International Journal of
Disabilities Sports and Health Sciences
e-ISSN: 2645-9094

RESEARCH ARTICLE

Which Cold Application is More Effective for Tennis Elbow? Cooling Gel vs Cold Pack

Nihan ÖZÜNLÜ PEKYAVAŞ[1*] and Senay ÇEREZCİ DUYGU[2]

[1]Başkent University, Faculty of Health Sciences, Physiptherapy and Rehabilitation Department, Ankara, Turkey
[2]University of Health Sciences, Gülhane Faculty of Health Sciences, Orthotics and Prosthetics Department, Ankara, Turkey
*Corresponding author: senay.cerezciduygu@sbu.edu.tr

Abstract

Objectives: The purpose of this study was to investigate which cold application is more effective to regulate skin temperature in patients with tennis elbow. Design: Randomized clinical study. Participants: Fifty-four patients with tennis elbow were randomly divided into 2 groups as cooling gel group (n=27) and cold pack group (n=27). Interventions: Cooling gel and cold pack applications were applied on painful lateral epicondyle region for 15 minutes. Main outcome measures: Patients were assessed before and after the application. Assessments included the severity of pain during wrist extension, evaluated by Visual Analog Scale (VAS) and thermal imaging of lateral epicondyle region evaluated by Infrared Thermography (FLIR5 Thermal Camera). Results: There were no significant differences between baseline assessments of pain severity and thermographic measurements in both groups ($p>0.05$). Significant differences were found between baseline and post-application measurements at pain and thermographic measurements in both groups ($p<0.05$). In comparison of cooling gel and cold pack groups, no significant differences were found in means of pain ($p=0.095$) and thermal imaging results ($p=0.333$). Conclusion: Both cooling gel and cold pack application are found effective in decreasing skin temperature in patients with tennis elbow and their use should be considered in treatment program.

Keywords
Thermal Analysis, Cold, Epicondylitis, Tennis Elbow, Pain

INTRODUCTION

Lateral epicondylitis (also known as tennis elbow) is a common seen pathology characterized by pain and tenderness at the lateral epicondyle region, as well as strength loss of the wrist extensors (Hong, Durand, and Loisel 2004; Goguin and Rush 2003; Barry S Kraushaar and Nirschl 1999). This is not only an inflammatory process, but also a process known as tendinosis in which fibroblastic activities and vascular responses are present. Especially changes in the collagen organization occur around the wrist extensors, especially Extensor Carpi Radialis Longus and Brevis muscles, necessitating more vascular increase with increase in inflammatory signs such as increase in skin temperature and pain (Hume, Reid, and Edwards 2006; Waseem et al. 2012). In the treatment of lateral epicondylitis, cold applications (cold pack, cooling gel, etc.), orthotics, taping, exercise therapy, electrotherapy applications, extracorporeal shockwave therapy and surgical treatment approaches are commonly used (K. Bishai and Plancher 2006; Barry S Kraushaar and Nirschl 1999; Fedorczyk 2006).

Received: 22 December 2021 ; **Accepted:** 20 April 2022 ; **Published:** 20 June 2022
[1]**ORCID**: 0000-0003-4060-9366, [2]**ORCID:** 0000-0003-0603-5688

An effective treatment of lateral epicondylitis is cold application to reduce circulation, to limit inflammation and to control pain, which is very important in the treatment and rehabilitation process. Owing to these reasons cold treatment agents are frequently used in various orthopedic disorders such as overuse injuries and sports injuries. Frequently applied cold agents are ice packs with local influences, cold packs (reduce the superficial skin temperature by 10.2±3.5°C), ice friction, ice water immersion, cold compression devices, cooler sprayers and cooler gels (Kanlayanaphotporn and Janwantanakul 2005; Lessard et al. 1997; Knight 1995).

Among the planned multidimensional treatments, thermal modalities including cold applications are frequently used. We clinically observe that cold agents increase the efficacy of treatment. According to this information and our clinical experiences, we think that using cold application may increase the effectiveness in treatment of lateral epicondylitis. As there is a lack of literature about this subject, our aim for this study was to investigate which cold application is more effective in decreasing skin temperature in patients with lateral epicondylitis.

