



Minimally Invasive Techniques for Facial Rejuvenation Utilizing Polydioxanone Threads

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KEYWORDS

• Polydioxanone • Neocollagenesis • Thread-lifting • Complications • Barbed • Vector • Candidates

KEY POINTS

- Thread lifts offer a less invasive alternative to surgical lifts with fewer postoperative complications.
- Threads can be used to stimulate collagen production in the dermis/subdermis to give patients' skin a more rejuvenated appearance.
- Thread lifts are not suitable for all patients, and thus providers must ensure that they selectively offer these treatments to only ideal candidates with realistic expectations.

INTRODUCTION

Facial rejuvenation treatments countering the effects of aging have continued to gain popularity over the past few decades. More providers across multiple specialties are now offering treatments to improve skin elasticity, promote collagen production, contour facial structures, and increase skin volume. Although rhytidectomy is considered by surgeons to offer the greatest benefit for lifting tissues, it may also have significant complications, longer recovery times, and scarring in the subdermis and around the ears and submentum.¹ Thus, for patients who are more risk averse or do not want to go through the recovery or expense of surgery, thread-lifting treatments offer a minimally invasive procedure that may yield similar results with fewer complications and shorter recovery time.²

Thread lifting as a nonsurgical cosmetic procedure was first introduced by Sulamanidze and colleagues in 1990 to contour sagging facial tissue.³ Since then, threading has advanced to treat fine

wrinkles, skin laxity, nasolabial folds, crow's feet, smoker's lines, jawline structure, marionette lines, tear trough regions, and submental fullness.⁴ Polydioxanone (PDO) threads have two main mechanisms of action: either to lift desired facial anatomy for structural changes or to promote collagen and myofibroblast stimulation improving overall skin texture and health. These procedures are also commonly used in conjunction with complementary treatments such as dermal fillers, neuromodulators, and autologous blood platelet therapy such as platelet-rich plasma or platelet-rich fibrin. Thread-lifting has become a highly sought-out procedure and an effective, but temporary, alternative to surgical options.^{5,6}

TYPES OF THREADS

Threads can be classified based on their direction, shape, absorbability, and chemical makeup. Threads can be unidirectional, bidirectional, or multidirectional, which describes the orientation of barbed projections on the threads. "Barbed"

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threads are suspension threads that engage the surrounding ptotic tissue and reposition superficial fat for accurate lifting. Bidirectional barbed threads do not require knots and have more consistent wound opposition compared with unidirectional threads. Sutures with knots have a higher risk of skin aggravation and scarring. Thus, bidirectional barbed threads may decrease the chances of these complications.⁷ Most barbed threads have barbs on four to six sides of the threads, which increases the engagement of the threads to the tissue and provides a more reliable facial lift.³ Barbed threads are usually inserted using a blunt cannula tip due to the lower risk of bruising, puncturing blood vessels, and injuring nerves.³ “Molded barbed” threads are similar to barbed threads except they provide more stability and less slippage from the tissue. However, they are limited in that they are more difficult to remove whether there are any complications and thus are not used as regularly as their barbed counterparts. Monofilament threads are “smooth threads” that do not have any barbs. They are best used for thin and crepey skin such as the neck, jawline, periocular region, and perioral region. These threads should be placed in the subdermis and not intradermally as they can cause an inflammatory response. “Twist” threads are oriented in a spiral around the needle applicator to promote neocollagenesis of thin and crepey skin. These threads, when placed near the vermilion border of the upper lip, stimulate collagen production and can provide a subtle lip enhancement (**Fig. 1**).⁹

Threads can also be categorized by being either nonabsorbable or absorbable. Nonabsorbable threads are not metabolized by the body and may need to be removed. Sulamanidze and colleagues originally used nonabsorbable barbed polypropylene antiptosis sutures (APTOSs) for nonsurgical facelifts.¹⁰ However, these sutures had a high risk of complications such as scarring, nerve damage, and foreign body sensation.^{11,12} Thus, thread-lifting treatments fell out of favor and resulted in a bad reputation across many specialties.¹³

