

Effectiveness of Manual Physical Therapy to the Cervical Spine in the Management of Lateral Epicondylalgia: A Retrospective Analysis

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Design: Retrospective ex-post facto design.

Objectives: To retrospectively review the management of patients with lateral epicondylalgia, and to compare self-reported outcomes to assess the potential benefit of manual physical therapy to the cervical spine.

Background: It has been postulated that dysfunction of the cervical spine may contribute to the symptoms associated with lateral epicondylalgia; however, the literature assessing the effectiveness of manual physical therapy to the cervicothoracic region in this patient population has been inconclusive. Documentation and analysis of outcomes of management strategies focusing on the cervical spine may lead to determining the most effective and efficient clinical practices.

Methods and Measures: Of the 213 charts reviewed, 112 satisfied inclusion-exclusion criteria and were divided into 2 groups: those who received treatment solely directed at the elbow (local management [LM]), or those who received treatment directed at the elbow and cervical manual therapy (LM+C). Telephone follow-up interviews were used to determine the number of successful outcomes. Percentages of successful outcomes in each group were compared using chi-square analysis. An independent samples *t* test was used to compare the total number of visits per group.

Results: Sixty-one of the 112 patients were in the LM group, while 51 received LM+C. Seventy five percent of the patients available for follow-up in the LM group and 80% in the LM+C group reported a successful outcome. Patients in the LM group received a greater number of visits (mean, 9.7; SD, 2.4) than patients in the LM+C group (mean, 5.6; SD, 1.7; $P < .01$).

Conclusions: The results of this retrospective review suggest that most patients had successful outcomes regardless of the inclusion of manual therapy interventions to the cervical spine. The LM+C group achieved the successful long-term outcome in significantly fewer visits. *J Orthop Sports Phys Ther* 2004;34:713-724.

Key Words: *extensor carpi radialis brevis, joint mobilization, lateral epicondylitis, tennis elbow*

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Lateral epicondylalgia, also referred to as lateral epicondylitis or tennis elbow, is a common musculoskeletal disorder frequently encountered by physical therapists.²⁸ In the general population, the prevalence has been reported to be between 1% and 10%, depending on the age group investigated.² The syndrome occurs more frequently in occupations involving repetitive wrist movements and, according to some authors, 35% to 61% of patients diagnosed with lateral epicondylalgia relate the cause to work in industrial settings.^{6,17} Approximately 27% of those afflicted with lateral epicondylalgia correlated leisure activities with their symptoms and 30% couldn't identify a precipitating factor.⁶

Lateral epicondylalgia is characterized by an insidious onset of pain at the lateral elbow, tenderness to palpation of the wrist extensors, and restricted movement of the wrist with consequences of altered function and disability.⁴⁰ The syndrome most commonly afflicts individuals between the ages of 35 and 50, and usually affects the dominant arm.¹³ Although lateral epicondylalgia has been pur-

ported to be an overuse disorder of the common extensor tendon, with the extensor carpi radialis brevis muscle being the most commonly involved,^{16,30-32} there is little consensus on the etiology of the syndrome. Several pathophysiological mechanisms have been proposed, including degenerative changes in tendon structures, radial nerve entrapment syndromes, somatosympathetic dysfunction, and somatic pain referral from articular structures of the cervical spine.^{35,37,39,42} Many management strategies have been reported to be effective.^{4,13,14,19-21,28,34,36,38,41} Unfortunately, most proposed strategies have not been subjected to the scientific scrutiny of clinical research.

In a recent randomized clinical trial, Smidt et al³⁴ found that the use of corticosteroid injections resulted in a higher rate of recovery than a program of physical therapy (pulsed ultrasound, deep friction massage, and exercise) or a wait-and-see policy in the short term (6 weeks) for the management of lateral epicondylitis. At the 1-year follow-up, recovery rates were greater in the physical therapy group than in the group receiving corticosteroid injections; however, the differences between the physical therapy and the wait-and-see groups were small and not statistically significant.

Joint mobilization techniques directed at the elbow region have been demonstrated to improve pain-free and maximum grip strength in the short term.^{1,29,38} Studies with long-term outcomes have not been reported.

