5-2024

# An Analysis of Targeted Physical Therapy Against Medial Epicondylitis

Rylie Howe
*Utah State University*

# AN ANALYSIS OF TARGETED PHYSICAL THERAPY AGAINST MEDIAL EPICONDYLITIS

by

Rylie Howe

**Capstone submitted in partial fulfillment of the requirements for graduation with**

## University Honors

with a major in
Human Biology

in the Department of Biology

**Approved:**

| | |
|---|---|
| **Capstone Mentor**<br>Dr. Andy Anderson | **Departmental Honors Advisor**<br>Dr. James Pitts |

**University Honors Program Executive Director**
Dr. Kristine Miller

**UTAH STATE UNIVERSITY**
**Logan, UT**

**Spring 2024**

# An Analysis of Targeted Physical Therapy Against Medial Epicondylitis

**Rylie Howe**

## Abstract

Medial epicondylitis, more commonly known as “golfer’s elbow”, is a musculoskeletal condition involving the common flexor tendon in the forearm at the attachment point of the medial epicondyle of the humerus bone. The repeated use of the tendon causes inflammation, swelling, as well as other types of straining that results in minute damage that accumulates to the overall strain and complications that come with medial epicondylitis. Targeted physical therapy is the overall recommended treatment for this condition. However, there is limited consensus to the most effective interventions. Mixed methods were used to investigate the possibility of the success of certain treatments compared to other alternative treatments while investigating innovative alternative options that could be more effective. An innovative treatment method utilizing shockwave and laser therapy proved to be most effective in reducing pain levels in patients following treatment.

## Acknowledgments

First, I’d like to thank my faculty mentor Dr. Andy Anderson for offering support and supervision throughout this research process. Additionally, I would like to thank Dr. Anderson for sparking my interest in human anatomy and physiology and inspiring me to research the pathophysiology of this topic after taking his Human Anatomy course. I’d like to acknowledge my faculty advisor Dr. James Pitts in appreciation for supervising my research project.

I would like to thank the healthcare professionals who contributed their knowledge and expertise to my project, including Dr. Jon Rhodes, Dr. David Bitner, Dr. Patrick Johnson, Dr. Monte Zundel, Dr. Lynn Carling, Sean Wayne, and Lori Olsen.

Lastly, I would like to thank my friends and family, especially my parents who have encouraged me and supported me not only throughout this project but through my entire college career.

## Introduction

Medial epicondylitis is an inflammatory condition commonly found in both athletic and non-athletic populations. It's a musculoskeletal diagnosis that primarily affects the flexor carpi radialis and the pronator teres, which both originate on the medial epicondyle of the humerus bone. Alongside the ulnar collateral ligament, this group of muscles assist in stabilizing the medial side of the elbow (Reese & Susmarksi). Repetitive and straining activities cause continual micro-damage to these tissues leading to pain and dysfunction of the joint. It is often referred to as "golfer's elbow" due to overload and repetitive use that golfers can put on the medial humeral area from their club-swinging motion. Especially in professional players, the continual swinging that they perform every day begins to irritate and inflame the target area. Other activities can also be associated with the condition including archery, weightlifting, and many throwing sports.

The presentation of this condition typically begins with an aching pain on the medial side of the elbow and may even experience a weakening of their grip strength. The medial epicondyle and the area surrounding is typically tender to the touch and patients report difficulty pronating the arm and flexing the wrist. Because the ulnar nerve runs along the medial side of the arm, there's approximately a 20% chance that some sort of ulnar neuropathy is present with epicondylitis (Young). This possibility can be ruled out by examining for the Tinel sign, which is paresthesia experienced when tapping along the ulnar nerve pathway.

Even though medial epicondylitis has a high prevalence rate, there are still many different strategies proposed to treat the condition. Physical therapy plays a primary role in the

conservation of the tissues on the medial epicondyle. With physical therapy comes a wide array of interventions that can be targeted towards alleviating the pain caused by this condition, restoring the function lost, and rehabilitating the patient to go forth with healthy tissue while maintaining range of motion.

A few non-invasive therapeutic modalities have been suggested to manage pain and inflammation caused by medial epicondylitis. Such treatments include the use of nonsteroidal anti-inflammatory drugs (NSAIDs) to treat the pain experienced and to decrease swelling of the area. Additionally, the utilization of elbow braces is suggested to mitigate the forces exerted by the muscles during physical activities among athletes while providing support and stability of the joint (Alfonso). In more severe cases, invasive interventions may be recommended, the first being the injection of corticosteroids. Cortisone injections work by decreasing inflammation at the site of injection, which can ease some of the pain experienced by the patient. However, these injections tend to be just a short-term solution to experienced symptoms (Alfonso).