However, in 2011, the development of absorbable threads gained popularity initially in Asia and Europe. These sutures have decreased risk of scarring and provide a more natural esthetic look, leading to higher patient satisfaction. The first absorbable threads used were polydioxanone (PDO) threads. PDO threads are monofilament threads that can be modified using laser technology to create unidirectional or bidirectional barbs.^{5,14} These threads have high tensile strength, low tissue reactivity, high flexibility, and high durability.⁹ Patients have reported sustained

results between 6 and 18 months post-treatment. Poly-L-lactic acid (PLLA) threads are similar to PDO threads as they are absorbable threads, but they are more expensive and are more complicated to place. These threads, however, have sustained results between 12 and 18 months. The most recent absorbable threads approved by the Food and Drug Administration (FDA) are the polycaprolactone (PCL) threads. These threads are designed for smaller facial lifts and have results that can last up to 18 months.

ANATOMY

The skin is composed of three layers. The epidermis is the most superficial layer and is the main region for skin hydration. The next layer, the dermis, is the location of collagen and elastin, produced by fibroblasts. Collagen and elastin provide strength and elasticity for the skin, which leads to more skin tightness and less wrinkles. The deepest layer, the subcutaneous layer, provides insulation and is highly vascularized.

Threads are typically placed in the superficial subcutaneous planes. Monofilament threads are typically placed closer to the dermis, whereas barbed or suspension threads are placed more in the superficial subcutaneous plane. Anchoring suspension threads may be anchored on the deep temporal fascia (DTF).⁹

Absorbable threads are metabolized by the body through hydrolysis over a period of around 3–12 months that result in myofibroblast production, fibroblast production, increased vascularization, tissue contraction, and neocollagenesis. Neocollagenesis is the process of collagen formation in the dermal layer of the skin and myofibroblasts help with wound healing and contraction.^{8,14,15}

THREAD PROCEDURES

Threads are mainly used as treatments for lifting the midface, lifting the lower third (jowls), brow lifting, neck rejuvenation, and collagen induction therapy. Barbed sutures are used during facial lifting procedures to engage the subdermal tissue and superficial fat pads while also repositioning them to the desired orientation. The barbs allow for better anchoring of the tissue compared with smooth threads. The barbed threads also induce fibrous tissue formation. Fibrous tissue helps keep the ptotic tissue in place after the skin has been lifted and thus sustains the facelift over longer periods. Histologic animal studies have demonstrated that the collagenesis and fibrous tissue formed by threads outlive the actual lifetime

