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The Efficacy of the Absorbable Polydioxanone (PDO) Thread Lift in Lower Face (Marionette Line) Rejuvenation

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Authors' contributions

This work was carried out in collaboration among all authors. Author MWG designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors GFRH and WAM managed the analyses of the study. Author IHEM managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To evaluate the efficacy of PDO thread lifting in lower face (marionette line) rejuvenation.
Study Design: Quasi experimental study.
Place and Duration of Study: Dermatology and Venereology Department, Tanta University Hospital, between January 2018 and April 2019.
Methodology: The study included 10 patients asking for lower face rejuvenation who were treated by PDO absorbable threads (2 threads in each side of marionette line).
Results: The mean validated grading scale for marionette line score before treatment was of 3.30 ± 0.82 while the mean score immediately after treatment was 1.70 ± 0.82. There was statistically

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significant improvement according to validated grading scale of marionette line after compared to before. These results were preserved after 1, 3 and 6months.
Conclusion: PDO threads is a simple, rapid, immediately effective and office technique procedure.

Keywords: PDO; thread; marionette line; face rejuvenation.

1. INTRODUCTION

Aging is a natural process affecting all of our body internally and externally. Skin acts as a mirror for all changes occurring in our organs [1]. Many factors accelerate skin aging as ultraviolet radiation, smoking and pollution by causing damage of DNA, proteins and lipids through increasing the oxidation process, clinically manifested as wrinkles, skin thinning, skin sagging and altered facial contour [2].

Many traditional methods were innovated to improve the sagging face as fillers, neurotoxins, laser (ablative and non-ablative types) and surgical face lifting procedures. No single method can fulfill all the requirements for the correction of the aging face. A better understanding of the alterations leading to an aged appearance, allowed the development of new techniques to act with the specific anatomy of facial aging [3]. One of these techniques is thread lifting, using the first barbed sutures called APTOS (antiptosis suture) made of polypropylene. The first model was made with cogs and bidirectional barbs then modified to become Endo Progressive Facelift suture with unidirectional barbs followed by a mesh suspension thread [4].

The non-absorbable polypropylene threads have been used in many techniques but they showed many drawbacks as ecchymosis, erythema, visible threads and discomfort. To overcome these complications, the absorbable monofilament polydioxanone (PDO) threads were innovated. PDO threads are polymer, non-barbed, thin threads (0.07-0.15 mm) which could be unidirectional and /or bidirectional, they are more flexible than the polypropylene and with greater strength [3,4].

2. MATERIALS AND METHODS

2.1 Sample Size and Study Type and Duration

This study included 10 patients seeking for lower face rejuvenation attending to the outpatient clinic of Dermatology and Venereology Department,

2.1.1 Inclusion criteria

The study included patients needed lower face rejuvenation without using previous procedure and their ages ranged between 30-65 years old.

2.1.2 Exclusion criteria

The study excluded patients below 30 years or above 65 years, with previous lower face lifting, Patients who have any dermatological, systemic disease, bleeding tendencies or on anticoagulants. Also excluded patients using non-steroidal anti-inflammatory drugs, with tendency for keloid formation or pregnant and lactating females.

The study excluded patients with either disorders of lipid metabolism, severe chronic disease states, acute infection or organ failure, history of deep vein thrombosis or pulmonary embolus. HIV patients on current highly active antiretroviral therapy (HAART) were also excluded.

Patients with scars in lower face or thick skin type were also excluded.

2.1.3 The entire patients were subjected to

- Complete history taking: personal history (age, sex, marital status, occupation and special habits), history of sun exposure and use of sun screen, present history of any chronic disease, keloid formation or active infection, history of allergy from general anesthesia, family history, past history of any method of rejuvenation in the last six months.
- General examination to exclude patients with systemic diseases.
- Dermatological examination.
- Clinical assessment was performed by two dermatologists and the average was taken for each patient to evaluate the skin photo type according to Fitzpatrick classification, pigmentation and texture.
- Local examination of lower face to assess the patients pre-operatively according to a validated grading scale for marionette line. It is a 5-point scale, whose score varies

from 1, indicating a minimum wrinkle severity to 5, indicating a maximum severity, with 1 = absent, 2 = mild, 3 = moderate, 4 = severe, and 5 = very severe [5].

- All patients received complete explanation about the nature, risks and purpose of the study.
- A written consent was taken for their agreement.
- All the studied patients were instructed to avoid using any other cosmetic procedure during the whole duration and follow up period of the study.

