INTRODUCTION

Human movement is controlled on the basis of afferent information of the visual, the vestibular and the somatosensory system. Balance is a very important factor for athlete talent identification since muscle can create adequate power and strength in balance during human movement. Postural control training is more important for people who are visually impaired, those patients affected by cerebrovascular accident as well as for the elderly. In addition, balance ability is essential for top archers to reach peak performance in competitions. Lord (1996) reported that exercise could significantly improve dynamic postural stability in older persons and has elucidated some possible mechanisms by which such improvements may be mediated. Generally, coaches and athletes assess balance ability from experience or personal observations. But without scientific data, it is difficult to compare how different athletes perform, even more so when comparisons are made over time. Several previous studies have compared the ability of balance between older people with stroke, those with Parkinson's disease and unaffected older people. Aiming at the insufficient research comparing between athletes and non-athletes. Therefore, the purpose of the present study was to investigate the difference of balance ability between archers and non-athletes.

METHODS

There were two groups in this study: the archers group that consisted of ten male archers (mean age 21.2 ± 1.6 years) and the other group consisting of ten non-athletes (mean age 20.8 ± 0.8 years). Exclusion criteria were history of severe heart disease, vertigo, epilepsy, and total hip replacement. The investigation is divided into three main sections: one-legged balance test, body sway test and static balance test. The one-legged balance test (Figure 1) tested the ability to maintain balance was evaluated by the length of time and a subject stood on one leg with eyes closed.

The body sway test (Figure 2) estimated body sway using a force platform to record the center-of-pressure (COP). An instrumented Kistler force platform measured the mean radius of the COP locus pattern under each subject’s feet during quiet two-legged standing. The subjects were tested under eyes-open and five trials for each test were conducted. The data were collected for trial duration of 20s and sampled at 100 Hz.

The static balance test (Figure 3) used the K.A.T. 2000 balance system, which consists of an inherently unstable circular platform supported at its central point on a small pivot. The stability of this platform is controlled by varying the pressure in a toroid pneumatic bladder that rests between the platform and the base of the unit. The platform is instrumented with a two-axis electrolytic tilt sensor fixed at the anterior edge of the circular platform. Each subject stood on a K.A.T. 2000 balance platform lasts 20 seconds.

Subject tried to maintain a red "crosshairs" at the origin of the X-Y axis in the center of a target, while keeping the platform as steady as possible for the five trials (K.A.T. User's Guide).

T-tests were used to examine statistical differences between two groups with significant level at 0.05.
RESULTS AND DISCUSSION

The results of the study are listed in Table 1. For the one-legged balance test, the standing time of archers group was significantly longer than the non-athletes group (p < .05). Conversely, with the body sway test, the radius of body sway COP of archers group was significantly smaller than the non-athletes group (p < .05). Similarly, with the static balance test, the Static Balance Index (SBI) of the archer group was significantly smaller than the non-athletes group (p < .05), which indicated that archers have better static balance ability than non-athletes.

This result suggested that regular sport training could significantly enhance the static balance ability. There is an agreement between current work and Lord’s study (1996). Lord suggested that regular exercise is essential for both healthy non-athletic persons and patients with disease. According to several previous studies, measuring body sway COP by using force platform is an effective and reliable way to evaluate static standing steadiness which is in agreement with other studies (Andres, 1980; Nashner, 1979, Odenrick, 1987). Force platform is a precision instrument for assessing the reaction force generated between an athlete and the ground, detecting the tiniest areas of force that cannot be seen with the human eye. It can also record the shear and vertical forces of the athletes’ leg leaving the ground and its relationship to body mass that can determine a person’s balance capabilities.

As a balance training system, the K.A.T. was found to be very effective because it allowed subjects to receive feedback pertaining to their stability performance via the K.A.T. pressure reading (p.s.i.). In clinical application, measuring balance index by using K.A.T. platform is a reliable way to assess balance ability that is in agreement with other studies (France, E.P. 1992). With this information, coaches and experts can have a clearer picture about technique and the characteristics of athletes. They can compare data between different athletes, correct flaws and improve overall performance.

Most archery techniques are aimed at keeping balance themselves during the aiming phase, a skill that requires high postural control ability in static situations. This finding is not too surprising considering that archers are frequently involved in motions such as arrow-releasing during competition and training.

CONCLUSION

Understanding the technical profile and characteristics of athletes while taking part in sport is crucial to coaches and the athletes themselves. Such information can have a direct impact on an athlete’s performance, especially for those rapid movements that cannot be seen by the naked eye.

Balance and stability are important attributes for those who wish to excel at archery. Based on the findings of this study, it is suggested that regular exercises could significantly improve balance ability. The results of this study hope to provide information about technique analysis to the archers as well as guidelines of training skills to the coaches.

REFERENCES


| Table 1: Means, Standard Deviations, and T-test Results for Balance Tests of Archers and Non-athlete Group (n = 10) |
|---------------------------------|-----------------|-----------------|------|------|
| Balance tests                  | Archers (M± S.D.) | Non-athletes (M± S.D.) | t    | p    |
| One-legged balance test (sec)  | 75.3± 40.6       | 30.6± 30.8       | -2.603 | .016 * |
| Radius of body sway COP (cm)   | 0.3± 0.1         | 0.5± 0.1         | 4.182 | .000 * |
| Static balance index           | 203.5± 108.1     | 549.3± 235.7     | 4.238 | .001 * |

*P < .05