

# A Case Study of Perceptions of Treatment for Breast Surgery-Induced Keloids

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## ABSTRACT

A review of the existing body of knowledge on the topic of keloids reveals that although there are numerous keloid treatments available globally, no treatment presently is specifically designed for breast surgery-induced keloids or deemed effective for keloids in general. Therefore, this research focuses on the perception of the abilities of various current keloid treatments in treating breast surgery-induced keloids. It does this by implementing a case study method containing semi-structured interviews with nine women who have breast surgery-induced keloids in North America and then a qualitative thematic analysis. All of the interviewees reported that the treatments they used resulted in no improvement for their breast surgery-induced keloids. More experimental research is needed to find if there is an effective breast surgery-induced keloid treatment already in North America, and if not, how a new treatment can be created that addresses issues with treatments available currently. Based on the most recent data from Brigham and Women's Hospital, more than 100,000 women have mastectomies each year in the United States (2022). A mastectomy is when one breast or both breasts—that is a double mastectomy—are surgically removed to prevent or treat breast cancer (Brigham and Women's Hospital, 2022). With such a great number of women in the United States today being forced to have mastectomies, there is in turn an increased vulnerability for keloids to develop. According to Scrimali et al. (2010), a group of researchers of Plastic Surgery at the University of Catania, a keloid is defined as an aberrant wound reaction (see Appendix A for photographs of two breast surgery-induced keloids from different angles—used with permission of participant). Meenakshi et al. (2005) state that this response results from trauma, inflammation, surgery, burns and/or spontaneous formation. Vivante et al. (2007) declare that one or more of these factors can cause over-abundant fibroblast proliferation and accordingly excessive collagen deposition, which produces a keloid. Therefore, mastectomy patients are susceptible to keloid production after having surgery. Alster and Tanzi (2003) express that keloids are damaging for an individual's aesthetic and function.

## Literature Review

In order to understand why this study is focused on finding the most effective treatment in North America for keloids in breast surgery patients, it is critical to review the existing body of knowledge on the topic. First of all, due to the similarities that keloids possess with hypertrophic scars, it is important to bring about awareness as to what differentiates a keloid from a hypertrophic scar and why it is more necessary to find the most effective treatment in North America for keloids. A hypertrophic scar is also a deviant wound reaction, but whereas a hypertrophic scar stays inside of the initial injury and is likely to regress, a keloid raises above the initial injury and rarely regresses (Scrimali et al., 2010). The greater strength of a keloid in comparison to a hypertrophic scar and a keloid's tendency to continue growing in height and width as a protrusion on a person's body are the reasons behind deciding to concentrate on keloids over hypertrophic scars.

In the research, there will be a focus primarily on breast surgery-induced keloids. There is little research in this particular area of keloid treatment. In previous studies that I had access to, such as the study executed by Devalia et al. (2008), when keloids in breast surgery patients are examined, they are used as case studies for treating keloids

as a whole. There is no specific consideration as to how breast tissue may need a distinctive keloid treatment from other keloid treatments. As reported by Saleem and John (2013), breast tissue is anatomically different from other tissues in the human body and therefore requires gentle tissue handling. Delicate tissue management is not an element of past studies.

Along with the gap in individualized keloid treatment for breast surgery-induced keloids, Coppola et al. (2018), reconstructive and aesthetic surgeons at the University of Rome, affirm that there is “no universally effective therapy” for keloids. Existing keloid treatment options are uncomfortable, expensive and/or unsustainable. Comfort is a priority because the treatment process for a keloid present in sensitive breast tissue should not be painful. Affordability is also of emphasis because breast surgery is already expensive; adding on more expenses for keloid treatment should be minimized. Keeping those two things in mind, sustainability is at the center of the research because the keloid treatment can then be used continually across the world without upending the environment.

Due to there being no globally accepted keloid treatment, there are many keloid treatments available throughout the world. According to Andrews et al. (2016), researchers at Thomas Jefferson University, keloid treatments fit into three categories—non-targeted therapies, corticosteroids and targeted therapies.

