

A novel technique for repositioning facial soft tissues with barbed polydioxanone threads based on the main aging vector force of rejuvenation

Abstract

Background: With the evolution of facial rejuvenation procedures, thread lifts have gained space among western patients who seek cosmetic improvement without undergo to surgeries. Absorbable wedge-shaped polydioxanone (PDO) sutures are currently available, and in mid-lower face and mandibular jowl lift, threads are most often implanted in a diagonal vector force – from medial-inferior up to lateral-superior site, near the temple. Herein, the authors introduce a new technique based on this oblique sum of anti-aging vector force to reposition and anchorage facial soft tissues, aimed for natural youth rejuvenation.

Objective: Describe a novel technique for counteracting the facial ptosis and laxity skin, as well as the duration of clinical lifting result and of skin quality improvement.

Methods: More than 84 patients were underwent in this thread technique once. The outcomes were assessed objectively using serial photography and subjectively based on the patients' spontaneous satisfaction through over these 4 years. Complications were also reported.

Results: Most patients considered the results satisfactory. The incidence of complications was low, and most of them were minor and temporary.

Conclusion: Wedge-shaped PDO thread repositioning and anchorage soft tissue is safe and effective method for rejuvenation.

Keywords: nonsurgical lift, threads, rejuvenation, youth face, facial anti-aging vector force

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Introduction

From birth throughout life, the aging process keeps going unabated. The face has all structures affected: skin, fat compartments, muscles, retaining ligaments and skeleton.¹ In addition, age might change not only the skin quality and quantity (hydration, wrinkles, sagginess), but also reduce the skin collagen synthesis.¹ It may also compromise the deeper facial layers. The volume loss of deep and superficial fat pads leads to skin laxity, prominent nasal labial and labial mental folds, jowls formation and the descent of the periorbital site.^{1,2} Also, facial bone aging changes and, consequently it compromises the position and the stability of ligaments that bend along each of their courses, affecting the subcutaneous compartments and the adhesions up to the skin.³

Furthermore, by the Newton's parallelogram or triangular rules,⁴ the main aging facial vector force has to be found. Gravity and the descent facial soft tissues - skin, retaining ligaments, fat compartments, loose muscles and facial fascias - play a role sliding onto the deep facial structures medially and downwards. If every action is accompanied by a reaction of an equal magnitude but opposite direction, the main anti-aging vector force (AAVF) plays an upward and lateral vector counteraction, repositioning all the drop of the superficial mobile layers.⁵ (Figure 1, Figure 2).

We propose a novel conceptual absorbable barbed polydioxanone (PDO) thread application based on these vectorial forces rules and the connection between the soft tissues to the depth. With all subjects in an upright position - not to alter the gravity vector force - four crucial

pulling points were pinpointed over the lower face. And, by making a slight finger test onto the skin, the major AAVF could be found, which not only might guide and lead to a better natural and physiological nonsurgical beauty rejuvenation, but also can soften the jowls and both folds – nasolabial e labiomental ones.

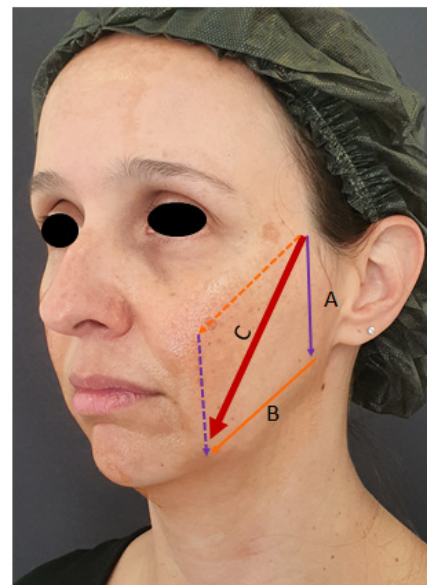


Figure 1 Triangular rule or the parallelogram rule: A) Gravity force vector; B) Flattened retained ligaments and fat pads force vector; C) The sum facial age force vector.