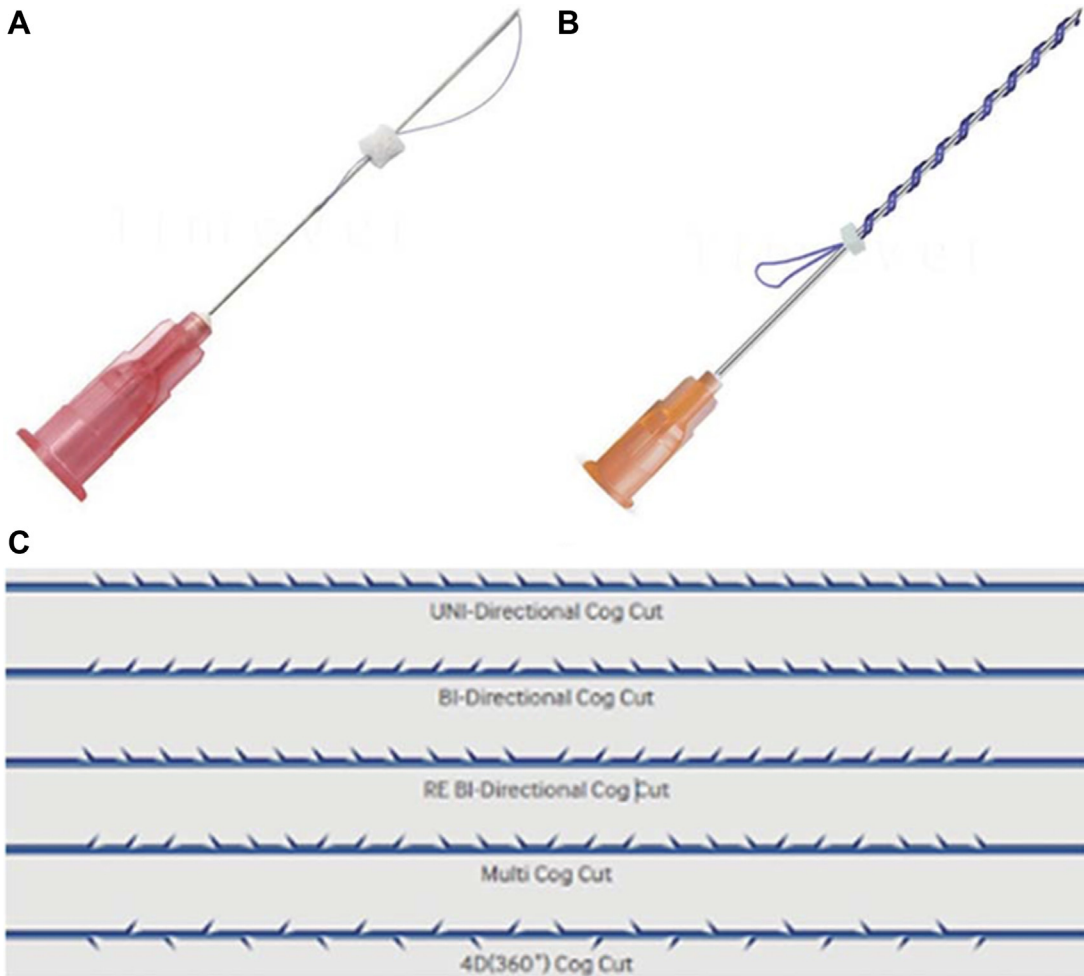


Fig. 1. Smooth thread (A) and Barbed thread (B). The barbs can be unidirectional, bidirectional, or multidirectional (C). Bidirectional barbed threads will change directions in the middle of the thread.³ (From Cobo R. Use of Polydioxanone Threads as an Alternative in Nonsurgical Procedures in Facial Rejuvenation. *Facial Plast Surg.* 2020 Aug;36(4):447-452. doi: <https://doi.org/10.1055/s-0040-1714266>. Epub 2020 Aug 31. PMID: 32866981. © Georg Thieme Verlag KG.)

of the threads.¹⁶ The sutures are placed along predetermined trajectories, or “vectors,” and then are pulled in opposite directions to lift the sagging tissue. The most sought-out areas treated are the midface, the neck, the brow area, and the lower third of the neck.

Threads also stimulate neocollagenesis as they are broken down by the body under the skin. The goal for patients is to create a more rejuvenated and youthful appearance for patients. Histologic reviews of the skin after PDO threading have shown evidence for collagen thickening with type one and type three collagen formation.³ Twist threads can be used as a hybrid treatment to provide both subtle lifting and stimulate neocollagenesis in areas such as the vermilion border.⁸

IDEAL CANDIDATES

Patient selection is crucial when determining ideal candidates for thread-lifting procedures as these procedures are not suitable for all people. It is important to stress to patients that thread lifting is only temporary and does not have as permanent or drastic effects as surgical intervention. Ideal candidates for facial thread lifts are between the ages of 30 and 50 with early signs of aging such as mild wrinkle formation, jowls, and decreased skin tightness. Ideal candidates also have thick skin, sufficient subcutaneous fat, strong bony projections, and flexible skin. Patients with too thin skin and insufficient subcutaneous fat increase the chances for postoperative complications and suboptimal results. Providers must also consider

their medical history. Patients with underlying infections, compromised immune systems, keloid formation, diabetes, obesity, etc., should not be considered for threading treatments. Finally, providers must choose candidates with reasonable and attainable expectations (Fig. 2).¹⁷

