

The Efficacy of Polycaprolactone Threads in Zygomatic and Mandibular Lifting: Consecutive Study from a Single Practitioner's Experience.

Kalyan R, Rafiq N and Wong V*

¹Federation V Medical Aesthetics Clinic, 64 Knightsbridge, London W1G 9PF, United Kingdom

*Corresponding author

Wong V, Federation V Medical Aesthetics Clinic, 64 Knightsbridge, London W1G 9PF, United Kingdom.

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Introduction

The ageing process brings with it characteristic changes to the dermal facial skin scaffolding, and its fat component. Connective tissue of the skin begins to wear thin, and elastic fibers undergo a collapse, causing noticeable weakening in prominent facial regions such as the cheeks, eyebrows, mandibular area and neck [1]. It is the dermatocalasis of facial and neck soft tissues, including the Superficial Muscular Aponeurotic System (SMAS), and the muscular tissue, that is culpable for the distinctive signs of ageing of the face [2]. Of all the facial ageing signs, emphasis can be placed on; The profile of the mandibular margin (which lacks previous clarity) resulting in the down-ageing of the jaw line, The presence of horizontal wrinkles on the forehead at which vertical ones add on to at the glabellar area, A downward sliding of the zygomatic malar region (middle face) being observed, The appearance of the lachrymal furrow and deepening of the naso-buccal and mandibular-bucco areas, The production of adipose bubbles resulting in the eyelid skin becoming saggy and protruding in correlation to the lower eyelid and Plasmatic parcel and cutaneous flabbiness disappearing from around the neck region [3].

The traditional facelift employed to correct facial ageing has thus far been an intricate and complex procedure associated with a lengthy recovery period [4]. The recent emergence of absorbable barbed sutures has paved the way for a non-invasive alternative technique that results in a lifting action countering the signs of facial ageing [5-13]. The barbs present on the surface of the threads permit their use in combination with additional non-surgical rejuvenation procedures such as botulinum toxin (which produces a six-month temporary effect), and substances possessing transient and volumizing filler properties. Supplementary non-surgical procedures include Radiofrequency, constrained to addressing only very superficial wrinkles, and Mesotherapy, the principles of which suggest that so-called useful chemicals are deposited under the skin to increase their effectiveness in skin rejuvenation, and improve tone [14]. The barbs located along the course of the thread act as 'hooks' to lift and support soft tissues of the face, forming a supportive structure that lifts the sagging skin [5,7]. It is a novel approach, going some way to achieving a safe and gentle reduction in the signs of facial ageing. The threads are categorized as non-absorbable or absorbable depending on the material they are composed of [10].

This research is a consecutive study to analyze the use of polycaprolactone threads for soft tissue lifting in the face. The aim of the study was to evaluate the outcomes associated with this type of threads in relation to soft tissue lifting in the zygomatic and mandibular areas of the face.

Materials And Methods Polycaprolactone Threads

The threads used in this study are absorbable, monofilament, suspension threads of synthetic origin (caprolactone). This study utilized two types of lifting threads:

- Free floating threads

These bidirectional threads were used for zygomatic area. A mixture of 12cm and 23cm long threads were used (2.0 usp caliber). The free floating threads were introduced into the hypoderm with the assistance of cannula (Length 9/15 cm, 21G caliber)

- Double needle threads

The double needle threads were used for the jaw line and sub mental area. They are convergent bidirectional threads with length of 12cm or 23 cm (2.0 usp caliber), a straight 24G needle of either 9cm or 15 cm is attached to each end of the thread.

Patient Selection

Twenty-three female patients, aged between 32 and 57 years old, who had thread lifting procedure with polycaprolactone threads between December 2016 and March 2017 were included. All participants had sagging soft tissue and required mild to moderate lifting. Patients with marked nasolabial folds slightly defined mandibular contour and relaxed neck and chin with skin-folds were considered suitable. Patients with advanced signs of ageing (such as facial lipoatrophy), overabundance of skin, very advanced cutaneous-muscular prolapse and diagnosed pathologies were excluded. All participants gave informed written consent for the procedures and completed an extensive medical questionnaire. Before and after photos were also taken with consent for evaluation.

Treatment Protocol

The polycaprolactone threads were inserted in hypodermic tissues of the face. The treated areas were numbed with local anaesthetic injections (2% lidocaine with adrenaline). The free floating threads were introduced into the subdermal tissues of the zygomatic area with a cannula needle (20/21G, 24 cm). Each thread was

inserted inside the needle carefully so to not damage the barbs. Subsequently, the cannula needle was removed, leaving the thread in its place. For jaw line redefinition, the double needle threads were inserted directly into the subcutaneous tissues using the needles attached to the threads. The first needle goes from the angle of the mandible to the temporal region and the second runs on the horizontal ramus of the mandible to a point medial to the pre jowl sulcus. In order to avoid thread displacement, all patients were advised to refrain from vigorous exercises and rubbing on the treated areas for the first 3 weeks.

Evaluation Protocol

Photographs of the treated areas were taken from different angles before the procedure, immediately after, and one month post procedure. The photos were scored using the Global Aesthetic Improvement Scale (GAIS) (Table 1) independently by a third party. Each participant also filled out a Patient Satisfaction Questionnaire (Appendix A) before treatment and at 1-month follow up, where they scored the overall appearance of the treated area, along with its definition and amount of tissue sagging on a 5-point scale. Patients were also asked to score their overall satisfaction and if they would have the procedure repeated in future. All scores were analyzed using Wilcoxon's signed rank test for nonparametric dependent continuous variables. SPSS software (version 17.00, SPSS, Chicago, USA) was used for statistical analysis. A P (two tailed) value of 0.05 was considered to indicate statistical significance.