2.2 Methods

2.2.1 The patients were subjected to

- Topical local anasethia cream applied one hour before the procedure.
- Disinfection of the area with betadine.
- Marking the treatment area before start.
- Local anasethia (2% lidocaine) injected subcutaneously into the insertion points with a 30-gauge hypodermic needle.
- A pilot hole was made with a 20-gauge hypodermic needle and 3.5-inch PDO threads were inserted into the pilot hole.
- Once the threads were inserted and engaged with surrounding tissue, the end of the thread, was trimmed and antibiotic ointment, was applied to the insertion points.
- The threads used were nontoxic, non-pyrogenic, heavy metal free polydioxanone suture (i-thread 4D cog) ,20EA, produced by IRIS medical supplies . The threads were 23 G sharp 90 mm 150 sculpt (mould type) approved by Korea Food and Drug Administration. For each patient two threads were applied in each side of lower face.
- The entry point was marked about 1 cm in front of tragus of the ear and the end point at the marionette line as shown in the picture. To protect the parotid gland we performed the pinch technique to reduce the pressure on soft tissues and passed the threads carefully through gentle operation.

Photo 1. Showing the external cover for threads to preserve them
Photo 2. Showing white marking on the face to know exactly where to insert threads
Photo 3. Showing the face after insertion of two PDO threads before trimming the ends

2.2.2 Post treatment care

- All patients were instructed to apply antibiotic ointment (mupirocin) immediately after the procedure.
- All patients were instructed to use analgesic only if they felt pain.
- All patients were instructed to sleep on their back not sides for at least one week to avoid damaging the cogs.
- Any possible complication was recorded at each visit.

2.2.3 Follow up

- All patients came to the follow up visits after one, three and six months.
- All photographs were taken by digital camera of Apple iPhone six s plus, 12 megapixels, made in china and the wrinkle scale was calculated.
- The photos were assessed by two dermatologists asked to record percentage of improvement for each patient after completion of technique at the final visit by comparing before and after photos.

(A) Global Aesthetic Improvement Scale (GAIS) as follows [6]:

0- **No improvement at all:** if improvement was 0%.
1- **Mild improvement:** 0-25 % improvement.
2- **Moderate improvement:** 26-50% improvement.
3- **Marked improvement:** 51-75% improvement.
4- **Excellent improvement:** 76-100 % improvement.

(B) Postoperative assessment according to a validated grading scale for marionette line: It is a 5-point scale, whose score varies from 1, indicating a minimum wrinkle severity to 5, indicating a maximum severity, with 1 = absent, 2 = mild, 3 = moderate, 4 = severe, and 5 = very severe [5].

(C) Evaluation of patient satisfaction: Each patient was asked at final visit about his/her satisfaction according to whether the patient was dissatisfied, slightly satisfied, satisfied or very satisfied.

(D) Evaluation of side effects: The patients were informed to report any complications as pain, dimpling, ecchymosis, allergic reaction or edema at the recipient site.

3. RESULTS AND DISCUSSION

3.1 Clinical Results

This study included ten female married patients. Their ages ranged from 35 to 60 years with a mean of (51.20 ± 6.76) years and median 52.50 (49.50 - 55.25) years. Regarding skin phototyping for patients according to Fitzpatrick classification [5], three patients (30%) were phototype II, five patients (50%) were phototype III and two patients (20%) were phototype IV. Regarding time needed to return back to work all patients (100%) returned to normal life the next day after the procedure. Regarding time of procedure, group (A) ranged from 15.0 – 20.0 min with a mean of 17.5 ± 2.64and median 17.5 (15.0 - 20.0).

According to the validated grading scale for marionette line that ranged from 1 to 5 (1 = absent, 2 = mild, 3 = moderate, 4 = severe, and 5 = very severe) [5], the average scale before the procedures was from 2 to 5 with a mean of 3.30 ± 0.82 and a median 3.50(2.75 – 4.0) while after treatment immediately, the validated scale range became 1 to 3 with a mean of 1.70 ± 0.82 and a median 1.50(3.0 – 4.0), There was a significant difference in the scale after the procedure than before [Table 1].

Regarding patients' satisfaction after treatment, in group (A), three patients (30%) were slightly satisfied, four patients (40%) were satisfied and three patients (30%) were very satisfied.

