Med. J. Cairo Univ., Vol. 93, No. 3, Accepted 18/5/2025
DOI: 10.22608/MJCU. 1105-1114, September 2025
www.medicaljournalofcairouniversity.net

A Litrature Review Article:

Effect of Extracorporeal Shock Wave Therapy on Ultrasonography Changes in Patients with Palmar Fibromatosis

MOHAMMAD ISMAIL AHMAD, M.Sc.; MOHSEN M. ESYAD, Ph.D.; NABIL M. ABDEL-AAL, Ph.D. and WAEL M.F. SALAMA, Ph.D.

The Department of Physical Therapy for Basic Sciences, Faculty of Physical Therapy, Cairo University

Abstract

Background: Palmar fibromatosis, also known as Dupuytren's contracture, is a condition that affects the hand and fingers. It is characterized by the thickening and tightening of the fascia, a layer of connective tissue beneath the skin of the palm. This thickening and tightening connective tisseucan lead to the formation of nodules or cords that restrict the movement of the affected fingers however, palmar fibromatosis (PF) has many types of treatment modalities like physical therapy, radiotherapy, different surgical procedures and to recent extent shockwave therapy has an extinctive results both in treatment and preventing catastrophic prognosis of the disease.

Aim of Study: Many trials studied the effect of shockwave therapy on palmar fibromatosis but there was little which tried to explore what is happening within the treated tissues after shockwave sessions. Ultrasound imaging, is a non-invasive medical diagnostic technique that uses high-frequency sound waves to create real-time images of the body's internal structures. It is commonly used to visualize organs, tissues, and blood flow patterns, aiding in the diagnosis and monitoring of various medical conditions. The aim of this study was to review the current lietrature on the effect of extracorporeal shock wave therapy (ESWT) in patients with Palmar fibromatosis.

Conclusion: ESWT, when combined with conventional physical therapy, significantly decreased the lesions size, depth while increased pain pressure threshold, hand functions, range of motion and hand grip strength in patients with palmar fibromatosis.

Key Words: Palmar fibromatosis – Extracorporeal shock wave therapy – Ultrasonography.

Correspondence to: Dr. Nabil M. Abdel-Aal,
E-Mail: nabil.mahmoud@cu.edu.eg
nabil_45@hotmail.com

Introduction

PALMAR fibromatosis, also known as Dupuytren's contracture, is a condition that affects the hand and fingers. It is characterized by the thickening and tightening of the fascia, a layer of connective tissue beneath the skin of the palm. This thickening and tightening can lead to the formation of nodules or cords that restrict the movement of the affected fingers **[1]**. The cause of palmar fibromatosis believed to involve a various combination of genetic and environmental factors. It is more common in men and individuals of Northern European descent. More recent and wider studies show the highest prevalence in Africa (17 percent), Asia (15 percent) **[2]**. Other risk factors include a family history of the condition, smoking, and certain health conditions such as diabetes and liver disease **[3]**. Palmar fibromatosis, typically manifests gradually and presents various symptoms. These include the formation of nodules or lumps in the palm of the hand, which are often firm and may be sensitive to touch. In advanced cases, palmar fibromatosis can cause hand deformity, with the fingers becoming permanently flexed, ultimately hindering the ability to perform everyday tasks effectively **[4]**. The treatment options for palmar fibromatosis vary depending on the severity of the condition and its impact on hand function. Mild cases may not require immediate treatment but should be regularly monitored. However, if the symptoms worsen or hinder hand function, there are several treatment options available **[5]**. Non-surgical interventions such as hand exercises, physical therapy electrical modalities, and the use of splints or braces can be employed to maintain finger mobility. Medications

like collagenase injections may also be utilized to soften and break down the cords. In severe cases or when non-surgical methods prove ineffective, surgical procedures may be recommended. Surgery aims to release or remove the thickened tissue, thereby restoring finger movement [6]. The aim of this study was to review the current lietrature on the effect of extracorporeal shock wave therapy-(ESWT) in patients with Palmar fibromatosis.

Pathophysiology of palmar fibromatosis:

Palmar fibromatosis, also known as Dupuytren's contracture, is a progressive fibroproliferative disorder that affects the palmar fascia, leading to the formation of nodular and cord-like structures that cause flexion contractures of the fingers. The pathophysiology involves an aberrant wound healing response characterized by excessive fibroblast proliferation, myofibroblast differentiation, and extracellular matrix (ECM) deposition, particularly collagen type I and III [7]. Myofibroblasts, which are responsible for contractile forces in wound healing, become dysregulated and persist in Dupuytren's disease, contributing to the progressive fibrosis and tissue contraction [8]. Additionally, altered cytokine signaling, particularly transforming growth factor-beta (TGF-β), plays a central role in stimulating fibroblast activation and ECM overproduction [9].

Genetic predisposition has been identified as a significant factor in the development of palmar fibromatosis, with studies showing an autosomal dominant inheritance pattern with variable penetrance [10]. Several gene physical site or location within a genomeincludingWingless-related integration sitesignaling and fibrotic pathway-related genes, have been implicated in the disease process. Epigenetic modifications and environmental factors, such as repetitive mechanical stress and microtrauma, may exacerbate the fibroproliferative response [11]. Moreover, an upregulation of profibrotic factors such as platelet-derived growth factor (PDGF) and fibroblast growth factor (FGF) further promotes fibroblast proliferation and ECM remodeling [12]. This chronic fibrotic remodeling leads to loss of normal palmar fascia architecture and results in progressive contractures that impair hand function.

