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Submitted: 10/04/2023 - Accepted: 10/05/2023 - Published: 23/06/2023

Health Technology: Stretching Exercises Through an Application Prototype for Deskets With Cervicalgia: Pilot Study

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Abstract

Introduction: Neck pain is painful symptoms in the neck and shoulders in which might lead to withdrawal from work activity. Objective: This study aimed to assessment the effect of stretching exercises guided by a prototype app on neck pain in secretaries. Quantitative approach and case series study. A sociodemographic profile questionnaire and the Visual Analogue Scale were accomplished to identify pain intensity. Result: Considering four participants in this study, all had fourty hours a week of work, with a mean age of 36.25 ± 8.65 , single and white ethnicity 75%. The average pain intensity of the research participants before the intervention was 8.5 ± 1.29 points, reducing

to 4 ± 0.81 points in the final evaluation. Conclusion: The results indicated that the prototype application with exercises for the cervical region was efficient in reducing the intensity of pain in the cervical region of the research participants.

Keywords: quality of life, worker's health, musculoskeletal system, telemedicine.

Introduction

Technologies are shaping our lives, work, and interaction since the digital revolution, and innovations (e.g., artificial intelligence and virtual reality) played an integral role in every aspect of society (Decary, 2019).

Those technologies enable quick information exchange, the automation of complex tasks, instant global connection, and the creation of interactive and engaging experiences. However, this technological advancement also brings challenges such as privacy issues, cybersecurity, and social and ethical impacts. As we continue to adopt and adapt these technologies into our everyday lives, it is essential to find a balance between their benefits and their potential consequences (Mayberry, 2019).

Among these technologies in the work activities of secretaries, the frequent use of computers stands out, which is associated with an increase in complaints of musculoskeletal disorders, notably neck pain, characterized by pain in the cervical region (Panahi & Tremblay, 2018).

Neck pain is not only a common symptom but also has a significant impact on the quality of life and functional capacity of individuals. The relevance of this problem is notorious, since pain in the cervical region is one of the main reasons for seeking medical assistance, generating consequent additional costs in the health system. Ranking as the fourth leading cause of disability (Kazeminasab, 2022).

Research regarding prevalence and its implications on neck pain has been relatively limited comparing to other disabling diseases. While neck pain can be treated and resolved in some cases, many episodes persist with varying degrees of discomfort. Neck pain has not received attention from governments and researchers and requires appropriate interventions to improve the quality of life and functional capacity of individuals (Safiri, 2020).

Given this scenario, mobile applications have stood out as educational tools in health, increasing being incorporated into people's routines. Some of these applications, focused on health care, offer various functionalities, including gamification, allowing the development of specific strengthening and stretching exercise protocols to mitigate neck pain symptoms (Oakley-Girvan, 2022).

This study sought to evaluate the effectiveness of exercises guided by a prototype application in relieving neck pain symptoms in secretaries, aiming to improve their quality of life and well-being.

Methodology

Approved by the Ethics and Research Committee of the University Center of Maringá, under opinion: 3,702,247. So, it is a case series study with a quantitative approach. It counted with the participation of four secretaries from a party organizer company in a countryside-city in State of Paraná. The inclusion criteria were based on the subjects facing pain in the cervical region for any reason for more than three months, being 18 years old or older and owning a smartphone.

The first assessment took place face-to-face by the authors, after the participants instructed to download the prototype on their cell phones and oriented on how to handle it. Hence, a WhatsApp group was created.

The application prototype called Proneck in this study was in the initial development phase, so the initial registration screen (Figure 1) and the second screen with stretching exercises for the cervical region were inserted in its programming. The participants performed the exercises for two weeks, three times a week and twice a day, totaling 12 sessions.

