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ORIGINAL ARTICLE

Text neck and neck pain in 18–21-year-old young adults

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Abstract

Purpose The aim of this study was to investigate whether there is an association between text neck and neck pain in young adults.

Methods Observational cross-sectional study with 150 18–21-year-old young adults from a public high school in the state of Rio de Janeiro was performed. In the self-report questionnaire, the participants answered questions on sociodemographic factors, anthropometric factors, time spent texting or playing on a mobile phone, visual impairments, and concern with the body posture. The neck posture was assessed by participants' self-perception and physiotherapists' judgment during a mobile phone texting message task. The Young Spine Questionnaire was used to evaluate the neck pain. Four multivariate logistic regression models were fitted to investigate the association between neck posture during mobile phone texting and neck pain, considering potential confounding factors.

Results There is no association between neck posture, assessed by self-perception, and neck pain (OR = 1.66, $p = 0.29$), nor between neck posture, assessed by physiotherapists' judgment, and neck pain (OR = 1.23, $p = 0.61$). There was also no association between neck posture, assessed by self-perception, and frequency of neck pain (OR = 2.19, $p = 0.09$), nor between neck posture, assessed by physiotherapists' judgment, and frequency of neck pain (OR = 1.17, $p = 0.68$).

Conclusion This study did not show an association between text neck and neck pain in 18–21-year-old young adults. The findings challenge the belief that neck posture during mobile phone texting is associated to the growing prevalence of neck pain.

Keywords Neck pain · Cervical pain · Mobile phone

Introduction

Neck pain is the fourth cause of disability around the globe [1]. This public health problem has been increasing considerably since the last decade. The prevalence in late adolescence is almost the same as in adults and is as high as the prevalence of low back pain [2–7]. There has been a potentially harmful increased use of and addiction to mobile phones for texting, especially among young people, in recent years, combined with the growing prevalence of neck pain [4, 8–10]. There is evidence that, compared to neutral standing, subjects display a more forward head posture when viewing a mobile phone screen [11, 12]. Furthermore, a forward head posture may increase the mechanical load on joints and ligaments of the cervical spine and may boost the demand on the posterior neck musculature by the increased gravitational moment [13–15]. Altogether, these facts raise a biomechanically based hypothesis that the inappropriate neck posture to text and read on a mobile phone, called text

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neck, may be the main explanation for the increasing prevalence of neck pain in this population [12, 13, 16–18].

The link between neck posture and neck pain is unclear [19]. Only one observational study regards mobile phone texting as an exposure variable. In a recent longitudinal study, Gustafsson et al. [20] found no association between texting on a mobile phone and new episodes of neck pain. Nevertheless, that study did not assess the type of neck posture adopted during mobile phone use. Therefore, the aim of this study was to investigate whether there is an association between text neck and neck pain in 18–21-year-old young adults.

Methods

This cross-sectional study enrolled a convenience sample composed of 150 students between 18 and 21 years old from a public high school in Rio de Janeiro, Brazil. The exclusion criteria were pregnancy and spinal surgery or any musculoskeletal or neurological diseases that did not allow a standing posture. The Institutional Ethics Committee at the Augusto Motta University Centre approved this study before execution (CAAE 55790816.6.0000.5235). All the participants were informed of the objectives and procedures of the study and signed a written informed consent form prior to enrolment, including explicit consent to use their image.

Self-reported measures

The participants were initially assessed to answer sociodemographic (age, gender) and anthropometric (weight, height) questions. The screen time using a mobile phone, including any apps (e.g. social media, texting and game), was assessed with the question: 'On a regular day, how long do you spend reading, texting and playing on your mobile phone?' The nine-item ordered options were: 'I use a mobile phone only to talk', 'less than 1 hour', and options ranging from 'about one hour' to 'about seven hours or more'. The questions about vision acuity were the following: 'Do you have a visual impairment?' (response options were: 'yes' or 'no') and 'If you have a visual impairment, do you wear glasses or lenses?' (response options: 'yes', 'no', or 'yes, but I am not wearing them today'). The participants were allowed to use corrective devices for the photographs. All students between 18 and 21 years old were invited to participate, regardless their texting behaviour and their scholarship.