Surgical intervention is typically the last resort when it comes to the treatment of medial epicondylitis but is occasionally an option for certain candidates. A technique called fascial elevation and tendon origin resection has been shown to be an effective though long therapeutic approach for the condition (Alrabaa). This technique includes the open debridement of degenerated tissue and repair of the flexor pronator tendon. While the success rate for this procedure is fairly high, the invasive nature of this intervention, as well as its recovery period, cannot be ignored. Moreover, the potential for surgical complications remains.

The therapeutic options mentioned are just a few of the many options available when it comes to treating medial epicondylitis. Each modality has pros and cons, and the most efficacious intervention remains unknown. This discovery is what led me down the path to investigate what the best possible treatment option for medial epicondylitis is determined from the expertise of professionals based on major themes such as recovery time and recurrence in patients who have experienced this condition.

## Literature Review

### Pathophysiology Overview

The musculoskeletal condition known as medial epicondylitis, or golfer's elbow, occurs when there is repetitive wrist flexion and extension followed by elbow pronation and supination. The continual motion of this nature over long periods of time can result in tenderness, trauma, and in some cases can lead to ulnar nerve irritation. The overload on the tendon causes cases of tendinopathy from the resulting degeneration in the medial epicondyle area (Physiopedia). This type of injury is commonly seen in golfers and baseball pitchers due to the valgus forces that are being exerted throughout this activity.

The musculature groups that are affected by this degeneration include the pronator teres, the flexor carpi radialis, the palmaris longus, the flexor digitorum superficialis, and the flexor carpi ulnaris all of which come together to form the common flexor tendon (Konarski). Although all of the muscles have the potential of being involved in this condition, the focus lands primarily on the flexor carpi radialis and the pronator teres. These muscles share a common origin point where the chief complaint occurs, the medial epicondyle of the humerus. The tendons attaching

the muscle to the medial epicondyle can become damaged leading to the breakdown and fibrosis of the tissue. It has been found that tendon degeneration has the tendency to affect the arrangement of the collagen fibers in the tissue (Konarski). The abnormal arrangement causes the collagen to lose its strength, becoming more prone to breakage and injury. This injury's repetitive nature leads to more and more tissue breakdowns, thereby weakening the tissue which is eventually replaced with scar tissue in the affected area (Konarski).

The patient's chief complaint typically begins with elbow pain just distal to the medial epicondyle with some radiation up and down the medial side of the arm. The pain is typically aggravated by flexion of the wrist and pronation of the arm. The diagnosis of "golfer's elbow" includes imaging studies like radiography and ultrasonography, valgus stress testing, and careful examination of the joint.

**Current Treatment Options**

The conservative management of medial epicondylitis can be achieved through a variety of methods depending on the case; however, the efficacy of the different options is a debated topic. The first treatment option being the recommended physical therapy modalities focusing on the stretching and strengthening of the common flexor tendon area. Stretching exercises targeting the wrist flexor muscles are intended to improve the range of motion and flexibility of the common flexor tendon. Strengthening, or eccentric, exercises focus more on the relaxation of the muscle in order to improve the area without unnecessary strain. Included with these exercises is reworking form during activity as well as improving functional alignment of the joint (Informed Health). Many physical therapists can also couple these exercises with Astym treatment which

aids in the regeneration of healthy soft tissue. Astym works by utilizing a handheld instrument to massage and mechanically break apart tissue through a series of “scraping” in order to stimulate tissue turnover. This tissue turnover can then encourage scar tissue resorption and regeneration of tendons and other soft tissues (Chughtai et al). These approaches coupled together are a common approach for treating medial epicondylitis and other soft tissue injuries.

A treatment option that can be used as an alternative or in addition to physical therapy is the injection of corticosteroids. Corticosteroids work by targeting nuclear steroid receptors which interrupt immune and inflammatory reactions (Ayhan). These anti-inflammatory properties help reduce pain when corticosteroid is injected into the joint and tendinous areas of the elbow. Although it's been shown to improve some function and reduce pain and inflammation, the injection tends to wear off in 6-8 weeks (about 2 months). This then typically results in only a short-term solution where the focus is placed more on symptom relief than targeting damaged tissue (Ayhan).

