

Telerehabilitation in patients with neck sprain at the first level of care

Telerrehabilitación en pacientes con esguince de cuello en el primer nivel de atención

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Abstract

Objective: To evaluate the effect of the neck specific exercise (NSE) program through telerehabilitation on the functional recovery of adults with grade I and II acute cervical sprain at the first level of care. **Method:** Quasi-experimental before-and-after study in a family medicine unit. Subjects with grade I and II cervical sprain were included, and a specific telerehabilitation program for the neck was applied. The effect of the program on functionality and pain was determined by means of the neck disability index and the visual analog scale. Program participants completed a 6-week intervention that included five weekly sessions, performing baseline measurements, at 2 and 6 weeks. **Results:** The EEC program using telerehabilitation after 6 weeks demonstrated a statistically significant decrease compared to baseline measurement in functional recovery (11 points) and pain (6.5 points). **Conclusions:** The findings suggest that the application of the EEC program through telerehabilitation is effective in both improving functional recovery and reducing pain in patients with grade I and II acute cervical sprain at the first level of care.

Keywords: Neck specific exercise. Telerehabilitation. Cervical sprain. Physiotherapy.

Resumen

Objetivo: Evaluar el efecto de un programa de ejercicio específico para el cuello (EEC) mediante telerrehabilitación en la recuperación funcional de adultos con esguince cervical agudo de grados I y II en el primer nivel de atención. **Método:** Estudio cuasiexperimental de antes y después en una unidad de medicina familiar. Se incluyeron sujetos con esguince cervical de grados I y II, y se aplicó un programa de telerrehabilitación de EEC. El efecto del programa en la funcionalidad se determinó mediante el índice de discapacidad del cuello, y el dolor con la escala visual análoga. Los participantes del programa completaron una intervención de 6 semanas que incluyó cinco sesiones por semana, realizando mediciones basales y a las 2 y 6 semanas. **Resultados:** El programa de EEC mediante telerrehabilitación demostró, después de 6 semanas, una disminución estadísticamente significativa en comparación con la medición basal en la recuperación funcional (11 puntos) y el dolor (6.5 puntos). **Conclusiones:** Los hallazgos sugieren que la aplicación del programa de EEC a través de telerrehabilitación es efectivo tanto para mejorar la recuperación funcional como para disminuir el dolor en pacientes con esguince cervical agudo de grados I y II en el primer nivel de atención.

Palabras clave: Ejercicio específico para el cuello. Telerrehabilitación. Esguince cervical. Fisioterapia.

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Introduction

Worldwide, in 2020, musculoskeletal disorders affected 494 million people. Compared with 1990, their prevalence has increased by 123.4%, and this increase is expected to reach 115% by 2050. Among these disorders, neck pain, of both traumatic and non-traumatic origin, is one of the most common.¹ Cervical sprain, a traumatic injury, is one of the main reasons for consultation in medical units at the primary care level (Fig. 1). It has been identified that, 12 months after the injury, between 20% and 50% of people who sustain a cervical sprain experience limitations in their activities of daily living.^{2,3} In these conditions, timely assessment and treatment by physical therapy, performed within less than 14 days, have been shown to reduce the likelihood of requesting complementary studies and interventional treatments, which in turn lowers institutional costs.⁴

Treatment of cervical sprain focuses on restoring the individual's functionality through a biopsychosocial approach, which includes patient education about the condition, emphasizing the importance of maintaining activities of daily living and movement.^{2,3,5} Although there is still no clear consensus on the best exercise program,⁶ it has been shown that a supervised neck/shoulder-specific exercise approach in patients with acute, subacute, and chronic cervical sprain results in greater pain reduction compared with unsupervised exercise.⁷ One of the supervised programs that has shown functional improvement and pain reduction is neck-specific exercise (NSE).⁸⁻¹⁰

Management of patients with cervical sprain at the primary care level is usually limited to pharmacological intervention, despite evidence supporting functional improvement through exercise prescription and patient education,¹¹ which unfortunately is not implemented systematically.¹² Based on the above, the aim of this study was to evaluate the effect of NSE delivered through telerehabilitation on functional recovery after 6 weeks in subjects with acute grade I and II cervical sprain at the primary care level.

Method

A longitudinal, prolective, before-and-after quasi-experimental study was conducted at the *Unidad de Medicina Familiar No. 33* from August 2022 through February 2023.