To assess the concern with body posture, we asked the following question: 'How often do you worry about your body posture?' The response options were based on a five-item Likert scale and comprised: 'very often', 'often', 'once in a while', 'rarely', or 'never'.

Neck pain

Neck pain was assessed with a body chart and the following questions based on the Young Spine Questionnaire [21]. The outcome neck pain was assessed by the question 'Have you had neck pain in the past week?' The response options were 'yes' or 'no'. The outcome frequency of neck pain was assessed by the question 'How often have you had pain in the neck?' The response options were 'very often', 'often', 'once in a while', 'rarely', or 'never'. For the multivariable analysis, a dichotomised variable was created: 'very often/often/once in a while' versus 'rarely'/'never'.

Text neck

Text neck was defined as the third or the fourth illustration of a person texting, on a mobile phone (Fig. 1) and inappropriate posture or excessively inappropriate posture in the photographic analysis (Fig. 2).

Self-perception

The self-perception of neck posture during mobile phone use was assessed using a question illustrating a person texting on a mobile phone adopting four different neck postures (Fig. 1). There were four response options. For the multivariate analyses, a dichotomised variable was created for the exposure text neck assessed by self-perception: '1' or '2' [no text neck] versus '3' or '4' [text neck]. Prior to the study, the question with the illustrations was assessed by a committee of three physiotherapists specialised in musculoskeletal pain, with the aim of developing the final version.

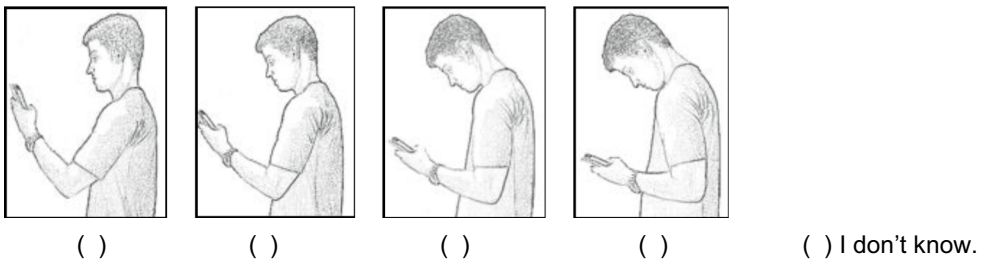

Fig. 1 Which is your most frequent position while using a mobile phone? Please choose one of the five options below