Dry needling has also been listed as a suggested method of treatment for medial epicondylitis. There are myofascial trigger points throughout the body that are associated with different movements that can be targeted by needles (Cleveland). A needle can be inserted into these trigger points to relax the area that could be causing a type of referred pain. In addition to alleviating tightness in these points, dry needling has also been said to increase blood flow to the area to aid in the stimulation of muscle fiber recovery (Cleveland).

The final and most invasive technique listed includes surgically repairing the damaged tissue through a procedure called a fascial elevation and tendon origin resection (Alrabaa). This

approach is typically left for the more severe cases or cases involving elite athletes (Alrabaa). This is not typically a common practice for medial epicondylitis recovery. This procedure involves an incision of the fascia of the flexor pronator and the identification of lesions found in the area. Once these are identified, they are either repaired or excised depending on the damage's severity (Alrabaa). Although this technique has been effective in many cases, it's still an invasive surgery where complications could arise.

**Innovative Technological Treatments**

The investigation into new and innovative treatments for soft tissue injuries such as medial epicondylitis has been imperative due to the stand-still of the latest treatments. Dr. Jon Rhodes, a physical therapist that participated in this project, informed me of the therapeutic approaches he takes to treat medial epicondylitis in order to stay at the forefront of technological advancements. The first of these new approaches being shockwave therapy, a type of acoustic wave is focused on damaged tissue transmitting high energy to promote the process of regeneration. According to Dr. Rhodes, these targeted waves help reverse chronic inflammation, stimulate collagen production, stimulate blood vessel formation, and accelerate tissue repair and cell growth.

The second approach that is being implemented by Dr. Rhodes is laser therapy. He explains that the laser targeted therapy mechanism works by utilizing photons to excite mitochondrial health and the cytochrome C pathway to decrease pain felt in the affected area. Low-level laser therapy uses a range of wavelengths from 600-1070 nanometers to effect biochemical processes that occur within the tissue cells (Rola et al). The reactions due to this

excitation involve reducing inflammation and increased cell proliferation which aid in the recovery process for medial epicondylitis (Rola et al).

The depth of penetration and effectiveness of these modalities have been shown to be more efficient at recovering damaged tissue than previous methods. Dr. Jon Rhodes informs us that since utilizing these new techniques he has seen a trend of decreased patient visits coupled with an increase to 90% recovery in his office. These techniques are still being introduced to many offices, which is why they're not more readily used. One of the drawbacks of these modalities is that because they're still so new and more technologically advanced they tend to be more expensive when it comes to receiving treatment. However, it is safe to say that these approaches seem to be the future of physiotherapy treatment when it comes to soft tissue injuries such as medial epicondylitis.

## Methodology

This research project employs a qualitative methodological approach to investigate the efficacy of different physical therapy methods for the treatment of medial epicondylitis, also known as golfer's elbow. The qualitative approach seemed to be best suited for this research in order to capture the nuanced and subjective aspects of experiences and perceptions of proposed treatment methods allowing us to explore the intricacies and possible outcomes of this research. The methodology used in this research facilitated the investigation of diverse viewpoints to allow for an in-depth understanding of conservative management techniques of medial epicondylitis. The study conducted is aimed to analyze the collective expertise of a focus group comprised of

physical therapists to better understand what treatment modality would be most effective for medial epicondylitis.

A virtual focus group was assembled that consisted of healthcare professionals who met the qualifications of either a DPT (Doctor of Physical Therapy) degree or an MD (Doctor of Medicine) degree. Each professional was given a questionnaire to fill out asking questions pertaining to the research project. The questionnaire began with basic background questions to better understand the expertise of the healthcare professionals. These questions include inquiries such as where they received their education, how long they have been practicing, if they specialize in any field, and how often they work with athletes or athletic-related injuries. Once these more general questions are answered the questionnaire moves into more specified questions relating to the research question being investigated. The questions included in the second part of this questionnaire involved the following benchmark questions: how often do you see patients experiencing medial epicondylitis (ME)? What is your recommended treatment plan for patients with ME? What's the average recovery time for ME following your treatment plan? What's the chance of recurrence that you've observed in patients with ME following treatment? Have certain treatments shown to be more effective than others? On average, what's the patient's pain level before and after treatment?

Please note that not all inquiries involved in the questionnaire have been incorporated into the methodology explanation due to conciseness and convenience. These questions being asked are used to develop a better understanding of common practices in therapeutic modalities regarding medial epicondylitis. Additionally, questions about patient recovery and pain levels

were used to determine which of these common practices seem to be most effective for the conservative management of medial epicondylitis.