Results

Significant improvement was observed in all patients, with 5 patients having good results (21.7%), 10 very improved patients (43.5%) and 8 patients with exceptional improvement (34.8%). Patients' perceived overall appearance of the treated area improved significantly from an average score of 2.04 to 4.0 ($p < 0.05$). The perceived definition of the treated area also increased from 2.04 to 3.78, which correlates with the reduction in perceived amount of tissue sagging from 3.91 to 2.14. Both scores achieved statistical significance at $p < 0.05$. Fifteen patients (65.21%) were satisfied with the treatment and six patients (26%) were highly satisfied. Two patients (8.79%) were neither satisfied nor dissatisfied. Twenty-two patients (95.65%) would have the procedure repeated.

The most frequent minor complications at 2-week follow up were bruising, observed in 20 patients (86.96%), and mild skin puckering in eleven patients (47.83%). Mild erythema was observed in five patients (21.74%) at the follow up appointment. No other complications were observed throughout the study period and no patients asked for the removal of the threads post-procedure.

Conclusion

Our study indicates that sub-dermal suspension with polycaprolactone threads in the zygomatic and mandibular regions is an efficient and safe procedure to provide mild to moderate soft tissue lifting. The procedures are performed under local anaesthesia, thus reducing the recovery period. The techniques used can be carried out in outpatient clinics with very minimal bleeding and discomfort to the patient.

Discussion

Innovations in operative techniques generally contribute to enhanced results, greater patient satisfaction and decreased operative morbidity [1,4]. The results of this study have exhibited that the use

of polycaprolactone threads is a safe and successful technique for facial rejuvenation. The thread's mechanism of action produces an immediate lifting of the tissue due to its mechanical properties, thus directly addressing the fallen areas of skin being treated. It is the orientation of the threads' barbs, strategically placed in two directions (divergent and opposite) that permits this desirable effect, in comparison to the middle point of the thread. The reactive strength generated from both its sides enable the connection of tissue on each barb, giving rise to the barbs 'hook' function, and simultaneously prevents unwanted sliding and movement of the thread in the two opposite directions. Anchorage points on the superior and inferior part of the facial anatomic region are therefore not required to provide lift due to the specific geometric properties of the threads. Once correctly positioned in the subcutaneous tissue, the threads will maintain their continual sustaining action on the tissues being treated.

The results obtained failed to detect any significant acute inflammatory response following treatment with polycaprolactone threads. The absence of such a response would therefore suggest that the desirable lifting result achieved can be attributed to the fibrosis reaction occurring along the length of the thread. Due to these reactions, the lifting effect achieved can be sustained, even following the thread's complete re-absorption after 12-15 months.

Polycaprolactone (PCA) threads possess distinct advantageous properties in comparison to the other commercially available threads. Polydioxanone threads (PDO), for instance, work in a similar fashion to PCA's in that their absorption also occurs through hydrolysis reactions. Like PCA, PDO triggers fibroblasts to produce collagen at the desired site. However, due to their component parts, PDOs only remain present in the subcutaneous tissue for six months. The monofilament PDO subcategory is also inferior to PCA in that they are barbless, restricting their usefulness further. Following the emergence of PDOs, Polylactic Acid threads (PLA) were developed and found their place in facial rejuvenation. Their slightly more complex formation accommodates the 'hook' function through the use of cones to achieve a lifting and volumizing effect of sagging areas of the skin. Again, like PCAs, PLAs are similar in their mode of action as they are both absorbable, and both act to regenerate collagen and hyaluronic acid through fibrosis, although again for a shorter duration than PCAs (around 12 months). Arguably, the greatest advantage of PCA over PDO and PLA threads is that it possesses the ability to initialize the production of type 1 and type 3 collagen. In contrast, PDO and PLA threads are limited in their abilities to only stimulate the production of type 1 collagen. This, coupled with the PCA threads' longer duration of action, renders it as a leading option when considering such treatments in facial rejuvenation.

Imperatively, one of the limitations of this technique lies in its indication to treat moderate cutaneous falling. For overabundant, severe tissue falling, traditional lifting would remain the order of the day. That being said, studies involving different barbed suture lifting have returned results claiming the occurrence of a significant number of adverse events, and high early recurrence rates [16, 17]. Therefore, given the results obtained from this study, the assumption that increasing the sample size of patients treated with polycaprolactone threads would continue to produce positive results is a feasible one to make. However, another limitation to this study was the relatively modest sample size of 23 patients being used. A follow up study would certainly warrant a larger

sample size to cement the findings from this study. A follow up of the results achieved after the 12-15 month duration of action would also certainly provide useful data in analyzing the longevity of PCA threads, as well as providing a platform to assess patient satisfaction following the complete re-absorption of the devices.

Finally, an important consideration when analyzing the results obtained from this study is the vetting process used to select the patients who constituted the sample population. For PCA threads, the most appropriate candidates would be those with relatively mild signs of ageing, and those requiring a relatively modest degree of lifting. In cases where more advanced and prolific signs of ageing are evident, traditional invasive and direct surgical intervention would be better suited. It is therefore imperative that strict selection criteria must be applied when selecting patients to undergo treatment using PCA threads.

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