



RESEARCH ARTICLE

Application of Platelet-rich plasma combined thread lifting in facial rejuvenation

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Abstract:

Background and Objective: Over the years, the use of platelet-rich plasma (PRP) and thread lifting in facial rejuvenation has become increasingly widespread. However, it is still difficult to fully meet the expectations of patients and therapists using PRP alone or thread-lifting alone. The objective of this study was to observe the synergistic effect of PRP and thread lifting on facial rejuvenation.

Methods: Between January 2015 and September 2017, 30 patients (2 men and 28 women) were selected for this study. Combined use of PRP and thread-lifting with absorbable barbed poly(para-dioxanone)(PPDO) threads for facial rejuvenation. Efficacy and adverse effects were investigated by patients and physicians at the end of the treatment.

Results: 28 of the 30 participants completed the treatment and study and were followed up for 3–12 months. After a series of treatments, most of the participants achieved satisfactory results. The total subjective satisfaction scores assessed by the participants and physicians were 89.28% and 92.86%, respectively. No serious complications, such as allergies, severe swelling, hemorrhage, infection, or nerve damage, were found.

Conclusion: The combined use of PRP and thread lifting is a safe and effective method for facial rejuvenation, with a lower risk of complications.

Abbreviations: ECM = extracellular matrix, PPDO = poly(para-dioxanone), PRP = platelet-rich plasma.

Key words: platelet-rich plasma (PRP), rejuvenation, skin aging, thread lifting

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1 | INTRODUCTION

As the largest organ in the human body, the skin gradually ages under the influence of both internal and external factors. Aging of the skin is a complex process. Factors that cause skin aging include intrinsic aging (genetic and hormonal influences) and extrinsic aging (ultraviolet light radiation, smoking, diet, chemicals, trauma, etc.). [1]. There are many signs that change with skin age, including wrinkles, poor texture, lack of firmness, xerosis cutis, and pigmentation heterogeneities. The face is continuously exposed to sunlight and gravity, resulting in pronounced facial skin aging.

Facial lifting surgery for rejuvenation requires extensive dissection of soft tissue on the face and a long recovery time. The incidence of complications is high. Minimally invasive cosmetic surgery is becoming increasingly popular. Some minimally invasive anti-aging methods such as lasers and microneedles activate fibroblasts to promote extracellular matrix (ECM) synthesis by damaging the skin, which may induce ECM remodeling by stimulating the removal of photodamaged ECM components and inducing the synthesis of new collagen by fibroblasts [2]. Simultaneously, PRP treatment can also promote the proliferation and differentiation of various cells, including stem cells, increase the expression of cyclin A protein, and upregulate the expression of type I collagen, MMP-1, and MMP-2[3-5]. During the last decade, the use of PRP for facial rejuvenation has become increasingly widespread owing to its powerful repair and regeneration functions [6]. Simultaneously, the thread-lifting technique for facial rejuvenation has become more common and popular in aesthetics.

Previous studies have confirmed that thread lifting is a safe and effective way to achieve facial rejuvenation without incisions and subsequent recovery time of a traditional rhytidectomy [7]. Both PRP and thread-lifting can be used for facial rejuvenation. Theoretically, the combined use of PRP and thread lifting should have synergistic effects. Few studies have investigated the use of PRP combined with thread lifting in facial rejuvenation. The purpose of this study was to determine whether the combination of PRP and thread lifting had a synergistic effect on facial rejuvenation.

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Participants, materials and methods:

The present study was approved by the Ethics Committee (blinded for peer review process). All participants signed an informed consent form before the study.

Cannot participate in research when participants have the following:

Participants:

From January 2015 to September 2017, 30 participants (2 men and 28 women; mean age , 37.4 years; range, 22–50 years) were selected for this study. Participants cannot participate in the study if they have diseases that affect the quantity and quality of platelets, such as diabetes and immunodeficiency.

Materials:

An automatic blood cell analyzer (BC-3000, Shenzhen Mindray) was used. Low-speed large-capacity centrifuge (Shanghai Anting, TDL-5-A). Barbed PPDO suspension thread (America, Johnson & Johnson)

PRP preparation:

PRP was prepared using two centrifugation steps ($900 \times g$ for 5 min and $1500 \times g$ for 15 min). The blood volume was approximately 40 ml each time. After the second centrifugation, platelet-poor plasma (PPP) was removed, and the PLT pellets were suspended in plasma. Finally, the PRP was activated by adding thrombin and calcium (PRP: thrombin: calcium gluconate). =10:1:1).The PLT counts in the whole blood and PRP are shown in Table 1.

