



“ Minimally invasive procedures to reverse the signs of ageing are gradually emerging as an alternative for patients to reconstructive surgery as they do not require an extended recovery period, yet retain high-satisfactory results, and decreased morbidity. ”

THE ART OF THREADS

A COMPREHENSIVE REVIEW

Dr. Christeen Youssef provides a comprehensive review of the use of threads in aesthetic medicine, including types, techniques and areas of the face that can be treated

ABSTRACT

Demand for minimally-invasive methods for the improvement of age-related soft tissue changes to the face and body are gradually increasing. Thread lifting is a cosmetic procedure that lifts and realigns sagging tissue to enhance the facial contour, tighten the tissue and volumize the area

of application. These threads are classified according to their absorbability, form (barbed or non-barbed) and length (long or short). The mechanical action produced by the threads gives an immediate lifting effect, which contrast the falling of the area treated. The type, form, length of thread, the technique used during the procedure

and practitioners knowledge are key factors for optimum facial rejuvenation results. Minimally invasive procedure such as thread lifting has been proven to be effective for lifting and long term facial rejuvenation and could be a great alternative for surgical procedures

AGEING IS A COMPLEX BIOLOGICAL process; it provokes many structural changes, particularly to the face, which are usually influenced by gravity, bone resorption, and soft tissue atrophy including the displacement of fat along with facial skin changes. However, thanks to practitioners understanding these factors, along with our in-depth knowledge on the mechanism of ageing, new techniques to reverse the signs of ageing have been developed.

Surgical procedures have long been considered the gold standard for facial rejuvenation; however, surgical procedures are associated with possible complications, such as infection, hematomas, skin necrosis, seromas and injury to the frontal and marginal branches of the facial nerve¹. Minimally invasive procedures to reverse the signs of ageing are gradually emerging as an alternative for patients to reconstructive surgery as they do not require an extended recovery period, yet retain high-satisfactory results, and decreased morbidity.

Thread lifting, also called a 'lunchtime facelift', was pioneered by Sulamanidze and colleagues in the early 1990s and gained popularity among dermatologist, plastic surgeons, and other cosmetic surgery practitioners due to its short downtime and immediate potential aesthetic improvement². This procedure lifts the skin and can also be

complementary to injectable fillers for its volumising effect, energy-based procedures for skin tightening, and muscle relaxation by neuromodulators. In addition, it counteracts the force of gravity and chronological signs of ageing while avoiding large incisions.

Over the years, as thread lifting techniques have become more in demand, the discovery of suture materials have also progressed with the addition of barbs and cones to non-absorbable suture materials³. Recently, the use of absorbable sutures has been the material of choice since it also offers excellent benefits. Aside from being degradable to human biological processes, it is also safer compared to permanent threads due to its minimal complications⁴.

This study consists of a literature review of thread lifting in regards to its types, forms, and techniques to be applied during the procedure together with an in-depth pre-treatment assessment to ensure a successful and promising result.

Method

The search was carried out through systematic review from PUBMED database for studies to retrieve the literature using the following keywords: Thread lifting, absorbable threads, non-absorbable threads, thread lifting technique, the efficacy of thread lifting and thread lifting for facial rejuvenation. All articles have been evaluated, and those >



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STORY

KEYWORDS

Sutures, Absorbable,
non-absorbable, threads

▷ studies which are not relevant to the topic have been removed. Full-text articles were summarized to come up with this topic review.

Result

The mechanism of thread lifting

Thread lifting involves the use of a suture made from a material usually used to close wounds. This material, when inserted under the skin, can tighten and lift the loose or saggy areas in various parts of the face and body while adding definition, particularly on facial contours⁶. There exist two mechanisms underlying the effect of thread lifting. The first mechanism exhibits a purely mechanical lifting. This involves the distribution of the gravity load to the surrounding areas via the thread. The second mechanism takes place after the placement of the threads subcutaneously, which initiates a foreign body reaction in the form of lymphocyte infiltration, collagen deposition and fibrosis. Fibrotic tissue and capsule formation play an important role in the ability of the suture material to lift tissue and hold, remodel and support to maintain an elevated position to prevent future ptosis. The effect of repositioned ptotic tissue, neovascularization and neocollagenesis in thread lifting influences the skin texture, structure, tone and contour^{4,7}.

