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SPECIAL TOPIC

Complications in Brow Lifts: A Systemic Review of Surgical and Nonsurgical Brow Rejuvenations

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Background: Brow lift has been a part of plastic surgeons' armamentarium for over a century. Although there are multiple different techniques available, there has been a dearth of literature comparing which technique is better and has lesser complications. In this study, we performed a systemic literature review of all brow lift techniques to determine and compare complication rates of each technique.
Methods: We performed a computerized search of brow rejuvenation techniques using the MEDLINE database. Data regarding the type of brow lift procedure, number of patients, and complications were collected.
Results: The systematic review was performed in December of 2017. A total of 326 articles were identified initially, and 76 studies remained after final review. The review showed highest revision rate in the hairline brow lift (7.4%), highest numbness rate in the direct brow lift (5.5%), highest asymmetry rate in the temporal/lateral brow lift (1.5%), and highest alopecia rate in the endoscopic brow lift (2.8%). In addition, we found 5 studies in nonsurgical brow rejuvenation (3 botulinum toxin, 1 fat injection, 1 radiofrequency).
Conclusion: Our study shows that each brow technique has a different complication profile, and it is important for plastic surgeons to understand the difference. Furthermore, the study demonstrated the lack of randomized prospective outcome studies and standardization of outcome measures in brow rejuvenation. We believe this information would be the key and next frontier in providing technically safe and long-lasting aesthetic outcomes for the patients. *(Plast Reconstr Surg Glob Open 2018;6:e1943; doi: 10.1097/GOX.0000000000001943; Published online 15 October 2018.)*

INTRODUCTION

Brow lift has been a part of plastic surgeons' armamentarium for over a century. Over time, the techniques have evolved from the most direct approach such as skin excision of upper forehead skin by Passot[1] in 1919 to minimally invasive lift using an endoscopic approach by Isse in 1994[2]. Currently, plastic surgeons have various types of techniques available for their disposal: direct, hairline, temporal, lateral, endoscopic, and transblepharoplasty brow lift[3–8] (Fig. 1).

Although there are multiple different techniques available, there has been a dearth of literature comparing the complication profile of these techniques.[9] It is critical for plastic surgeons to understand the complication profile of each technique and anticipate possible postoperative complications for each technique. Therefore, we present a systemic review of all brow rejuvenation techniques.

PATIENTS AND METHODS

A computerized search of the MEDLINE database was performed using OVID. The OVID search was performed using the following search terms and including all subheadings:

- Brow lift
- Brow rejuvenation
- Periorbital rejuvenation
- Periocular rejuvenation

The following limits were applied for each search term:

- Language: English
- Dates: no limits

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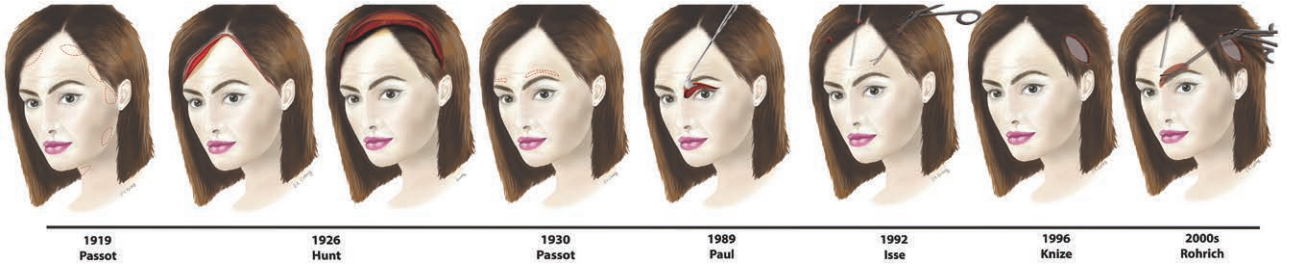

Fig. 1. Brow lift evolution.

The resulting articles were reviewed using the following inclusion and exclusion criteria.

Inclusion criteria

- Controlled studies, cohort studies, randomized controlled trials, systemic reviews

Exclusion criteria

- Case reports, review articles, case series, expert opinions
- Publications not in the English language

All studies were reviewed and analyzed by one of the authors (M.J.C.). Data regarding the type of brow lift procedure, number of patients, complications, and outcomes were collected. We categorized articles into 3 groups: endoscopic brow lift, open brow lift, and nonsurgical brow lift. The open brow lift articles were categorized into coronal, hairline, direct, temporal/lateral, and transblepharoplasty brow lifts.