MATERIALS AND METHODS

Study Design and Participants

This study was approved by Baskent University Institutional Review Board and Ethics Committee (Project no: KA22/141). The clinical trial number is NCT04536948. The assessments were explained in detail and the written informed consent was taken before intervention. Same physiotherapist done assessments before and after cold application.

Patients diagnosed with lateral epicondylitis by a physiatrist were included in the preliminary evaluation. Subjects with elbow pain for at least 3 months, those between 20 and 40 years of age who did not have cold allergies were included in our study. The exclusion criteria were; having any other orthopedic elbow pathology, cervical or other upper extremity pathology, elbow joint operation history, tendon rupture, limited range of motion due to humerus, radius or ulna fracture, history of osteoporosis, malignancy, hemophilia, neurological or cognitive dysfunction.

As a result of the evaluations 54 participant were included in our study and were randomly divided into two groups. The groups were as follows: Cooling Gel (n=27) (Age X±SD: 27.96±10.59, BMI X±SD: 23.61±3.79) & Cold Pack (n=27) (Age X±SD: 20.81±3.45, BMI X±SD: 21.50±2.40).

Assessments

Pain Severity: The severity of shoulder pain at rest, night and activity was evaluated by Visual Analogue Scale (VAS). Accordingly, in a line of 10 cm 0 point refers to no pain, 10 point was considered to be the maximum value of pain. Patients were asked to mark the severity of their pain on line and measured value was recorded in cm (Downie et al. 1978).

Thermographic Assessment: An infrared thermometer, FLIR E5 Thermal Camera (FLIR Systems AB, Sweden) was used for thermographic assessment. In the measurement made with infrared thermography, thermal camera receives and processes the infrared radiation emitted from the surface of the body and records the temperature distribution of the skin (Beneliyahu 1992; Vainer 2005; Cerezci Duygu et al. 2018). Each participant was evaluated in the same room (ambient temperature set to 21°C) (Loughin and Marino 2007) and participants were left for 10-20 minutes to ‘acclimatize’ to the thermographic imaging environment (Tunley and Henson 2004). The measurements were taken at a distance of about 1 meter from lateral epicondyle during wrist extension. It was reported that infrared themography may be a reliable and valid measure of treatment outcomes with clinical utility and sensitivity (Tunley and Henson 2004) (Figure 1a-b).

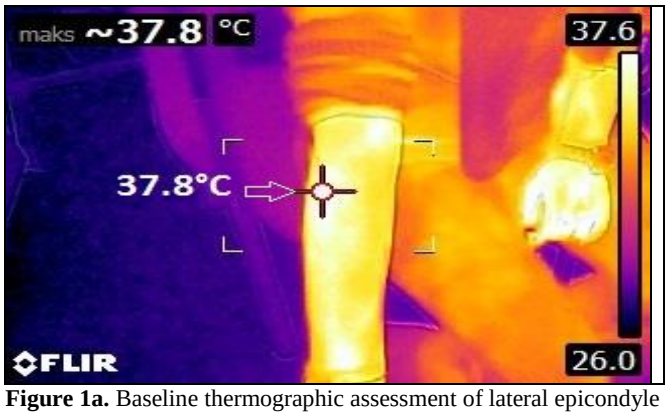

Figure 1a. Baseline thermographic assessment of lateral epicondyle

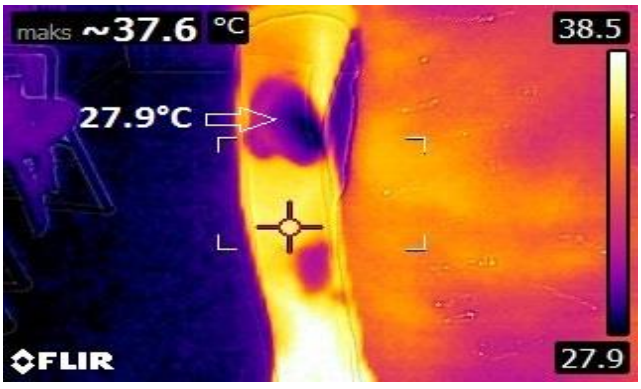

Figure 1b. Thermographic assessment of lateral epicondyle 15 minutes after cooling gel application