The variety of sutures and techniques that are currently available reflects the origins of thread lifting. A promising outcome of a thread lifting procedure depends on the proper selection of the type of thread according to its mode of absorption, form, and length.

Type of threads according to the mode of absorption

Thread materials used for a lifting procedure are available in absorbable and non-absorbable forms. Absorbable thread material is gradually broken down over time by various processes such as hydrolysis and proteolytic enzymatic degradation and are absorbed by the body.

Commercially, the most common type of bio-absorbable thread material is primarily composed of polydioxanone, poly-lactic acid, or poly-caprolactone. A polydioxanone (PDO) thread is the most popular suture material used for thread lifts in recent years. It is made up of colourless, crystalline, bio-absorbable synthetic polymers that were developed specifically as a wound closure material. This material is fully absorbed within the body through hydrolysis in approximately 6 months and are the site for

only a minimum foreign body tissue reaction in the vicinity of the implant⁴ and are less likely to harbour bacteria due to its monofilament nature. PDO has low tissue reactivity and prolonged tensile strength, which made it garner preference over others in the use of thread lifting. However, PDO threads retain their shape for 12 weeks and become fragmented after 24 weeks and fully dissolved in 48 weeks according to the study performed by Sulamanidze GM⁸.

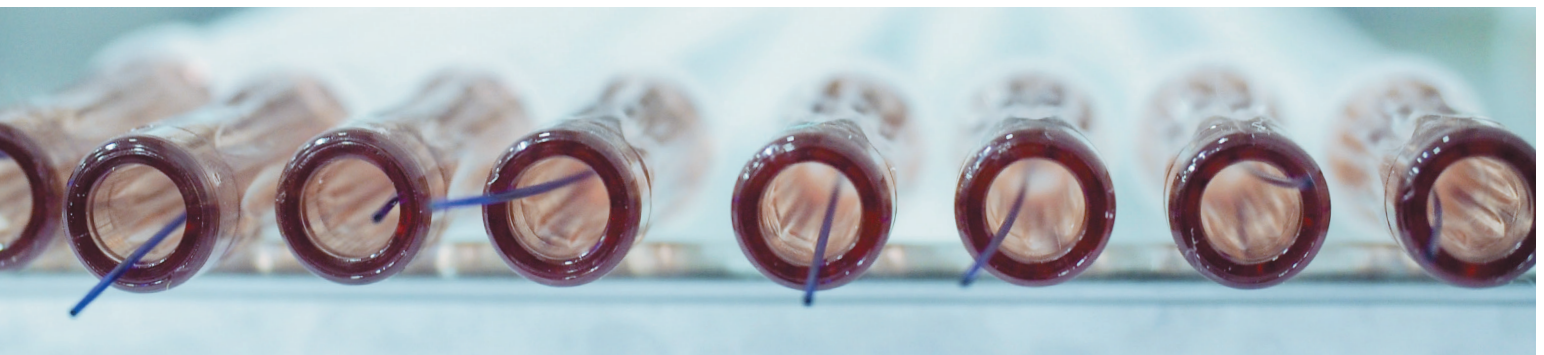
Poly-lactic acid (PLA) is a biocompatible polymer derived from lactic acid that has been used in many applications, such as orthopaedic pins and sutures. PLA is another popular dermal filler material and induces a bio-stimulatory effect via a capsule formation orchestrating macrophages, fibroblasts, and collagen. The degradation time of PLA into water and carbon dioxide ranges from 9 to 30 months, which is longer than the 6-month duration reported for PDO. PLA threads can be fully absorbed by the body in approximately 2 years.

Poly-caprolactone is the newest type of bio-absorbable monofilament suspension thread of synthetic origin. Polycaprolactone breaks down within the body through hydrolysis as with PDO threads and may last for 1.5 to 2 years⁹. According to Wong et al., it regenerates collagen over a longer time than PDO and PLA threads.