The global aesthetic improvement scale [6] according to two dermatologists' opinions it was ranged from 20-90% with a mean of 59.0 ± 24.92 and a median 57.50(40.0 – 82.50). Two patients (20%) had mild improvement, two patients (20%) had moderate improvement, three patients (30%) had marked improvement and three patients (30%) had excellent improvement [Table 2].

Regarding appearance of side effects, thread lifting was office technique with mild side effects which were tolerable by most patients. Minor side effects like dimpling in two patients disappeared within one week, ecchymosis in two patients disappeared after five to seven days and allergic reaction in one patient disappeared after four hours from the procedure as the patient received antihistaminic.

Table 1. Comparison according to marionette scale in patients before and after procedure

Marionette scale	Patients (n = 10)
Before	
Min. – Max.	2.0 – 4.0
Mean ± SD.	3.30 ± 0.82
Median (IQR)	3.50(2.75 – 4.0)
After	
Min. – Max.	1.0 – 3.0
Mean ± SD.	1.70 ± 0.82
Median (IQR)	1.50(3.0 – 4.0)
p_1	0.004*

*U: Mann Whitney test; p: p value for Wilcoxon signed ranks test for comparing before and after in the study; *: Statistically significant at p ≤ 0.05*

Table 2. The improvement according to global aesthetic improvement scale

Global aesthetic improvement scale	The patients (n = 10)	
	No.	%
Mild	2	20.0
Moderate	2	20.0
Marked	3	30.0
Excellent	3	30.0
Min. – Max.	20.0 – 90.0	
Mean ± SD.	59.0 ± 24.92	
Median (IQR)	57.50(40.0 – 82.50)	

Regarding follow-up: All the patients were followed up at 1, 3, 6 months after the procedure. After one and three months, all patients were reassessed according to marionette scale and it was found that all patients in both groups still preserved the same result. After six months, all the patients were reassessed according to the marionette scale. 7 patients (70%) still had the same result they got immediately after the procedure while 3 patients (30%) were lowered by a degree on the marionette scale [Table 3].

3.2 Discussion

Marionette lines are the lines that laterally circumscribe the chin which appear with advancing age. They tend to appear as the ligaments around the mouth and chin relax and begin to loosen, and fatty tissues of the cheek descend during the aging process [7].

The present study included ten patients, their ages ranged from 35 to 60years with a mean of 51.20 ±6.76 and median 52.50 (49.50 –55.25), while in Jung et al., [8] study on 48 patients using PDO threads divided into four groups in different parts of face. Marionette line group included 12 patients (all were women). Their mean age was 37.1 years (range: 31-49 years). By comparing his study to ours, it was found that people in our society usually seek aesthetic procedures later than other countries. Also, this pointed to the average age at which females in our society start to take real steps to ameliorate aging marks on their face was about fifties. This may be due to the financial factor.

In the current study, regarding time needed to return back to work, all patients (100%) returned to normal life the next day after the procedure. This showed that thread lifting is more suitable for patients who are not able to take long vacancies or sick leaves. This goes with Jung et al. [8] who reported that patients can return immediately after treatment with thread lifting.

This current study showed regarding patients satisfaction, three patients (30%) were slightly satisfied, four patients (40%) were satisfied and three patients (30%) were very satisfied. The global aesthetic improvement scale according to two dermatologists' opinions ranged from 20-90% with a mean of 59.0 ± 24.92 and a median 57.50(40.0 –82.50). Two patients (20%) had mild improvement, two patients (20%) had moderate improvement, three patients (30%) had marked improvement and three patients (30%) had excellent improvement.

Table 3. Follow up results after 1, 3, 6 months according to marionette scale

Follow up	The patients (n = 10)
After 1 month	
Min. – Max.	1.0 – 3.0
Mean ± SD.	1.70 ± 0.82
Median (IQR)	1.50(3.0 – 4.0)
After 3 months	
Min. – Max.	1.0 – 3.0
Mean ± SD.	1.70 ± 0.82
Median (IQR)	1.50(3.0 – 4.0)
After 6 months	
Min. – Max.	1.0 – 3.0
Mean ± SD.	2.30 ± 0.82
Median (IQR)	2.50(1.75 – 3.0)

Photo 4. Female patient aged 55 years old. Before treatment and after treatment with 2 PDO threads in each side of marionette line with marked to excellent improvement