It has been purported that cervicothoracic spine dysfunction may contribute to the etiology of lateral epicondylalgia.²¹ However, the literature investigating the effects of manual therapy directed at the cervical and thoracic spine in patients with lateral epicondylalgia is also sparse. In a nonrandomized clinical trial, Rompe et al³³ demonstrated that low-energy shock wave therapy plus manual therapy (joint mobilization) to the cervical and upper thoracic spine was no more effective than low-energy shock wave therapy alone at a 12-month follow-up. However, the lack of randomization precludes making inferences about the benefits of the manual physical therapy intervention. Gunn and Milbrandt¹¹ reported the effects of various forms of physical therapy targeting the cervical spine in a cohort of 50 patients with recalcitrant lateral epicondylalgia. Following 4 weeks of treatment, 29 patients returned to their previous occupation and 14 returned to light duties. Although the authors conclude that manual therapy to the cervical region may be beneficial for patients with chronic lateral epicondylalgia, multiple methodological shortcomings in this study restrict the conclusions that can be drawn. Lastly, Vicenzino et al³⁷ demonstrated the effects of cervical spine manipulative therapy on pain associated with lateral epicondylalgia. Improvements in pain-free grip and

24-hour pain ratings were recorded immediately following treatment and at a 24-hour follow-up, respectively, but no long-term outcomes were reported.

The literature in regard to utilizing manual physical therapy directed at the cervical spine and cervicothoracic junction in the treatment of lateral epicondylalgia is of poor quality and has been inconclusive.^{31,33} A meta-analysis by Labelle et al²⁰ reported that the studies investigating the effects of management strategies for lateral epicondylalgia exhibited a mean quality score of 33%, while a score of 70% was necessary to be considered a valid clinical trial. It is essential to document the outcomes of various treatment strategies to assist with determining the most effective and efficient clinical practices. Hence, the purpose of this study was to retrospectively review the management of patients with lateral epicondylalgia and to compare self-reported outcomes to assess the potential benefit of manual physical therapy to the cervical spine.

METHODS

Patients

From March 1999 through September 2002, 213 patients who were diagnosed by their referring physician with lateral epicondylalgia were treated at an outpatient orthopaedic physical therapy clinic in southern New Hampshire. Physical therapy records for all 213 patients were reviewed to collect the following information: gender, age, duration of symptoms, hand dominance, affected arm, medication usage, number of physical therapy sessions, duration of treatment, and physical therapy interventions utilized. This study was exempt from the Institutional Review Board at Franklin Pierce College, Concord, NH.

The therapists managing patients with lateral epicondylalgia used a standardized examination form consisting of a patient interview history and physical examination. The standardized interview included questioning the patient regarding past episodes of their symptoms, duration of symptoms, relieving and aggravating factors, current medications, and past treatments for their current complaints. The physical examination consisted of evaluation of the elbow, upper limb tension tests, and a screening examination of the cervical spine, which included testing active cervical range of motion with assessment of symptom response. If cervical range of motion did not elicit any symptoms, overpressure was applied at the end range of movement.

Patients were selected for inclusion in the review if, on the examination form, 2 or more of the following were identified: (1) pain during palpation of the lateral epicondyle, (2) pain with resisted wrist extension, or (3) pain with resisted middle finger exten-

sion. Patients were excluded from the study for the following reasons: (1) if the patient was under workers' compensation, as individuals with ergonomic risk exposures, such as manual laborers, may have a poorer prognosis than the general public^{7,12}; (2) if he/she was actively involved with or seeking litigation at the time of the study; (3) if the patient demonstrated multiple diagnoses (shoulder pathology or cervical spine radiculopathy) or had evidence of systemic disease (fibromyalgia, central nervous system disorder, diabetes); (4) if the patient had received a corticosteroid injection within the year prior to, or during the time of, physical therapy, or had undergone surgical intervention to the painful elbow; (5) if bilateral upper extremity symptoms were present; (6) if this was not the patient's first episode of lateral epicondylalgia; or (7) if the clinical examination was consistent with radial tunnel syndrome, such as pain to palpation over the radial tunnel and pain with full pronation of the forearm.²³

Of the 213 patients with lateral epicondylalgia, 101 did not meet the inclusion/exclusion requirements of

the study. The remaining 112 patients were selected for review. These patients were divided into 2 groups: those that received solely local management (LM), defined as treatment directed at the elbow region, and those that received local management plus manual therapy directed at the cervical spine (LM+C). Patients were categorized into the LM+C group if any mobilization techniques were applied to the cervical spine during the course of physical therapy. A flow chart describing patient selection can be found in the Figure.