Histologically, all implanted biomaterials aggravate the recruitment and combination of macrophages and the development of giant cells that are dominant early responders to biomaterial implantation. These cells bind themselves to the biomaterial surface and promote fibrosis that results in the development of a fibrotic capsule around it. Implanted biomaterials regardless of their composition, induce a cellular and tissue response whereby the type of response depends on the nature of biomaterial implanted⁹. The cutaneous fibrotic reaction that appears along the length of an absorbable thread remains constant even when the material is fully absorbed by the body.

In a histological study by Lee et.al⁹, all three types of bio-absorbable threads have been implanted into rat skin to evaluate the histological changes that occur into the implanted bio-absorbable material. Collagen, being the most abundant protein produced in humans, is a fundamental contiguous formation of the interstitium in the skin. There are 28 different types of collagen⁹ and a higher proportion of collagen type 1 and 3 can be found in human skin compared to other collagen types. Type 1 collagen accounts for approximately 80% and type 3 collagen for approximately 10% of the adult human ▷

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▷ dermis. Type 3 collagen is the primary component of the granulation tissue and is rich in embryonic tissue. It also plays an important role in fibrillogenesis. These two types of collagen act together to form broad extracellular fibres that confer the tensile strength of the human dermis⁵. Chang et al., found in their study that PDO, PLLA and PCL predominantly induced type 3 collagen in rats in contrast to the study by Wong et al., in which PDO and PLA threads only induced type 1 collagen while PCL induces both type 1 and type 3 collagen. The fibrous sheaths surrounding each thread type contained relatively similar amounts of collagen. The volume of collagen formation, regardless of the type, depends on the surface area of the thread implanted.

According to a study performed by Yoon et al., PDO threads demonstrate a collagen-producing effect for more than 48 weeks provided that the procedure is performed for the purpose of collagen production. In a study from Kulkarni⁶, subcutaneous implantation of PLLA has demonstrated a very mild inflammatory response with evidence of a foreign body reaction in the first week, fibroplastic activity and proliferation by week 2 and growth of tissue fibres by week 4 with no further inflammatory reaction. Cutright reported in his study that the degradation of PLLA suture is gradual and is attended by a giant cell reaction and the size of the suture gradually increases as a result of an inflammatory reaction as well as the infiltration of tissue between the strands⁷.

Absorbable threads, whether they are PDO, PLLA or PCL have their own unique functions when it comes to lifting. PDO threads are better at repositioning and revitalizing tissue but not for providing lift so may be better suited for younger patients. PLLA threads are also applicable for rejuvenation and for patients requiring a small amount of tissue lift. PCL threads can be used to both rejuvenation and for tissue that requires a moderate lift⁴.

Non-absorbable threads are a type of thread that is relatively unaffected by the biologic activities of the body tissue and is therefore permanent unless removed. The *in vivo* tissue response around a non-absorbable material involves fibroblasts that encapsulate the suture by fibrous capsule formation. Adjacent macrophages and foreign body giant cells respond in a process known as frustrated phagocytosis, where they attempt to degrade the non-degradable suture⁸. Its main advantage over absorbable threads is their long-lasting effect; however, it is associated with complications⁵.

Another factor that can influence the efficacy of a thread lifting procedure is by its form of thread used, which can be either barbed or non-barbed.

Threads with tiny hook-like projections cut into their long axes are referred to as barbed sutures. This form of thread is produced by cutting or moulding in accordance with the direction of pull. Its function is to grasp tissue, distribute tensile strength along the length of the suture and elevate or compress and counteract skin laxity along a specific trajectory to address ptosis⁹. Barbed or cogs do not



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require suspension to produce a lifting effect since they are self-supporting and can also greatly minimise the stress relaxation and cheese wiring associated with 2-point fixation.