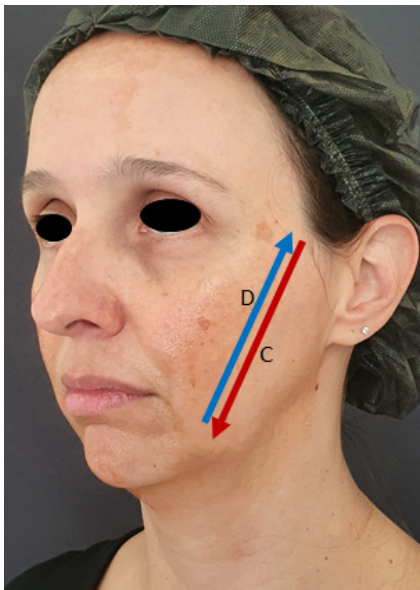


Figure 2 By Newton's third law, vector D is equal vector C in force and magnitude, but in the opposite direction. Vector D may guide non-surgical procedures.

For that, some important anatomy concepts have to be known: midface has two different SMAS areas that histologically show fibrous septa, which in turn, build fat compartments. In the preparotidial site, connections of fibrous septa between the skin and the mimic muscles were showed. And, in the parotidial one, there is parallel alignment of the fibrous septa, anchoring the skin to the parotid fascia.⁶

Furthermore, the retaining ligaments of the cheek must be kept in mind at all times: the zygomatic ligament and the mandibular ligaments tether the facial bone up to the skin. The platysma auricular ligament and the anterior platysma cutaneous ligament are condensations of platysma fascia that extend up to the dermis. And in the anterior border of the masseter muscle there is a vertical septum that links the masseteric fascia to the overlying muscular aponeurotic system (SMAS).⁷ The SMAS superficial facial fascia is dense and wraps the platysma muscle within the cheek. Thus, in some locations the superficial and deep facial fascias are toughly adherent to each other: through the anterior border of the masseter muscle and overlying the parotid gland.⁸ In addition, there is a line of ligaments that separates the mobile (anterior) face from the relatively fixed (posterior) face.⁹ Other ligaments are the temporal ligamentous adhesion (TLA), lateral orbital thickening (LOT) both considered triangular fibrous condensations,¹⁰ zygomatic, masseteric and mandibular ligaments.⁹ (Figure 3)

The facial ligament supports, tethers and keeps skin and SMAS stabilized and settled to the bone and together - with the retinacula cutis - and it might create adhesion sites to divide the face into superficial and deep fat pads.^{9,11} The zones between the ligaments are potential spaces and compartments which facial movements can be made.^{9,12,13} At the same time, there is growing evidence that skin aging is not only and solely connected with its structure modification, but also it's significantly depending on the properties of the underlying subcutaneous white adipose tissue.¹⁴

Most of the alterations might happen into the finer superficial retinacula cutis branches - from the SMAS through the subcutaneous fat layer up to the dermis -, which lose strength over the years because

of repetitive movements.^{9,15} Facial ligaments are fully involved with both fat compartments and mimetic muscles giving that fascia an ongoing extension. Superficial fat layers tend to move and are subject to both the resting and dynamic strains of the mimetic muscles.⁹ Mimetic muscles are one of those responsible for changing the facial volume and contour by inserting themselves into the dermis and thereby playing a role in both the suspension and structural integrity of the soft tissue envelope.^{9,16,17}

