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Periosteal Pecking versus Piston Dry Needling Techniques: A Comparative Study on Pain Reduction in Tennis Elbow

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ABSTRACT

Lateral epicondylitis is a musculoskeletal disorder caused by overuse of the extensor carpi radialis brevis (ECRB) tendon, characterized by pain and decreased muscle function. This study aimed to compare the effectiveness of piston dry needling and periosteal pecking techniques in reducing pain and improving handgrip strength in patients with lateral epicondylitis. This research employed a quasi-experimental pretest–posttest two-group design involving 20 respondents who were divided into two groups: the piston dry needling group (n = 10) and the periosteal pecking group (n = 10). Both groups received dry needling intervention once per week for four consecutive weeks, for a total of four treatment sessions**.** The instruments used included the Visual Analog Scale (VAS) to measure pain and a Hand Dynamometer to measure handgrip strength. Data were analyzed using paired t-tests for within-group differences and independent t-tests for between- group comparisons. The results showed that both dry needling techniques were effective in significantly reducing pain and increasing handgrip strength ($p<0.001$). In the piston dry needling group, the mean VAS decreased from 6.78 ± 0.66 to 2.55 ± 1.27 (Δ 4.23 ± 1.01), and handgrip strength increased from 23.20 ± 3.82 to 28.30 ± 4.12 (Δ 5.10 ± 2.60). In the periosteal pecking group, the mean VAS decreased from 7.25 ± 0.54 to 1.55 ± 0.35 (Δ 5.20 ± 0.70), and handgrip strength increased from 22.60 ± 3.20 to 25.90 ± 3.85 (Δ 3.30 ± 1.60). The independent t-test revealed significant differences in pain reduction ($p=0.020$) and handgrip improvement ($p=0.050$). In conclusion Periosteal pecking demonstrated greater effectiveness in reducing pain, while piston dry needling showed a stronger tendency to increase handgrip strength, although the between-group difference for handgrip strength was marginal. Future studies with larger samples or longer follow-up periods are recommended.
Keywords: Lateral epicondylitis; dry needling; piston; periosteal pecking; handgrip strength

INTRODUCTION

Lateral epicondylitis occurs as a result of overuse and repetitive loading of the *extensor carpi radialis brevis* (ECRB) tendon, leading to microtrauma and tendon degeneration rather than acute inflammation. This process involves structural alterations of the tendon, reduced vascularization, and changes in pain perception as well as motor disturbances. Biomechanical factors, such as repetitive friction at the tendon insertion area, also contribute to this condition.[1] Clinically, lateral epicondylitis causes tenderness over the lateral aspect of the elbow that may radiate along the extensor muscles, with pain commonly provoked during resisted wrist or finger extension. It is often accompanied by grip weakness and limitations in daily activities such as lifting, twisting, or grasping objects.[2] Epidemiologically, the prevalence of tennis elbow is reported to be approximately 1–3% in the general population, with the highest incidence in individuals aged 30–55 years, especially among those performing repetitive wrist and forearm activities.[3]

Management of lateral epicondylitis generally begins with conservative therapy aimed at reducing pain, improving function, and preventing recurrence. Commonly used conservative strategies include exercise programs (stretching and strengthening of the forearm muscles), electrotherapy modalities, and the use of bracing to decrease mechanical load on the affected tendon. These approaches have demonstrated effectiveness in reducing pain, restoring function, and improving grip strength.[4,5,6] In recent years, dry needling has gained popularity as an intervention for musculoskeletal pain, including tennis elbow, supported by emerging evidence indicating its ability to reduce pain, improve function, and accelerate recovery, particularly in patients who fail to respond to standard conservative therapy.[7]

