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EFFECT OF DRY NEEDLING ASSOCIATED WITH ECCENTRIC EXERCISE ON PAIN AND GRIP STRENGTH IN AMATEUR PADEL ATHLETES WITH LATERAL ELBOW PAIN

Henrique Santos Lima
Franciscan University - Physiotherapy Course
Santa Maria - RS
ORCID: 0000-0002-5452-9781

Eduardo Figueiredo Beust
Franciscan University - Physiotherapy Course
Santa Maria - RS
ORCID: 0000-0001-5672-2270

Pablo Mendes Lopes
Franciscan University - Physiotherapy Course
Santa Maria - RS
ORCID: 0009-0008-6375-3268

Vitória Gerloff Ventorini
Franciscan University - Physiotherapy Course
Santa Maria - RS
ORCID: 0009-0000-5535-0487

Pâmella Schramm Fernandes
Franciscan University - Biomedical Engineering Course
Santa Maria - RS
ORCID: 0000-0004-0603-0788

Lilian Oliveira de Oliveira
Franciscan University - Physiotherapy Course
Santa Maria - RS
ORCID: 0000-0002-4116-0866
http://lattes.cnpq.br/0739341240075133

Conrado Pizzolatto Castanho
Franciscan University - Physiotherapy Course
Santa Maria - RS
ORCID: 0000-0001-6567-6982

João Rafael Sauzem Machado
Franciscan University - Physiotherapy Course
Santa Maria - RS
ORCID: 0000-0003-0918-9682
http://lattes.cnpq.br/7402410174306137

Jaqueline de Fátima Biazus
Franciscan University - Physiotherapy Course
Santa Maria - RS
ORCID: 0000-0002-7741-475
http://lattes.cnpq.br/0088847587632365

ABSTRACT: Padel is a high-intensity racket sport, with repetitive gestures that can predispose amateur athletes to lateral epicondylitis, the most common injury in the sport. This case series study evaluated whether the combination of dry needling with eccentric exercises reduces pain and improves grip strength in amateur athletes with lateral elbow pain in Santa Maria - RS. Data was collected from 12 athletes using the *Patient-rated Tennis Elbow Evaluation Questionnaire* (PRTEE), pressure algometry and handgrip dynamometry. After the intervention, the average PRTEE score decreased from 43.2 to 28.4 points, the pressure pain threshold increased from 5.6 kg to 6.7 kg, and grip strength varied from 50.6 kg to 49.2 kg. The results indicate that the intervention reduced pain and increased the pressure pain threshold, but did not improve grip strength. Randomized controlled trials are needed to strengthen the evidence on the treatment of lateral epicondylitis.
KEYWORDS: Muscle Strength Dynamometer, Lateral epicondylitis, Racquet sports, Pain threshold.

INTRODUCTION

Padel is a racket sport played on a 20 × 10m grass court, divided by a net and bordered by glass and railings. The sport originated in Mexico in 1969, adapted from a squash court with tennis elements. Recently, a growing number of players and courts have sprung up in more than 40 countries. A padel court is about a third smaller than a tennis court and the racket is made of carbon fiber and/or glass. The sport has been defined as high-intensity, combining high-frequency sporting gestures. In addition to the dynamics of the game and the technical-tactical demands, padel performance is influenced by the physical capacity and kinematic patterns of recreational athletes with less demanding competitive demands, but which can hide the risk of injury (Demeco *et al.*, 2022).

In terms of the differences between the sexes of amateur players, men tend to play padel more often, have been practicing for longer and position themselves closer to the net, developing a more aggressive game. Therefore, although there are many factors that determine the appearance of injuries, gender is a fundamental intrinsic factor in their appearance and characteristics (Muñoz *et al*., 2022).

Sport seems to play an important role in promoting constant physical activity and a better lifestyle among adults. Despite this, considering the increase in chronic pain that can eventually lead to injuries and abandonment of practice, recreational players should consider prevention strategies, focusing on proper technique from their start in the sport (Sánchez-Alcaraz *et al*., 2021).

