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ORIGINAL ARTICLE

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

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ABSTRACT

Background: One of these methods in the thread lifting approach is polydiaxonone(PDO)threads. They are thin, non-barbed polymerized threads with a diameter of 0.07 to 0.15 mm. They can be unidirectional or bidirectional and they possess higher strength and flexibility compared to other thread types.This study aimed to evaluate the efficacy and safety of polydioxonone thread lifting in lower face (marionette line) rejuvenation.

Methods: This study is single non-blinded study, included thirty female patients their ages ranged from 32 to 60 years seeking for lower face rejuvenation attending to the outpatient clinic of Plastic surgery Department, Zagazig University Hospitals in the period between September 2023 till March 2024. Patients were treated with three PDO threads on each side of their lower face while all patients were followed up in the first week, one, three and six months after the procedure.

Results: Average scale before the procedure according to the validated grading scale was from 2 to 5 with a mean of 3.37±0.76 and a median 3.50(2.75-4.0). The validated scale range changed to 1 to 3 with a mean of 1.70±0.82 and a median of 1.50(3.0-4.0) immediately following therapy. The global aesthetic improvement scale in group patient, ranged from 20-90% with a mean of 46.33±18.92 and a median 40(20.0-75). There was 10% improvement in three patients, 50% improvement in fifteen patients, 30% improvement in nine patients, and an excellent 10% improvement in three patients.

Conclusions: Polydiaxonone threads are simple, quick, and successful office technique operation.

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

INTRODUCTION

Growing older is a normal part of life that has an internal and exterior impact on every part of our body. All changes in our organs are reflected to us through our skin [1]. Numerous causes, such as pollution, smoking, and UV radiation, damage DNA, proteins, and lipids by speeding up the oxidation process. This results in clinically noticeable signs of ageing such as wrinkles, thinning, sagging skin, and altered face contours [2].

Due to their major role in the extracellular matrix of the skin, collagen fibres give the skin its suppleness and

volume, therefore any changes to their synthesis can cause the skin to age [3,4].

Many conventional techniques, including as fillers, neurotoxins, lasers, etc., were developed to enhance the slack face. Each of these movements has its own set of advantages, disadvantages, expenses, and methods. All the necessary conditions for the correction of the ageing face cannot be met by a single technique. New methods for addressing the unique anatomy of facial ageing have been developed thanks to a deeper understanding of the changes that take place to the soft tissues of the face, giving the impression of ageing [5].

Using the original polypropylene barbed sutures known as APTOS (antiptosis suture), which had cogs and bidirectional barbs at first and was later changed to become the mesh suspension thread and unidirectional barbs of the Endo Progressive Facelift suture, is one of these approaches for thread lifting [6].

Non-absorbable polypropylene threads have been utilized in numerous procedures; however, they have demonstrated several problems, including visible threads, erythema, ecchymosis (which is the most prevalent), edema, and discomfort. The absorbable monofilament polydioxanone (PDO) threads were developed as a solution to these issues.

PDO threads are thin, non-barbed polymer threads that range in thickness from 0.07 to 0.15 mm. They can be either unidirectional or bidirectional, and they possess higher strength and flexibility compared to polypropylene[5,6]. This study aimed toevaluate the efficacy and safety of polydioxonone thread lifting in lower face (marionette line) rejuvenation.

METHODS

This study included 30 female patients seeking for lower face rejuvenation attending to the outpatient clinic of Plastic surgery Department, Zagazig University Hospitals in the period between September 2023 till March 2024. This study is single non-blinded study, and it was approved by Research Ethics Committee (IRB# 101065) of Faculty of Medicine, Zagazig University. The protocol for the study adhered to the Helsinki Declaration, which is the World Medical Association's guideline of ethics for human research.

***Inclusion criteria*:**

Patients ranged in age from 30 to 65 and required lower face rejuvenation without utilizing prior procedures.

Exclusion criteria:

Patients under 30 years old or over 65 years old, those with a history of lower face lifting, dermatological or systemic diseases, have bleeding issues or are taking anticoagulants, have a tendency to form keloids, who are pregnant or nursing, those with severe chronic illness states, have acute infections or organ failure, have scars on their lower faces, those with very deep wrinkles or thick skin types, and those who have severe lower face sagging.