RESULTS

A Systematic Literature Review

The computerized search was performed in December 4 of 2017. A total of 326 articles were identified from the initial search: brow lift, n = 253; brow rejuvenation, n = 6; periorbital rejuvenation, n = 61; and periocular rejuvenation, n = 6. The abstracts of each article were reviewed, and 139 studies of potential relevance remained: brow lift, n = 106; brow rejuvenation, n = 6; periorbital rejuvenation, n = 21; and periocular rejuvenation, n = 6. Then, each article was reviewed, and final 76 studies remained: coronal brow lift, n = 9; endoscopic brow lift, n = 34; direct brow lift, n = 10; temporal/lateral brow, n = 10; hairline brow lift, n = 4; transblepharoplasty brow lift, n = 4; and nonsurgical brow lift, n = 5. In total, 94.4% of studied subjects were female, whereas the other 5.6% were male.

Open Brow Lift

For open brow lift, we identified 37 studies from the literature review (2,858 patients). Of the 37 studies, the direct brow lift had the most number of the studies (10 studies), followed by coronal (9), temporal (6), lateral (4), hairline (4), and transblepharoplasty (4).

In comparison, the revision rate was the highest in the hairline brow lift (7.4%), followed by 3.6% in the direct brow lift, 2.4% in the temporal brow lift, 1.8% in the coronal brow lift, and 0.1% in the transblepharoplasty (Tables 1, 2). For the rate of numbness, it was the highest in the direct brow lift (5.5%), followed by the transblepharoplasty (2.1%), and the temporal/lateral brow lift

Table 1. Open Brow Lift Complications

Coronal		
Complication	**No. Patients**	**Percentage (n = 449)**
Alopecia	10	2.2
Chemosis	1	0.2
Frontal paralysis	1	0.2
Hematoma	2	0.4
Pruritus	1	0.2
Recurrence	1	0.2
Revision	8	1.8
Visible scar	5	1.1
Direct		
Complication	**No. Patients**	**Percentage (n = 439)**
Asymmetry	4	0.9
Eye problem	1	0.2
Nerve injury	1	0.2
Numbness	24	5.5
Overcorrection	3	0.7
Revision upper blepharoplasty due to ptosis	16	3.6
Recurrence	1	0.2
Visible scar	9	2.1
Hairline		
Complication	**No. Patients**	**Percentage (n = 374)**
Flap necrosis	3	0.7
Paresthesia	7	1.7
Revision	30	7.4
Widened scar	1	0.2
Temporal/Lateral		
Complication	**No. Patients**	**Percentage (n = 780)**
Alopecia	6	0.8
Asymmetry	12	1.5
Bruising	4	0.5
Chronic irritation	1	0.1
Frontal palsy	2	0.3
Hematoma	3	0.4
Infection	16	2.1
Numbness	2	0.3
Palpable suture	2	0.3
Persistent edema	1	0.1
Recurrence	4	0.5
Revision	9	1.2
Transblepharoplasty		
Complication	**No. Patients**	**Percentage (n = 816)**
Asymmetry	6	0.8
Dehiscence	3	1.5
Dysesthesia	2	0.5
Eye problem	8	0.1
Hematoma	1	0.3
Lymphedema	1	0.4
Numbness	8	2.1
Revision	1	0.3
Residual ptosis	11	0.3
Suture granuloma	2	0.1
Visible	4	0.5

Table 2. Comparison of Complication Rates

Complication	Complication Rate (%)	Type of Brow Lift
Alopecia	2.8	Highest in endoscopic
	0.8	Lowest in temporal/lateral
Asymmetry	1.5	Highest in temporal/lateral
	0.7	Lowest in transblepharoplasty and endoscopic
Numbness	5.5	Highest in direct
	0.3	Lowest in temporal/lateral
Revision	7.4	Highest in hairline
	0.1	Lowest in transblepharoplasty

Table 3. Endoscopic Brow Lift Complications

Endoscopic		
Complication	**No. Patients**	**Percentage (n = 7,273)**
Alopecia	204	2.8
Asymmetry	54	0.7
Edema	18	0.2
Dehiscence	1	0.0
Eye problem	12	0.2
Glabellar irregularity	2	0.0
Granuloma	1	0.0
Hematoma	7	0.1
Infection	4	0.1
Nerve injury	4	0.1
Numbness	148	2.0
Pain	8	0.1
Palpability	21	0.3
Pruritus	37	0.5
Recurrence	9	0.1
Revision	86	1.2
Screw exposure	1	0.0
Seroma	1	0.0
Skin burn	1	0.0
Visible scar	3	0.0

(0.3%). The rate of asymmetry was the highest in the temporal/lateral brow lift (1.5%), followed by the direct brow lift (0.9%), and the transblepharoplasty (0.7%). Lastly, the rate of alopecia was the highest in the coronal brow lift (2.2%), followed by the temporal/lateral brow lift (1.5%).

