



## Research article

# Effectiveness and safety of botulinum toxin type A combined with blepharoplasty in treating sagging skin around the eyes

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## ARTICLE INFO

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## ABSTRACT

**Objective:** Researchers looked into the safety and effectiveness of blepharoplasty in conjunction with botulinum toxin type A for the treatment of periorcular skin laxity.

**Methods:** 92 patients who received treatment at our institution for periorcular skin laxity were chosen as research subjects. Their admission time ranged from May 2020 to December 2022. Using various therapy modalities, the patients were split into two groups: an observational team (n = 46) and a controlling team (n = 46). They were respectively given blepharoplasty treatment intervention and botulinum toxin type A combined with blepharoplasty treatment intervention. Eyelid bags, crow's feet, skin radiance and aesthetic results, quality of life were analyzed before and after the intervention, and physician and patient' satisfaction with the results were compared.

**Results:** 95.65 % was the effective rate of the observed group, which was 71.74 % compared with the control group, and significantly increased (P < 0.05). After interference, the score, aesthetic effect and quality of life grade of skin gloss, crow's feet and eyelid bags were significantly higher in the observation group than in the control group (P < 0.05). The complication rate in the observation group was 6.52 % was significantly higher than 30.43 % in the control group (P < 0.05). The patient satisfaction of the observation group was 93.48 %, significantly greater than the control group 69.57 % (P < 0.05); the customer satisfaction of the observation group was 95.65 %, which was significantly higher than the control group 82.61 % (P < 0.05).

**Conclusion:** The combination of type A botulinum toxin and eye bag plastic surgery has a good effect on improving skin laxity around the eyes. It can significantly reduce eyelid bags and crow's feet, improve skin gloss, increase aesthetic effects, and comprehensively restore vitality to aged eye skin, improve life quality, and have high doctor-client contentment and safety.

## 1. Introduction

Sagging skin around the eyes is usually the first obvious sign of facial aging, mainly manifesting as fine lines and wrinkles around the eyes [1,2]. Due to the thin skin around the eye area and its anatomical proximity to the eyeball, caution should be exercised in the treatment of the eye area. Surgery, laser, fillers, etc. Are the main treatments for skin laxity around the eyes, but they still have certain limitations, including the greater trauma caused by surgery to the eye periphery, and laser surgery may be limited due to hyperpigmentation [3,4]. In addition, the duration of filler treatment is still short, and regular repairs are required in the later period, which

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may cause a high economic burden [5]. A powerful neurotoxic protein called botulinum toxin type A is primarily produced by the *Clostridium botulinum* bacteria. Studies have found that [6,7], it plays an important role in reducing wrinkles around the eyes and improving facial rejuvenation. Nevertheless, there aren't many studies on using botulinum toxin type A in conjunction with blepharoplasty to treat periorbital skin laxity. Based on this, the patients receiving therapy at our hospital for periocular skin relaxation were chosen as the research subjects for this research. The patients received blepharoplasty along with Botulinum Toxin A to investigate the safety and efficacy of treating periocular skin relaxation and to provide pertinent data for the therapy of clinical periocular skin relaxation.

## 2. Materials and methods

### 2.1. Basic information

The hospital ethics committee gave its approval for this research (approval number: LL-20-SCI-003). 92 patients who received treatment at our institution for periorbital skin laxity were chosen as research subjects. Their admission time ranged from May 2020 to December 2022. The patients were separated into controlling team (n = 46) and observational team (n = 46) according to different treatment methods. Among them, there were 6 men and 40 women in the controlling team; Their average age was (49.46 ± 7.24), with ages ranging from 37 to 66. There were 4 men and 42 women in the observational team; Their average age was (50.17 ± 8.66) years, with a range of 36–67 years. The clinical data did not significantly differ between the controlling team and the observational team ( $P > 0.05$ ). For more information, look at Table 1.

### 2.2. Inclusion criteria

(1) All of the patients satisfy the necessary diagnostic standards for periorbital skin laxity [8]; (2) The patient and their family members have a clear understanding of the relevant content of the study, and sign and confirm on the consent form; (3) The patient has clear cognitive function and is able to cooperate with the relevant work in the study; (4) The patient has complete clinical information; (5) No eye-related surgical treatment has been performed in the past.