Non-targeted therapies attack a keloid as a whole, first and foremost, and then may target a more specific component of the keloid later on. Non-targeted therapies include sole surgical excision and surgical excision combined with another supportive therapy, pointedly pulsed-dye laser treatment, radiation, pressure therapy, topical silicone gel or CO<sub>2</sub> laser removal. Surgical excision alone has extraordinarily high rates of recurrence. Ogawa et al. (2019), researchers at Nippon Medical School Hospital, specify that 50 to 80% of keloids reappear after surgically removing them. As priorly stated, after surgical excision of a keloid, pulsed-dye laser treatment, radiation, pressure therapy and/or CO<sub>2</sub> laser removal can be employed. Grouls et al. (2021) explain that pulsed-dye laser treatment utilizes a fixed light beam that is transformed into heat, which eradicates the blood vessels that make up a keloid; recurrence or only a partial reaction may take place with this removal method. Radiation, specifically electron beam ( $\beta$ -ray) irradiation, can be beneficial to prevent the reappearance of a keloid. As a result of using a maximum dose of 30 Gy on a keloid, thus improving the safety of the radiotherapy, and starting to customize the approach to surgery based on the body site where the keloid is located, the recurrence rate of keloids of which have undergone electron beam ( $\beta$ -ray) irradiation has decreased to 9.3% (Ogawa et al., 2019). Pressure therapy, simply applying pressure to the area where a keloid was, has been put forward as a way to treat keloids on ears and other exposed parts of a body through adjusting fibroblast action and aiding collagen degeneration (Andrews et al., 2016). When it comes to non-exposed areas of a body, such as breasts, this treatment provides little to no help. Unlike other non-targeted therapies, topical silicone gel can be applied to the keloidal surface by the person spreading it upon the keloidal surface themselves. Through their study of the success of topical silicone gel for keloid treatment, Puri and Talwar (2009) found that topical silicone gel controls fibroblast formulation and diminishes collagen creation. This leads to an 86% decrease in the texture, an 84% decrease in the color and a 68% decrease in the height of a keloid (Puri & Talwar, 2009). Finally, the last treatment that is commonly united with surgical excision is CO<sub>2</sub> laser removal where a concentrated CO<sub>2</sub> laser beam destructs the tissue of a keloid (Scrimali et al., 2010). Garg et al. (2011) acknowledge that recurrence is present with CO<sub>2</sub> laser removal.

A corticosteroid is a steroid that can be injected into a keloid to decrease its height and width (Andrews et al., 2016). The most efficient and therefore frequently used direct corticosteroid injection is triamcinolone acetonide, abbreviated as TMC (Andrews et al., 2016). This treatment necessitates precision and time. Until a keloid becomes level to the skin surrounding it, every four to six weeks for an undetermined number of months, TMC is injected into the mid-dermis at a prearranged depth so as to not cause permanent deterioration of the epidermis (Andrews et al., 2016). TMC restricts fibroblast development and boosts collagen decay, but there is still at times a 30% keloid recurrence rate (Andrews et al., 2016).

Targeted therapies are treatments that dwindle or completely rid of one or more critical components for the development of fibrotic tissue needed to connect the tissues of a keloid (Andrews et al., 2016). For example, as described by Memariani et al. (2021), the incorporation of depsipeptide tacrolimus into fibrotic keloid tissue is a therapy

aimed at constraining the calcineurin complex with particular binding proteins. Hindering the calcineurin complex results in the restriction of fibroblast generation, movement, collagen production and crucial TGF- $\beta$ /SMAD signaling passageways, which can repress keloid growth (Memariani et al., 2021). No clinical study that I had access to, including the aforementioned study, has found a high effectiveness for a targeted therapy.

Currently, no keloid treatment is always effective. No keloid treatment is comfortable, inexpensive and sustainable. No keloid treatment is suited for individuals with breast surgery-induced keloids because no treatment has ever been researched for that specific purpose based on the studies I had access to. The research into a more effective, comfortable, inexpensive and sustainable treatment is valuable because a keloid is an abnormal response to a wound that could come to be in many different ways, meaning a keloid has the capability to develop in any person that has been injured. Therefore, there is a considerable population susceptible to growing a keloid. Vulnerability to keloid growth is even greater among women who have undergone breast surgery. Every one of these women has experienced a wound, making them all vulnerable.