Preoperative preparations:

Every patient underwent a thorough history taking, general, and dermatological examination. Two doctors conducted a clinical assessment, and each patient's skin phototype was assessed based on Fitzpatrick classification, pigmentation, and texture using an average **[7]**and local examination of the lower face to evaluate the patient before to surgery using an established marionette line grading scale. The wrinkle severity is measured on a 5-point scale, where 1 represents no wrinkles, 2 mild wrinkles, 3 moderate wrinkles, 4 severe wrinkles, and 5

very severe wrinkles [8]. Every subject in the trial was told not to have any additional cosmetic procedures done for the length of the study and the follow-up period.

Technique:

Apply a topical local anaesthetic cream one hour prior to the surgery. The region should be cleaned with a Bovidon iodine solution. Marking the treatment region before beginning at the front tragus of the ear, starting at 1 cm and moving in 3 lines toward the marionette line where it ends, with the first line stopping just below the mouth's corner, the second line ending 1.5 cm below the first, and the third line 1.5 cm below the second (Fig.1B). Using a 30-gauge hypodermic needle, subcutaneous injections of local anaesthetic (2% lidocaine) were made into the insertion sites. After drilling a pilot hole with a 20-gauge hypodermic needle, 3.5-inch PDO threads were inserted into the hole. Following insertion and engagement of the threads with the surrounding tissue, the thread end was clipped and 2% antibiotic bactroban (also known as Mupirocin ointment) was applied to the insertion sites. The threads utilized were polydioxanone suture (FIGO Z cog), 20EA, heavy metal free, nontoxic, and nonpyrogenic, made by IRIS medical supplies. (Fig.1A). Three threads were inserted into each patient's lower face on each side. The tragus of the ear served as the entering point, while the marionette line served as the exit point as shown in Fig. 1B & 1C.

The time of procedure in the current study varied from 20.0 to 40.0 minutes, with a mean of 26.0 ±6.99 minutes and a median of 25.0 (20.0 - 30.0) minutes.

Regarding the estimated cost of materials, estimated cost was about 63.000 L. E (cost of threads, syringes, local anaesthesia, gloves), that's mean each case was costing 2,100 L.E

Regarding the amount of time required to resume work, all patients (100%) in the patient group in the current study went back to their regular lives the day following the procedure.

Post treatment care:

Following the surgery, all patients were directed to apply 2% ointment of the antibiotic bactroban, also known as mupicin. Every patient was told to take an analgesic (500 mg of paracetamol) only when they experienced pain. For at least one week, all patients were advised to sleep on their backs rather on their sides to prevent cog damage. Every potential issue was noted throughout every visit.

Follow up:

All patients were followed up at one week to look at any side effect after the procedure, and then visit us for one, three and six months. All patients were subjected to photographing on each visit, placing their head in a neutral position and neutral gaze with no facial expression. All photographs were taken by digital camera and the computation of the wrinkle scale. Two physicians evaluated the images and were asked to compare the before and after pictures to determine the percentage of improvement for each patient following the completion of the procedure at the last visit.

Statistical Analysis

(IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.) was used to gather, tabulate, and statistically analyze all the data.

RESULTS

Table (1) showed that the age of the cases studied ranged from 32 to 60 years with a mean 43.2 years. Regarding age group, 70% were less than 45 years old. All the studied

cases were female. Most of them (93.3%) were married while only 2 cases (6.7%) were single. That most frequent skin type was III (50%) followed by IV (26.7%) and least frequent was II (23.3%).

Table (2) showed that there was a statistical significance difference in Marionette Scale at different time of follow-up. Using post hoc Bonferroni test revealed that the significance was between pre and all post times (immediately, after 1m, after 3m and after 6 months) but no difference was found between different post times in the scale.

Table (3) showed that Global aesthetic improvement scale among the studied cases ranged from 20 to 75 % with median 40%. Most frequent improvement degree was moderate (50%) followed by marked (30%).

Table (4) showed that 23.3% of the cases had side effects. Most frequently were pain and dimpling (6.7% both).

