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Effects of Neck Immobilization on Turning and Standing up During Activities of Daily Living of Young Females

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The purpose of this study was to determine the effect of neck immobilization on turning positions, such as rolling over and sitting up or standing up from the supine position. This study was designed to describe the time delay required to change positions while wearing a collar during an experimental procedure. Twenty-one young females, 20 or 21 years old, were enrolled in this study. Their mean height was 160 cm (range 147-164 cm) and their mean weight was 53 kg (range 44-64 kg). A cervical collar was used for neck immobilization. The time required to perform the given experimental procedures with or without a cervical collar was measured three times for each procedure. The experimental procedures were consisted of the following four different actions: (1) turning over from supine to prone position, (2) turning over from prone to supine position, (3) sitting up from supine position and (4) standing up from sitting position. The results indicated a statistically significant increase in the time required to perform each of these procedures when the neck was immobilized. No significant correlations were observed between either height or weight and the time required for any of the procedures.

Key Words

Neck immobilization,
Activities of daily living,
Turning over,
Standing up,
Time required for changing position.

Introduction

Cervical fixation is often used for the treatment of patients who suffer from neck injuries or immobilization after neck surgery. A reduction in the range of motion is also recognized as a symptom of Parkinson's syndrome or due to aging changes in the cervical vertebrae. Patients with neck immobilization experience difficulties in their activities of daily living (ADL) and may risk falling. It is, therefore, important to take proper care of the patients with neck immobilization, but not much attention has been paid to this problem. ADL management is an important responsibility for both nurses and other medical professionals.

A previous study of ours[1)] suggested that young females' ADL were affected by neck immobilization. We found that the motions required for both picking up a tea cup and going up and down steps was significantly slowed down by neck immobilization.

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Kaneko[2] investigated the motor speed of the upper extremities under conditions of neck immobilization. In his work, a significant delay in motor action of the arm was demonstrated in the population with cervical immobilization. This suggested that neck immobilization would disturb movement and locomotion in ADL. On the other hand, Nakata[3] stated that persons with a fixed neck position showed a significant improvement in walking patterns and a reduced time for stair-climbing as a result of their careful walking to avoid obstacles on the floor. These observations indicate that adequate nursing care for the patients with an immobilized neck is very important when they move and change posture.

The purpose of this study, then, is to determine the effect of neck immobilization on changes in position, such as rolling over, sitting up and standing up from a supine position.

Methods

Subjects were twenty-one healthy females nursing students aged 20 and 21. They ranged in height from 147 to 164 cm (mean : 158, SD : 4.62 cm) and in weight from 44 to 64 kg (mean : 53, SD : 5.2 kg).

A height-adjustable cervical collar (Kinki Gishi Seisakusho, Kobe, Japan) was used for neck immobilization. The range of cervical movement, such as flexion, extension, rotation and lateral bending, was restricted by the collar within five degrees. The following experimental procedures were then performed on a floor mat.

Procedure 1 : turning over from supine to prone position
Procedure 2 : turning over from prone to supine position
Procedure 3 : sitting up from supine position
Procedure 4 : standing up from sitting position

Each of these procedures was performed with or without a collar three times each and the time required for completing each procedures was measured.

The time measurements obtained were then statistically analyzed with a paired t-test to compare conditions with or without a collar. Correlation coefficients between height, weight and the time needed to change position for each of the experimental conditions were also calculated. A probability value of $p < .05$ was considered significant.

Results

Figures 1 to 4 show the time required for changing position with or without a collar. Most of the participants needed much more time to change position with a collar than without a collar.