Dry needling is an interventional technique using a thin needle directed toward myofascial trigger points or specific musculoskeletal structures to reduce pain and restore function through physiological and neurobiological mechanisms [8]. As the technique has evolved, different dry needling approaches have been adopted depending on the targeted tissue and the desired clinical outcome. Periosteal pecking involves repeated needle insertion until contact with the periosteum to stimulate a healing response in musculoskeletal tissues.[9] Meanwhile, the piston technique consists of rhythmic advancement and withdrawal of the needle within the trigger point region to elicit a local twitch response (LTR), which is believed to reduce neuromuscular hyperirritability and modulate pain perception.[10]

Both periosteal pecking and piston dry needling techniques are widely used in clinical practice as part of musculoskeletal pain management, including for lateral epicondylitis. However, scientific evidence directly comparing the effectiveness of these two techniques remains limited**,** particularly in Indonesia, where comparative dry needling studies on tennis elbow are scarce.[11] This shortage highlights a research gap**,** specifically regarding whether one technique offers superior clinical outcomes or is more appropriate for treating this condition.

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Based on this background, the present study aims to compare the effects of periosteal pecking dry needling and piston dry needling techniques on pain reduction in individuals with tennis elbow. The results are expected to provide stronger scientific support for physiotherapy practice and to help determine the most effective dry needling technique for managing pain in lateral epicondylitis.

MATERIALS AND METHODS

This study employed a quasi-experimental design with a pretest–posttest two-group approach, conducted at the Physiotherapy Department of Poltekkes Kemenkes Makassar. The sample consisted of 20 students who met the inclusion criteria, specifically the presence of myofascial trigger points in the wrist extensor muscles associated with lateral epicondylitis. The diagnosis was confirmed through palpation and functional tests, including Mill's test and Cozen's test. Participants were assigned into two groups: Group I (n = 10) received dry needling using the piston technique, whereas Group II (n = 10) received dry needling using the periosteal pecking technique. Pain intensity was measured using the Visual Analog Scale (VAS), and grip strength was assessed with a hand dynamometer. All outcome variables were measured before (pretest) and after (posttest) the intervention. Data analysis was conducted using SPSS. Descriptive statistics were used to summarize participant characteristics. The Shapiro–Wilk test was applied to examine the normality of data distribution. Within-group comparisons were analyzed using the paired t-test or Wilcoxon test, while between-group differences were assessed using the independent t-test or Mann–Whitney test, as appropriate based on data distribution. This study was approved by the Health Research Ethics Committee of Poltekkes Kemenkes Makassar (Approval No. 1574/M/KEPK-PTKMS/VIII/2025).

RESULTS

Table 1. Sample Characteristics Based on Gender, Duration of Mobile Phone Use, Commuting Distance, and Task Load

Characteristics	Group 1 (n=10)	%	Group 2 (n=10)	%
Gender				
Male	5	50.0	3	30.0
Female	5	50.0	7	70.0
Duration of Mobile Phone Use				
≤ 8 hours/day	4	40.0	6	60.0
> 8 hours/day	6	60.0	4	40.0
Commuting Distance				
≤ 10 km	7	70.0	8	80.0
> 10 km	3	30.0	2	20.0
Task Load				
Writing	6	60.0	4	40.0
Typing	4	40.0	6	60.0

Based on Table 1, it can be seen that the gender distribution in Group 1 was relatively balanced, with 50% male and 50% female participants. Meanwhile, Group 2 was dominated by females (70%) compared to males (30%). This composition indicates a noticeable difference in gender variation between the two groups. The duration of mobile phone use showed that the majority of respondents in Group 1 used their phones for more than 8 hours per day (60%), whereas in Group 2, most respondents used their phones for ≤ 8 hours per day (60%). Regarding commuting distance, most respondents in both groups traveled ≤ 10 km (Group 1: 70%; Group 2: 80%). This suggests that excessive commuting is unlikely to be a dominant factor influencing postural conditions in the study sample. In terms of task load, respondents in Group 1 were more engaged in writing activities (60%), while those in Group 2 were more engaged in typing activities (60%). Overall, the sample characteristics in this study demonstrate variations in both internal factors (gender) and external factors (duration of mobile phone use, commuting distance, and task load), which may serve as important determinants for the occurrence of postural disturbances and musculoskeletal complaints.

