

## 4.7 Evaluation of Gait Balance on Mt. Fuji (3776 m)

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### 1. Introduction

Dizziness is a common symptom of acute mountain sickness (AMS). At high altitudes, mountaineers may experience dizziness, which can cause an increase in the degree of body sway and result in loss of balance. This increases the likelihood of falls (Fig. 4.7-1).

### 2. Subjects and methods

It may be beneficial for mountaineering safety to identify the degree of body sway as a parameter for estimating a mountaineer's physical condition during a climb. We assessed gait and balance by using an accelerometer for the timely detection of changes in the degree of body sway.

Accelerometer measurements were taken on Mt. Fuji (3776 m above sea level) and at ground level. We enrolled 7 healthy volunteers for this study after obtaining their



Fig. 4.7-2: Accelerometer used to gather data

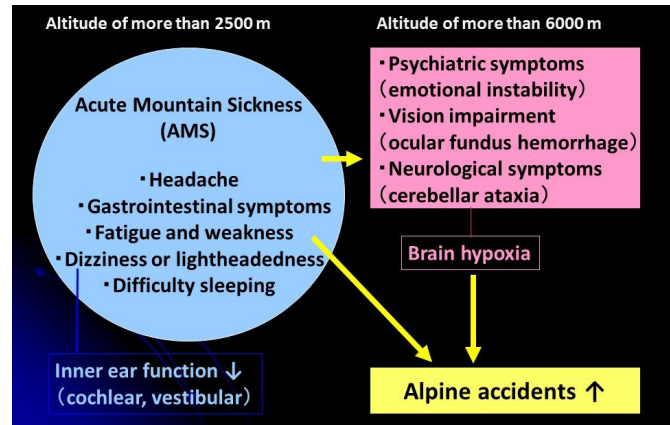


Fig. 4.7-1: Relationship between AMS and Alpine accidents

informed consent in accordance with the Declaration of Helsinki. The participants were 42-78 years old (mean age:  $60.4 \pm 13.8$  years). Accelerometer measurements of changes in the degree of body sway were taken to assess gait and balance. AMS score,  $SpO_2$  (a measure of arterial oxygen saturation), and heart rate measurements were also taken (Fig. 4.7-2).

### 3. Results

The flat gaits did not change between walking at ground level and on Mt. Fuji. However, while descending, an increased degree of body sway was noted in most of the volunteers, and an AMS score of 3 was obtained for 3 participants who also had  $SpO_2$  levels of approximately 70%, which was clearly indicative of AMS (Fig. 4.7-3). Of these 3 participants, 2 exhibited an increased degree of body sway. The locus of the body sway increased, but statistical analysis did not show significant differences.

### 4. Discussion

Descending may result in more intense effects because of an increase in body sway and intensity of shock. These may be factors in causing slips and falls as climbers descend the mountain.

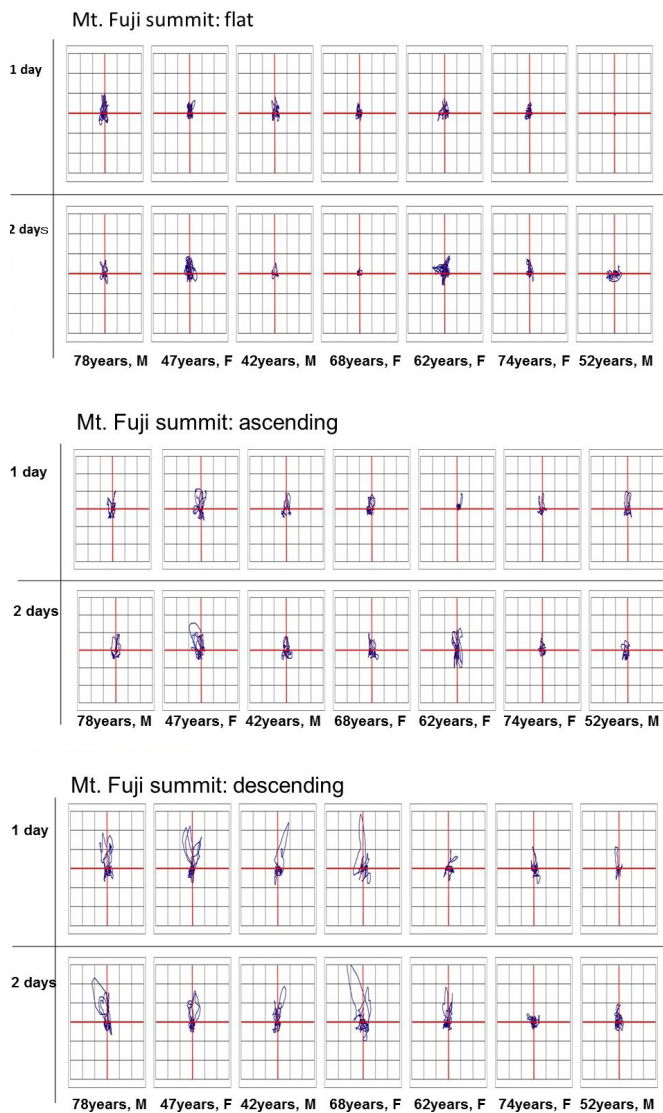


Fig. 4.7-3: Results of accelerometer measurements

## 5. Conclusion

Our results suggest that an increase in the degree of body sway is also a symptom of AMS. The accelerometer measurements reflected total balance and gait impairment, and consequently indicated that it was caused by weakening of the fatigued triceps surae muscle because of the tension applied to it while climbing. An accelerometer is a small, lightweight gadget, which makes it a practical instrument for evaluating impairments in gait and balance while trekking at high altitudes.