

## Research Article

# Autologous Plasma Gel as an Effective Method of Facial Volume Restoration and Skin Rejuvenation

Lidia Majewska 

*ESME Clinic, Kraków, Poland*

Correspondence should be addressed to Lidia Majewska; [drlmajewska@gmail.com](mailto:drlmajewska@gmail.com)

Received 26 December 2022; Revised 8 June 2023; Accepted 29 July 2023; Published 11 August 2023

Academic Editor: Raúl Cabrera

Copyright © 2023 Lidia Majewska. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

The primary aim of this retrospective study was to investigate the potential effectiveness of autologous platelet gel as a method for facial volume restoration and skin rejuvenation. High-frequency ultrasonography was utilized to assess the outcomes of the treatment. The study included a cohort of ten female patients aged between 40 and 50 who actively participated in the research. They reported moderate-to-severe static and dynamic wrinkles, volume loss, thinning, and roughness of the skin. Each patient received one session of autologous platelet gel injections. The gel was prepared accordingly with the manufacturer's (INNMEDIS, ATR™) instructions. Medium viscosity gel was injected into the superficial subdermal fat pads in the temples, as well as in the middle and lower face areas, to improve facial volume. A high-frequency ultrasound (US) device was employed to quantify skin density, skin thickness, and the depth of nasolabial folds. The US images were captured at three time points: before gel administration, one month after the procedure, and three months after the procedure. The imaging focused on the nasolabial folds area to monitor changes and assess the effectiveness of the treatment over time. Based on the analyses, the use of autologous platelet gel is beneficial towards improving skin density and decreasing nasolabial fold depth. However, further research should be conducted into the gel's effects on dermis thickness to achieve a stronger, more statistically significant conclusion. The level of satisfaction of the enrolled patients regarding their facial appearance was evaluated using the visual analogue scale (VAS). The VAS assessment revealed an average score of 4.1 before the commencement of the treatment, an average score of 7.9 one month after the treatment, and an average score of 7.5 three months following the treatment. The results indicate a significant increase in patient satisfaction following treatment completion. Autologous platelet gel appears to hold promise as a treatment option for volume replacement and skin rejuvenation, making it an attractive choice for individuals seeking natural skin treatments. Despite the encouraging findings from this observation, further validation is required through a larger controlled study to definitively confirm whether autologous platelet gel is indeed an effective method for volume replacement and skin rejuvenation.

## 1. Introduction

The aging process affects all structural tissues and layers of the face. It is noticeable on the skin, which changes its texture and structure and becomes lax. However, it also affects the supporting bones which are subject to atrophy, as well as soft tissues such as muscles, fat pads, and retaining ligaments. Continuously growing popularity of various types of dermal fillers can address these changes. Though their safety profile is high, in recent years the number of complications following dermal filler injections has been growing [1]. The most common ones being early or delayed inflammatory reactions, oedemas, surface irregularities, skin

discolorations, nodules, and infections. These complications are most likely the main reason behind growing demand for minimally invasive aesthetic medicine procedures based on natural autologous methods.

In the late 1990s, Marx was among the first to describe the clinical applications of platelet concentrates [2]. Since then, platelet-rich plasma (PRP) has been utilized in various medical and dental fields for its diverse range of applications. PRP has a significant growth potential, it induces faster healing, and promotes tissue regeneration [3] due to the release of growth factors following activation [4]. Several studies have demonstrated that reducing the centrifugal speed and increasing the spin duration can lead to higher

concentrations of leukocytes and platelets in the product. This improvement in product quality enhances its stimulating potential for various applications [5].

A search for safe and natural methods of soft tissue augmentation and skin stimulation led to the development of the plasma rich in growth factor-derived autologous gel [6]. This 3D biomaterial is easy to prepare, possesses regenerative properties, and provides lifting capacity, thus reshaping the volume of injected tissues. Platelet gel is an autologous gelatinous material prepared from patient's own plasma. It is injectable and serves as a filler, but is also a biologically active material. The autologous gel forms a temporary scaffold; it induces recruitment, and growth, of resident cells and stimulates endogenous hyaluronic acid (HA) and collagen synthesis via an increase in mitogenic activity of dermal fibroblasts. The formula can be customized towards varied viscosities (hard, medium, and soft), addressing different dermatological needs. Currently, there are few publications on this topic; this paper contributes to the limited assortment of the literature on the subject.

