



Research Article

The Renaissance of Non-Invasive Facial Rejuvenation : A Deep Dive into PDO Thread Lifts and the BISTOOL's VXIL Innovation

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Abstract

In the rapidly evolving world of non-invasive aesthetic treatments, polydioxanone (PDO) thread lifts have emerged as a leading procedure for facial rejuvenation. The aim of this paper is to comprehensively evaluate the scientific underpinnings of PDO thread lifts, with a specific focus on the significant innovations presented by the VXIL product developed by BISTOOL Co. Ltd., Seoul, Korea. A thorough investigation was carried out, encompassing biomechanical properties and biocompatibility. Concurrently, the research delved into the unique attributes of VXIL, examining its design nuances aimed at enhancing tissue anchorage and ensuring optimal biocompatibility. The VXIL threads distinguished themselves with design advancements that not only provide superior tissue grip but also minimize potential inflammatory reactions. It has shown superior outcome in tensile strength, anchoring strength and durability via design and number of cogs as well as manufacturing method, press sculpting mold. BISTOOL's VXIL represents a paradigm shift in the domain of PDO thread lifts, synergizing technological finesse with clinical acumen. The detailed analysis of its features, combined with the elucidation of the biological processes driving its efficiency, make it a transformative solution in the landscape of non-surgical facelifts. This research offers a pivotal resource for aesthetic professionals and plastic surgeons aiming to integrate cutting-edge innovations in their facial rejuvenation toolkit.

Keywords: BISTOOL; Facial rejuvenation; PDO thread lift; VXIL

Introduction

In the vast panorama of aesthetic medicine, the journey from simple dermal fillers to sophisticated, technologically advanced procedures have been nothing short of revolutionary. Central to this revolution is the PDO thread lift-an ingenious amalgamation of

biomaterial science and surgical dexterity. (Figure 1) Historically, Polydioxanone, a biodegradable synthetic polymer, was confined to the surgical sutures arena. (Figure 2) Their exceptional biocompatibility and safety profile prompted leading aesthetic visionaries to explore their potential in skin rejuvenation. This exploration led to a paradigm shift, opening doors to extensive research, technique optimization, and a renewed emphasis on patient outcomes [1].

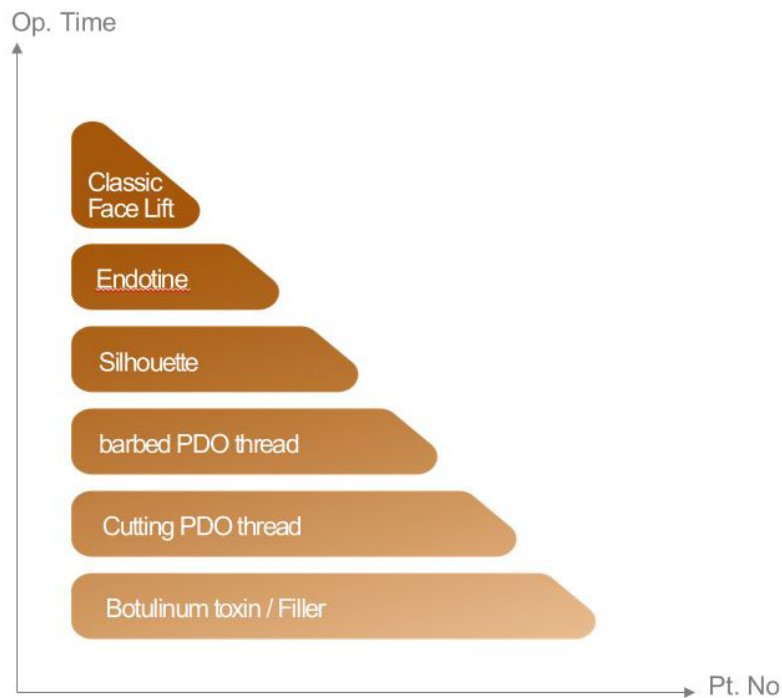


Figure 1: Various tools for facial rejuvenation according to the invasiveness. PDO thread lift has positioned as one of the mainstays.

