





State of the art of surgical techniques with PDO thread in facial aesthetics: a concise systematic review

Karla Sucupira Mota 1*¹⁰

¹ Human Clinic. Street:Diogo Jácome, 50, Vila Nova Conceição. Zip code: 04512000, São Paulo, Brazil.

*Corresponding author Dr. Karla Sucupira Mota. Human Clinic. Street: Diogo Jácome, 50, Vila Nova Conceição. Zip code: 04512-000, São Paulo, Brazil. E-mail: dra_karlasucupira@hotmail.com DOI: https://doi.org/10.54448/mdnt25210 Received: 01-28-2025; Revised: 04-07-2025; Accepted: 04-28-2025; Published: 04-30-2025; MedNEXT-id: e25210

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Abstract

Introduction: The fascination with beauty attracts optimizations of surgical techniques through the use of PDO (polydioxanone) threads. In recent years, the use of barbed tensor threads has gained popularity as a means of rejuvenating the face. **Objective:** This study presented the main clinical and aesthetic approaches to optimizing techniques using PDO threads for facial rejuvenation. Methods: The systematic review rules of the PRISMA Platform were followed. The search was carried out from December 2024 to January 2025 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. Results and Conclusion: A total of 101 articles were found. A total of 17 articles were evaluated and 14 were included in this systematic review. Considering the Cochrane risk of bias tool, the overall assessment resulted in 38 studies with a high risk of bias and 35 studies that did not meet GRADE. Most studies showed homogeneity in their results, with $X^2=65.7\%>50\%$. It was concluded that the combination of lower blepharoplasty and midface lift using PDO threads is a comprehensive and effective approach for facial rejuvenation. It significantly improves wrinkle reduction, midface lift, and patient satisfaction. Ultrasound-guided thread lift, a method of evaluating and performing midface lift, proves to be safe and efficient. This approach holds promise as a future option in anti-aging cosmetic surgery, presenting a minimally invasive alternative with natural-looking results and reduced downtime. The Cartesian Technique™ with Smart PDOs[™] is an effective protocol for skin resurfacing that enhances cellular biostimulation through the release of bioactive drugs. Using PDO threads for midface lifting is simpler, faster, and less invasive than conventional surgical methods, and this method simultaneously achieves satisfactory results. The combination of hyaluronic acid fillers and PDO threads was effective in achieving and maintaining long-term improvements in facial volume and contour. Thread lifting with short, wedge-shaped PDO sutures is safe and effective for facial rejuvenation. The vertical lifting technique has shown advantages over current approaches. Wedgeshaped PDO sutures in a folded configuration are a promising treatment option for deep static wrinkles in the upper face. The "Half Moon Base" incision and use of 4.0 PDO threads have shown significant aesthetic results in the eyebrow.

Keywords: Threads. PDO. Facial rejuvenation. Aesthetics. Techniques.

Introduction

The fascination with beauty attracts optimizations of surgical techniques through the use of PDO (polydioxanone) threads. In recent years, the use of barbed tension threads has gained popularity as a means of rejuvenating the face. However, there is still a dearth of comprehensive techniques and explanations for the use of barbed sutures [1].

This innovative approach employs minimally invasive methods to elevate and tighten the skin of the neck using barbed threads. These threads are equipped with tiny barbs that securely grip and lift the tissue. Through careful insertion of these threads using tiny needles and strategic positioning, the desired lifting effect is achieved. Due to its minimal invasiveness, minimal downtime, and lack of scarring, it has become a preferred option for individuals seeking a non-surgical alternative to traditional neck lifts [1,2].

In this sense, facial aging increases the demand for lifting procedures, shifting from targeted improvements in younger individuals to general improvements in facial contour as skin elasticity has decreased in recent years. Thus, it is necessary to examine the evolution of PDO volume threads, outlining their development from initial limitations to contemporary innovations that aim to address tissue deformation and maintain thread integrity after insertion.

Categorizing these threads based on elasticity, shape, and functionality highlights their versatility and application nuances, addressing specific wrinkle correction, contour shaping, and facial volume restoration. In this regard, the discussion emphasizes the fundamental role of thread characteristics in achieving optimal results, and minimizing potential complications [3].

Therefore, this article aimed to present the main clinical and aesthetic approaches to optimizing techniques for the use of PDO threads for facial rejuvenation.

Methods

Study Design

The present study followed an international systematic review model, following the PRISMA (preferred reporting items for systematic reviews and meta-analysis) rules. Available at: http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1.

Accessed on: 01/18/2025. The AMSTAR 2 (Assessing the methodological quality of systematic reviews) methodological quality standards were also followed. Available at: https://amstar.ca/. Accessed on: 01/18/2025.