Table (5) showed that 60% of the cases studied were satisfied with the results and 16.7% were very satisfied while 23.3% were slightly satisfied.

Figure (2). Female patient aged 56 years old. (A): before treatment, (B) immediately after treatment with 3 PDO threads on each side of marionette line with excellent improvement. (C) After 6 months with preserved effect.

Figure (3). Female patient aged 60 years old. (A): before treatment, (B) immediately after treatment with 3 PDO threads on each side of marionette line with marked improvement. (C) After 6 months with preserved effect.

Table (1): Demographic Charactersin the studied group.

Variable		**(n=30)**	
Age: (years)	Mean ± Sd	43.2±7.08	
	Range	32-60	
Variable		**No**	**%**
Age group:	<45	21	70
	≥ 45	9	30
Sex:	Female	30	100
Marital status:	Single	2	6.7
	Married	28	93.3
Skin type:	**II**	7	23.3
	III	15	50
	IV	8	26.7

Table (2): Marionette Scale at different times of follow up among the studied cases.

Marionette Scale	(n=30) Mean ± SD Range	Test	Post hoc			
			Versus immediately	Versus 1 m	Versus 3m	Versus 6m
Pre:	3.37±0.76 2-5	**F 118.29 P <0.001****	**<0.001 ****	**<0.001 ****	**<0.001 ****	**<0.001 ****
Immediately after:	1.7±0.60 1-3			0.43 NS	0.43 NS	0.12 NS
After 1 month:	1.83±0.59 1-3				1 NS	0.99 NS
After 3 months:	1.83±0.59 1-3					0.99 NS
After 5 months:	1.9±0.55 1-3					

SD: Standard deviation F: Repeated measure ANOVA test Post hoc: Bonferroni m=month

NS: non-significant (P>0.05) *: Significant (P<0.05) **: highly significant (P<0.001)

Table (3): Global aesthetic improvement scale among the studied cases after six months.

Variable		(n=30)	
Global aesthetic improvement scale:	Mean ± Sd Median Range	46.33±18.29 40 20-75	
Variable		**No**	**%**
Scale category:	Mild Moderate Marked Excellent	3 15 9 3	10 50 30 10

SD: Standard deviation

Table (4): Side effects among the studied cases.

Variable		(n=30)	
		No	**%**
Side effects	No	23	76.7
	Pain	2	6.7
	Dimpling	2	6.7
	Ecchymosis	1	3.3
	Edema	1	3.3
	Infection	1	3.3

Table (5): Patient's satisfaction of the studied cases.

Variable		(n=30)	
		No	%
Satisfaction	Slightly satisfied	7	23.3
	Satisfied	18	60
	Very satisfied	5	16.7

Figure (1A): showing the external cover for threads to preserve them.