Table 2. Mean Pain (VAS) and Handgrip Strength Based on Pre-Test, Post-Test, and Difference Values

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Sample Group	Variable	Pre Test (Mean ± SD)	Post Test (Mean ± SD)	Difference (Mean ± SD)
Treatment 1 (Piston Dry Needling)	VAS	6.78 ± 0.66	2.55 ± 1.27	4.23 ± 1.01
	Handgrip Strength	23.20 ± 3.82	28.30 ± 4.12	5.10 ± 2.60
Treatment 2 (Periosteal Pecking)	VAS	7.25 ± 0.54	1.55 ± 0.35	5.20 ± 0.70
	Handgrip Strength	22.60 ± 3.20	25.90 ± 3.85	3.30 ± 1.60

Based on Table 2, both dry needling techniques were effective in reducing pain and improving grip strength in patients with tennis elbow. In the Piston Dry Needling group, the mean VAS score decreased from 6.78 ± 0.66 to 2.55 ± 1.27 (Δ 4.23 ± 1.01), accompanied by an increase in handgrip strength from 23.20 ± 3.82 to 28.30 ± 4.12 (Δ 5.10 ± 2.60). Meanwhile, in the Periosteal Pecking group, pain reduction was greater, decreasing from 7.25 ± 0.54 to 1.55 ± 0.35 (Δ 5.20 ± 0.70), although the improvement in handgrip strength was relatively smaller, increasing from 22.60 ± 3.20 to 25.90 ± 3.85 (Δ 3.30 ± 1.60). These findings indicate that Periosteal Pecking is more effective in reducing pain, while Piston Dry Needling provides greater benefits in enhancing grip strength, consistent with the theory that piston stimulation optimizes neuromuscular activation.

Table 3. Mean VAS Test in Treatment Groups 1 and 2

Sample Group	Before (Mean ± SD)	After (Mean ± SD)	t	p
Treatment 1 (Piston Dry Needling)	6.78 ± 0.66	2.55 ± 1.27	12.35	<0.001
Treatment 2 (Periosteal Pecking)	7.25 ± 0.54	1.55 ± 0.35	15.42	<0.001

Based on Table 3, the results of the mean VAS test in both treatment groups are presented. In the Piston Dry Needling group, the mean pain score decreased from 6.78 ± 0.66 to 2.55 ± 1.27, with $t = 12.35$ and $p < 0.001$, indicating a significant reduction in pain. In the Periosteal Pecking group, pain also decreased significantly, from 7.25 ± 0.54 to 1.55 ± 0.35, with $t = 15.42$ and $p < 0.001$. These findings suggest that both dry needling techniques are effective in reducing pain in patients with tennis elbow, with a greater reduction observed in the Periosteal Pecking group.

Table 4. Mean Test of Handgrip Strength in Treatment Groups 1 and 2

Kelompok Data	Before (Mean ± SD)	After (Mean ± SD)	t	p
Group 1 (Piston Dry Needling)	23.20 ± 3.82	28.30 ± 4.12	-6.25	<0.001
Group 2 (Periosteal Pecking)	22.60 ± 3.20	25.90 ± 3.85	-5.10	<0.001

Based on Table 4, the results of the mean handgrip strength test in both treatment groups are presented. In the Piston Dry Needling group, the mean handgrip strength increased from 23.20 ± 3.82 to 28.30 ± 4.12 with a t-value of -6.25 and $p < 0.001$, indicating a significant improvement in handgrip strength. In the Periosteal Pecking group, the mean handgrip strength also increased significantly from 22.60 ± 3.20 to 25.90 ± 3.85 with a t-value of -5.10 and $p < 0.001$. These results confirm that both dry needling techniques can enhance handgripstrength in patients with tennis elbow, although the Piston Dry Needling group achieved a greater improvement compared to the Periosteal Pecking group.