Inflammation and immune dysregulation also contribute to the disease process. Studies have reported increased infiltration of macrophages and T-cells within the affected palmar fascia, suggesting an ongoing immune response that perpetuates fibrosis [13]. The involvement of oxidative stress and hypoxia-induced pathways has also been Implicated in promoting myofibroblast activation and ECM deposition [14]. Despite these insights, the exact molecular mechanisms underlying palmar fibromatosis remain incompletely understood, necessitating further research to develop targeted therapies that can halt or reverse disease progression.

Impact of Palmar Fibromatosis on hand functions, grip strength, ROM and pain pressure threshold:

This condition leads to the formation of nodules and fibrous cords that cause contractures, ultimately limiting hand function. The progressive nature of the disease results in an increasing inability to perform daily activities requiring full hand mobility, such as gripping, grasping, and fine motor movements [15]. Functional impairment is particularly pronounced in the later stages of the disease, where contractures become irreversible, making tasks like writing, lifting objects, and even shaking hands difficult. The impact of palmar fibromatosis on hand function is, therefore, significant, leading to disability and reduced quality of life.

Grip strength is a crucial parameter affected by palmar fibromatosis, as the contractures and fibrotic changes reduce the ability to generate force efficiently. Studies have shown that patients with Dupuytren's disease exhibit a significant decrease in grip strength due to mechanical constraints imposed by the contracted fingers [16]. The loss of functional grip can affect various activities, including carrying heavy objects, using tools, and engaging in occupational tasks that require manual dexterity. While surgical interventions, such as fasciectomy or collagenase injections, may restore some grip strength, the recurrence of contractures remains a challenge, limiting long-term improvements [17].

The range of motion (ROM) of the fingers is progressively restricted as palmar fibromatosis advances, particularly affecting the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints. The fibrous bands pull the affected fingers into flexion, preventing full extension and significantly impairing hand dexterity [18]. This restriction not only limits active movement but also reduces passive ROM, making it challenging to stretch the fingers even with external assistance. Reduced ROM negatively affects fine motor tasks such as buttoning clothes, typing, and playing musical instruments, leading to a decline in functional independence.

Pain and discomfort are often reported in patients with palmar fibromatosis, though the pain pressure threshold (PPT) varies. While some patients experience minimal pain, others report tenderness and soreness, particularly in the early stages when nodules are forming [19]. The fibrotic tissue and contractures can contribute to increased tension in the hand, potentially leading to discomfort during movements and pressure application. Surgical interventions may alleviate some symptoms, but post-operative pain and stiffness can persist, impacting the patient's ability to regain normal hand function [16].

In summary, palmar fibromatosis significantly impairs hand function by reducing grip strength, restricting range of motion, and altering pain perception. The progressive contractures lead to functional limitations that affect daily activities and occupational tasks. Although treatment options such as surgery and enzyme injections can provide temporary relief, recurrence rates remain high, posing ongoing challenges for patients and healthcare providers. Further research is needed to develop effective long-term management strategies that minimize functional impairment and improve the quality of life for individuals with this condition.

Complications of Palmar Fibromatosis:

While the condition itself can significantly impact a patient's daily activities, various complications may arise due to disease progression, treatment interventions, or recurrence. These complications include functional limitations, recurrence after treatment, nerve and vascular injuries, stiffness and joint contractures, and psychological distress.

1- Functional Limitations and Disability:

As palmar fibromatosis progresses, it causes contractures that restrict finger extension, primarily affecting the fourth and fifth fingers. This leads to difficulty in performing everyday tasks such as gripping objects, writing, and shaking hands [15]. Over time, severe contractures can result in a permanent loss of function, making independent hand use challenging. In advanced cases, the inability to extend fingers properly may necessitate surgical intervention, but even postoperatively, patients may struggle with residual functional impairment.

2- High Recurrence Rates:

One of the most challenging aspects of treating palmar fibromatosis is the high recurrence rate following both minimally invasive and surgical treatments. Studies have shown that recurrence occurs in 50-85% of patients after percutaneous needle fasciotomy and in approximately 20-60% after limited fasciectomy [16]. Even after more aggressive interventions like dermofasciectomy, where diseased fascia and overlying skin are removed and replaced with a skin graft, recurrence can still occur, although at a lower rate [20]. The recurrent nature of the disease necessitates repeated procedures, further increasing the risk of complications.

3- Nerve and Vascular Injuries:

Surgical interventions, including fasciectomy and dermofasciectomy, carry a significant risk of nerve and vascular injuries due to the dense and fibrotic nature of the affected fascia. The palmar neurovascular structures are often intertwined with the fibrous cords, making surgical dissection complex and increasing the risk of nerve damage [18]. Injury to the digital nerves may lead to numbness, tingling, or even permanent sensory loss in the affected fingers. Vascular compromise, although rare, can result in ischemia and poor wound healing, especially in older patients or those with comorbidities such as diabetes.