Endoscopic Brow Lift

A total of 34 studies were identified (7,273 patients) for the endoscopic brow lift (Table 3). The most common complication was alopecia (2.8%), followed by numbness (2%), revision (1.2%), asymmetry (0.7%), pruritus (0.5%), palpability (0.3%), edema (0.2%), eye-related complication (0.2%), and hematoma/infection/nerve injury/pain/recurrence (0.1%).

Nonsurgical Brow Rejuvenation

The literature review revealed 5 outcome studies in nonsurgical brow rejuvenation: botulinum toxin (3), fat injection (1), and radiofrequency (1; Table 4). The review showed that the most common complication in botulinum toxin was bruising (1.7%), flu-like symptoms/persistent wrinkles/trace ptosis (0.7%), and eyelid ptosis/excessive elevation (0.3%). For the fat injection, infection was the only documented complication (0.4%), and there were no complications documented for radiofrequency brow lift.

Table 4. Nonsurgical Brow Rejuvenation Complications

Botulinum Toxin		
Complication	**No. Patients**	**Percentage (n = 297)**
Bruising	5	1.7
Eyelid ptosis	1	0.3
Excessive elevation	1	0.3
Flu-like symptoms	2	0.7
Persistent wrinkles	2	0.7
Trace ptosis	2	0.7
Radiofrequency		
Complication	**No. Patients**	**Percentage (n = 125)**
No complication	125	100
Fat		
Complication	**No. Patients**	**Percentage (n = 250)**
Infection	1	0.4

DISCUSSION

Reflecting the current trend toward minimally invasive procedures in cosmetic surgery, brow rejuvenation has undergone several transformations past decades.[1,2,5–8] It has evolved from most invasive approach such as coronal brow lift to endoscopic approach to botulinum toxin injection[10–12] (Fig. 1). Although there are various types of techniques available, very little is known about the relative complication profile of each technique, and how each technique differs from the other approach except few retrospective and cohort studies.[9,13,14] Therefore, we performed a systemic literature review of all brow lift techniques to determine and compare complication rates of each technique.

Our study shows that the majority of complication rate was minimal (< 5%), and each technique has a different complication profile (Table 1). For the open brow lift techniques, we reviewed 37 studies (2,858 patients), and found the following: (1) numbness (5.5%) was the highest in the direct brow lift; (2) revision rate (7.4%) was the highest in the hairline brow lift; (3) asymmetry rate (1.5%) was the highest in the temporal brow lift; and (4) alopecia rate (2.2%) was the highest in the coronal brow lift. So far, there has been only one retrospective study comparing open brow techniques,[9] and the sample size for each open brow technique was very small (< 10 patients). In this study, they found that alopecia and sensory-related complications were the highest in the coronal brow lift.[9] Except for our study and the study by Koch et al.,[9] the majority of studies compare open versus endoscopic brow lift by combining all open approaches as a one group.[3,15]

For the endoscopic brow lift, we reviewed 34 studies (7,273 patients) and found that the patients experienced lower complications rates than the open brow lift. The most common complication rate was alopecia (2.8%), followed by numbness (2%), and revision (1.2%). The remaining complication rates were < 1% in asymmetry, pruritus, palpability, edema, eye-related complications, hematoma, infection, nerve injury, pain, and recurrence. This finding is in agreement with our earlier study of open versus endoscopic brow lift.[3] In the previous study, we found dysesthesia and alopecia were the common complications in the endoscopic brow lift.