The presented findings indicate that autologous platelet gel injections appear to be a cost-effective, safe, and well-tolerated technique for enhancing facial volume and skin density. This minimally invasive approach results in a significant aesthetic improvement in facial appearance, making it an attractive option for individuals seeking natural methods of facial rejuvenation.

## 2. Materials and Methods

In this retrospective study, we examined a group of ten female patients (ages 40–50) with a mean age of 46.5. The procedure investigated is regularly performed in our clinic for individuals seeking to enhance facial appearance and skin quality through natural methods. The selected patients in group expressed concerns related to facial volume loss, skin thinning, and roughness. Clinical examination of the patients excluded those with signs of inflammation, skin infections, blood disorders, general chronic diseases, and previous treatments with dermal fillers. The patients underwent one session of autologous platelet gel injections. Autologous gel was prepared accordingly with the manufacturer's (INNMEDIS, ATR™) instructions, i.e., after collection of 20 mL of blood into two sterile 10 mL tubes containing ACD (acid citric dextrose) as anticoagulant and centrifugation for 3 minutes at 90 G, 3 mL of the platelet rich plasma (PRP) were aspirated and put aside in a sterile syringe. The remaining blood was further centrifuged at 1500 G for 5 minutes. 8 mL of the platelet poor plasma (PPP) was obtained, and high viscosity gel was prepared following the manufacturer's instructions (INNMEDIS ATR™), i.e., heating the PPP for 8 minutes at 80°C and then cooling it down to 33°C in the ATR Gel Maker™. After obtaining a high-viscosity gel, it was mixed (Figure 1) in aseptic conditions with PRP to produce a medium-viscosity gel (Figure 2). The gel (approx. 11 mL) was then injected subdermally in the areas in the temporal region, then in the middle and the lower face. Linear retrograde mode was employed to administer the gel using a 25 G, 50 mm cannula



FIGURE 1: Mixing of the autologous high-viscosity platelet gel and PRP.

(TSK) to address the following superficial fat compartments (FC): lateral temporal cheek FC, infraorbital FC, medial cheek FC, middle cheek FC, nasolabial FC, and chin FC.

Clinical assessments of the patients were conducted both before the treatment sessions and at the conclusion of the follow-up period. To measure skin density, a high-frequency ultrasound device, specifically the DUB SkinScanner with the frequency of 75 MHz, was utilized. The DUB SkinScanner is a high-definition imaging system designed for noninvasive skin analysis. The scans were performed in the nasolabial folds area at three time points: baseline, 1 month after treatment, and 3 months after the procedure. The ultrasound measurements have been carried out on the limited region of the nasolabial folds (4 × 4 cm area) using a 4 × 4 cm template which provided repeatability of the measurements in different patients.

The following parameters were measured: skin density, skin thickness, and nasolabial folds depth.

Statistical analyses are given in Tables 1–3.

The one-way ANOVA was used to analyze the results to compare the means between the following groups: baseline, 1 month after the treatment, and 3 months after the treatment. Three parameters were considered, for which 3 separate ANOVAs were performed: skin density, nasolabial folds depth, and dermis thickness.

Alpha was set to 0.05 to meet the significance requirements of the statistical test.

The calculated F value is greater than the F crit value for the designated degree of freedom: 2/27, which permits to reject the null hypothesis. The calculated P value supports the statistical significance of rejecting the null hypothesis (it is much smaller than  $\alpha=0.05$ ). Consequently, the test suggests a positive influence of autologous platelet gel on skin density with 95% certainty for the test group.

Once again, the calculated F value is greater than the F crit value for the designated degree of freedom, which

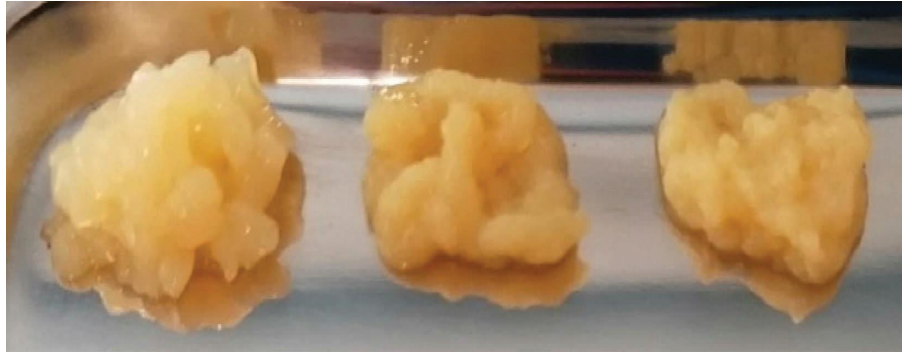


FIGURE 2: Medium-viscosity autologous platelet gel.