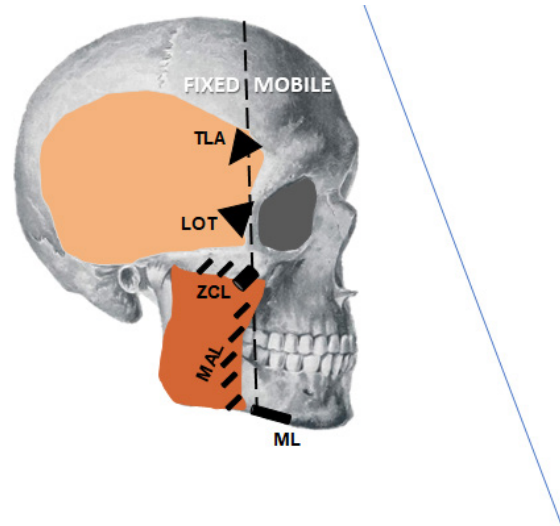


Figure 3 A vertical line of retaining ligament. From the top of skull down to the mandible/mandibular bone, the ligaments are: temporal ligamentous adhesion (TLA), lateral orbital thickening (LOT), zygomatic cutaneous ligament (ZCL), masseteric ligaments (MaL) and mandibular ligaments (ML).

Material and methods

Based on anatomy and the main mid-inferior facial aging vector force (AVF) in every patient, this new technique is being conducted at LCMA Dermatology Clinic, São Paulo/Brazil for four years (more than 84 cases). For these cases, at least 4 barbed threads (I-Thread, barbed PDO thread 19G/100mm/160mm, Hyundai Meditech Co./Korea) on each side, from middle to lower face are being suggested, in order to make the main physiological soft tissue suspension and anchorage.

The patient must be outlined in the upright position:

- I. A line (#) from the lateral epicanthus of the eye to the hair implantation is draw.
- II. With a strong blink, the orbicular *oculli* muscle could be clinically defined.
- III. A line (A) is outlined over the mandible body from the gonio down to the mandible ligament.
- IV. The labialmental fold down to the mandibular ligament was delineated by drawing another line (B), that clinically extends from the lip commissure down to line A following the labiomental fold. This endpoint was named Px.
- V. The Jowls (J) is clinically limited and outlined and point Y (Py) is found when the jowl's drawing is crossed posteriorly into line A.
- VI. P1 is found when a 2.0cm horizontal line is drawn from the lip commissure, and then, 0.5cm downwards.
- VII. Starting from Px, a line is drawn 1.0cm up and another one 1.0cm posterior through line A. Then, a square is closed and P2 is found at the end of the diagonal inside this square.

- VIII. P3 is the lowest point of the jowl (Pi) clinically demarcated and elevated over to line A.
- IX. P4 is found 1.0cm up from Py, which is the posterior intersection from the jowl clinically demarcated and line A.
- X. Making a finger test by slightly and gently pulling the skin with the thumb towards the ear helix, a diagonal vector force will be found and it will pull P1, P2, P3 and P4 with the least skin resistance.
- XI. Over the zygomatic arch - posterior from the orbicular *oculi* muscle, up to the superior limit of the zygomatic bone, under the line #, a point which is actually a narrow strip zone (Luciana Zone - LZ) is the easiest surface to move the skin and soft tissues to by traction. It is the thread entrance zone.
- XII. Between P2 and P3 a diagonal line was found towards LZ, defined by the finger test. This is the main diagonal AAVF, which goes from the inferiomedial up to superiorlateral, towards the ear helix top.
- XIII. After that, a 3mm distance line crossing the LZ is created over the zygomatic bone near the hair line, and two points of entrance (PE1 and PE2) to implant the barbed threads were outlined.
- XIV. Through each PE, 2 barbed threads were implanted down to P1 and P2 (PE1) and two more barbed threads down to P3 and P4 (PE2) through the superficial subcutaneous layer in order to grip and reposition the soft tissues.
- XV. After the threads implantation, 2 knots were tied between the two threads into both PE1 and PE2. (Figure 4 & Figure 5)

none of them asked for further sedation. It was considered a relatively fast procedure (around 50 minutes).

