Contents

Keywords

Aging · Facial aging · Thread lifting · Thread lift · Facial rejuvenation · Nonsurgical · APTOS · PDO · Silhouette soft · Woffles threads · Nonsurgical facelift · Facial thread lift

Thread lifting, an increasingly popular technique in aesthetic medicine, has a rich and fascinating history that is inextricably tied to the evolution of materials science, technological innovations, and changing societal attitudes toward beauty and aging. This procedure, which uses sutures or "threads" to lift and tighten sagging skin, has undergone significant developments since its inception.

Over the years, society's perception of cosmetic treatments has undergone a transformative shift. Once considered a luxury reserved for the affluent and famous, these treatments have become increasingly democratized. The pursuit of health, well-being, and aesthetic enhancement is no longer confined to a select few but has become a global phenomenon. This transformation has been fueled by increased accessibility to both surgical and nonsurgical cosmetic procedures, competitive pricing, and substantial investment in the development of new nonsurgical techniques and technologies.

The past few decades have witnessed a significant evolution in nonsurgical aesthetic medicine. Innovations and advancements have democratized access to safe and effective rejuvenation and enhancement of the face and body. Aided by increased media attention and societal acceptance, the willingness of individuals to undergo such procedures has grown exponentially. The present-day aesthetic landscape is characterized by a preference for nonsurgical, quick, noninvasive, and natural modalities [1–4] A noteworthy trend is the increasing demand for cosmetic and antiaging treatments among younger patients [3]. This shift in demographic interest is evidenced by the reported doubling of millennials' usage of injectable cosmetic products from 2014 to 2020 [3].

Moreover, it is becoming internationally acceptable to have more frequent noninvasive or minimally invasive treatments over time for enhancement and antiaging, than extensive surgical procedures with an extended downtime [3].

This has spurred the development and popularization of various techniques and technologies aimed at mitigating and potentially reversing age-related changes. Among these, the use of absorbable sutures, or "thread lift" techniques, has seen a resurgence. These techniques leverage use of suture (threads) with various characteristics as a biostimulant and to enable soft tissue repositioning [5, 6].

The utilization of sutures is not a recent phenomenon; their application in facial and plastic surgery has a rich historical background. Some report the use of gold threads for facial rejuvenation as far back as ancient Egypt, though not proven [7]. Furthermore, in Asia, gold thread embedding acupuncture has been practiced, and its use for tightening facial tissues has become once more widespread. This process

triggers a mild inflammatory response, resulting in collagen deposition around the threads and subsequent tissue contraction and tightening [7–9]. One of the earliest threads used for lifting were the "gold/golden threads." However, these lacked an anchoring function, negating the "lifting" effect and leading to their eventual decline in popularity. These threads can be detected on radiographic head and neck scans such as Orthopantomogram (OPG) often leading to much confusion [9, 10]. This critical information should be incorporated into the training curricula for healthcare professionals, including dental surgeons.

Surgical sutures for facial tissue repositioning and hence rejuvenation go back to the 1950s (Dr Buttkewitz). In 1970, Rene Guillemain used special needles for thread implantation and presented the "Curl lift" technique in Paris. This technique is becoming popular once more, with studies reporting "long-lasting result procedure to elevate the eyebrows" [11].

In 1964, Dr. John Alcamo, a general surgeon, patented the use of his barbed sutures, and this was the first time this concept of the use of sutures without knots was first described. His sutures' patent was on barbed and unidirectional sutures (Fig. 1.1) [7, 12]. Soon afterwards, Dr. Alan McKenzie, an orthopedic surgeon,