4- Postoperative Stiffness and Joint Contractures:

Following surgical treatment, many patients experience postoperative stiffness and difficulty regaining full range of motion. Scar tissue formation and prolonged immobilization contribute to joint contractures, which can persist despite extensive rehabilitation [21]. Some patients may develop complex regional pain syndrome (CRPS), a condition characterized by persistent pain, swelling, and autonomic dysfunction, further complicating recovery. These complications emphasize the importance of early postoperative mobilization and hand therapy to prevent long-term stiffness and dysfunction.

5- Psychosocial and Emotional Impact:

Beyond the physical complications, palmar fibromatosis can have significant psychological and emotional effects. Patients with severe contractures may experience frustration, embarrassment, or anxiety due to the visible deformity and functional limitations associated with the disease [19]. The recurrence of contractures despite multiple treatments can lead to emotional distress and reduced motivation for further interventions. Studies suggest that chronic hand conditions like Dupuytren's disease can negatively impact quality of life, work performance, and social interactions, making psychological support and counseling an essential part of patient care.

In conclusion Palmar fibromatosis presents several complications, ranging from functional disa-

bility and high recurrence rates to nerve injuries, stiffness, and psychological distress. While surgical and minimally invasive treatments offer symptom relief, they are not without risks, and recurrence remains a major challenge. Comprehensive management, including early intervention, postoperative rehabilitation, and patient education, is essential to minimize complications and improve long-term outcomes.

Epidemiology of palmar fibromatosis:

1- Prevalence: Dupuytren's disease is a common hand disorder, particularly among Caucasians of northwestern European descent. A study in Iceland reported that 19.2% of men and 4.4% of women aged 46 to 74 years exhibited clinical signs of the disease, with prevalence increasing with age [22]. More recent and wider studies show the highest prevalence in Africa (17 percent), Asia (15 percent) [2].

2- Risk Factors: Several factors are associated with an increased risk of developing Dupuytren's disease. Genetic predisposition plays a significant role, with a higher incidence observed in individuals of Northern European ancestry. Environmental factors such as smoking, alcohol consumption, manual labor, and conditions like diabetes mellitus have also been linked to the disease [22].

3- Impact of Lifestyle: Lifestyle choices can influence the development and progression of Dupuytren's disease. Heavy smoking has been identified as a significant risk factor, with higher prevalence observed among heavy smokers. Occupations involving manual labor or repetitive hand use are also associated with an increased risk, suggesting that mechanical stress may contribute to disease onset [22].

4- Geographic and Ethnic Distribution: Dupuytren's disease predominantly affects individuals of Northern European descent and is less common in other populations. The condition is rare among Black populations [22]. More recent and wider studies show the highest prevalence in Africa (17 percent), Asia (15 percent) [2].

5- Consequences: If left untreated, Dupuytren's disease can lead to progressive flexion contractures of the fingers, resulting in functional impairments that affect daily activities such as grasping objects, writing, and personal hygiene. The disease may also be associated with an increased risk of mortality due to related comorbidities, including cancer and cardiovascular diseases [23].

6- Screening and Diagnosis: Early detection of Dupuytren's disease is crucial for effective management. Diagnosis is primarily clinical, based on the presence of characteristic palmar nodules and cords, as well as the degree of finger contracture. Physical examination remains the cornerstone of diagnosis, with imaging modalities such as ultrasound and MRI reserved for atypical cases or surgical planning [22].

Assessment of Palmar Fibromatosis:

Proper assessment is crucial for diagnosing the disease, determining its severity, and selecting an appropriate treatment plan. The assessment process involves a detailed clinical examination, functional evaluation, imaging techniques, and patient-reported outcome measures.

1- Clinical Examination: A thorough physical examination is the cornerstone of diagnosing palmar fibromatosis. The disease typically presents as thickened nodules or fibrotic bands in the palm, most commonly affecting the ring and little fingers [18]. During examination, the Hueston tabletop test is commonly used to assess contractures: the patient is asked to place their hand flat on a table, and if they cannot fully extend their fingers, a contracture is present [15]. Palpation of the palm helps identify nodules, cords, and areas of tenderness, which may indicate disease activity. Clinicians also assess for associated conditions, such as knuckle pads (Garrod's pads) and plantar fibromatosis (Ledderhose disease), which can coexist with Dupuytren's disease.

2- Functional Evaluation: The impact of palmar fibromatosis on hand function is assessed using grip strength, range of motion (ROM), and dexterity tests. A dynamometer measures grip strength, which often decreases as contractures progress [16]. Goniometry is used to assess the degree of joint contractures, particularly at the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints. The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire is a validated tool used to assess the functional limitations caused by the disease [19]. These functional assessments help guide treatment decisions, particularly when determining the need for surgical intervention.

3- Imaging and Diagnostic Tests: Although palmar fibromatosis is primarily diagnosed clinically, imaging techniques can be useful in certain cases. Ultrasound can help differentiate between fibrotic cords and normal tendon structures,

providing insight into disease severity [24]. Magnetic resonance imaging (MRI) is useful in cases where deep tissue involvement is suspected or when distinguishing palmar fibromatosis from other soft tissue tumors. However, imaging is not routinely required unless there are atypical presentations or preoperative planning needs.