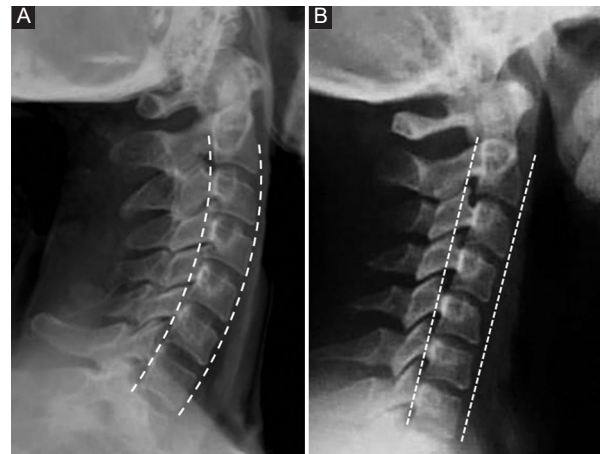


Figure 1. Lateral radiographs of the cervical spine. **A:** normal cervical lordosis. **B:** cervical lordosis secondary to grade II sprain.

Study subjects

Subjects diagnosed with acute grade I and II cervical sprain, aged 18 to 60 years, who had a smartphone or a computer with Internet access were included. Individuals who could not read or write, those with neurological conditions, latex allergy, or temporomandibular joint disorders were excluded. Subjects who were lost to follow-up, defined as those who did not answer calls or messages, were eliminated.

Sample size

For the sample size calculation, a mean difference of 6.9 points in functionality score between the beginning and the end of the study was considered, measured using the Neck Disability Index (NDI). A significance level of 0.05 and a power of 80% were considered, and based on these assumptions, a sample size of 14 participants was estimated.

Intervention

The NSE program is specifically designed to address neck muscle problems and focuses on relearning motor skills, improving coordination, endurance, and strength of the neck muscles, and postural correction. The program is divided into four stages with a total duration of 12 weeks. This program was carried out through the Moodle® platform (MD).

For the purposes of this study, only the first 2 complete stages, lasting 3 weeks, and the first 3 weeks of

the third stage were considered; these were available on the MD platform in video format. The stages were described both verbally and in writing so that the information would be accessible to the patient. The telerehabilitation program lasted 6 weeks, during which five sessions per week were provided, each lasting 30 minutes, using videos uploaded to the MD platform, with a frequency of 2-3 times per day.

Initially, the program focused on gentle isometric cervical flexion, extension, and rotation exercises without resistance, consisting of three sets of five daily repetitions of each exercise at home, with the aim of facilitating activity of the deep cervical muscle layers. Subsequently, the exercise progressed in each direction with low isometric resistance, increasing the exercise parameters to three sets of ten repetitions in the supine and seated positions in preparation for the next gym exercise.

Once the teaching activity on use of the platform had been completed, each patient was given a light resistance band, 1.3 kg, from the Thera-Band® brand to perform part of the protocol, and follow-up was provided.

The importance of maintaining good posture was emphasized to further facilitate the function of the deep cervical muscles. Gym-based exercise was gradually introduced with progressive resistance training, focusing on low-load resistance training, using a weighted pulley for head resistance or a Guild board.

Although a standardized exercise framework was followed, progression was adapted to each individual according to their capacity and symptomatic response; thus, participants were encouraged to avoid aggravating pain. In addition to the NSE program, all participants received the pharmacological treatment regimen recommended by the clinical practice guideline for the care of patients with cervical sprain at the primary care level.¹³

Response variables

The effectiveness of the telerehabilitation program was determined using the NDI. This index identifies how neck pain affects the patient's ability to carry out activities of daily living.^{14,15} Pain was assessed using the visual analog scale (VAS).

Procedure

All participants received verbal and written information about the study, and once they accepted and

signed the informed consent form, they were taught how to use the telerehabilitation program on the MD digital platform, a learning management system designed to create and manage online learning environments. After completing the teaching activity on the MD platform, emphasis was placed on resolving any questions related to its use at that time.

Follow-up

A personalized message was sent daily to each participant through the WhatsApp application or by text message. The purpose was to remind them of the importance of carrying out the exercise program and also to resolve any questions about the use of the MD platform and the exercise program itself, as well as to report any discomfort related to the exercise.

Follow-up was conducted for 6 weeks, with an initial assessment and two subsequent assessments at 2 and 6 weeks after starting the protocol, by telephone calls.

