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BRIEF ORIGINAL

Effectiveness of deep transverse friction massage and muscle strengthening in lateral epicondylitis among cleaning workers

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Keywords:
lateral epicondylitis; massage, friction; physical therapy; musculoskeletal manipulations; rehabilitation (source: MeSH-NLM).

ABSTRACT

Objective. To analyze the effectiveness of deep transverse friction massage and Flexbar-based strengthening exercises in lateral epicondylitis among cleaning workers. **Methods.** A quasi-experimental design with percentage analysis was applied to 12 cleaning workers at the Universidad Adventista de Bolivia, evaluated through a physical therapy assessment form and the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. **Results.** After the application of deep transverse friction massage and Flexbar-based strengthening exercises in cleaning workers with lateral epicondylitis, pain decreased according to the Numerical Rating Scale (41.7 % reported no pain post-intervention), orthopedic tests such as Cozen's and Maudsley's became negative (100 %), and muscle strength increased as measured by dynamometry (up to 25 kg). The DASH questionnaire showed significant functional improvement. **Conclusions.** The combination of deep transverse friction massage and Flexbar-based strengthening exercises proved effective in reducing pain, improving muscle strength, and enhancing elbow function in cleaning workers with lateral epicondylitis at the Universidad Adventista de Bolivia.

Efectividad del masaje transverso profundo y el fortalecimiento muscular en la epicondilitis lateral en trabajadores de limpieza

Palabras clave:
epicondilitis lateral; terapia de zona; fisioterapia; manipulaciones musculoesqueléticas; rehabilitación (fuente: DeCs-BIREME).

RESUMEN

Objetivo. Analizar la efectividad del masaje transverso profundo y el fortalecimiento muscular con la Flexbar en la epicondilitis lateral de trabajadores de limpieza. **Métodos.** Se aplicó un diseño cuasiexperimental bajo un análisis porcentual en 12 trabajadores de limpieza de la Universidad Adventista de Bolivia, evaluados mediante una ficha kinésica física y el cuestionario Disability of Arm, Shoulder, and Hand (DASH). **Resultados.** Luego de la aplicación del masaje transverso profundo y el fortalecimiento con la Flexbar en trabajadores de limpieza con epicondilitis lateral se redujo el dolor según la escala numérica del dolor (41,7 % sin dolor posintervención), se normalizaron pruebas ortopédicas, como Cozen y Maudsley, (100 % negativas) y se incrementó la fuerza muscular en prensión evaluada por dinamometría (hasta 25 kg). El cuestionario DASH mostró una mejora funcional relevante. **Conclusiones.** La combinación de masaje transverso profundo y fortalecimiento muscular con la Flexbar fue efectiva para reducir el dolor, mejorar la fuerza muscular y aumentar la funcionalidad del codo en trabajadores de limpieza con epicondilitis lateral de la Universidad Adventista de Bolivia.

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INTRODUCTION

Lateral epicondylitis is often referred to as tennis elbow, although it is also known as carpenter's elbow or helmsman's elbow. It was first described in the literature by Runge [1] in 1873. This concept aligns with Morris [2], who in 1882 referred to it as "lawn tennis elbow". This syndrome occurs in patients who perform repetitive forearm activities involving wrist extension. It is characterized by a tendinopathy of the musculature that inserts on the lateral epicondyle of the distal humerus [3].

Internationally, its incidence is estimated at 4 to 7 cases per 1,000 inhabitants annually and affects between 1 % and 3 % of the general population [4]. However, this prevalence may reach up to 23 % in manual laborers exposed to repetitive tasks, such as housewives, industrial operators, or cleaning personnel [5-7]. In Bolivia, although no specific epidemiological records exist, an increase in cases of lateral elbow pain has been identified among cleaning workers, highlighting the need for effective and accessible therapeutic strategies for this group exposed to repetitive overload in their occupational tasks.

Risk factors include repetitive physical stress, persistent pain lasting more than three months, and the coexistence of cervical symptoms. In response to this, various therapeutic strategies have been proposed [6]. One of the most commonly used in physiotherapy is deep transverse massage, a technique developed by Dr. James Cyriax, which aims to regenerate connective tissue through local mechanical stimuli [5,8,9]. Additionally, eccentric training has been demonstrated as an effective intervention to improve tendon endurance and function. In particular, the use of the Flexbar resistance bar has gained popularity as an economical and functional tool for upper-limb muscle strengthening [10,11].

