

# Effect of Shin-Torso Alignment and Biomechanical Positioning on Lower Extremity Joint Angles in Hockey Players

Stacy Solomon & Dr. Ryan Conners, Department of Kinesiology

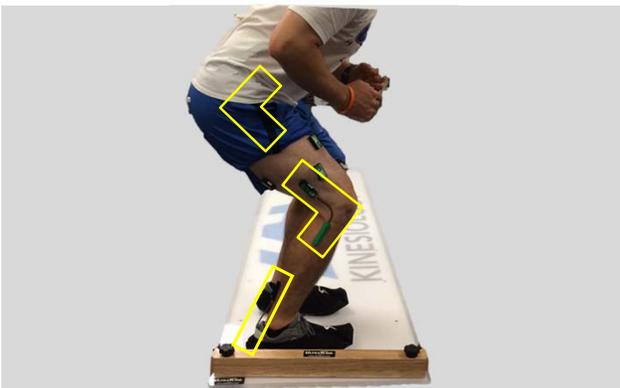
## Introduction

While “hockey stance” has been described as a key determinant of ice hockey performance, there is no well-defined criteria available on the ideal position (1,2). Measurement of joint angles using electrogoniometers (EG) have been highly correlated with patterns of muscle activity measured by electromyography in previous studies (2,3). This study aims to identify differences in joint angles between three hockey stances using EG to measure joint angles during the hockey trials.

## Methods

Each Division I collegiate ice hockey player (n=6) had EG sensors placed on the hip, knee, and ankle joint. After the sensors were calibrated in a neutral standing position, each player participated in a 45 second familiarization trial on the slide board. Next, each player performed three 45 second trials in a position of randomized order: forward lean, shin-torso alignment, and upright. The players received 2 minutes rest between trials. Maximum and min. joint angles were recorded and averaged for each repetition of movement. Statistical analyses were performed using the Statistical Package for the Social Sciences to determine significance.

Figure 1. Location of EG sensors



## References

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## Results

A higher degree of hip flexion was found in the forward lean position when compared to the shin-torso alignment. A higher degree of ankle inversion was also found in the forward lean when compared to the shin torso alignment. Ankle plantarflexion did not show a significant difference, but had a large effect size.

Table 1. Lower Extremity Joint Angles

Joint & Movement	Forward Lean	Shin-torso Alignment	Upright	Effect Size
Hip flexion	<b>80.345 ± 12.183</b>	<b>70.540 ± 21.804</b>	66.783 ± 30.372	0.634
Hip Extension	41.634 ± 8.841	32.173 ± 10.597	28.321 ± 16.592	0.23
Hip Adduction	10.421 ± 4.413	8.099 ± 4.829	7.019 ± 13.238	0.067
Hip Abduction	-23.924 ± 10.891	-28.445 ± 5.459	-24.049 ± 14.682	-.166
Knee Flexion	84.401 ± 12.691	80.182 ± 14.453	79.731 ± 14.070	0.315
Knee Extension	13.314 ± 10.338	13.560 ± 11.759	16.13 ± 7.718	0.135
Knee Varus	3.221 ± 13.696	4.794 ± 11.935	3.751 ± 13.359	0.271
Knee Valgus	-23.113 ± 15.661	-19.633 ± 13.524	-17.047 ± 13.517	0.368
Ankle Inversion	<b>29.103 ± 4.615</b>	<b>27.092 ± 5.075</b>	25.624 ± 4.193	0.59
Ankle Eversion	2.809 ± 5.862	2.497 ± 6.613	4.750 ± 4.762	-0.067
Angle Dorsiflexion	23.556 ± 3.733	24.410 ± 4.330	24.419 ± 3.000	0.106
Ankle Plantarflexion	-15.849 ± 8.412	-17.204 ± 11.361	-13.605 ± 12.060	0.734

Note. Values denote mean ± standard deviation in degrees. Bold values are significantly different (p>0.05).

## Conclusions

The significant difference in hip and ankle angle shows that a forward lean position might influence injuries and fatigue associated with increased flexion/inversion. The results also indicated that an upright stance has less of an impact on positioning. In regard to upright skating, it may be more beneficial to allow players to find a position most comfortable or efficient for them, as it appears to have limited effect on limb alignment.

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