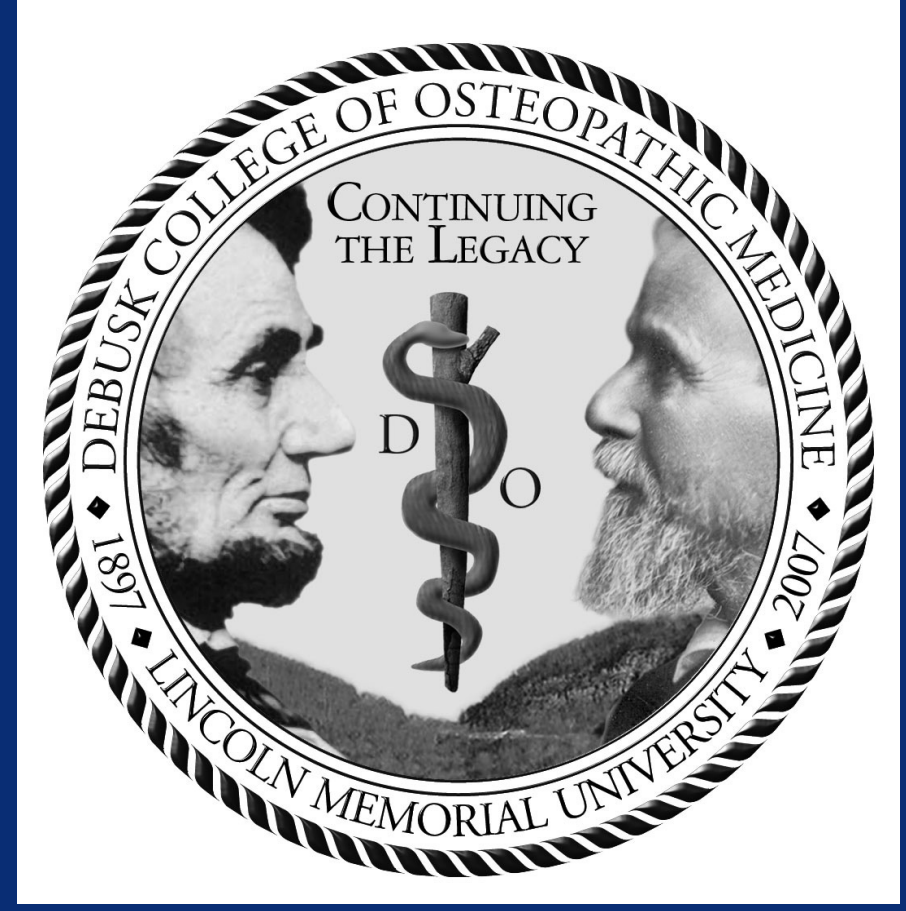


# A Literature Review on Osteopathic and Integrative Approaches to the Treatment of Scars



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## Abstract

**Background:** Scars are a widespread problem affecting nearly all medical specialties, and people of varying ages and genetic backgrounds worldwide. To most, scars are cosmetically unwanted, and the causative events are numerous. Traumatic scarring is an extremely common complication following soft tissue injury that is troublesome due to the presence, disfigurement, pain, and motion restriction they can cause. Nevertheless, definitive scar treatment remains elusive. Patients are often left with a constant reminder of their injury in the form of densely deposited fibrous tissue. Osteopathic models in current research are addressing the broader region of whole body with lymphatic and respiratory circulatory models, and regionally with myofascial release techniques. Osteopathic therapy can dramatically improve a patient's quality of life and curative process, by understanding the body's power for self-regulation and self-healing. Non-surgical treatments have also been studied on effectiveness, and value they may have as a remedy to scars. Due to their permanence and undesired physical appearance, finding valuable scar treatment for patients is an everyday conundrum; making it essential to apply osteopathic models, and integrative approaches such as beneficial non-surgical options, into everyday patient care.

