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Pilot study: an investigation of the relationship between external cervical measurements and the preference of cervical pillow thickness

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Objective: *To assess whether external measurements of the subject's neck are predictive of the preferred thickness of cervical pillow, given a choice of four different contour thicknesses.*

Design: *Preliminary correlational study.*

Subjects: *The subjects consisted of asymptomatic adults between the ages of 18–45 years, and were drawn from student and faculty populations of the Canadian Memorial Chiropractic College (CMCC).*

Sample size: *A total of 105 eligible adults were recruited, of which 53 were male and 52 were female.*

Outcome Measures: *Subjects were assessed using the following measurements of the cervical spine:*

(1) the external occipital protuberance (EOP) to the seventh cervical spinous process posteriorly,
(2) the mastoid to the acromioclavicular joint laterally, and
(3) neck girth measured at the fourth cervical vertebra. Subjects were asked to choose one of the four possible thicknesses with respect to comfort over a short period of time (i.e. about 10 minutes).

Statistical Analysis: *Results were analyzed at the 0.10 level of significance using the Pearson's Product Moment Correlation Coefficient. Analyses were stratified by gender.*

Results: *This study found no statistically or clinically significant correlation between neck dimensions and pillow size preference ($r < 0.7$, $p > 0.02$).*

Conclusion: *The results of this study suggest that the three specifically outlined cervical measurements may not serve as good predictors for size preference for this type of cervical pillow. The results of this study also do not suggest "one-size" pillow fits all. Patients may still*

Objectif *: Évaluer si les dimensions externes du cou d'un sujet peuvent servir à prédire l'épaisseur de prédilection d'un oreiller cervical lorsque quatre courbures de différentes épaisseurs sont offertes.*

Type d'étude *: Étude préliminaire de corrélation.*

Sujets *: Adultes sains, âgés de dix-huit à quarante-cinq ans, recrutés parmi les étudiants et la communauté universitaire du Canadian Memorial Chiropractic College (CMCC).*

Taille de l'échantillon *: Un total de 105 adultes admissibles ont été recrutés, parmi lesquels se trouvaient cinquante-trois hommes et cinquante-deux femmes.*

Mesures effectuées *: Les sujets ont été évalués en utilisant les mesures de la colonne cervicale suivantes :*

(1) de la protubérance occipitale externe (POE) jusqu'à la septième apophyse épineuse cervicale, postérieurement;
(2) de l'apophyse mastoïde à l'articulation acromio-claviculaire, latéralement;
(3) le tour du cou à la quatrième vertèbre cervicale. On a demandé aux sujets de choisir l'oreiller qu'ils préféraient au niveau du confort parmi les quatre proposés après les avoir essayer pendant une courte période (environ dix minutes).

Analyse statistique *: Les résultats ont été analysés à un niveau de signification de 0.10 à l'aide du coefficient de corrélation de Pearson. La répartition des analyses a été effectuée selon le sexe.*

Résultats *: L'étude n'a démontré aucune corrélation significative tant d'un point de vue statistique que clinique entre les dimensions du cou et la préférence pour une épaisseur quelconque d'oreiller ($r < 0,7$; $p > 0,02$).*

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require a selection of cervical pillow thicknesses. Pending further investigation of this important clinical problem, it may be prudent to continue recommending double-contoured or other variably-sized pillows.
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KEY WORDS: pillow, cervical, thickness, predictor.

***Conclusion** : Les résultats de l'étude semblent indiquer que les trois mesures cervicales expressément relevées ne servent pas nécessairement de prédicateurs justes en ce qui concerne la préférence pour une épaisseur quelconque de ce type d'oreiller cervical. De plus, ils ne laissent pas supposer qu'un oreiller à « taille unique » convient à toutes les personnes. Les malades peuvent vouloir choisir parmi une gamme d'oreillers cervicaux de différentes épaisseurs. En attendant que d'autres études soient entreprises sur cette importante question d'ordre clinique, il serait prudent de continuer à recommander les oreillers à double courbure ou ceux de grandeur variable.*
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MOTS CLÉS : oreiller, cervical, épaisseur, prédicateur.