PREOPERATIVE PLANNING

Vector Planning

Vector planning is a useful tool to visualize planned treatments, make adjustments, and decrease mistakes. Although using a dermal marker, physicians will draw vectors from the insertion point to the end of the thread placement. Vector lines should be straight and can share the same insertion point but should not overlap.¹⁸ For the midface, the zygomatic arch is typically used as the anchor and insertion point. The vectors will then extend along toward the oral commissure. For the lower third of the face and neck and temple regions, insertion points are near local ligaments to provide further stability (Fig. 3).

Materials

These materials are needed for threading treatment (Fig. 4).

- Topical anesthetic cream
- Lidocaine HCL 1% with epinephrine 1:1,000,000
- 1% Plain lidocaine
- 8.4% Sodium bicarbonate
- Suture scissors
- Forceps
- 18G needles
- 27G needles
- DermaSculpt 22 gauge 2 ³/₄" microcannula
- 3-mL syringes
- Tegaderm transparent film dressing 4' x 4'
- Disposable Chux
- Alcohol
- Peroxide
- Hibiclens antiseptic antimicrobial skin cleanser
- Ice packs
- 4x4 gauze
- Ultrasound gel

Pretreatment

Patients are advised to stop blood thinners 7 days before treatments as blood thinners can cause excessive bleeding during procedures. Patients should also stop smoking 2 weeks before procedures and stop drinking 3 days before treatments as both tobacco and alcohol can interfere in the healing process. Finally, patients should be well

hydrated and have adequate sleep. Optionally, patients can take Arnica 2 days before treatments to help with any posttreatment edema and erythema.¹⁹

Photos and Consents

Photographs are important before and after treatments so patients can better visualize lifts of their facial structures and facial rejuvenation.²⁰ Pre-photo morphing using photo editing software is advised to give realistic expectations to the patient and to further plan out the procedure. Photos should be taken at multiple angles including the frontal view, bilateral profiles, and bilateral oblique positions. Two frontal photos should be taken with and without the patient smiling. Ensure that the patient is leveled with their head straight and any excess hair pushed behind their ears. It is important to make sure that there are not any unwanted shadows on the patient's face to avoid unrealistic perceptions in the photos. Thus, adequate lighting and camera angles are essential to consider. Providers must also replicate these photos postoperatively for accurate comparisons.

Consent forms must be signed after thoroughly explaining expectations, risks, recovery, procedure techniques, and complications. Patients must understand that although thread lifting can provide similar results to surgical interventions, these procedures are temporary and routine follow-up procedures are needed for long-term effects. Consent forms should also indicate that there are no guarantees for the treatment, and the sutures may need to be removed.

OPERATIVE TECHNIQUES

Lifting

Once the patient has their planned vectors drawn on their face, consent forms signed, and photographs taken, the procedure can begin. The patient will be prepared by cleansing and sterilizing their face. The patient is then numbed with lidocaine HCL 1% with epinephrine 1:1,000,000 at each planned insertion point and allowed 10 minutes for the numbing to take effect. Although using a long 22 gauge 2 ³/₄ inch cannula inserted in the superficial subcutaneous plane along each vector, the face is further numbed with 2.5 mL of 1% plain lidocaine and 0.5 mL of sodium bicarbonate, 8.4%. The barbed threads are then fed into each cannula from the proximal to the distal end away from the insertion point (Fig. 5). Once the threads are placed along the vectors, the cannulas are slowly removed, thus engaging the tissue and lifting the sagging structures. It is during this part of the process that most of the



IDEAL CANDIDATE

- (1) Sufficient Skin Thickness and Subcutaneous Fat
- (2) Strong Bony Projections
- (3) Skin of Sufficient Pliability and Mobility