**Objectives:** To analyze and investigate the use of scientifically proven osteopathic manipulative techniques (OMT), integrative non-surgical treatments, and current evidence-based recommendations to facilitate scar healing. Furthermore, to discover the science behind the difficulty of initiating scar treatment and illuminate proven techniques that medical practitioners and the general population can include as additional therapy.

**Method:** Utilizing PubMed, the following keywords were applied: "osteopathic manipulative treatment", "osteopathic medicine", "scar formation", "scar treatment", "hypertrophic scars", "myofascial", "soft tissue", "scar laser treatment", "platelet rich plasma", "hydro-dissection", "regenerative treatment".

**Results:** Data shows that adjunctive OMT enhances the body's systemic response to healing skin trauma. Osteopathic techniques, such as myofascial release, soft tissue manipulation, and lymphatic pump therapy can further induce relaxation of scar tissue and improve blood flow to the skin. Studies also show that the use of non-surgical options such as hydro-dissection and laser treatments increases scar tissue relief, resulting in diminished appearance and pain. Based on published discoveries, it is determined that OMT is clinically effective and useful as additive therapy rather than pharmacologic drugs or scar creams alone.

**Conclusions:** Continuing to cultivate knowledge on essential applications and outcomes of OMT on scar treatment will elevate exceptional patient care not only from an aesthetic aspect, but to enhance patient health, confidence, and overall quality of life.

## Introduction

**Overview:** Manipulative therapy on active scars has also been studied since the 1930's by the Huneke brothers. One of the most common complications after a soft tissue injury is traumatic scarring, and because structure and function are interrelated in the human body, leaving active scars untreated can become debilitating. It is important to take consideration of the different types of scarring, location, and characteristics of the patient when deciding which technologically advanced integrative approach would be the most beneficial in the scar healing process<sup>5</sup>.

**Scar Formation:** Hypertrophic scarring is caused by a proliferation of fibroblasts leading to abnormal fibrous tissue and increased collagen buildup into the skin following a trauma. This can lead to pain, itching, physical abnormalities, and negatively impact a patient's mental health<sup>14</sup>. Treatment strategies that can manipulate the body's response to injury and diminish inflammation have immense possibilities for skin regeneration and reducing scar formation<sup>4</sup>. Osteopathic manipulative techniques can improve scar appearance during these stages and increase blood flow to assist in scar healing altogether.