Introduction

Most cervical pillows are designed to support the cervical lordosis while resting or sleeping. Despite their wide use, there appears to be very little research supporting the use of cervical pillows. At best, the chiropractic and medical literature anecdotally discusses various aspects of postural supports including cervical pillows.[1–6] In 1990, there were at least 12 different patented cervical pillow designs on the North American market.[7] Clearly, there needs to be further investigation regarding the validity of this device.

It is thought that one-third of the average person's life is spent sleeping in bed.[3] The development of the lordotic cervical curve has long been recognized as a necessity for the maintenance of the human bipedal posture.[8] Gray's Anatomy[9] states that the cervical curve is a secondary curve which first appears in intrauterine life and "is further accentuated when the child is able to hold up its head (at three to four months), and to sit upright (about nine months)". In the adult, this lordosis extends from the atlas to the second thoracic vertebra.

Leach[10] radiographically evaluated cervical curve depth (CCD) of 35 patients who presented with cervical hypolordosis or kyphosis (CH/K). Of these, one group of 20 patients who received only chiropractic manipulative therapy (CMT) gained a mean improvement of 4.55 degrees ($p < 0.01$) while the second group of 9 patients who received both CMT and orthopaedic cervical pillow therapy improved 2.22 degrees. The control group of 6 patients had a mean improvement of 0.83 degrees. The significance of this finding is clouded by the fact that the author had no way of knowing if the patients given the cervical pillow used it properly as a normal population would have. Proper use of the "right" kind of pillow during sleep may be important in improving the posture of the whole body.[2]

Our review of current literature revealed only a few investigative studies in the field of cervical pillows. A case series by Smythe[11] involving 91 prior fibromyalgia patients and 60 non-prior fibromyalgia patients, all with neck pain, found that after 18 months of using a cervical pillow, 63% and 84% of the respective group, achieved clinically significant relief; however, Smythe does not indicate what kind of cervical pillow(s) the subjects were exposed to.

In another study, Jackson[12] used lateral radiographs of the cervical spine with and without regular and roll-shaped pillows. Jackson concluded that the roll-shaped pillow restores the cervical lordosis and decreases neck pain and discomfort while sleeping. However, Jackson did not provide any details with respect to the research methods and data, making it difficult to evaluate the findings.

To date, the most recent published study in the field of cervical pillows is that by Lavin from the Johns Hopkins University School of Medicine. Lavin et al.[13] compared

three pillows with regard to pain intensity, pain relief, quality of sleep, disability, and overall satisfaction in subjects with benign cervical pain. The three pillows evaluated were the subjects' usual pillow, a roll pillow, and a water-based pillow. This study was designed as randomized crossover. Forty one subjects used their usual pillow for the first week and subsequently were randomly assigned to use each of the other two pillows for 2 week periods. The results of the study indicated that the water-based pillow was associated with reduced morning pain intensity, increased pain relief, and improved quality of sleep. The authors concluded that proper selection of a pillow can significantly reduce pain and improve quality of sleep but does not significantly affect disability outcomes measured by the Sickness Impact Profile (SIP). The paper does not however, reveal what the water-based vs roll-shaped vs regular pillows baseline data were, so that it cannot be seen if randomization was successful in yielding acceptably equivalent baseline measures. There does not appear to have been a "washout period" between pillow administrations (bringing the subjects back to their baseline levels); without this, it is unclear whether there were interaction effects between the pillows; further, the analysis appears to have utilized the averages of each treatment period, rather than pre-post treatment period changes, so that it is not clear whether the cross-over data may not largely be the post-treatment data of the *previous* pillow.