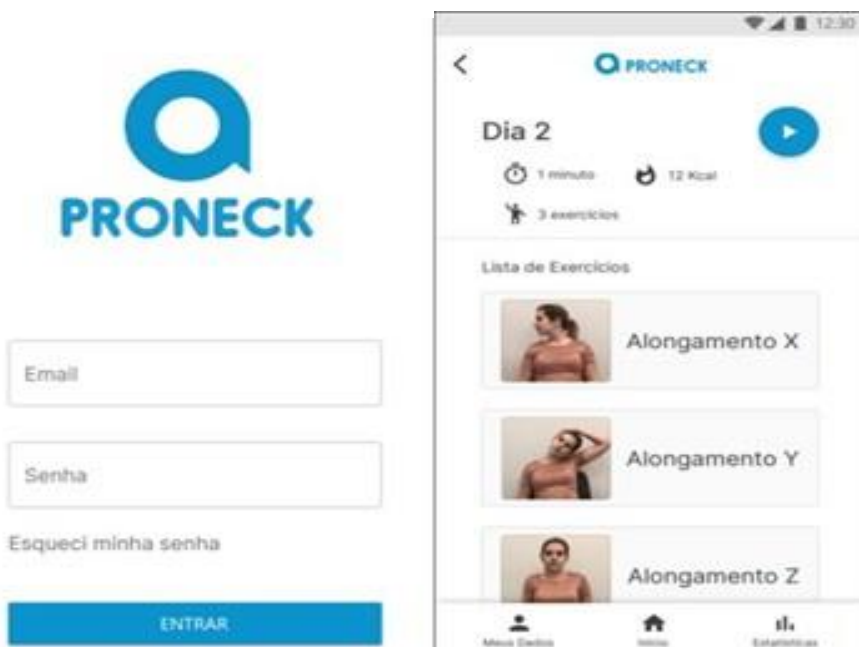








Figure 1- Interfaces in the application prototype development phase.

Table 1 presents the guidelines presented in the prototype through image and text on posture and performing the movement in time or repetitions and guidance for completing the exercise.

Table 1- Stretching exercise protocol.

Exercise		Description	Time/repetitions
	cervical flexion	Sit correctly in the chair with your feet flat on the floor, lean your head forward and place both hands on top of it.	Hold the stretches for 30 seconds.
	cervical extension	Sit correctly in the chair with your feet flat on the floor, tilt your head back and fingers resting on your chin with your palms touching.	Hold the stretches for 30 seconds.
	right lateral flexion	Sit correctly on the chair with your feet flat on the floor, tilt your head to the right with the help of your hand.	Hold the stretches for 30 seconds.
	left lateral flexion	Sit correctly on the chair with your feet flat on the floor, tilt your head to the left with the help of your hand.	Hold the stretches for 30 seconds.
	Shoulder flexion to 90° with internal rotation	Sit correctly in the chair with your feet flat on the floor, extend your arms forward to shoulder height.	Hold the stretches for 30 seconds.
	Shoulder flex to 180° with internal rotation.	Sit correctly in the chair with your feet flat on the floor, extend your arms forward and raise them above your head.	Hold the stretches for 30 seconds.

For the evaluation of the departments in the pre, immediate post-intervention and after six months, a sociodemographic profile form and the Visual Analog Scale (VAS) were used to identify the intensity of pain, composed by a 10 cm line that has, in general, as extremes the phrases “absence of pain and unbearable pain” accompanied by the numbers from 0 to 10 (JENSEN, 1986). The secretaries also answered questions about the difficulties encountered while using the prototype to perform the

exercises. After six months of intervention, the researchers contacted the participants, when the Visual Analog Scale (VAS) was again accomplished and questions were asked about the difficulties and facilities to continue performing the exercises during these six months.

The research participants were informed in advance and clarified about the research and the previously structured Free and Informed Consent Form was agreed. Subsequently, the instruments for evaluation already described were applied, and the immediate and late reassessment intervention was carried out (after six months).

Data were tabulated in SPSS software version 25 and treated using descriptive statistics (mean, relative frequency, tables and graphs).

