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ORIGINAL ARTICLE

IMPACT OF SMARTPHONE USAGE ON CERVICAL SPINE PAIN COMPLAINTS

WPŁYW KORZYSTANIA Z TELEFONU KOMÓRKOWEGO NA WYSTĘPOWANIE DOLEGLIWOŚCI BÓLOWYCH KRĘGOSŁUPA SZYJNEGO

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ABSTRACT

Introduction

Mobile phones have become integral to daily life, increasing screen time and contributing to cervical spine pain, possibly due to non-ergonomic posture during smartphone use.

Aim

The study aimed to examine the relationship between cervical spine pain and phone usage time, considering respondents' physical activity levels.

Materials and methods

The survey included 70 respondents (average age 22.4 years). The questions concerned their occupation, cervical spine pain occurrence and intensity (Numerical Rating Scale), physical activity duration and intensity (Modified Borg Rating of Perceived Exertion). Additionally, respondents completed the Neck Disability Index and reported the daily phone usage over the past 14 days according to smartphone system data.

Results

70% of the respondents reported cervical spine pain (average intensity 3.6). Participants used their phones for 5 hours daily on average. 85.7% of the respondents were physicaly activie for 4.6 hours weekly on average, with an average intensity of 2.8. The average Neck Disability Index score was 6.1. No correlation was found between the pain intensity and the phone usage, nor between physical activity duration and intensity. No correlation was found between the Neck Disability Index score and phone usage or physical activity duration and intensity.

Conclusion

Cervical spine pain affects many young people. No relationship was found between phone usage time and pain intensity, but a tendency for longer smartphone usage was observed among individuals with higher Neck Disability Index scores. No impact of physical activity on pain was found. Further studies are needed on a larger group, considering additional factors.

Keywords: pain, mobile phone, cervical spine

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STRESZCZENIE

Wprowadzenie

Telefony komórkowe stały się nieodłącznym elementem codzienności, co spowodowało wydłużenie czasu spędzanego przed ekranem, a tym samym wzrost dolegliwości bólowych w odcinku szyjnym kręgosłupa. Przyczyną tego zjawiska może być nieergonomiczna pozycja ciała podczas użytkowania smartfona.

Cel

Celem badania było zbadanie zależności pomiędzy bólem odcinka szyjnego kręgosłupa oraz czasem używania telefonów, uwzględniając poziom aktywności fizycznej respondentów.

Materiał i metody

Ankieta została wypełniona przez 70 respondentów, średnia wieku wynosiła 22,4 lata. Pytania dotyczyły wykonywanej pracy, występowania i intensywności bólu odcinka szyjnego kręgosłupa (Numerical Rating Scale), czasu i intensywności (Zmodyfikowana Skala Borga) aktywności fizycznej. Ponadto ankietowani wypełnili Neck Disability Index oraz podali dzienny czas korzystania z telefonu z ostatnich 14 dni zgodnie z danymi systemowymi smartphona.

Wyniki

70% respondentów zgłosiło bóle odcinka szyjnego kręgosłupa o średniej intensywności 3,6. Uczestnicy używali telefonu średnio 5 godzin dziennie. 85,7% ankietowanych uprawiało aktywność fizyczną średnio 4,6 godzin w tygodniu ze średnią intensywnością 2,8. Średni wynik kwestionariusza Neck Disability Index wynosił 6,1. Nie wykazano korelacji pomiędzy intensywnością bólu, a czasem użytkowania telefonu oraz intensywnością i czasem wykonywania aktywności fizycznej. Nie wykazano także korelacji pomiędzy wynikami kwestionariusza Neck Disability Index, a czasem użytkowania telefonu oraz intensywnością i czasem wykonywania aktywności fizycznej.

Wnioski

Bóle odcinka szyjnego kręgosłupa dotyczą znaczącej części młodych ludzi. Nie wykazano związku pomiędzy czasem używania telefonu, a odczuwaniem bólu, jednakże zauważono tendencję do dłuższego korzystania ze smartfonów przez osoby z wyższymi wynikami kwestionariusza Neck Disability Index. Nie wykazano także wpływu aktywności fizycznej na dolegliwości bólowe. Konieczne są kolejne badania na większej grupie, uwzględniające dodatkowe czynniki.