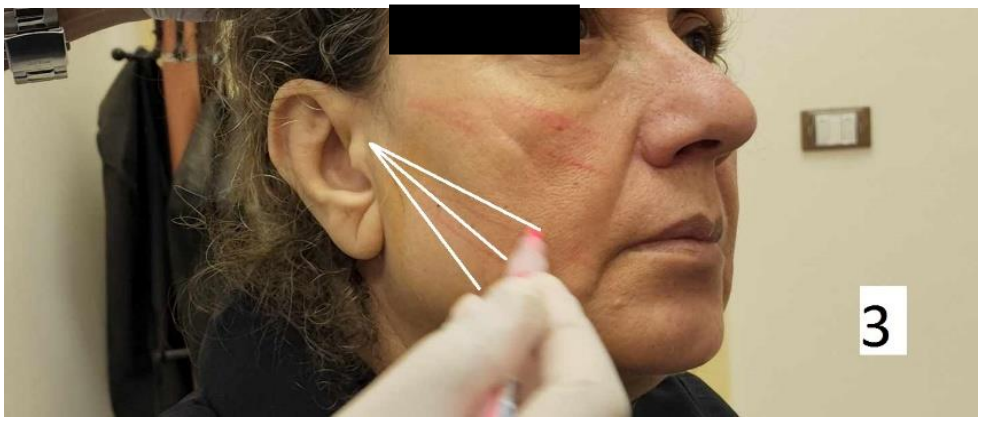
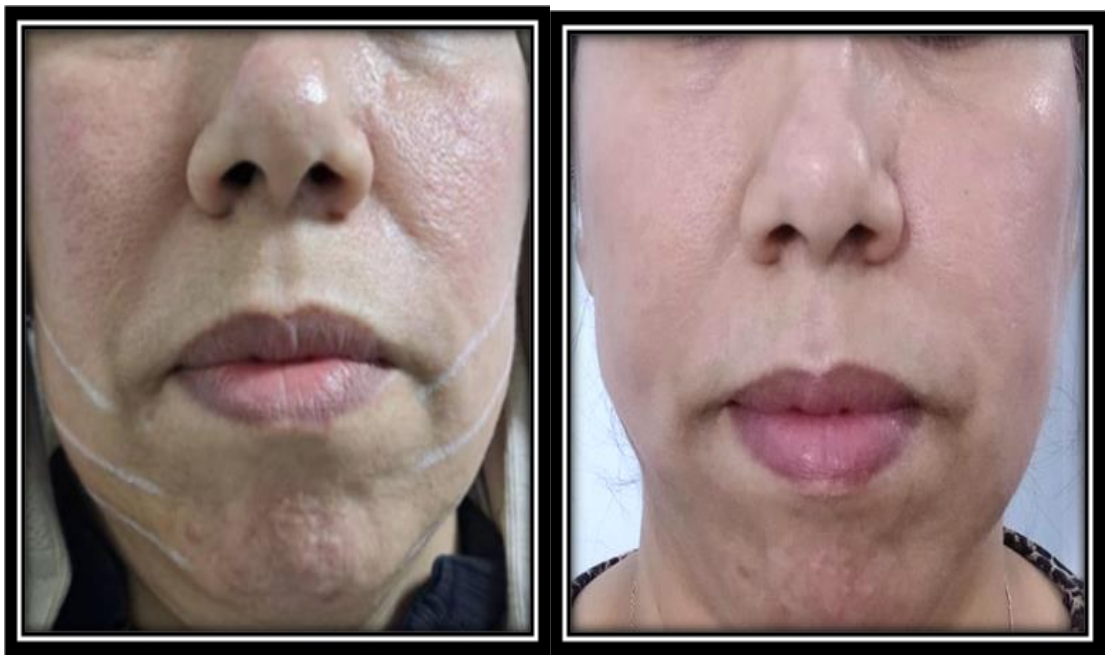


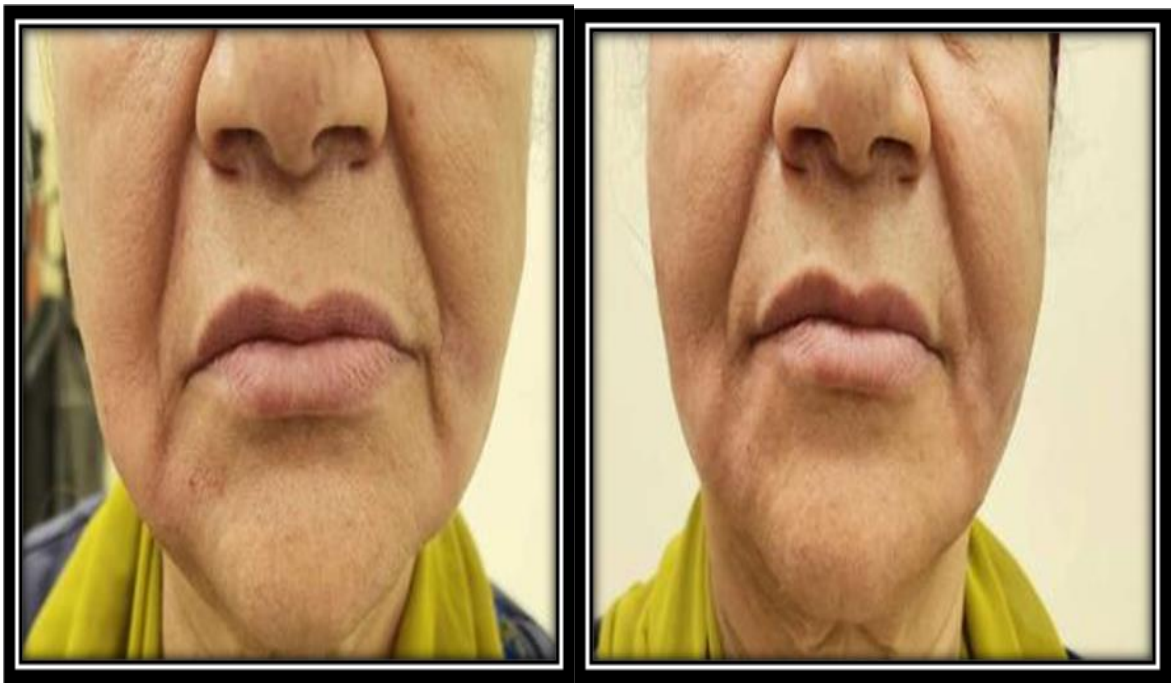
Figure (1B):Showing white marking on the face to know exactly where to insert threads.