The questionnaire was also used to investigate the possibilities of new and innovative therapeutic treatments being analyzed to improve the current status of available treatments. Once the data is collected from the questionnaires, the pain levels before and after the listed treatment will be compared to see which therapeutic modality provides the greatest percentage of improvement. Doctors were also asked to rate the chance of recurrence after completed treatment in the questionnaires as either none, low chance, average, or high chance of recurrence. These percentages cross-examined with recurrence rates are then used to determine the most effective treatment for medial epicondylitis.

## Results

The results were based on which treatment modalities were most frequently used by healthcare professionals cross-referenced with the treatments with the most improved pain level ratings on average. The most common modality reported from the focus group was stretching and strengthening exercises partnered with Astym scraping, whereas the least common modality reported was the shockwave and laser therapy treatment. Starting with the treatment regimen involving resting and icing the joint along with stretching of the area, there was an average of a 25% decrease in pain levels seen in patients. The next commonly recommended treatment was stretching combined with eccentric exercises followed by activity modification which gave us an average improvement rate of approximately 43%. The second most effective treatment method reported was exercises focused on soft tissue therapy coupled with Astym therapy. This method

resulted in a 50% decrease where the initial pain rating was an 8 and the post-treatment pain rating was an average of 4 (out of 10). Lastly, the most effective therapeutic modality was the shockwave and laser therapy method showing a decrease in pain ratings by 60%.

The majority of treatments were reported to have approximately the same average recovery time of 6-8 weeks (about 2 months) except for one outlier. The treatment regimen involving rest, ice, and stretches seemed to have slightly longer recovery time of about 3 months. The chance of recurrence after treatment was completed was also answered. Rest, ice, and stretches was the only regimen said to have a high chance of recurrence. The modalities that were reported to have an average chance of recurrence included eccentric exercises with activity modification and the shockwave and laser therapy methods. Lastly, the stretching and strengthening exercises coupled with Astym scraping was said to have a low chance of recurrence. The average answers to the other questions from the questionnaire were recorded giving us the information that the interviewed doctors see patients with medial epicondylitis come into be treated approximately every week with 50% of patients being from the general population and 50% being athletes.

## Discussion

As seen from the results, the new and innovative technique of using shockwave and laser therapy to treat medial epicondylitis showed the most improvement of pain ratings from the treatment. This technique was followed closely by the use of stretching and strengthening exercises partnered with Astym scraping which also happened to be the most reported method

from the questionnaire. However, a question arose from comparing these results to the results of the recurrence rates. Yes, the shockwave and laser therapy had a bigger decrease in pain levels compared to exercises partnered with Astym, but it also had an average recurrence rate whereas the Astym had a low recurrence rate. Because of this, it's difficult to express which treatment plan is more effective.

The shockwave and laser therapy techniques are a new development in physical therapy, especially when it comes to medial epicondylitis. Because of this, the data collected from the questionnaire about laser and shockwave therapy only came from a single office, not providing as diverse of a view compared to the other methods. Outside research done into this technique has shown that it has been very effective in soft tissue therapy which begs the question, why hasn't it been implicated in more physical therapy offices? A potential explanation could be the fact that it's still so new and not many physical therapists are aware of it yet, but we are unable to say for sure.

One of the main limitations of this experiment was the size of the focus group. I was able to reach out to 9 physical therapy offices and for the remaining data I outsourced it from different case studies. The knowledge I gained from hearing the insights of many healthcare professionals was very beneficial, however, there were some drawbacks to having a limited number of sources. In the future I believe that expanding the focus group size by two or even three times the size would provide more consistent data and trends for the experimental inquiries. Another limitation was not being able to examine or interview actual patients from the offices who filled out the

questionnaires, but due to HIPPA regulations I was only able to ask more general questions to the physical therapists treating the patients instead of obtaining individual responses.

Overall, I believe that developing and improving diverse physical therapy techniques for these kinds of soft tissue injuries is pertinent to the field. Whether the patient is an athlete or an individual in the general population, injuries such as medial epicondylitis greatly impact the efficacy of their duties and not everyone has the choice to rest in order to recover. Further investigation and development into technologies such as shockwave and laser therapy are the future of physical therapy and the conservative management of medial epicondylitis. Additionally, advancing our understanding of efficient therapeutic techniques can improve the processes of relieving pain and restoring function to patients. Continued research in this field will be greatly beneficial for the enhancement of patient care and treating musculoskeletal conditions.