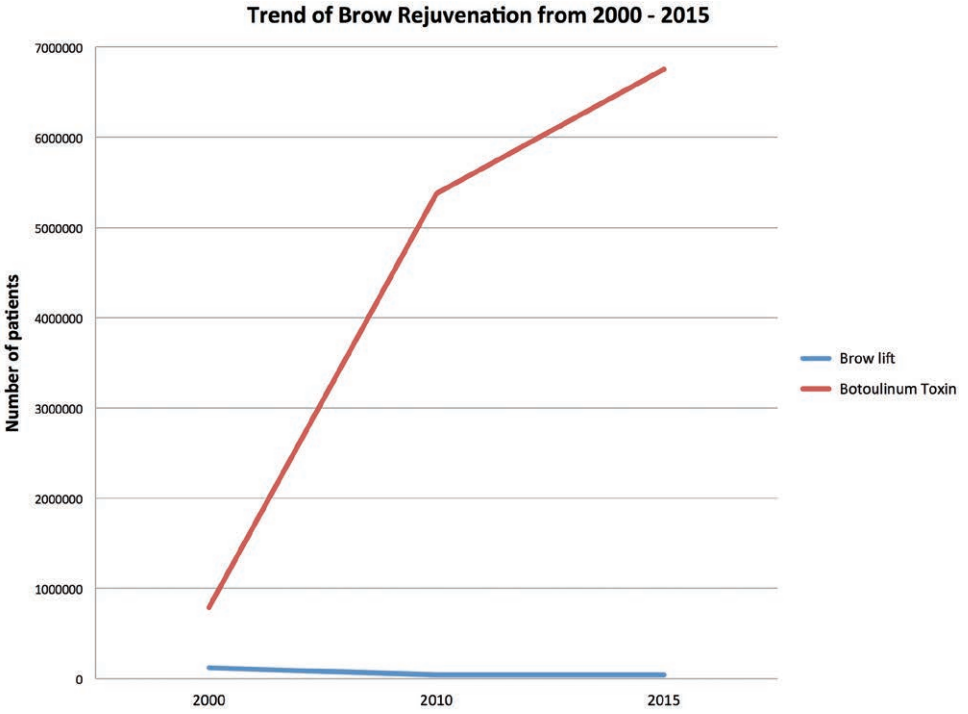

Fig. 2. Trend of brow rejuvenation from 2000 to 2015.

Interestingly, our review revealed that there are only 5 studies (672 patients) on nonsurgical brow rejuvenation: botulinum toxin (3), fat injection (1), and radiofrequency (1). According to American Society of Plastic Surgeons, brow rejuvenation by botulinum toxin has become exponentially popular (797%) past 16 years, whereas the percentage of surgical brow rejuvenation has decreased about 64% during the same period (Fig. 2). Despite the increased popularity of nonsurgical brow rejuvenation, we found a strikingly small number of outcome studies on its use.[16] Nevertheless, the analysis shows that these techniques are associated with minor complications (bruising, flu-like symptoms, persistent wrinkles, trace ptosis, infection).[10,11,17,18] In addition, the rates of recurrence and revision rates are unknown.

The limitation of our study is the inconsistency in the types of complications reported in the studies. Each study reported different types of complications and had different follow-up periods. Therefore, we were not able to compare a specific type of complication rate in all types of brow lift techniques. In addition, there was no standardization of each type of brow lift. Each study added their own modifications to historical described direct, coronal, temporal/lateral, transblepharoplasty, endoscopic, and botulinum toxin brow lift. Therefore, it is difficult to determine if certain technical modification resulted in lower or higher complications. Lastly, our study is a limited systemic review without a meta-analysis. The results from the identified brow lift studies were not matched using biostatistical techniques.

As demonstrated, our study shows the lack of randomized prospective outcome studies and standardization of outcome measures in brow rejuvenation. As there is a lack of high-quality evidence-based medicine in aesthetic surgery, we believe future prospective studies with standardized surgical and aesthetic outcome measures of brow rejuvenation are necessary.[19] This information would be the key to provide technically safe and long-lasting aesthetic outcomes for the patients.

CONCLUSIONS

The brow lift approach has transformed from the most invasive technique such as a coronal brow lift to the minimally invasive technique such as botulinum toxin injection. Although there are countless techniques and modifications available at our disposal, there is a limited number of studies on the complication profile of each technique. Our study shows that each brow technique has a different complication profile and it is important for plastic surgeons to understand the difference. Furthermore, the study demonstrated the lack of randomized prospective outcome studies and standardization of outcome measures in brow rejuvenation. We believe this information would be the key and next frontier in providing technically safe and long-lasting aesthetic outcomes for the patients.

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