### 2.3. Exclusion criteria

(1) Patients who are intolerant to surgery or allergic to drugs used in surgery; (2) Patients with liver, kidney or heart dysfunction; (3) There has been a history of eye plastic surgery or eye trauma.

### 2.4. Research methods

(1) Control group: The patient was given blepharoplasty treatment intervention and local anesthesia. At the bottom edge of the lower lashes and approximately 1 mm from the outside corner of the eye, a little incision was created parallel to the eyelid margin and crow's feet. Take part of orbital fascia, remove the fat, fully expose the main ligament and cut it, and suture the main ligament to the external ophthalmic ligament or the periosteum of the outer orbital rim; Patient's orbital fat condition was observed; routinely remove part of the loose orbicularis muscle or lower eyelid skin. Suture the skin after sufficient hemostasis; apply antibiotics after surgery to prevent infection, pay attention to eye hygiene, and come to the hospital for regular check-ups. (2) Observation group: Patients were given botulinum toxin type A (Lanzhou Institute of Biological Products Co., Ltd., production batch number: S10970037, specification: 100U/tube) combined with blepharoplasty treatment intervention. Inject the diluent of this product using sterile, needle sizes 27–30/0.40–0.30 mm, and inject it at approximately 1 cm (1 point) on the outer corner of the eye, 3 cm (1 point extends parallel to about 2 cm) on the outer corner of the eye, and 1 cm (1 cm above or below 1 point) on the outer corner of the eye. The injection amount is 1.25–2.5U. Both groups were followed up for half a year.

**Table 1**

Contrast of clinical data of patients [n (%), ( $\bar{x} \pm s$ )].

Group	n	Age (years)	Body mass index (kg/m <sup>2</sup> )	Gender (%)		Eyelid bag type (%)		Crow's feet length (cm)
				male	female	Simple fat bulging type	Skin or orbicularis muscle laxity	
Control group	46	49.46 ± 7.24	22.70 ± 1.12	6 (13.04)	40 (86.96)	25 (54.35)	21 (45.65)	1.86 ± 0.49
Observation group	46	50.17 ± 8.66	22.28 ± 1.34	4 (8.70)	42 (91.30)	29 (63.04)	17 (36.96)	1.89 ± 0.88
$\chi^2/t$		0.428	1.619	0.449		0.717		0.200
P		0.669	0.109	0.503		0.397		0.842

### 2.5. Observation

Indicators (1) Analysis of the improvement of skin laxity around the eyes: According to the Wrinkle Severity Rating Scale (WSRS) [9], the degree of skin laxity around the eyes of patients was evaluated and divided into grades I to V. The difference in grade before and after treatment was considered significant, effective, and ineffective, with a difference of 2 or more grades and a difference of 1 grade and no difference, respectively. The treatment effectiveness rate was calculated. (2) The improvement of upper eyelid skin relaxation is 1~5, and the total score is 30, of which 1–10 are unsatisfactory, 11–20 are general, and 21–30 are satisfactory. The higher the score, the higher the satisfaction.

(3) Analysis of eyelid bags, crow’s feet and skin gloss: Eyelid bags, crow’s feet and skin gloss are tested using a self-made scale, with scores ranging from 0 to 20. The enhancement of skin gloss, crow’s feet, and eyelid bags is indicated by a higher grade. (4) Analysis of complications: Observe the occurrence of complications in patients, including redness, swelling, scars, exudate, infection, secretions, etc. (5) Analysis of aesthetic effect and quality of life: Patients’ aesthetic effects are measured using a self-made scale that ranges from 0 to 15. A higher score is related to a better aesthetic effect. Patients’ life quality is measured using the SF-36 health scale, which has a grade range of 0–100. A higher life quality is correlated with higher grades. (6) Satisfaction analysis: Use a self-made satisfaction scale to evaluate the satisfaction of doctors and patients, including very satisfied, basically satisfied, generally satisfied and dissatisfied, and calculate the satisfaction.