Table 1 shows the mean values and standard deviations of the times needed for changing position with or without a collar for each of the procedures. Subjects needed 1.56± .15 sec. when wearing a collar to change position from supine to prone, showing a less than 1% level of significance ($t=-3.699$, $p= .0014$) of time delay compared to performing the procedure without a collar (1.33± .14 sec.). They also needed 1.57± .13 sec. with a collar compared to 1.38± .14 sec. without a collar to roll over from the prone to the supine position for a significant t-value at the less than 1% level ($t=-3.154$, $p= .0050$). To complete procedure 3, 1.47± .16 sec. was required with the collar and 1.28± .12 sec. without the collar, showing significance at

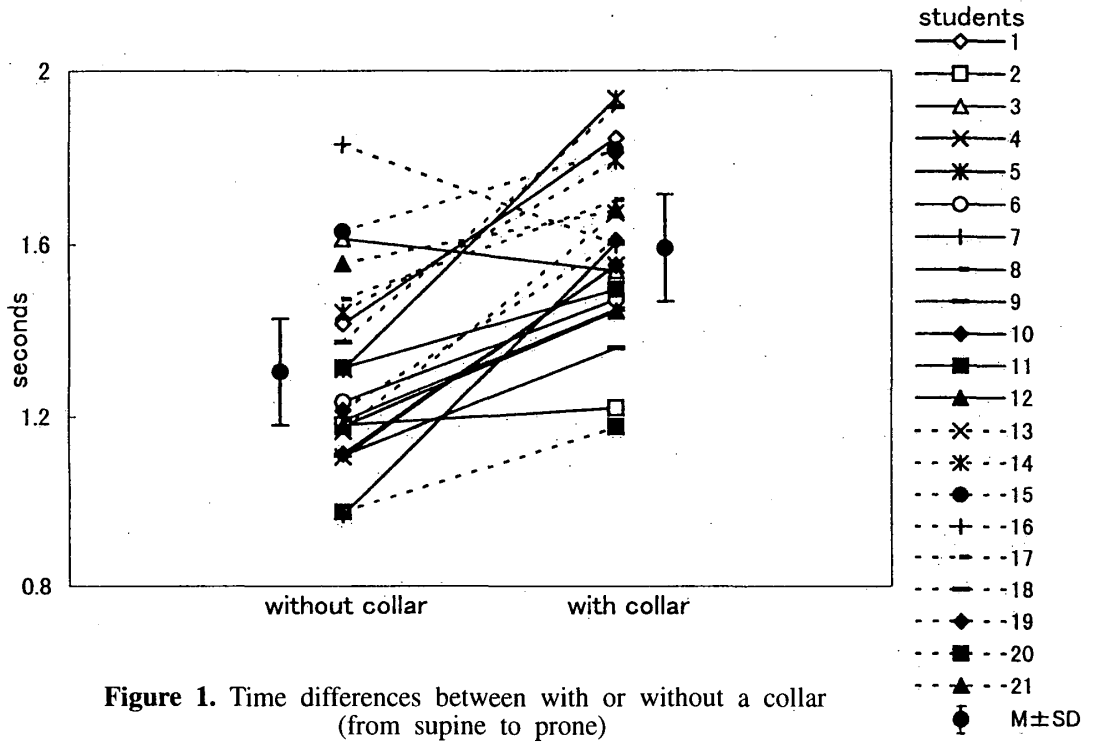

Figure 1. Time differences between with or without a collar (from supine to prone)