Search Strategy and Search Sources

The literature search process was carried out from December 2024 to January 2025 and developed based on Scopus, Embase, PubMed, Science Direct, Scielo, and Google Scholar, covering scientific articles from various periods to the present day. The following health science descriptors (DeCS/MeSH Terms) were used "Threads. PDO. Facial rejuvenation. Aesthetics. Techniques", and the Boolean expression "and" was used between MeSH terms and "or" between historical findings.

Study Quality and Risk of Bias

Quality was classified as high, moderate, low, or very low regarding the risk of bias, clarity of

comparisons, precision, and consistency of analyses. The most evident emphasis was on systematic review articles or meta-analyses of randomized clinical trials, followed by randomized clinical trials. Low quality of evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument by analyzing the Funnel Plot graph (Sample size versus Effect size), using Cohen's d test.

Results and Discussion

Summary of Findings

As a corollary of the literature search system, a total of 101 articles were found that were submitted to eligibility analysis and, subsequently, 14 of the 17 final studies were selected to compose the results of this systematic review. The listed studies presented medium to high quality (Figure 1), considering in the first instance the level of scientific evidence of studies in study types such as meta-analysis, consensus, randomized clinical, prospective, and retrospective observational. Biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies presented homogeneity in their results, with X^2 =65.7%>50%. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 38 studies with a high risk of bias and 35 studies that did not meet GRADE and AMSTAR-2.

Figure 1. Screening and selection of articles.



Source: Own authorship.

Figure 2 presents the results of the risk of bias of the studies using the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using Cohen's Test (d). Precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph had a symmetrical behavior, not suggesting a significant risk of bias, both among studies with small sample sizes (lower precision) that are shown at the base of the graph and in studies with large sample sizes that are presented at the top.

Figure 2. The symmetrical funnel plot suggests no risk of bias among the studies with small sample sizes that are shown at the bottom of the graph. Studies with high confidence and high recommendation are shown above the graph (n=14 studies).



Source: Own authorship.

Current Clinical Findings - Facial Aesthetics and PDO

In the scenario of anti-aging aesthetic procedures, several changes in facial rejuvenation techniques using PDO threads are guiding the improvement of these procedures, with satisfactory results for collagen biostimulation. The combination of technologies with PDO threads can guarantee patient safety while maintaining the integrity of the threads. PDO threads can be used in conjunction with microfocused ultrasound technology since the melting point of the PDO polymer is between 110° and 115°C [4]. In this context, PDO threads promote absorbable sutures that stimulate collagen production and tissue contraction, offering better aesthetic results.

The authors Park, Jeong, and Park (2024) [5] evaluated through a retrospective study the combined use of PDO threads for mid-cheek lifting and lower blepharoplasty for facial rejuvenation. Targeting individuals with sagging lower eyelids and pronounced nasolabial folds, outcome measures included the modified Fitzpatrick Wrinkle Scale, the Allergan® Midface Volume Deficit Scale, the interzygomatic distance width, the patient and observer scar assessment and scale, patient satisfaction questionnaires assessed at baseline, 3 months, and 1 The year postoperatively. combined procedure demonstrated superior aesthetic results and increased patient satisfaction compared to lower blepharoplasty alone. Improvements were most significant in wrinkle reduction, midface volume, and inter zygomatic distance

in the combined procedure group. Although the combined procedure had a longer mean operative time, scar assessment scores were similar between the two groups, with no complications reported. Therefore, the combination of lower blepharoplasty and midface lift using PDO threads is a comprehensive and effective approach to facial rejuvenation. It significantly improves wrinkle reduction, midface lift, and patient satisfaction. Ultrasound-guided thread lifting, a method for evaluating and performing midface lifting, has proven to be safe and efficient.

The authors Velazco de Maldonado et al. (2023) [6] developed a new facial lifting protocol using PDO incorporated in acetyl hexapeptide-8 (Argireline [Arg]). Arg is assumed to enhance the effects of PDO threads, as it is a mimetic of botulinum toxin. The ability of PDO sutures as a system for controlled release of acetyl hexapeptide-8 for application in deep wrinkles of the upper third was analyzed. Three segments of 21G PDO threads, 1 cm long, were immersed in 1 mL of Arg. The PDO threads were observed under an optical and electron microscope at 24, 48, and 72 hours later. They were also weighed before and after being soaked in Arg, and the rate of Arg release from the PDO suture was measured using ultraviolet (UV)-visible spectroscopy. Finally, the PDO-Arg suture was inserted following a protocol specially developed for deep static wrinkles in the upper third. Results: Electronic weighing revealed that the PDO suture enjoys capillary action by the peptide, doubling its weight every 24 h. UV spectra revealed that the PDO suture is a well-controlled release system for Arg, allowing its sustained release for 1 h. Optical and electron photomicrographs confirm the swelling of the PDO suture by the absorption of Arg by its capillarity, but this hydrophilicity does not lead to its premature physical degradation. Thus, the PDO suture system with Arg is an intelligent bioactive system useful in facial harmonization.