## Reflection

Gaining an undergraduate education at Utah State University helped spark my interest in pursuing a career in the medical field. I've always been interested in the STEM field, but furthering my education by studying Human Biology was a key element in discovering my interest in the healthcare field. I quickly realized how much I enjoyed learning about human health and how to best protect and treat patients to avoid any maladies. While studying at Utah State not only did I learn about human health but also other sciences that can be applicable in the improvement of the medical field.

Years of coursework and learning is was led to the work that I wanted to research for my capstone project. My project was the product of incorporating the depth of my education and knowledge from my undergraduate degree. I discovered during my junior year that I was very interested in human anatomy and the conditions and diseases that affected healthy individuals. In a human anatomy class, taught by my faculty mentor Andy Anderson, I learned about how injuries occur and the mechanisms that damage the muscle and tissue that we thoroughly were educated on. It was in this class where I first learned about medial epicondylitis, the condition that, little did I know, would become the center of my honors capstone thesis. The comprehensive understanding of the human body its physiology that I needed to complete this project is credited largely to Dr. Andersons's course and is the root cause of my interest in pursuing this capstone.

This project carried great significance in adding to the development of my overall education as well as the beneficial lessons that will aid me in the pursuit of my future career. Being able to understand this human biology from the perspective of a researcher allowed me to observe the process in a new light and deepen my knowledge of physiology and treatment. This nuanced perspective is one that I believe will be critical throughout my career as a physician. Developing investigational and experimental skills is crucial if one's to become a doctor and be tasked with the challenge of solving and treating medical mysteries everyday. The critical thinking as well as data interpretations that was required for this project contributed indispensable skills that can be applied to my future career.

As mentioned earlier, my mentor Dr. Andy Anderson was a crucial part of the development of my capstone project and a main contributor to my inspiration not only of this project, but of the pursuit of my future career in the medical field. Participating in Dr. Anderson's human anatomy class was when I truly discovered just how passionate I was for the medical field. Not only did he teach me about human anatomy, but he also expanded my education of the physiology, disease pathways, injuries, medical conditions, treatment possibilities, and so much more. I developed crucial critical thinking skills that contributed to the work done throughout my capstone project. Dr. Anderson's guidance during my research and encouragement was a key component to my success of this project. His influence allowed me to pursue new ideas and receive helpful feedback on my overall capstone while also teaching me the importance of professional mentorship.

My experience with conducting research was fairly limited until I completed my capstone project. I had learned the basics and aided in a few projects throughout my years at Utah State, but I never had the opportunity to be in charge and carry-out my own project. Having this solo experience where I was in charge of seeing through every detail was incredibly beneficial to me and my education. I learned how to carry out my own methodologies and data analytics in order to have a successful experiment. Additionally, I strengthened my ability to interpret many different outside sources and research papers to contribute to my background research and design of my experiment.

Being able to incorporate critical thinking skills for this project, or any project for that matter, was crucial in the planning and development of my capstone. It was important to have a

well-rounded understanding of the anatomy and physiology of the medial epicondyle and the connective tissues involved in my researched condition. It was also important to understand why this particular injury occurs and why the different methods of treatment vary in their effectiveness in order for me to research this topic. Being able to identify and incorporate these facts allowed me to locate the gaps in knowledge surrounding this topic and form my own hypothesis based on my knowledge. The ability to think critically about these types of situations can be influential in how I approach issues in my future career.

Although I'm primarily interested in human anatomy and how that applies to my future in medicine, this capstone also allowed me to incorporate other disciplines and fields that contributed to my research. Not only did I have to incorporate my knowledge of anatomy and physiology in this project, but I also had to use statistical and biological analyses to develop and interpret the results of my methods. And because my methodology incorporated both qualitative and quantitative aspects I was able to utilize many scientific disciplines to obtain and properly translate the data I collected.

Having the opportunity to engage with other members of the community is always a valuable experience that can add significantly to any project. For my capstone I had the opportunity to interview and discuss treatment ideas with healthcare professionals all across Northern Utah. They shared their in depth knowledge with me about my research topic and shared how they personally would approach and treat a patient experiencing the condition of medial epicondylitis. Receiving firsthand insights from qualified professionals allowed me to gain a better understanding of the impact my research could have on actual real-world scenarios.

Not only were the healthcare professionals crucial to my research, but they also provided me with great advice on my future career aspirations. Receiving advice from professionals who have accomplished the exact goal I'm wanting to accomplish helped me open my eyes to the many possibilities to come throughout my journey. Overall, the process of developing and researching my own capstone project provided nothing but beneficial experiences for me while allowing me to strengthen critical skills that I can utilize in my future.