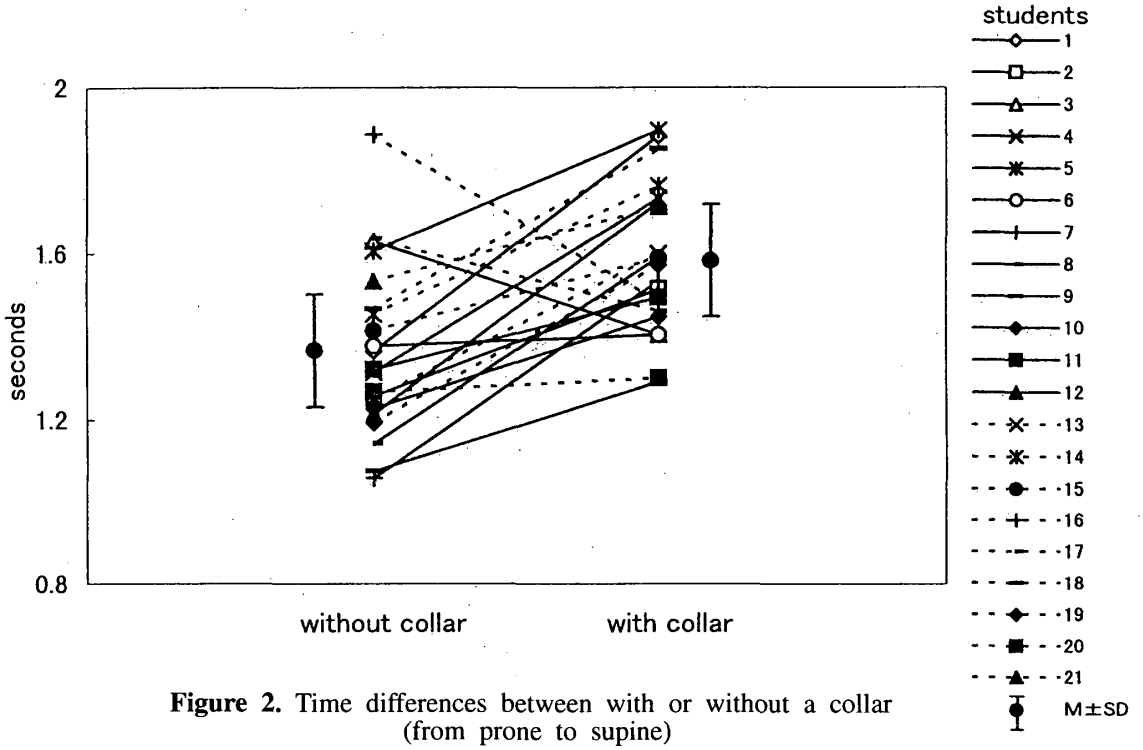

Figure 2. Time differences between with or without a collar (from prone to supine)