Fig. 2. Characteristics of an ideal candidate for threading treatments. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)

irregularities such as skin dimpling can occur. However, the provider will also use their other hand to gently massage the face in the direction of the lift and aid in redraping the tissue in the correct position. Alternatively, if using an applicator instead of cannulas, the provider will also twist the end of the applicator handle to engage the tissue. After the threads have been placed and the cannula or applicator removed, the physician will

gently pull on the thread to make sure it is securely engaged. The thread will simply be pulled out if it is not. If the thread is pulled out, then the process is repeated with a new thread. Once the threads are securely engaged, the threads are cut making sure no threads are visible above the skin as the patient relaxes their face. More advanced techniques described recently will tie a knot between two threads, have the knot buried, and have the proximal segment of the thread rethreaded superolaterally and anchored on the DTF overlying the temporalis muscle. Finally, the face is massaged once more from the distal to the proximal end to ensure that the barbs are engaged and flat. This procedure takes between 30 and 60 minutes.²¹

Fig. 6 shows a pre- and post-thread result.



Fig. 3. Example of preoperative vector planning for thread lifting. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)

MESH Procedure

Mesh procedures involve using smooth sutures to create a matrix in hollow parts of the face that will stimulate neocollagenesis and myofibroblast production. The mesh procedure is very similar to the lifting technique; however, the cannulas or applicators will remain in the skin throughout the procedure to determine where the threads have already been placed (**Fig. 7**). Once the matrix is created, the cannulas or applicators are then removed. In this technique, the face is not massaged in a certain direction since no lifting is occurring. The body then breaks down these threads stimulating collagen and myofibroblast production. Typically, six to nine threads are used for each jawline, five to ten threads for the

| Location | Pilot Needs (Barbs) | Size of Cannula (Barbs) | Barb Size | Pilot Needle Size (Molded) | Size of Cannula (Molded) |
|-----------|---------------------|-------------------------|-----------|----------------------------|--------------------------|
| Lower 1/3 | 18G or 20G | 18G or 21G x 90mm | 4 | 18G | 18G x 90mm |
| Midface | 18G or 20G | 18G or 21G x 90mm | 4 | 18G | 18G x 90mm |
| Brows | 20G | 21G x 60mm | 4 | 18G | 18G x 90mm |
| Neck | 20G | 21G x 90mm | 4 | 18G | 18G x 90mm |

Fig. 4. Diagram showing the proper materials needed for different parts of the face for thread lifting.⁸ (Data from Karimi K, Chester CF, Reivitis A, Zhang E, Hunter A. Microcannula utilization for the injection of filler: standard of care? *The American Journal of Cosmetic Surgery* 2018; 35(4): 189-197.)

jowl, and three to five threads for each temporal region.³ Skin rejuvenation is usually first noted about 2 weeks after the procedure.⁹

POSTOPERATIVE CARE

Patients are advised to follow up 2 to 3 weeks after treatments. This allows enough time for postoperative edema and erythema to subside. In this interval, patients can apply cold compresses to the treated areas for 10 minutes every hour. The compresses will help reduce the expected swelling. Patients should also sleep elevated for the first 3 to 5 days and avoid exercise for a week. For pain, patients should take Arnica for 5 days postoperatively and take acetaminophen or ibuprofen as needed.¹⁹ Providers must stress to avoid any excessive facial expressions the week after treatment to prevent any displacement of the threads. Also, patients should avoid any facial massages or dental work for 1 month.²² For general hygiene, patients are advised to wash their faces in the direction of the threads. Thus, it is important to review the procedure postoperatively and demonstrate proper cleaning techniques. Patients can return for their next thread appointment after a minimum of 6 months. However, the threads have lasted up to a year for many patients. If patients