Figure (1C): Showing the face after insertion of PDO threads

A  B

C 

Figure(2)

A  B

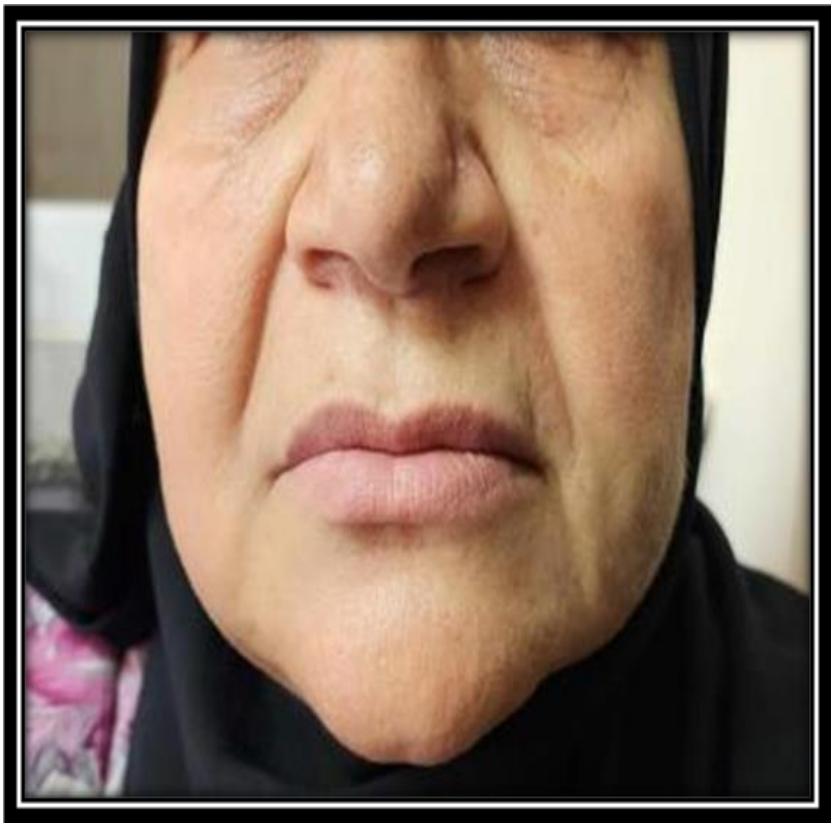
C 

Figure (3)

DISCUSSION

The skin is the first material to display time marks **[7]**. Both intrinsic and extrinsic factors contribute to the aging of the skin, which results in a loss of physiological function and decreased structural integrity. The primary internal biological elements that impact intrinsic aging include the biological sex, ethnicity, and unique characteristics of an individual, which are characteristics that are specific to them, such hyperdynamic facial expressions [8].Increased UV exposure and smoking are common extrinsic factors for skin aging [9].

As people age, they develop marionette lines, which are lengthy vertical lines that laterally encircle the chin. The fatty tissues of the cheeks collapse and descend with age, and the chin and mouth's encompassing ligaments often become more relaxed, loosen, and sag as a result [8].