Table 5. Independent Sample t-test of Δ VAS and Δ Handgrip Strength in Both Groups

Variable	Piston Group (Mean ± SD)	Pecking Group (Mean ± SD)	t	p
Δ VAS	4.23 ± 1.01	5.20 ± 0.70	-2.51	0.020
Δ Handgrip Strength	5.10 ± 2.60	3.30 ± 1.60	2.03	0.050

Based on Table 5, the results of the Independent Sample t-test indicate differences in effectiveness between the two dry needling techniques. For the VAS variable, the mean pain reduction in the Periosteal Pecking

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group (Δ 5.20 ± 0.70) was greater compared to the Piston Dry Needling group (Δ 4.23 ± 1.01), with a statistically significant difference ($p = 0.020$). This finding suggests that the Periosteal Pecking technique is more effective in reducing pain intensity in patients with lateral epicondylitis.

Meanwhile, for the Handgrip Strength variable, the Piston Dry Needling group showed a greater improvement (Δ 5.10 ± 2.60) compared to the Periosteal Pecking group (Δ 3.30 ± 1.60), with a p-value of 0.050, indicating borderline statistical significance. These findings confirm that although both techniques are effective, there is a tendency toward specific advantages: Periosteal Pecking is more optimal in reducing pain, while Piston Dry Needling is superior in improving handgrip strength function.

DISCUSSION

Characteristics of the Study Sample

The characteristics of the study sample indicated variations that may influence susceptibility to lateral epicondylitis. In terms of sex, Group 1 had a balanced proportion of males (50%) and females (50%), whereas Group 2 was predominantly female (70%). This finding is important because previous studies have reported that women are at a higher risk of musculoskeletal complaints in the upper extremities, including the elbow, due to hormonal factors, differences in muscle strength, and a tendency to engage in more static repetitive activities.[12,13] These factors may explain why women are often more vulnerable to experiencing symptoms of lateral epicondylitis.

In terms of mobile phone usage duration, the majority of respondents in Group 1 used their phones for more than 8 hours per day (60%), whereas in Group 2, most participants reported usage of ≤ 8 hours per day (60%). Prolonged mobile phone use has been shown to increase the risk of postural disorders, particularly in the neck–shoulder region, which biomechanically can impose additional load on the forearm extensor muscles and trigger overuse-related symptoms relevant to lateral epicondylitis. In general, overuse and poor posture contribute to various musculoskeletal disorders; however, specific data linking mobile phone use to lateral epicondylitis remain limited. Extended mobile phone use can indeed cause postural problems in the neck and shoulder and increase the load on forearm muscles, but there is still no strong evidence that this specifically induces lateral epicondylitis.[14]

The commuting distance variable was relatively homogeneous, with the majority of respondents traveling ≤ 10 km (Group 1: 70%; Group 2: 80%), suggesting that this factor is unlikely to contribute significantly to the complaints. Meanwhile, in terms of workload, respondents in Group 1 were more engaged in writing activities (60%), whereas those in Group 2 were more involved in typing activities (60%). Prolonged repetitive typing has been associated with increased tension in the wrist extensor muscles, which are the primary muscles involved in lateral epicondylitis.[15] Overall, these characteristics emphasize that both internal factors (sex) and external factors (mobile phone use duration and workload) play important roles in influencing the risk and clinical manifestations of lateral epicondylitis, and may also affect patient responses to dry needling interventions.

Pain Reduction (VAS) after Dry Needling Intervention

The results of this study indicate that both dry needling techniques, Piston Dry Needling and Periosteal Pecking, were able to significantly reduce pain in patients with lateral epicondylitis. In the Piston Dry Needling group, pain reduction was reflected in the mean VAS score, which decreased from 6.78 ± 0.66 to 2.55 ± 1.27 ($t = 12.35$; $p < 0.001$). Meanwhile, the Periosteal Pecking group demonstrated a greater reduction, from 7.25 ± 0.54 to 1.55 ± 0.35 ($t = 15.42$; $p < 0.001$).