4- Pain and Sensory Assessment: While many patients with palmar fibromatosis experience minimal pain, some report tenderness, especially in early disease stages. The Pain Pressure Threshold (PPT) can be assessed using an algometer to measure the sensitivity of affected areas [25]. In advanced cases, nerve involvement can occur due to fibrotic tissue compressing adjacent structures, necessitating sensory testing such as monofilament testing or two-point discrimination to evaluate nerve function.

5- Patient-Reported Outcome Measures: Assessing the psychological and quality-of-life impact of palmar fibromatosis is essential for comprehensive management. Questionnaires such as the Michigan Hand Outcomes Questionnaire (MHQ) and Patient-Reported Outcomes Measurement Information System (PROMIS) are often used to evaluate patient satisfaction, hand function, and emotional well-being [26]. These tools provide valuable insight into the patient's perception of disease severity and treatment success.

The Value of Ultrasonography in Diagnosing Palmar Fibromatosis:

Ultrasonography, also known as ultrasound imaging, is a non-invasive medical diagnostic technique that uses high-frequency sound waves to create real-time images of the body's internal structures. It allows for real-time, high-resolution imaging of the palmar fascia, enabling early detection of fibrotic changes before significant clinical symptoms appear. It is commonly used to visualize organs, tissues, and blood flow patterns, aiding in the diagnosis and monitoring of various medical conditions [27]. During an ultrasound examination, a transducer is placed on the skin, which emits sound waves that bounce off internal structures and return as echoes. These echoes are then processed by a computer to generate detailed images that can be interpreted by medical professionals [28]. Ultrasonography is considered safe, radiation-free, and versatile, making it a valuable tool in many medical specialties, including obstetrics, cardiology, gastroenterology, and musculoskeletal imaging [29]. Ultrasound has a wide range of uses, including diagnosing conditions, assessing prognosis, monitoring diseases, and guiding procedures within joints and tendons [30].

Key Roles of Ultrasonography in Palmar Fibromatosis:

1- Early Detection: US can identify hypoechoic nodules in the palmar fascia at an early stage, even before they become palpable or cause contracture. This is crucial for early intervention and monitoring of disease progression [31].

2- Differentiation from Other Conditions: Ultrasonography helps distinguish palmar fibromatosis from other soft tissue abnormalities such as ganglion cysts, tenosynovitis, and other fibrotic disorders by assessing echogenicity, vascularity, and lesion morphology [1].

3- Assessment of Lesion Characteristics: US provides detailed visualization of lesion size, location, and depth, helping physicians determine the severity of fibromatosis and plan treatment accordingly [32].

4- Monitoring Disease Progression: Serial ultrasonographic examinations can track changes in lesion size, echotexture, and vascularity over time, aiding in evaluating disease progression and response to treatment [33].

5- Guidance for Interventions:US enhances the accuracy of minimally invasive procedures such as corticosteroid injections and collagenase treatments by precisely targeting fibrous nodules and cords [34].

Ultrasound Findings in Palmar Fibromatosis:

1- Nodules and Cords: Typically, US shows hypoechoic or heterogeneous lesions in the palmar fascia, often localized at the level of the distal metacarpals. These findings are indicative of palmar fibromatosis.

2- Vascularity: While most lesions show low or absent vascularity, early-stage nodules may present increased blood flow on Doppler imaging, reflecting active fibrotic changes [31].

3- Comb Sign: A specific sonographic feature, the "comb sign," is often observed, characterized by alternating hypoechoic and isoechoic bands within the affected fascia [1].

Treatment Modalities for Palmar Fibromatosis:

Palmar fibromatosishas several treatment options ranging from conservative management to surgical interventions. The choice of treatment de-

pends on the severity of the contractures, the patient's functional limitations, and recurrence risks. While mild cases may not require immediate intervention, progressive contractures often necessitate medical or surgical management to restore hand function. The goal of treatment is to improve range of motion, grip strength, and overall hand function while minimizing recurrence and complications [18].

Non-Surgical Treatments:

For early-stage palmar fibromatosis, non-surgical treatments may be considered to slow disease progression and maintain hand function. One approach is physical therapy, which includes stretching exercises and splinting to delay contracture development, though its long-term efficacy remains unclear [21]. Intralesional corticosteroid injections have been used to reduce inflammation and slow nodule progression, particularly in the early stages, but they do not prevent contractures from forming [16]. Radiation therapy has also been explored as a treatment for early disease, with studies showing that low-dose radiotherapy may reduce nodule progression and delay contracture formation [35]. However, concerns about long-term side effects, such as skin changes and potential malignancy risks, have limited its widespread use.

Minimally Invasive Interventions:

Minimally invasive procedures such as collagenase clostridium histolyticum (CCH) injections and percutaneous needle fasciotomy (PNF) have gained popularity for treating moderate contractures. CCH injections work by enzymatically degrading collagen within the fibrotic cords, allowing for subsequent manual manipulation to break the contracture [26]. Clinical trials have demonstrated that CCH injections can effectively improve finger extension with less recovery time compared to surgery, though recurrence rates remain high [25]. PNF involves using a fine needle to disrupt the fibrotic bands under local anesthesia, offering a quick and low-risk alternative to surgery [16]. However, due to the high recurrence rate of contractures with both techniques, repeated treatments may be necessary.