Most health practitioners know from their clinical experience that not all patients can adapt to the contoured cervical foam pillow. While almost half of patients "fall in love" with the pillow, some have no desire to use the pillow. Health practitioners often feel more comfortable prescribing a double-contoured cervical pillow, as it may provide the patient with greater selection, allowing adaptation to a variety of neck sizes. The authors suggest three neck measurement techniques that may be useful in prescribing appropriate pillow size. It can be argued that people require different and specific shoe and glove sizes; therefore, since not all cervical spines are alike, it may be reasonable to suggest that pillows be prescribed by physical "size" in order to maximize comfort and effectiveness.

The objective of this study was to determine whether cervical measurements are predictive of a patient's preference for cervical pillow size ($r_P >= 0.7$, $p = < 0.02^*$).

* Bonferroni corrected alpha = 0.1

Methods and materials

Design architecture

This study utilized a preliminary (exploratory) correlational design.

Sample profile

The sample consisted of students and staff of the Canadian Memorial Chiropractic College, 18–45 years of age, who were asymptomatic with respect to neck pain. Asymptomatic subjects were chosen because the assumption was made that if there were a correlation of $r >= 0.7$ between cervical measurements and pillow-size preference in asymptomatic subjects, who are more available than symptomatic subjects, then a similarly clinically significant correlation might exist for symptomatic subjects. It would then be worthwhile to assess the strength of this latter correlation.

Sample size

A total of 105 (53 male and 52 femlae) adults were recruited for this trial.

Outcome measures

Our review of current literature provided some rationale for prescribing different types and sizes of cervical pillow; therefore, we chose the following four outcome measurements for this study:

1 size preference of a new cervical pillow (subjects were given a choice of four thicknesses);
2 posterior neck measurement, measured in centimetres from the external occipital protuberance (EOP) to the seventh cervical spinous process posteriorly (see Figure 1);
3 lateral neck measurement, measured in centimetres from the mastoid process to the acromioclavicular joint laterally (see Figure 2); and
4 neck girth measurement, measured in centimetres at the fourth cervical vertebra posteriorly and thyroid cartilage anteriorly (see Figure 3).

Protocol

The neck measurements were taken with the subject sitting and looking straight ahead i.e. the neutral position of the cervical spine (see Figures 1 and 3). Care was taken to avoid any alteration in the subject's head position while

Figure 1 Measurement of cervical spine lordosis curve from the external occipital protuberance (EOP) to the seventh cervical spinous process posteriorly.

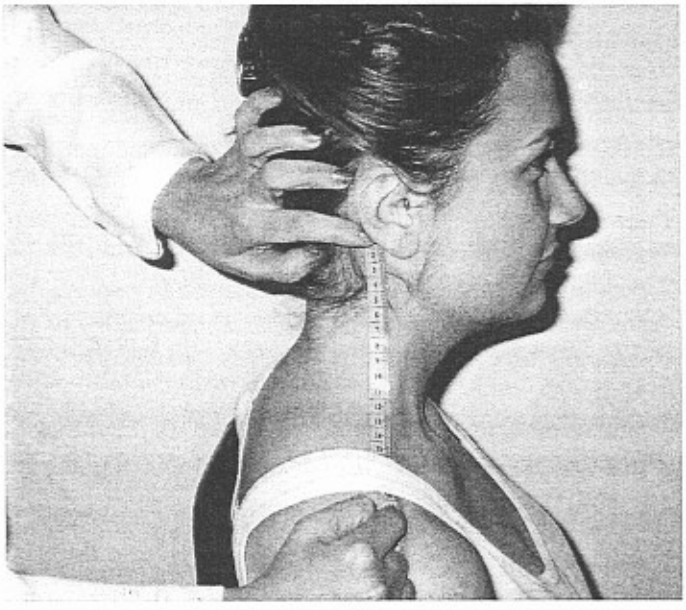

Figure 2 Measurement of the lateral neck from the mastoid process to the acromioclavicular joint laterally.