TABLE 1: Skin density.

Groups	Count	Sum	Average	Variance		
<i>Summary</i>						
Baseline	10	42.12	4.212	1.334128888889		
1 month after treatment	10	64.14	6.414	1.91318222222222		
3 months after treatment	10	62.08	6.208	0.88730666666667		
Source of variation	SS	df	MS	F	P value	F crit
<i>Anova</i>						
Between groups	29.5841866666667	2	14.7920933333333	10.732861508628	0.000371571521209989	3.3541308285292
Within groups	37.21156	27	1.37820592592593			
Total	66.7957466666667	29				

TABLE 2: Depth of the nasolabial folds.

Groups	Count	Sum	Average	Variance		
<i>Summary</i>						
Baseline	10	7133	713.3	10996.2333333333		
1 month after treatment	10	5187	518.7	7620.45555555557		
3 months after treatment	10	5552	555.2	7971.06666666668		
Source of variation	SS	df	MS	F	P value	F crit
<i>ANOVA</i>						
Between groups	213990.066666667	2	106995.033333333	12.0726662816384	0.000179692405835013	3.3541308285292
Within groups	239282.8	27	8862.58518518518			
Total	66.7957466666667	29				

TABLE 3: Thickness of the dermis.

Groups	Count	Sum	Average	Variance		
<i>Summary</i>						
Baseline	10	10150	1015	10027.7777777778		
1 month after treatment	10	11073	1107.3	10330.6777777778		
3 months after treatment	10	10990	1099	11971.1111111111		
Source of variation	SS	df	MS	F	P value	F crit
<i>ANOVA</i>						
Between groups	52147.2666666667	2	26073.6333333334	2.41948495030865	0.108010058915025	3.3541308285292
Within groups	290966.1	27	10776.5222222222			
Total	66.7957466666667	29				

permits to reject the null hypothesis. The calculated *P* value is smaller than  $\alpha = 0.05$ , supporting the rejection. Consequently, the test suggests a positive influence of autologous platelet gel on the depth of the nasolabial folds with 95% certainty for the test group.

Here, the calculated *F* value is inferior to the *F* crit value prompting an acceptance of the null hypothesis; however, the *P* value  $> \alpha = 0.05$  suggests that the deviation from the original hypothesis is not statistically significant. Overall, the ANOVA for the dermis thickness suggests accepting  $H_0$

with 89.2% certainty; use of autologous platelet gel has no, statistically significant, effect on dermis thickness.

Based on the analyses, collected data suggest that the use of autologous platelet gel is beneficial towards improving skin density and decreasing the depth of nasolabial folds; however, it has no statistically significant effect on dermis thickness. Nevertheless, because of the high alpha for the dermis thickness ANOVA, further research should be conducted into this parameter.

### 3. Results

The findings revealed a notable improvement in skin density for all patients following a single procedure. On average, the skin density was 1.52 times higher than the baseline after 1 month and this enhancement persisted at 1.47 times higher than the baseline after three months. These changes were visually confirmed using the imaging capabilities of the DUB SkinScanner (Figure 3).

The depth of nasolabial folds decreased by 27.3% between the baseline and 1 month after the treatment, with an overall decrease of 22.2% after 3 months; the depth increased by 5.1% between 1 month after treatment and 3 months after treatment.

On average, skin thickness increased by 8.3% between the baseline and 1 month after the treatment and then fell, to a net increase of 7.6% 3 months after treatment. However, these values are not statistically significant according to the ANOVA and should therefore be disregarded as a reliable representation of the autologous gel's effect on increasing skin thickness.

The level of satisfaction among the enrolled patients concerning their facial skin appearance was assessed using the visual analogue scale (VAS) at three time points: baseline, one month after treatment, and three months after treatment. Additionally, digital photographs were taken before the treatment and immediately after the procedure to visually document the changes (Figure 4(a)).