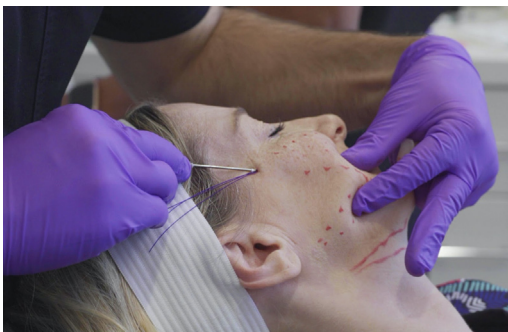


Fig. 5. Thread insertion on upper one-third of face. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)

are not satisfied and the provider deems “touch ups” are appropriate, then a thread treatment may be considered 3 months later. The provider may encounter fibrosis if placing additional threads where threads were placed previously. For patients considering rhytidectomy after placement of threads, it is recommended the patient delay surgical intervention for 6 to 12 months to allow for the reversal of the microfibrils created by the threads.⁹

COMPLICATIONS

PDO threads may incur postprocedure complications that usually resolve with time but can still cause some concerns for patients. Thus, it is important to review all complications before treatments and before signing consent forms.

Common Postprocedural Complaints

Most patients after treatments should expect edema and swelling. The body's immune system naturally responded to wounds and punctures with inflammation. This usually subsides about 1 to 2 weeks after treatments.²³ Also, swelling occurs from the injected anesthesia fluid that the body will then break down. To help with the swelling, patients should ice the treatment areas three to four times per day. They can also take Arnica as a safe homeopathic method to reduce swelling post-treatment.¹⁹

Patients can also experience bleeding during and after treatments. To control the bleeding, blot and apply pressure using a sterile gauze to the area.²⁴ Excessive bleeding can occur but is rare. Thus, providers must have appropriate equipment and protocols ready if the bleeding is not easily controlled. Limiting blood thinner intake a week prior will not only limit the risk of excessive bleeding but will also limit the risk of unwanted errors during the procedure.⁹

Pain is common during and after treatments as well. Although patients are numbed with topical and injected anesthetics, patients can still



Fig. 6. Before and 7 months after thread lifting procedure. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)

experience mild discomfort to sharp but short nerve pains. Patients can ice or take over-the-counter pain medications until symptoms resolve. In most cases, prescribed narcotics are not needed nor are recommended. In rare cases, the threads can be placed too deeply causing muscle pains for many weeks.

Patients may also experience bruising near the proximal insertion points. It is less common for patients to have bruising near the distal ends of the threads. Bruising will usually resolve by itself but can be aided with the use of icing and taking Arnica.

Finally, facial tenderness in the treatment areas is normal and common. However, patients should still avoid any excessive facial expressions 1 week

after treatments as they could compromise the positioning of the threads.

Complications

Threads can incite a foreign body response by the immune system if placed too superficially. Instead of breaking down the threads to stimulate neocollagenesis, the immune system within the dermis may instead try and push the threads out through the skin. This can cause an inflammatory event or visualization of the sutures through the skin. In the occurrence of this response, the threads must be removed and antibiotics may be prescribed to avoid possible infections.²⁵

Threads may also be placed too superficially, which will cause a visual projection of the thread. These threads must be removed and replaced (**Fig. 8**).

The threads can create visual bumps on the patient's face that may be painful and aesthetically displeasing to the patient. The patient can perform gentle upward massages to resolve these bumps, but in more severe cases the threads must be removed.^{6,11}

There are cases where the threads cause facial asymmetry, typically due to one or more threads not having gripped the tissue fully. In these cases, additional threads may also be placed to attain the desired look. Most faces, however, are not naturally symmetric. Thus, minor asymmetry may be expected, and attempts at fixing it could cause



Fig. 7. Cannula matrix set up before thread insertion for collagen stimulation. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)