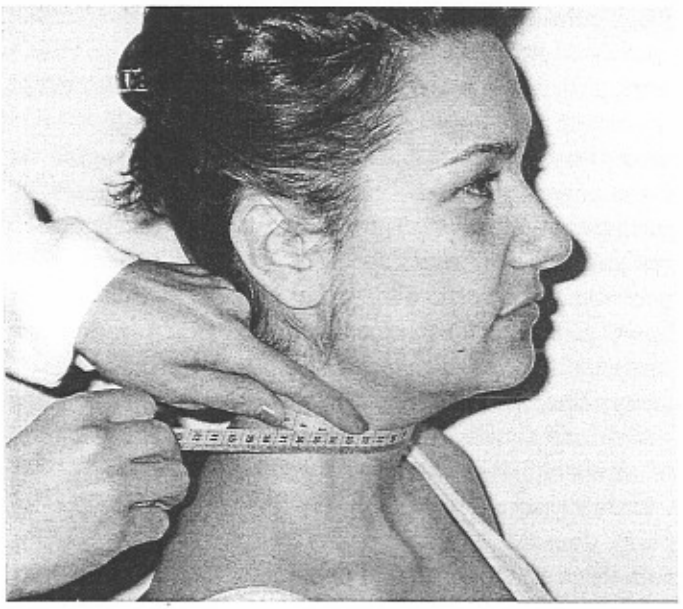

Figure 3 Neck girth measured at the fourth cervical vertebra posteriorly and thyroid cartilage anteriorly.

taking the measurements. The measurements were performed by one student investigator only, in an attempt to keep measurement biases consistent.

Subjects were requested to indicate their pillow size preference in the supine position, irrespective of their normal sleeping positions. The preference-selection was made by presenting each participant with the side labelled 'A' followed by 'B', 'C', and 'D'. Subjects were then requested to choose between two sides, followed by as many retrials as necessary until they were able to select one thickness or pillow size as being the most comfortable.

Materials

Materials used for this study included: A Media-Mart retractable cloth measuring tape and a specially designed cervical foam pillow with four sides of equal width but increasing in thickness from side A through side D (see Figures 4 and 5).

Statistical analysis

Results of this pilot study were analyzed at the 0.10 level of statistical significance using a Pearson's Product Moment Correlation Coefficient. Because the analyses were

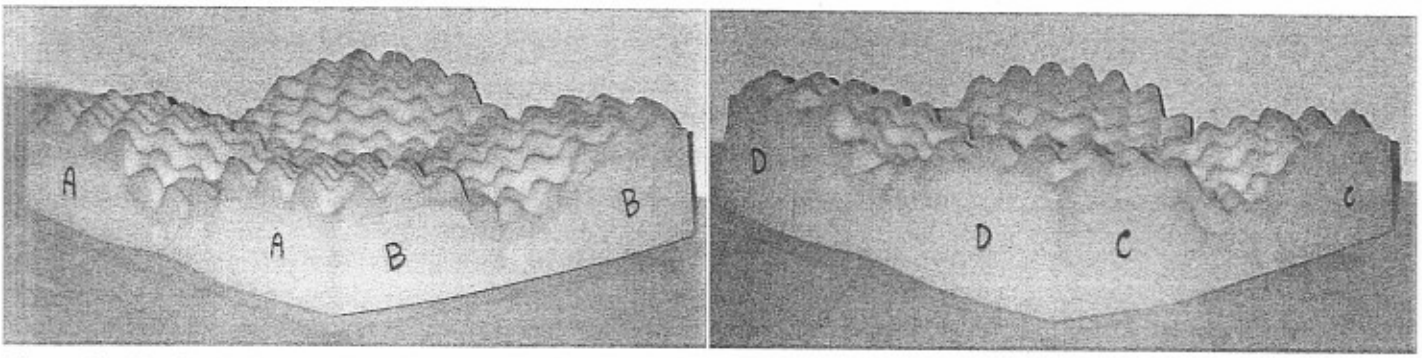

Figure 4 The Cervical Pillow's different sizes.