The VAS assessment results, with 0 indicating extreme dissatisfaction and 10 indicating maximum satisfaction, were as follows: the average score before treatment was 4.1, which increased to 7.9 one month after treatment and 7.5 after three months. These scores indicate a significant increase in patient satisfaction following the completion of the treatment, reflecting a notable improvement in their perceived facial skin appearance.

Immediate and substantial significant clinical improvement was observed in all subjects following autologous platelet gel injections, and this improvement was sustained throughout the follow-up period. Notably, all patients reported significant enhancement in skin condition and texture. The reported side effects were minimal and temporary, mainly consisting of bruising, oedema, and slight pain at the injection site, all of which diminished after 24 hours.

### 4. Discussion

The objective of this paper is to present a cosmetically effective and noninvasive alternative for managing facial

volume loss and enhancing skin condition. As the variety of noninvasive aesthetic medicine treatments expands, so does the likelihood of encountering complications [1]. Autologous platelet gel is a promising treatment modality. Recent studies [6, 7] have shown that autologous platelet gel appears to be an effective solution for facial sculpting and can be used to even skin surface irregularities. Plasma gel injections, as a dermal filler, have been shown to have immediate effect due to several factors. First, the gel contains denatured proteins and fibrin bundles, which provide a volumetric filling effect and constant stability. Consequently, the gel quickly fills in wrinkles and lines in the skin. Secondly, platelets found in the plasma gel work through degranulation of their alpha-granules, which contain pre-synthesized growth factors [7]. The growth factors, such as platelet-derived growth factor alpha and beta (PDGF-AB), insulin-like growth factor I (IGF-I), epithelial growth factor (EGF), and transforming growth factor-beta 1 (TGF-beta1) are key factors for skin regeneration. The gel not only provides a stable structure for the platelets, but it allows them to continue synthesis and release of bioactive growth factors after injection.

The growth factors can engage with dermal fibroblasts, by binding to their specific cellular receptors, leading to the promotion of neovascularization and neocollagenesis. This corresponds with the present results, showing an increase in skin density of the injected areas. The autologous gel serves as a temporary scaffold, inducing recruitment and growth of resident cells and stimulating endogenous HA and collagen synthesis, via increase of mitogenic activity of dermal fibroblasts [8].

In the present study, the effect of wrinkle amelioration and filling was observed throughout the whole follow-up period. This corresponds with other authors' findings [7] who observed its persistence in the tissues for up to 16 weeks.

Statistical analysis has shown a significant decrease in the depth of nasolabial folds after 3 months following the injections (22.2%). Previous reports [8] on determining mechanical and rheological properties of autologous platelet gel showed that the gel exhibited optimal viscoelastic gel-like behavior for soft tissue augmentation. This finding was confirmed by other authors [9], via a significant reduction in the mean values of wrinkle severity rating scale (WSRS) and tear trough rating scale (TTRS), after autologous plasma gel injections. In the study, mean value of WSRS decreased from  $3.18 \pm 0.81$  before treatment to  $1.65 \pm 0.61$  after three months from the last session with  $P$  value  $<0.05$ .

Moreover, in the TTRS group, all participants demonstrated a statistically significant improvement not only in correcting the tear through deformity but also in addressing dark circles and rhytids by the end of the follow-up period. Another study [10] also supported the clinical effectiveness of both PPP gel and PRP procedures for aesthetic enhancement of the infraorbital region; however, PPP gel appeared to be notably more effective than PRP as a therapeutic choice. Additionally, following autologous platelet gel injections, participants reported improvements in skin quality, specifically in terms of skin elasticity and reduction of wrinkles.



