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SEQUENTIAL CHANGES OF STANDING POSTURE WHILE CARRYING A BABY IN THE ARMS

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In order to clarify the characteristics of sequential changes of baby-carrying posture, an experiment was conducted using a baby dummy. The subjects were 12 female students aged from 20 to 22years. First, each subject was instructed to wear sneakers, next to wear medium high-heel shoes. The motion and the changes of the posture of each subject were recorded, also, electromyograms were recorded. The difference of the sequential changes of baby carrying posture according to the shoes worn by each subject was not large. However, individual differences were seen in the muscular activities while carrying the dummy during the three-minutes period.

INTRODUCTION

Although cultural difference is seen in baby-carrying style, carrying a baby in the arms might be the most popular baby-carrying style in the world. For example, mothers usually carry their babies in their arms and stand for a while, not only when they fondle their babies but also when they have to wait a bus or a train together with their babies at a bus stop or at a station. However, to carry a baby in the arms without a carrier might restrict the free movement of both of the arms of the mother carrying the baby. This seems to create a safety problem for both the mother and the baby because the average body weight of a 6-month-baby may be as much as 7.5kg and its height often reaches more than 65cm. It might be considerably hard to stand and keep balance for a pretty long time carrying a heavy baby. When a mother stands carrying a baby in her arms, what kind of sequential changes can be seen in the standing posture. This study attempts to clarify the characteristics of sequential changes of the baby-carrying posture, and try to know the difference of the standing posture according to the carrying load and the shoes worn by a carrying person.

SUBJECTS AND METHODS

The subjects were 12 female students aged from 20 to 22 years. The mean and SD of their body size are 156.6(4.7)cm in height and 48.0(4.4)kg in weight. An experiment was conducted using a baby dummy which was made in order to prevent accidents during the experiment. Awakening babies usually show active motion when they are carried; however, they do not move noticeably while sleeping. Therefore, the dummy simulate closely the state of a real baby while sleeping. The size of the dummy is the same as that of an average Japanese 6-month-old female baby (66cm, 7.5kg). None of the subjects had an experience to carry a real baby in their arms. Therefore, the subjects practiced picking up the dummy and tried to find an appropriate way to hold it in their arms for some minutes.

The procedure of the experiment is like this. First, each subject was instructed to stand in front of cameras without carrying anything for three minutes. Next, each subject was instructed to pick up the dummy and stand carrying it in her arms for three minutes. This six-minute sequence was first done with subjects wearing sneakers, and then immediately repeated with subjects wearing medium high-heel shoes. The motion and the changes of the posture of each subjects were recorded during the entire twelve-minute period using 35mm cameras and a video camera. Also, electromyograms were recorded with surface electrodes placed on both the left and the right *tibialis anterior* and *gastrocnemius*.

This study employed the pictures which were taken showing the left side of the subjects and measured the leaning and the flexion of the body. The leaning of the body is defined as shown in Figure 1-2 in this study. Figure 1-3 also shows the measurement of the lumber and the neck flexion of the subjects in each situation.

Results

Initial Style of Carrying Posture

All the subjects picked up the dummy and carried it in a face-to-face position. More than half of them (7, or 58.3%) carried the dummy putting its head on the right side of the chest, and the rest of them (5, or 41.7%) carried it putting the head on the mid or left side of the chest. All of them placed their arms in parallel pattern around the dummy to support it firmly. Figure 2 shows the position of the dummy on the chest and the pattern of the usage of the arms observed in the experiment.

Difference of the Posture according to the Load

The subjects stood leaning forward slightly when they had nothing on the chest or on the back. They showed a tendency to lean backward when they stood carrying the dummy on in their arms. The difference of lumbar flexion according to the load was not large; however, the neck flexion differed significantly (sign-test: $p<0.01$). Compared with the standing posture without carrying anything, the neck flexion angle in the case of carrying on the chest was smaller. When the subjects carried the dummy on the chest, their total body leaned slightly backward, but their faces leaned forward because most of them looked the face of the dummy.

In the case, carrying the dummy, muscular activities of the left and the right *gastrocnemius* got larger. However, the difference was not significant. The muscular activities of the left and the right *tibialis anterior* did not show any change according to the carrying load.

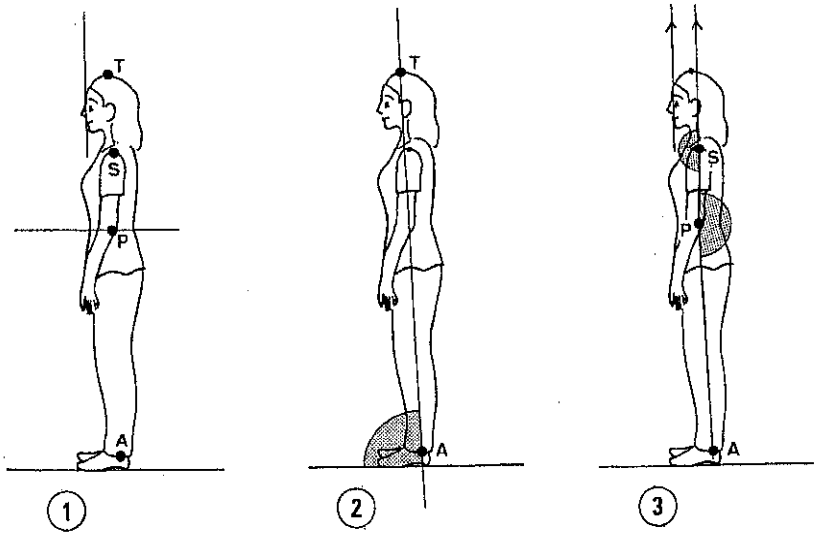

Fig. 1.