With a great number of treatments available worldwide, and not one of them being specifically designed for breast surgery-induced keloids or being deemed effective for keloids in general, the research will focus on the perception of the abilities of various current keloid treatments in treating breast surgery-induced keloids. The question that will be answered is—what is perceived to be the most effective treatment available in North America for breast surgery-induced keloids?

## Hypothesis

Initially, the hypothesis was that it would be perceived that there is no most effective treatment available in North America for breast surgery-induced keloids. This hypothesis was formed based on conclusions drawn from findings in previous studies surrounding the topic of keloid treatment. Due to there being no universally effective treatment for keloids and no treatment for breast surgery-induced keloids that takes into account the differences in breast tissue compared to tissue throughout the rest of the human body, a belief was formed that there would not be a significant difference in the perceived effectiveness of various keloid treatments accessible in North America.

## Method

In order to answer the research question effectively, a case study method was implemented containing semi-structured interviews and then a qualitative thematic analysis. Becker et al. (2022) define a case study as the acquisition and display of descriptive information regarding a specific participant or small group. Typically, a case study contains details of subjects themselves (Becker et al., 2022). This research concentrated on a case study of nine women who have breast surgery-induced keloids in North America. The case study method was employed because the diverse experiences these women have had with different keloid treatments can be more thoroughly analyzed using the case study method, and the case study method was approved by the Institutional Review Board. The reasoning behind using this type of method was to evaluate what treatment available in North America has proven to be the most effective, comfortable, inexpensive and sustainable or if a comfortable, inexpensive and/or sustainable treatment is needed. Comparing various experiences of women using different keloid treatments through the precise assessment produced by a case study was the most straightforward way to analyze and find the data that was being looked for. Moreover, information could be compiled by way of semi-structured interviews and then inspected with a qualitative thematic analysis through the case study method.

In order to gather data on the personal experiences of women with breast surgery-induced keloids and to answer the research question, semi-structured interviews were conducted as the first element of the case study. According to Mathers et al. (1998), a semi-structured interview is an interview that includes a sequence of open-ended

questions rooted in the topic areas the researcher is covering in their research. Due to the nature of open-ended questions, a semi-structured interview has very few constraints as to what the interviewer and the interviewee can and cannot do and say. First off, the questions asked present the topic being examined, but little extra guidance, allowing the interviewer and interviewee to contemplate some topics in greater detail. Next, given the interviewee is struggling to answer a question or supplies only a short response, cues or prompts can be used by the interviewer to help the interviewee to further think over the question. Lastly, the interviewer has the ability to pursue a path of inquiry brought about by the interviewee or to ask the interviewee to expand on their original response. With the final goal being to find an effective, comfortable, inexpensive and sustainable treatment for breast surgery-induced keloids, it was essential that the experiences of women trying to treat their breast surgery-induced keloids were collected with as much topic-focused detail as possible. Thus, semi-structured interviews were utilized as they are designed to have the interviewees go in depth on topics directly related to the research.

Yet, before the interviews could occur, at least five individuals were needed to be found that met the criteria to be an interviewee for the research. A minimum of five individuals were necessary for the research to guarantee that a synthesis of the findings would be employing a number of participants that was large enough to verify that the findings are credible. The requirements to be one of the five or more interviewees consisted of two points—the interviewee has a breast surgery-induced keloid, and the interviewee lives in North America. Given these necessities, women meeting these specifications were searched for. Eventually, an organization that helps women impacted by breast cancer was found. This organization has an Instagram account in which the leaders of the group are listed. These women were contacted via email and informed of the research and what was possibly needed from them. After a woman with the characteristics to be a participant agreed to be interviewed, they were provided with an informed consent form in which more details about the research were included, as well as exactly what their role in the research would be and how their rights as a research participant would be protected (see Appendix B for the exact informed consent form used). Then, following their signing of that document and therefore consenting to be interviewed for the study, a one-on-one interview was organized that was planned to take approximately five to twenty minutes. The goal of each interview was to determine what keloid treatment had proven to be the most effective for the interviewee, which could be measured through perceived changes in height, width and color of the breast surgery-induced keloid after using treatment as illustrated by previous research using case studies. With that specific goal in mind, all interviews encompassed the same five questions on a woman's experiences with treating their breast surgery-induced keloids (see Appendix C for the specific interview questions). The interviews were all conducted in person or on Zoom. All of the questions were open-ended, so interviewees were able to expand on their answers. The questions were also sorted into three categories—past experiences (one question), present happenings (three questions) and future desires (one question). The past experiences category asked interviewees about experiences with treating keloids in the past years. The present happenings category handled questions about keloid treatment being used now, improvements noticed in the appearance of the keloid and problems occurring with keloid treatments. The future desires category explored changes wanted for future keloid treatments. The questions were classified in this way to attain as many experiences, both positive and negative, with different keloid treatments as possible. After each interview concluded, the sampling method of snowball sampling was incorporated into the research. The Institutional Review Board for the Human Research Protection Program at Oregon State University (2010) explains that snowball sampling is when researchers ask the participants in a study to help them determine other potential participants. Through snowball sampling, eight more participants were acquired. In total, nine women were interviewed as part of the study.