To date, several studies have reported the efficacy of polydioxonone thread lifting for facial rejuvenation. Kang et al. [9] reported in his study on 39 korean patients of facial laxity treated with vertical thread lifting using short (6 cm in length), wedge-shaped PDO sutures that most patients (89.7%) considered the results satisfactory, among which, 10 (25.6%) patients considered the outcomes to be excellent, 20 patients (51.3%) considered the outcomes to be very good, and 5 patients (12.8%) considered the outcomes to be good.. Consensus ratings by 2 independent dermatologists showed that the objective outcomes at the 6-month follow-up were largely categorized as very much improved (10.3%), much improved (43.6%), and improved (33.3%). The present study agreed with Kang's study in using PDO sutures but we were different in using the long (15cm) type in oblique manner.

The current study was concomitant with both Kim et al. [10] who reported a significantly improved Wrinkle Severity Rating Scale (WSRS) after the procedure (PDO thread lifting).

This current study showed minimal self-limited side effects, five patients had mild side effects, two patients (20%) complained of dimpling which disappeared in a week in both patients, two patients (20%) complained of ecchymosis that disappeared after five to seven days and only one patient (10%) showed immediate allergic reaction to the material the threads made of that disappeared after four hours from the procedure as the patient received antihistaminic. No facial asymmetry, no malar eminence accentuation and no thread extrusion were reported in this study.

The incidence of complications in Kang's study was low, and the complications were minor. Dimpling was the most common side effect (2 patients, 5.1%), followed by bruise (1 patient, 2.6%). On the contrary of the current study, facial asymmetry (1 patient, 2.6%), thread extrusion (1 patient, 2.6%), and malar eminence accentuation (1 patient, 2.6%) were reported. Significant adverse events such as nerve damage or foreign body granuloma were not observed in their study [9].

Baek et al. study reported a few minor complications, and no significant problems were observed in their study. The complications encountered were pustule formation, pain, swelling, subjective discomfort of tightness, and skin dimpling. These side effects were usually self-limited [11]. This is concomitant with the current study as both of them showed minor complications.

Tang et al. [12] reported in his case study report using thread lifting technique with small incision rhytidectomy to treat facial aging. Ten days after the procedure, the patient complained of subcutaneous nodule with palpable knot at the left side which was treated by minimal invasive approach (under local anesthesia, small needle knife was inserted to break the fibrosis around the knot without cutting the thread). This nodule disappeared after one month.

This was not found in the present study as any invasive procedure that could induce fibrosis was avoided, the usual technique was used for introducing threads into the face and gentle pressure was done to pull and fix the thread into place.

El Maadawy et al. [13] conducted a clinical pilot study using thread lifting technique on 12 female patients with mild to moderate mid face laxity, reported that mild side effects encountered as pain in (100%) patients, slight ecchymosis in four patients (33.33%) and slight edema in 3 patients (25%) .All these complications considered mild as those occurred in the current study but in the current study none of the patients suffered from edema.

Several studies [9,10,11,12,13] proved the efficacy of thread lifting as simple effective procedure and this was also approved by the current study. On other hand, Rachel et al. [14] in her study on 28 women and one man, aged 32 to 68 (mean 54) over 17 months reported that the barbed suture lift had many adverse events and early recurrence and this was common in all technical variables regardless open or closed technique.

Gülbitti et al. [15] demonstrated that little or no evidence has been added to the peer-reviewed literature to support or sustain the promising statement about thread-lift sutures as made by Villa et al. in 2006 who reported that the technique was still in its infancy, but it is a promising one. On the contrary, the current study approved that thread lifting procedure is a simple effective and promising one.

The PDO threads are made of polydioxonone which is colourless bioabsorbable crystals. PDO threads have bioabsorption period of about 6 months. Thread lifting is reliant on two mechanisms: physical thread strength to lift and hold sagging tissues, and the biological processes to improve skin and soft tissue quality as a reaction to the threads [16,17].

PDO threads aim to promote targeted lipolysis of fatty areas and neocollagenesis in sagging skin, as well as lift the treated areas. Biological processes occur within 5 days of PDO threads insertion into subcutaneous tissues, including the presence of fibroblasts and macrophages. The presence of increased fibroblasts and macrophages may remain until the full absorption of the material. Histological studies have demonstrated the thicker dermal papillae following PDO thread insertion, suggesting interstitial growth of new collagen components (neocollagenesis). All of these changes aid in the reduction of tissue laxity and help to rejuvenate the structure and appearance of skin, enhancing the lift obtained up to the endpoint of treatment (about 1-year post treatment) [17].

