

# THE EFFECT OF KNEE JOINT COOLING ON ISOKINETIC TORQUE PRODUCTION OF THE KNEE EXTENSORS: CONSIDERATIONS FOR APPLICATION

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## ABSTRACT

**Background:** Cryotherapy is commonly used in sport for the management of injury or during recovery, however the effects on concentric isokinetic strength appear unclear when considering the effect of joint cooling distal to the anterior thigh.

**Purpose:** The purpose of this study was to investigate the effect of cooling of the knee joint on quadriceps concentric isokinetic torque production. The results will inform the use of cryotherapy in practice.

**Study Design:** Observational cohort, Repeated Measures

**Methods:** Fourteen healthy male participants volunteered to take part in the study, all of whom regularly played competitive sports (mean age  $20.24 \pm 1.51$  years; body mass  $80.34 \pm 11.34$  Kg and height  $179.45 \pm 6.59$  cm). 800 g of crushed ice was applied over the anterior knee joint for 20 minutes. Concentric quadriceps strength was measured using an isokinetic dynamometer (IKD) by measuring concentric peak (PkT) and average torque (AvT) outputs at pre-, immediately post and 20 minutes post cooling intervention. Additionally, skin surface temperature ( $T_{sk}$ ), was measured using a hand-held thermometer at the patella at the same time intervals. Measurement was taken at the mid-point of each participant's patella, which was ascertained by measuring between the base and apex.

**Results:** Significant main effects reported for PkT, for time post-ice application ( $p=0.02$ ,  $\eta^2=0.161$ ). Post-hoc analysis revealed pre-ice application PkT to be significantly higher ( $p \leq 0.003$ ) than all other timepoints. Quadratic regression analysis revealed a strong correlation between reductions in quadriceps torque production and time post application ( $r=0.82$ ). The quadratic pattern of recovery displays a minima of 17.28-minutes and maxima of 34.56-minutes post ice application. AvT post-ice application demonstrated significant main effects for time post-ice application ( $p=0.03$ ,  $\eta^2=0.152$ ). Post-hoc analysis revealed pre-ice application AvT to be significantly higher ( $p \leq 0.005$ ) than at all other timepoints. Quadratic regression analysis revealed a strong correlation between reductions in quadriceps torque production and time post application ( $r=0.80$ ). The quadratic pattern of recovery displays a minima of 18.38-minutes and maxima of 36.76-minutes post ice application.  $T_{sk}$  reduced significantly, immediately post intervention ( $p \leq 0.05$ ) without returning to baseline measures at 20-minutes post ( $p \leq 0.05$ ).

**Conclusions:** Isokinetic peak torque values of the quadriceps diminish after cryotherapy application to the knee joint and are not fully recovered at 20 minutes post application on the knee. These findings could have potential implications for participation in activity immediately following ice application.

**Level of Evidence:** 2b

**Keywords:** Cryotherapy, Isokinetic Dynamometry, Knee, Quadriceps

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