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# Correlation of dynamic visual acuity between aerobic exerciser group and muscle exerciser group using VR HMD system

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## *Abstract*

*This study analyzes dynamic visual acuity correlations between aerobic exercise group and strength exercise group. Measurements of dynamic visual acuity were measured by DEM test (VHD) based on VR HMD system and conventional DEM test (DEM). The experiments were conducted with DEM vertical test, DEM horizontal test, VHD vertical test, and VHD horizontal test. As a result of the study, there was no statistically significant difference between the results of the correlation analysis. It is concluded that there is no significant effect on dynamic visual acuity performance between aerobic exercise and strength exercise. Future studies will need to analyze the dynamic visual acuity correlation between the expert exercise group and the general group.*

***Keywords****: Head-mounted display, Developmental eye movement, Virtual reality, Dynamic visual acuity*

## 1. INTRODUCTION

Humans acquire external information through various body organs. Among them, vision plays an important role in deriving or helping other senses. Most of the methods of acquiring external information from human beings are transmitted through the eyes [1]. The visual function uses organic functions such as lens adjustment function, eye alignment, stereoscopic vision, and peripheral vision to clearly view external information. Even with good visual acuity, visual function may be impaired. Visual acuity can be classified into static visual acuity and dynamic visual acuity [2], of which dynamic visual acuity plays an important role in physical activities such as exercise [3-4]. In this study, we measured the dynamic visual acuity between the aerobic exercise group and the strength exercise group.

## 2. EXPERIMENTAL SUBJECTS

The subjects were selected from 17 subjects who did not have special ophthalmologic diseases, mental

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illnesses, systemic diseases and visual acuity of 0.8 or more in the 20s and 30s who understand and agree with the purpose of this study (aerobic exercise group: 9, strength exercise group: 8).

## 3. TEST METHOD

Before starting the experiment, the participant checked the eye movement abnormality through the H-S scale [5] and checked the factors affecting the body condition and the experiment by performing the history examination. Participants were divided into aerobic exercise group (9) and strength exercise group (8).

Data analysis was performed by Spearman's rho correlation analysis of SPSS (Ver. 18.0 for Window, SPSS Inc, Chicago, IL, USA). A 95% confidence interval was considered statistically significant at $p < 0.05$.

## 4. RESULTS AND DISCUSSION

### 4.1 DEM vertical result

In the DEM vertical analysis, there was a weak negative correlation ($-0.1 \geq r \geq -0.3$) between the aerobic exercise group and the strength exercise group and there was no statistical significance ($r = -0.190$, $p = 0.651$).

**Table 1. DEM vertical correlation between aerobic exercise group and strength exercise group**

| variable | aerobic exercise | strength exercise |
|---|---|---|
| aerobic exercise | 1 | |
| strength exercise | -0.190 (p=0.651) | 1 |

(*: $p<0.05$)

### 4.2 DEM horizontal result

There was a weak negative correlation ($-0.1 \geq r \geq -0.3$) between the aerobic exercise group and the strength exercise group in the DEM horizontal, and there was no statistical significance ($r = -0.167$, $p = 0.693$).

**Table 2. DEM horizontal correlation analysis between aerobic exercise group and strength exercise group**

| variable | aerobic exercise | strength exercise |
|---|---|---|
| aerobic exercise | 1 | |
| strength exercise | -0.167 (p=0.693) | 1 |

(*: $p<0.05$)

### 4.3 VHD vertical result

In the VHD vertical, no correlation was found between the aerobic exercise group and the strength exercise

group ($0.1 \geq r \geq -0.1$) and no statistical significance was found ($r = -0.095$, $p = 0.823$).

**Table 3. VHD vertical correlation between aerobic exercise group and strength exercise group**

| variable | aerobic exercise | strength exercise |
|---|---|---|
| aerobic exercise | 1 | |
| strength exercise | -0.095 (p=0.823) | 1 |

(*: p<0.05)

4.4 VHD horizontal result

There was a strong negative correlation between the aerobic exercise group and the strength exercise group in the VHD horizontal ($-0.3 \geq r \geq -0.7$), but no statistical significance was observed ($r = -0.357$, $p = 0.385$).

**Table 4. VHD horizontal correlation analysis between aerobic exercise group and strength exercise group**

| variable | aerobic exercise | strength exercise |
|---|---|---|
| aerobic exercise | 1 | |
| strength exercise | -0.357 (p=0.385) | 1 |

(*: p<0.05)

4.5 Discussion

There was no correlation or negative correlation in the dynamic visual acuity correlation analysis between the aerobic exercise group and strength exercise group, and no statistical significance was shown. Although the aerobic exercise group was expected to have a difference in dynamic visual acuity compared to the strength exercise group, there was no significant correlation in the experiment of this study. In addition, the amount of exercise at the level of the general public does not affect the dynamic visual acuity ability.

## 5. CONCLUSIONS

Dynamic visual acuity, which works to recognize objects clearly while moving among visual functions, is a very important function in city life. Unlike static visual acuity, dynamic visual acuity tends to be unrecognized because its measurement system is not standardized. Dynamic visual acuity requires excellent binocular vision and is similar to body motion system due to the characteristics of visual system, so it can improve its function through sports vision training. As a result, the training program activities related to vision are performed to improve the performance of sports. It is necessary to analyze the correlation between the exercise and the

dynamic visual acuity and to verify the training effect through the comparative experiment between the expert groups.

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