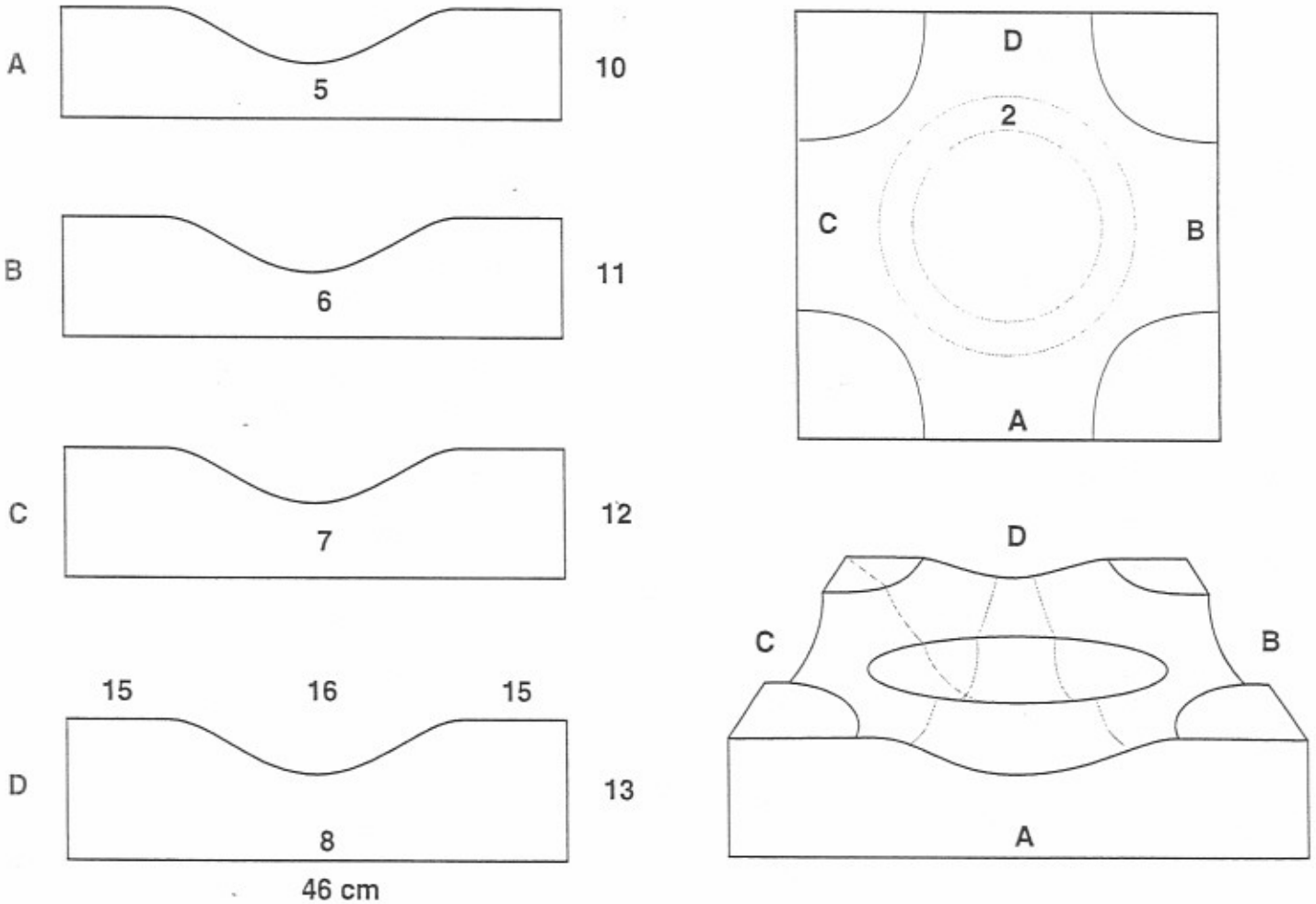

Figure 5 The Cervical Pillow's different size measurements.

stratified by gender, the level of significance was Bonferroni adjusted to 0.02 (0.10/6). A correlation of $r \geq 0.7$ was considered to be clinically significant.