Słowa kluczowe: ból, telefon komórkowy, odcinek szyjny kręgosłupa

Introduction

Mobile phones have become an inseparable part of our lives. The multitude of functions and available applications, along with quick access to information, increases the time spent using smartphones. In recent years, cervical spine pain complaints have become one of the most common musculoskeletal issues (Cevik *et al.,* 2020). More and more young people are suffering from these conditions. Students using smartphones most commonly report cervical spine pain (Cevik *et al.,* 2020). Pain results in poorer well-being, decreased quality of life, discourages physical activity, and complicates work tasks (Cevik *et al.,* 2020). While using a phone, the body adopts a non-ergonomic position, with the cervical spine consistently bent forward. Long-term static positions contribute to muscle overload

and the onset of pain, putting significant pressure on spinal structures and causing micro-damages to tissues (Cevik *et al.,* 2020, Alsalameh *et al.,* 2019). Furthermore, cervical lordosis is reduced (Maayah *et al.,* 2023). Some structures are stretched, while antagonistic muscles are contracted. This can lead to postural abnormalities, which may overload other spinal segments and even cause issues with temporomandibular joints (Foltran-Mescollotto *et al.,* 2023). An improper cervical spine position can result in concentration and memory problems, along with headaches (Jung *et al.,* 2024, Delen *et al.,* 2023, Fernández-de-Las-Peñas *et al.,* 2023). Despite the prevalence of pain complaints and frequent smartphone use among young people, there is still a lack of information regarding the relationship between these two factors.

Aim

The aim of the study was to investigate whether there is a relationship between cervical spine pain complaints and smartphone usage time. An additional objective was to explore whether the respondents' level of physical activity influences their perception of cervical spine pain.

Materials

70 respondents (54 women and 16 men, aged 34 ± 2.64 years, range: 19–34) participated in the study. The table below contains data related to the respondents' type of work and/or studies.

Table 1. Characteristics of respondents.

Declared professional activity and/or studies	Amount of people
Work	9
Study	29
Work and study	32

Methodology

Respondents completed an anonymous survey that included sections analyzing phone usage time, physical activity level, and cervical spine pain complaints.

Daily phone usage time was defined based on the "screen time" function of smartphones (available on both Android and iOS). Respondents were asked to provide the "screen time" for the last 14 days. Physical activity was determined through a survey, with questions about the type of physical activity and the hours spent engaging in sports. Activity intensity was defined using the Modified Borg Rating of Perceived Exertion (Scherr *et al.,* 2013). To assess pain intensity, respondents completed the Neck Disability Index, validated in Polish (Guzy *et al.,* 2013). Based on the results of the questionnaire, their level of disability was evaluated, as shown in Table 2. Respondents were also asked to describe the nature and frequency of cervical spine pain. Pain intensity was rated using the Numerical Rating Scale from 0 to 10.

Statistical analysis

The Statistica (13.1) program was used for data analysis.

Shapiro-Wilk's test was used to check for normal distribution. For normally distributed variables, Student's t-test was used, while the Mann-Whitney U test was used for non-normally distributed variables.

The statistical significance threshold was set at $p < 0.05$.

Results

Aggregated analysis of the sample group

According to the survey, respondents spent an average of 5 hours per day using their mobile phones. The minimum reported phone usage time was 1.5 hours per day, and the maximum was 9 hours per day. Respondents' average physical activity time was 4.6 hours per week, with a minimum of 0 hours per week and a maximum of 14 hours per week. The average Neck Disability Index score was 4.1 points,

Table 2. Level of disability based on the number of points scored on the Neck Disability Index questionnaire.

Level of disability	The amount of points scored in the Neck Disability Index questionnaire
No disability	0–4
Mild disability	5–14
Moderate disability	15–24
Severe disability	25–34
Complete disability	35–50

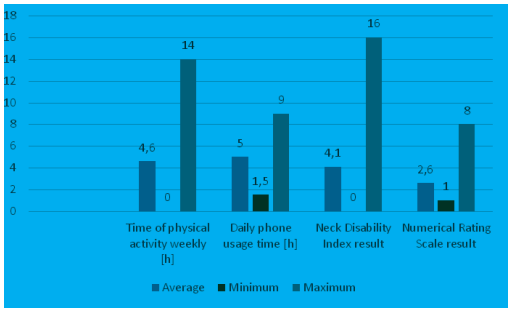

Figure 1. Average time spent using the telephone, time spent being physically active, Numerical Rating Scale subjective pain score and Neck Disability Index questionnaire score among respondents

with a minimum of 0 and a maximum of 16. Pain was rated on average 2.6 on the NRS scale, with scores ranging from 1 to 8.