2 | METHODS

The degree of sagging of the face and thickness of the subcutaneous fat were evaluated, and the treatment plan was determined before surgery. The soft tissue was gently pushed by hand, and when the direction was right, the contour of the face improved. This was the course during which the barbed PPDO threads traveled. The position of the needle was determined, and it was selected as far as possible at the hairline or concealed part. The course of the barbed PPDO threads on the patient's face was marked.

The face was routinely sterilized, and the operation was performed under local or nerve block anesthesia. Anesthetic configuration included 2% lidocaine 5 ml of normal saline 15 ml, and epinephrine hydrochloride 0.1 mg. After anesthesia was satisfactory, an 18G needle was used to puncture the needle into the skin, which was then used the puncture needle to enter the entry point at an angle of 30° - 45° , and entered the area to be lifted under the subcutaneous or the superficial muscular aponeurotic system (SMAS) layer. Subsequently, the sagging skin was gently pushed using the left hand.

Before the puncture guide needle was pulled out of the right hand, the prepared PRP and PPP were pushed into it (**Figure 1,2**). Each thread course was injected with 0.1 ml -0.2 ml PRP and PPP. The barbed PPDO threads were tightened, SMAS layer was fully tightened, sagging soft tissue was lifted, and exposed thread was trimmed.

Postoperative treatment:

Severe facial expression movements should be avoided after surgery. Avoiding pressure on the operation area. Do not touch the water to the treatment site within 24 h of treatment. Intermittent ice was applied within 48 h of treatment, 15-30 minutes each time, and the ice bag was covered with a disinfecting towel. The wound was kept clean and dry within 3 days after surgery. After the operation, the patient was reexamined once per week. After 4 weeks, PRP was injected into the face for a total of 3-4 injections. The treatment interval was two weeks.

Outcome evaluation:

The effectiveness and side effects of the treatment were assessed by the following parameters before, during, and during the follow-up: wrinkles (nasal and lip grooves, neck lines, crow's feet); skin texture (enlarged pores, rough skin, telangiectasia); skin sagging (eye bags); pigmentation (dark eye circles); facial tissue atrophy. Subjective satisfaction was assessed by the participants and physicians after the completion of follow-up. (**Table 2, 3**)

Participants' subjective satisfaction:

Participants estimated their satisfaction with the treatment by themselves. When the degree of improvement was $\leq 25\%$, the results were considered unsatisfactory. The evaluation results were satisfactory when the degree of improvement was greater than 25% [moderate satisfaction (26–50% improvement), good satisfaction (51–75%), and excellent satisfaction ($>75\%$)].

Physicians' subjective satisfaction:

Two experienced physicians compared the photographs before and after treatment to assess satisfaction. If the evaluation of the same patient by two physicians was inconsistent, follow the record of poor evaluation (for example, physician A was satisfied with the evaluation result of one patient, and if the result of doctor evaluation result evaluated by physician was unsatisfactory, it was recorded as unsatisfactory). When the degree of improvement was $\leq 25\%$, the results were considered unsatisfactory. The evaluation results were satisfactory when the degree of improvement was greater than 25% [moderate satisfaction (26–50% improvement), good

satisfaction (51–75%), and excellent satisfaction ($>75\%$)].

RESULTS

28 of the 30 participants completed the treatment and study and were followed up for 3–12 months. After a series of treatments, most participants achieved satisfactory results (**Figures 3–5**). The total subjective satisfaction assessed by participants and physicians was 89.28% [not satisfied (three cases), moderate satisfaction (five cases), good satisfaction (six cases), and excellent satisfaction (fourteen cases)] and 92.86% [not satisfied (two cases), moderate satisfaction (five cases), good satisfaction (eight cases), and excellent satisfaction (13 cases)], respectively. No serious complications, such as allergies, severe swelling, hemorrhage, infection, or nerve damage, were observed.

Six patients had mild bruises on their skin and recovered naturally after 1 week. There were two cases of mild asymmetry of the face and depression of one side of the face. After injection of hyaluronic acid, it was corrected. In 2 cases, the thread was exposed and cut off again. No other complications such as allergies, nerve damage, or infection occurred.