The scarcity of published studies examining padel injuries in recreational athletes limits the availability of robust data on injury rates, mechanisms and associated factors. This knowledge gap hampers our ability to develop evidence-based injury prevention strategies, implement targeted interventions and ultimately promote the well-being of padel players. The elbow joint is the site most affected by injuries in padel players and lateral elbow tendinopathy is the most commonly reported pathology (Dahmen *et al.,* 2023).

Pain in the lateral epicondyle of the humerus during loading of the wrist extensor muscles is a common musculoskeletal dysfunction. The above symptom is associated with the clinical diagnosis of lateral elbow tendinopathy, also known as tennis elbow or lateral epicondylitis (Coombes; Bisset; Vicenzino, 2015).

The lateral epicondyle, located above the humeral chapter, is the proximal insertion of the wrist extensor and forearm supinator muscles. The most common site of lateral elbow tendinopathy is where the origin of the common extensor digitorum muscle meets the lateral epicondyle of the humerus (Lucado *et al.,* 2022).

According to the clinical practice guideline by Lucado *et al.* (2022), it is strongly recommended to assess athletes with lateral elbow tendinopathy using the Patient-rated Tennis Elbow Evaluation Questionnaire (PRTEE) by Rompe; Overend; MacDermid (2007) and the moderately recommended assessments are pressure algometry and handgrip dynamometry. As for treatment, it is known that eccentric wrist extensor contraction exercises and dry needling are recommended as moderate evidence and should be used to manage lateral elbow tendinopathy. However, the literature lacks studies evaluating the efficacy of the two associated interventions.

Eccentric strengthening exercises should be used as a first-line treatment for lateral elbow tendinopathy in order to lengthen the musculotendinous unit, inducing structural adaptation of the tendon, changes in tendon length and a reduction in neurovascular growth (Yoon *et al.,* 2021).

Dry needling is defined as an approach that uses a filiform needle to stimulate the skin, trigger points in muscles or connective tissue for the treatment of musculoskeletal pain. This needling does not introduce any substance into the tissues (Navarro-Santana *et al*., 2020).

Therefore, this study sought to verify whether dry needling associated with eccentric exercise reduces pain and improves handgrip strength in a group of amateur padel athletes from Santa Maria (RS) with lateral elbow pain.

METHODOLOGY

This study is a clinical trial of the case series type, which was carried out at the Fair Play Arena club, located in the city of Santa Maria (RS), where the athletes' identification form, questionnaire (PRTEE), pressure algometry, which evaluates pressure defined as pain in kilograms, handgrip dynamometry, which evaluates maximum strength in kilograms and the eccentric exercise protocol of

the wrist extensors associated with dry needling were collected. The research project took place from June to October 2024.

The study sample consisted of male padel players. The athletes met the following inclusion criteria: They agreed to take part in the study, signed the informed consent form, had a pre-established schedule and training time, reported elbow pain for at least 3 months and had more than 75% attendance during the study. The exclusion criteria were: use of analgesic medication during the intervention, fear of needles and having done heavy manual labor in recent days.

The final sample consisted of 12 athletes who met the inclusion criteria. The padel players were in training and aged between 26 and 54.

This study is part of the Research Project entitled "Analysis of Respiratory, Biochemical and Musculoskeletal Variables and Quality of Life of Athletes", approved by the Ethics Committee of the Franciscan University, under CAAE number: 04319118.3.0000.5306. The research only took place after the signatures of the person in charge of the Fair Play Arena Club in Santa Maria - RS, the athletes signed the ICF, Assent Form and all received the confidentiality form. After signing the ICF and the Informed Consent Form, the evaluation day was scheduled with all the athletes at the Fair Play Arena Club in Santa Maria.