These days, a lot of useful methods based on the idea of the four Rs Relaxation, refilling, repositioning, and resurfacing are altered to remove undesirable wrinkles. It was stated that the four Rs idea cannot be covered by a single technique. Relaxation, this is most effective for treating fine lines on the forehead and upper face, is the therapeutic paralysis of the muscles that control facial expression with botulinum toxin. Refilling is the process of utilizing different types of fillers or fat transfer to restore lost facial volume. This is a useful treatment for tear trough abnormalities, hollow cheeks, and temporal depressions. Improved thread types made possible by the advent of biomaterials can be used to realign soft tissue that is drooping. Lastly, fine wrinkles can be rejuvenated by resurfacing methods that use mechanical force, chemical compounds, or lasers. These treatments are all included in the rejuvenation category [10].

Among these least invasive surgical methods for face rejuvenation is barbed suture lifting. Absorbable thread therapy, also referred to as nonsurgical face lifting or balance lift, is a novel aesthetic medicine method that helps to stretch and support the tissues of the body and face. There were only a few minor issues with these implants, like the sutures poking through the skin, asymmetry in the cosmetic result that frequently needed to be corrected with extra sutures, and limited effects durability [11].

The aim of this study was to evaluate the efficacy and safety of polydioxonone thread lifting in lower face (marionette line) rejuvenation. This study included 30 patients treated by polydioxonone thread lifting. All patients followed up for 6 months after the procedure. The current study included 30 patients who were all females (100%). It seems from this that female patients were more self-conscious about their appearance than male patients. This is consistent with several other research, as most of the patients included in each study were female [12-18].

The current study regarding the marital status showed, 28 patients were married while 2 patients were single. This data indicates that nowadays more married patients are seeking cosmetic procedures to look younger and more beautiful to protect their marriage.

Thirty patients, ranging in age from thirty to sixty, were enrolled in this investigation with a mean of and median 43.2±7.08 regarding age group, 70% were less than 45 years old.

Jung *et al.*[16]in his research, 48 individuals were separated into four groups and given PDO threads in various facial

regions. In the Marionette line group, twelve patients all females were involved. They were 37.1 years old on average (range: 32-60 years old). His research was compared to ours, and the results showed that, in general, compared to those in other countries, our society was later in seeking out cosmetic operations. Additionally, data indicated that women in our society typically begin to take significant action to lessen the appearance of aging marks on their faces around the age of fifty. The financial factor could be the cause of this.

In the current study, about patient skin phototyping based on Fitzpatrick classification in group of patients seven patients (23.3%) were divided into three groups: eight patients (26.7%) were phototyping IV, 15 patients (50%) were phototyping Ill, and Regarding sun exposure effect and sunscreen use in the groups. Showed fifteen patients (50%) with presence of sun exposure effect (mottled pigmentation). Group of patients showed 18 patients (60%) used to apply sunscreen. Regarding skin photo typing, sun damage or sunscreen use.

The most excellent case in group was skin photo type III, with presence of sun exposure effect and not accustomed to applying topical sunscreen. Also, the worst case was skin photo type IV, with absence of sun exposure effect and used to apply sunscreen. These results showed that there wasn't any correlation between the improvement in both groups and either skin photo typing, presence of sun exposure effect (as mostly housewives or workers away from excess sun exposure) or sunscreen application.

Regarding the amount of time required to resume work, all patients (100%) in the patient group in the current study went back to their regular lives the day following the procedure. This demonstrated that patients who are unable to take extended leaves of absence or sick days will benefit more from thread lifting. This is consistent with the findings of Jung *et al.* [16], who said that patients might return right away following thread lifting treatment.

The time of procedure varied from 20.0-40.0 min in the current investigation, with a mean of 26.0 ±6.99 min and a median of 25.0 (20.0 - 30.0) min. Compared to the research conducted by Park *et al.* [22] our study's process time ranged from 20 to 40 minutes.

According to 30 patients in our study, the estimated cost of materials was almost 63.000 L.E. (cost of threads, syringes, local anaesthetic, and gloves). This translates to a mean cost of 2,100L.E. per case. In contrast to Bertossi, Dario, *et al.* [23]based on 28 patient evaluations on RealSelf, the average cost of a thread lift is $1,950=58,500L.E., meaning that each instance costs an average of 2,089 L.E. The two investigated cost differences are not significantly different from one another.