Respondents' level of disability

Based on the Neck Disability Index results, 26 respondents reported no disability, 42 had mild disability, and 2 had moderate disability. None of the respondents scored in the severe or complete disability range.

Gender variation in results

The time spent using the phone was similar for men and women. Men reported engaging in sports 1.5 hours more per week than women, though this difference was not statistically significant ($p = 0.2371$). Women reported twice as much pain on the Numerical Rating Scale compared to men, and this difference was statistically significant ($p = 0.007$). Women also scored higher on the Neck Disability Index.

Variation in results by duration of phone use

No statistically significant differences in Neck Disability Index scores or Numerical Rating Scale scores were found between respondents who used their phones for less than 4 hours per day and those who used them for 4 hours or more. However, there was a trend towards a higher Neck Disability Index score among those using their phones for more than 4 hours per day.

Variation in results by duration of physical activity

No significant differences were observed between respondents who reported engaging in physical activity for less than 5 hours per week and those who engaged in more than 5 hours per week, either in the Neck Disability Index or Numerical Rating Scale scores.

Relationship of complaints to time of phone use and physical activity

According to the collected data, no correlation was found between cervical spine pain intensity and time spent using the phone or physical activity time.

Table 3. Telephone usage time, physical activity time, Numerical Rating Scale subjective pain score and Neck Disability Index questionnaire score among men and women.

Factor / Daily phone usage time [h]	Repondents whose time using the phone was less than 4 hours		Repondents whose time using the phone was more than 4 hours		Value p
	mean	min. – max.	mean	min. – max.	
Numerical Rating Scale result	2.1	0–7	2.9	0–8	0.1765
Neck Disability Index result	4.2	0–16	6.6	0–15	0.0904

The table shows the mean value, standard deviation (SD) and p-value.

Table 4. Comparison of subjective pain scores according to the Numerical Rating Scale and Neck Disability Index questionnaire scores between those using the phone less than 4 hours a day and respondents using the phone for longer or equally 4 hours a day.

Factor / Gender	Women		Men		Value p
	mean	SD	mean	SD	
Daily phone usage time [h]	4.9	1.6	5.1	2.1	0.6420
Time of physical activity weekly [h]	4.3	2.9	5.9	4.3	0.2371
Numerical Rating Scale result	3	2.1	1.5	2.2	0.007
Neck Disability Index result	6.8	4	5	2.4	0.0161

The table shows the mean, minimum, maximum and p-value.

Table 5. Comparison of subjective pain scores according to the Numerical Rating Scale and the results of the Neck Disability Index questionnaire between those who are physically active less than 5 hours per week and respondents who are physically active equally or more than 5 hours per week.

Factor / Time of physical activity weekly [h]	Respondents whose time doing physical activity was less than 5 hours		Respondents whose time doing physical activity was more than 5 hours		Value p
	mean	min. – max.	mean	min. – max.	
Numerical Rating Scale result	2.8	0–8	2.6	0–7	0.5888
Neck Disability Index result	6.5	1–16	5.6	0–4	0.3282

The table shows the mean value, the range from minimum to maximum value and the p-value.

Table 6. Correlation between time of phone use and physical activity and intensity of cervical spine pain.

Correlation / Factor	Pain intensity	
	value r	value p
Phone usage time	0.0411	0.7357
Time of physical activity	0.117	0.3344

The table shows the r-value and the p-value.

Table 7. Correlation between phone use time and physical activity and Neck Disability Index questionnaire scores.

Correlation / Factor	Neck Disability Index	
	value r	value p
Phone usage time	0.0511	0.6743
Time of physical activity	0.2020	0.0937

The table shows the r-value and the p-value.

No correlation was found between Neck Disability Index scores and time spent using the phone or physical activity time.

For parametric data, Pearson's r correlation coefficient was used, and for non-parametric data, Spearman's rank correlation coefficient was applied.

Discussion

Aggregated analysis of the sample group

This study aims to determine the impact of smartphone use on cervical spine pain among young people.

The average time spent using a phone daily is concerning, amounting to nearly 20% of

the day (5 hours daily). After subtracting sleep time, it approaches 30%. The study by Ayhualem *et al.* showed similar time of phone usage daily (Ayhualem *et al.,* 2021). Young people spend a similar number of hours a day in front of a screen daily as they do on sports activities for an entire week.

Respondents' level of disability

It is surprising that 60% of young, healthy people report a Neck Disability Index score indicative of mild disability. Almost identical results were obtained in the study by Czępińśka *et al.* (Czępińska *et al.,* 2024).