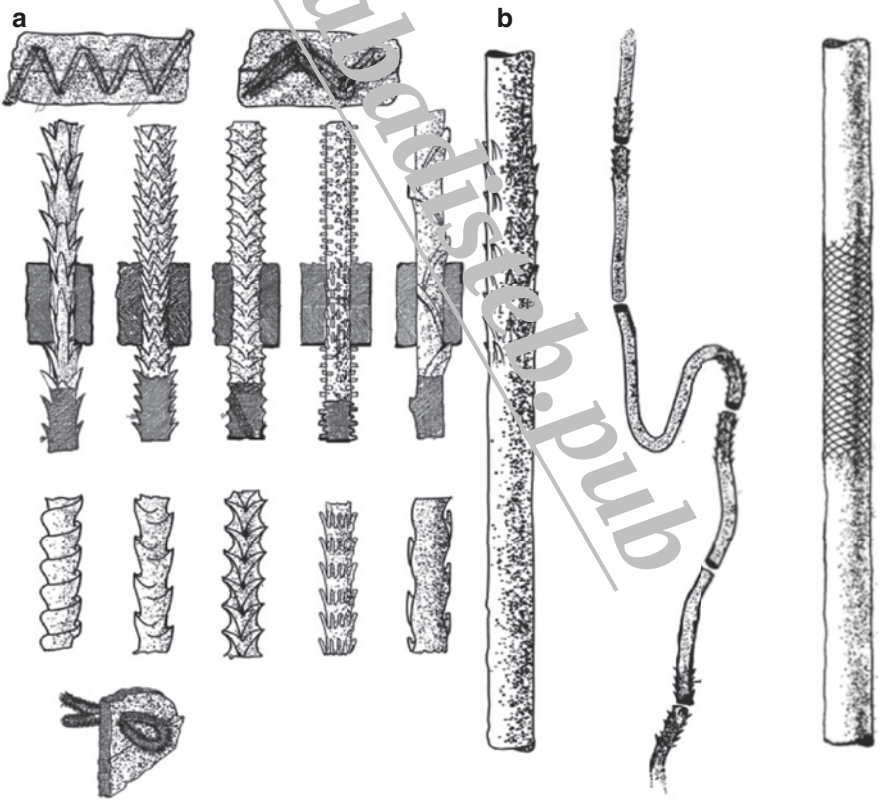

Fig. 1.1 Original drawings for barbed sutures (**a** and **b**). Reproduced from Alcamo JH. US Patent 3,123,077, 1964 [17]. Obtained from USPTO.gov websites

significant turn towards cosmetic applications, thanks to the pioneering work of Georgian plastic surgeons M. and G. Sulamanidze. [20, 21]. They introduced the first barbed threads for cosmetic surgery, branded as 'antiptosis' or APTOS threads—a name derived from the Greek words for 'against' and 'sagging.' Their innovation laid the groundwork for soft tissue thread lifting, which they had been presenting worldwide since 1996, thereby popularizing thread use for anti-aging and rejuvenation purposes [19].

Dr. Woffles Wu from Singapore envisioned and developed a barbed suture sling in 2002 (Woffles Threads). He combined the properties of a suture suspension sling with the self-retaining properties of the barbed threads. The Woffles thread is a blue Prolene 2.0 suture 30 cm in length with bidirectional barbs on either side of a 4 cm clear (non-barbed) zone at the midpoint of the thread enabling the thread to be folded at this point into a U-shaped sling. Clinical application of the Woffles Lift began in late 2002. He published nonsurgical "Woffles Lift," using long, barbed self-retaining slings which get inserted via a needle introducer to suspend loose, mobile and ptotic facial tissue (skin, subcutaneous fat, and SMAS of the lower face) to the dense tissue of the scalp (thick and immobile temporal fascia) [22].

In 2002, Drs Sassaki and Cohen used two needles with nylon thread combined with a surgical face lift [21, 23, 24]. Dr. Mathay, an expert from the Philippines, reported utilizing hypodermic needles to reduce his patients' nose tips. Nikolai Serdev, a professor at the New Bulgarian University, demonstrated comparable techniques with a cannula. Apart from removing various layers of soft face tissues, these procedures can secure the thread to the anchor zones, including fascia and periosteum, resulting in a long-lasting effect. The French surgeon Pierre Fournier's lectures and scholarly papers presented at numerous congresses and scientific conferences aided in the development of thread lifting techniques [19].

