

The History of Aesthetic Medicine and Surgery

Nils Krueger PhD,^a Stefanie Luebberding MSc,^a Gerhard Sattler MD,^b C. William Hanke MD,^c Macrene Alexiades-Armenakas MD,^d and Neil Sadick MD^e

^aDivision of Cosmetic Science, University of Hamburg, Germany

^bRosenparkklinik, Darmstadt, Germany

^cIndiana University School of Medicine, Indianapolis, IN

^dDepartment of Dermatology, Yale University, New Haven, CT

^eWeill Medical College, Cornell University, NY

ABSTRACT

The history of beauty is as old as mankind itself - throughout history people have tried to improve their attractiveness and to enhance their beauty. The technical basis for many of nowadays procedures like lipoplasty, breast augmentation or rhinoplasty was thereby initiated more than a hundred years ago and evolved to the modern standards of today. The aim of this article is to recall the early days of aesthetic medicine and show the swift progress up to the highly specialized medical discipline of our modern time. Combining the past, present and future of aesthetic medicine, allows to incorporate this perspective and ultimately to delivery better patient care.

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INTRODUCTION

The history of beauty is as old as mankind itself - throughout history people have tried to improve their attractiveness and to enhance their beauty. The ancient Egyptians had already been using animal oils, salt, alabaster, and sour milk to aesthetically improve the skin.¹ Although philosophers such as Plato or Imanuel Kant tried to define the term 'beauty', a universally valid definition remains elusive. Nowadays, study results show that key properties, such as clarity, symmetry, harmony and vivid color, are elements of an attractive and beautiful appearance.² However, appearance is the most public part of the self and therefore men and women both try to improve their (apparent) imperfections with the intention to increase their self-perception and quality of life.³

The market for cosmetic surgery and aesthetic treatments is booming. According to the American Society for Aesthetic Plastic Surgery (ASAPS) the overall number of cosmetic procedures has increased by 197 percent since the tracking of the statistics first began in 1997 through 2011.⁴ In 2011 in the US, almost 9.2 million cosmetic surgical and nonsurgical procedures were performed.² The technical basis for many of these procedures like lipoplasty, breast augmentation or rhinoplasty was initiated more than a hundred years ago and evolved to the modern standards of today.

The aim of this article is to recall the early days of aesthetic medicine and to show the swift progress up to a highly specialized medical discipline of our modern time. Therefore, a comprehensive literature review was conducted to identify the first published articles for pioneering aesthetic treatments from the beginning of the 19th century down to present day.

Up Until the 19th Century

The history of cosmetic surgery has a long tradition. Originating in India over 2000 years ago the forehead flap for reconstruction

for noses mutilated by war and criminal punishment is the oldest known procedure in aesthetic medicine.⁵ Throughout history the technique has been modified and adjusted by many different surgeons and has evolved to become a popular way of repairing nasal defects.⁶ In 1845, the Prussian surgeon Johann F. Differbach started publishing several monographs about facial reconstruction, where he mentioned the term "rhinoplasty" for cosmetic reason for the first time.^{7,8} With the development of the antiseptic surgery in 1867, the British surgeon Josef Lister laid the foundation for reducing post-operative infections by using carbolic acid to sterilize surgical instruments and to clean wounds. With increased safety for patients, the cosmetic surgery saw a boom with many inventions at the end of the 19th Century.⁹

In 1871, Tilbury Fox described the use of 20% phenol in order to lighten the skin, which became the first chemical peel, a technique that Paul G. Unna refined in 1882 when he described the properties of salicylic acid, resorcinol, phenol and trichloroacetic acid (TCA).¹ In 1881, Robert T. Ely described the first otoplasty for protruding ears,¹⁰ and six years later, in 1887, John O. Roe took an important step forward in the development of cosmetic surgery when he performed the first subcutaneous rhinoplasty.¹¹

The first injections for tissue augmentation were described in the last decade of the 19th century. In 1893, Franz Neuber was the first physician who used autologous fat as filler material.¹² Robert Gersuny recommended the use of paraffin 6 years later, in 1899.^{13,14} Paraffin became a very common material for augmentation for several years. As shown later, the choice was a mistake, as a foreign-body reaction to the exogenous paraffin lead to granulomas. At the end of the 19th century, Vincent Czerny introduced the first augmentation mammoplasty. He successfully transplanted a lipoma from the back of a patient into the patient's breast to correct a defect that was left from the removal of a breast adenoma.^{14,15}