Gender variation in results

The literature shows that women are more likely to report complaints of pain than men (Ayhualem *et al.,* 2021, Salameh *et al.,* 2024). Interestingly, our study conduct that women reported twice as much pain as men, despite having similar phone usage times and slightly lower physical activity levels.

Variation in results by duration of phone use

Contrary to expectations, no correlation was found between cervical spine pain intensity and phone usage duration. These results align with other studies (Cevik *et al.,* 2020, Maayah *et al.,* 2023, Foltran-Mescollotto *et al.,* 2021, Alsalameh *et al.,* 2019).

A study of 867 medical students by Maayeh *et al.* found that the number of hours spent using a phone while studying was one of factors that caused cervical spine pain. In addition, it has been shown that the most important factor which influence the experience of cervical spine pain while using the telephone was past trauma to this area (Maayah *et al.,* 2023). It can be assumed that, due to the young age of the respondents and therefore better recovery, the unfavourable position did not have a significant impact on the onset of the complaints (Maayah *et al.,* 2023). In the study by Cevik *et al.* the study group was of a similar age to the above study. They performed MRIs of the cervical spine on all examined patients. The presence of degenerative changes, Modic changes, protrusions or extrusions were assessed and the angle of cervical lordosis was measured. It was shown that people who use the phone for more than three hours a day had statistically significantly more degenerative and Modic-type lesions than those who use the phone for less than three hours a day. Furthermore, prolonged smartphone use was associated with a reduction in cervical lordosis of the spine. These negative changes can be associated with the onset of pain in the cervical spine, increased muscle tension and the occurrence of headaches. Although our study did not show a correlation between the incidence of cervical spine pain and the duration of phone use there was a trend towards a higher disability score according to the Neck Disability Index questionnaire among those using the phone longer. The authors state that degenerative changes of the spine begin to appear after the age of 20 so the age of the respondents may be relevant to the results of the above study, as the majority of respondents are students. Although similar studies have been carried out in different age groups majority of them refer to people of university age. More and more middle-aged and older people use mobile phones and therefore there is a need for more research in higher age groups (Maayah *et al.,* 2023).

In a study of 20 students, there was no correlation that excessive time spent in front of a screen was directly related to the occurrence of cervical spine pain. Despite taking up a position with a flexed cervical spine and head protraction which is negative for joints and soft tissues among young people as in the study conducted there is no effect on the reporting complaints of cervical spine pain (Foltran-Mescollotto *et al.,* 2021).

In a study conducted on a group of medical students, the most common complaint reported in relation to phone use was cervical spine pain. It was shown that students who did not report cervical spine pain were not dependent on phone use (Alsalameh *et al.,* 2019).

Relationship of complaints to time of phone use and physical activity

Our study did not demonstrate an effect of systematic sports activity on the reduction of cervical spine pain. Other studies, despite an age-similar study group, have shown an effect of physical activity on the likelihood of cervical spine pain. They showed that regular exercise reduces the risk of neck discomfort (Salameh *et al.,* 2024, Ayhualem *et al.,* 2021).

Study by Ayhualem *et al.* found a significant effect of breaks during smartphone use on cervical pain. A lack of breaks during phone use increases the likelihood of neck discomfort by as much as 3 times (Ayhualem *et al.,* 2021).

Prevention of pain during phone usage

Nowadays it is impossible to give up the conveniences of mobile phones. It is likely that the time spent in front of the phone will increase so it is important to educate the patient and implement the prevention of cervical spine overload. Changing positions and taking short breaks putting the phone away will be a good recommendation for people who spend a lot of time in front of the screen. In addition, ergonomic principles such as supporting the forearms on a table and positioning the device as close to the eye line as possible can reduce the risk of cervical spine pain (Maayah *et al.,* 2020).

We believe that our results do not prove that there is no effect of the duration of phone use, but reflect the high compensatory capacity of young people. We believe that changes may have a cumulative effect the body increasing the risk of degenerative changes, while this requires a study on an older group as well as long-term prospective studies.

Conclusions

Cervical spine pain is prevalent among a significant portion of young people.

No direct correlation was found between phone usage duration and cervical spine pain, although there was a trend toward higher Neck Disability Index scores among those who used smartphones longer.

Physical activity had no significant impact on cervical spine pain or complaint intensity.

Further research with a larger sample size and consideration of additional factors is necessary.

Declarations

The authors declare no conflicts of interest related to this study.

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