### 2.6. Statistical methods

SPSS24.0 was used for all data analysis in this research. Enumeration data such as improvement of skin laxity around the eyes, incidence of complications, and satisfaction were expressed as [n (%)]. Pairwise comparisons were made through independent samples, using  $\chi^2$  test; measurement data such as aesthetic effects and quality of life are expressed by  $(\bar{x} \pm s)$ , and pairwise comparisons are made by independent sample *t*-test. The statistical result  $P < 0.05$  was considered as a statistically meaningful disparity.

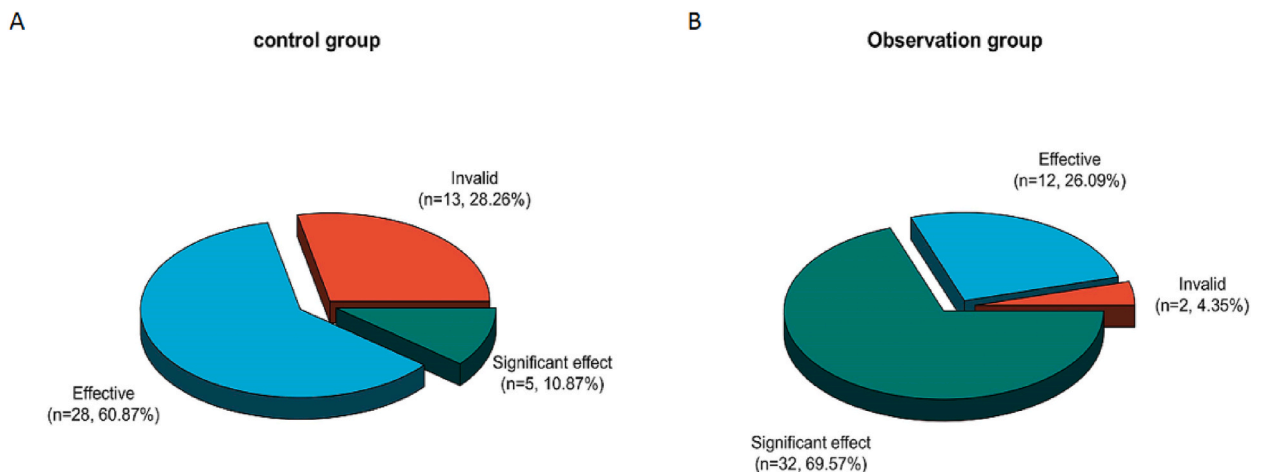
## 3. Results

### 3.1. Analysis of the improvement of skin laxity around the eyes of patients

95.65 % was the observational team’s effective rate (effective rate of 26.09 % + significant rate of 69.57 %)(See Fig. 1B) contrasted with the controlling team, the effective rate was 71.74 % (effective rate of 60.87 % + significant rate of 10.87 % (See Fig. 1A), which was significantly higher ( $P < 0.05$ ). See Table 2.