Results

Table 1 shows the sociodemographic profile of the study participants. The mean age was 36.25 ± 8.65 years, and they remained in a sitting position daily in front of the computer for at least 6 hours.

Table 1- Sociodemographic profile of the secretaries (n= 4).

Participant	Age	Marital status	Family income	Educational level	Race	Length of time in the job	n° professional activities
1	32	Married	3 a 4 Ms	High school complete	Black	5 years	1
2	28	Single	1 a 2 Ms	High school complete	Black	2 years	2
3	48	Single	1 a 2 Ms	High school complete	white	5 years	1
4	37	Married	3 a 4 Ms	High school complete	Black	6 years	2

Ms: minimum salary

The Figure 1 shows the pain intensity of each participant before and after the two weeks of intervention. Mean pain intensity before and after the intervention was 8.5 ± 1.29 and 4 ± 0.81 , respectively.

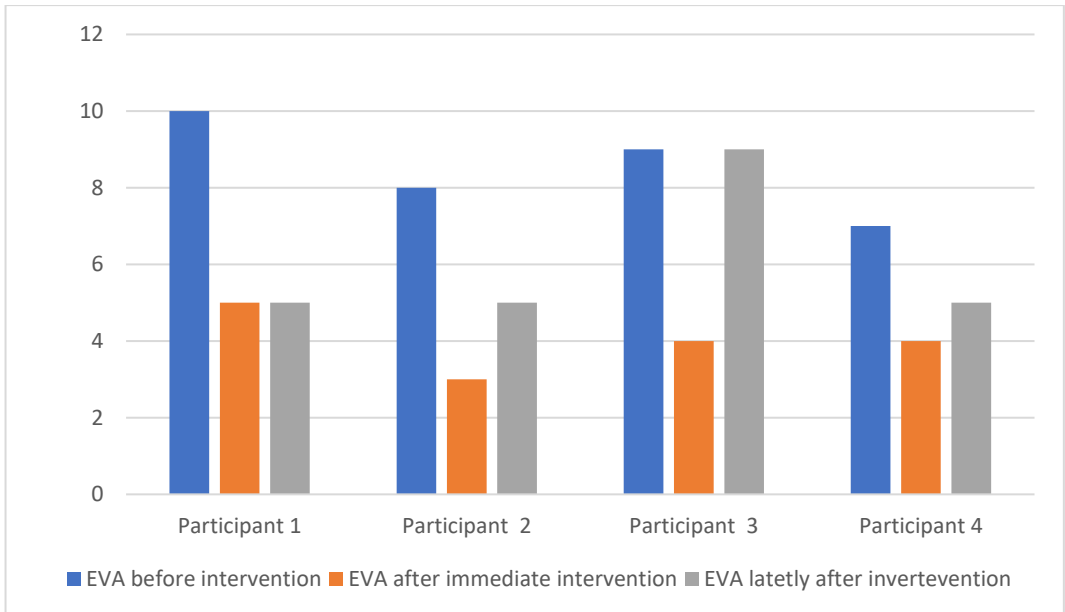


Figure 1- Scores of the Visual Analog Scale (VAS), in the pre- and post-intervention moments of the secretaries and 6 months after the intervention.

In Table 1, it is possible to observe the difficulties encountered during the intervention with the prototype. All participants answered that the greatest difficulty found was not having a stopwatch in the prototype to guide the exercise time.

Table 1 – Difficulties reported by research participants during the intervention.

Participant	Dificuldades
Participant 1	Not having a timer and not having an exercise video.
Participant 2	Not having a stopwatch; the prototype does not notify the time to perform.
Participant 3	Not having a timer, and sometimes the prototype screen crashes.
Participant 4	Not having a timer and not having a video with the exercises.

In chart 2, the difficulties and facilities after the intervention with the prototype were reported, with the majority pointing out that they no longer had the prototype to perform with the exercises and the failure was to have learned which exercises to be performed that help to reduce the pain in the cervical region.