## Author Biography

Rylie Howe was born in Ogden, Utah where she graduated from Weber High School in 2020 with the hopes of attending Utah State University to study biology. While studying at Utah State she discovered her passion for medical sciences and decided to pursue pre-medical route. Rylie aided her passion for the medical field by joining USU's pre-med club. She also participated in other activities such as neurobiology research, hospital volunteering, homeless outreach volunteering, and studying abroad in Cusco, Peru to learn about their healthcare system. She will be graduating from Utah State University in the Spring of 2024 with a major in Human Biology and a minor in Chemistry. She will then apply to medical school the following summer in hopes to pursue a career as a physician specializing in Sports Medicine.

## Works Cited

Alfonso, Lacie. "Surgery for Medial Epicondylitis (Golfer's Elbow) Treatment & Management: Conservative Therapy, Surgical Therapy, Complications." *EMedicine*, 5 June 2023,

emedicine.medscape.com/article/1231997-treatment?form=fpf&scode=msp&st=fpf&socialSite=google&icd=login_success_gg_match_fpf#d10. Accessed 7 Apr. 2024.

Alrabaa, Rami George, et al. "Elbow Common Flexor Tendon Repair Technique." *Arthroscopy Techniques*, vol. 8, no. 11, Nov. 2019, pp. e1367–e1371, https://doi.org/10.1016/j.eats.2019.07.016.

Ayhan, Egemen. "Intraarticular Injections (Corticosteroid, Hyaluronic Acid, Platelet Rich Plasma) for the Knee Osteoarthritis." *World Journal of Orthopedics*, vol. 5, no. 3, 2014, p. 351, www.ncbi.nlm.nih.gov/pmc/articles/PMC4095029/, https://doi.org/10.5312/wjo.v5.i3.351.

Chughtai, Morad, et al. "Astym® Therapy: A Systematic Review." *Annals of Translational Medicine*, vol. 7, no. 4, Feb. 2019, pp. 70–70, www.ncbi.nlm.nih.gov/pmc/articles/PMC6409241/, https://doi.org/10.21037/atm.2018.11.49.

Cleveland Clinic. "Dry Needling & Physical Therapy | Cleveland Clinic." *Cleveland Clinic*, 2017, my.clevelandclinic.org/health/treatments/16542-dry-needling.

Information, National Center for Biotechnology, et al. *Golfer's Elbow: Strengthening and Stretching Exercises*. *Www.ncbi.nlm.nih.gov*, Institute for Quality and Efficiency in Health Care (IQWiG), 30 May 2018, www.ncbi.nlm.nih.gov/books/NBK507006/.

Konarski, Wojciech, et al. “Current Concepts of Natural Course and in Management of Medial Epicondylitis: A Clinical Overview.” *Orthopedic Reviews*, vol. 15, 9 Sept. 2023, orthopedicreviews.openmedicalpublishing.org/article/84275-current-concepts-of-natural-course-and-in-management-of-medial-epicondylitis-a-clinical-overview, https://doi.org/10.52965/001c.84275.

“Medial Epicondyle Tendinopathy.” *Physiopedia*, 2013, www.physio-pedia.com/Medial_Epicondyle_Tendinopathy.

“Medial Epicondylitis - Golfer’s Elbow | Elbow Conditions | Dr. Chris Ahmad.” *Dr. Christopher S Ahmad*, www.drahmadsportsmedicine.com/expertise/elbow/medial-epicondylitis-golfers-elbow/.

Ott, Nadine, et al. “Medial Epicondylopathy—Microtrauma and Pathologic Overuse as a Cause of Degeneration of the Flexor Tendons.” *Obere Extremität*, 2 Oct. 2020, https://doi.org/10.1007/s11678-020-00603-y.

Reece, Christopher L., and Adam Susmarski. “Medial Epicondylitis.” *PubMed*, StatPearls Publishing, 2022, www.ncbi.nlm.nih.gov/books/NBK557869/#:~:text=The%20flexor%20carpi%20radialis%20and.

Rola, Piotr, et al. “Changes in Cell Biology under the Influence of Low-Level Laser Therapy.” *Photonics*, vol. 9, no. 7, 1 July 2022, p. 502, www.mdpi.com/2304-6732/9/7/502, https://doi.org/10.3390/photonics9070502.

Young, Craig. “Medial Epicondylitis: Background, Epidemiology, Functional Anatomy.” *EMedicine*, 12 July 2021, emedicine.medscape.com/article/97217-overview#a5.