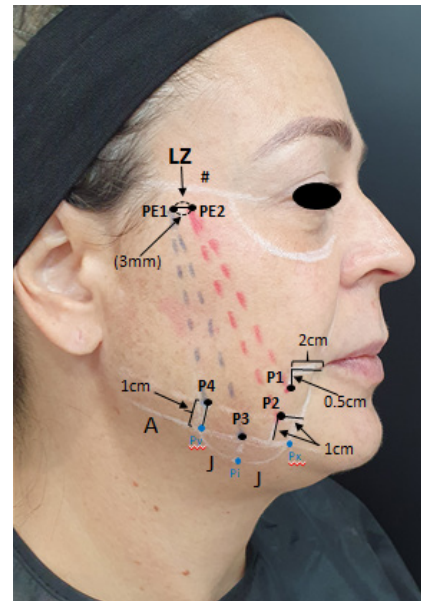


Figure 5 The draw measures (in cm) and positions of the barbed end points P1, P2, P3, P4.

A) Mandible body line. Pi is the lowest point of the jowl (J) clinically demarcated. P3 is the transposition of Pi into the line A.

LZ (Luciana-Zone) narrow strip zone was found by making the slightly finger test. PE1 and PE2 the entrance points of the barbed threads and were 3.0mm separated.

This technique can naturally smoothen the traits of age without losing the peculiarities of each and every patient by repositioning the soft tissues. It can also alleviate the jowls and both folds - nasolabial e labiomental ones. (Figure 6 & Figure 7)

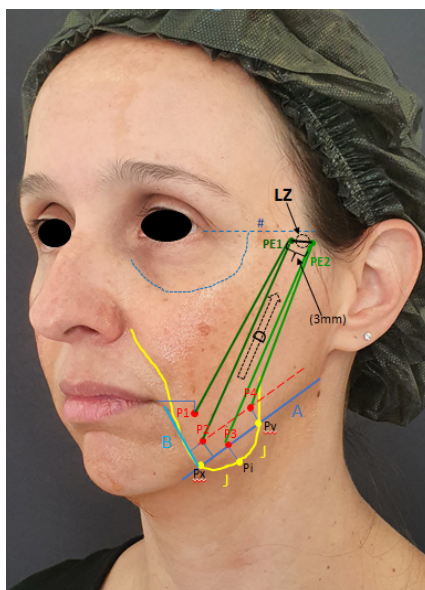


Figure 4 The draw marks. A) mandible body line; B) labialmental fold down to mandibular ligament; J) the jowl; Px and Py) jowl's draw points that cross the line A; Pi) The lowest point of the jowl; P1, P2, P3, P4) the main pulling points. P3 is the transposition of Pi into the line A. The main anti-aging force vector (D) that was found by making the slight finger test and looking for the easiest narrow zone (Luciana-Zone; LZ) to pull P1-P4 up; PE1 and PE2) the entrance points of the barbed threads. The distance between PE1 and PE2 is 3mm, to soften the inflammation (instead of only one entrance point).

Results

The procedure was well tolerated and caused minimal discomfort under topical and local intradermal anesthetics for most patients, and



Figure 6 The barbed threads implantation over de sum of anti-aging vector force.

Based on spontaneous reports, most patients could clinically notice a softer aging face right after the procedure and mainly around 3-4 months. They were very satisfied with the results and

all of them (100%) could feel skin quality improvement becoming gradually better, with the greatest firmness skin texture around 9-11 months. And, based on pre-treatment, and 3 and 5 month pictures, we can observe skin quality improvement and long lasting soft tissue repositioning results. (Figure 8 A, B, C & Figure 9 A, B, C).



Figure 7 Pulling the barbed threads to smoothen the jowls, the nasolabial and the labiomental folds.



Figure 8 A) Pré-TX **B)** 100 days post-TX **C)** 150 days post-TX.



Figure 9 A) Pré-TX **B)** 100 days post-TX **C)** 150 days post-TX.

On monthly follow-up visits some side effects were pointed out: mostly minimal bruises (and two large ones maybe owing to previous rhytidoplasty, which might have altered the anatomy), minor to moderate swelling and pain or sensitivity, some dimples and one foreign body granuloma due to an implantation of a hair along with the thread knot into the skin. Significant adverse events such as nerve or muscle damages, lip rhyme deviation or transfixation of the parotid duct were not observed.