Results

A total of 105 subjects were recruited for this study. An essentially equal gender distribution was obtained with 52 females and 53 males having participated. The distribution of pillow size preference among the participants is shown in Table 1. Side D (the largest size) was preferred most often.

As evident in Table 2, there were no clinically or statistically significant relationships between the cervical measurements obtained in this study and the preferred size of cervical pillow.

Table 1
Cervical pillow side preference based on gender

Preferred Side	Number of Male Subjects (%)	Number of Female Subjects (%)	Total Number of Subjects (%)
A	9 (17)	12 (23)	21 (20)
B	17 (32)	10 (19)	27 (26)
C	7 (13)	12 (23)	19 (18)
D	20 (38)	18 (25)	38 (36)
A+B+C+D	53 (100)	52 (100)	105 (100)

Table 2
Pearson's Rho Correlation/Probabilities

	GENDER					
	FEMALE			MALE		
	Size pref vs EOP	Size pref vs AC	Size pref vs GIRTH	Size pref vs EOP	Size pref vs AC	Size pref vs GIRTH
r	0.04	0.08	0.18	0.00	0.07	–0.06
p	0.76	0.56	0.19	0.99	0.61	0.69

Discussion

One of the secondary goals of this study was to demonstrate the validity of the research hypothesis that prescribing a cervical pillow thickness should be based on specific cervical spine measurements. The results show that (at least in the short term and for asymptomatic subjects), the measurement criteria used in this study are not useful for predicting cervical pillow size preference; i.e. based on these results, one cannot assume that "fitting" a patient with a pillow based on neck measurements will improve his/her level of head/neck comfort while using the pillow. One can also not rule out the possibility that symptomatic subjects may respond differently from asymptomatic ones; therefore, we recommend repeating a similar investigation on a symptomatic sample.

Some of the problems with this study's methodology include:

1 In taking measurements of subjects, the examiner may have inadvertently altered the patient's required position. Another possible error may have occurred with landmarking. Although all the measurements in this project were performed by one student investigator, slight errors in measurements may have contributed to decreased accuracy; however, we do not believe this will have had an overall significant effect.

2 Since soft tissue mass of the neck and shoulder varies between individuals, bony landmarks were used for taking the measurements in this study. The soft tissue bulk in some subjects may have contributed to errors in measurement, due to improper landmarking or measurement interpretation.

3 As this is an original-design pillow, and no other commercially available pillows were assessed, we are not able to extrapolate our findings to any other cervical pillow.

4 The alotted pillow evaluation time of 10 minutes may not have been sufficient for subjects to evaluate the pillow adequately. This is a potentially very significant failing of this study. If subjects had been given a longer time (for example overnight) to choose their preferred pillow side, the results may have been quite different.

Conclusion

Our search of literature did not reveal any studies addressing the relationship between patients' external cervical measurements and preferences of cervical pillow thick-

ness; moreover, we were unable to find tested criteria for prescribing a particular pillow design and/or size. Our study attempted to address this deficiency; however, because only one pillow was tested, we are not able to generalize these results to other cervical pillows.

The results of our study suggest that the three cervical measurements assessed may not serve as good predictors for size preference for this type of cervical pillow. If however, patients were able to assess the pillow for a longer period of time, there may yet be a clinically significant correlation between pillow size preference and cervical measurements; therefore, further study on asymptomatic and symptomatic individuals addressing the methodological problems cited above are recommended. For the reasons cited above, the results of this study do *not* suggest a "one-size" pillow fits all. Patients may still require a selection of cervical pillow thicknesses; therefore, pending further investigation of this clinical problem, it may be prudent to continue recommending double-contoured or other variably-sized pillows to neck pain patients.

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