Following the completion of the semi-structured interviews, the research transitioned into the second stage of the case study—the qualitative thematic analysis. As established by Chad R. Lochmiller (2021), qualitative thematic analysis is identifying patterns in data, whether that be interview transcripts, observational notes or videos, etc., and then describing them as researcher-generated themes. For the intentions of the research, this method was adopted to analyze the experiences conferred by the women in their interviews. The qualitative thematic analysis was able to achieve this by presenting how frequent themes throughout the interviewees' distinctive interview transcripts led to

finding the most effective breast surgery-induced keloid treatment. The qualitative thematic analysis was divided into two portions. The first portion was detecting similar experiences among the interviewed women. These similar experiences determined the kinds of keloid treatments that women tended to use when treating their breast surgery-induced keloid. The overarching objective of this step was to identify the type of keloid treatment that was applied most often by women with breast surgery-induced keloids due to its benefits. Following this initiatory process of pinpointing common experiences, the second portion of the qualitative thematic analysis was next—the comparable experiences with treatments were analyzed for how they could be the most effective treatments for breast surgery-induced keloids. At this point in the research, the common experiences were separated into groups. Each group was then classified with a comprehensive theme, which was incorporated in the analysis of which keloid treatment is the most effective for breast surgery-induced keloids. Therefore, this research method was employed to recognize common themes throughout the experiences of women with breast surgery-induced keloids, which were analyzed to identify the most effective breast surgery-induced keloid treatment. Thematic analysis was the second phase of this case study as it was the most fitting method to analyze the information introduced in the semi-structured interviews. Considering this study’s goal was to discern what the most effective breast surgery-induced keloid treatment is, analyzing the common themes would signify the kinds of experiences with treatments that make one such treatment the most effective treatment. A thematic analysis does this by determining the prevalent themes within a sample size—therefore it was utilized for the research.

## Findings

The results from the semi-structured interviews were arranged into the table below.

Table 1  
*A Summary of the Nine Interviews*

Interviewee #	Keloid Treatments Used	Perceived Effectiveness
1	Vitamin E cream	No improvement
2	Silicone tape	No improvement
	Hemp cream	No improvement
3	Vitamin E oil	No improvement
	Massage	No improvement
4	Silicone tape	No improvement
5	Silicone tape	No improvement
	Massage	No improvement
	Vitamin E cream	No improvement
6	Massage	No improvement

Interviewee #	Keloid Treatments Used	Perceived Effectiveness
	Silicone tape	No improvement
7	Massage	No improvement
	Silicone tape	No improvement
	Cocoa butter	No improvement
	Coconut oil	No improvement
8	Silicone tape	No improvement
	Medical tape	No improvement
9	Physical therapy	No improvement
	Massage	No improvement

As stated before, nine women with breast surgery-induced keloids from North America were interviewed on their experiences with treating their breast surgery-induced keloid. Their names have not been included in this study, hence the first column simply designates a number for each interviewee. The distinct number for each interviewee presents that every row in the table depicts a single woman's interview and through connection, their experiences.

The second column consists of the keloid treatment/s used by each individual which came out in each interview. They were placed in the table because specific mention of the keloid treatments used is needed to discern which treatment is the most effective in treating breast surgery-induced keloids. Lastly, the third column in the table displays the perceived effectiveness of each keloid treatment based on the changes in height, width and color that each woman saw in their own breast surgery-induced keloid. The information in this column was critical in that it helped compare the perceived effectiveness of the different keloid treatments to each other.