This study showed that PDO threads have the advantage of being simple, rapid office technique that doesn't need prepared operating theater, showing immediate effective results with minimal side effects such as dimpling, ecchymosis and allergic reaction to this synthetic material that resolves within few days. The patient doesn't need a long recovery period but it is temporary procedure that disappear after 6 months to one year. Thread lifting is more suitable for patients who are not able to take long vacancies or sick leaves.

4. CONCLUSION

Polydiaxonone threads is a simple, rapid, immediately effective office technique procedure

but with temporary effect lasting for 6 months with minimal side effects.

CONSENT

Tanta University Hospital with informed written consent after full explanation about the procedure technique and side effects in the period between January 2018 till April2019.

ETHICAL APPROVAL

This study is experimental study and it was approved by Research Ethics Committee of Faculty of Medicine, Tanta University. (Code No. 32022/12/17)

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Verschoore M, Nielson M. The rationale of anti-aging cosmetic ingredients. J Drugs Dermatol. 2017;16(6):s94-s97.
2. Garre A, Martinez-Masana G, Piquero-Casals J, Granger C. Redefining face contour with a novel anti-aging cosmetic product: An open-label, prospective clinical study. Clin Cosmet Investig Dermatol. 2017;10:473-82.
3. Tavares JP, Oliveira CACP, Torres RP, Bahmad F Jr. Facial thread lifting with suture suspension. Braz J Otorhinolaryngol. 2017;83(6):712-9.
4. Karimi K, Reivitis A. Lifting the Lower Face with an Absorbable Polydioxanone (PDO) Thread. J Drugs Dermatol. 2017;16(9):932-4.
5. Fitzpatrick TB. The validity and practicality of sun reactive skin types I-VI. Arch Dermatol. 1988;124(6): 869–71.
6. Carruthers A, Carruthers J, Hardas B, Kaur M, Goertelmeyer R, Jones D, et al. A validated grading scale for marionette lines. Dermatol Surg. 2008;34:167-72.
7. Kaur M, Garg RK, Singla S. Analysis of facial soft tissue changes with aging and their effects on facial morphology: A forensic perspective. Egypt. J. Forensic Sci. 2015;5(2):46-56.
8. Jung GS, Song H. An innovative form, scaffold type of thread lift: its satisfactory performance and safety. Hong Kong J Dermatol. 2019;27(3):121-6.
9. Kang SH, Byun EJ, Kim HS. Vertical lifting: A new optimal thread lifting technique for Asians. Dermatol. Surg. 2017;43(10):1263-70.
10. Kim JY, Choi JH, Kim SW, Chung YK, Song MH, Kim KY, et al. Effectiveness of Cogged Polydioxanone Thread for Aging Lower Face Improvement. Pain. 2018;6:2-6.
11. Baek WI, Kim WS, Suh JH, Kim BJ. Lower facial rejuvenation using absorbable

casting barbed thread. Dermatol. Surg. 2017;43(6):884-7.
12. Tang S, Sun Z, Wu X, Wang YY, Zhang J. An innovative thread-lift technique for facial rejuvenation and complication management: A Case Report. Medicine. 2018;97(21).
13. EL Maadawy IH, Hodeib AA, ALshawadfy SA, Abada DI. Assessment of efficacy and safety of thread lift in mid face. Med J Cairo Univ. 2019;87:2621-9.
14. Rachel JD, Lack EB, Larson B. Incidence of complications and early recurrence in 29 patients after facial rejuvenation with barbed suture lifting. Dermatol. Surg. 2010;36(3):348-54.
15. Gülbitti HA, Colebunders B, Pirayesh A, Bertossi D, Van Der Lei B. Thread-lift sutures: Still in the lift? A systematic review of the literature. Plast Reconstr Surg. 2018;141(3):341-7.
16. Kwon TR, Han SW, Yeo IK, Kim JH, Kim JM, Hong JY, et al. Biostimulatory effects of polydioxanone, poly-d, l lactic acid, and polycaprolactone fillers in mouse model. J. Cosmet. Dermatol. 2019;18(4): 1002-8.
17. Swaminathan V. Polydioxanone thread lifting: Considerations and patient expectations. J. Aesthet Nurs. 2016;5(2): 70-3.

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