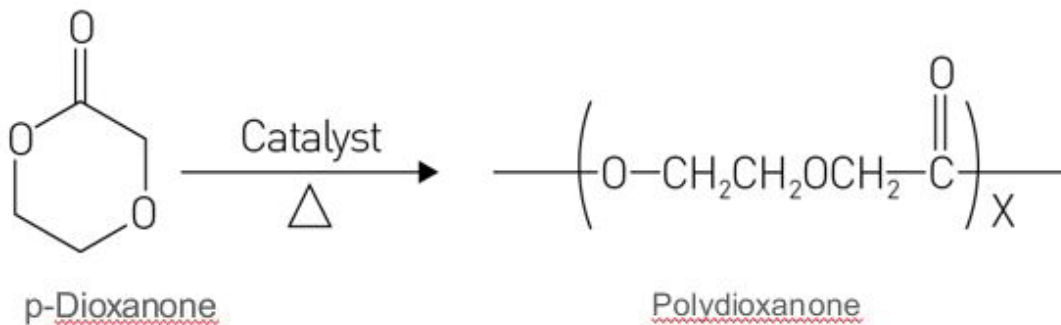


Figure 2: Polydioxanone (PDO) is a polymer with p-Dioxanone which is the first monofilament product, synthesized and used as suture material in 1970's.

The intrinsic biological mechanisms of PDO threads offer a multi-pronged rejuvenation strategy. It usually stays for 180 to 240 days in vivo, which is longer period compared to other common suture materials including PGA, PLGA and PGCL. (Figure 3) Beyond mere physical elevation, these threads actively engage the skin's regenerative capacities. They stimulate fibroblasts, cells pivotal for collagen synthesis, infusing the skin matrix with enhanced elasticity and firmness. The induced collagen remodeling not only imparts a youthful vigor but also promotes neovascularization, vital for the skin's radiant aura. A lesser discussed but equally significant phenomenon accompanying PDO thread insertion is the ensuing fibrotic encapsulation. As the threads undergo hydrolytic degradation, they leave behind this fibrotic scaffold, ensuring sustained elevation and enduring aesthetic outcomes [2].

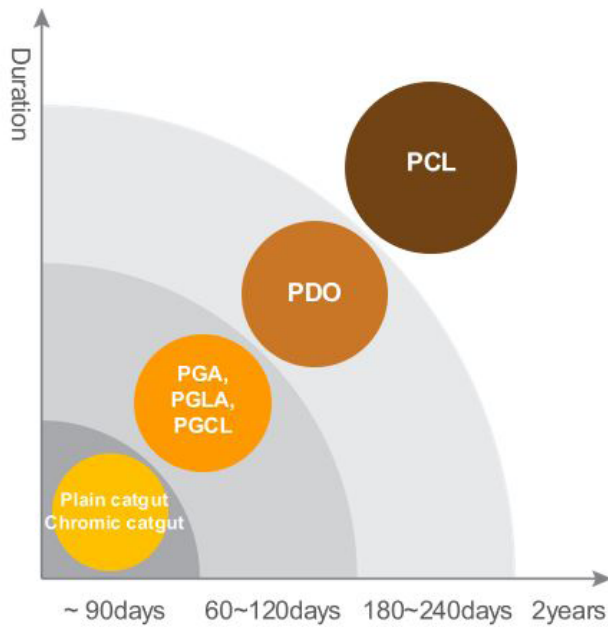


Figure 3: Duration of various suture materials including PDO that usually stays for about 180 to 240 days.