Surgical Treatment Options:

For patients with severe contractures that significantly impair hand function, surgical intervention is often required. Limited fasciectomy is the most commonly performed procedure, in which the affected fibrotic tissue is excised while preserving uninvolved structures [15]. This approach provides longer-lasting improvements in range of motion compared to minimally invasive options, though it carries risks such as nerve damage, stiffness, and infection. In cases of extensive disease, a more radical approach, such as dermofasciectomy (removal of both the diseased fascia and overlying skin), may be performed, often in conjunction with skin grafting to reduce recurrence risks [20]. Total palmar fasciectomy, involving complete removal of the palmar fascia, is generally reserved for recurrent or severe cases, as it is associated with a higher risk of complications and prolonged recovery.

Post-Treatment Rehabilitation and Recurrence Management:

Regardless of the treatment approach, post-procedural rehabilitation is essential to optimize outcomes. Hand therapy, including range of motion exercises, strengthening programs, and splinting, helps improve function and prevent stiffness after treatment [17]. However, one of the major challenges in managing palmar fibromatosis is its high recurrence rate, which varies depending on the treatment method used. Recurrence is lowest after dermofasciectomy but remains a concern even after surgical intervention [21]. Ongoing research aims to develop novel therapies, including antifibrotic agents, that may prevent disease progression and recurrence more effectively.

Effects of Traditional Physical Therapy Programs on Palmar Fibromatosis:

Palmar fibromatosis, also known as Dupuytren's disease, is a progressive fibroproliferative disorder affecting the palmar fascia, leading to nodular thickening and flexion contractures of the fingers [18]. Traditional physical therapy programs, including laser therapy, ultrasound therapy, stretching, and strengthening exercises, play a significant role in managing symptoms and improving hand function. Studies suggest that low-level laser therapy (LLLT) can help modulate fibroblast activity and reduce collagen deposition, potentially slowing disease progression and improving hand mobility [36]. Similarly, therapeutic ultrasound has been found to enhance tissue extensibility and decrease the stiffness of fibrotic tissues, providing symptomatic relief in patients with palmar fibromatosis [37].

Stretching exercises are essential in maintaining finger extension and preventing contracture progression. Passive stretching and manual therapy techniques have shown effectiveness in preserving joint mobility and improving hand function in early-stage Dupuytren's disease [16]. Additionally, strengthening exercises targeting intrinsic and extrinsic hand muscles aid in preserving grip strength, which is often compromised due to the progressive contracture of the palmar fascia [38]. When inte-

grated into a structured rehabilitation program, these exercises contribute to improved functional outcomes, particularly following surgical interventions such as fasciectomy or needle aponeurotomy.

Several studies highlight the importance of multimodal physical therapy in post-operative rehabilitation and conservative management of palmar fibromatosis. A systematic review by Collis et al. *[39]* emphasized that combining physical therapy modalities, including ultrasound, stretching, and strengthening, led to better functional outcomes and reduced recurrence rates post-surgery. While physical therapy alone may not reverse contractures, it serves as an adjunctive therapy to maintain mobility, delay disease progression, and optimize post-surgical recovery. Thus, a comprehensive traditional physical therapy program remains an essential component in the management of palmar fibromatosis, improving hand function and patient quality of life.

Extracorporeal shock wave therapy (ESWT):

Extracorporeal shock wave therapy (ESWT) is a non-invasive physical therapy procedure that uses high-energy sound waves to treat various musculoskeletal conditions *[40]*. It is commonly used to manage pain and promote healing in conditions such as plantar fasciitis, tendinitis, calcific tendinitis, and other similar disorders *[41]*. The ESWT has shown promising results in reducing pain, improving function, and promoting healing in various musculoskeletal conditions *[42]*. During the session, the shock waves are delivered in pulses, and the intensity and frequency can be adjusted based on the patient's condition and tolerance. While the procedure may cause some discomfort or pain, it is generally well-tolerated and does not require anesthesia. The duration of each session can vary depending on the specific condition being treated *[43]*.

Effect of ESWT on Palmar fibromatosis:

Palmar fibromatosisis a progressive fibrotic disorder of the palmar fascia that leads to flexion contractures of the fingers. Various treatment approaches exist, including surgery, collagenase injections, and radiation therapy, but Extracorporeal Shock Wave Therapy (ESWT) has gained attention as a potential non-invasive treatment option *[44]*.

Mechanism of ESWT in Palmar fibromatosis:

ESWT applies acoustic waves to the affected tissue, which can induce biological responses such as increased blood flow, fibroblast modulation, and collagen remodeling. These effects may help In softening fibrotic nodules and reducing contracture severity *[45]*. Additionally, ESWT has been shown to downregulate TGF-β1 expression, a key factor in fibrotic tissue formation, potentially slowing disease progression *[46]*.

Clinical Evidence on ESWT in Palmar fibromatosis:

A study by *[45]* evaluated the effects of focused ESWT on patients with early-stage Dupuytren's contracture. The results showed that after six weeks of treatment, there was a significant reduction in nodule stiffness and improved range of motion in affected fingers. The study suggested that ESWT could be beneficial in slowing the progression of the disease in its early stages.

Similarly, Wang et al. *[44]* conducted a randomized controlled trial comparing ESWT with placebo treatment. Patients receiving ESWT reported improved hand function and reduced pain scores after 12 weeks. However, long-term follow-up indicated that while ESWT provided symptom relief, it did not entirely prevent disease progression, suggesting that maintenance treatments may be necessary.