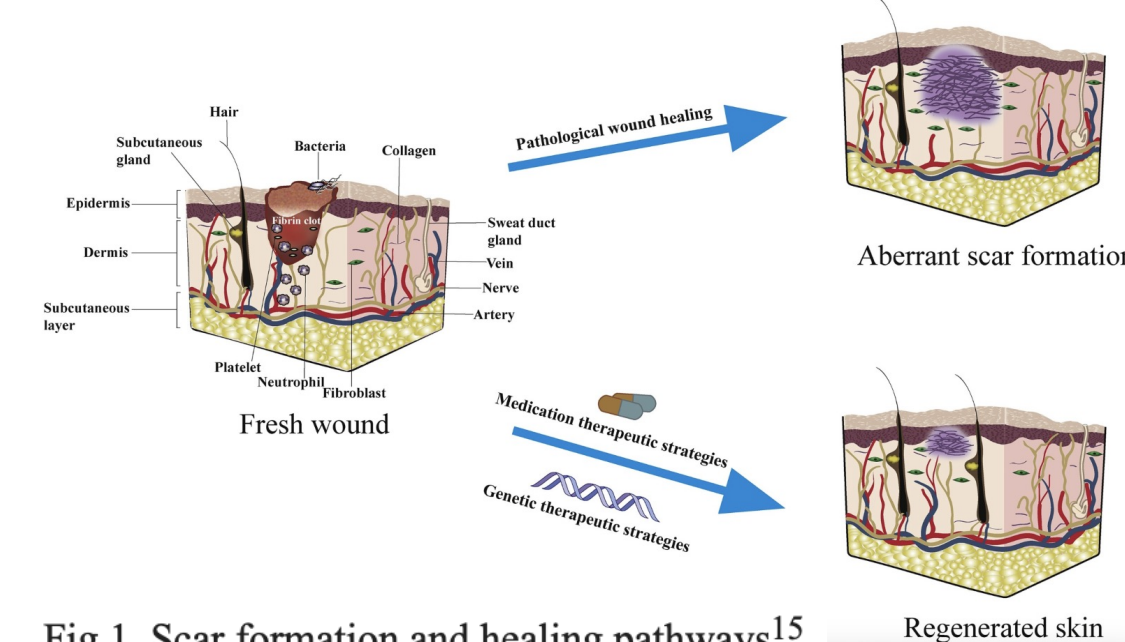


Fig 1. Scar formation and healing pathways<sup>15</sup>

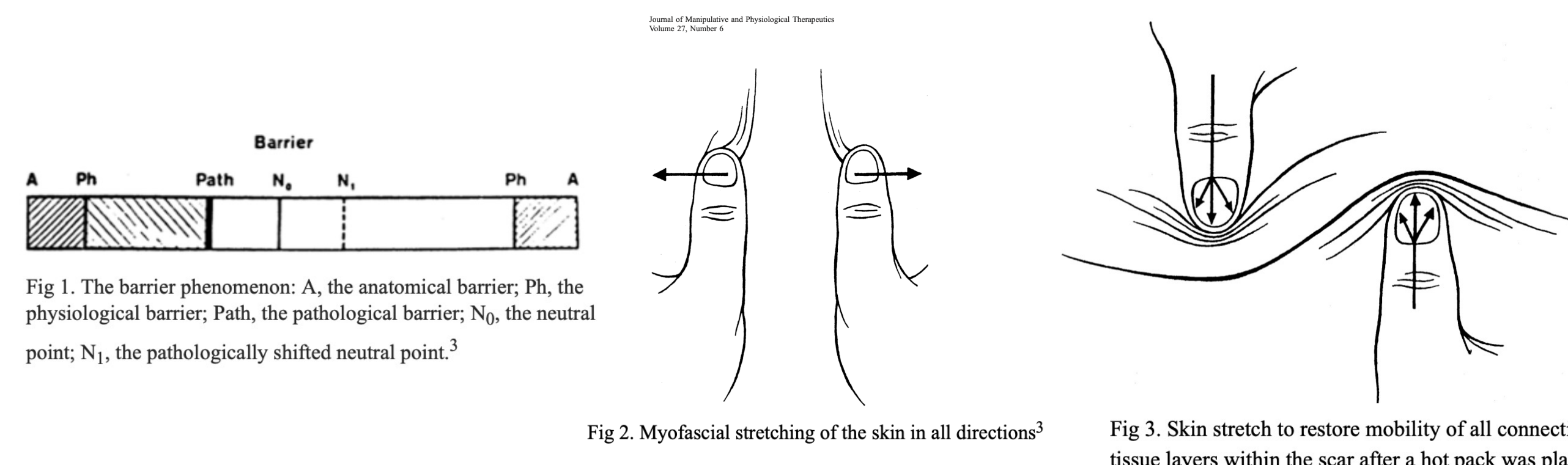
**Research Aims:** It is critical to understand the body's power for self-regulation and self-healing. This literature review compiles the most important and relevant data on a topic that affects nearly all medical specialties. Therefore, we aim to advance the understanding of science and osteopathic medicine by discussing scientifically proven treatments to aid scar treatment, such as myofascial and lymphatic techniques, and how medical practitioners and the general population can employ these methods daily<sup>1-2</sup>.

## Methods

Our literature review was conducted between November 2022 and March 2023. The decision to use a resource was ranked by amount and level of data presented. We also narrowed our search to exclude patients with absolute contraindications to osteopathic manipulative treatment.

## Results

**Soft Tissue Manipulation:** Scars can affect all layers of soft tissue, so it is important to palpate the affected area for resistance (pathological barriers)<sup>3</sup>. Surgical operations are commonly carried out a distance from the initial superficial incision (i.e., Laparoscopy), which can cause soft tissue changes in the deeper tissues without leaving superficial scarring. A 2002 study included 51 patients with varying levels of pain and procedural scars on different parts of the body, aimed to restore skin stretch and mobility of all soft tissue layers, proceeding from superficial to deep<sup>3</sup>.