The DASH scale (Disabilities of the Arm, Shoulder and Hand) has proven to be a valid tool for measuring the functional impact of this condition, as it allows assessment of clinical progression and the therapeutic effect of treatment programs [7]. Therefore, the objective of this study was to analyze the effectiveness of a therapeutic protocol based on deep transverse massage and muscle strengthening using the Flexbar in cleaning workers diagnosed with lateral epicondylitis [8] in order to contribute clinical evidence for conservative management in occupational settings.

METHODS

Type and area of study

A quasi-experimental design without a control group and with a descriptive scope was applied. The study was conducted at the Universidad Adventista de Bolivia, in the city of Cochabamba, during 2024, and focused on cleaning workers exposed to biomechanical overload, repetitive strain, and limited task rotation. These conditions represent a high risk for developing lateral epicondylitis, with direct repercussions on job performance and quality of life.

Population and sample

The population consisted of 30 cleaning workers from classroom blocks A, B, C, and D. Inclusion criteria were being between 18 and 25 years of age, of either sex, presenting pain in the lateral aspect of the elbow during gross grasping movements, and exhibiting three positive orthopedic tests for epicondylitis. Exclusion criteria included the presence of other pathologies, direct trauma, underlying conditions, or refusal to participate in the study. Finally, a non-probabilistic convenience sample of 12 cleaning workers with confirmed lateral epicondylitis was selected, of whom 9 were female and 3 male.

Variables and data collection instruments

Two instruments were used for data collection. First, a physical kinesiological assessment form validated by faculty in the area of trauma physiotherapy using a rubric based on the study's general and specific objectives and on the operationalization of the variables.

This form allowed the anamnesis, physical examination, and quantification of pain using an algometer and the Numerical Pain Rating Scale (NPRS); measurement of joint range of motion through goniometry; muscular strength of the epicondylar muscles using active resistance testing and grip strength with a handheld dynamometer; and the application of specific tests for epicondylitis (Cozen, Maudsley, Bowden, and Thomson), as well as varus and valgus stress tests. Afterwards, the treatment plan was implemented, starting with deep transverse massage, followed by strengthening exercises using the Flexbar (yellow and red resistance). The intervention lasted 12 weeks, with a frequency of two sessions per week. An initial evaluation session was performed before starting the intervention, and upon completion of the treatment plan, a final

evaluation was conducted using the same kinesiological assessment form.

Second, the DASH questionnaire was used. This is an auto-administered, validated, and reliable instrument that assesses functional capacity to perform daily activities of the upper limb, providing a deeper measurement of the pathology's impact on daily tasks.

Techniques and data collection procedure

Two main techniques were applied to collect data: structured observation through the physical kinesiological assessment form and functional self-evaluation using the DASH questionnaire. The procedure was conducted in three phases: initial evaluation, intervention, and final evaluation. In the initial evaluation, the kinesiological form was used to record pain through algometry and the Numerical Pain Rating Scale (NPRS), muscular strength through manual dynamometry, joint range of motion using goniometry, and specific orthopedic tests for lateral epicondylitis (Cozen, Maudsley, Bowden, and Thomson). Subsequently, the therapeutic protocol was applied over 12 weeks, with a frequency of two sessions per week. At the end of the intervention, the same instruments were administered to compare pre- and post-intervention results.

Data analysis

Data analysis was carried out using descriptive statistics, applying percentage analysis to observe the distribution of variables before and after the intervention, in accordance with the exploratory nature of the study. Absolute and relative frequencies were calculated for variables such as pain intensity, muscular strength using hand grip dynamometry, specific tests (Cozen, Maudsley, Bowden, and Thomson), and DASH questionnaire scores. The analysis was performed using Microsoft Excel spreadsheets.

Ethical considerations

This study involved the participation of human subjects; therefore, the ethical principles established in the Declaration of Helsinki and international health research regulations were respected. All participants were adequately informed about the study's objectives and procedures and signed informed consent prior to participation. Likewise, the research protocol was reviewed and approved by the Research Coordination Office of the Physiotherapy and Kinesiology Program of the Universidad Adventista de Bolivia, ensuring confidentiality, voluntary participation, and the right to withdraw from the study at any time.

RESULTS

The results of the pain-during-activity assessment show significant improvement after the intervention. Initially, 50% of patients reported moderate pain and 30 % reported severe pain. Nevertheless, after the intervention, 41.7 % of patients reported no pain, and 41.7 % reported mild pain. This reduction in pain intensity—particularly in the moderate and severe categories—indicates the effectiveness of the treatment in relieving patients' symptoms (see Figure 1).

