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Original Article

Effect of pillow size preference on extensor digitorum communis muscle strength and electromyographic activity during maximal contraction in healthy individuals: A pilot study

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Abstract

Background: Cervical pillow height is an important factor that affects the perception of pillow comfort. However, few studies have addressed methods for predicting a patient's preferred cervical pillow size. We studied the effect of pillow size preference on the strength and electromyographic (EMG) signals of the upper extremity muscle. If the response of the upper extremity muscle is affected by pillow size preference, this would aid in devising an alternate strategy for selecting the optimal pillow size.

Methods: Twenty-nine healthy individuals (mean age: 28.6 years, range: 24–55 years) participated in this study. The participants performed isometric maximal finger extension in the supine position with their heads supported on four different size preferences of cervical pillow (the most comfortable, next most comfortable, worst, and next worst). Maximal contraction force and peak-to-peak EMG amplitude of the extensor digitorum communis (EDC) during contraction were measured. One-way repeated-measures analysis of variance was used to evaluate the effect of pillow size preference. We also explored the relationship between anthropometric parameters and the individual's cervical pillow height preference.

Results: The two most comfortable pillows were associated with significantly larger maximal EDC force than the two worst pillows. However, no significant differences in EMG were observed between pillows. No statistically significant correlation was found between anthropometric parameters and pillow height preference.

Conclusion: The results suggest that anatomical body measurements are not good predictors of optimal pillow height. As EDC muscle strength is affected by pillow height preference, maximal EDC muscle strength may be a useful complement for selecting the optimal pillow size.
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Keywords: bedding and linens; electromyography; muscle strength

1. Introduction

Cervical pillows come in a variety of heights and curves, with the goal of maintaining proper cervical spine alignment. Recent studies have shown that cervical pillow height is an important factor that affects the perception of pillow comfort.[1,2] Erfanian et al[1] showed that a cervical pillow with a uniform height is not appropriate for everyone. Therefore, the "best" cervical pillow height differs among individuals.

Nevertheless, few studies have addressed methods for predicting a patient's preferred cervical pillow size. When trying to select a comfortable pillow among several sizes, most consumers base their choice on their physical "size". Erfanian et al[1] found no statistically significant correlation between cervical dimensions and pillow height preference. The authors concluded that cervical measurements are not useful for

Conflicts of interest: The authors declare that there are no conflicts of interest related to the subject matter or materials discussed in this article.

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predicting appropriate cervical pillow height. Therefore, the physical size of an individual may not serve as a good predictor for pillow height preference. Hence, recommendations of optimal pillow height based on physical size are inappropriate. Without an effective tool to assist consumers in the selection of optimal pillow size, this has become a difficult task. Thus, it is necessary to develop methodologies for assessing the optimal pillow size.

Changes in cervical afferent input may play a role in the modulation of muscle response of the upper extremity. In a study conducted by Suter and McMorland,[3] neck pain was shown to cause substantial muscle inhibition in bilateral elbow flexors, but this muscle inhibition decreased immediately following cervical spine manipulation. Moreover, a growing body of evidence indicates that extremity muscle inhibition is reduced immediately after spinal chiropractic adjustment, which in turn immediately improves muscle strength.[3–6] A possible neurophysiologic mechanism is that the altered afferent information due to joint manipulation can affect efferent motor output to the surrounding musculature.[3,5,7] Taken together, this evidence suggests that altered cervical afferent input may affect upper extremity muscle activation. These results question whether changes in cervical alignment due to pillow size preference, which change sensory input, alter activation of the upper extremity muscles. Thus, it can be hypothesized that an uncomfortably sized pillow may produce noxious or inappropriate sensory input and result in a poor motor response. If the response of the upper extremity muscle is affected by pillow size preference, this would aid in devising an alternate strategy for selecting the optimal pillow size.

Therefore, the objective of this study was to determine the effect of pillow size preference on maximal voluntary contraction and electromyographic (EMG) activity of the extensor digitorum communis (EDC) muscle. Muscle activity was hypothesized to significantly differ with different pillow size preferences. In addition, the relationship between anthropometric parameters and the individual's cervical pillow height preference was investigated.

2. Methods

2.1. Participants

The inclusion criteria were healthy individuals aged >18 years who were able to understand and follow simple verbal instructions and had no injury to the cervicothoracic spine or dominant upper limb in the previous 6 months. Participants were excluded if they had a neurological or orthopedic condition on the dominant upper limb, cervicogenic dizziness/headache, or were currently receiving treatment for cervicothoracic spine pain.

2.2. Experimental procedure

The study was approved by the Institutional Review Board of Taipei Veteran General Hospital, Taipei, Taiwan. All participants provided informed consent.

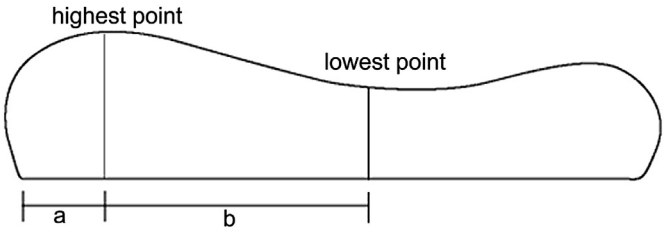

Fig. 1. Illustration of the pillow construction where 'a' represents the distance (in length) from the highest point of the pillow to its top edge and 'b' represents the distance (in length) from the highest point of the pillow to its lowest point.

2.3. Participant self-selection of preferred and non-preferred pillows

Eleven cervical pillows with the same content but different sizes were tested. To ensure consistency in materials and production, all cervical pillows were obtained from the same manufacturer; therefore, only the pillow size and curvature differed. The pillow construction is illustrated in Fig. 1. The detailed dimensions of the 11 trial pillows are shown in Table 1. The pillow height varied from 6 cm to 12 cm and pillow width from 31 cm to 34 cm. The length of the pillows was 61 cm. To assist in blinding of the participants and assessors, the trial pillows were covered with pillowcases of the same brand and color. The pillowcase of each pillow was numbered randomly from 1 to 11.

All participants were asked to test every trial pillow in the supine position and to select the most comfortable, next most comfortable, worst, and next worst of the 11 pillows. Participants were allowed as much time as needed to make their selection, and were given time to sit up, stretch, and move their neck between their evaluation of each pillow.

2.4. Measurements

The initial assessment included anthropometric parameters including body mass index (BMI), neck length, and neck width. All measurements were taken by the same physical therapist. The neck measurements were obtained with the participant's neck positioned in the neutral position while standing erect. Neck length was measured from the external occipital

Table 1
Details of the 11 trial pillows.

Pillow	Pillow dimensions (cm)			a (cm)	b (cm)
	Length	Width	Height		
1	61	31	6	6.0	12.5
2	61	31	6	5.0	12.5
3	61	31	7	6.5	12.0
4	61	31	7	4.0	12.0
5	61	31	8	4.5	15.0
6	61	31	8	4.0	12.0
7	61	31	9	3.5	14.5
8	61	31	9	4.0	13.0
9	61	32	10	5.5	12.5
10	61	34	11	5.5	12.0
11	61	34	12	5.5	12.5

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