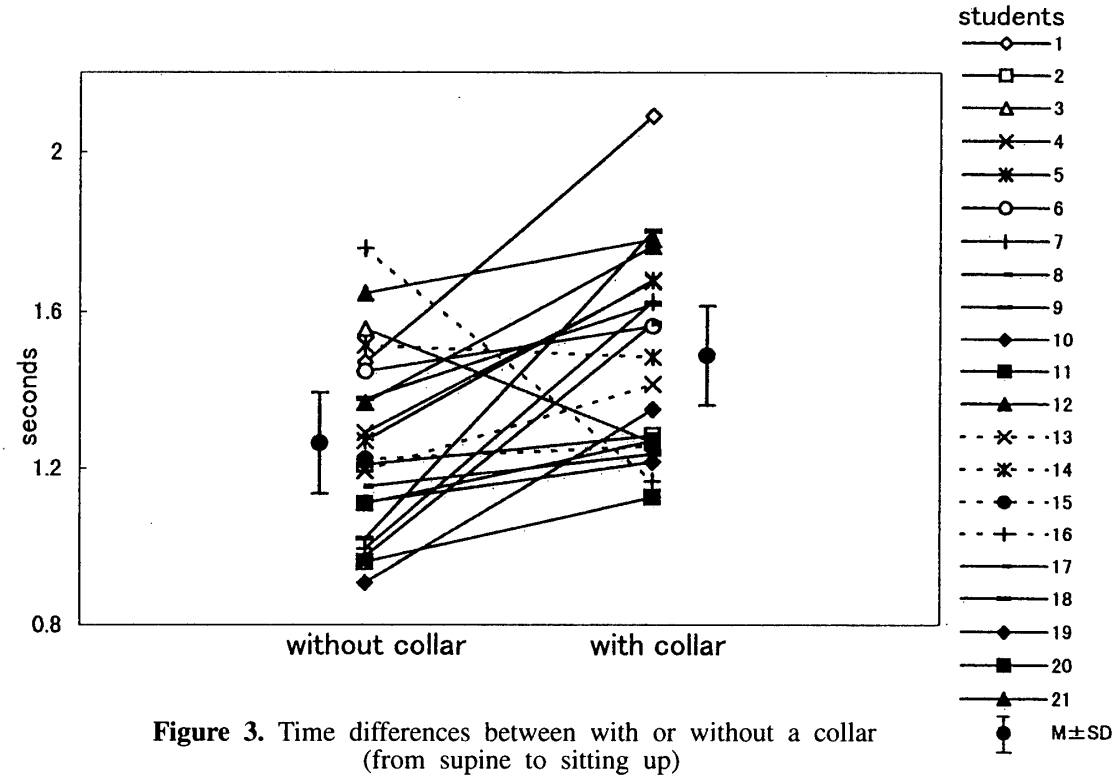

Figure 3. Time differences between with or without a collar (from supine to sitting up)

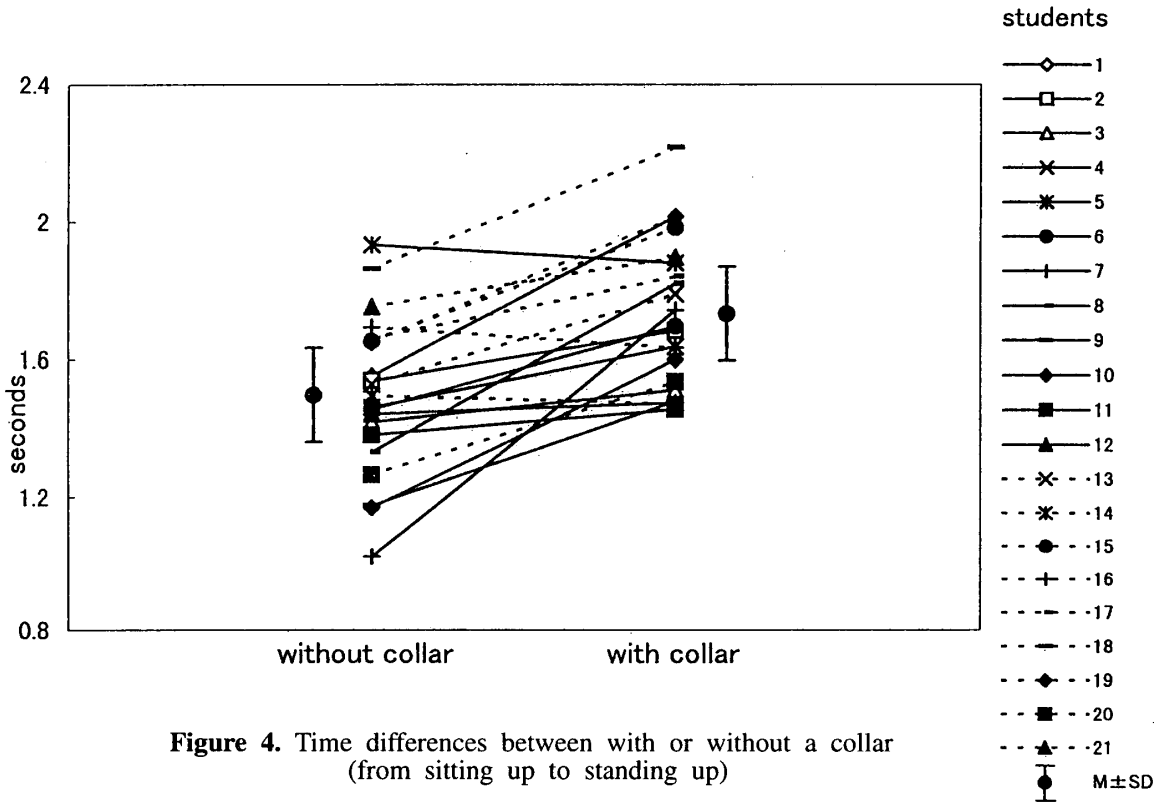

Figure 4. Time differences between with or without a collar (from sitting up to standing up)