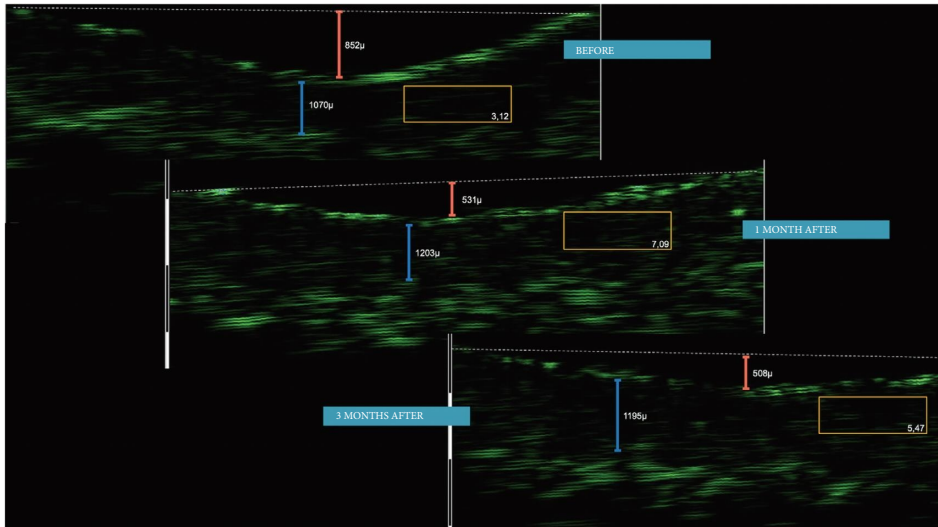


FIGURE 3: US measurements, patient #1. Skin density measurements marked in yellow, skin thickness measurements marked in blue, and depth of the nasolabial fold measurements marked in red. Measurements performed before the treatment, 1 month, and 3 months following the procedure.



FIGURE 4: A Digital images before and immediately after the procedure.

General patient satisfaction scores in the current study correspond with other authors' results and are significant [8].

The collected data suggest that the use of autologous platelet gel is beneficial towards improving skin density and decreasing the depth of nasolabial folds. This finding can be explained by the ability of growth factors to enhance ECM matrix components synthesis. Additionally, growth factors play a role in healing processes; they stimulate collagen production, which results in skin texture and elasticity improvement. However, further research should be conducted into its effects on dermis thickness to achieve a more statistically significant conclusion. Nevertheless, in other studies [7, 8], ultrasound analyses revealed a significant increase in dermal thickness after platelet gel treatment.

In the present study, patients showed the volumization of the superficial fat compartments and reduction of the depth of the nasolabial folds as well as skin density improvement; all of the above resulted in noticeable facial appearance correction. Similar results were obtained by other authors [11] who achieved revolumization of the mid- and lower-face following autologous gel injections. In this study [11], participants were administered personalized treatment regimens tailored to their specific therapeutic requirements. At the conclusion of the follow-up period, the evaluation of clinical performance was conducted, using standardized macrophotographs, clinical assessments, and patient surveys based on Likert's scales. Following PRGF-gel treatment, authors reported fine line amelioration, wrinkle reduction, and sagging

improvement in all patients (with overall patient satisfaction of 8/10). Pre/postphotographs demonstrated noticeable face rejuvenation and skin surface texture softening and tone recovery.

The utilization of high-frequency ultrasound for evaluating the outcomes of therapeutic treatments is increasingly becoming common. There is a rising trend in employing high-frequency ultrasound to assess skin condition, as it provides clear visualization of the results of injection treatments and serves as an objective tool for measuring skin density and thickness. High-resolution ultrasounds are expected to be employed more frequently, not only for examining skin disorders and diseases but also for evaluating the effectiveness of aesthetic treatments [12, 13].

This study has certain limitations that should be acknowledged. First, the small size of the study population with only 10 subjects may limit the generalizability of the findings. Additionally, the absence of a control group in the study design may be considered a drawback in evaluating the treatment's effectiveness accurately. Moreover, this study did not take into account the patients' baseline status, as no specific scales were utilized to assess facial volume deficiency and skin condition before the treatment. To address this, future studies should refine the inclusion criteria to concentrate on individuals with facial volume deficiency and specific skin conditions, allowing for more detailed and comprehensive analysis. Another limitation is the statistical analysis result for the dermis thickness which suggests that the use of autologous platelet gel has no statistically significant effect on dermis thickness. Nevertheless, because of the high alpha for the dermis thickness ANOVA, further research should be conducted into this parameter.

All additional data, ultrasound scans measuring skin density and the depth of nasolabial folds as well as the visual analogue scale (VAS), showed a significant change in values which strengthens the claim made in the study confirming autologous platelet gel efficacy.

While the results of this observation show great promise, it is essential to conduct a larger controlled study to definitely establish the efficacy of autologous platelet gel as a method for facial volume restoration and skin revitalization.

## 5. Conclusion

Autologous platelet gel injections seem to be a cost-effective, safe, well-tolerated, and minimally invasive technique improving facial volume and skin density. The gel produces significant aesthetic correction of facial wrinkles and facial appearance and may be a solution for those seeking natural facial rejuvenation methods. Autologous platelet gel injections might be an alternative to costly HA fillers injections, at the same time having a stimulating effect on the skin and improving its condition. It may be a safe therapeutic solution for patients who cannot be qualified for HA treatments due to medical contraindications.