**Myofascial Release (MFR):** MFR is an osteopathic manipulative technique that can be applied to anyone and only requires correct palpation technique to achieve results without being costly<sup>10</sup>. Scars have a direct link to connecting fascia and can create adhesions to nearby soft tissue causing restriction and tension<sup>11</sup>. MFR enhances microcirculation in the wound area to engage the lymphatic system, improves circulating immune complexes within the body, and helps prevent hypertrophic scar formation<sup>10</sup>. One study applied MFR in clinical trials shortly after burn trauma to the skin. Carefully applied slow pressure MFR close to the wound helped patients see vast improvement in scar healing<sup>10</sup>. Another study shared that MFR has been proven to benefit women after a cesarean section, by diminishing pain at the incision site, releasing tension of the soft tissue layers, and correcting the sympathetic tone<sup>11</sup>. Four women were treated post cesarean section, and scar appearance and pain were reported to be diminished after successful treatment. A similar post cesarean section study portrayed that applying MFR to the chronic scars of two women achieved relief<sup>12</sup>.

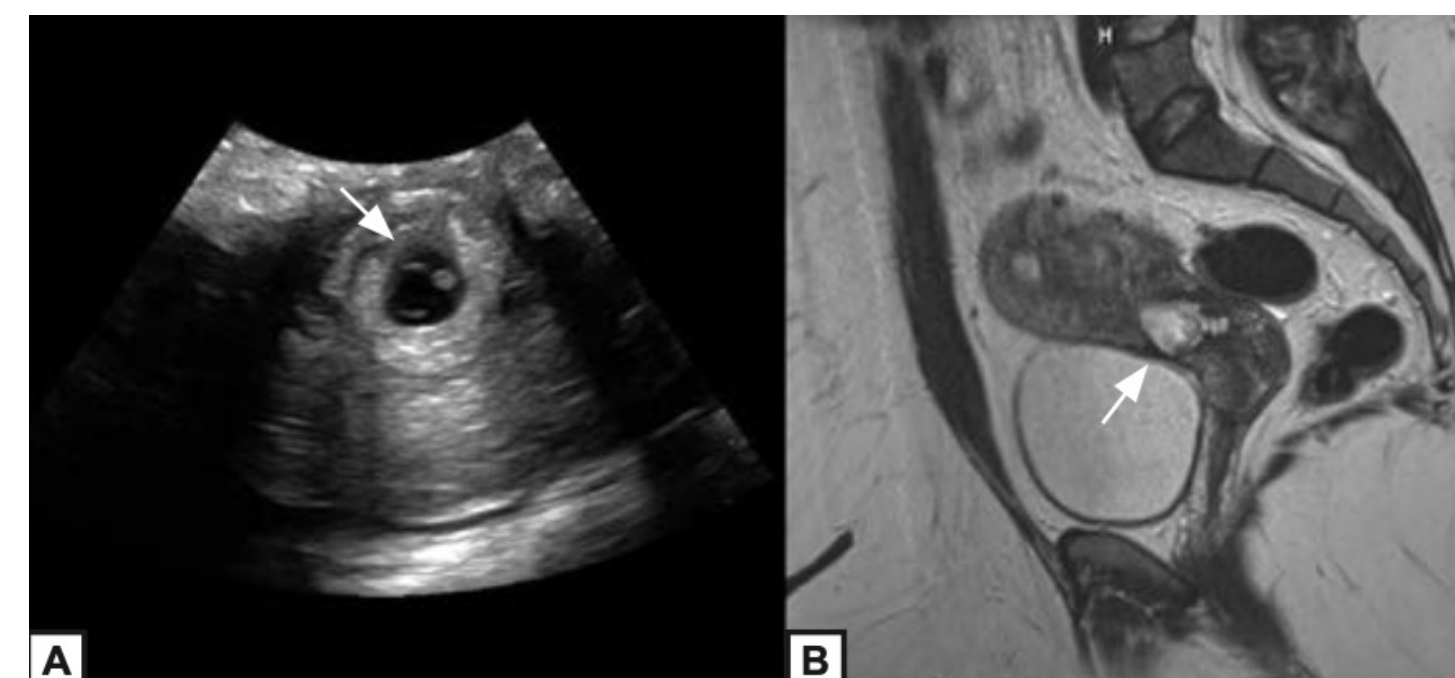


Fig 4. Imaging of cesarean scar ectopic pregnancy. In the ultrasonographic image (A), the abnormally positioned ectopic gestational sac is shown (arrow) with fetal pole and yolk sac in the lower uterine segment adjacent to the previous cesarean scar. In the magnetic resonance image (B), an early gestational sac (arrow) was seen implanted in the anterior aspect of the lower uterine segment infiltrating into the previous cesarean scar<sup>3</sup>

**Lymphatic Pump Therapy:** Impaired lymphatic dynamics in the body can result from injuries to the tissues and focal ischemia, ultimately leading to an inadequate immune system preventing a healing response. When utilizing lymphatic pump techniques, they assist in mobilizing lymph passage through the lymphatic channels of the body, removing harmful fluid and inflammatory mediators<sup>13</sup>.

**Ultrasound Guided Hydro-Dissection:** Ultrasound guided hydro-dissection can assist in diminishing traumatic scarring by improving anti-scarring drug delivery through mechanical pressure of the skin<sup>7</sup>. This technique avoids a direct injury to the nerve and alleviates entrapment that could be caused by soft tissue adhesion to the nerve by using an anesthetic or saline solution<sup>7</sup>. There are two widely used hydro-dissection techniques called in-plane and out-of-plane methods, which both show relief and no reported adverse events<sup>8</sup>.