Treatment Protocol

Cooling Gel and Cold Pack Applications: Cooling gel (Nelsons Arnicare Arnica Cooling Gel) was applied to the lateral epicondyle region with sponge head 3 times a day ("American Medical Association | AMA" n.d.). The cooling gel was applied to the painful area around the lateral epicondyle. Cold pack was applied to the painful area for 15 minutes on a moist towel placed on the painful area around the lateral epicondyle (Wilson and Best 2005; Fedorczyk 2006).

Statistical Analysis

The power analysis indicated that 27 participants for each group were needed with 80 % power and a 5 % type 1 error. The power analysis of our study showed a power of 80% with skin temperature as the primary outcome. For statistical analysis; pain severity and thermographic values of the painful area due to lateral epicondylitis was recorded before and after application. The data were found to be non-parametric due to normality analysis. Wilcoxon Signed-Rank Test was used to compare baseline and post-application measurements. Mann Whitney-U test was used to analyze differences between groups. The level of significance was always set as $\alpha = 0.05$. All analyses were conducted using a statistical program (SPSS for Windows 21.0).

RESULTS

Both cold pack and cooling gel groups were found to be similar in terms of pain and skin temperature at baseline ($p>0.05$). Significant difference was found between baseline and post-application measurements in both group in terms of pain and skin temperature ($p<0.05$) (Table 1). Considering the differences between baseline and post-application measurements, cooling gel application group has decreased 1.5 cm in VAS for pain intensity whereas cold pack application group has decreased 1.33cm. Considering the surface temperature of the lateral epicondyle region examined in the thermographic assessment, cooling gel application group has decreased 2.64 C°, whereas cold pack application group has decreased 2.62 C°. In comparison of cooling gel and cold pack groups, the difference was not statisticly significant in terms of pain ($p=0.095$) and skin temperature ($p=0.333$)

Table 1. Differences between baseline and post-application results

	Pain (cm)			Skin temperature (°C)		
	Baseline	Post-application		Baseline	Post-application	
	X±SD	X±SD	p	X±SD	X±SD	p
Cooling Gel (n=27)	2.82±2.63	1.32±1.07	0.001*	26.42±4.50	23.78±3.45	0.015*
Cold Pack (n=27)	1.88±1.61	0.55±0.43	0.001*	24.73±1.72	22.11±2.66	≤0.01*

*p<0.05

DISCUSSION

The aim of our study was to investigate the effects of different cold applications in the treatment of lateral epicondylitis. Cold pack and cooling gel application decreased the tissue temperature and pain significantly. The difference between the two groups in reducing pain and decreasing skin temperature was not statisticliy significant.

Researchers indicate that the increased skin temperature can be determined by the thermal imaging. Increased tissue temperature is a symptom of the inflammatory process. It has been observed that overuse and pathological problems increase the tissue temperature (B S Kraushaar and Nirschl 1999). Increased temperature in inflamed tissue causes vasodilatation. Decreased tissue temperature causes vasoconstriction and reduces blood circulation. Tissue temperature is important in determining the localization of the inflammation site. Thermal camera is a technology developed to display the heat control associated with the physical functions of the skin. It helps to localize the increase and decrease in skin temperature (Coben and Padolsky 2008). In our study, thermal camera was used to assess the skin temperature of the painful area due to lateral epicondylitis. The skin temperature was re-evaluated after application of cold modalities. We found that both cooling gel application and cold pack applications decreased skin temperature equally after application. We might say that both applications are effective in decreasing skin temperature and they have no advantage over each other. As cold pack is a more conservatively used modality for cold application, we can say that cooling gel may be an alternative treatment to cold pack application.