### 3.2. Analysis of eyelid bags, crow’s feet, and skin gloss in patients

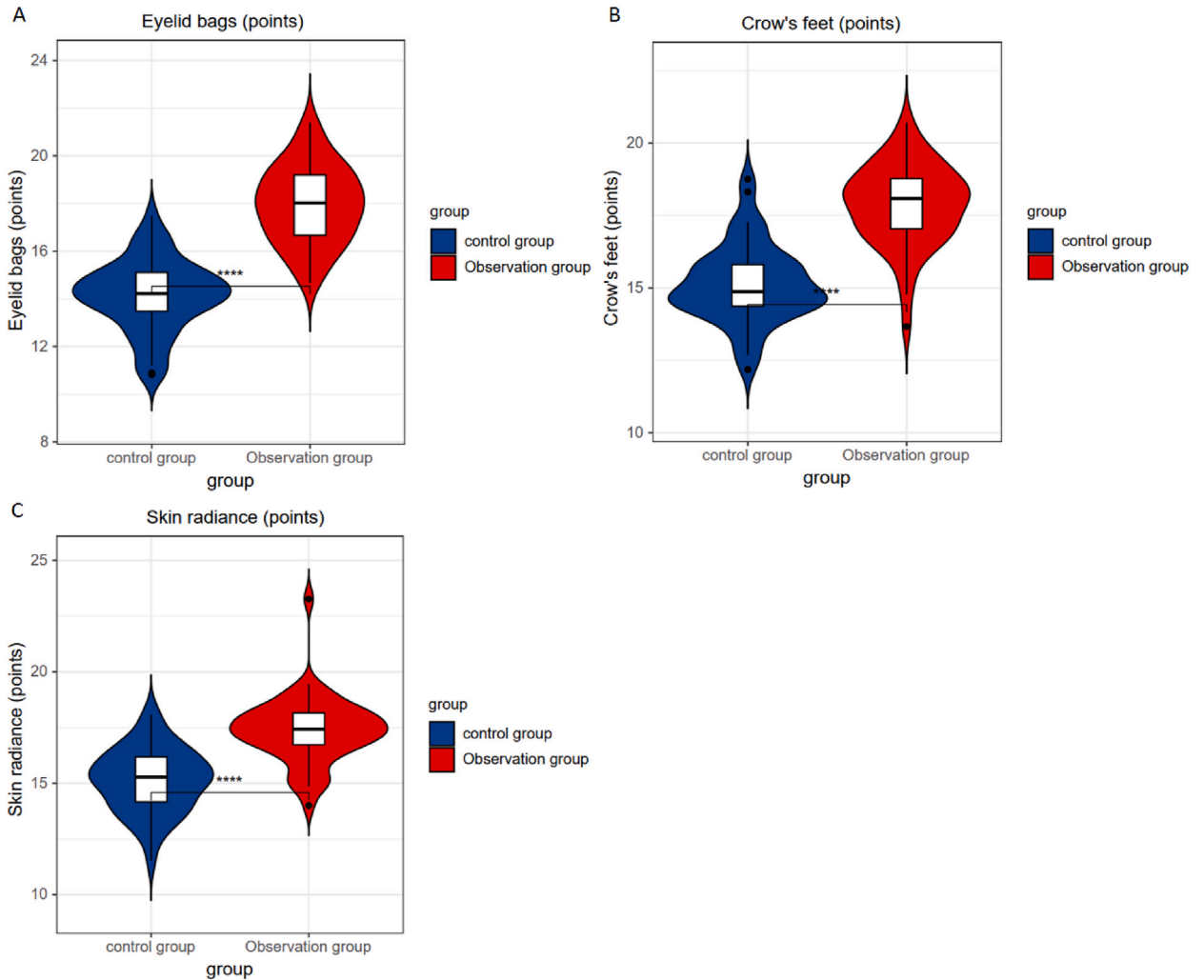
Prior to interference, there was no discernible change between the observational team and the controlling team’s grades for skin gloss, crow’s feet, and eyelid bags ( $P > 0.05$ ); Following the interference, both the controlling team and the observational team showed a substantial rise in the grades for skin gloss, crow’s feet, and eyelid bags when contrasted to prior to the interference ( $P < 0.05$ ); and the observational team was considerably higher than the controlling team ( $P < 0.05$ , See Fig. 2A, B and 2C.). Look at Table 3.



**Fig. 1.** Distribution chart of improvement of skin laxity around the eyes of patients. Fig. A: the distribution of the improvement of skin relaxation in the control group; Fig. B: distribution of the improvement of skin relaxation in the eye axis of the observation group.

**Table 2**  
Analysis and contrast of improvement of skin laxity around the eyes of patients [n (%)].

Group	n	Invalid	Efficient	Effective	Efficient
Control group	46	13 (28.26)	28 (60.87)	5 (10.87)	33 (71.74)
Observation group	46	2 (4.35)	12 (26.09)	32 (69.57)	44 (95.65)
$\chi^2$					9.638
P					0.002



**Fig. 2.** Distribution map of patients' eyelid bags, crow's feet and skin gloss  
 Fig. A: comparison chart of eyelid bag scores between the two groups; Fig. B: Comparison chart of crow's feet scores of two groups; Fig. C: Comparison of eyelid bag scores between the two groups.