Table 2- Reassessment of secretaries after six months of intervention.

Participant	Dificuldades	Facilidades
Participant 1	No longer having the prototype to guide the exercises and encourage them to perform.	With the prototype it was possible to learn the exercises to have a better idea of what can be done during the work activity. He continued to perform the exercises.
Participant 2	The intervention helped to maintain daily exercise, but not as frequently. He continued performing the exercises.	The intervention helped to maintain daily exercise, but not as frequently. He continued performing the exercises.
Participant 3	The prototype encourages the performance of the exercises.	The intervention helped to keep the exercises on a daily basis, but not as often. He continued to perform the exercises.
Participant 4	Without the prototype, there is no more incentive to continue, and for not having the notification during the day to perform the exercises.	With the prototype it was possible to learn the exercises to have a better idea of what can be done during the work activity. He continued to perform the exercises.

Discussion

The study was composed of only women, as the literature shows that pain in the cervical region always affects females more, which might be explained by the hormonal composition of the woman and the double workday and having multiple tasks as a mother, wife, housewife and work activity, which can significantly influence a poor quality of life (Safiri, 2022).

One of the limitations faced in physical exercise therapies is the low adherence level to prescribed exercises and lower adherence to perform the exercises, implying on less effective therapy. However, mobile applications show better adherence to exercise programs observed in this study where most participants reported that, after six months of intervention, they did not continue the exercises as they did not have the prototype helping (Hewitt, 2020).

There is no consensus in which physical exercise is more effective in cervical pain. However, this study showed that stretching exercises were sufficient to reduce the

pain of the secretaries. So, if the participants were associated with interventions in the psychological and mental dimensions, the results should be better expressive (Babatunde, 2017).

Physical stretching exercises in the workplace proved to be effective in relieving pain in the cervical region of secretaries, emphasizing that it is still necessary to associate active/aerobic mobilization, strengthening and relaxation exercises that are considered essential for pain relief. (Miyamoto, 2019).

Apps are being considered as a support for health professionals to promote and prevent health into the unrestricted population in addition to being related to the theory of behavioral change and becoming even more effective in the population of workers (Lee, 2018). Therefore, apps usage on desks during work activity can decrease muscle tension during computer use, which is considered a factor which impacts on neck pain increase (Annan, 2021).

In view of this, it is noteworthy that it is possible to improve satisfaction in the work environment, reduce financial expenses, leave from work activities and a better quality of life for workers (Nagata, 2018).

After six months of intervention, three of the four participants continued to perform physical exercises. This result is aligned with the study by Annan et al. (2021) that after 12 months of intervention with a chatbot, the participants had a similar adherence, proving to be effective those technologies usage in musculoskeletal disorders.

The use of these technology tools are effective in improving the quality of life in the female population, as well as reducing pain, better performance of physical activity in a more interactive and accessible way for everyone (Arfaei, 2021 & Pelle, 2020 & Thongtipmak, 2020)

Conclusion

Although not reaching a complete relief, we concluded that the app prototype with stretching exercises for the cervical region is a way to reduce pain intensity in the cervical since this research was a pilot study. In the future, we intend to carry out this research in large number of participants.

Acknowledgment

Coordination for the Improvement of Higher Education Personnel (CAPES).

Bibliography

- [1] Dé Cary, S., Barton, J. L., Proulx, L., Richards, D. P., Paterson, G., de Wit, M., & Toupin-April, K. (2020). How to Effectively Support Patients with Rheumatic Conditions Now and Beyond COVID-19. *ACR Open Rheumatology*, 2(9), 505.