First, they filled in an identification form made up of open and closed questions, containing personal data, frequency and time of training, the side of the court the participant usually plays on, dominant upper limb, age, weight, height, use of medication, brand, weight and how long they have been playing with a racket and which category they compete in. The athletes were then taken to a quiet, safe space where they answered the PRTEE questionnaire, underwent pressure algometry in the painful region of the lateral epicondyle and handgrip dynamometry. From the 2nd to the 5th week, the eccentric wrist extensor exercise protocol was carried out with 3 sets of 12 repetitions and dry needling, which was applied by the same two academics on the same athletes throughout the intervention. In the 6th, 7th and 8th weeks, the same exercises were performed, but with 3 sets of 15 repetitions and dry needling. The 9th and 10th weeks were breaks with the aim of prospectively measuring the intervention protocol. The 11th week of the intervention was a reassessment using the same instruments. The interventions lasted approximately 50 minutes and were carried out once a week. The intervention is shown in Figure 1.

Intervention protocol:

1. Eccentric contraction exercises for the wrist extensors:

The exercises chosen were based on the guideline recommendation by Lucado *et al.* (2022) and the sets and repetitions adapted from the protocol by Dunning *et al.* (2024).

Exercise 1: Patient seated with elbow in 90 degrees of flexion supported on the stretcher, with resistance from a mini band held by the therapist generating instability, comes out of a wrist extension and resists the movement by performing a wrist flexion, emphasizing the eccentric contraction of the wrist extensors.

Exercise 2: Patient seated with elbow in pronation and extension supported on stretcher with free wrist and with resistance from a mini band attached to the foot itself, performs wrist extension at high speed with the aid of the other hand and controls the movement by flexing the wrist, emphasizing eccentric contraction of the wrist extensors.

2. Dry needling:

4 insertion points were used and the time that the needles remained in the points was 20 minutes and they were discarded in the decarpack. The points where the needles were applied were based on and adapted from the protocol by Dunning *et al.* (2024).

Point 1: Proximal insertion of the tendon of the extensor digitorum communis on the lateral epicondyle;

Point 2: Proximal insertion of the extensor carpi radialis brevis;

Point 3: Insertion through the lateral area of the brachioradialis with the aim of reaching the supinator;

Point 4: Three fingers proximal and anterior to the lateral epicondyle with needle depth to reach the anterior brachial.

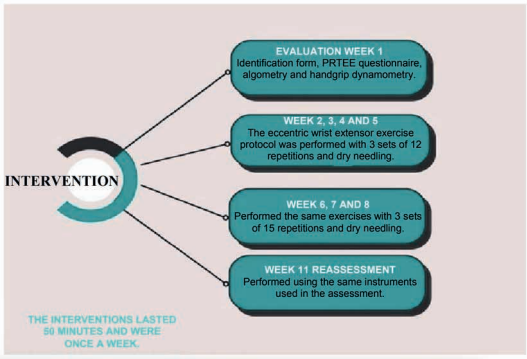


Figure 1 - Intervention protocol flowchart

Source: Authors' data, 2024.

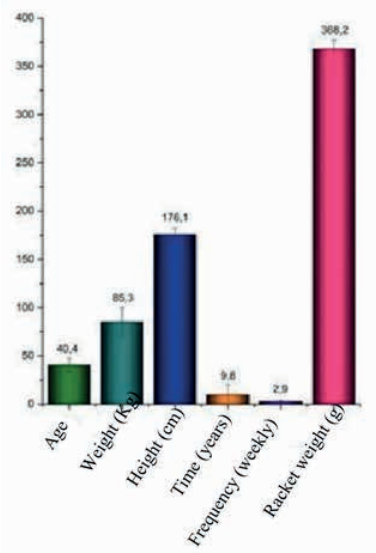
During the assessment and intervention, participants from the Sports Analysis Research Group (GPAD) at Franciscan University helped with the data collection.

For the statistical analysis, descriptive statistics were used (mean, standard deviation and percentage). The Shapiro-Wilk test was also carried out to verify the normality of the data collected. The T-test for paired samples was used to compare the results. Pearson's Correlation Coefficient test was also used to correlate the data. The significance level used was $p \leq 0.05$. Origin software was used for the statistical analysis.