Method

The VXIL (BISTOOL Co. Ltd., Seoul, Korea) emerges as 4th generation molding PDO threads, a testament to relentless innovation. (Figure 4) Its design nuances, like the precise calibration

of diameter and design of molded cog ensure an optimal subdermal anchor. (Figure 5) This robust anchor facilitates sustained, natural-looking elevation, lending VXIL a distinctive edge over competitors. Moreover, the evolution of its barb geometry is a testament to VXIL's commitment to excellence. (Figure 6) Fine-tuned to perfection, these barbs optimize tissue engagement while minimizing procedural trauma reaching less edema and shorter downtime. Complementing its structural brilliance is VXIL's unmatched biocompatibility, achieved through cutting-edge manufacturing processes. (Figure 7) These processes ensure that upon insertion, the threads elicit a precisely controlled, therapeutic inflammatory response, pivotal for optimal rejuvenation. (Figure 8).



Figure 4: History of PDO thread from 1st to 4th generation.

	Mono	Spring	Double twist	Mono directional cog	Bi-directional cog
cog	X	X	X	0	0
design					
Features	Easy treatment, full-body use	Easy treatment	Easy treatment Wide skin contact surface produces a lot of collagen and increases elasticity	Increased traction	Increased traction and retention effects
Type and shape	Mono type	Screw type	Twist type	Mono directional cutting cog	Bi-directional cutting cog
Fixation method	no	no	no	no	Reversed cog has retention effect
Required Technique level	*	*	*	**	***
Raw material & Effectiveness duration	PDO / 6 months	PDO / 6 months	PDO / 6 months	PDO / 6 months	PDO / 6 months
Specification	29G/6-0/3,5,7,9cm	26G/6-0/5,7cm 25G/5-0/5,7cm	27G/5-0/5,7cm 25G/4-0/7cm 23G/3-0/7,8,15cm	23G/4-0/6cm 23G/4-0/9cm	19G/1-0/14cm 19G/1-0/15cm 19G/1-0/18cm

	Cutting thread1	Cutting thread2	Cutting thread3	Molding thread	VXIL(Press Sculpting)
Tensile Strength	+	+	+++	+++ 37N (self-test results)	++++ 42N (self-test results)
Anchoring Strength	+	+	+++	++++	++++
Duration	+	+	+++	+++	++++
Tissue Trauma	++	++	+++	++++	++
Price	+	++	+++	++++	+++

Figure 5: Comparison among different types of PDO threads from 1st to 4th generation. It shows that VXIL has the strongest tensile and anchoring strength.

Other company's cutting barb	VXIL molding barb
The tensile strength is low because the strength of the barb part is weak	The tensile strength is high because the strength of barb part is strong

	VXIL	Other 1	Other 2	
Company	BISTOOL	*	*	
Cog	Shape			
	Type	Bi-directional Type	Helical Type	Bi-directional Type
	Features	No possibility of dimples	Dimples may occur if cogs are inserted into the skin surface	No possibility of dimples
	Number	12 cogs in 1cm	3 cogs in 1cm	8 cogs in 1cm

Figure 6: A manufacturing and geometric difference of VXIL. A molding barb of VXIL shows stronger tensile strength than cutting barb PDO threads. The type and number of cog in VXIL make a difference in clinical outcomes.