DISCUSSION

Facial aging is a multi-factor, complex process that affects the appearance of an individual and, thus, affects their quality of life. Facial aging involves various anatomical structures of the face, including the skin, subcutaneous tissue, ligaments, fat, and bones [8]. Subcutaneous adipose tissue reduction and local accumulation, retaining ligament relaxation, muscle atrophy, and bone tissue absorption are all causes of facial aging [9]. It is mainly characterized by wrinkles, poor texture, loss of elasticity, loss of luster, lack of firmness, xerosis cutis, and pigmentation heterogeneity [10]. Face rejuvenation refers to various methods that enable an aging face to rejuvenate its appearance (shape, anatomy, and physiological structure). There are a variety of treatments, including various types of soft tissue fillers[11] (hyaluronic acid, collagen, autologous fat transplantation), cosmeceuticals, botulinum toxin, laser, intense pulsed light and radiofrequency therapy, ultrasound, chemical peeling, microneedling, plasma skin regeneration, thread-lifting, PRP, stem cell-based therapies, and invasive surgery.

PRP consists of a small volume of plasma with platelet concentrations higher than those of normal peripheral blood. Platelets in PRP are activated to release a variety of biologically active substances, including growth

factors and proteins, including anti-aging proteins. The synergistic effects of these bioactive components may promote cell migration, attachment, proliferation, differentiation, extracellular matrix (ECM) accumulation, collagen production, and fibroblast multiplication in aged skin [12].

Several studies have shown that PRP can be used to treat skin aging and achieve skin rejuvenation. Gawdat et al. showed that it is effective and safe for skin rejuvenation, comparable to readymade growth factors, with higher patient satisfaction, fewer side effects, and more sustainable results [6]. Cameli et al. demonstrated that PRP poor in leukocytes can provide objective improvements in the skin texture. Gross skin elasticity, skin smoothness parameters, skin barrier function, and capacitance were significantly improved after PRP injection [13]. Mehryan et al. assessed the effect of P-PRP on infraorbital dark circles and crow feet. They found that the improvement in infraorbital color homogeneity was statistically significant, but no statistically significant changes were observed in melanin content, stratum corneum hydration, wrinkle volume, or visibility index [14]. Yuksel et al. applied P-PRP three times at 2-week intervals in ten healthy volunteers and found a statistically significant difference between the general appearance, skin firmness, sagging, and wrinkle state before and after the application [15]. Alshami et al. reported that PRP is a useful treatment for periorbital hyperpigmentation [16].

Studies by Hersant et al. showed that combining PRP and hyaluronic acid seems to be a promising treatment for facial rejuvenation, with a very significant improvement in facial appearance and skin elasticity compared to PRP or hyaluronic acid alone [17].

In recent years, with the widespread use of thread-lifting for facial rejuvenation, it is an excellent choice for patients who are expected to have younger skin and are reluctant to undergo invasive surgery. Threads used for lifting can be classified as absorbable or nonabsorbable. Fukaya et al. [18] found that the rejuvenation effect of the insoluble thread-lifting procedure decreased during the first 11 months after the operation and increased one year after the procedure. However, non-absorbable threads remain permanently in the tissue and may result in complications. Therefore, absorbent threads have become increasingly popular. Lee et al. [19] achieved the desired facial rejuvenation using polydioxanone thread in Asians. Bellity et al. [20] showed that the use of absorbable barbed sutures can yield a natural effect caused by the

mobilization and strong fixation of the nasolabial fat and jowl fat in the direction opposite to their displacement. Baek et al. [21] showed that the procedure using an absorbable casting barbed thread for the correction of nasolabial folds and lower facial drooping is a favorable technique.

However, it is still difficult to fully meet the expectations of the therapist using PRP alone or thread-lifting alone. In cosmetic surgery, doctors often combine a variety of aesthetic therapies to improve skin aging, promote skin rejuvenation, and achieve satisfactory results [22]. However, most studies have evaluated the potential facial rejuvenation effect of PRP in combination therapies with other methods, such as microneedling, soft tissue fillers, lasers, and fat grafting. Few studies have investigated the use of PRP and thread lifting for facial rejuvenation. Both PRP and thread-lifting can be used for facial rejuvenation. Theoretically, the combined use of PRP and thread lifting should have synergistic effects. Ali et al. [23] reported that significant facial rejuvenation is obtained by thread lifting and highly augmented results when combined with Botox, fillers, and/or PRP rejuvenation.