This current study showed in group of patients who was treated by polydioxonone thread lifting, eighteen patients (60%) were satisfied, five patients (16.7%) were very satisfied, and seven patients (23.3%) were just somewhat satisfied. Dermatologists and plastic surgeons agreed that the worldwide cosmetic improvement scale was between 20 and 75 percent, with a mean of 46.33±18.29 and a median of 40. There was a 10% improvement in three patients, a 50% improvement in fifteen patients, a 30% improvement in nine patients, and an excellent improvement in three patients (10%).

The effectiveness of polydioxonone

thread lifting for face rejuvenation has been documented in several research to date. Kang *et al.* [12]in his research, he looked at 39 Korean patients 38 female and 1 male who had vertical thread lifting for facial laxity utilizing small, wedge-shaped PDO sutures (6 cm long). Of them, 10 patients (25.6%) thought the results were great, 20 patients (51.3%) thought the results were very good, and 5 patients (12.8%) thought the results were good. Of these, most patients (89.7%) thought the outcomes were satisfactory. Consensus evaluations by two independent dermatologists characterized the objective outcomes at the 6-month follow-up largely as very much better (10.3%), much improved (43.6%), and improved (33.3%).

The current study used PDO sutures in a manner like Kang's work, however we used the long (15 cm) kind in an oblique manner. Additionally, this study only included 30 female patients who complained of face laxity; there were no male participants as all[12].

The current study show used PDO threads as a single session procedure, According to the validated marionette line grading scale, the scale ranged from 1 to 3 with a mean of 1.70±0.60 and a median 1.50(3.0- 4.0) before the procedures, and from 2 to 4 with a mean of 3.37±0.76 and a median 3.50(2.75- 4.0) after treatment with statistically significant decrease in the scale of severity of wrinkle after than before treatment by greater than 1 point. After l and 3 months, it was found that all patients preserved the effect they got immediately after the procedure. After 6 months of follow up, the scale ranged from 1 to 3 with a mean of 1.9±0.55 and a median 1.50 with decrease in the scale by 1 point in five patient when comparing the follow up scale results with its counterpart before the procedure.

Kim *et al.* [13]found that PDO thread lifting, when performed on 55 patients (52 females and 3 males) with mild to moderate wrinkles (grades 3 and 4 only included), was more effective than lasers, which require repeated sessions.

Kim *et al.* [13] according to the study, following the initial visit, individuals' satisfaction scores tended to decline. The strain on the skin is weakened when the absorbable thread begins to deteriorate, causing the tension produced by PDO threads to gradually drop from its peak right after the treatment. But as collagen starts to grow around the thread, the wrinkle improvement becomes more durable. When considered together, the wrinkle improvement seems to have significantly improved at week 1 following the treatments; nevertheless, this is essentially an overcorrection of the wrinkle brought on by oedema. But when the facial oedema goes down, the overcorrected wrinkles begin to settle into the skin. Given the significant difference that was visible just after the operation, the individuals may perceive this as a less-than-ideal outcome. This could account for the reduced satisfaction rating that was noted at week 12 following surgery[8].

In the current study, it differs from Kim's study in that group of patients enrolled 30 female patients with facial wrinkles grade 2, 3 and 4. Three PDO threads were used to treat each patient on each side of the marionette line, in contrast to Kim study they used 15 to 20 threads in both sides. The study agreed with them that most patients showed immediate improvement on the validated grading scale for marionette line. All our cases showed difference in WSRS score from

baseline by greater than 1 point. After 6 months follow up, showed 24 patients (80%) six individuals (20%) experienced a degree worsening on the marionette scale, while the remaining patients maintained the same outcome following the operation. The study agreed with Kim *et al* study in their explanation of losing the effect.

Baek *et al.* [14] had severe nasolabial wrinkles and lower face sagging, scoring a 3 or 4 on the Wrinkle Severity Rating Scale (WSRS) in their study. When they compared the scale before, after 4 weeks, and after 24 weeks, they found statistically significant differences. The scale dropped more than one point both during the treatment and during the six-month follow-up period. This is related to the ongoing research.