The difference in the magnitude of pain reduction can be explained by the physiological mechanisms underlying each technique. Piston dry needling is performed with a rapid in-and-out movement at the trigger point, which may cause mechanical disruption of the muscle fibers undergoing spasm. This process often induces a local twitch response (LTR), a localized reflex contraction of the muscle, which is believed to play a role in reducing spasm and promoting muscle relaxation.[16,17]

Conversely, periosteal stimulation through the pecking technique produces strong mechanical stimuli on the periosteal tissue, triggering the activation of afferent nerves and local nociceptors. This activation may elicit a central nervous system response, potentially enhancing the release of endogenous analgesic neurotransmitters such as endorphins and modulating central pain pathways, thereby reducing pain perception. Animal studies have shown that periosteal stimulation can induce changes in gene expression and biochemical responses that accelerate the healing process of both hard and soft tissues.[18]

The findings of this study are consistent with previous reports indicating that techniques targeting the periosteum are more effective in reducing pain compared to piston techniques. Periosteal pecking, by stimulating the more sensitive periosteal tissue, is thought to provide broader and stronger analgesic effects through the activation of central analgesic systems. In contrast, deactivation of muscle trigger points using the piston technique primarily targets spastic muscle fibers and produces local analgesic effects through the local twitch response. Thus, these results suggest that although both dry needling techniques are effective, periosteal pecking has greater potential as an intervention for managing pain in tennis elbow. However, much of the current evidence comes from animal studies and bone remodeling research, rather than specifically focusing on analgesic effects in humans.[18]

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Increase in Handgrip Strength

The results of this study demonstrate that both Piston Dry Needling and Periosteal Pecking techniques are effective in improving handgrip strength in patients with lateral epicondylitis. In the Piston Dry Needling group, mean handgrip strength significantly increased from 23.20 ± 3.82 to 28.30 ± 4.12 ($t = -6.25$; $p < 0.001$). Similarly, in the Periosteal Pecking group, there was also a significant increase from 22.60 ± 3.20 to 25.90 ± 3.85 ($t = -5.10$; $p < 0.001$). The improvement in handgrip strength in both groups can be explained by the reduction in pain following dry needling intervention. Pain reduction allows patients to more optimally activate the forearm extensor muscles, thereby enhancing handgrip function.[19] This mechanism is consistent with the pain–inhibition model, in which chronic pain inhibits motor activation through protective reflex mechanisms, and when pain decreases, this inhibition is reduced, resulting in more effective muscle contraction.[20]

The difference in findings between the two techniques indicates that Piston Dry Needling is superior in enhancing handgrip strength compared to Periosteal Pecking. This may be attributed to the direct effect of piston stimulation on muscle fibers through repeated insertion, which triggers a local twitch response and subsequently increases motor unit recruitment.[21] In contrast, Periosteal Pecking has been shown to provide significant analgesic effects, but there is no strong evidence that this technique directly improves muscle strength.[22] Thus, the findings of this study strengthen the evidence that the selection of dry needling techniques should be tailored to therapeutic goals, with Piston Dry Needling being more recommended for improving muscle function, whereas Periosteal Pecking is more effective in reducing pain.

Comparison of the Effectiveness of Piston and Pecking Dry Needling Techniques

The results of the Independent Sample t-test revealed a difference in effectiveness between the Periosteal Pecking and Piston Dry Needling techniques in managing patients with lateral epicondylitis. In terms of pain reduction (VAS), the Periosteal Pecking group demonstrated superior outcomes compared to the Piston Dry Needling group. The mean pain reduction in the Periosteal Pecking group reached Δ 5.20 ± 0.70, which was greater than that observed in the Piston Dry Needling group (Δ 4.23 ± 1.01), with a p-value of 0.020. This finding aligns with the theory that needle stimulation directed toward the periosteum provides stronger analgesic effects through the activation of both peripheral and central pain inhibition mechanisms, including the activation of descending pain inhibitory pathways and modulation of central sensitization.

