The main purpose of this research was to investigate and compare the factors affecting the impact characteristics of body height and head height roundhouse kick of Taekwondo (TKD) players. In this study, 5 highly skilled TKD players participated. To measure the impact force, two accelerometers were fixed to a PVC pipe in a sandbag while the Vicon\textsuperscript{©} motion analysis system captures the motion. Each subject performed 10 turning kicks trunk and face height in random order. Only the trial with the most accurate (most central impact) measurement was used in the statistical analysis ($\alpha <0.05$). For impact force, there was a significant difference according to the height approximately $6400 \pm 898$N for the mid section and $5419 \pm 659$N for the high section of TKD. With this reliable method of measuring high impact forces, due to the roundhouse kick, it is possible to investigate the differences of impacts due to various techniques i.e. punching power, kicking power, etc. Through this impact estimation from roundhouse kicking, different expected impact forces according to a players’ weight division may be established. Thus, the safety provided by current martial arts suppliers may be investigated in the future.

**Key Words**: Turning kick, impact force, Taekwondo, Yongmudo
Introduction

Taekwondo is a Korean martial art form that was originally taught for warfare, self-defense and physical fitness. In competition Taekwondo, points are scored when contact to the torso or head produces a ‘trembling shock’ (WTF rule book). Needless to say that with the opponent required to produce a ‘trembling shock’ for the acknowledgement of points, there have been many injuries caused (Zemper & Pieter, 1989). As a direct result of these high number of injuries chest protection and head protection are now required for participation in kyorugi. With this in mind the evaluation of chest gear and head protection must be considered.

According to Sidthilaw (1996), the impact forces recorded for a beginner Muai Thai Kickboxer’s roundhouse kick was estimated to be $6702 \pm 3514N$, $7240 \pm 3477N$ and $5618 \pm 3253N$ for low, medium and head height respectively. For the estimation of force, three one dimensional 50g accelerometers perpendicular were fixed inside a bowling ball. This bowling ball was then placed in a sand bag. In other related research, Chiu, Wang and Chen (2007), the kicking force of the roundhouse and back kick and the speed of the kicking foot were measured. Chiu et al. (2007) used a different method to measure the kicking force, an air bag was fixed to a wall and the difference in air pressure caused by the force of the kick was measured. The roundhouse kick and back kick force measured at $8252 \pm 720N$ and $8023 \pm 836N$. The kicking forces of various kicks were measured by a force transducer and they ranged from 2759 to 9711.9 N (Gray, 1979). Even with these other studies (Chiu, Wang and Chen 2007, Gray 1979, Sidthilaw 1996) related to the forces created by martial artists it is believed that the results in these studies could be improved by reviewing other researchers’ designs and modify them.

With the technique of the Taekwondo turning kick being slightly different according to height, it was therefore deemed that a comparison between the impact forces and the two movement characteristics of these two heights could be used to help establish a standard for the testing of safety equipment.