Statistical analysis

Qualitative variables were summarized as absolute and relative frequencies, and quantitative variables were summarized using measures of central tendency and dispersion. If they met the normality criterion according to the Shapiro-Wilk test, the mean and SD were used; otherwise, the median and quartiles 1 and 3 were used. To compare the dependent variables in the telerehabilitation group before and at the end of the study, Student's *t* test for paired samples was applied; if they did not meet the normality criterion, the Wilcoxon test was used. A value of $p < 0.05$ was considered statistically significant. All analyses were performed using SPSS statistical software, version 25.

Results

A total of 41 potential participants were identified, of whom 65.85% ($n = 27$) did not meet the inclusion criteria, and 14 were ultimately selected to begin the program (Fig. 2). The demographic characteristics of the 14 participants were collected (Table 1): 64.3% were women, the mean age was 34 years, and, regarding participants' educational level, 42.9% reported having a bachelor's degree and 14.3% had basic education. Of all participants, 64.3% had grade I

cervical sprain and 35.7% had grade II cervical sprain. The cause of the sprain was a motor vehicle collision in 57.1%. The mean prescription for soft collar use was 6.27 ($\pm$ 3.52) days, and the mean number of sick leave days was 9.27 ($\pm$ 5.14).

Regarding the effects of the NSE program (Table 2), at baseline assessment, the median NDI score was 11; at 2 weeks, it was 1; and at 6 weeks, it was 0, with a statistically significant difference between the beginning and the end of treatment. Regarding the degree of pain according to the VAS, at baseline assessment the median was 6.5, and at 2 and 6 weeks thereafter it was 0 in both measurements, with a statistically significant difference. Adherence to NSE through telerehabilitation during the first stage was 92.8%; in the second stage, it was 72.8%, with one dropout (13.6%); and during the third stage, it was 77.7%, with two dropouts (7.4%).

No adverse effects were reported during patient follow-up.

Discussion

After 6 weeks, the NSE program delivered through telerehabilitation demonstrated statistically significant changes in patients' functionality and neck pain.

The results of this study are consistent with those previously reported by several authors,^{9,16-18} who found that the NSE program delivered through telerehabilitation promotes functional recovery, as well as pain reduction, in patients with both acute and chronic grade I and II cervical sprain at the primary care level. These findings indicate that interventions delivered through digital media are a novel, easily accessible, and simple-to-use tool that provides health professionals at the primary care level with a complementary means of managing low-complexity musculoskeletal problems.

Early physical therapy intervention may contribute significantly to adequate functional recovery and pain relief, since the available evidence has identified early management of musculoskeletal conditions as a favorable prognostic factor for functional recovery.^{4,19,20} Given that health services have limited capacity, specifically in the area of physical therapy, telerehabilitation represents an excellent treatment alternative with satisfactory results for caring for all patients with cervical sprain.

Regarding age and sex, the results are consistent with previous studies.^{1,12,21} Neck sprain has been associated with motor vehicle accidents, and therefore its

Table 1. Demographic characteristics of the participants

Variable	n = 14
Sex, n (%)	
Female	9 (64.3)
Male	5 (35.7)
Age in years, mean (SD)	34.91 (9.41)
Educational level, n (%)	
Secondary school	2 (14.3)
High school	5 (35.7)
Bachelor's degree	6 (42.9)
Postgraduate degree	1 (7.1)
Sprain classification, n (%)	
I	9 (64.3)
II	5 (35.7)
Cause of sprain, n (%)	
Motor vehicle collision	8 (57.1)
Trauma	6 (42.8)
Days of collar prescription, mean (SD)	6.27 (3.52)
Days of sick leave, mean (SD)	9.27 (5.14)
Days after the event to care, median (IQR)	1 (0-1)

SD: standard deviation; IQR: interquartile range.