Telephone follow-up interviews were used to determine the number of self-reported successful outcomes for each group. The lead author (JC), who was unaware of the group assignment conducted all interviews. The standard telephone follow-up interview form can be found in Appendix A. A successful outcome was defined as a return to all functional activities without recurrence of symptoms after discharge from physical therapy. Recurrence was defined as a return of the patient's familiar elbow symptoms

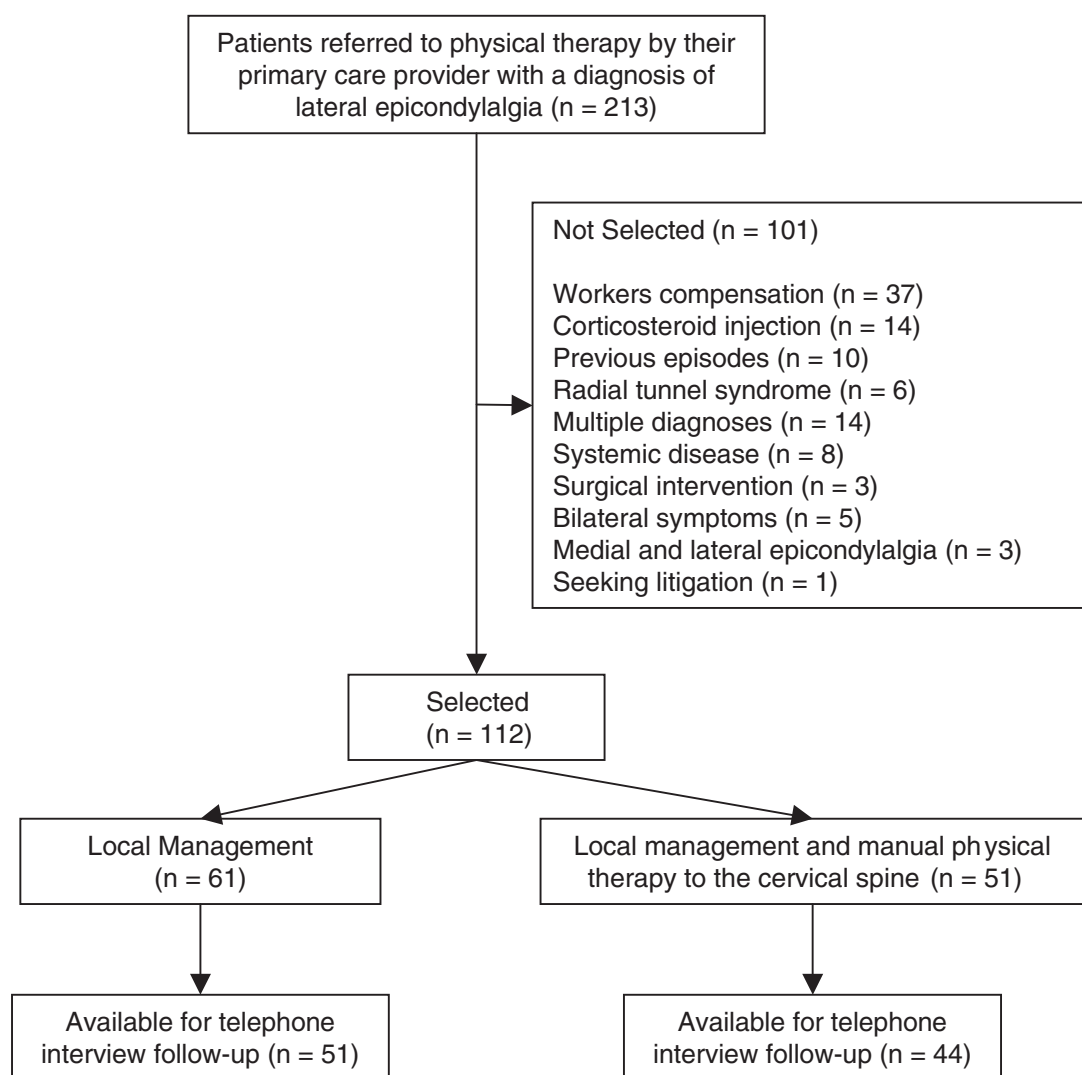


FIGURE. Flow chart describing patient selection.

after previous resolution of the problem.¹⁵ For the purpose of this retrospective analysis, the recurrence had to result in the patient seeking treatment from a medical practitioner.

Data Analysis

Patients were placed into the LM or LM+C treatment group based on the interventions received during physical therapy. The percentage of patients with successful outcomes in each group was compared using a chi-square analysis. The mean number of visits in each group was compared using an independent samples *t* test. The types of interventions directed at the elbow region were examined for each treatment group, and the percentage of patients in each treatment group receiving each intervention directed at the elbow region were compared using chi-square analysis. If a difference was found between the treatment groups with respect to an intervention directed at the elbow region, the impact of that particular intervention was further explored by comparing the rates of successful outcome and mean number of visits among all patients receiving the intervention versus those not receiving the intervention. The influence of the therapist on outcomes was also examined by comparing the rates of successful outcome among the treating therapists. Data were analyzed statistically using the Statistical Package for the Social Sciences (SPSS, Version 10.0 for Windows; SPSS, Inc, Chicago, IL).