The First Part of the 20th Century

In 1907, Charles C. Miller published a cosmetic surgery text titled where he introduced procedures for cosmetic eyelid surgery, face lifts and double chin correction.¹⁶ Besides Miller, the German Frederick S. Kollé experimented with paraffin injections and implants for the repair of facial imperfections, wrinkles and tightening of the skin contour.¹⁷ Eugen Holländer introduced one of the first face lifts in 1912 by removing skin pieces at the margins of the hairline to fresh-up skin wrinkles and dropping cheeks. All these aesthetic procedures became very popular and were refined in the following years. Pioneers in this field who helped evolve such techniques were Raymond Passot, Adalbert G. Betman, Jaques Joseph and Erich Lexer.^{5,8,17} The first woman who appeared in the history of cosmetic surgery, an early pioneer in the development of facelift and blepharoplasty, was Suzanne A. Noël in the early 20ths. Noël, a dermatologist, was also one of the first to emphasize the important benefits obtainable from pre- and postoperative photographs.¹⁷

The 1950s and 1960s

The history of modern augmentation mammoplasty started in 1955, when John W. Pangman described the use of sponge-like breast implants made of polyvinyl alcohol.¹⁸ However, as problems with incrustation and calcification were frequent, Thomas Cronin and Frank Gerow presented an important innovation regarding new implants made of thin silicone elastomer (polysiloxanes) around a soft but firm silicone-gel compound in 1963.^{14,19} They quickly became the implant of choice and a gold standard. In 1968, Demsey and Latham proposed the submuscular-retropectoral-implantation, thereby reducing the capsular contracture rate from 40 to 5%.^{20,21}

The first study of silicone as a filling agent for tissue augmentation was published by Thomas P. Rees et al in 1965.²² The inert, clear, oily substance was easy to inject and promised to be an uncomplicated filler with a long duration and natural feel. Unfortunately, over the following years, it was noted that the injected silicone could migrate and fistulize. Due to several severe events injectable liquid silicone was restricted by the FDA in 1976.

In the 1950s, the history of modern hair transplantation began with the theory of "donor dominance" by Norman Orentreich in 1959.²³ However, 20 years before, the Japanese physician Shoji Okuda had reported the punch graft hair transplantation in burn victims.²⁴ Nevertheless, Orentreich was the first in the Western world who showed that hair from the back of the head, where it infrequently falls out, keeps growing when transferred to regions with hair loss. His punch technique was the basic procedure for hair transplantation for many years,⁵ especially in the treatment of androgenetic alopecia.²⁴

One other significant innovation of this time period was the use of lasers in dermatology. In 1965, Leon Goldman published a visionary article regarding the treatment of tattoos with a ruby laser.²⁷

Due to high rates of hypertrophic scarring and pigment alteration that occurred, the technology was abandoned for about 15 years.

The 1970s and 1980s

The 70's and 80's were important decades in the progression of lipoplasty. In 1972, the German oral and maxillofacial surgeon Joseph Schröder started this development started by describing the curetting of subcutaneous fat. Since he used a sharp uterine curette for the procedure, it frequently resulted in prolonged drainage, lymphorrhea, hematoma, and even skin necrosis. Arpad and George Fisher enhanced the technique in 1977 by adding suction to facilitate fat extraction. Since the tip of the device was still sharp, the rate of complications remained high. This changed dramatically when Yves-Gerard Illouz presented the blunt lipoplasty technique in combination with the infiltration of 200 to 300 mL of infusate in 1980.^{28,29} In 1987, Jeffrey A. Klein introduced the tumescent technique, allowing the procedure to be done in an office setting with only local anesthesia.^{29,30} Further developments targeted the manipulation of adipocytes to fragment them before aspiration. In 1992, Michele Zocchi first described ultrasound-assisted liposuction³¹ and David B. Apfelberg published the first article on laser-assisted liposuction.³² To this day liposuction is the most frequent surgical procedure in the USA.⁴

Another idea that influenced cosmetic surgery significantly was Rox Anderson and John Parrish's theory of selective photothermolysis in 1981.³³ This theory refers to the precise targeting of a structure or tissue using a specific wavelength of light with the intention of absorbing light into that target area alone, while allowing the surrounding area to remain relatively untouched. They verified their groundbreaking work using the pulsed dye laser for the treatment of vascular lesions in 1981,³³ and paved the way for laser-based innovations like, the Q-switched ruby laser for tattoo removal introduced by William H. Reid in 1983³⁴ or the pulsed CO₂ laser for ablative resurfacing introduced by Laurence M. David in 1989.³⁵

In 1981, bovine collagen was the first facial filler approved for cosmetic use in the United States,³⁶ four years since Terry R. Knapp published first results.³⁷ Since its approval, an immense number of animal- and human-derived, natural and synthetic fillers became available on the market. Collagen, although, had notable disadvantages and was the most important substance for augmentation for more than 20 years.³⁸

The 1990s

In 1992, the Canadian ophthalmologist and dermatologist Jean and Alastair Caruthers published their article on the treatment of glabellar frown lines with Clostridium botulinum-A exotoxin that dramatically changed the public perception of cosmetic surgery in the last decade of the 20th century.³⁹ The neurotoxin had been used for several indications in ophthalmology and neurology in the past; therefore, its specified use had been well-established.