Furthermore, the same authors Velazco de Maldonado et al. (2024) [7] in a randomized clinical study evaluated the controlled release of silicon from the smart polydioxanone suture (Smart PDOs[™]) and the clinical effect of the Cartesian Technique[™] in facelift. Preclinical trials included instrumental analysis of siliconenriched sutures by optical microscopy, electron microscopy, and ultraviolet-visible spectroscopy (UVvis). The clinical trial included 35 patients with primary and secondary rhytids, grade I lipomatosis, and grade I deflation. PDO sutures are inserted following the Cartesian Technique[™], a vector survey of the intersection of the Cartesian planes of the face. Once the cannulas were inserted with the PDO thread, 0.1 mL of organic silicon was dosed. Turgidity was examined by the skin turgor pinch test. To measure the position of

sagging or deflated tissues, the deflation scale was used. The controlled release of organic silicon from the PDO sutures was verified. Its clinical application revealed that after 8 days, the improvement in turgor, reversion of wrinkles, and tightening of sagging was maintained in 100% of the sample. After 15 days, reversion of rhytids was observed, softening of deep grooves in 80%, and the initial turgor and skin tightening were maintained without deflation in 90% of cases. The histopathological findings reveal that silicon synergistically enhances the tissue effect of the PDO suture, generating greater biostimulation of fibroblasts with better quality collagen fibers, greater restructuring and densification of the skin, and avoiding the late inflammatory response.

Authors Myung and Jung (2020) [8] described the use of 18-G polydioxanone (PDO) threads to improve midface soft tissue laxity and achieve satisfactory results through a minimally invasive procedure. A total of 64 patients (all female; age, 33-60 years) underwent a midface thread lift from January 2017 to January 2018. After a punch incision was made using an 18-G needle over the lateral orbital rim, three precannulated 18-G PDO threads were inserted, targeting the deep medial fat pad and the inner layer of the superficial muscular aponeurotic system. The threads were anchored to the lateral orbital periosteum, suspending the soft tissue in a more superior direction. Surgical outcomes were assessed subjectively (patient satisfaction ratings) and objectively (blinded physician ratings based on changes in the vertical position of the malar prominence). No major complications (postoperative hematoma, infection, or temporary sensory/motor impairment) were observed. The mean procedure time was 15 minutes, and all patients underwent local anesthesia. Patient satisfaction was highest at 1 month postoperatively (mean 4.7/5.0) and decreased at 1 year postoperatively (2.8/5.0). Objective assessment scores followed the same trend (4.5/5.0 at 1 month; 3.1/5.0 at 1 year).

A clinical study by authors Khan et al. (2021) [9] evaluated the efficacy of PDO threads using a combination of cog and cog press threads (Ncog and Nfix) and cog thread (Ncog) alone. A total of 30 patients (51.8 years) who underwent PDO thread treatment for facial rejuvenation and tightening of sagging skin tissues were evaluated. The follow-up period was 7 months. Objective and subjective photographic evaluations were performed during this period. There was a statistically significant difference between the preoperative and 1-month postoperative results in both groups with a mean score of 1.94 ± 0.43 (p < 0.05). Furthermore, the combination of Ncog and N fix showed slightly better results than Ncog alone. According to patient

satisfaction, all patients were satisfied with the clinical results.

In addition, the authors Unal et al. (2021) [10] presented the efficacy and safety of PDO thread lifting for facial rejuvenation to prevent thread migration. A total of 38 patients (39.6 ± 7.5 years) underwent PDO cog treatment for facial rejuvenation. Using a sharp 23 G/90 mm needle, the bidirectional barbed PDO cog thread was inserted into the subcutaneous tissue. The results of the procedure were evaluated by the Global Aesthetic Improvement Scale (GAIS) and patient satisfaction. The GAIS score showed satisfactory results (very improved: 78.9%; very improved: 18.4%; improved: 2.6%). According to patient satisfaction, all patients were satisfied with the clinical results of the procedure (excellent: 76.3%; very good: 21.0%; good: 2.6%).

A recent prospective, blinded clinical study developed by authors Wan et al. (2024) [11] highlighted the combination of hyaluronic acid (HA) fillers and PDO thread lift, evaluating the efficacy and safety of the combined treatment of HA filler and PDO thread for midface rejuvenation over 24 months. Eleven individuals, aged between 29 and 70 years, with midface volume loss rated from 1 to 4 on the anteromedial cheek fullness scale were included. Participants were treated with cross-linked HA dermal fillers and PDO threads. Assessments were conducted using the Global Aesthetic Improvement Scale (GAIS), investigator-led clinical assessments, and volumetric measurements using the Morpheus 3D system at baseline, 6, 12, and 24 months post-treatment. Quantitative analysis revealed a significant reduction in midface width from a mean baseline of 149.27-145.00 mm at 24 months (p < 0.00001). Similarly, lower face width decreased from 130.36 to 117.27 mm at 24 months (p < 0.00001). GAIS scores demonstrated high levels of subject satisfaction, with 9 of 11 patients reporting satisfaction or consistent improvement over 24 months. Minimal adverse events were reported, and no serious complications occurred.