Discussion

According to the Facial Laxity Rating Scale (Classes 1–9: mild, moderate, and severe laxity),¹⁸ we could observe at LCMA Dermatology Clinic that patients who were selected from class 1 up to class 5 for the treatment present better results, agreeing with another

study that confirms the thread procedure is indicated for those who are relatively young and have a modest degree of facial soft tissue laxity,¹⁹ and for patients who want to improve the jowls with up to moderate sagginess without plastic surgery.²⁰

We could soften the jowls and the nasolabial and labiomental folds pulling the mobile tissues within the main AAVF - a diagonal from medialinferior toward the temple area -, implanting only four barbed threads per hemiface (total of 8 threads) into the subcutaneous layer around the zygomatic bone area near the hair implantation line (LZ) - found by the slight finger test. An interesting article identified the angle of maximal rejuvenation during rhytidectomy saying it was more superior than posterior.²¹ In our methodology, we could reinforce it with the “finger test”, even though it was done with patients in the upright position. The most important limitation of this technique is that it is not indicated for moderate to severe facial soft tissue laxity. Skin quality is essential in order to grab the barbed threads and fix them into the subcutaneous layer so to obtain better and longer lasting results.

Conclusion

Furthermore, all patients who underwent this thread procedure, reported the improvement of skin quality (better texture, brightness and firmness). Some histological articles revealed that, upon collagen formation, the dermal collagen fibers thickened and the elastic punctiform fibers became longer, persisting for up to twelve months.^{22,23} And, some collagen fibers that grew around the thread started to connect and merge with the pre-existing fibrous connective tissue. Through this process, thick fibrous bridges are formed and link the dermis toward the fascia, enhancing the quality of the superficial connective area down to depth.²²

Side effects might occur in every cosmetic procedure. In our clinic, bruises, minimal swelling, minimal to moderate pain or sensitivity are common. It is sorted out with pain medication. Foreign body granuloma could be possible if a hair implantation happens along with the thread knots. It is resolved by incision and hair removal from the skin, and massage with corticosteroid cream. Dimples were adjusted with massage and, in the minority of cases, subcision with local anesthesia was needed. Significant adverse events were not observed due to the correct thread technique, which is into the superficial subcutaneous layer. In addition, any previous facial surgery or rhytidectomy must be informed prior to thread procedures, since the anatomy might be altered.

Although the mid-lower face improvement, for those with heavy face or significant jaw line, may require more threads or other skin techniques for better contour and results.¹⁹ From this point, not only it's demanded individualizing treatment depending on particular issues and needs, but also detailed anatomical understanding and attention to the degree of skin laxity.²¹

Nevertheless, each and every patient is unique, given the huge variability in facial physiognomy between genders and races as well as the differing ethnic ability to produce collagen and elastin. So that, there is no single diagram for occurrence and development of facial true retaining ligaments⁷ In addition, in the same ethnicity, there is variation in density, shape, and distribution of these retaining ligaments. Everyone has their own particular ligamentous anatomy and topography. Consequently, the onset and outcome of aging varies,⁷ high cheekbones are attractive and a beauty pattern for westerners, although not appreciated by the Asian culture.¹⁹ So, we must pay attention to all these issues. Overall, spontaneous data about the efficacy of AAVF wedge-shaped PDO thread implantation

for soft tissue suspension and repositioning was favorable, the clinic outcome satisfaction rate ranges around 6 months, and the skin quality improvement rate, around 12 months.

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None.

Conflicts of interest

Authors declare there is no conflict of interest.