**Table 3**  
Analysis and contrast of patients' eyelid bags, crow's feet and skin gloss ( $\bar{x} \pm s$ ).

Group	n	Eyelid bags (points)		Crow's feet (points)		Skin radiance (points)	
		before intervention	after intervention	before intervention	after intervention	before intervention	after intervention
Control group	46	10.93 ± 1.46	14.15 ± 1.49	11.87 ± 1.37	15.13 ± 1.35	11.49 ± 1.46	15.14 ± 1.42
Observation group	46	11.26 ± 1.45	17.95 ± 1.62	12.08 ± 1.35	17.86 ± 1.41	11.62 ± 1.33	17.37 ± 1.50
t		1.084	11.684	0.751	9.485	0.433	7.316
P		0.281	<0.001	0.454	<0.001	0.666	<0.001

### 3.3. Examination of the incidence of problems among patients

In the observational team, the incidence of complications was 6.52 % (the incidence of redness and swelling was 2.17 % + the incidence of scars was 2.17 % + the incidence of infection was 2.17 %). Contrasted with the control ling team, the incidence of complications was 30.43 % (the incidence of redness and swelling was 4.35 % + scar incidence rate 8.70 % + exudation incidence rate 4.35 % + infection incidence rate 6.52 % + secretion incidence rate 6.52 %) was significantly reduced ( $P < 0.05$ ). See [Table 4](#).

### 3.4. Analysis of patients' aesthetic effects and life quality

Prior to the interference, there was no discernible disparity between the controlling team and the observational team in terms of the aesthetic effects or life quality grades ( $P > 0.05$ ); When contrasted to prior to interference, the observational team's and the controlling team's aesthetic effect and life quality grades increased considerably after the interference ( $P < 0.05$ ); and the observational team was considerably higher than the controlling team ( $P < 0.05$ , See [Fig. 3A](#) and B.). Look at [Table 5](#).

### 3.5. Analysis and comparison of doctor-patient satisfaction

In the observational team, the percentage of satisfied patients was 93.48 % (Basic satisfaction rate of 28.26 % + extraordinary satisfaction rate of 65.22 %)(See [Fig. 4A](#)), which was considerably higher than that in the controlling team, which was 69.57 % (Basic satisfaction rate of 21.74 % + extraordinary satisfaction rate of 47.83 %)(See [Fig. 4B](#)) ( $P < 0.05$ ) (See [Table 6](#)). The client contentment of the observational team was 95.65 % (Basic satisfaction rate of 23.91 % + extraordinary satisfaction rate of 71.74 %)(See [Fig. 5A](#)), which was considerably higher than that of the controlling team, which was 82.61 % (Basic satisfaction rate of 39.13 % + extraordinary satisfaction rate of 43.48 %)(See [Fig. 5B](#)) ( $P < 0.05$ ) (See [Table 7](#)).