Cold pack and cooling gel applications are the simplest and easiest treatment methods for cold application. Cold application is effective in two ways in reducing pain. First, cold application removes or reduces pain by eliminating edema and muscle spasm. Second, it is effective in relieving pain by slowing or blocking the transmission of peripheral nerves. Apart from these effects, it also reduces pain by activating the Gate-Control Theory mechanism, stimulating the touch receptors and increasing the release of substances such as endogenous (Mehmet Beyazova and Yeşim Gökçe Kutsal n.d.; Uçan and Ovayolu 2019).

Another factor we think may have an effect is that the cooling gel we use contains menthol. Menthol from Mentha plant is a refreshing and pain relief agent. Menthol can be used in cream, lotion, liquid or gel forms. When these gels are applied to the skin, they create an effect such as coolness. Local administration of menthol-containing substances also provides external analgesia. Menthol administration also alleviates pain by pulling attention away or reducing pain perception. In addition, it is stated in the literature that menthol stimulates the cortex by closing the pain gate or by increasing the release of endorphins, alleviating the pain. Menthol application is used in arthritis, various muscle-joint and tendon pains, back and neck pain, tension-related headaches and sports injuries (American Physiological Society 2004; Stanos 2007). In our study, a statistically significant result was obtained in cooling gel application to reduce pain and decrease skin temperature. It can be used as an agent to reduce pain and reduce skin temperature such as cold pack and other cold modalities.

The cooling gel is a portable and stored more easily than the cold pack and offers ease of application. While the cold package can be applied on a wet or damp towel, the cooling gel can be applied easily by applying it to the application area with a cream sponge head, which is an advantage for application. We think that both cold pack and cooling gel applications may be a part of treatment program in patients with lateral epicondylitis.

Ethics Statement

The studies involving human participants were reviewed and approved by Baskent University Institutional Review Board and Ethics Committee (Project no: KA22/141). Written informed consent to participate in this study was provided by the patients/participants.

Author Contributions

Study Design, NÖP, SÇD; Data Collection, NÖP, SÇD; Statistical Analysis, NÖP; Data Interpretation, NÖP; Manuscript Preparation, NÖP, SÇD; Literature Search, NÖP, SÇD. All authors have read and agreed to the published version of the manuscript.

Declaration of conflicting interests

The authors declare no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

American Medical Association. Accessed January 8, 2018. https://www.ama-assn.org/.

American Physiological Society. (2004). *Adding Menthol to Topical Creams for Osteoarthritis Provides Significant Pain Relief*. https://www.eurekalert.org/pub_releases/2004-04/aps-amt041104.php.

Beneliyahu, D. (1992). "Infrared Thermography and the Sports Injury Practice." *Dynamic Chiropractic* 10 (7).

Cerezci Duygu, S., Ozunlu Pekyavas, N., Uzun A., Cinar Medeni, O.,Baltaci, G., Er, F., Suveren, C., & Colakoglu, F.F. (2018). "Muscle Skin Temperature Responses for Hamstring and Quadriceps to Aerobic and Anaerobic Test Conditions in Turkish Olympic Sailing Athletes." *Journal of Thermal Analysis and Calorimetry*. https://doi.org/10.1007/s10973-018-7865-8.

Coben, R., and Padolsky, I. (2008). "Infrared Imaging and Neurofeedback: Initial Reliability and Validity." *Journal of Neurotherapy* 11 (3): 3–13. https://doi.org/10.1080/10874200802126100.

Downie, W. W., Leatham, P. A., Rhind, V. M., Wright, V., Branco, J. A., & Anderson, J. A. (1978). "Studies with Pain Rating Scales." *Annals of the Rheumatic Diseases* 37 (4): 378–81.

Fedorczyk, J. M. (2006). "Tennis Elbow: Blending Basic Science with Clinical Practice." *Journal of Hand Therapy* 19 (2): 146–53. https://doi.org/10.1197/j.jht.2006.02.016.

Goguin, J. -P., & Rush, Fr. (2003). "Lateral Epicondylitis.What Is It Really?" *Current Orthopaedics* 17: 386–89. https:// doi.org/ 10.1016/S0268.

Hong, Q. N., Durand, M. J., & Loisel, P. (2004). "Treatment of Lateral Epicondylitis: Where Is the Evidence?" *Joint Bone Spine* 71 (5): 369–73.https://doi.org/10.1016/J.JBSPIN.2003.05.002.