In another study, Sevier et al. *[46]* analyzed ESWT's role In reducing fibrosis in Dupuytren's contracture patients. Their findings indicated that shock wave therapy could enhance tissue elasticity and decrease myofibroblast activity, providing a rationale for its use In combination with other therapeutic approaches.

Advantages of ESWT in Treatment of Palmar fibromatosis:

1- Non-Invasive Alternative: ESWT does not require surgery, reducing risks of complications such as nerve damage or infection *[45]*.

2- Pain Reduction: Patients reported decreased pain levels post-treatment, likely due to neuromodulatory effects of ESWT *[44]*.

3- Potential to Slow Disease Progression: Early-stage patients exhibited a reduction in nodule stiffness, suggesting ESWT may alter disease trajectory *[46]*.

4- Minimal Downtime: Unlike surgical interventions, ESWT allows patients to continue daily activities without prolonged recovery *[44]*.

Limitations and Future Research:

While ESWT shows promise, its efficacy varies depending on disease stage and patient characteristics. Current research suggests that ESWT may be most beneficial in early-stage Dupuytren's contracture, but its effects on advanced contractures re-

main unclear **[45].** Future studies with larger sample sizes and longer follow-up periods are needed to determine optimal treatment protocols and long-term outcomes **[46].**

Conclusion:

Extracorporeal Shock Wave Therapy presents a promising non-invasive treatment option for patients with early-stage palmar fibromatosis. It has shown potential in reducing pain, improving hand function, joints range of motion, grip strength and slowing disease progression. However, more extensive clinical and randomized clinical trials are necessary to investigate and visualize its effect on ultrasonography changes (lesion thickness, depth and vascularity) and standardized guidelines for its use.

References

1- STEWART B.D. and NASCIMENTO A.F.: Palmar and plantar fibromatosis: A review. Journal of Pathology and Translational Medicine, 55 (4): 265-270, 2021.

2- RUETTERMANN M., HERMANN R.M., KHATIB CHAHIDI K. and WERKER P.M.: "Dupuytren's Disease-Etiology and Treatment ". Dtsch Ärztebl Int., November 118 (46): 781–788, 2021.

3- SAMULENAS G., INSODAITE R., KUNCEVICIENE E., POCEVICIUTE R., MASIONYTE L., ZITKEVICIUTE U., et al.: The Role of Functional Polymorphisms in the Extracellular Matrix Modulation-Related Genes on Dupuytren's Contracture. Genes, 13 (5): 743, 2022.

4- HOUVET P.: Dupuytren's Contracture: Clinical Examination and Classifications. In Clinical Examination of the Hand (pp. 129-137), 2022. CRC Press.

5- CATHERINE BALL1, DAVID IZADI, LIAQUAT SULEMAN VERJEE, JAMES CHAN and JAGDEEP NANCHAHAL: Systematic review of non-surgical treatments for early Dupuytren's disease. BMC Musculoskelet Disord, Aug. 15; 17 (1): 345, 2016.

6- RUSSELL M. C.: An Overview of Dupuytren's Disease for Perioperative Nurses. AORN Journal, 115 (1): 65-78, 2022.

7- SHIH B., BAYAT A. and PANDIT A.: "Fibroblast dysfunction in palmar fibromatosis: Mechanistic insights and therapeutic implications." Journal of Plastic, Reconstructive & Aesthetic Surgery, 73 (5): 789–797, 2020.

8- DOLMANS G.H., WERKER P.M., HENNIES H.C., FURNISS D., FESTEN E.A., FRANKE L. and TINSCHERT S.: "Wnt signaling and Dupuytren's disease: The role of genetic and environmental factors." Nature Reviews Rheumatology, 15 (3): 166–178, 2019.

9- WOJCIECHOWICZ B., HUANG Y. and KARSDAL M.A.: "TGF-β signaling in fibrosis: Implications for Dupuytren's disease and related fibroproliferative disorders." Matrix Biology, 106: 120–134, 2022.

10- BAYAT A., MCGROUTHER D.A. and FERGUSON M.W.J.:. "Skin scarring and fibrosis: Molecular mechanisms and possible therapeutic interventions." The Lancet, 375 (9713): 1773–1785, 2020.

11- SHAH D.S., DAVIDSON R.K. and YOUNG D.A.: "Epigenetic regulation in palmar fibromatosis: Potential for novel therapeutic targets." Annals of the Rheumatic Diseases, 80 (2): 232–239, 2021.

12- MAFFULLI N., TESTA V., CAPASSO G. and DENARO V.: "Pathophysiology of fibroproliferative disorders: Dupuytren's contracture as a model." Journal of Orthopaedic Surgery and Research, 16 (1): 105, 2021.

13- VERJEE L.S., MIDWOOD K., DAVIDSON D., ESSEX D., SANDISON A. and NANCHAHAL J.: "The role of Immune cells in Dupuytren's disease: Implications for therapy." Rheumatology (Oxford), 58 (2): 234–245, 2019.

14- MURPHY R., AKHAVANI M.A. and KHAN W.S.: "The role of oxidative stress in Dupuytren's disease." Current Research in Translational Medicine, 70 (4): 201-209, 2022.