RESULTS

Sixty-one of the 112 patients (54%) selected for review were categorized as belonging to the LM group, while 51 (46%) were categorized as belonging to the LM+C group. Ninety-five (85%) of the 112 patients were available for telephone interview follow-up. Seventeen patients were unavailable for follow-up interview and therefore were omitted from the outcome analysis. Fifty-one (85%) of the 61 patients in the LM group and 44 (86%) of the 51 patients in the LM+C group were contacted. The mean time from discharge to follow-up was 74 weeks (range, 19-143; SD, 36) for patients in the LM group and 72 weeks (range, 3-144; SD, 42) for those in the LM+C group ($P>.05$).

Thirty-eight (75%) of the 51 patients in the LM group were considered to have a successful outcome. Of those who did not report a successful outcome, 8 (16%) reported a recurrence of symptoms after their time of discharge from physical therapy. The remaining 5 patients (13%) reported that they did not make a full return to all functional activities during or after their respective course of therapy. Three of these patients reported that they had experienced an increase in symptoms during physical therapy intervention (2 underwent corticosteroid injections).

Thirty-five (80%) of the 44 patients in the LM+C group had a successful outcome. Of those who did not experience a successful outcome, 5 (11%) reported a recurrence of symptoms following discharge

TABLE 1. Number (percentage) of patients (n = 44) treated with specific manual physical therapy techniques directed toward the cervical spine.

Manual Technique	Number (%) of Patients
Mobilization techniques ²⁴	35 (80%)
• Passive physiological intervertebral mobilizations	
• Passive accessory intervertebral mobilizations	
Mobilization with movement ²⁷	13 (30%)
• Natural apophyseal glides	
• Sustained natural apophyseal glides	
• Reverse natural apophyseal glides	
Muscle energy techniques ⁸	23 (52%)

TABLE 2. Descriptive characteristics of participating patients.

	Local Management Group (n = 51)	Local Management Plus Manual Physical Therapy to the Cervical Spine Group (n = 44)
Age (y)	42.9 ± 10.4	41.8 ± 9.9
Duration of symptoms (wk)	18.2 ± 28.3	19.0 ± 17.0
Gender		
Male	18 (35%)	21 (48%)
Female	33 (65%)	23 (52%)
Hand dominance		
Right	56 (90%)	38 (86%)
Left	5 (10%)	6 (14%)
Dominant arm affected	42 (81%)	37 (85%)

TABLE 3. Medications that patients were taking at the time of their initial evaluation.

	Local Management Group (n = 51)	Local Management Plus Manual Physical Therapy to the Cervical Spine (n = 44)
Aspirin	3 (6%)	7 (16%)
Celebrex	7 (14%)	4 (9%)
Diclofenac	2 (4%)	0 (0%)
Ibuprofen	13 (25%)	9 (20%)
Naproxen	8 (16%)	4 (9%)
Naproxen Sodium	6 (12%)	6 (14%)
Tylenol	3 (6%)	4 (9%)
Vioxx	5 (10%)	4 (9%)
None	4 (8%)	6 (14%)

from therapy. The remaining 4 (10%) reported that they did not make a full return to all functional activities following therapy. One reported that physical therapy intervention resulted in an increase in symptoms, 2 patients reported that physical therapy was not beneficial (both underwent corticosteroid injection), and 1 reported being unable to make the time commitment required to attend regular physical therapy sessions.

Patients in the LM+C group underwent 1 or more treatment sessions in which manual therapy directed to the cervical spine or cervicothoracic junction was utilized. The manual physical therapy techniques used included passive accessory intervertebral and passive physiological intervertebral mobilization techniques,²⁴ mobilization with movement techniques,²⁷ and muscle energy techniques.⁸ Table 1 shows the percentage of patients who received each of the aforementioned manual therapy techniques. The selection of manual therapy techniques was based solely upon manual assessment and preference of the treating therapist.

Demographic data, symptom duration, hand dominance, and involved limb can be found in Table 2. The LM and LM+C groups were statistically equivalent with respect to age and symptom duration ($P>.05$). However, the LM group had a greater percentage of females than the LM+C group (66% and 51%, respectively; $P<.05$). Medications that each patient was taking at the time of the initial physical therapy evaluation can be found in Table 3.

Chi-square analysis demonstrated no significant association between treatment group and outcome ($P>.05$). Patients in the LM group were treated a mean of 9.7 visits (range, 4-10; SD, 2.4), while those

in the LM+C group were treated a mean of 5.6 visits (range, 2-12; SD, 1.7; $P<.01$).