Essentially, this table abridges the experiences of each woman interviewed into two particularly significant segments that help more concisely determine the perceived most effective treatment for breast surgery-induced keloids in North America. Through the table, it is attainable to find recurring themes within the data set, which can then, through qualitative thematic analysis, establish what the perceived most effective treatment for breast surgery-induced keloids is in North America.

## Results

The experiences compiled through the semi-structured interviews epitomized the types of keloid treatments being used by women with breast surgery-induced keloids in North America and the perceived effectiveness of those keloid treatments. These keloid treatments were sorted by theme, and then studied through a qualitative thematic analysis. This section will explain the results of the qualitative thematic analysis in conjunction with the answer to the research question that the data indicates. It is important to note that in regards to all nine interviews, collectively there was only one consistently recurring theme. This repeating theme highlighted the lack of effective current keloid treatments in North America for women with breast surgery-induced keloids.

For increased understandability, the results from the qualitative thematic analysis were further organized into the table below based on that one particular recurring theme.

**Table 2**  
*Recurring Theme in Non-Targeted Therapy*

<b>Type of Treatment</b>	<b>Treatments within Category</b>	<b>Perceived Effectiveness</b>
Tapes	<ul style="list-style-type: none"> <li>● Medical tape</li> <li>● Silicone tape</li> </ul>	<u>No improvement</u>
Creams/oils	<ul style="list-style-type: none"> <li>● Vitamin E cream/oil</li> <li>● Hemp cream</li> <li>● Cocoa butter</li> <li>● Coconut oil</li> </ul>	<u>No improvement</u>
Pressure therapy	<ul style="list-style-type: none"> <li>● Massage</li> <li>● Physical therapy</li> </ul>	<u>No improvement</u>

There was a total of eight different keloid treatments used among the nine women interviewed. Every keloid treatment that was used by an interviewee is a non-targeted therapy. In the first column, the treatments were separated into three different categories—tapes, creams/oils and pressure therapy—all under the same general keloid treatment category of non-targeted therapy. The second column identified which of the eight keloid treatments were in each category of non-targeted therapy. In the tapes group, there was one woman who used medical tape, and then seven out of the nine women used silicone tape, making it the most commonly used treatment among the nine women. Next, in the creams/oils group, vitamin E cream/oil was used by three women. Hemp cream, cocoa butter and coconut oil were each used by one woman respectively. The last category is pressure therapy, which includes massage used by four women and physical therapy used by one woman.

The third column displays the perceived effectiveness of each type of non-targeted therapy based on the interviewees' views of change in height, width and color of their keloid. There is emphasis on this column in the table in that the words in the column are underlined. Although it is clear that many different treatments were used among the subjects, the third column exhibits that each treatment produced the same result for the women—no improvement. Furthermore, all nine women said that the treatment they used for their breast surgery-induced keloid had no effect on the height, width or color of their keloid. In other words, all eight of the treatments were perceived to be ineffective in treating breast surgery-induced keloids.

## Discussion Of Results

Due to these results, this case study implies that the initial hypothesis was correct—no treatment in North America for breast surgery-induced keloids was perceived to be the most effective. This conclusion is clear through the new knowledge from the case study that all of the treatments used by the interviewees resulted in no improvement for the breast surgery-induced keloids that women across North America had. Moreover, the work of other researchers affirms this conclusion. For example, the study done by Coppola et al. in 2018 also found that there was “no universally effective therapy” for keloids.

## Limitations

Before discussing the implications and future directions of the study, it is important to acknowledge limitations which could have affected the strength of the data. First, the sample size was most likely the biggest limitation. The research was a case study, meaning only a small group of women with breast surgery-induced keloids were included to represent the entire population of women with breast surgery-induced keloids in North America. The whole population of North American women with breast surgery-induced keloids is a much greater number of women than the group of nine compiled in this study.

Secondly, the keloid treatment categories of targeted therapies and corticosteroids were unable to be covered in the data and results due to the interviewees' experiences. Although subjects were asked about the breast surgery-induced keloid treatments they were using in general with no reference to any specific type of treatment, the women talked exclusively of treatments that are non-targeted therapies. Therefore, only results about the effectiveness of non-targeted therapies could be included to represent the effectiveness of keloid treatments in all three of the categories—non-targeted therapies, targeted therapies and corticosteroids.