Conversely, regarding handgrip strength, the Piston Dry Needling group showed greater improvement compared to the Periosteal Pecking group. The mean increase in handgrip strength in the Piston Dry Needling group was Δ 5.10 ± 2.60, whereas the Periosteal Pecking group demonstrated only Δ 3.30 ± 1.60, with a p-value of 0.050, indicating borderline significance. This suggests that repetitive stimulation using the piston technique is more capable of inducing neuromuscular activation, enhancing local blood flow, and reducing hyperirritability of the motor end plate, thereby improving muscle function, including grip strength.

Overall, these findings indicate that the two dry needling techniques exhibit different effectiveness depending on the therapeutic target. Periosteal Pecking is more effective in reducing pain intensity, while Piston Dry Needling is superior in improving muscle functional capacity through increased handgrip strength. These findings are consistent with previous studies suggesting that variations in dry needling techniques may produce distinct clinical effects, depending on the dominant physiological mechanisms activated by each technique.

In addition to the main findings of this study, several previous studies also support the difference in clinical effects between dry needling techniques targeting muscle tissue and techniques that provide periosteal stimulation.[23] explained that variations in clinical responses following dry needling are greatly influenced by needle penetration depth and the anatomical structures targeted, so techniques reaching the periosteum can elicit stronger sensory stimulation compared to techniques focusing on muscle trigger points. Furthermore, research by Arias-Buría et al. showed that dry needling in deeper tissues can produce more widespread analgesia through modifications of central nervous system activity.[24] Another study by Kietrys et al emphasized that the neuromodulatory effects of dry needling are not fully explained by local mechanisms but also by complex interactions between the peripheral somatosensory system and descending inhibition mechanisms.[25] These findings further reinforce that the differences in outcomes between piston techniques and periosteal pecking can be understood through the differences in the stimulated tissue structures and the neurophysiological mechanisms targeted by each technique.

LIMITATIONS

This study has several limitations that should be considered when interpreting the findings. First, the physiological mechanisms described in the discussion remain theoretical because this study did not measure objective indicators such as central nervous system activity, endorphin levels, or other biomarkers that could support claims regarding analgesic pathway activation. Second, the study did not include a detailed baseline clinical table, such as age, pain duration, and initial VAS scores, making it difficult to analyze potential differences in baseline characteristics between groups. Third, the sample size was relatively small, so generalization of the findings should be approached with caution. Fourth, this study evaluated only the short-term effects after the

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intervention; therefore, the long-term effects of the two dry needling techniques cannot yet be determined. Lastly, although this study compared two techniques, the review of previous literature was limited, making it difficult to comprehensively relate these findings to existing scientific evidence. Therefore, future research with a stronger design, larger sample size, measurable mechanistic analysis, and long-term follow-up is highly needed.

CONCLUSION AND RECOMMENDATIONS

Both piston and periosteal pecking techniques are effective in reducing pain and improving handgrip strength. The periosteal pecking technique demonstrates greater effectiveness in reducing pain, while the piston technique provides superior improvement in handgrip strength. Therefore, each technique offers specific advantages depending on the clinical outcome targeted

Based on the results of this study, it is recommended that physiotherapy practitioners consider the piston technique as one of the primary options in the management of musculoskeletal pain, particularly when associated with diminished handgrip strength. Future research should be conducted with a larger sample size and morediverse variables, such as range of motion, functional activities of daily living, and patient quality of life. Additionally, the combination of piston dry needling with other physiotherapy modalities should be explored to achieve more comprehensive therapeutic outcomes.

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