury.
- 4 Continued research is needed to further establish the potential benefits of Spring Loaded braces amongst military personnel with knee injury.

## References

1. Jones, B. H., Canham-Chervak, M., Canada, S., Mitchener, T. A., & Moore, S. (2010). Medical surveillance of injuries in the US military: descriptive epidemiology and recommendations for improvement. *American journal of preventive medicine*, 38(1), S42-S60.
2. Lincoln AE, Smith GS, Amoroso PJ, Bell NS, (2002). The natural history and risk factors of musculoskeletal conditions resulting in disability among US Army personnel. *Work*, 18(2): 99–113.
3. Hill, O. T., Bulathsinhala, L., Scofield, D. E., Haley, T. F., & Bernasek, T. L. (2013). Risk factors for soft tissue knee injuries in active duty US Army soldiers, 2000–2005. *Military medicine*, 178(6), 676-682.
4. Cameron, K. L., Shing, T. L., & Kardouni, J. R. (2017). The incidence of post-traumatic osteoarthritis in the knee in active duty military personnel compared to estimates in the general population. *Osteoarthritis and Cartilage*, 25, S184-S185.