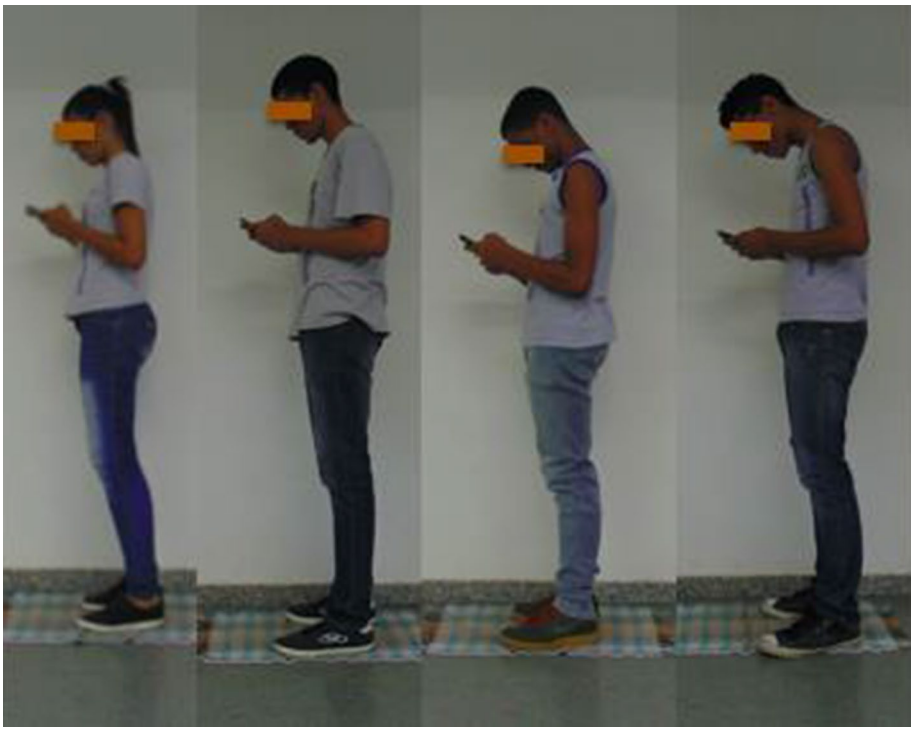

Fig. 2 The posture profile examples in sequence, from left to right: appropriate posture, acceptable posture, inappropriate posture, excessively inappropriate posture

Photographic analysis

Lateral photographs were taken with the subjects standing in their habitual posture at a mark on the floor as in a previous study [22]. The verbal command was: 'stand normally, relax, and type the text: "the thing I like to do most is…" on your mobile phone'. Digital photographs (4608 × 2592 pixels) were taken with a digital camera (Sony DSC-H100, Japan) placed on a tripod 0.8 m high and 2.5 m lateral to the participant.

The photographs were imported to a computer and sent to two raters with 10 years of clinical experience in musculoskeletal physiotherapy and to one rater with 17 years of clinical experience. The illustration with the four postures used for the self-report was shown to the raters, who were instructed to pragmatically classify the posture based on the magnitude of the protrusion and/or flexion of the head in the picture as 'normal' (=1), 'acceptable' (=2), 'inappropriate' (=3), and 'excessively inappropriate' (=4) (Fig. 2). One dichotomised variable ('1' or '2' [no text neck] versus '3'or '4' [text neck]) for each physiotherapist's response was created. For the multivariate analysis, the exposure text neck assessed by physiotherapists' judgment was created considering the decision made according to the absolute agreement of at least two out of the three raters. In other words, text neck was the combination of the result of the three dichotomised variables.

Sample size

Previous authors have suggested that samples for multivariate logistic regression models require at least 10 events per candidate per variable [23]. As the higher number of variables included in one of the models was four, and the lower number of events of the models was 54, we had at least 13 events per variable.

Statistical analysis

All analyses were performed using the RStudio version 0.99.486. Participants' characteristics were described using proportions and mean and standard deviations. Four logistic models were fitted to investigate the association between text neck during mobile phone texting and neck pain. Neck posture assessed by self-perception or physiotherapists' judgment was modelled as the independent variable, whereas neck pain or frequency of neck pain was modelled as the dependent variable. Potential confounding factors (age, gender, height, weight, time spent texting, vision conditions, and body posture concerns) with a $p < 0.2$ in the univariate analysis were also included in the logistic regression models.

Results

Our sample was comprised of 51.3% women, with a mean age of 18.4 (SD = 0.7) years (Table 1). The majority of the participants (76.6%) reported more than 4 h of mobile phone use per day. Almost half of the participants (45.3%) had visual impairments. A proportion of 81.4% of the participants reported that they had been concerned with their posture at least once in a while. Considering the four illustrations of posture, the majority of the participants chose the 'inappropriate' posture (57.6%), followed by the 'excessively inappropriate' posture (24.8%), the 'acceptable' posture (15%), and the 'normal' posture (0.3%). As a binary variable ('1' or '2' = 0; '3' or '4' = 1), 15.3% of the participants self-reported a normal/acceptable posture, and 84.7% self-reported text neck. The physiotherapists' judgment (agreement of at least two opinions) classified 40% of the participants as text neck.