The specific interventions directed at the elbow region among all patients were pulsed ultrasound, iontophoresis, deep tissue massage of the forearm muscles, stretching and strengthening exercises for muscles of the upper extremity, cold modalities, and elbow joint mobilization, including mobilization of the radiohumeral, ulnohumeral, and proximal and distal radioulnar joints. Interventions were not standardized and were based solely on the judgment of the treating therapist. Table 4 depicts the percentage of patients that received each of the aforementioned specific interventions. Chi-square analyses of the specific interventions directed at the elbow revealed that elbow joint mobilization occurred with greater frequency in the LM+C group, while the utilization of ultrasound, iontophoresis, and cold modalities was more frequent in the LM group. Further analysis of these interventions failed to reveal significant differences in percentages of successful outcomes among patients receiving the intervention versus those who did not ($P>.05$). A difference was found in the number of physical therapy visits among patients receiving iontophoresis (mean, 8.7; SD, 3.3) and those not receiving iontophoresis (mean, 7.3; SD, 2.6) ($P = .036$).

Six physical therapists with varying degrees of experience in orthopaedic physical therapy (mean, 12 years; range, 1-40 years) treated all patients reviewed in this retrospective analysis. Individual clinician descriptive statistics, including the number of years of orthopaedic experience, the number of patients treated in each group, the success rate achieved in each group, and the number of treatment sessions utilized, can be found in Table 5.

TABLE 4. Number (percentage) of patients treated with interventions directed at the elbow region for both treatment groups.

	Local Management (n = 51)	Local Management Plus Manual Therapy for the Cervical Spine (n = 44)	P Value
Modalities			
Ultrasound	41 (80%)	17 (39%)	<.01
Iontophoresis with dexamethasone	26 (51%)	7 (16%)	<.01
Soft tissue mobilization	48 (94%)	42 (95%)	.376
Elbow joint mobilizations (radiohumeral, ulnohumeral or radioulnar joints)	11 (22%)	23 (52%)	.002
Neuromobilization techniques	4 (8%)	5 (11%)	.406
Stretching exercises	51 (100%)	44 (100%)	*NA
Strengthening exercises	49 (96%)	43 (98%)	.556
Cold modalities	51 (100%)	39 (89%)	.019

*Not able to calculate.

TABLE 5. Number of patients treated by each clinician and clinicians' years of orthopaedic physical therapy experience.

	Local Management (n = 51)	Local Management Plus Manual Therapy for the Cervical Spine (n = 44)
Therapist 1 (12 y)		
Number of patients treated	3 (6%)	0 (0%)
Percentage of successful outcomes	66%	*NA
Average number of visits	9.0	*NA
Therapist 2 (9 y)		
Number of patients treated	12 (24%)	27 (61%)
Percentage of successful outcomes	83%	77%
Average number of visits	10.56	5.6
Therapist 3 (1 y)		
Number of patients treated	2 (4%)	0 (0%)
Percentage of successful outcomes	100%	*NA
Average number of visits	11.5	*NA
Therapist 4 (40 y)		
Number of patients treated	19 (37%)	10 (23%)
Percentage of successful outcomes	79%	70%
Average number of visits	9.4	5.5
Therapist 5 (1 y)		
Number of patients treated	10 (20%)	6 (14%)
Percentage of successful outcomes	70%	100%
Average number of visits	9.6	5.7
Therapist 6 (3 y)		
Number of patients treated	5 (10%)	1 (2%)
Percentage of successful outcomes	40%	100%
Average number of visits	8.6	4.0

* Unable to calculate as no patients in this group were treated by the therapist.

DISCUSSION

The multitude of physical therapy interventions commonly utilized to treat lateral epicondylalgia makes the accurate assessment of the source of the symptoms vital. Research that evaluates the current treatment options can help determine the most effective and efficient clinical practices. This study is the first to describe the interventions used for a large sample of patients, as well as to provide information regarding long-term patient-reported outcomes and total number of physical therapy visits utilized.

The results of this retrospective analysis appear to suggest a relatively high success rate for all patients with lateral epicondylalgia undergoing physical therapy (overall success rate of 77% with an average follow-up time of 73 weeks). These findings are more favorable than those reported by Binder and Hazleman,⁵ who found that over 50% of all patients continued to experience activity-limiting symptoms (following a course of ultrasound and steroid injections) at a 3- to 4-month follow-up visit. In addition, at the 1-year follow-up, 11% of these patients had "severe pain." Halle and colleagues¹⁴ examined the effectiveness of ultrasound with a coupling agent, ultrasound with a 10% corticosteroid coupling agent, and transcutaneous electrical stimulation after 5 treatment sessions (on 5 consecutive days) combined with

a tennis elbow cuff, activity modification, and cryotherapy. Although the treatment program was effective, the magnitude of improvement ranged from 56% to 69% and a considerable percentage (19%-23%) of the subjects exhibited increased pain.