This study's five patients experienced mild side effects, two (6.7%) complained of dimpling, which went away in a week, one (3.3%) complained of ecchymosis, which went away in five to seven days, and only one (3.3%) experienced an immediate allergic reaction (oedema) to the material the threads were made of, which went away four hours after the procedure as long as the patient took antihistaminic medication and one patient (3.3%) complained of infection at site of entry treated by systemic antibiotic and disappeared in four day. This investigation revealed no evidence of thread extrusion, malar eminence accentuation, or facial asymmetry.

In Kang's study, there were very few difficulties and only a few small compilations. The most frequent adverse event (2 patients, 5.1%) was dimples, which was followed by bruises (2 patients, 2.6%). In contrast to the present investigation, three cases were documented: accentuation (2.6%), thread extrusion (2.6%), and facial asymmetry of the malar eminence (2.6%). They did not find any significant adverse events in their investigation, such as nerve injury or foreign body granuloma[12].

*Baek*et al.analysis noted a few small issues, but no major issues were found during the investigation. Complications included the development of pustules, discomfort from tightness, oedema, and dimpling of the skin. Usually, these adverse effects were self-limiting[14].

Tang *et al.* [18]stated in his case study report that he treated facial aging by combining the tiny incision rhytidectomy with the thread lifting procedure. Ten days following the surgery, the patient reported having a bump under the skin. on the left side with a palpable knot. The minimally invasive approach involved inserting a small needle knife under local anaesthetic to without severing the thread, break the fibrosis encircling the knot. A month later, this nodule disappeared.

Since no invasive technique that could cause fibrosis was performed in the current investigation, this was not discovered. The customary method was employed to insert threads into the face, and the threads were then pulled and secured into position with light pressure.

El Maadawy *et al.* [15] 12 female patients with mild to severe midface laxity underwent a clinical pilot trial using the thread lifting technique. The study's findings indicated that the patients' modest side effects included pain in 100% of the cases, slight ecchymosis in 4 cases (33.33%), and mild oedema in 3 cases (25%).

Several investigations demonstrated the effectiveness of thread lifting as a quick and easy process. However, Rachel *et al.* [19] found that there were a lot of negative outcomes and an early recurrence from the

barbed suture lift in all technical factors, regardless of open or closed approach. The study included 28 women and 1 man, ages 32 to 68 (mean 54), and it was conducted over a 17-month period.

Gülbitti *et al.* [20]shown that, although the technique is still in its infancy, there has been little to no evidence supplied to the peer-reviewed literature to support or sustain the positive remark about thread-lift sutures made. Except for two trials, all the available literature in the authors' review showed that the lifting effect had a very limited endurance at best. The two successful studies, sponsored by Eremia and Willoughby, the firms that make the thread-lift sutures, demonstrated an improvement in face laxity up to 16 months following the surgery, with the nasolabial folds and the tear trough/malar fat pads showing the most benefit. It should be mentioned, though, that Angiotech, the company that makes the Contour threads, gave this research group a grant. Also, De Benito *et al.* [21]demonstrated that thread lifting techniques yield consistent outcomes and a great degree of satisfaction for both surgeons and patients. It is important to acknowledge, though, that de Benito *et al.* were compensated by the Silhouette Lift Company for consultancy services related to travel and lodging costs incurred in giving lecture and surgery seminars for the business.

According to this data, although sometimes not substantially preserved, the thread lifting procedure is more appropriate for patients who require an immediate positive outcome. One advantage of the PDO threads is that they are a simple, fast office process that doesn't require any require an operating room to be ready, and they have minor adverse effects, such as ecchymosis, dimpling, and a short-lived allergic reaction to the synthetic material. Although it is a transient technique that goes away in six months to a year, the patient doesn't require a lengthy recuperation period. Patients who are unable to take extended periods of absence or sick days might benefit more from thread lifting.

CONCLUSIONS

Using polydiaxonone threads is an easy, quick, and instantaneously efficient office technique approach but with temporary effect lasting for six months. Method was effective in the treatment of marionette line wrinkles. There were minor side effects in PDO technique like dimpling, ecchymosis, local infection and mild allergic reaction that disappeared in about one week.

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