Methodology

Twelve subjects were recruited in Lok Wah Taekwondo Club. The Taekwondo practising history of the athletes was recorded in terms of length and frequency of training. General anthropometric parameters (height, weight), and physical fitness level of all subjects were measured (Table 1). Each subject gave informed consent and the study was explained to them before they participated in the experiment.

Table 1

<u>**Subjects Information**</u>

	Mean	SD
Age (year)	25.25	8.34
Weight (kg)	62.56	5.17
Height (cm)	170.78	6.42
Shoulder width (cm)	33.88	1.73
Years of training (year)	7.50	2.50
Frequency of training (hr/week)	2.67	1.87
Percentage of body fat (% fat)	11.28	4.29
Flexibility (cm)	40.13	5.97
Handgrip strength (kgf)	40.50	5.95

<u>Note.</u> The percentage of body fat was calculated by using the 7-skinfold sites with ACSM provided equation. Takei handgrip dynamometer was employed to measure the handgrip strength. ACUFLEX sit-and-reach box was employed in flexibility measurement.

In order to find out the prime muscles used in kicking, a pilot test was done before the beginning of the testing sessions. The results of the pilot test were then used to

investigate the activities of eight muscle groups. The muscle activity was expressed as a percentage of Maximum Voluntary Contraction (%MVC).

A pre- and post-test design was used in this project to examine the effectiveness of the training protocols. For each (pre- and post-) test session, the maximum voluntary isometric contraction test was conducted before the kicking trial started. Afterwards, each subject was asked to perform several kicking skills, including sidekick, pushing kick, slap kick and back kick. The performed skills were recorded by video filming and EMG measurement simultaneously. The recorded videotapes were then digitised on a motion analysis system.

The data collected from the pre-test were used as a baseline to design the training protocol, which focused on an exercise to strengthen the major muscles used during kicking and technique training.

The subjects were divided into two groups, training group and control group. After the pre-test, the training group underwent the training programme, whereas the control group was only asked to conduct the post-test without any special training.

Motion analysis.   Two Peak high-speed video cameras with 120 Hz in filming rate and 500Hz in shutter speed were positioned at a distance of 5 metres from the subject to record the subject's movements (Figure 1). An 800W lamp was used to increase the light intensity during the filming. The recorded video tapes were then digitised and analysed on the 3-D module of the motion analysis system (BAS). To facilitate the transformation of image data from 2-D to 3-D, a 3-D calibration frame, two metres high, was used (Figure 3). A 21-point biomechanical model of an athlete's body was

used to perform the motion analysis. The output data from the motion analysis included time characteristics during kicking.

Figure 1. The Peak high-speed video camera was placed at a distance of 5 metres from the subject.
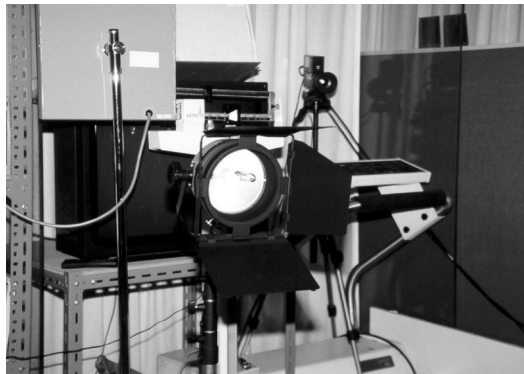
Figure 2. The 800W lamp was used to increase the light intensity during the video filming.

Figure 3. A two-metre high frame was employed for 3-D motion analysis calibration.