Although both treatment groups in our study showed relatively high rates of successful outcomes, patients receiving manual therapy to the cervical spine received fewer physical therapy visits than the patients not receiving these interventions (5.6 versus 9.7, respectively). Although both groups in our study fell within the expected prognosis as defined in the *Guide to Physical Therapist Practice*³ (80% of patients are expected to achieve goals within 6 to 24 visits), the fewer number of visits among patients receiving manual therapy to the cervical spine leads to speculation that inclusion of these interventions may result in more efficient treatment. These results correlate with the study by Gunn and Milbrandt¹¹ who found that 29 of 50 patients with chronic lateral epicondylalgia were able to return to their previous occupation after physical therapy management was directed at the cervical spine.

Although the results of our study found a relationship between improved efficiency of therapy and the use of manual therapy to the cervical spine, several other factors may have contributed to this observa-

tion. The LM and LM+C treatment groups also showed differences in the rates of utilization of other interventions directed to the elbow region. The LM group received ultrasound, iontophoresis, and cold modalities at a higher rate, while the LM+C group received manual therapy to the joints of the elbow region more frequently. Due to the retrospective nature of this study, the potential confounding effects of these interventions cannot be excluded. However, analysis of success rates based on receiving these interventions did not reveal any relationships between these interventions and rates of successful outcome.

It has been purported that both intrinsic and extrinsic factors contribute to the etiology of lateral epicondylalgia.^{21,28} Intrinsic factors include excessive loading of musculoskeletal tissues and articular/myofascial dysfunction at the elbow, resulting in stimulation of local nociceptors. Extrinsic factors have been documented to include mechanical dysfunction of the cervical and thoracic spine and neurophysiological sequelae of these altered mechanics.²¹ Although only 3 patients all in the LM+C group reported cervical symptoms on the initial evaluation, it is possible that a detailed cervical spine examination might not have been performed by the clinicians with less training in manual physical therapy. This hypothesis is based on the report that a considerable proportion of patients presenting with lateral epicondylalgia also exhibit hypomobility of the lower cervical spine.³⁷ If it is accurate that lateral epicondylalgia is a multifactorial syndrome, the rate of recovery in the LM+C group may have been expedited by the fact that both intrinsic and extrinsic factors were addressed.

Some researchers^{26,37} suggest that joint mobilization to the cervical spine results in immediate and significant hypoalgesia at the lateral epicondyle and increases in pain-free grip strength in patients with lateral epicondylalgia. More specifically, Wright et al^{39,40} and Smith et al³⁵ have identified that a neurophysiological mechanism exists which potentially explains the pain and mechanical hyperalgesia experienced in patients with lateral epicondylalgia. They speculate that central sensitization may be an important factor contributing to mechanical hyperalgesia and that neuronal changes within the spinal cord may be a greater contributor to symptoms than the peripheral nociceptor sensitization in subjects with lateral epicondylalgia.⁴⁰ These spinal mechanisms may explain the immediate and significant ($P<.001$) short-term reduction in pain in patients with lateral epicondylalgia who were treated with manual therapy to the cervical spine in a recent double-blind, placebo-controlled, randomized clinical trial.³⁷ Similarly, the manual therapy techniques to the cervical spine may have expedited recovery in our patients.

A number of limitations exist in this retrospective analysis. Perhaps of greatest relevance is the fact that 1 treating therapist identified cervical dysfunction at a greater rate than the rest of the group (Table 3). However, this therapist did not achieve a higher success rate among patients receiving manual therapy for the cervical spine, or utilize fewer visits as compared to the rest of the clinicians. The nature of our study cannot address the question of whether the other therapists should have used manual therapy for the cervical spine at higher rates, or if these therapists simply had a lower percentage of patients with cervical spine dysfunction. A high utilization of manual therapy for the cervical spine is consistent with the findings of other authors who report that greater than 90% of patients with lateral epicondylalgia exhibit cervical spine dysfunction.^{33,37}

The decision to use manual physical therapy to the cervical spine was based solely on clinician perception of the presence of cervical spine dysfunction upon physical examination. With the paucity of literature supporting the effectiveness of these practices in a patient population with lateral epicondylalgia, it is not surprising that the frequency of incorporating manual therapy techniques directed at the cervical spine varied between clinicians. It should be noted that experience did not appear to impact the outcomes achieved, as the trends for the entire group are similar to those of the therapist who had the most clinical experience (40 years).

