FUNCTIONAL EVALUATION OF ELLIPTICAL TRAINER WITH HUMAN MOTION ANALYSIS

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INTRODUCTION
The exercise equipment used for strengthening muscle and shaping body is getting more prevalent due to the increased population and limited space in exercise. Elliptical trainer is regarded as a good approach with full body motion like treadmill but reduced impact force [1, 2]. However, unfitting exercise trainers and working over a long period of time cause musculoskeletal disorders. Little information is known for choosing the comfortable exerciser.

The purpose of this study was to understand the factors affecting the musculoskeletal uncomfortableness with motion analysis system. The factor was set to three loads and two type of elliptical trainer. The evaluated parameters of elliptical trainer include the kinematic data, center of mass (COM) and joint angle.

METHODS
Ten physically healthy male subjects volunteered for this investigation. None had ever suffered from upper extremity injuries or disorders. Three resistant loads, low (70 Watt) \( \cdot \) middle (220 Watt) and high (370 Watt), were set to two type of elliptical trainer, home-used (machine A) and club-used (machine B). Full markers on body landmarks defined by Vicon polygon model were attached on subjects [3]. Trajectories of human motion were collected using Motion Analysis System. Joint motion and COM with respect to time were then analyzed for effects of two independent parameters, loads and type of exercise trainer. Two-way ANOVA Repeated Measures procedure was conducted to evaluated the difference with \( p<0.05 \) as significant level.

RESULTS
In the result, there was significant difference in both up/down and anterial/posterial excursion of COM in low load and high loads compared between two types of elliptical trainer (figure 1). The excursion ratio of COM, Machine A/Machine B, was 238% \( \cdot \) 211% and 199% in up/down direction and 156% \( \cdot \) 154% and 131% in anteral/posterial direction respectively (table 1).

There was significant difference right/left excursion of COM in high load and low load compared between the same machine (figure 1). There was no significant difference for joint angle (hip, knee and ankle) among loading group.

CONCLUSIONS
The home-used level of elliptical trainer showed fewer excursions than club-used level. The COM can be used for evaluation the fitness of exercise trainer.

REFERENCES

Figure 1: the displacement of COM in three directions, anterial/poster (A/P), right/left (R/L) and up/down (U/D) between two type of elliptical trainer, home-used Machine A and club-used Machine B, and three type of loads.

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Table 1: Percentage of COM displacement ratio by Machine A/Machine B

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<th>A/P%</th>
<th>R/L%</th>
<th>Up/Down%</th>
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<tbody>
<tr>
<td>Low</td>
<td>156%</td>
<td>108%</td>
<td>238%</td>
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<tr>
<td>Middle</td>
<td>154%</td>
<td>103%</td>
<td>211%</td>
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<tr>
<td>High</td>
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