Barbed threads can be also classified according to the orientation of the barbs, which includes unidirectional, bidirectional or multi-directional barbed threads. Unidirectional barbed threads are characterised by a single line of unidirectional thorns. The cogged side is introduced into the tissue that requires elevation, creating a lifting effect perpendicular to the long axes of the sutures and allows fibrosis to occur within the tissues, which, in turn, provide pull that limits the detachment of the skin tissue. It is designed to anchor from a higher fixation point, such as the temporal fascia. Bidirectional threads elevate soft tissue and anchor them to the stable temporalis or mastoid fascia. Bidirectional barbed threads were originally developed by Marlen Sulamanidze in Russia and named the APTOS (anti-ptosis) thread. This type of orientation has no anchoring points due to its two-way direction of barbs at the suture midpoint and has a needle on each end. It is inserted within a hollow needle and placed in a manner that it cannot move in either way^{18,19}. Another type of orientation is multi-directional barbed threads that fix and support the skin in various directions to achieve the lifting effect in the tissue and new collagen generation.

Non-barbed threads can be either monofilament plain, monofilament screw or spiral. These types of threads are free from cogs or barbs and are implanted 'free-floating'. The use of non-barbed thread may cut through tissue at the point of maximal tension unless placed among deeper, tougher tissue, such as the SMAS, and anchored at a stable structure, such as the periosteum. This procedure induces temporary oedema that has a bio-stimulatory effect²⁰. Non-barbed or unidirectional threads, since they are both anchored in a stable structure, allow for an easier post-operative correction if there is an asymmetry of the face from the thread insertions⁷. The immediate lifting result of these threads was similar to results seen after an acupoint therapy where multiple injections stimulate a variety of acupoint points, thereby improving the blood flow, lymph improvement and adjustment of strained muscles²⁰.

Length of threads

The thread lifting technique adopted by the practitioner also depends on the length of threads to be used in specific areas of the face and body. Short sutures are a type of thread shorter than 90mm in length. While long suture techniques use a thread longer than 90mm⁶. Appropriate thread length was selected depending on the length of the insertion area¹.

Principles of thread lifting

Facial ageing is a result that correlates to a three-dimensional process with anatomic, biochemical and genetic factors; as a result, alteration in the position of the soft tissue and overlying muscles causes the appearance ▷

▷ of ageing. Thorough knowledge of the facial anatomy, especially the SMAS, superficial and deep fascias, and compartments of the face, as well as the nerves, is required for a successful thread lifting treatment.

There are several natural ageing changes to examine before considering a facial rejuvenation procedure. The first includes the gradual ptosis of the cheek skin below the inferior orbital rim with descent of the lax lower eyelid skin. This creates a skeletonized appearance with hollowness around the infraorbital area, descent of the malar fat pads with the loss of malar prominence in projection, a prominence and deepening of the tear trough area, and lastly a marked enhancement of the nasolabial fold. These areas are the hallmark of the so called 'triangle of youth'²⁰.

Optimum lifting through thread lifting can be achieved through understanding and appreciation of the vectors, which improves the outcomes by repositioning ptotic soft tissue into a vertical direction¹.

Facial rejuvenation using threads is based on two general concepts according to Tavares et al.¹; first is the subcutaneous suspension using SMAS as the fixation basis with tissue elevation using the posterolateral vectors, and the second is the fixation based on the subperiosteal detachment and en bloc repositioning of all structures using purely vertical vectors.

Technique, application and procedure

To best counteract facial ageing, proper planning of vector positions should be made during the assessment. These vectors must be placed perpendicular to the plane the practitioner intends to elevate. These vectors are determined based on the desired movement of the tissues and how much it can be mobilised during the assessment and are always placed endoscopically in a superior-lateral direction.

Thread implantation is a sterile procedure; therefore, the treatment areas must be carefully prepped and draped in a sterile fashion. The number of threads used is dictated by the degree and distribution of lift required. Each suture is marked with one entry point and two exit points according to the vectors chosen. A combination of 1-2% lidocaine mixed with 1:200,000 epinephrine for analgesia and hemostasis is injected into the skin and the subcutaneous layer at entry and exit sites 1 hour before the implantation. Typically, this mixture is applicable for cogged or barbed threads or any threads longer than 90mm. 7-15% lidocaine creams can be used for superficial plain threads⁶. A local anaesthetic is not required for needle pathways as it may cause tissue distortion.