RESULTS

The population was made up of 30 male athletes. After the assessment using the inclusion and exclusion criteria, the final sample was 13 athletes. There was a sample loss during the reassessment after the end of the intervention, one athlete did not show up due to travel and was excluded from the study, closing the sample at 12 athletes.

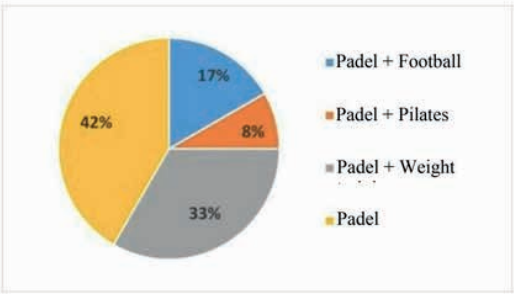
Graph 1 shows the profile of the athletes with average age, weight, height, time spent playing paddle tennis, weekly frequency of practice and racket weight.



Graph 1 - Description of the athletes' profile

Source: Authors' data, 2024.

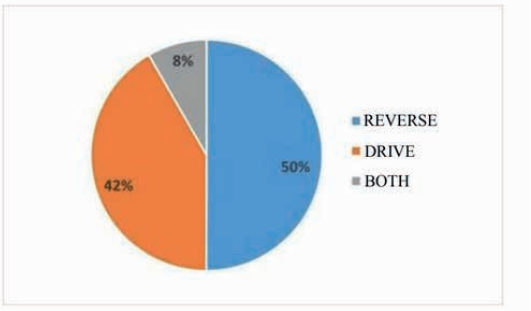
The list of athletes who do something other than padel is shown in Graph 2.



Graph 2 - Padel and other exercise.

Source: Authors' data, 2024.

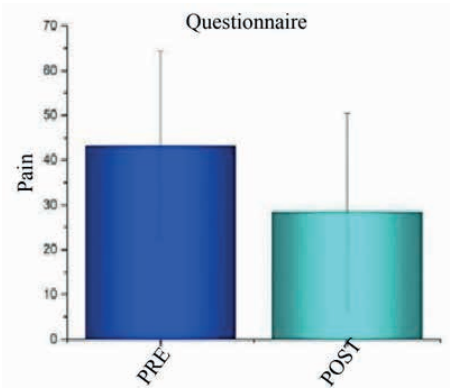
The percentage of the position on the court that the athletes play is shown in Graph 3.



Graph 3 - Position on the court.

Source: Authors' data, 2024.

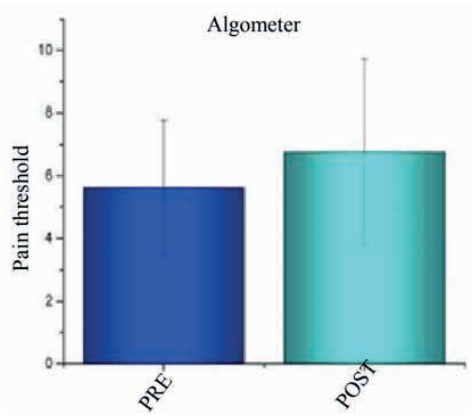
The results of the questionnaire (PRTEE), validated for Portuguese, has 5 items on pain, 6 items on the difficulty in carrying out usual activities and 4 items on the difficulty in carrying out specific activities, and the three parts were added together to calculate the total score. The best score is 0 and the worst is 100 (pain, usual and specific activities contribute equally to the score). The results of the pre-intervention assessment had a mean of 43.25 on a scale of 0 to 100 points with a standard deviation (SD) of 21.08. In the post-intervention reassessment, the average was 28.41 with a standard deviation of 21.99, reducing the average by 14.84 points. This shows a statistically significant reduction in scores ($p = 0.02$), as shown in Graph 4.



Graph 4 - Questionnaire (PRTEE)

Source: Authors' data, 2024.