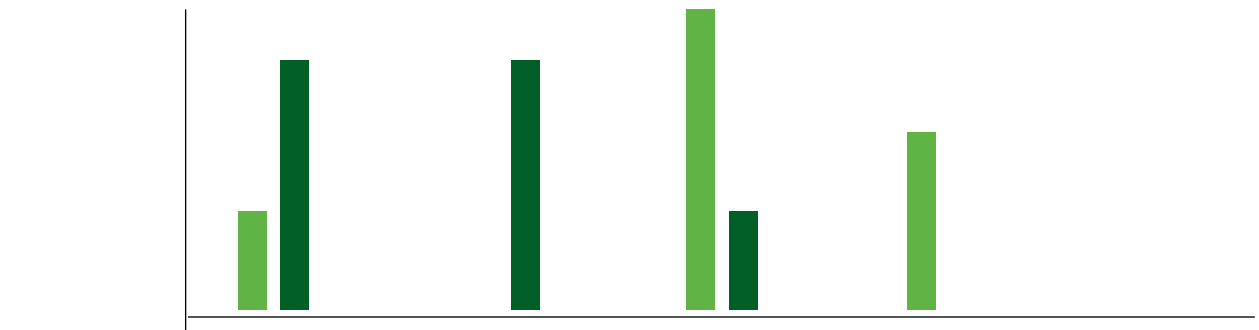

Figure 1. Initial and final evaluation of pain during activity in cleaning workers with lateral epicondylitis

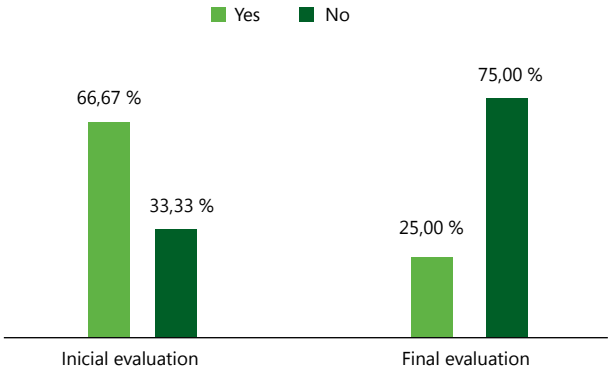

Figure 2. Initial and final evaluation of perceived tendon thickening on palpation in cleaning workers with lateral epicondylitis

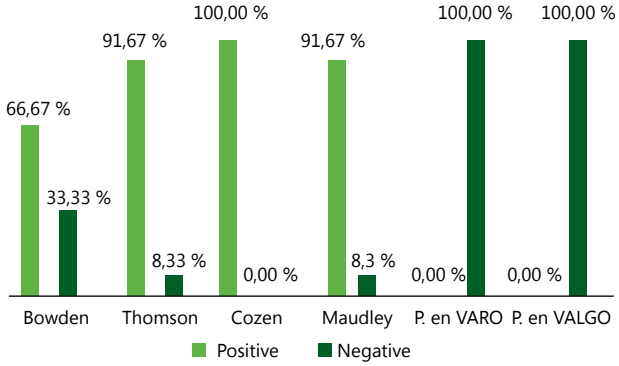

Figure 3. Initial evaluation with specific diagnostic tests for lateral epicondylitis in cleaning workers

On the other hand, the assessment of tendon thickening also showed significant improvement after the intervention. Initially, 66.7 % of patients presented tendon thickening. However, after the intervention, this percentage decreased to 25.0 %. This reduction in tendon thickening suggests improvement in the condition of the tendinous tissue (see Figure 2).

The specific tests used to diagnose lateral epicondylitis also showed significant improvement in the final evaluation. These included Cozen's test, which was 100 % negative, and Maudsley's test, also 100 % negative—considered the most relevant for diagnosing this condition—showing complete resolution in all patients. Bowden's test was negative in 83.3 % of cases, and Thomson's test was negative in 91.7 %, both demonstrating a significant decrease in positive results. These findings support the usefulness of these tests for assessing the progression of lateral epicondylitis and the impact of the implemented treatment (see Figures 3 and 4).