The surgeon creates a hole in the skin to the subcutaneous tissue in a perpendicular fashion past the deep aspect of the dermis. This is achieved using an 18G needle that serves as an entry point for the suture for lifting. Threads are then placed perpendicular to the skin and advanced at about 5mm. At this point, the needle is redirected in the subcutaneous plane and advanced in the pre-determined vector. The length of each vector



depends on how much pull is required for the soft tissue to be lifted²⁶. Once the suture is placed, a minimum amount of tension can be applied to the superior suture with a thumb or finger gently over the surface of the suture without advancing the tissue²¹. Suspension techniques either lift the SMAS or rearrange facial structures at the supraperiosteal level²².

Incisions to be made, however small and wherever the place of insertion in the face, should be made in a location where they can be hidden to minimize unwanted and visible scars.

Thread lifting treatment Selection of the right candidate

Patient selection is paramount to any cosmetic procedure since it is the basis for determining operative success. Patients who are suitable for thread lifting should have mild skin laxity, mild fat pad prolapse and superficial rhytids. Usually, women between 35-45 years old who begun to see more prominence of the jaw, relaxed mid-facial appearance or slight bags under the eyes or on the neck. Patients with advanced facial lipoatrophy, excessive skin laxity that requires removal of the skin as well as muscular prolapse and including those patients who request immediate results are not suitable for thread lifting. Patients with low body fat percentage have more favourable outcomes, while obese patients tend to have less than favourable results which can be explained by complex fat distribution in the face and fat density that these patients have². The practitioner must assess the patient and understand the primary concern of the patient before selecting the appropriate technique and suture type to use²¹.



“It is also important to place the thread at the correct depth as incorrect placement may either cause skin rippling or dimpling.”

Application

As mentioned earlier, the thread lifting insertion technique can be distinguished through the length of the thread to be used, i.e., whether it is a long suture or short suture. In general, permanent threads are approved for the correction of facial and cervical ptosis while absorbable threads are only approved for soft tissue procedures as well as suturing incisions.

Short sutures, usually consisting of plain or screw polydioxanone threads, use the 'free-floating' method for implantation. The number of threads required to be inserted in a patient depends on the severity of skin laxity or the adipose tissue present. Needles can be inserted into the dermis plane for skin tightening and rejuvenation while minimising the excess adipose tissue can be achieved by inserting the needle deeper into the subcutaneous plane⁶.

Long sutures are usually barbed, including bi-directional and unidirectional threads. Since unidirectional threads have an anchoring point, the technique applied is often the fixed method. In contrast, for bi-directional threads, the 'free-floating' method is used because of a lack of anchoring points. The incision point for the fixed method should be located at the deep temporal fascia or periosteum to customize the anchoring point⁶.

It is also important to place the thread at the correct depth as incorrect placement may either cause skin rippling or dimpling².

Approaches for different locations

Brow Lift

A brow lift aims to provide a pleasing arch to the brow with the highest point in the line vertically with the lateral

limbus or just lateral to this. The proposed path of the suture is marked on the skin from the scalp behind the hairline to the lateral third of the brow^{6,23}.

Upper face

Suture lifting of the temporal area is an important rejuvenation procedure for the upper face and acts by lifting the tail of the eyebrow, the lateral canthus and the upper cheek. Elevation of tissue by 2-3mm in the periorbital area provides a noticeable improvement²³.

Midface

The main task in lifting the midface area is to create a high contour to the bucco-zygomatic region by elevating the soft tissue ptosis that is situated between the nasolabial fold and lachrymal groove. Placing threads within the subcutaneous fat in the form of steep arches followed by pulling the ends to straighten the suture and accordingly pushing together the soft tissue along the length of the thread towards the middle. The middle portion of the thread passes relatively deep, catching the SMAS from the depth toward the surface with its elevated fatty tissue²⁴.