## Data Availability

The data used to support the study are available from the corresponding author upon request.

## Ethical Approval

I affirm that all procedures were conducted in compliance with the principles outlined in the Declaration of Helsinki, adhering to regional laws and good clinical practices for studies involving human subjects.

## Consent

All participating patients provided their informed consent for the procedure and the publication of their images in the journal.

## Conflicts of Interest

The author declares that there are no conflicts of interest.

## References

- [1] J. L. Cohen, J. Hicks, A. Nogueira, V. Lane, and B. Andriopoulos, "Postmarket safety surveillance of delayed complications for recent FDA-approved hyaluronic acid dermal fillers," *Dermatologic Surgery*, vol. 48, no. 2, pp. 220–224, 2022.
- [2] R. E. Marx, "Platelet-rich plasma (PRP): what is PRP and what is not PRP?" *Implant Dentistry*, vol. 10, no. 4, pp. 225–228, 2001.
- [3] R. E. Marx, E. R. Carlson, R. M. Eichstaedt, S. R. Schimmele, J. E. Strauss, and K. R. Georgeff, "Platelet-rich plasma: growth factor enhancement for bone grafts," *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology & Endodontics*, vol. 85, no. 6, pp. 638–646, 1998.
- [4] S. Dashore, K. Chouhan, S. Nanda, and A. Sharma, "Platelet-rich fibrin, preparation and use in dermatology," *Indian Dermatol Online J*, vol. 12, no. 7, pp. S55–S65, 2021.
- [5] M. Fujioka-Kobayashi, R. J. Miron, M. Hernandez, U. Kandalam, Y. Zhang, and J. Choukroun, "Optimized platelet-rich fibrin with the low-speed concept: growth factor release, biocompatibility, and cellular response," *Journal of Periodontology*, vol. 88, no. 1, pp. 112–121, 2017.
- [6] E. Anitua, A. Pino, M. Troya, P. Jaén, and G. Orive, "A novel personalized 3D injectable protein scaffold for regenerative medicine," *Journal of Materials Science: Materials in Medicine*, vol. 29, no. 1, p. 7, 2017.
- [7] N. Jiménez Gómez, A. Pino Castresana, G. Segurado Miravalles et al., "Autologous platelet-rich gel for facial rejuvenation and wrinkle amelioration: a pilot study," *Journal of Cosmetic Dermatology*, vol. 18, no. 5, pp. 1353–1360, 2019.
- [8] E. Fedyakova, A. Pino, L. Kogan, C. Eganova, M. Troya, and E. Anitua, "An autologous protein gel for soft tissue augmentation: in vitro characterization and clinical evaluation," *Journal of Cosmetic Dermatology*, vol. 18, no. 3, pp. 762–772, 2019.
- [9] N. N. Doghaim, R. A. El-Tatawy, and Y. M. E. Neinaa, "Assessment of the efficacy and safety of platelet poor plasma gel as autologous dermal filler for facial rejuvenation," *Journal of Cosmetic Dermatology*, vol. 18, no. 5, pp. 1271–1279, 2019.

- [10] Y. M. E. Neinaa, A. A. E. Hodeib, M. M. Morquos, and L. H. Elgarhy, "Platelet-poor plasma gel vs platelet-rich plasma for infraorbital rejuvenation: a clinical and dermoscopic comparative study," *Dermatologic Therapy*, vol. 33, no. 6, Article ID e14255, 2020.
- [11] L. Godfrey, J. Martínez-Escribano, E. Roo, A. Pino, and E. Anitua, "Plasma rich in growth factor gel as an autologous filler for facial volume restoration," *Journal of Cosmetic Dermatology*, vol. 19, no. 10, pp. 2552–2559, 2020.
- [12] R. Kleinerman, T. B. Whang, R. L. Bard, and E. S. Marmur, "Ultrasound in dermatology: principles and applications," *Journal of the American Academy of Dermatology*, vol. 67, no. 3, pp. 478–487, 2012.
- [13] L. Majewska, "Platelet-rich fibrin as an effective method of skin revitalization," *Dermatologic Therapy*, vol. 2023, Article ID 9040608, 4 pages, 2023.