This study showed satisfactory results for facial rejuvenation when combined with thread-lifted PRP. After a series of treatments, the total satisfaction rates assessed by the participants and physicians were 89.28% and 92.86%, respectively. However, PRP and thread-lifting treatments are ineffective in treating facial tissue atrophy. No serious complications, such as allergies, severe swelling, hemorrhage, infection, or nerve damage, were observed.

The combined use of PRP with thread-lifting has the following synergistic effects: PRP contains leukocytes and directly releases antibacterial peptides, which can reduce inflammation and even reduce pain [24]; the hemostasis and coagulation effects of platelets prevent the occurrence of hematoma after thread lifting; and the combination of PRP and PPDO enhances the stimulation and regeneration effect of aging tissues. This can achieve a comprehensive effect of treating facial wrinkles, improving skin texture, tightening pores, and brightening the skin tone. In addition, PPP can promote tissue repair and regeneration [25,26]. PPP contains high concentrations of fibrinogen [27]. Therefore, we injected PPP into the tissue cavity caused by thread lifting, hoping that this could play a role in tissue augmentation, tissue regeneration, and reduced exudation.

This study showed the synergistic effect of PRP combined with thread lifting. However, PRP combined

with thread lifting was ineffective in treating facial tissue atrophy. It can be combined with botulinum toxin, hyaluronic acid, fat transplantation, lasers, surgery, and other methods to comprehensively rejuvenate the face and develop individualized treatment plans, which may yield better results. However, Bulam et al.[28] reported that PRP might inhibit the effects of botulinum toxin type-A. In addition, side effects should be considered when combining PRP with thread lifting. The possible side effects include no improvement in the treatment area, pain infection, allergic reaction, skin discoloration, facial asymmetry, ecchymosis, hematoma, recurrence, extrusion, inclusion cysts, and other severe complications such as nerve damage, significant scarring, blindness, and induced skin cancer [29-31].

CONCLUSION

The combined use of PRP and thread lifting is a safe and effective method for facial rejuvenation, with a lower risk of complications. However, the number of cases in this study was small and there was a lack of rigorous controlled studies. Further better-designed, multicenter, large-sample, split-faced, long-term randomized controlled trials are needed to confirm the preliminary results of our study.

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ETHICAL APPROVAL

All authors declare that the present study was conducted with approval from the Ethics Committee. All participants signed an informed consent form before the study.

Disclosure statement

No potential conflict of interest was reported by the authors.

Author contributions

All authors participated in the review of the manuscript.

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Figure legends



Figure1. The threads were implanted under under the subcutaneous or the SMAS layer (a), and the prepared PRP and PPP were slowly injected into the catheter of the embedding threads with a 1 ml syringe, and then the guide needles were pulled out(b–c).