In 2003, Dr. Isse was inspired by Woffles Wu and APTOS threads and developed "Isse Endo Progressive Facelift Sutures" and consequently Silhouette Suture®

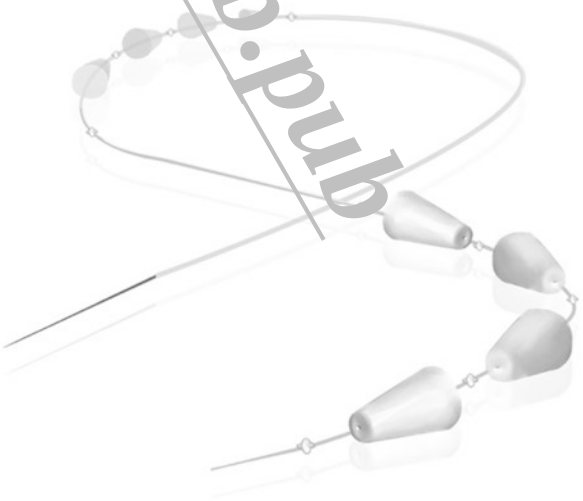

Fig. 1.3 Silhouette Suture® threads with "cones" throughout the threads

threads with "cones" along the threads (Fig. 1.3). These cones were placed on the threads to help increase the "holding" power of the threads on placement and resorption (8 months post-placement). This would produce an enhanced inflammatory response, causing new collagen formation and increasing the longevity of the effects [7, 25, 26].

Taking inspiration from Dr Fernandes and the APTOS suture, Wu developed Woffles lift and threads (60-cm length of 2–0 Prolene with two long barbed sections) and presented successful results in 2003 [7, 14].

Dr. Gregory Ruff designed Contour Threads, now known as Articulus, with opposing barbs and straight needles. It received FDA clearance in 2004. In his words: "Inspired by the quill of the North American porcupine, I envisioned a bidirectional array of barbs that could secure tissue without relying on constricting loops. One set of barbs could anchor the other." Knotless, strong, and "easy to place", barbed sutures (bidirectional and unidirectional formations) offered the potential to suspend ptotic tissues with no surgical intervention [13].

The primary objective of these sutures, also known as threads, was to realign the ptotic subcutaneous tissues, thereby creating a "lift" effect. Given their diverse material composition, lengths, sizes, and surface characteristics, these threads can be adapted for a multitude of applications. These include rejuvenating the face, neck, and body through strategic repositioning of soft tissues, wrinkle reduction, and volume enhancement [27, 28].

The rise of synthetic materials in the twentieth century catalyzed a revolution in thread lifting procedures. Threads were developed from a variety of materials, including polydioxanone (PDO), polycaprolactone (PCL), and poly-L-lactic acid (PLLA), each with distinct advantages and uses. These threads are absorbable, minimally invasive, and have helped improve the longevity and outcomes of thread lifting procedures.

The evolution of thread lifting has not been limited to materials alone. Over time, threads have been designed in various lengths, sizes, and with different surface characteristics to cater to the diverse aesthetic need of patients. Modern threads often feature barbs, cogs, or cones that aid in anchoring to the subcutaneous tissues, enhancing the lifting effect and tissue repositioning.

The application of thread lifting has also expanded beyond facial rejuvenation to include neck and body treatments. The ability to strategically reposition soft tissues, reduce rhytids, and enhance volume has made thread lifting a versatile tool in aesthetic medicine.

Today, thread lifting is considered a minimally invasive, in-office procedure that can be performed under local anesthesia. The procedure offers a relatively quick recovery time with immediate visible results, making it a popular choice for patients seeking nonsurgical cosmetic treatments.