The test–retest percentage agreement of the self-perception of the posture during mobile phone use was 91.1%, and the *k* coefficient was substantial (Kappa = 0.74, IC 95% 0.54–0.86). The percentage agreement of the three raters regarding the photographic analysis of the posture during mobile phone use was 66.2%, and the *k* coefficient was moderate (Kappa = 0.5, IC 95% 0.39–0.61).

Neck pain was reported by 36% (95% CI 28.4–44.3%) of the sample. Multivariate logistic regression analysis showed that there is no association between neck posture, assessed by self-perception, and neck pain (OR = 1.66, 95% CI 0.64–4.33), nor between neck posture, assessed by physiotherapists' judgment, and neck pain (OR = 1.23, 95% CI 0.56–2.66) (Table 2). Univariate analysis showed female gender, lower weight, and visual impairments as potential confounders ($p < 0.2$). However, none of the confounders were persistently associated to the outcome after the multivariate logistic regression analysis.

Regarding the association between the exposure variables and the outcome frequency of neck pain, multivariate logistic regression analysis showed no association between neck posture assessed by self-perception and frequency of neck pain (OR = 2.19, 95% CI 0.89–5.34), nor between neck posture assessed by physiotherapists' judgment and frequency of neck pain (OR = 1.17, 95% CI 0.55–2.49). Univariate analysis showed female gender and higher weight as potential confounders ($p < 0.2$). However, only female gender was persistently associated to neck posture after the multivariate logistic regression analysis (OR = 3.48, CI 95% 1.25–9.72).

Table 1 Characteristics of the participants

Gender		Visual impairment	
Male	48.7% (73)	Sim	45.3% (68)
Female	51.3% (77)	Não	54.7% (82)
Age(years)	18.4 (0,7)	Concern about the posture	
Height(cm)	167.8 (9.6)	Very often	8.7% (13)
Weight(kg)	65.18 (15.14)	Often	18.7% (28)
Mobile phone use		Once and while	54% (81)
Less than 1 h	3.3% (5)	Rarely	16% (24)
Between 1 and 2 h	6.0% (9)	Never	2.7% (4)
Between 3 and 4 h	14% (21)		
Between 5 and 6 h	25.3% (38)		
7 h or more	51.3% (77)		

Categoric data presented as percentages and number of participants

Continuous data presented as mean and standard deviation

Table 2 Adjusted Odds Ratios (OR) for the association between the text neck, assessed by self-perception or physiotherapists' judgment, and the outcomes neck pain or frequency of neck pain

	Neck pain			Frequency of neck pain		
	Adjusted OR	95% CI	*p* value	Adjusted OR	95% CI	*p* value
Self-perception	1.66	0.64–4.33	0.29	2.19	0.89–5.34	0.09
Physiotherapists' judgment	1.23	0.56–2.66	0.61	1.17	0.55–2.49	0.68

Models with the outcome neck pain were adjusted for weight, gender and visual conditions

Models with the outcome frequency of neck pain were adjusted for weight and gender

A secondary analysis showed that even considering the excessively inappropriate posture as the only poor posture classified by the committee of physiotherapists, there is still no association between the exposure variable and the outcome neck pain (OR = 0.91, 95% CI 0.39–2.17, $p = 0.84$).

Discussion

This study showed that neck posture during mobile phone texting, assessed by physiotherapists or by self-perception, was associated with neither neck pain nor the frequency of neck pain in 18–21-year-old young adults. Our results conflict with the idea that the mechanical stress caused by poor posture due to mobile phone use is a threat to cervical spine integrity [13]. Although the cervical spine seems to be more vulnerable in bending in cadaveric samples when compared to the lower back, the average compression force at which the cervical disc-vertebral body units reach their elastic limit is 540 lb before reaching breaking points [24]. This value is nine times greater than the 60 lb claimed by Hansraj [13]. Furthermore, Przybyla et al. [24] stated that living people might be able to resist and adapt to higher loads than cadaveric specimens. Unquestionably, there is an awkward neck position to be found in many mobile phone users but this does not, according to our results, imply an association with neck pain.