Hume, P. A., Reid, D., & Edwards, T. (2006). "Epicondylar Injury in Sport." *Sports Medicine* 36 (2): 151–70. https://doi.org/10.2165/00007256-200636020-00005.

Bishai, S. K., & Plancher, K. (2006). The Basic Science of Lateral Epicondylosis: Update for the Future. *Techniques in Orthopaedics*. Vol. 21.https://doi.org/10.1097/01.bto.0000252115.76643.78.

Rotsalai, K. and Janwantanakul, P. (2005). "Comparison of Skin Surface Temperature during the Application of Various Cryotherapy Modalities." *Archives of Physical Medicine and Rehabilitation* 86 (7): 1411–15.

Knight, K. L. (1995). *Cryotherapy in Sport Injury Management*. Human Kinetics.

Kraushaar, B. S., & Nirschl, R. P. (1999). "Tendinosis of the Elbow (Tennis Elbow). Clinical Features and Findings of Histological, Immunohistochemical, and Electron Microscopy Studies." *The Journal of Bone and Joint Surgery. American Volume* 81 (2): 259–78.

Kraushaar, B. S., & Nirschl, R. P. (1999). "Current Concepts Review Tendinosis of the Elbow (Tennis Elbow)." *The Journal of Bone and Joint Surgery* 81-A (2): 259–77.

Lessard, L. A., Scudds, R. A., Amendola, A., & Vaz, M. D. (1997). "The Efficacy of Cryotherapy Following Arthroscopic Knee Surgery." *Journal of Orthopaedic & Sports Physical Therapy* 26 (1): 14–22. https://doi.org/10.2519/jospt.1997.26.1.14.

Loughin, C. A., & Marino, D. J. (2007). "Evaluation of Thermographic Imaging of the Limbs of Healthy Dogs." *American Journal of Veterinary Research* 68 (10): 1064–69. https://doi.org/10.2460/ajvr.68.10.1064.

Beyazova, M., & Kutsal, Y. G. eds. n.d. *Fiziksel Tıp ve Rehabilitasyon 1-2*. Güneş Tıp Kitapevleri. Accessed February 25, 2019. https://www.guneskitabevi.com/Fiziksel-Tip-ve-Rehabilitasyon-1-2,PR-130.html.

Stanos, S. P. (2007). "Topical Agents for the Management of Musculoskeletal Pain." *Journal OfPain and Symptom Management* 33 (3): 342–55. https://doi.org/10.1016/j.jpainsymman.2006.11.005.

Tunley, B. V., and Henson, F. M. D. (2004). "Reliability and Repeatability of Thermographic Examination and the Normal Thermographic Image of the Thoracolumbar Region in the Horse." *Equine Veterinary Journal* 36 (4): 306–12.

Uçan, Ö., & Ovayolu, N. (2007). " Non-pharmacological methods used in the control of cancer pain." Journal of Fırat Health Services; 2(4): 123-133.

Vainer, B. G. (2005). "FPA-Based Infrared

Thermography as Applied to the Study of Cutaneous Perspiration and Stimulated Vascular Response in Humans." *Physics in Medicine and Biology* 50 (23): R63–94. https://doi.org/10.1088/0031-9155/50/23/R01.

Waseem, M., Nuhmani, S., Ram, C. S., & Sachin, Y. (2012). "Lateral Epicondylitis: A Review of the Literature." *Journal of Back and Musculoskeletal Rehabilitation* 25 (2): 131–42.

Wilson, J. J., & Best, T. M. (2005). "Common Overuse Tendon Problems: A Review and Recommendations for Treatment." *American Family Physician* 72 (5): 811–18.

How to cite this article: Özünlü Pekyavaş, N. and Çerezci Duygu, Ş. (2022). Which Cold Application is More Effective for Tennis Elbow? Cooling Gel vs Cold Pack. *Int J Disabil Sports Health Sci*;5(1):1-8.https:// doi.org/ 10.33438 /ijdshs.1039813.