The success of thread lifting procedures is influenced by a myriad of factors, including the type, quality, biocompatibility, and the mechanical, physical, and chemical properties of the threads used. The production process of these threads is equally crucial, playing a pivotal role in their clinical effectiveness and safety. Despite technological advancements, it's essential to recognise that thread lifting is

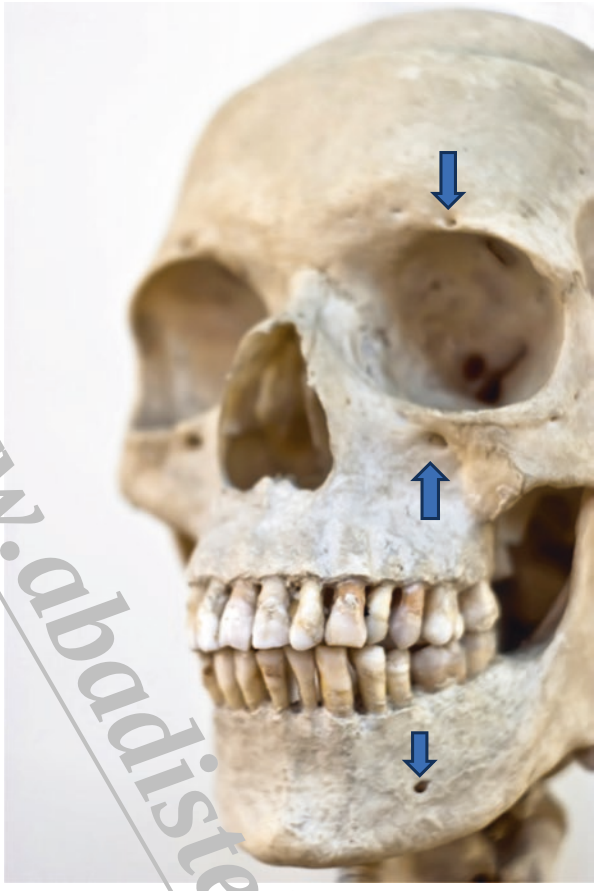

Fig. 2.2 Foramina: *Supraorbital, infraorbital, zygomaticofacial and mental. Image Credit: Shutterstock*

3. *Zygomaticofacial foramen*
   (a) It is present in the lateral wall of the zygomatic bone on each side and transmits the zygomaticofacial nerve.
4. *Mental foramen*
   (a) It is present inferior to the second premolar on the mandible and provides passage to the mental nerves and vessels [1].

Soft Tissue Layers

The facial structure can be characterised by five basic layers, most prominently observed in the scalp region (Fig. 2.3). These layers extend across the facial expanse, with noticeable modifications and compaction in various facial regions, serving functional adaptations (Fig. 2.4). Notably, the retaining ligaments and facial spaces