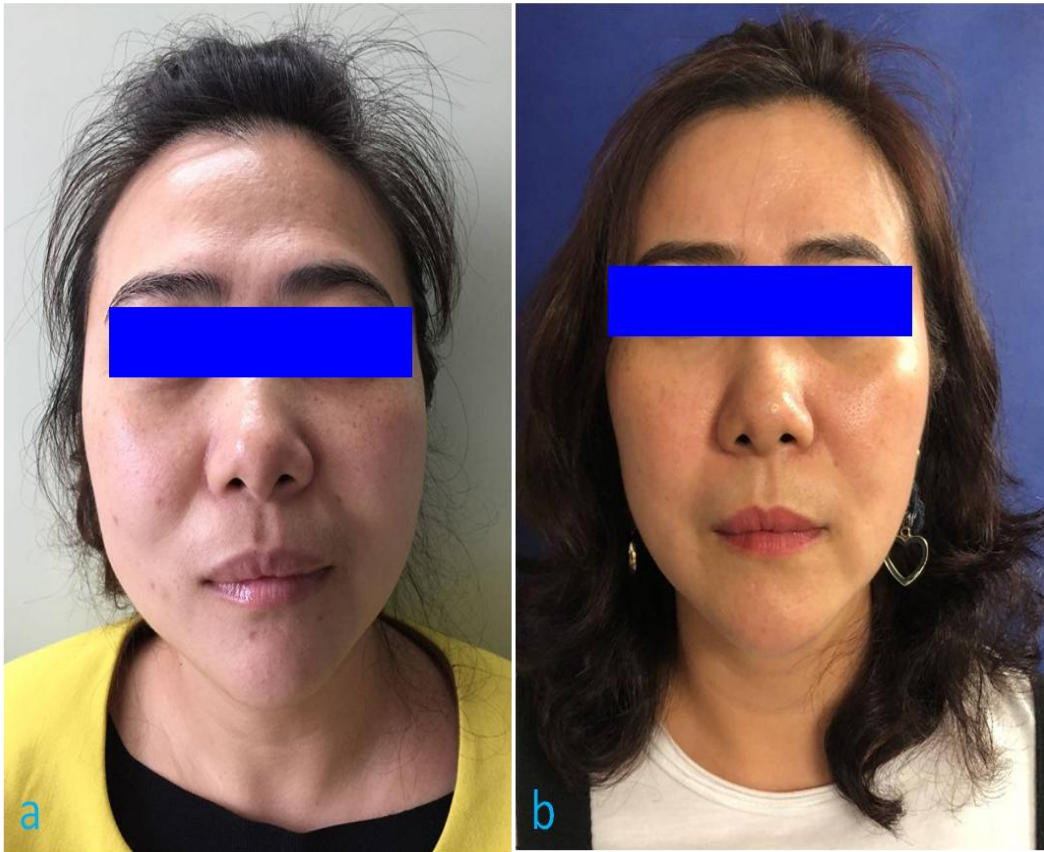


Figure 2. 46-year-old female. Pretreatment (a), Immediately after treatment (b).

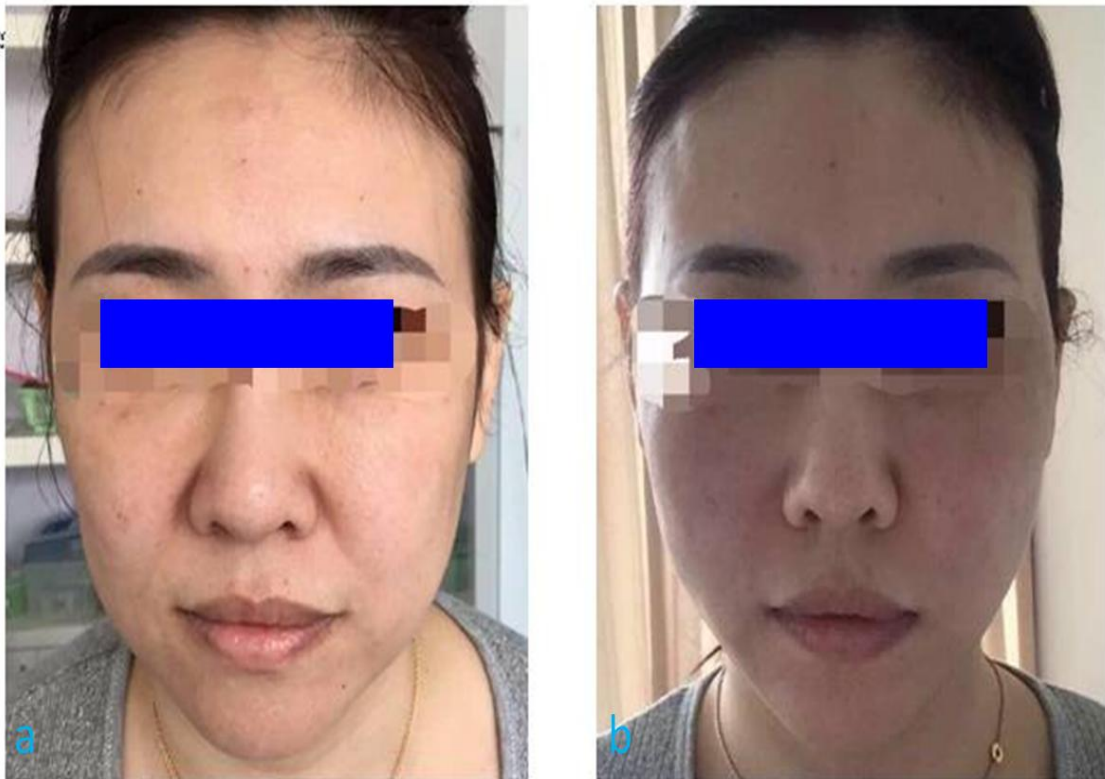


Figure 3 46-year-old female. Pretreatment (a), four months after treatment (b).



Figure 4. 36-year-old female. Pretreatment (a), three months after treatment (b).



Figure 5. 46-year-old male. Pretreatment (a), three months after treatment (b).