**Fractional Laser/Intense Pulsed Light (IPL)/Radiofrequency Technology:** Fractional lasers utilize collagen remodeling to improve appearance of scar tissue and relieve pain<sup>5</sup>. IPL decreases the blood supply to the thickened scar to diminish formation which helps to improve texture and color of the scar<sup>5</sup>. IPL is a vascular targeted device that can be used solely or combined with fractional laser indicated for erythematous traumatic scars<sup>5</sup>. Radiofrequency induces thermo-lysis which assists in remodeling the skin's epidermis and dermis layers to alleviate hypertrophic and atrophic scarring<sup>5</sup>. Ultrasound is utilized as an adjuvant therapy with radiofrequency or fractional laser mainly for hypertrophic traumatic scars<sup>5</sup>. Randomized control trials were done on patients with atrophic scars, acne scars, and scars from burns utilizing fractional laser treatment. Recipients reported moderate to significant relief in all types of scarring<sup>5</sup>.

**Evidence-Based Herbal Medicine:** Research has been arising on the topic of evidence-based herbal medicine and its effectiveness on inhibiting fibroblast growth and reducing inflammation that leads to scar formation<sup>14</sup>. In 2022, a published study was done on Traditional Chinese Medicine (TCM) relating to scar treatment<sup>14</sup>. This new method utilizes botanical compounds and extracts that have properties of scar tissue breakdown. TCM includes very few adverse side effects, providing ideas for further research. Clinical trials of in-vitro and animal studies have started to commence, following long-term sustained release of extracted botanical compounds, such as hydrogel, nano, microneedle, and liposome. These pose a new potential idea for implicit scar treatment as supplemental TCM botanical drugs are being developed<sup>14</sup>.

## Discussion

According to published work, it is adamant that OMT is clinically useful and worthwhile as additive therapy. The incorporation of OMT into daily practice can be significant to patients undergoing or recovering from medical procedures, or to patients with pre-existing/healing scars. It appears the most beneficial treatments in alleviating scars and the pain that may cause, are osteopathic manipulative treatments such as soft tissue manipulation and myofascial techniques as of current.