Lower face

A lower facelift improves the definition of the jawline and enhances the shape of the face. In lifting the mental regions, threads should be implanted parallel to the mandibular edge with a slight arch-like sagging within the area of the hanging lip. The depth of implantation varies on the skin and fat thickness, along with the degree of involution alterations²⁴.

Neck

Placement of threads in the neck is very distinct from a midface lift as neck anatomy is more complex as it also includes platysma and other neck muscles and resident vasculature. The practitioner should be aware and must distinguish the difference between excess tissue due to excess fat, excess laxity and skin descent. Vectors of the neck are more horizontal than those placed in the midface. Vectors must be placed in a straight line at a 90 degrees angle to the medial border of the platysma muscle, defined by the extent of neck redundancy²².

Discussion

The ultimate goal of facial rejuvenation is to address the needs of the patients who seek a more enhanced and youthful appearance safely and efficiently to achieve a long-lasting result. With the advancement of these techniques and the demand for a rapid recovery, minimally invasive procedure, such as thread lifting have gained in popularity.

Since the introduction of thread lifting procedures in lifting the soft tissue of the face and shifting volume without making any incisions have been in demand, several evolutions of pattern, method and material have been developed to provide a better result.

Ideally, adhesion to adjacent tissues is a result of the homogenous fibrous capsule that forms around the threads under the skin 4 weeks after the implantation. ▷

▷ The dermal papillae will demonstrate a greater thickness that indicates interstitial collagen growth.

Permanent sutures used for thread lifting have a number of drawbacks due to the high complication and revision rates reported. Most of the reported cases experience infection, migration, severe pain, skin dimpling and foreign body reactions. Alongside the complications recorded for permanent sutures, additional concern

involves the difficulty of removal, which often leaves residual fragments that continue to be symptomatic²⁵. Recently, the used of absorbable threads in thread lifting procedures have regained market demand. A variety of studies have been reported that these type of materials demonstrate a

positive outcome and rare to no complication and faster healing. Histological studies also demonstrated that these materials-PDO, PLLA, and PCL-exhibit collagen formation type 1 and type 3 that gives the skin a more moisturised, revitalised, and firm result.

A quick non-surgical procedure, such as thread lifting, regardless of the technique to be applied should consider the fact that deeper tissue, such as the subcutaneous SMAS and subperiosteal, must be repositioned before the skin is pulled or resected.

As the thread lifting procedure for facial rejuvenation continues to improve, new techniques and materials are also being developed that can be effective to each appropriate patient. These materials will likely lead to additional improvements in efficacy. Since a surgical procedure is still the most effective choice of treatment in



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addressing facial ageing, the risk of complications is still the reason why many individuals shift to minimally invasive procedures²⁵.

Non-absorbable materials, on the other hand, despite promising results, practitioners must still take caution since previously marketed product shared from several studies have experienced unsuccessful outcomes. Thread lifting using absorbable materials should be considered a reasonable alternative to face lifting in the appropriately selected patients since these materials are able to achieve excellent results with a low record of morbidity and rapid recovery and downtime.

Conclusion

A thread lifting procedure using absorbable materials has proven to be effective for lifting, long term facial rejuvenation, and could be a great alternative for invasive procedures. Different threads and specific techniques differ per case. The type, form, length and composition of threads together with an in-depth assessment should be considered necessary before conducting any thread lifting procedure. A successful outcome of the treatment is also based on how good the patient selection is, excellent pre and post-operative care and on how knowledgeable a practitioner is when it comes to the underlying anatomical and biological changes of the face.

► **Declaration of interest** None

Key points

- 1 Skin ageing is a multifactorial and inevitable process that enables the development of new techniques, such as minimally invasive procedures to reverse any signs of ageing with low downtime and significant improvement
- 2 Thread lifting procedure involve the implantation of biocompatible and absorbable threads that have the ability to recontour the face through biological processes and mechanical lifting of the skin
- 3 Proper planning of the vector placement is important to best counteract the signs of ageing
- 4 Treatment using threads can be effective in appropriately selected patient, types and forms of suture material, and based on the practitioners' knowledge

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