## 4. Discussion

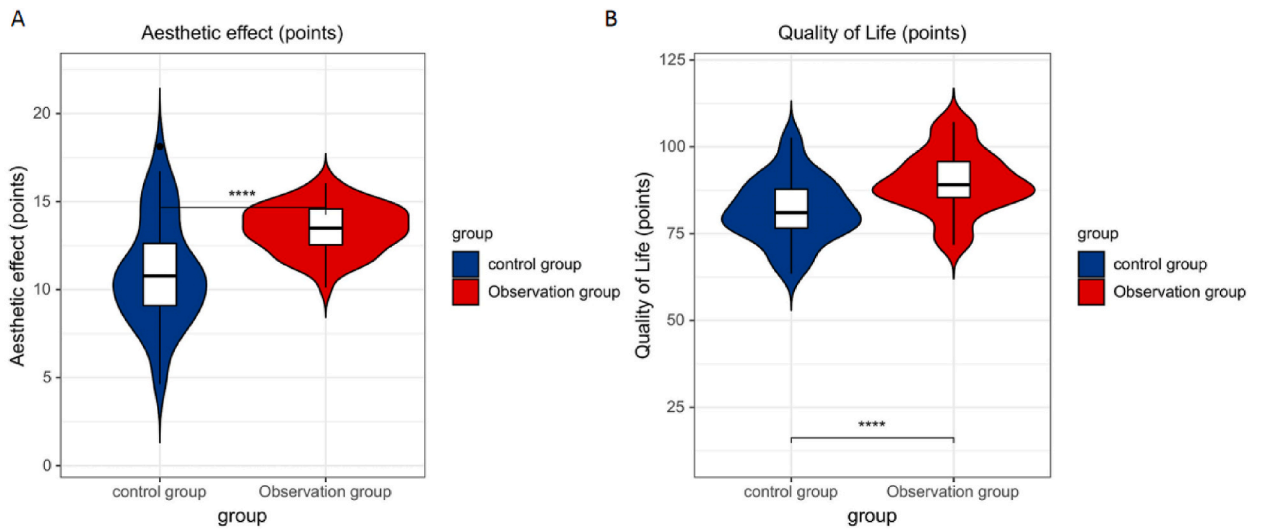
As the saying goes, "the eyes are the windows of the soul," and they play a crucial role in nonverbal communication. It stands for one of the most endearing and fascinating features of our faces that others typically notice right away. The skin around the eyes is the thinnest portion of the human body, and its look affects how beautiful and aged the face appears overall. Wrinkles and fine lines in the eyes could result from a decrease in collagen [10,11]. The search for a younger, more "fresh" facial appearance is one of the main reasons why people seek clinical help, whether surgical or non-surgical. One of the most popular eye procedures in recent years is blepharoplasty, which can enhance and repair the aging indications in the vicinity of the eyes [12]. Relevant studies have found that [13–15], blepharoplasty is a common procedure used to help patients' eyes look more vibrant and their surrounding skin look more rejuvenated. However, blepharoplasty is still an invasive surgery, and complications such as infection and bleeding may occur, which may affect the patient's postoperative recovery [14,16,17]. Therefore, choosing a method that is less invasive, effective, and has fewer complications plays an important role in alleviating sagging skin around the eyes and making the skin appear younger.

The periorbital area of the face is the first to age and may exhibit changes in bone, fat, muscle, and skin. Before conducting cosmetic rejuvenation procedures, the soft tissue, vascular, and bone structure of the periocular region should be thoroughly considered in order to provide a safe, natural repair strategy for the fragile eyelids and supporting components [18–20]. Facial fillers can help patients restore vitality to the periocular area, increase youthfulness and fullness, and thus maximize the improvement of skin laxity [21]. The primary source of botulinum toxin type A is the anaerobic Gram-positive bacillus *Clostridium botulinum* [22]. According to certain research, botulinum toxin type A can cause tissue paralysis by preventing acetylcholine from being released from cholinergic nerve terminals and neuromuscular synapses [23,24]. In addition, according to relevant reports, botulinum toxin type A can have relatively long-term effects in a variety of eye diseases and cosmetic surgeries, and has high safety [25,26]. Botulinum toxin type A's introduction has completely changed how wrinkles around the eyes are reduced and face rejuvenation is achieved.

The periorbital area is the earliest and most significant feature of the body's aging process. Aging skin around the eyes can be caused by a number of reasons, such as collagen deficit, gravity shift, photoaging, and skin shrinkage [27–29]. There are several factors that can contribute to aging skin around the eyes, including collagen deficiency, gravity shift, photoaging, and skin shrinkage [30]. In this study, our hospital performed botulinum toxin type A combined with blepharoplasty on patients with sagging skin around the eyes. The outcomes demonstrated that the observational team's effective rate was considerably higher than the controlling team's, and that the enhancement in skin gloss, crow's feet, and eyelid bags was considerably bigger in the observational team than in the controlling team. The observational team exhibited a considerably lower incidence of problems such as redness, swelling, scars, and infection in comparison to the controlling team. Furthermore, the observational team's life quality and aesthetic effect grades were