A clinical study described by authors Wan et al. (2024) [12] presented two successful cases of nose augmentation using volume and dentate threads, providing evidence of their efficacy and demonstrating the insertion techniques via a supplemental video. Two female patients (aged 26-33 years) underwent nonsurgical nose augmentation. The first patient received volume threads to improve the nasal contour, while the second patient received barbed threads to refine the nasal tip and alar base. Both procedures were performed using PDO threads. Both patients exhibited significant improvement in nasal contour and projection, with results maintained for up to 8 months postprocedure. Patients reported high satisfaction with the aesthetic results, and no complications were observed during the follow-up period.

Also, Kang, Byun, and Kim (2017) [13] present a more suitable vertical lift technique, in which short (6 cm long) wedge-shaped PDO sutures are inserted vertically downward into the anterior malar and submalar areas. The authors also aimed to evaluate the safety and overall efficacy of wedge-shaped PDO thread lifts in facial rejuvenation. A total of 39 patients were included. All participants underwent a single treatment session. Outcomes were evaluated objectively using serial photography and subjectively based on patient satisfaction scores. Most patients (89.7%) considered the results satisfactory. Consensus ratings by 2 independent dermatologists showed that objective results at 6month follow-up were broadly categorized as much improved (10.3%), much improved (43.6%), and improved (33.3%). The incidence of complications was low, and complications were minor. The vectors directly oppose vertical facial sagging, which makes the technique highly efficient.

Authors Kang et al. (2019) [14] described a novel technique using wedge-shaped bent PDO threads ("solid fillers") applicable to deep static wrinkles in the upper face and evaluated its safety and efficacy. A total of 33 patients with glabellar and forehead wrinkles were included. All participants underwent a single treatment session. Outcomes were assessed objectively using serial photography and subjectively based on patient satisfaction scores. Patients had moderate (15.2%), severe (39.4%), and very severe (45.4%) static wrinkles at baseline. Most patients (81.8%) considered the results satisfactory. Consensus assessments by two independent dermatologists showed that the objective results at the 2-month follow-up were much improved (30.3%), much improved (30.3%), and improved (24.2%). The incidence of complications was low, and complications were minor.

Finally, the author Fernandes (2023) [15] presented her optimized experience with a "Half Moon Base" incision and the use of PDO 4.0 thread based on the study by Castanares [16] and Viñas [17], with important aesthetic results. A subcutaneous suture was performed anteriorly through the orbicularis oris muscle and posteriorly through the frontalis muscle with polydioxanone (PDO) 4.0 thread to promote a more pronounced arch, as well as an intradermal suture with PDO 4.0 thread to reduce tension and allow the PDO to stimulate collagen. The surgical indication depends more on the signs of aging than on the patient's chronological age. This approach is used to correct the lateral end of the eyebrow (tail), mainly in patients with hairless eyebrows or in patients who use makeup to disguise eyebrow ptosis.

Limitations

Recommendations for future research directions, including long-term safety assessments and patientspecific outcomes, aim to improve the clinical utility and applicability of the new PDO thread techniques, as well as in combination with other techniques. Randomized controlled clinical trials are recommended to verify these aesthetic improvements.

Conclusion

It was concluded that the combination of lower blepharoplasty and midface lift using PDO threads is a comprehensive and effective approach for facial rejuvenation. It significantly improves wrinkle reduction, midface lift, and patient satisfaction. Ultrasound-guided thread lift, a method of evaluating and performing midface lift, proves to be safe and effective. This approach holds promise as a future option in anti-aging cosmetic surgery, presenting a minimally invasive alternative with natural-looking results and reduced downtime. The Cartesian Technique[™] with Smart PDOs[™] is an effective skin resurfacing protocol that enhances cellular biostimulation through the release of bioactive drugs. Using PDO threads for midface lifting is simpler, faster, and less invasive than conventional surgical methods, and this method simultaneously achieves satisfactory results. The combination of hyaluronic acid fillers and PDO threads was effective in achieving and maintaining long-term improvements in facial volume and contour. Thread lifting with short, wedge-shaped PDO sutures is safe and effective for facial rejuvenation. The vertical lifting technique has shown advantages over current approaches. Wedgeshaped PDO sutures in a folded configuration are a promising treatment option for deep static wrinkles in the upper face. The "Half Moon Base" incision and use of PDO thread 4.0 have shown significant aesthetic results in the eyebrow.

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The authors declare no conflict of interest.

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