INTRODUCTION
The weakness of hip muscles is a negative predictor of ambulation performance in below-knee amputees (Sansam, 2009). The isokinetic method is an effective exercise to improve strength of the targeted muscles in below-knee amputees (Klingenstierna, 1990). However, there is no evidence demonstrating the effect of hip strengthening exercises on gait performance. Furthermore, there are no studies of isokinetic exercise in patients with above-knee amputation. The purpose of this study was to evaluate the effects of isokinetic training of hip muscles on gait performance in above-knee amputees.

METHOD
Eight participants (6 male and 2 female, aged 25 to 70) from Southern Medical Rehabilitation Center, Songkhlanagarind Hospital, with unilateral above-knee amputation were included in this one group pre- and post-intervention, prospective study. The study was conducted from July to September 2016. Participants performed isokinetic training of hip muscles of the amputated limb, twice a week for 3 consecutive weeks. Outcome measures included gait analysis by Tailgait® system and peak torque of hip muscles of the amputated limb by isokinetic dynamometer (CON-TREX®) before and after exercise training program. Shapiro-Wilk test was used to normalize the data. Each parameter for pre- and post-training was analyzed with paired t-test. The level of statistical significance was set at P-value less than 0.05.

RESULTS
All eight participants showed significant improvement of mean peak torque of the hip muscles (Figure 1). However, there was no significant difference in the mean of velocity, cadence, step length, step time and percentage of stance and swing phase (P-values >0.05). For the amputated limb, there was a significant decrement of anterior-posterior pelvic tilt during stance phase. Furthermore, there were no significant changes on pelvic motion in horizontal and coronal planes as shown in Table 1.

DISCUSSION
This three-week isokinetic training program showed significant improvement of hip muscle strength. The main mechanism describing the result was neural adaptations. However, only muscle strengthening effected no significant change on gait parameters. The insignificant result may be due to an inadequate exercise training period. Since the participants had equipped their prostheses for over 5 years, they were used to the gait pattern which was gradually adapted. Another finding showed prolonged step time in intact limb compared with prosthetic limb. It was resulted from push off deficiency (Adamczyk, 2015). Further study should be conducted using the powered prosthesis system.

CONCLUSION
This study provides evidences of the efficacy of a three-week isokinetic training of hip muscles can improve hip strength and better pelvic control without any significant change in gait parameters.

CLINICAL APPLICATIONS
The aforementioned conclusion could provide some instructions to improve the above-knee amputee training program. To accomplish the better gait performance, the program should be accompanied with prosthetic training and gait re-education. However, the improvement of a prosthetic component to resolve the push off deficiency might be required.

REFERENCES

![Figure 1](image-url)