The next limitation was that the scope for the research could not be narrowed down on a particular city, state, region or even country because not enough subjects could be found in any of those less populated areas. Initially, only possible subjects in the surrounding city and then the surrounding state were contacted, but only three subjects agreed to be interviewed in the span of three weeks, even though numerous other possible subjects had been found and contacted. Thus, the decision was made to expand the scope of the research to a national, plus Canada—therefore North American scope—so that five or more subjects could be ensured for the study.

Lastly, there was a limited amount of resources and time, which prevented this study from being an experimental study. Provided a treatment from each keloid treatment category and a longer amount of time than the two months AP Research students are allotted to complete their research, treatments from different categories could have been used on subjects with their permission for a set amount of time to determine more hands-on what the most effective treatment available in North America for breast surgery-induced keloids was. Instead, the results were based upon what each subject said was true of their experience. With more participants, all keloid treatment categories being covered, a more narrow scope and/or an experimental study, it is possible that there would be different results.

## Implications

Even with its limitations, the research has multiple implications for the field of keloid research. First of all, the research fills the gap of there being no breast surgery-induced keloid focused research in the entirety of the world of research based on the studies I had access to. The research shows that the treatment of breast surgery-induced keloids is an important, but often overlooked, issue that researchers and scientists need to put more time and effort into solving. The research helps verify that no keloid treatment is suited for individuals with breast surgery-induced keloids because no treatment has ever been researched for that specific purpose. With no most effective treatment available in North America for breast surgery-induced keloids, there is extensive room for improvement. Women who have undergone breast surgery have already endured a lot of life changes throughout the surgery and recovery, having no effective treatment for a keloid produced by the surgery is yet another thing forced upon their plate. Based on this study's findings, researchers and scientists should put more attention into research regarding this subject.

There are many paths that can be followed from here with future research. First, a possible future direction is that the experimental study mentioned previously could be pursued and executed. Subjects could try other keloid treatments with the purpose of finding out if there is an effective breast surgery-induced keloid treatment already in North America. Another possible future direction is creating a new treatment for breast surgery-induced keloids that addresses issues with treatments available currently, such as comfort, expense and sustainability, and is the most effective treatment possible. The new treatment would be specifically designed for breast surgery-induced keloids,



meaning the differences in breast tissue compared to other kinds of tissue would be considered when creating the new treatment. The last future direction would be talking to doctors about this study. Throughout the interviews for this research, women said that they wished their doctors would have talked to them more about the possibility of keloids developing after their surgery and the possible treatments for them if that did occur. Sharing that information with doctors throughout North America can help them in preparing and assisting their patients when the patients are susceptible to facing breast surgery-induced keloids.