The majority of the studies that tested the association between neck posture and neck pain did not support the idea that bad posture is an important issue associated to neck pain. In a Swiss study, Grob et al. [25] found no association between global cervical curvature or segmental angles and neck pain. In a Japanese study with 762 participants, Kumagai et al.[26] also found no association between sagittal alignment of the cervical spine and neck symptoms. Among young populations, in a cross-sectional study with 1100 17-year-old adolescents, Richards et al. [27] found four different clusters of posture ('upright', 'intermediate', 'slumped thorax/forward head', 'erect thorax/forward head'). However, none of the clusters was associated to neck pain. The authors also found that the cluster 'slumped thorax/forward head' was associated with depressive symptoms. They suggested that neck pain is associated with changes in pain regulatory mechanisms rather than biomechanics.

On the other hand, there are a few studies pointing out an association between posture and neck pain. In a Portuguese study, Ruivo et al. [28] found an association between head protraction posture and neck pain. However, the authors did not consider potential confounding factors in the statistical analysis. Nejati et al. [29] showed that workers with neck pain had poorer posture of the cervical and thoracic spine, measured by high thoracic and craniovertebral angles, during working time.

A systematic review of prospective longitudinal studies found only female gender and a previous history of neck complaints as risk factors that predict an onset of neck pain [19]. In our study, female gender was persistently associated to the frequency of neck pain even after multivariate logistic regression analysis. In the first prospective longitudinal study about this issue, Gustafsson et al. [20] found no association between texting on a mobile phone and new episodes of neck pain. Nevertheless, the study did not assess the type of neck posture during the mobile phone use. The high percentage of participants who use a mobile phone for more than 4 h per day in our study is a concern, since the time spent with this device seems to be a risk factor for hand/finger symptoms [20]. Furthermore, an excess of screen time could lead to physical inactivity which is associated with neck and back pain in young adults [30, 31].

Our findings should be interpreted within certain limitations. A cross-sectional design precludes causal inference. The question of whether the participants started to adopt a better posture after having neck pain could only be responded with longitudinal studies. Another issue is that the head forward flexion posture was not objectively measured. However, as text neck arises from health professionals' observations, it is reasonable to consider the subjective photographic analysis made by the physiotherapists as a pragmatic way of assessing text neck. Furthermore, the reliability of the two assessment tools was, at least, acceptable for epidemiological studies. A possible assessment option, though less pragmatic, would be the photographic method to assess the sagittal head and cervical postures by head tilt angle, neck tilt angle, forward head shift, and gaze angle [12]. Future studies should also include photographic analysis of the sitting posture during mobile phone texting and a negative verbal command to text. Due to the wide confidence intervals, caution should be exercised when interpreting the results and an association may not be ruled out.

The strength of our study is that it is the first to test the association between text neck and neck pain. In addition, we used a multivariate analysis, adjusting for potential confounding factors, to test in different models the association between two pragmatic independent exposures with neck pain and with the frequency of neck pain.

This study did not show an association between text neck and neck pain or frequency of neck pain in 18–21-year-old young adults. Our findings challenge the belief that inappropriate neck posture during mobile phone texting is the leading cause of the growing prevalence of neck pain.

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Compliance with ethical standards

Conflict of interest None.

Research involving human participants and/or animals The Institutional Ethics Committee at the Augusto Motta University Centre approved this study before execution (CAAE 55790816.6.0000.5235).

Informed consent All the participants were informed of the objectives and procedures of the study and signed a written informed consent form prior to enrolment, including explicit consent to use their image.

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