**Soft Tissue Manipulation:** Soft tissue manipulation not only discusses the diminishing scar appearance, but further states the resolution of chronic pain this technique can solve<sup>9</sup>. One study concluded: "The scope of manipulative treatment is greatly widened. If the scar is relevant, it may be the most effective type of treatment."<sup>3</sup> This indicates the importance of OMT techniques in allowing the body to self-heal and stimulate scar tissue breakdown. There may not be enough evidence on soft tissue manipulation to make definitive conclusions, portraying the necessity of more research regarding scarring and alleviation of pain altogether.

**Myofascial Release (MFR):** Overall, the most fascinating findings involved women with post cesarean section incisions that also helped to reduce their pain. Not waiting until wound healing has concluded to perform OMT, has extreme benefit to preventing scars from occurring in some cases<sup>10</sup>. A limitation to this study was that the women in the measured cases all had a BMI of 22 or less, and that further studies should be done on patients with a greater variance in BMI's. Evidence suggests that women with repeated cesarean sections can also have the same outcome as primary cesarean sections since MFR can reduce adhesions, release tension of the myofascial tissue layers, and improve lymphatic drainage to achieve proper healing and prevention of scar formation<sup>11</sup>.

**Ultrasound Guided Hydro-Dissection:** Even though there is evidence suggesting ultrasound guided hydro-dissection has the potential to benefit nerve mobility, there is limited published data on this option in general<sup>8</sup>. There has not been enough evidence to completely evaluate the need for this technique over others and its absolute safety specifically, and further research is necessary to determine its effectiveness.

**Fractional Laser/Intense Pulsed Light (IPL)/Radiofrequency Technology:** All these advanced technologies alone or combined, have been proven to effectively and safely improve the thickness, texture, erythema, pigmentation, pain and itch, and alleviate the contractures to improve function<sup>5</sup>. Even so, treatment of traumatic scars with these technologies has not been optimized, and the efficacy and long-term outcome of these technologies have yet been compared until now. Therefore, basic research to explore thoroughly the mechanisms, as well as randomized controlled clinical trials to explore the optimal treatment protocols, should be completed. A better understanding of these technologies will promote the appropriate implementation of these technologies in clinical practice for traumatic scars treatment<sup>5</sup>.

**Evidence-Based Herbal Medicine:** Some limitations of this new herbal medicine development we discovered through our research include needing more clinical trials of larger populations done for it to move on to human study, and that as of now, TCM lacks sufficient evidence for the correct amount of dosing that would be needed for effective scar treatment, as it has not progressed to pharmacology studies thus far. Future research on this new drug delivery treatment will be valuable in the years to come as it is currently a flourishing and compelling proposal that has the potential to succeed in modern medicine one day<sup>14</sup>.

**Limitations:** The limitation of this project is the exceedingly small amount of evidence-based research on successful manual/manipulative treatment of scars altogether. To our knowledge, there are no osteopathic articles written on this topic. Even though several methods for treating different types of scars have been discussed throughout the years, all having their own advantages and disadvantages, the most favorable leading choice for successfully treating and curing scars has not been confirmed to this date as it is very limited in medical research.

**Future Studies and Potential Impacts:** Due to the limited amount of evidence-based research on this topic, the potential for future impact is vast. Continuing to cultivate knowledge on beneficial applications and outcomes of OMT on scar treatment will elevate exceptional patient care not only from an aesthetic aspect, but to enhance patient health, confidence, and overall quality of life. Future research should make a synergistic effort to appreciate the underlying pathological mechanisms associated with scar formation to help guide supplemental treatment. We recommend that future studies involve more women in clinical trials of all ages and weight, comparing control groups of women receiving myofascial treatments post cesarean incisions to women not receiving these OMT treatments, to fully appreciate the outcomes on time frame of the scar healing process and pain reduction.

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## Acknowledgements

We would like to thank the Research and Grants Committee at LMU-DCOM for choosing us as the DeBusk College of Osteopathic Medicine Basic Science/Clinical Research Scholar Award recipients to assist us in further developing our research. We would also like to show our appreciation to Dr. Anne Marie Zeller, DO, for her expertise, and phenomenal guidance throughout this project.