Difference of the Posture according to the Shoes

The subjects stood leaning forward slightly when they wore either sneakers or medium high-heel shoes. The difference of lumber flexion in each situation was not large; however, the neck flexion differed significantly ($P<0.05$). Compared with the standing posture wearing sneakers, the neck flexion angle in the case of wearing medium high-heel shoes was somewhat larger. In the case, wearing medium high-heel shoes, the subjects showed a tendency to stand turning their face upward.

The muscular activities of the left and the right *tibialis anterior* and *gastrocnemius* did not show any significant changes according to the carrying load.

Motion Observed while Carrying the Dummy

More than half of the subjects (7, or 58.3%) changed the carrying style during the three minutes; however, the rest of the subjects (5, or 41.7%) continued the initial style throughout the term. Although some of the subjects did not change their initial carrying style, almost all the subjects slightly lifted up the dummy to adjust its position in their arms. The frequencies of this movement among the subjects were different.

Some of the subjects (4, or 33.3%) swayed while carrying the dummy in their arms. One of them kept swaying for more than two minutes; however, others showed short time-intermittent swaying.

Although the upper limbs of the subjects were used to carry the dummy on their chest, they frequently patted the back or the haunch of the dummy with either the left or the right hand.

The legs of the subjects were observed to rarely move. However, those who stood with their feet placed somewhat apart (3, or 25.0%) sometimes shifted their body weight from one foot to another. These movements were clearly observed on the record of the electromyograms of the right and the left lower legs.

Patterns of Sequential Changes

The difference of the sequential changes of baby carrying posture according to the shoes worn by each subject was not large. However, individual differences were seen in the muscular activities while carrying the dummy during the three-minutes period.

By applying cluster analysis to the motion of the arms, hands and the head of the subjects, and muscular activities of each lower leg of the subjects,

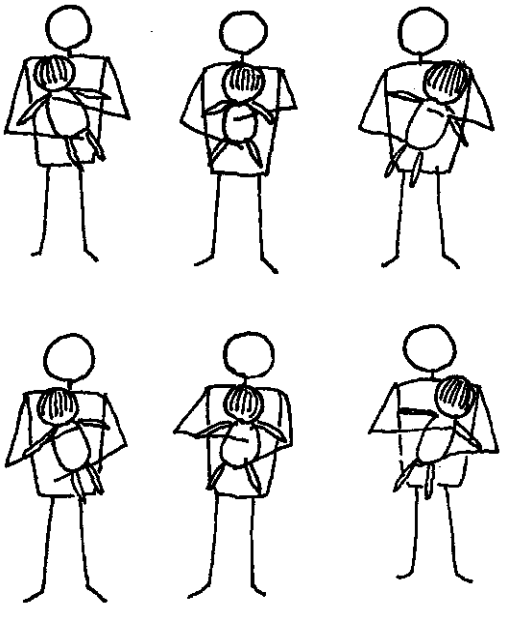

Fig. 2.

the subjects were divided into two groups (group A and group B) when the subjects carried the dummy wearing sneakers. The subjects who belonged to group A (6, or 50%) showed a tendency to move actively during the three-minutes period. They frequently changed the carrying style, frequently lifted up the dummy to adjust its position and softly patted the dummy. On the other hand, those who belonged group B moved scarcely during the period. This seem to indicate that the attitude to carry a baby in the arms is somewhat different among young women.

DISCUSSION

The physical load in carrying a baby in the arms or in the baby-carrier was discussed comparing with the load in carrying a baby on the chest with a carrier and the piggyback style (Inukai, 1998). Inukai measured the energy consumption and clarified that the RMR 3.1 for carrying a baby in the arms, 3.1 for carrying by baby-carrier and 2.8 for carrying on the back. Fromthis point of view, to carry a baby on the chest without a carrier is not appropriate way for young mothers. The case carrying piggyback is practiced in Japan, but it seems to be the most efficient and suitable way for young mothers to carry their babies. However, in Japan, instead of the traditional piggyback band, various types of newly designed baby-carriers have been young mothers sometimes carry their baby without a carrier.

This study clarified that the attitude to carry a baby in the arms seemed to be somewhat different among young mothers. And the difference of the sequential changes of baby carrying posture according shoes was not large. However, individual differences were seen in the muscular activities while carrying the dummy. Therefore, the individual differences of physical load seems to get bigger when mothers wear inappropriate shoes to carry their babies.

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