Regarding epicondylar muscle strength assessed through the active resistance test, patients initially scored predominantly at grades 3 (fair) or 4 (good), indicating limited muscular strength. In the final evaluation, most reached grade 5, representing normal muscular strength. For grip strength, dynamometry showed changes in the study population. Initial grip-force values (in kilograms) were low, averaging 7.5-8.5 kg. In the final evaluation, values increased considerably, reaching up to 25 kg in some cases (see Table 1).

Overall, the results of this study demonstrate the effectiveness of the treatment plan based on deep transverse massage and muscle strengthening with the Flexbar for lateral epicondylitis. The reduction in pain during activity, improvement in tendon condition, increased grip strength, and resolution of specific diagnostic tests indicate that this treatment plan is an effective therapeutic option for patients with this condition.

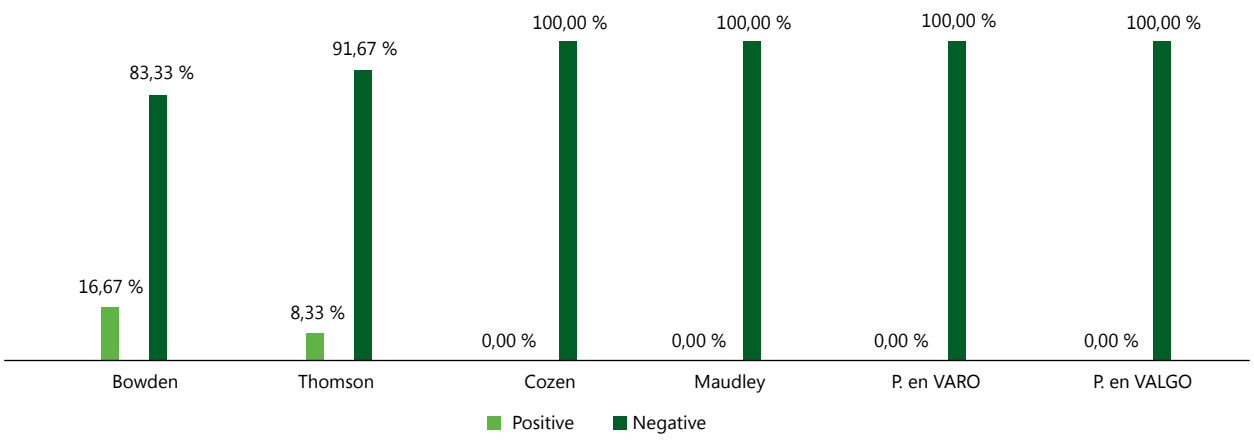

Figure 4. Final evaluation with specific diagnostic tests for lateral epicondylitis in cleaning workers

Table 1. Tendon palpation pain using an algometer and grip strength using a handheld dynamometer in cleaning workers

Patient	Evaluation	Lateral epicondylitis		Pain on palpation		Muscle strength	
		Right	Left	Manual palpation	Algometer (kg)	Active resistance	Dynamometry (kg)
P1	Initial	P	--	Severe	0.571	Grade 3	7.5
	Final	A	--	Mild pain	1.110	Grade 5	10
P2	Initial	P	--	Severe	0.959	Grade 4	14.5
	Final	A	--	No pain	2.134	Grade 5	25.0
P3	Initial	P	--	Severe	0.480	Grade 3	5.5
	Final	P	--	Moderate	1.518	Grade 4	8.5
P4	Initial	P	--	Severe	0.833	Grade 3	7
	Final	A	--	Mild pain	1.387	Grade 5	12.5
P5	Initial	--	P	Severe	0.467	Grade 3	8
	Final	--	A	No pain	0.312	Grade 5	15
P6	Initial	--	P	Severe	0.518	Grade 4	5.5
	Final	--	P	Moderate	2.752	Grade 5	16.5
P7	Initial	--	P	Moderate	0.866	Grade 3	6.5
	Final	--	A	No pain	2.345	Grade 4	14.5
P8	Initial	--	P	Severe	0.491	Grade 3	3.5
	Final	--	A	Moderate	1.781	Grade 4	6.5
P9	Initial	--	P	Severe	1.128	Grade 3	8
	Final	--	P	Moderate	2.489	Grade 4	11.5
P10	Initial	P	--	Severe	1.211	Grade 3	4.5
	Final	P	--	Mild pain	2.671	Grade 4	9.5
P11	Initial	P	--	Moderate	0.687	Grade 3	4
	Final	A	--	No pain	2.050	Grade 5	17.5
P12	Initial	P	--	Moderate	0.993	Grade 4	11.5
	Final	A	--	No pain	3.349	Grade 5	15

* P = present, A = absent.