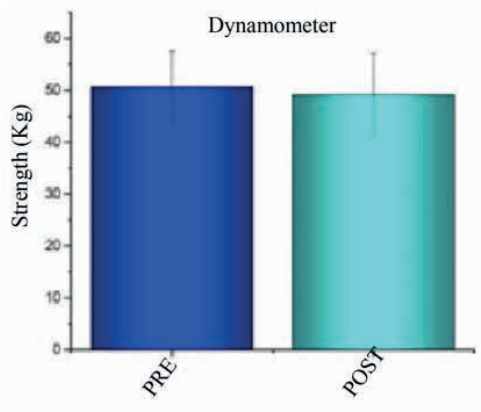
When assessing the outcome of the pressure pain threshold with the MED.DOR algometer, numerically, the outcome improved. However, there was no statistical difference between the means (5.6kg) pre- and (6.7kg) post-intervention ($p = 0.11$), shown in Graph 5.



Graph 5 - Pressure algometry

Source: Authors' data, 2024.

When assessing maximum handgrip strength using the Electronic Hand Dynamometer, model EH101, it was found that, statistically, there was no difference in the results before and after the intervention, which were 50.6kg and 49.2kg respectively ($p = 0.86$), shown in Graph 6.



Graph 6 - Handgrip dynamometry

Source: Authors' data, 2024

DISCUSSION

The alternative hypothesis of this study was that dry needling associated with eccentric exercise would be effective in increasing

the pressure pain threshold, grip strength and reducing the total score of the Patient-rated Tennis Elbow Evaluation Questionnaire (PRTEE). The aim was to see if dry needling associated with eccentric contraction exercises of the wrist extensors would improve the aforementioned outcomes. It was found that there was no statistically significant difference in the pressure pain threshold and maximum grip strength scores before and after the intervention, but there was a significant reduction in the total score of the PRTEE according to the statistics.

In this study, when evaluating the profile of the athletes, it can be seen that the average age was 40.4 years. (2023) on the incidence of padel injuries, which analyzed eight studies with a total of 2022 participants, found that the age range was 31 to 57 years, which is close to the average of the present study, where the age ranged from 26 to 54 years. This research also agrees with Uygur; Aktas; Yilmazoglu., (2021), who carried out a controlled trial with 108 people with lateral elbow pain, divided into 2 groups with 54 people in each group, where they evaluated the effect of dry needling (DN) against corticosteroid injection on pain and function using the questionnaire (PRTEE), where they used a population with an average age of 47.7, corroborating the average age of the present study.

The study by Muñoz *et al.* (2022) analyzed the incidence of injuries in amateur padel players, the average height of the men was 177.5 cm and weight 78.7 kg, the study also showed how long the players had been practicing the sport, 48% started playing more than 5 years ago and it was also seen that 71% of the individuals play padel more than 3 hours a week, and the average time of a game is 1 hour. Finally, they analyzed the weight of the racket, where 83% of the rackets weighed more than 350g and the study also points out that a weight of 350g or more seems to be a parameter that is related to the appearance of injuries in amateur padel players. The results are similar to those of the present study, where the average height was 176.1 cm, the average weight was 85 kg, the average number of days played per week was 2.9 days and the average racket weight was 368.6 g, which could be related to the onset of lateral epicondylitis. The same study by Muñoz *et al.* (2022) showed that practicing another sport does not influence the appearance of padel injuries in the upper body. In the present study, 58% of the athletes, i.e. the majority, play padel and practice another sport, followed by 42% who only play padel. From this, it is not possible to make a direct causal relationship between lateral epicondylitis and playing only Padel or not.

When showing the percentage of court position of the athletes in this study, the majority (50%) play on the left side (reverse), followed by 42% on the right side (drive) and, finally, 8% reported that they play on both sides. This shows that most of the players in the sample play more aggressively and a little more intensely because they play on the left. Muñoz *et al.* (2022) compared the aggressiveness of the game between men and women and found that men tend to play closer to the net, making more attacking shots than defensive ones, with more vertical jumps and manual grip on the racket, thus developing a more aggressive and intense playing characteristic, which is in line with the present study, as the sample is made up of men.