**Table 4**  
Examination and contrast of the incidence of problems in patients [n (%)].

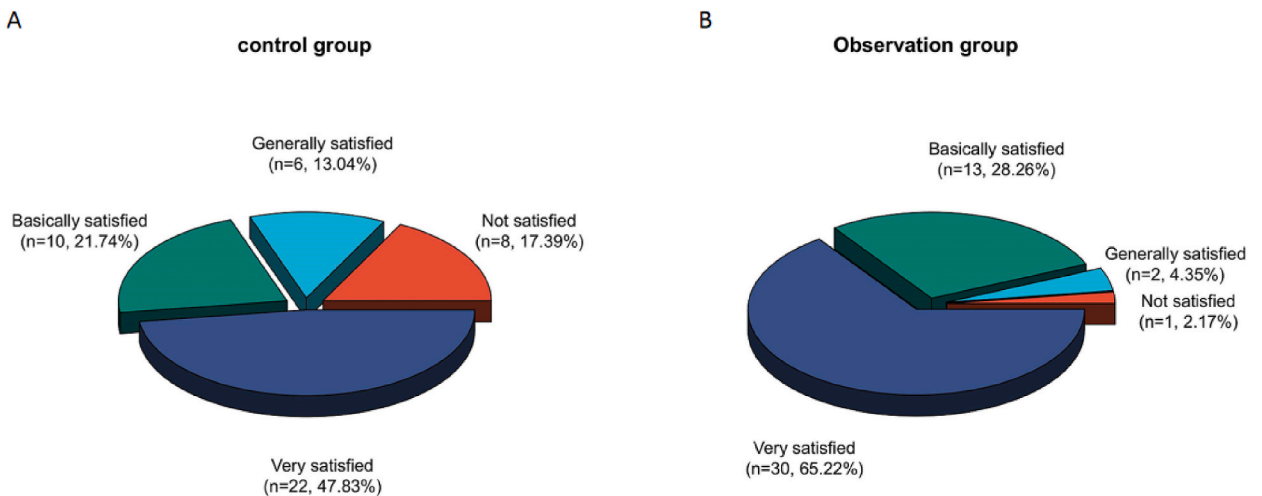
Group	n	Redness and swelling	Scar	Exudate	Infect	Secretions	Total
Control group	46	2 (4.35)	4 (8.70)	2 (4.35)	3 (6.52)	3 (6.52)	14 (30.43)
Observation group	46	1 (2.17)	1 (2.17)	0 (0.00)	1 (2.17)	0 (0.00)	3 (6.52)
$\chi^2$							8.731
P							0.003



**Fig. 3.** Distribution map of patients' aesthetic results and quality of life.  
 Fig. A: Comparison chart of two groups of aesthetic effect scores; Fig. B: Comparison of quality of life scores between the two groups.

**Table 5**  
 Analysis and contrast of patients' aesthetic effects and life quality ( $\bar{x} \pm s$ ).

Group	n	Aesthetic effect (points)		Quality of life (points)	
		before intervention	after intervention	before intervention	after intervention
Control group	46	6.17 ± 2.28	10.96 ± 3.05	74.43 ± 12.15	81.75 ± 9.13
Observation group	46	6.35 ± 2.39	13.45 ± 1.35	75.28 ± 10.94	89.82 ± 8.84
t		0.369	5.064	0.351	4.303
P		0.713	<0.001	0.727	<0.001