References

1. Toledo Avelar LE, Cardoso MA, Santos Bordoni L, et al. Aging and Sexual Differences of the Human Skull. *Plast Reconstr Surg Glob Open*. 2017;5(4):e1297.
2. Farkas JP, Pessa JE, Hubbard B, et al. The Science and Theory behind Facial Aging. *Plast Reconstr Surg Glob Open*. 2013;1(1):e8–e15.
3. Cotofana S, Fratila AA, Schenck TL, et al. The Anatomy of the Aging Face: A Review. *Facial Plastic Surgery: FPS*. 2016;32(3):253–260.
4. Newton I, Chittenden NW. *Newton's principia: The mathematical principles of natural philosophy*. Geo P Putnam, 1850.
5. Cohen S, Artzi O, Mehrabi JN, et al. Vectorial facial sculpting: A novel sub-SMAS filler injection technique to reverse the impact of the attenuated retaining ligaments. *Journal of Cosmetic Dermatology*. 2020;19(8):1948–1954.
6. Sandulescu T, Buechner H, Rauscher D, et al. Histological, SEM and three-dimensional analysis of the midfacial SMAS - New morphological insights. *Annals of anatomy-Anatomischer Anzeiger : official organ of the Anatomische Gesellschaft*. 2019;222:70–78.
7. Furnas DW. The retaining ligaments of the cheek. *Plastic and Reconstructive Surgery*. 1989;83(1):11–16.
8. Stuzin JM, Baker TJ, Gordon HL. The relationship of the superficial and deep facial fascias: relevance to rhytidectomy and aging. *Plastic and Reconstructive Surgery*. 1992;89(3):441–451.
9. Alghoul M, Codner MA. Retaining ligaments of the face: review of anatomy and clinical applications. *Aesthetic Surgery Journal*. 2013;33(6):769–782.
10. Muzaffar AR, Mendelson BC, Adams WP. Surgical anatomy of the ligamentous attachments of the lower lid and lateral canthus. *Plastic and Reconstructive Surgery*. 2002;110(3):873–911.
11. Rohrich RJ, Pessa JE. The fat compartments of the face: anatomy and clinical implications for cosmetic surgery. *Plastic and Reconstructive Surgery*. 2007;119(7):2219–2227.
12. Warren RJ, Aston SJ, Mendelson BC. Face lift. *Plastic and Reconstructive Surgery*. 2011;128(6):747e–764e.
13. Mendelson BC, Freeman ME, Wu W, et al. Surgical anatomy of the lower face: the premasseter space, the jowl, and the labiomandibular fold. *Aesthetic Plastic Surgery*. 2008;32(2):185–195.
14. Kruglikov IL, Scherer PE. General theory of skin reinforcement. *PLoS One*. 2017;12(8):e0182865.
15. Wong CH, Mendelson B. Newer Understanding of Specific Anatomic Targets in the Aging Face as Applied to Injectables: Aging Changes in the Craniofacial Skeleton and Facial Ligaments. *Plastic and Reconstructive Surgery*. 2015;136(5 Suppl):44S–48S.
16. Coleman SR, Grover R. The anatomy of the aging face: volume loss and changes in 3-dimensional topography. *Aesthetic Surgery Journal*. 2006;26(1S):S4–S9.
17. Swift A, Liew S, Weinkle S, et al. The Facial Aging Process From the “Inside Out”. *Aesthetic Surgery Journal*. 2021;41(10):1107–1119.
18. Leal Silva HG. Facial Laxity Rating Scale Validation Study. *Dermatologic Surgery*. 2016;42(12):1370–1379.
19. Kang SH, Byun EJ, Kim HS. Vertical Lifting: A New Optimal Thread Lifting Technique for Asians. *Dermatologic Surgery*. 2017;43(10):1263–1270.
20. Karimi K, Reivitis A. Lifting the Lower Face with an Absorbable Polydioxanone (PDO) Thread. *Journal of Drugs in Dermatology*. 2017;16(9):932–934.
21. Jacono AA, Ransom ER. Patient-specific rhytidectomy: finding the angle of maximal rejuvenation. *Aesthetic Surgery Journal*. 2012;32(7):804–813.
22. Yoon JH, Kim SS, Oh SM, et al. Tissue changes over time after polydioxanone thread insertion: An animal study with pigs. *Journal of Cosmetic Dermatology*. 2019;18(3):885–891.
23. Amuso D, Amore R, Luigo Iorio E, et al. Histologic evaluation of a biorevitalisation treatment with PDO wires. *Aesthet Med*. 2015;1:111–117.