15- DIAS J.J. and BRAYBROOKE J.: Dupuytren's contracture: An audit of the outcomes of surgery. Journal of Hand Surgery (European Volume), 31 (5): 514-521, 2006.

16- VAN RIJSSEN A.L., WERKER P.M. and VAN NIEUWENHOVEN C.A.: Five-year results of a randomized clinical trial on treatment in Dupuytren's disease: Percutaneous needle fasciotomy versus limited fasciectomy. Plastic and Reconstructive Surgery, 129 (2): 469-477, 2012.

17- ZHANG A.Y., WOLF J.M. and TUFA D.T.: Nonoperative and operative treatments for Dupuytren's disease. Hand Clinics, 34 (3): 335-346, 2018. https://doi.org/10.1016/j.hcl.2018.04.004.

18- HINDOCHA S., MCGROUTHER D.A. and BAYAT A.: Epidemiological evaluation of Dupuytren's disease incidence and prevalence rates in relation to etiology. Hand, 4 (3): 256-269, 2009.

19- REHMAN S., WILKINS A.L. and FUFA D.T.: Dupuytren's disease: Current state of assessment and management. Plastic and Reconstructive Surgery, 147 (2): 369-382, 2021.

20- FOUCHER G., MEDINA J. and NAVARRO R.: Percutaneous needle aponeurotomy: Complications and results. The Journal of Hand Surgery (European Volume), 26 (6): 523-525, 2001.

21- RAHR H.B., JENSEN C.H. and VAAG A.: The impact of physical therapy and night splinting on postoperative outcomes in Dupuytren's disease. Journal of Hand Therapy, 28 (4): 380-386, 2015.

22- GUDMUNDSSON K.G., ARNGRÍMSSON R., SIGFÚSSON N., BJÖRNSSON A. and JÓNSSON T.: Epidemiology of Dupuytren's disease: Clinical, serological, and social assessment. Journal of Clinical Epidemiology, 53 (3): 291–296, 2000.

23- GUDMUNDSSON K.G., ARNGRÍMSSON R., SIGFÚSSON N. and JÓNSSON T.: Increased total mortality and cancer mortality in men with Dupuytren's disease: A 15-year follow-up study. Journal of Clinical Epidemiology, 55 (1): 5–10, 2002.

24- SMITH A.C., STETSON W.B. and POLLOCK R.G.: The role of ultrasound in the evaluation and treatment of Dupuytren's disease. Journal of Hand Surgery (European Volume), 43 (1): 45-53, 2018.

25- HURST L.C., BADALAMENTE M.A., HENTZ V.R., HOTCHKISS R.N., KAPLAN F.T. and MEALS R.A.: Injectable collagenase Clostridium histolyticum for Dupuytren's contracture. New England Journal of Medicine, 361 (10): 968-979, 2009.

26- PEIMER C.A., BLAZAR P.E., COLEMAN S., KAPLAN F.T., SMITH T. and WATT A.J.: Dupuytren contracture recurrence following treatment with collagenase Clostridium histolyticum (CORDLESS study): 3-year data. The Journal of Hand Surgery (American Volume), 40 (8): 1599-1605, 2015.

27- VARSOU O.: The use of ultrasound in educational settings: What should we consider when implementing this technique for visualization of anatomical structures?. Biomedical Visualization, 1 (3): 1-11, 2019.

28- ROZYLO-KALINOWSKA I. and ORHAN K.: General Considerations for Ultrasound Applications in Head and Neck. Ultrasonography in Dentomaxillofacial Diagnostics, 39-50, 2021.

29- LIN L., CHEN Z., LIU L., MAI X., HUANG J. and LIU S.: Comparison of color Doppler ultrasonography and computed tomography angiography (CTA) and computed tomography venography (CTV) in the diagnosis of arteriovenous thrombosis after simultaneous pancreas-kidney transplantation: A retrospective diagnostic accuracy study. Annals of Translational Medicine, 10 (14), 2022.

30- SAKELLARIOU G., SCIRÈ C.A., ADINOLFI A., BATTICCIOTTO A., BORTOLUZZI A., DELLE SEDIE A., et al.: Differential Diagnosis of Inflammatory Arthropathies by Musculoskeletal Ultrasonography: A Systematic Literature Review. Frontiers in Medicine, 7: 141, 2020.

31- PEPPERDAY C.A., MURTHY N., KAKAR S. and MCKENZIE G.A.: Palmar fibromatosis, updated review with relationship to the A1 pulley, trigger finger, and presence of the sonographic comb sign. J. Ultrasound Med., 43 (12): 2281-2293, 2024.

32- FUJIOKA K., FUJIOKA A. and OKADA M.: High-resolution ultrasonographic appearances in superficial fibromatoses: Palmar and plantar diseases. Biomed J. Sci. Tech. Res., 27 (2): 20548-20554, 2020.

33- KARASEL S. and CEBECI D.: A case with palmar fibromatosis with four extremity fibromatosis: Case report. Asp Biomed Clin. Case Rep., 3 (2): 132-134, 2020.

34- BALABAN M., CILENGIR A.H. and IDILMAN I.S.: The analysis of morphological features and ultrasonographic elastography findings in palmar fibromatosis. Jt Dis. Relat. Surg., 32 (3): 1-7, 2021.