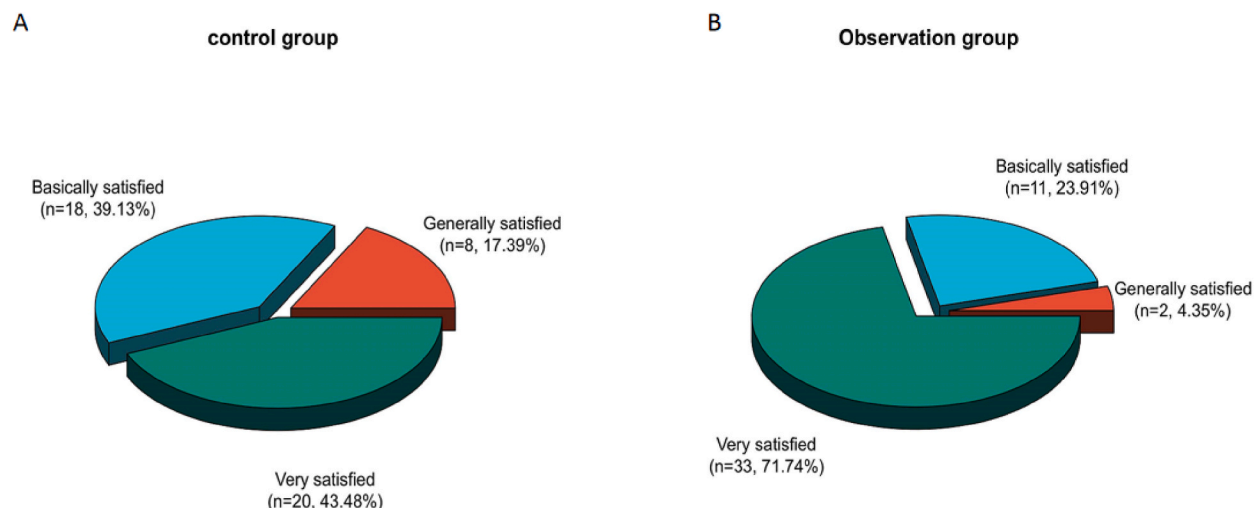


**Fig. 4.** Patient satisfaction distribution chart  
 Fig. A: the distribution of patients' satisfaction in the control group; Fig. B: Distribution of patients' satisfaction in the observation group.

much greater than those of the controlling team ( $P < 0.05$ ). Botulinum toxin type A combined with blepharoplasty can have a good effect on sagging skin around the eyes, and plays an important role in suppressing eyelid bags and crow's feet, improving skin gloss, increasing aesthetic effects, and improving life quality. Analysis of the reasons may be related to the fact that botulinum toxin A combined with blepharoplasty can reduce the tension around the surgical incision, inhibit the contraction of nerve and muscle fibers, promote the early recovery and healing of surgery, and improve the beauty of patients' faces, and the drug botulinum toxin A used in

**Table 6**  
Analysis and contrast of client contentment [n (%)].

Team	n	Not satisfied	Generally satisfied	Basically satisfied	Very satisfied	Satisfaction
Control team	46	8 (17.39)	6 (13.04)	10 (21.74)	22 (47.83)	32 (69.57)
Observation team	46	1 (2.17)	2 (4.35)	13 (28.26)	30 (65.22)	43 (93.48)
$\chi^2$						8.731
P						0.003



**Fig. 5.** Distribution chart of doctor satisfaction  
Fig. A: the distribution of doctor satisfaction in the control group; Fig. B: distribution chart of doctors' satisfaction in the observation group.

**Table 7**  
Analysis and contrast of doctor contentment [n (%)].

Team	n	Not satisfied	Generally satisfied	Basically satisfied	Very satisfied	Satisfaction
Control team	46	0 (0.00)	8 (17.39)	18 (39.13)	20 (43.48)	38 (82.61)
Observation team	46	0 (0.00)	2 (4.35)	11 (23.91)	33 (71.74)	44 (95.65)
$\chi^2$						4.039
P						0.044

the study is within the acceptable dosage range of human body and does not increase the risk of adverse reactions. Satisfaction is one of the important indicators for evaluating treatment effects. In this study, by analyzing the doctor-patient satisfaction before and after treatment, following the interference, it was discovered that the observational team's doctor-client contentment was noticeably higher than that of the controlling team. This shows that compared with blepharoplasty, botulinum toxin type A combined with blepharoplasty can achieve higher satisfaction in the treatment of sagging skin around the eyes. This may be because botulinum toxin type A combined with blepharoplasty to treat sagging skin around the eyes can better tighten the skin around the eyes, promote rejuvenation around the eyes, thereby improving doctor-patient satisfaction.

**5. Conclusion**

In summary, the combination of type A botulinum toxin and eye bag plastic surgery has a good effect on improving skin laxity around the eyes. It can significantly reduce eyelid bags and crow's feet, improve skin gloss, and enhance aesthetic effects, so as to fully restore vitality to aged eye skin, improve quality of life, and have high doctor-patient satisfaction and safety. However, our study still has certain limitations, including small sample size and short time, which may cause certain errors in the research results. Future larger client sample randomized controlled trials will be required to validate our results.

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## Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Ethics approval

The hospital ethics committee gave its approval for this research (approval number: LL-20-SCI-003).

## Informed consent

The patient and their family members have a clear understanding of the relevant content of the study, and sign and confirm on the consent form.

## CRedit authorship contribution statement

**Jin Huang:** Writing – original draft. **Xiaojian Zhang:** Software, Methodology, Formal analysis. **Yi Chang:** Writing – review & editing, Writing – original draft.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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