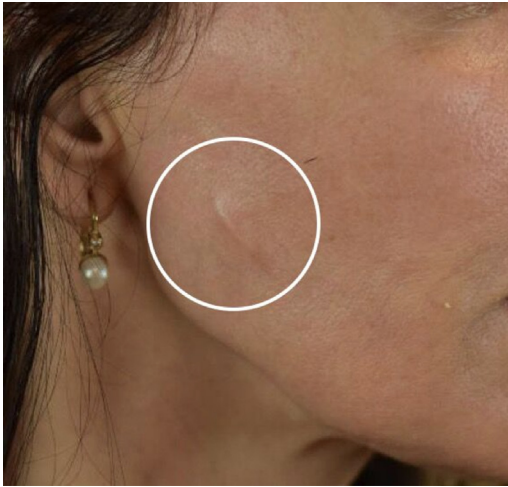


Fig. 8. Thread visualization through the skin. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)

further unwanted asymmetry.^{14,25} Therefore, it is important to compare preoperative and postoperative photos to make an informed decision with patients to proceed with correcting any asymmetry.

Threads can also break and rip when under too much tension. If the desired lift is then lost due to this breakage, the physician may add another thread as a replacement. Otherwise, thread

breakage does not pose as a major complication. The thread will still be broken down and stimulate neocollagenesis.¹

COMPLEMENTARY PROCEDURES

Thread-lifting treatments can provide more natural rejuvenation than other modalities as they reposition ptotic tissues into a more youthful position. However, when paired with complementary treatments such as dermal fillers or neuromodulators, thread-lifting treatments are enhanced and patients are more satisfied.²⁶

Thread lifting and dermal fillers are a perfect complement—threads lift ptotic tissues and fillers replace lost volume. Anecdotally, one of the authors (Dr. Kian Karimi) has found that when threads are used to lift the midface and lower third, the volume of dermal fillers typically required to achieve the desired outcome is cut in half. Thread-lifting treatments and dermal fillers are safe to use during the same appointment. However, the fillers should be used after threads have been placed to properly visualize the loss of volume and to prevent any interference with the engagement of the threads.²⁷ After dermal fillers and thread lifting treatments are finished, patients can also have neuromodulators injected to address any unwanted wrinkles.²⁸ These treatments are safe but must not be injected into the exact same place where the threads were placed to avoid interfering with the engagement of the threads (Figs. 9–16).



Fig. 9. Before and after left lateral view of a patient with threads and dermal fillers. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)



Fig. 10. Before and after frontal view of a patient with threads and dermal fillers. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)



Fig. 11. Frontal view of NovaThreads Barb-5 with Infinity Plus and 1.0 mL of Restylane Contour to the Chin. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)



Fig. 12. Frontal view of NovaThreads Barb-5 with Infinity Plus and 1.0 mL of Restylane Contour to the Chin. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)



Fig. 13. Right oblique view of NovaThreads Barb-5 with Infinity Plus and 1.0 mL of Restylane Contour to the Chin. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)



Fig. 14. Left oblique view of NovaThreads Barb-5 with Infinity Plus and 1.0 mL of Restylane Contour to the Chin. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)



Fig. 15. Left profile view of NovaThreads Barb-5 with Infinity Plus and 1.0 mL of Restylane Contour to the Chin. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)



Fig. 16. Left profile view of NovaThreads Barb-5 with Infinity Plus and 1.0 mL of Restylane Contour to the Chin. (Courtesy of Dr. Kian Karimi Rejuva Medical Aesthetics, Los Angeles.)

SUMMARY

The application of threads has evolved in the cosmetic realm of medicine and is a new tool in the esthetic armamentarium. Threads have become an important method to provide more natural-looking rejuvenation without the added potential complications of surgical intervention. However, threads are still limited in that only a select type of patient can actually have realistic benefits. Thread-lifts will continue to advance to provide a method for patients to achieve minimally invasive, safe, and effective ways to achieve natural facial rejuvenation.

CLINICS CARE POINTS

- Thread-lifting has become a highly sought-out procedure and an effective, but temporary, alternative to surgical options.
- Threads are used as treatments for lifting the midface, lifting the lower third (jowls), brow lifting, neck rejuvenation, and collagen induction therapy.
- Ideal candidates for facial thread lifts are between the ages of 30 and 50 with early signs of aging such as mild wrinkle formation, jowls, and decreased skin tightness.

DISCLOSURE

The authors have nothing to disclose.

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