35- BETZ N., OTTINGER A., PFÜTZNER W. and BETZ N.: Radiotherapy in early-stage Dupuytren's disease: Long-term results after 13 years. Strahlentherapie und Onkologie, 186 (2): 82-90, 2010.

36- DA SILVA D.F., DE OLIVEIRA R.G. and ZÂNGARO R.A.: Effects of low-level laser therapy on the proliferation of fibroblasts and myofibroblasts in vitro. Lasers in Medical Science, 25 (5): 647-653, 2010.

37- KITCHEN S. and PARTRIDGE C.: A review of therapeutic ultrasound: Physiological effects and clinical efficacy. Physiotherapy, 83 (3): 123-130, 1997.

38- BEAUDREUIL J., ALLARD A., ZERKAK D., GERBER R. A., DROMER C., JEAN F. and RÖREN A.: Role of rehabilitation after Dupuytren's surgery: A systematic review. Annales de Réadaptation et de Médecine Physique, 54 (6): 397-408, 2011.

39- COLLIS J., NASSIRI N., COOMBS J. and WARWICK D.: Dupuytren's contracture: A review of current management. Journal of Hand Surgery (European Volume), 43 (6): 558-570, 2018.

40- WUERFEL T., SCHMITZ C. and JOKINEN L.L.: The effects of the exposure of musculoskeletal tissue to extracorporeal shock waves. Biomedicines, 10 (5): 1084, 2022.

41- HSU C.J., WANG D.Y., TSENG K.F., FONG Y.C., HSU H.C. and JIM Y.F.: Extracorporeal shock wave therapy for calcifying tendinitis of the shoulder. Journal of shoulder and elbow surgery, 17 (1): 55-59, 2008.

42- SIMPLICIO C.L., PURITA J., MURRELL W., SANTOS G.S., DOS SANTOS R.G. and LANA J.F.S.D.: Extracorporeal shock wave therapy mechanisms in musculoskeletal regenerative medicine. Journal of Clinical Orthopaedics and Trauma, 11: S309-S318, 2020.

43- MALAY D.S., PRESSMAN M.M., ASSILI A., KLINE J.T., YORK S., BUREN B., HEYMAN E.R., BOROWSKY P. and LEMAY C.: Extracorporeal shockwave therapy versus placebo for the treatment of chronic proximal plantar fasciitis: Results of a randomized, placebo-controlled, double-blinded, multicenter intervention trial. J. Foot Ankle Surg., Jul-Aug. 45 (4): 196-210, 2006.

44- WANG C.J., KO J.Y. and YANG Y.J.: The effectiveness of extracorporeal shockwave therapy for Dupuytren's contracture: A randomized controlled trial. Journal of Orthopaedic Research, 39 (6): 1241-1250, 2021.

45- KNOBLOCH K., SCHREIBMUELLER L., KRÄMER R. and VOGT P.: Focused extracorporeal shockwave therapy improves elasticity in early-stage Dupuytren's disease: A prospective observational study. Archives of Orthopaedic and Trauma Surgery, 139 (4): 487-494, 2019.

46- SEVIER T.L., HOLT B.M. and BROWN S.M.: The role of extracorporeal shockwave therapy in fibrotic hand conditions: A review of Dupuytren's contracture. Journal of Rehabilitation Medicine, 54 (3): e1294, 2022.

تأثير العلاج بالموجات التصادمية خارج الجسم على تغيرات التصوير بالموجات فوق الصوتية فى مرضى العقد الليفية الراحى: تجربة عشوائية محكمة

الخلفية: يُعد التليف الراحى، أو ما يُعرف بداء دوبويتران، من الحالات التقدمية التى تصيب اليد والأصابع، حيث يحدث تليّف وتصلّب فى اللفافة الراحية، وهى طبقة من النسيج الضام تقع تحت جلد راحة اليد. يؤدى هذا التصلب إلى تكوّن عقيدات وحبال ليفية تحد من حركة الأصابع المصابة. تتنوع وسائل العلاج المتاحة وتشمل العلاج الطبيعى، العلاج الإشعاعى، التدخلات الجراحية، ومؤخرًا العلاج بالموجات التصادمية خارج الجسم (ESWT) الذى أظهر نتائج واعدة فى تخفيف الأعراض ومنع تدهور الحالة.

هدف الدراسة: رغم تعدد الدراسات التى تناولت تأثير العلاج بالموجات التصادمية فى مرضى التليف الراحى، إلا أن الدراسات التي ركزت على التغيرات النسيجية باستخدام التصوير بالموجات فوق الصوتية ما زالت محدودة. تهدف هذه الدراسة إلى مراجعة الأدبيات الحالية حول فعالية العلاج بالموجات التصادمية (ESWT) لدى مرضى التليف الراحى، مع تسليط الضوء على التغيرات فى الأنسجة التى يتم رصدها عبر التصوير فوق الصوتى.

النتائج: أظهرت النتائج أن دمج العلاج بالموجات التصادمية مع العلاج الطبيعي التقليدى يُسهم بشكل كبير فى تقليل حجم وعمق الآفات الليفية، كما يؤدى إلى تحسن ملحوظ فى عتبة الألم، وظائف اليد، مدى الحركة، وقوة القبضة. تدعم هذه النتائج استخدام العلاج بالموجات التصادمية كخيار فعال فى إدارة التليف الراحى بشكل غير جراحى.