According to the results of the DASH questionnaire, a significant impact on upper-limb function was observed in cleaning workers. Addressing this issue comprehensively is essential, combining therapeutic interventions with preventive measures to improve quality of life. Therefore, once the treatment plan combining both techniques—deep transverse massage and Flexbar-based muscle strengthening—was applied, the combined approach proved effective (see Table 2).

Table 2. Initial and final DASH questionnaire evaluation in cleaning workers

Patient	Initial evaluation	Final evaluation
P1	Moderate–marked disability	Mild disability
P2	Limit of moderate disability	Mild disability
P3	Severe disability	Moderate disability
P4	Marked disability	Mild disability
P5	Moderate disability	Moderate disability
P6	Marked disability	Mild disability
P7	Marked disability	Mild disability
P8	Moderate disability	Mild disability
P9	Moderate–marked disability	Moderate disability
P10	Moderate disability	Mild disability
P11	Marked disability	Mild disability
P12	Marked disability	Mild disability

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DISCUSSION

The findings of this study suggest that the combination of deep transverse massage and muscle strengthening with the Flexbar is an effective intervention for the conservative treatment of lateral epicondylitis in cleaning workers. Changes were observed in the reduction of pain intensity, improvement in muscle strength, and enhanced upper-limb functionality, supporting the main objective of the study.

The reduction of pain, measured using the Numerical Pain Rating Scale (NPRS), and the improvement in specific orthopedic tests (Cozen, Maudsley, Bowden, and Thomson) are consistent with previous studies by López et al. [9] and Kerry et al. [12], which highlight the effectiveness of deep transverse massage as a useful technique for soft-tissue regeneration and reduction of fibrous adhesions. This technique, developed by Cyriax [5], has been shown to promote realignment of collagen fibers and improvement of local vascularization—effects that are clinically reflected in the reduction of painful symptoms.

Furthermore, muscle strengthening with the Flexbar showed positive results in increasing grip strength and active resistance, which is consistent with research supporting eccentric training as a cornerstone of functional tendinopathy treatment [10,13]. In this study, participants progressed from limited strength levels (grades 3 and 4) to normal strength (grade 5), with increases of up to 25 kg in dynamometry, demonstrating a tangible clinical impact.

Additionally, the improvement in DASH questionnaire scores reinforces the functional relevance of this intervention, as it demonstrates reduced limitations in performing daily activities. This instrument has been validated in various clinical contexts [14], and in this specific case confirmed the perceived benefit reported by participants in their work environment.

Compared with other more costly or invasive therapeutic modalities, such as shockwave therapy or the use of isokinetic dynamometers, this protocol offers an accessible, practical, and low-cost alternative, particularly useful in occupational settings with limited resources. The applicability of this treatment in the real work environment of cleaning staff constitutes one of its main strengths.

Nonetheless, the study has limitations that should be considered. The small sample size, lack of a control group, and absence of inferential statistical analysis restrict the ability to generalize the results or establish definitive causal relationships. Likewise, follow-up was limited to 12 weeks, with no medium- or long-term evaluation. These limitations open opportunities for future research with more robust designs, larger samples, and longitudinal evaluations that allow validation and expansion of the findings obtained.

Despite the favorable results, it is suggested that future research include larger sample sizes, control groups, and inferential analysis to strengthen the external validity of the findings and broaden the evidence base regarding the effectiveness of this type of intervention. From a clinical perspective, this protocol represents a useful tool in daily physiotherapy practice, particularly for populations exposed to repetitive movements and continuous physical effort. Its implementation could contribute not only to symptomatic improvement, but also to prevention of chronicity, reduced absenteeism, and improved quality of life for workers.

Conclusions

The combined application of deep transverse massage and muscle strengthening with the Flexbar proved effective in reducing pain, increasing muscle strength, and improving upper-limb functionality in cleaning workers diagnosed with lateral epicondylitis. This therapeutic protocol made it possible to resolve specific clinical signs, increase manual grip strength, and decrease functional limitations in a working population exposed to repetitive movements. It thus positions itself as an accessible, non-invasive, and clinically viable alternative within conservative physiotherapeutic management, especially in occupational environments with limited resources.

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Authorship contribution

RCR: investigation, project administration, analysis of results, and discussion.

SRRR: final review of the article, supervision, data acquisition, methodology, conceptualization, and data curation.

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Conflict of interest statement

The authors declare no conflicts of interest.