Table 1. Time required to change position with or without a collar (N=21)

	without collar		with collar			
	mean (seconds)	SD	mean (seconds)	SD	t-value	p-value
Procedure 1	1.334	.141	1.563	.145	-3.699	.0014
Procedure 2	1.380	.135	1.569	.127	-3.154	.0050
Procedure 3	1.284	.124	1.469	.164	-2.469	.0227
Procedure 4	1.496	.132	1.735	.106	-5.850	<.0001

(See text for details of procedure 1,2,3 & 4)

the 5% level (t=2.469, p= .0227). For procedure 4, subjects needed 1.74± .11 sec. with a collar and 1.50± .13 sec. without a collar, for a significant t–value at the .1% level (t=5.850, p< .0001).

No significant correlations were observed between either height or weight and the time required for each of the procedures (data not shown).

Discussion

Some studies have identified the effect of neck immobilization on activities such as motor speed of the upper extremities[3], walking or going up and down steps[1, 2]. The time needed to pick up something from the floor was also prolonged by neck immobilization[1]. All these studies showed that the time needed for completing given procedures was slowed down significantly by neck immobilization, and suggested that there was a relationship between cervical rotation and motion of the trunk.

The study presented here focused on motions involving locomotion of the point of gravity during ADL. The analysis of the four experimental procedures show that neck immobilization significantly increases the time needed to change position compared to when the neck is free.

1) Turning position

The normal pattern of rolling over from the supine position begins with neck rotation prior to trunk rotation[4]. Muraki stated that independent rolling over for elderly people would require at least a 60–degree neck rotation to the unilateral side. The main reason for the delay in the turning over is thought to be that the limitation of neck rotation reduces flexibility of motion of the trunk, thus increases the time required to change position.

2) Rising position

The main reason for the increase in time for procedure 3 is that the normal pattern of changing position from a supine to a sitting up position is also affected by the subjects' neck immobilization. VanSant[5] reported that young

adults varied greatly in the movement patterns they used to change from a supine position to an erect stance. However, the most frequently observed action of the axial region is symmetrical flexion followed by extension, and the neck and trunk then move forward symmetrically past the vertical plane for rising. This shows that the axial region has a very important role in rising, that is, the normal pattern of rising begins with the anterior flexion of the neck. Therefore, immobilization of the neck flexion interferes with changing the position from supine to sitting up, and increases the time required to accomplish this change.

Another major reason for the increase in time, especially for procedure 4, could be the loss of balance when standing up from the sitting position. The reason for this is thought to be that the righting reflexes, such as labyrinthine righting reaction acting on the head and neck and righting reaction acting on the body[6], may be affected by neck immobilization. Neck immobilization restricts the righting reflexes because of the disturbance of the normal tonic neck reflex[7] and causes imbalance of the trunk when changing from a sitting to a standing position. Statokinetic reactions and equilibrium reactions[6] are also related to maintaining body balance for changing positions. These reactions may be reduced by neck immobilization due to restriction of the righting reflexes. As a result, the time required to change position increased when subjects stood up from the sitting position on the floor mat.

As the subjects of our study were young healthy females, they could change position independently even while wearing a neck collar, but the motor speed decreased significantly because the normal movement pattern of the cervical spine was restricted. When subjects changed position from supine to prone and from prone to supine, they could not rotate the neck adequately. When changing position from supine to sitting up and from sitting up to standing up, they could not flex their neck forward fully prior to starting their motion. Furthermore, during the change of position, the muscle tone may be affected by the neck position due to a reflex mechanism[7]. Movement patterns also alter with age[8] and differences in daily activities[9].

These findings indicate that neck immobilization affects self-care during ADL. It is therefore suggested that nurses should pay careful attention to patients with neck immobilization, and assess how the immobilization affects movement patterns when patients move or change posture in order to help them to be safe and independent in their ADL.

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