The diagnostic criteria utilized to classify the patients as having lateral epicondylalgia in this retrospective analysis have not been scientifically validated. It is possible that many of the subjects may have been misdiagnosed and that their symptoms may have been referred from the cervical or thoracic spine.³⁷ Therefore, management of the cervical spine may have actually addressed the primary pain-generating tissues in these patients.

Although both groups exhibited statistically similar baseline characteristics such as age and symptom duration, lack of randomization does not allow for a true cause-and-effect relationship to be demonstrated. The outcomes of the patients could be related to other variables that could not be abstracted (as a result of documentation inconsistencies) from the charts including, activity level, type of work performed, any work modifications made, and prescription or compliance with home exercise programs. Also, lateral epicondylalgia has been described as a self-limiting disorder.^{11,32} Therefore, the demonstrated outcomes could be due to natural history of the disorder rather than a response to physical therapy interventions. Additionally, no standard outcome assessment tools exist for patients with lateral epicondylalgia and our retrospective analysis used a self-reported measure of a successful outcome. The development of a valid measure of function with the

ability to detect clinically significant change would be beneficial in determining effective management strategies for patients with lateral epicondylalgia.

It should also be recognized that the manual therapy to the cervical spine group did not include any form of high-velocity, low-amplitude spinal manipulation techniques. There is some evidence that high-velocity manipulation, as part of a multimodal treatment program, may improve outcomes in patients with chronic neck pain.⁹ Also, perhaps the results of this retrospective study would have been different if thrust manipulation techniques were directed at the elbow in either group, or to the cervical spine in the LM+C group.

Overall, the available literature regarding the evaluation of patients with lateral elbow pain and interventions for lateral epicondylalgia is lacking. Further investigations addressing the etiology and pathophysiology of lateral epicondylalgia, as well as validity testing of commonly utilized diagnostic criteria, should be conducted. It would also be beneficial to establish consistent terminology among the medical community. The relationship between lateral epicondylalgia, the cervical spine, and upper thoracic region should also be further investigated. Ultimately, methodologically sound, randomized clinical trials must be performed to more definitively determine the effectiveness of manual physical therapy to the cervical spine in the management of patients with lateral epicondylalgia.

CONCLUSION

In conclusion, the results of this retrospective analysis suggest that patients undergoing local management supplemented by manual therapy directed to the cervical spine for lateral epicondylalgia demonstrate a relatively high self-reported successful long-term outcome (75% and 80%, respectively). Although the success rates for both groups in this study were similar, the group that also received manual physical therapy directed to the cervical spine achieved the successful long-term outcome in significantly fewer visits (5.6 compared to 9.7). Based upon these results, we hypothesize that utilizing local management along with manual physical therapy to the cervical spine may be a more efficient management strategy than solely local management in this patient population. However, further randomized clinical trials are necessary to determine the effectiveness of manual physical therapy techniques directed at the cervical spine in patients with lateral epicondylalgia.

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Appendix

Standard Telephone Interview Questionnaire

Subject ID# _____

Date: _____

“Hello Mr/Mrs _____. I am a representative from _____ investigating functional outcomes achieved after receiving physical therapy treatment for elbow pain. Would it be okay to ask a few questions related to your physical therapy experience and functional status following treatment for your elbow pain?” (Yes/No)

1. “As a result of physical therapy intervention were you able to return to **ALL** functional activities following treatment for your elbow pain? This is defined as the ability to perform all leisure, work and household management activities as you were able to prior to developing elbow pain.” (Yes/No)

2. If no: “What activities were you not able to return to?”

3. If the patient was not able to return to all activities: “What factors do you think might have been attributed to your inability to make a full functional recovery?”

4. “Have you experienced a recurrence of your elbow symptoms since discharge from physical therapy? Recurrence is defined as a return of your elbow symptoms after resolution requiring you to seek medical attention for your symptoms.” (Yes/No)

Invited Commentary

This commentary will cover several issues canvassed by Cleland et al in their retrospective analysis of the addition of cervical spine treatment to local elbow treatment for lateral epicondylalgia. These issues encompass the etiology of the condition and the basis on which a practitioner devises a plan of care.

It is interesting that the 2 key diagnostic features of lateral epicondylalgia, that is, pain over the lateral epicondyle and impaired gripping due to pain, appear to parallel the current best practice evidence of the underlying etiology of the condition. In lateral epicondylalgia the reported pain is characterized by mechanical but not thermal hyperalgesia,^{13,19,20,21} which appears to be a sign of a compromised nociceptive system. The impairment in gripping tasks, which is best measured by pain-free grip strength,¹⁴ appears to reflect dysfunction in the motor system,^{10,14} for example, at sensory motor¹¹ and motor control⁵ levels.