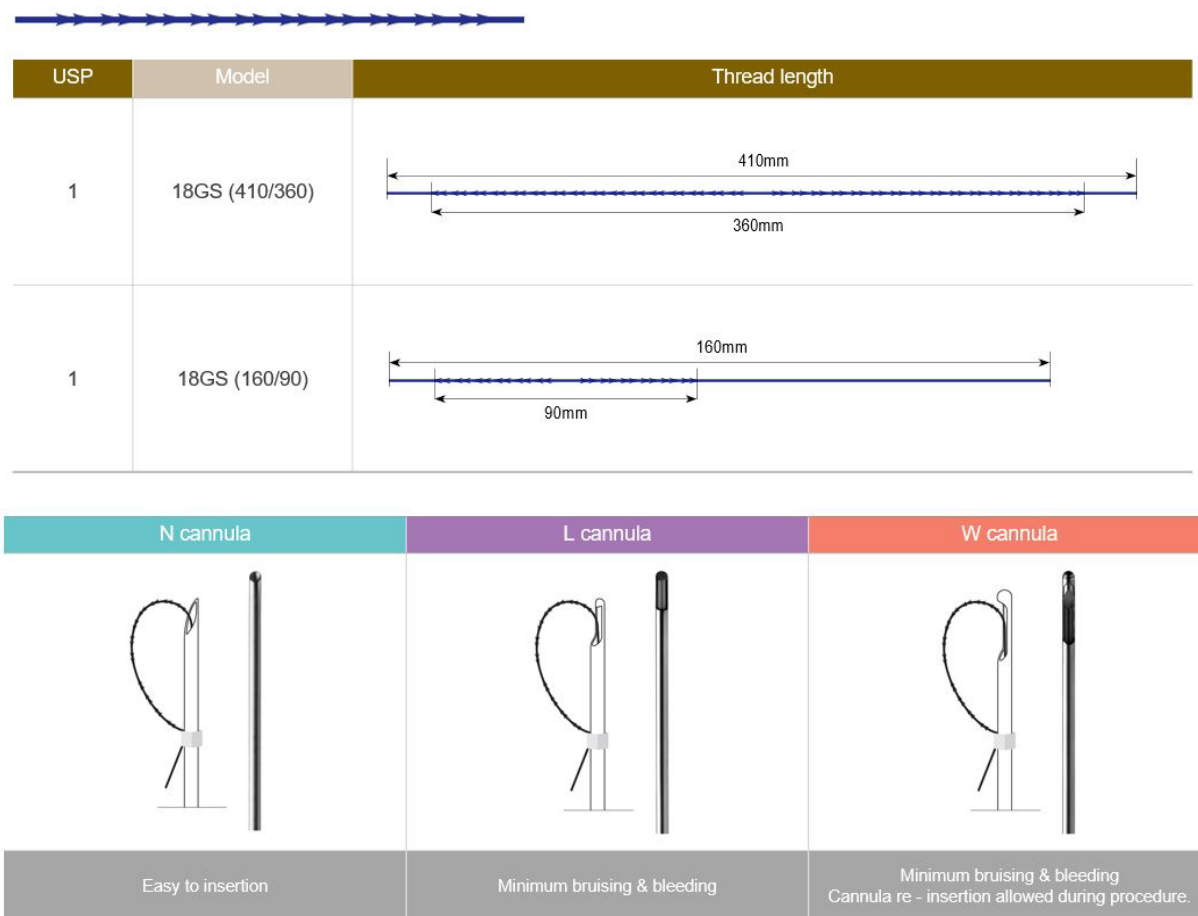


Figure 7: Types of VXIL according to the length of PDO threads. Different types of cannula according to the purpose. N type is easy to insert but more trauma is expected due to sharp end. L and W type has blunt end, thus less bruise and bleeding follow. W type is designed to allow re-insertion with different direction before pulling out the cannula.

Specification	Test method	Limits	Results
Strand Length	USP	≥ 98% of labeled length	≥ 98%
Diameter	EP	0.575 ~ 0.605	0.597 mm
Knot-pull tensile strength	EP	Initial ≥ 6.60 kgf	8.21 kgf
Retention test	MMS-001-S010	Initial ≥ 11.60 kgf	14.50 kgf
	MMS-001-S010	2 Weeks ≥ 75%	90.4%
Extractable Color	USP	Should not be darker than MS.	Conform
Water content	USP<921>	≤ 500 ppm	≤ 500 ppm
Residual monomer content	MMS-001-S010	≤ 1%	≤ 1%
Heavy metal	USP<231>	≤ 10 ppm	ND