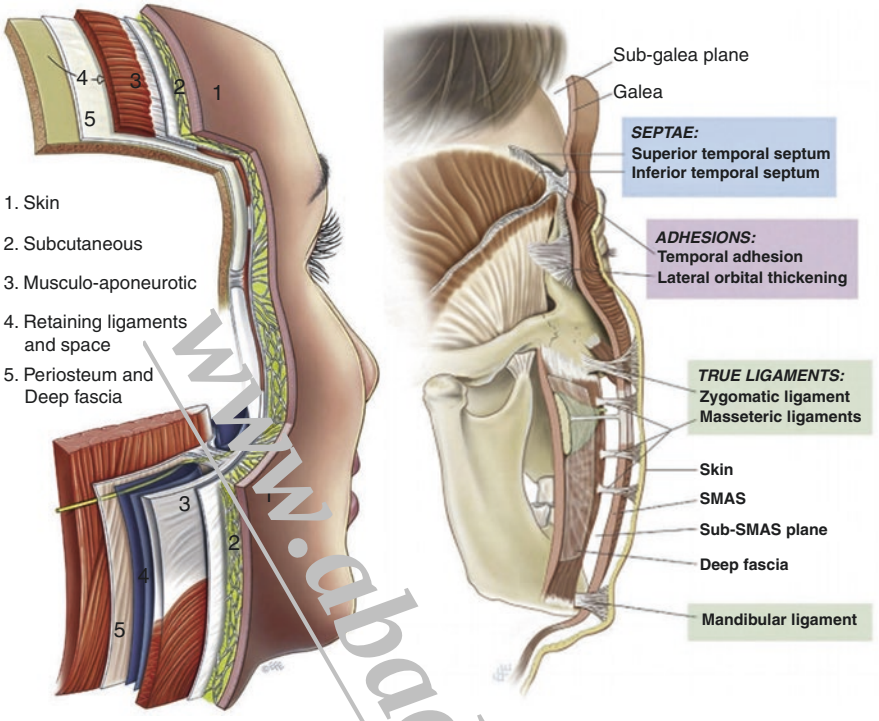

Fig. 2.3 The face is constructed of five basic layers. Reproduced with permission from Fitzgerald R, Carqueville J, Yang PT. An approach to structural facial rejuvenation with fillers in women. Int J Womens Dermatol. 2018 Dec 13;5(1):52–67

represent the layer undergoing the most significant modifications. These alterations underscore the dynamic nature of facial anatomy and the adaptability of its structures to fulfil their specific roles and requirements [4]. The primary five layers include [4]:

Facial layers can further be seen as (Fig. 2.4):

1. Skin
2. Superficial fat layer
3. Superficial musculoaponeurotic system (SMAS)
4. Retaining ligaments and spaces
5. Deep fat layer
6. Periosteum/deep fascia
7. Bone

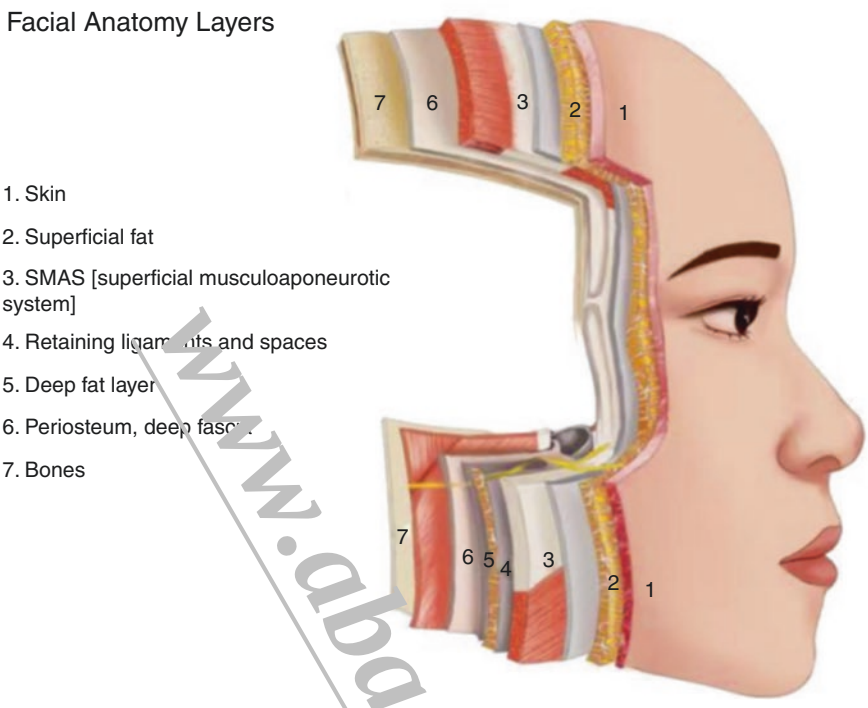

Fig. 2.4 Facial layers. There is significant modification and compaction of these layers in different parts of the face for functional adaptation

A recent study has reported a new layered arrangement for the forehead (Fig. 2.5) [5]:

- Layer 1: Skin
- Layer 2: Superficial fatty layer (superficial fat compartments)
- Layer 3: Suprafrontalis fascia
- Layer 4: Frontalis muscle
- Layer 5: A homogeneous layer of fat separated by the orbicularis retaining ligament and supraorbital ligamentous adhesion into three parts:
  - Preseptal fat
  - Retro-orbicularis fat
  - Retrofrontalis fat
- Layer 6: Subfrontalis fascia
- Layer 7: A supraperiosteal plane containing loose areolar connective tissue separated into compartments and deep fat
- Layer 8: Periosteum