## References

- Alster, T. S., & Tanzi, E. L. (2003). Hypertrophic scars and keloids: Etiology and management. *American Journal of Clinical Dermatology*, 4(4), 235-243. <https://doi.org/10.2165/00128071-200304040-00003>.
- Andrews, J. P., Marttala, J., Macarak, E., Rosenbloom, J., & Uitto, J. (2016). Keloids: The paradigm of skin fibrosis – pathomechanisms and treatment. *Matrix Biology*, 51, 37-46. <https://doi.org/10.1016/j.matbio.2016.01.013>.
- Becker, B., Dawson, P., Devine, K., Hannum, C., Hill, S., Leydens, J., Matuskevich, D., Traver, C., & Palmquist, M. (1994-2022). Case Studies. *The WAC Clearinghouse*. <https://wac.colostate.edu/resources/writing/guides/casestudies/>.
- Brigham and Women's Hospital. (2022). *Mastectomy and Double Mastectomy*. Brigham and Women's Hospital. Retrieved April 24, 2022, from <https://www.brighamandwomens.org/surgery/surgical-oncology/resources/mastectomy>.
- Devalia, H., Mansfield, L., Minakaran, N., & Banerjee, D. (2008, February 24). A case of unilateral keloid after bilateral breast reduction. *International Seminars in Surgical Oncology*, 5, 3. <https://doi.org/10.1186/1477-7800-5-3>.
- Garg, G. A., Sao, P. P., & Khopkar, U. S. (2011, January-April). Effect of carbon dioxide laser ablation followed by intralesional steroids on keloids. *Journal of Cutaneous and Aesthetic Surgery*, 4(1), 2-6. <https://dx.doi.org/10.4103%2F0974-2077.79176>.
- Grouls, A., Jalali, O., Kim, S. J., Nwogu-Onyemkpa, E. N., Orengo, I. F., Ren, V. Z., Rosen, T., Shimizu, I., Wasko, C. A., Wolf, J., Diwan, A. H., & Huttenbach, Y. T. (2021). *Laser Treatment with Pulsed Dye Laser | Baylor Medicine*. Baylor College of Medicine. Retrieved April 24, 2022, from <https://www.bcm.edu/healthcare/specialties/dermatology/laser-surgery/laser-treatment-with-pulsed-dye-laser>.
- Lochmiller, C. R. (2021, June 22). Conducting Thematic Analysis with Qualitative Data. *The Qualitative Report*, 26(6), 2029-2044. <https://doi.org/10.46743/2160-3715/2021.5008>.
- Mathers, N., Fox, N., & Hunn, A. (1998). Trent Focus for Research and Development in Primary Health Care: Using Interviews in a Research Project. *Trent Focus*. <http://web.simmons.edu/~tang2/courses/CUAcourses/lsc745/sp06/Interviews.pdf>.
- Meenakshi, J., Jayaraman, V., Ramakrishnan, K.M., & Babu, M. (2005). Keloids and hypertrophic scars: A review. *Indian Journal of Plastic Surgery*, 38(2), 175-179.

<https://search.ebscohost.com/login.aspx?direct=true&db=aqh&AN=20510675&site=ehost-live>.

Memariani, H., Memariani, M., Moravvej, H., & Shahidi-Dadras, M. (2021). Emerging and novel therapies for keloids. *Sultan Qaboos University Medical Journal*, 21(1), 22-33.  
<https://doi.org/10.18295/squmj.2021.21.01.004>.

Morelli Coppola, M., Salzillo, R., Segreto, F., & Persichetti, P. (2018, July 24). Triamcinolone acetonide intralesional injection for the treatment of keloid scars: patient selection and perspectives. *Clinical, Cosmetic and Investigational Dermatology*, 11, 387-396. <https://doi.org/10.2147/CCID.S133672>.

Ogawa, R., Tosa, M., Dohi, T., Akaishi, S., & Kuribayashi, S. (2019). Surgical excision and postoperative radiotherapy for keloids. *Scars, Burns & Healing*. <https://doi.org/10.1177/2059513119891113>.

Puri, N., & Talwar, A. (2009). The efficacy of silicone gel for the treatment of hypertrophic scars and keloids. *Journal of Cutaneous and Aesthetic Surgery*, 2(2), 104-106. <https://doi.org/10.4103/0974-2077.58527>.

Saleem, L., & John, J. R. (2013, May-Aug). Unfavourable results following reduction mammoplasty. *Indian Journal of Plastic Surgery*, 46(2), 401-407.  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3901921/>.

Scrimali, L., Lomeo, G., Nolfo, C., Pompili, G., Tamburino, S., Catalani, A., Siragò, P., & Perrotta, R. E. (2010). Treatment of hypertrophic scars and keloids with a fractional CO2 laser: A personal experience. *Journal of Cosmetic & Laser Therapy*, 12(5), 218-221. <https://doi.org/10.3109/14764172.2010.514924>.

The Institutional Review Board for the Human Research Protection Program at Oregon State University. (2010, September 14). *Snowball Sampling*. Oregon State University. Retrieved March 28, 2022, from <https://research.oregonstate.edu/irb/policies-and-guidance-investigators/guidance/snowball-sampling>.

Vivante, H., Salgueiro, M.J., Ughetti, R., Nicolini, J., & Zubillaga, M. (2007). 32P-patch contact brachyradiotherapy in the management of recalcitrant keloids and hypertrophic scars. *Indian Journal of Dermatology, Venereology & Leprology*, 73(5), 336-339.  
<https://search.ebscohost.com/login.aspx?direct=true&db=aqh&AN=27023951&site=ehost-live>.