- [2] Mayberry, L. S., Lyles, C. R., Oldenburg, B., Osborn, C. Y., Parks, M., & Peek, M. E. (2019). mHealth interventions for disadvantaged and vulnerable people with type 2 diabetes. *Current diabetes reports*, 19, 1-15.
- [3] Panahi, S., & Tremblay, A. (2018). Sedentariness and health: is sedentary behavior more than just physical inactivity?. *Frontiers in public health*, 6, 258.
- [4] Kazeminasab, S., Nejadghaderi, S. A., Amiri, P., Pourfathi, H., Araj-Khodaei, M., Sullman, M. J., ... & Safiri, S. (2022). Neck pain: global epidemiology, trends and risk factors. *BMC musculoskeletal disorders*, 23(1), 1-13.
- [5] Safiri, S., Kolahi, A. A., Hoy, D., Buchbinder, R., Mansournia, M. A., Bettampadi, D., ... & Ferreira, M. L. (2020). Global, regional, and national burden of neck pain in the general population, 1990-2017: systematic analysis of the Global Burden of Disease Study 2017. *bmj*, 368.
- [6] Oakley-Girvan, I., Yunis, R., Longmire, M., & Ouillon, J. S. (2022). What works best to engage participants in mobile app interventions and e-health: a scoping review. *Telemedicine and e-Health*, 28(6), 768-780.
- [7] Hewitt, S., Sephton, R., & Yeowell, G. (2020). The effectiveness of digital health interventions in the management of musculoskeletal conditions: systematic literature review. *Journal of medical Internet research*, 22(6), e15617.
- [8] Babatunde, O. O., Jordan, J. L., Van der Windt, D. A., Hill, J. C., Foster, N. E., & Protheroe, J. (2017). Effective treatment options for musculoskeletal pain in primary care: a systematic overview of current evidence. *PloS one*, 12(6), e0178621.
- [9] Miyamoto, G. C., Lin, C. W. C., Cabral, C. M. N., van Dongen, J. M., & van Tulder, M. W. (2019). Cost-effectiveness of exercise therapy in the treatment of non-specific neck pain and low back pain: a systematic review with meta-analysis. *British journal of sports medicine*, 53(3), 172-181.
- [10] Lee, K., Kwon, H., Lee, B., Lee, G., Lee, J. H., Park, Y. R., & Shin, S. Y. (2018). Effect of self-monitoring on long-term patient engagement with mobile health applications. *PloS one*, 13(7), e0201166. *PLoS Um* 2018 ; 13 :e0201166.
- [11] Anan, T., Kajiki, S., Oka, H., Fujii, T., Kawamata, K., Mori, K., & Matsudaira, K. (2021). Effects of an artificial intelligence–assisted health program on workers with neck/shoulder pain/stiffness and low back pain: randomized controlled trial. *JMIR mHealth and uHealth*, 9(9), e27535.
- [12] Nagata, T., Mori, K., Ohtani, M., Nagata, M., Kajiki, S., Fujino, Y., ... & Loeppke, R. (2018). Total health-related costs due to absenteeism, presenteeism, and medical and pharmaceutical expenses in Japanese employers. *Journal of Occupational and Environmental Medicine*, 60(5), e273.

- [13] Arfaei, C. S. S., Mohaddes, H. H. R., Saadati, H., Hosseini, S. H., Jafari, Y., Ganji, R. (2021). The effect of mobile-app-based instruction on the physical function of female patients with knee osteoarthritis: a parallel randomized controlled trial. *BMC Womens Health*. 21 (1):333.
- [14] Pelle, T., Bevers, K., van der Palen, J., van den Hoogen, F., van den Ende, C. 2020. Effect of the Dr. Bart application on healthcare use and clinical outcomes in people with osteoarthritis of the knee and/or hip in the Netherlands; a randomized controlled trial. *Osteoarthr Cartil*. 28 (4):418–427.
- [15] Thongtipmak, S., Buranruk, O., Eungpinichpong, W., Konharn, K. 2020. Immediate effects and acceptability of an application-based stretching exercise incorporating deep slow breathing for neck pain self-management. *Healthc Inform Res*. 26 (1):50–60. doi: 10.4258/hir.2020.26.1.50.