In the current study, it was observed that the eccentric exercise and dry needling did not result in a statistically significant difference in the pre- and post-intervention values related to maximum muscle strength of palmar grip and pressure pain threshold. However, the results of the post-intervention questionnaire (PRTEE) showed a statistically significant reduction in its total score compared to

the previous weeks of the protocol. According to a meta-analysis of 54 placebo-controlled trials by Ezzatvar *et al.,* (2024) which quantified the proportion not attributable to specific effects (EPC) of physiotherapy interventions for musculoskeletal pain, the non-specific effects were the Hawthorne effect, natural history of disease, regression to the mean, placebo and contextual effects. It was reported that dry needling had 75% (EPC), i.e. only 25% of the improvement was due to the dry needling treatment itself, while exercise therapy had 46% (EPC), and 54% of the improvement was due to the exercise treatment itself. This highlights the importance of carrying out a controlled trial to eliminate the confounding factors mentioned above.

Still in relation to the questionnaire (PRTEE) used in this study to assess pain and self-reported function by the athletes, it was observed that the average total score after the intervention was lower than before the exercises and dry needling, with statistical significance. A study by Uygur; Aktas; yilmazoglu.., (2021) who carried out a controlled trial with 108 people with lateral elbow pain, divided into 2 groups with 54 in each, evaluated the effect of dry needling (DN) x corticosteroid injection on pain and function using the (PRTEE), and found that the total score of the questionnaire was statistically lower in both groups after treatment, however, in the DN group the reduction was greater, with an average of 15.7 on a scale of 0 to 100 points with a standard deviation of 7.7, which corroborates the results of the present study.

The systematic review by Cullinane; Boocock; Trevelyan, (2014) which aimed to establish the effectiveness of eccentric exercise as a treatment intervention for lateral epicondialgia, analyzed 12 studies, 8 of which were controlled trials with a total of 334 individuals. After treatment with eccentric exercise, it was observed that there was an improvement in pain, function and grip strength compared to baseline values. Seven studies reported improved grip strength for therapeutic treatments including eccentric exercise compared to those excluding eccentric exercise. Eccentric exercise was used associated with dry needling as a treatment for athletes with lateral epicondylitis in the present study, and the results of the study are not in line with the review cited above, as there was no significant difference in grip strength after the weeks of intervention.

When evaluating the pressure pain threshold of the athletes in the present study, it was found that there was no statistically significant difference in the mean values pre-intervention (5.61 kg) and post-intervention (6.75 kg). The controlled trial by Smidt *et al.* (2002) aimed to compare the effectiveness of a "wait and see" policy with that of physiotherapy and corticosteroid injections on the pressure pain threshold. With 185 participants randomly divided into the three groups, the study had follow-ups of 3, 6, 12, 26 and 52 weeks and it was found that, at 6 weeks, the injections were superior to the other groups. However, in the long term, the differences between physiotherapy and injections were in favor of physiotherapy, which included strengthening exercises in the program. This shows that, in the long term, the pressure pain threshold outcome improved compared to "wait and see" and injections, which goes against the results of this study.

The review of surgical and physiotherapy treatments including eccentric stretching, muscle strengthening, electrothermophototherapeutic resources and deep tissue massage for lateral epicondylitis by Wolf, (2023) showed that there is no strong evidence to support significant benefits of any intervention on pain and grip strength in patients with the condition, some evidence, although inconsistent and of low to moderate quality, supports

physiotherapy for lateral epicondylitis. This review corroborates the present study, which found that eccentric exercise associated with dry needling showed no significant improvement in maximum grip strength. The design of this study has some limitations, as it does not have a comparison group (control) and thus does not exclude confounding factors/measuring biases, which are: the placebo effect, regression to the mean, the natural history of the disease and the Howthorne Effect.

CONCLUSION

Based on the results obtained in this study, it can be concluded that the protocol with dry needling associated with eccentric exercise of the wrist extensors reduced the total score of the questionnaire (PRTEE), improved the pressure pain threshold values and, finally, did not improve the maximum handgrip strength of the athletes. Randomized controlled trials with large samples and good methodological quality are needed to improve the evidence on treatments for lateral epicondylitis.

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