Table 2. Effects of the neck-specific exercise program over time

Variable	Baseline (n = 14)	2 weeks (n = 13)	6 weeks (n = 12)	p
NDI, median (IQR)	11 (7.75-15.75)	1 (0.5-7)	0 (0-0)	0.01
Pain, median (IQR)	6.5 (4-9)	0 (0-4)	0 (0-0)	0.01

NDI: Neck Disability Index; IQR: interquartile range.

most frequent presentation is in young people. In our sample, we observed a greater number of women with cervical sprain, probably due to women's greater susceptibility to injury after a motor vehicle accident.²² In our study, the mean duration of sick leave was 9 days, shorter than previously reported in a study conducted in a general hospital of the Instituto Mexicano del Seguro Social (IMSS),¹¹ 75 days, which also included grade I and II injuries; this may be related to the implementation of the NSE program.¹²

In this study, patients with grade I and II cervical sprain were observed to use a collar for an average of 6 days; however, according to clinical practice guidelines and the international literature, collar use is currently not recommended because it may delay functional recovery of the neck. Interestingly, another study conducted in 2013 indicated that the number of days for which a collar is prescribed has been

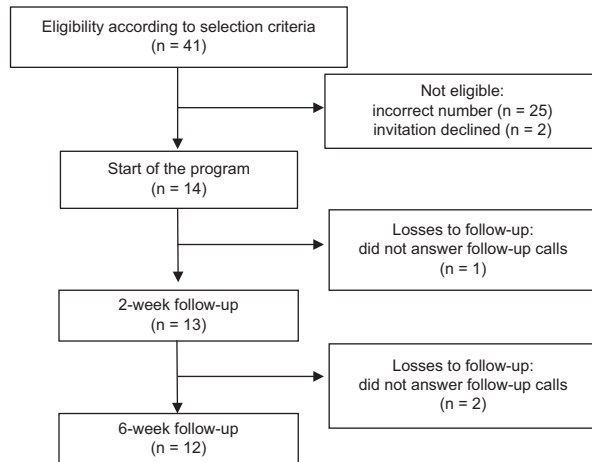


Figure 2. Flowchart of participant recruitment.

decreasing. Based on the above, we believe that training strategies should be developed for primary care physicians to avoid collar use in grade I and II sprains and promote functional recovery.^{23,24}

Among the strengths of the study, it is worth noting that this was the first early telerehabilitation intervention for people with cervical sprain at the primary care level in the IMSS. This innovation will make it possible to overcome physical barriers and reach a greater number of people in less time, and it also lays the groundwork for follow-up and treatment of patients with cervical sprain through telerehabilitation at the primary care level.

The main limitations of the study are that it had a quasi-experimental before-and-after design in a single group. This type of design does not include a control group to compare the results of the intervention, but this choice is justified by the novelty of the intervention. It is important to recognize that this design has lower validity compared with controlled clinical trials; therefore, it is considered an initial study that lays the groundwork for future research including a control group and random allocation. The sample size was small, despite the absence of major losses to follow-up; this was reflected in the data analysis, since the vast majority showed a nonparametric distribution, and therefore a larger sample size is recommended for future research. The NSE program was originally designed to last 12 weeks, but because of the nature of the condition, acute cervical sprain, it was limited to only 6 weeks, resulting in clinically and statistically significant improvement; however, it is suggested that future interventions be extended in both the acute and chronic stages.

The health system requires constant development and continuous improvements to provide timely, higher-quality care. In this context, Internet-based physical therapy programs represent a valuable complement to standard treatment, as has been demonstrated in the care of various conditions in which their usefulness has been confirmed.^{25,26}

Undoubtedly, Internet-based physical therapy programs can play a crucial role in improving access to medical and physical therapy care, regardless of geographic distance. In addition, they offer a significant advantage for people who are actively employed, since they avoid the need to be absent from work. This type of intervention benefits not only patients, but also optimizes resources and reduces costs for society as a whole, representing an opportunity to optimize care and improve patients' quality of life.

The results of our study support the need to implement this tool in clinical practice. This study may be considered pioneering in the field, as it lays the groundwork for future research aimed at the rehabilitation of musculoskeletal disorders through digital media.

Conclusions

The study findings indicate that an NSE program delivered through telerehabilitation is effective both in improving functional recovery and in reducing pain in patients with acute grade I and II cervical sprain at the primary care level.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical considerations

Protection of humans and animals. The authors declare that no experiments on humans or animals were performed for this research.

Confidentiality, informed consent, and ethical approval. The authors followed their institution's confidentiality protocols, obtained informed consent from the patients, and received approval from the Research

Ethics Committee under institutional registration number R-2022-3511-021. The recommendations of the SAGER guidelines were followed, according to the nature of the study.

Declaration on the use of artificial intelligence.

The authors declare that no type of generative artificial intelligence was used for the writing or creation of content in this manuscript.

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