N/A : Not Applicable
 ND : Not Detected

No.	Item	Standard	Test Criteria	Test Results
1	Cytotoxicity Test	ISO 10993-5	Shall be conformity, when tested in accordance test criterions.	Pass
2	Intracutaneous	ISO 10993-10	Shall be conformity, when tested in accordance test criterions.	Pass
3	Skin sensitization	ISO 10993-10	Shall be conformity, when tested in accordance test criterions.	Pass
4	Acute Systemic Toxicity	ISO 10993-11	Shall be conformity, when tested in accordance test criterions.	Pass
5	Pyrogen	ISO 10993-11	Shall be conformity, when tested in accordance test criterions.	Pass
6	Haemolysis	ISO 10993-4	Shall be conformity, when tested in accordance test criterions.	Pass

Figure 8: Analysis data of the VXIL threads shows distinguished superior tissue grip in performance test and minimized potential inflammatory reactions in biologic test.

Peeling back the layers of VXIL’s surgical protocol reveals a procedure rich in subtleties and intricacies. Every step, from initial facial assessment to post-operative care, is a meticulous dance of science and artistry. Detailed anatomical mapping, cognizance of potential risk zones, and selecting optimal insertion planes lay the foundation. Upon this bedrock, surgeons sculpt the aesthetic masterpiece, leveraging VXIL’s unique attributes. Precise depth calibration ensures threads remain invisible, nestled in their optimal plane. Nuanced vector analysis guarantees natural, harmonious elevation. The surgical journey doesn’t culminate with thread insertion. Surgeons emphasize bespoke post-operative care regimens, tailored to individual needs. (Figure 9) This could encompass lymphatic massages, facial relaxation techniques, or specific skincare protocols, all aimed at optimizing and prolonging the rejuvenation effects.