Cleland et al state that they could find little consensus on the etiology of lateral epicondylalgia. Although the primary focus of their paper was on treatment and not on the etiology of lateral epicondylalgia, it is appropriate in terms of the topic

covered in the paper that an accurate representation of the most recent evidence on etiology is available to the reader. Further, it is also tempting to speculate that recent evidence for the pathophysiology underlying lateral epicondylalgia may well provide some support, albeit indirect, for treatment applied to the cervical spine. In a recent series of case control experiments, Alfredson and his colleagues³ used an in vivo microdialysis technique to demonstrate increased concentrations of glutamate, an excitatory neurotransmitter, at the site of pain in lateral epicondylalgia, as well as at other common sites of chronic tendinopathy, such as at the Achilles¹ and patellar² tendons. These studies¹⁻⁴ also showed that levels of prostaglandin E-2, a chemical marker of inflammation, were normal in chronic tendon pain, confirming earlier reports⁸ that there is no evidence of an inflammatory process in lateral epicondylalgia. Hence, the rationale for dropping the use of the term epicondylitis^{6,20} and the increasing realization that lateral epicondylalgia may involve altered nociceptive system function. In addition, substance P immunoreaction in biopsies from lateral epicondylalgia,⁷ along with increased expression of

glutamate NMDAR¹ receptors in Achilles tendinopathy,¹ lends further support to a neurogenic component in the pathophysiology of chronic tendon pain.

Interestingly, prior to this latest direct evidence of neurogenic involvement in lateral epicondylalgia,^{1-4,7} Wright and his coworkers^{12,20,22} provided indirect in vivo evidence of patterns of pain system dysfunction that mirrored, to the extent possible through in vivo human-based research, those described for secondary hyperalgesia in the pain science literature. One defining characteristic of secondary hyperalgesia is that the source of the pain is at a distance from where it is perceived,¹⁹ which allows for a possible biologically plausible notion of the involvement of cervical spine structures in lateral epicondylalgia. Also of interest is the previously reported findings of a high proportion of patients with lateral epicondylalgia demonstrating cervical spine impairment on manual physical examination.¹⁶ It should be noted that in our study¹⁶ none of the subjects were reporting neck pain or any other upper limb pain apart from that at the lateral epicondyle and forearm extensor muscles. However, caution should be taken when interpreting our findings, because, in our study, the therapist who examined the subjects was not blind to their condition. The paper by Cleland et al highlights the need for a detailed therapist-blinded (to group allocation, eg, nonsymptomatic versus symptomatic) randomized controlled investigation of the clinically discernable cervical spine involvement in lateral epicondylalgia, possibly coupled with detailed imaging studies of the cervical spine (eg, MRI).

Cleland et al reported that the decision to use manual physical therapy directed at the cervical spine was based solely on the individual practitioners' physical examination findings and that given the paucity of literature supporting this practice it was not surprising to find a range of approaches taken by the practitioners in the study. This would not surprise many physical therapists and raises the need for the development of a concerted research agenda to evaluate the approaches (and their efficacy) taken by therapists to arrive at their plan of care.

A serendipitous finding from some of our research may provide some insight into a potentially new means by which to devise a treatment plan. Studies of an oscillatory (frequency ~1.3 Hz¹⁷) lateral glide manipulation of the lower cervical spine have shown that it produces relatively larger effects in pressure-pain threshold (measured at the symptomatic lateral epicondyle) than it does in pain-free grip strength,^{15,16} whereas studies of an elbow manipulation (lateral glide mobilization with movement [MWM]) have shown it to preferentially improve pain-free grip strength.^{9,18} Possibly in the near future, there will exist research data that provide information on the relative effects of specific interventions, which

can be used to guide treatment plans. For example, in the case of deciding whether to use a lateral glide of the cervical spine versus a MWM at the elbow, perhaps, from the above, a patient with markedly reduced pressure-pain thresholds relative to pain-free grip strength deficits would be first treated addressing the neck region, whereas the patient with relatively greater deficit in pain-free grip strength could be better treated by MWM applied at the elbow. In this way, conceivably in the near future, physical impairments of conditions like lateral epicondylalgia may well be measured by reliable and valid means, such as pain-free grip strength and pressure-pain threshold, and that these features, on an individual basis, along with data of treatment-induced effects on these measures, may guide treatment application.

In summary, even though, as Cleland et al correctly express, this retrospective analysis is not of a high order of evidence, this paper does provide much needed impetus for further consideration, discussion and exploration, through both research and practice paradigms of the phenomenon of improved outcomes for management of lateral epicondylalgia by the additional treatment of the cervical spine.

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