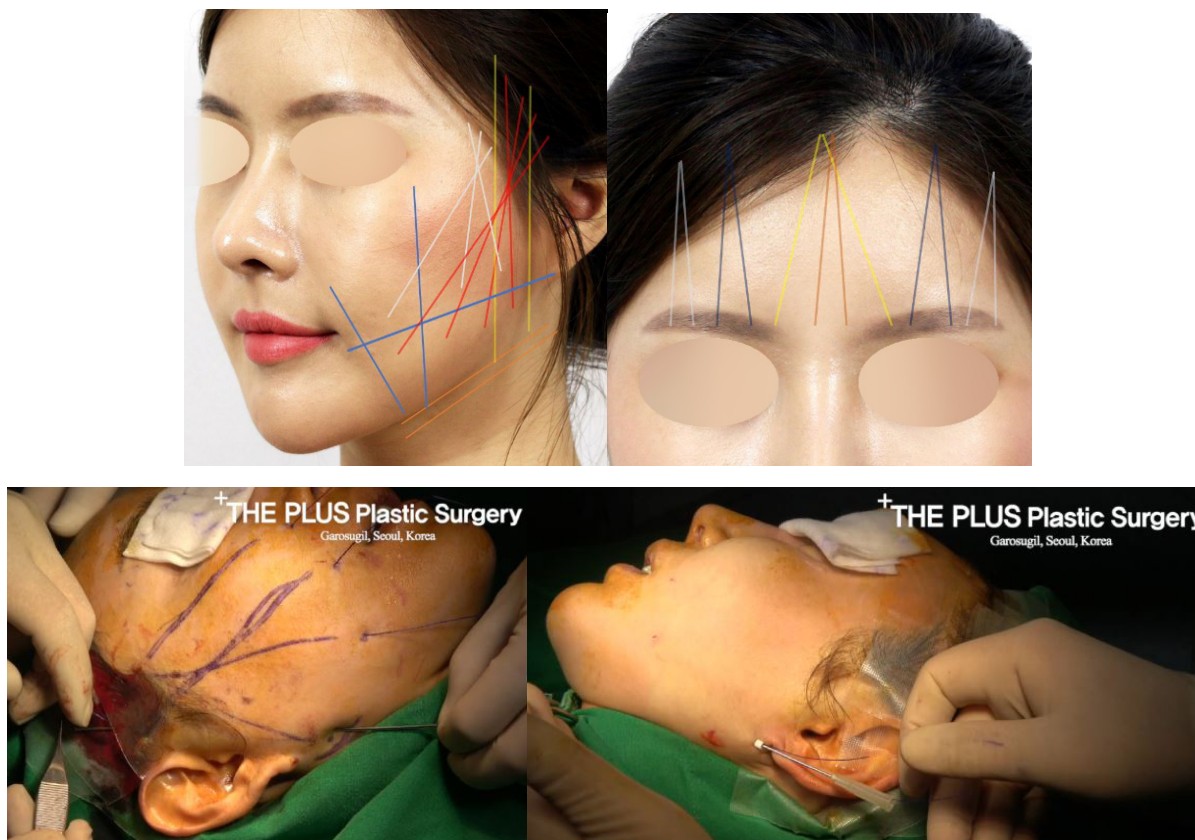


Figure 9: Various designs and procedures are available with different kinds of VXIL for facial rejuvenation including forehead, cheek, and jaw line.

Result

In the constantly evolving aesthetic universe, even revolutionary products like VXIL can't entirely negate procedural risks. For the astute surgeon, knowledge and preparedness are the best defenses. Even though complications with PDO thread lifting procedures are few, the most frequent complaints are bruising, swelling, facial asymmetries, skin dimpling, and, in some reports, infection. Most of the reported complications are not severe and usually do not require additional interventions [3]. While VXIL's superior design and quality standards considerably mitigate these risks, a surgeon's arsenal should always be equipped with mitigation and management strategies. (Figures 10,11) Any new technique requires a critical analysis of potential complications [4]. So far, there were no major complications such as infection and facial nerve damage with overall high satisfaction rate during VXIL thread lift.



Figure 10: A 69 year-old woman who complained droopy face. Thread lift using VXIL has been applied for entire face. Preoperative and postoperative 1-month view.



Figure 11: A 46 year-old woman who complained droopy face. Thread lift using VXIL has been applied for entire face. Preoperative and postoperative 6-month view.

Discussion

Aesthetic procedures using absorbable PDO threads are an interesting alternative for facial rejuvenation. Minimally invasive procedures to rejuvenate the aging face, such as the application of threads, are booming, with an increase greater than 100-fold since 1997 [5]. Different types of threads and techniques can be used depending on the patient's needs [3]. The technique using PDO thread does not require general anesthesia and avoided scarring, as an incision was not needed. The procedure was effective for uneven facial textures, slack midface, and minimal to moderate jowls in selected patients. The incidence of complications was low and not serious. Aesthetic procedures using PDO thread are a safe method for facial rejuvenation and lifting and there are many articles announcing

quite high satisfaction rate from the patients [5,6]. However, the number of publications related to PDO threads lift and its complications is limited in the literature [7]. In addition, the most important limitation of this technique is that it is indicated for a moderate degree of facial soft tissue laxity. Therefore, barbed suture lifting has shown a significant number of adverse events and an early recurrence of laxity [8]. There have been various efforts to reinforce the effect of PDO threads including stronger tensile strength as well as anchoring strength. Moreover, the efforts to reduce the side effects of PDO threads including tissue trauma and cytotoxicity. Actually, there is a report about the problems of some brand of PDO threads that is already approved by CE and sold in European Union. It shows that the material and safety data presented may enable improved thread design and inform clinical decision-making [1].

Conclusion

The aesthetic horizon is continuously expanding, with products like BISTOOL's VXIL charting its trajectory. More than a mere innovation, VXIL is a transformative leap, setting new benchmarks in non-invasive facial rejuvenation since VXIL has been improved in performance as well as the safety. As we stand at this exciting crossroads, embracing and mastering such pioneering tools ensures unparalleled patient satisfaction and heralds a new era in aesthetic excellence.

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