The brand name of the drug "Botox[®]" (Allergan, Irvine, USA) became extremely fashionable after its approval for cosmetic use in 2002. Today, botulinum toxin (BoNTA) is used in dermatology for the treatment of glabellar and horizontal forehead lines, crow's feet, nasal flare, and chin dimpling. Reports also described BoNTA as highly effective for the treatment of hyperhidrosis of the axilla, palms of the hands and feet.⁴⁰

Another innovation in 1998 began in Sweden when Michael Olenius presented the first clinical study on skin augmentation with hyaluronic acid.⁴¹ Hyaluronic acid quickly displaced collagen as the number one filler substance, as its allergy potential was much lower. In 2003, seven years after its market release in Europe, the first hyaluronan filler for augmentation of soft tissue defects such as facial wrinkles was approved in the USA.³⁸ These days, dermal fillers based on hyaluronic acid have become the worldwide standard with a wide range of products for all kinds of facial and non-facial augmentation techniques including the treatment of fine and marked wrinkles, body contouring or mesotherapy.

Another dermal filler that emerged around the same time was poly-L-lactic acid. This synthetic biodegradable, resorbable polymer had been used since the mid-1990s in various maxillofacial and orthopedic procedures.⁴² In 1999, it was approved in Europe for increasing the volume of depressed skin areas such as wrinkles, folds, scars or eye rings. In 2004, it was approved in the USA for the restoration of facial lipotrophy.⁴³

Furthermore, the 90s were the decade when light-based devices such as laser and IPL grew large in cosmetic surgery. In 1991, Q-switched Nd:YAG laser with 1064 nm were approved for tattoo removal in the USA and many authors published articles about new laser systems and areas of application.

In 1996, Mitch Goldman observed that hair regrowth was reduced after intense pulsed light (IPL) treatments. This was reported to the FDA as an adverse effect. The application of IPL for hair reduction was born! In 1997, a first study was published by Michael Gold, showing the efficacy of intense IPL for hair reduction.⁴⁴ While 1996 Melanie C. Grossman was the first to show that a normal-mode ruby laser can be used to reduce hair growth in dogs,⁴⁵ it was Curt M. Littler and David J. Goldberg who published one year later the first articles on successful hair removal with the Q-switched Nd:YAG in humans.^{46,47} It was another 3 years before Eliot F. Battle presented a widely recognized study on laser hair removal at the Annual Meeting of the American Society for Laser Medicine and Surgery in 2000. A full article on this topic was first published by Robert Adrian and Kathleen Shay in the same year.

In 1999, Gregg M. Menaker presented the successful treatment of facial rhytides with a non-ablative Nd:YAG laser⁴⁸ and David

H. McDaniel demonstrated a significant reduction in leg veins using a long-pulsed alexandrite laser with 755 nm.⁴⁹

The 21st Century

Just as injectable fillers have addressed the need for non-surgical methods to restore desired volume of the dermis, a minimally invasive treatment was invented to reduce unwanted volume of the subcutis.⁵⁰ In 2001 the Brazilian physician Patricia Rittes first published an article about the injection of phosphatidylcholine to reduce localized fat deposits of infraorbital fat pads for cosmetic reasons.⁵¹ The method turned out to be effective but was accompanied by serious side effects, including an increase in complications, that the product was restricted in Brazil soon. In 2004, studies by Adam Rotunda et al. showed that sodium deoxycholate is the major active component responsible for cell lysis.⁵² This active alone seems to be better tolerable to reduce unwanted localized fat depots at the hips, abdomen, "love handles", neck or jowls, as well as for the treatment of benign lipomas.^{50,53}

The first non-invasive device driven approach to reduce body fat was published by Sydney R. Coleman in 2009 et al.⁵⁴ They demonstrated the possibility to induce apoptosis in humans adipocytes caused by cold exposure. The so-called cryolipolysis was shown to be effective to reduce body fat at the flanks and abdomen without damaging the upper skin layers or peripheral nerves.

Beside ongoing improvements of established techniques, the first decade of the 21st century is characterized by new non-invasive devices for skin tightening and the selective combination of various techniques for a holistic approach in cosmetic surgery. In 2003, Javier Ruiz-Esparza was the first who published a study on a new noninvasive, nonsurgical approach to tighten facial tissue.⁵⁵ The technique is based on using energy in the radiofrequency segment of the electromagnetic spectrum to produce heat within the skin and thereby achieve shrinking of collagen fibers. An improvement of this technique is the combination of radiofrequency with simultaneous applied optical laser energy, which was first described by Seema Doshi in 2005,⁵⁶ to target both skin laxity and facial rhytides. The latest idea is the combination of radiofrequency with pulsed magnetic fields to increase the production of collagen fibers via a non-thermal mechanism. A first clinical study proving the concept is published by Young B. Lee et al.⁵⁷ A minimal invasive enhancement of radiofrequency technology is the use of microneedles to bypass the epidermis and apply the electromagnetic energy directly to the dermis. This so-called sub-lative fractional radiofrequency was first shown to be safe by Basil Hantash et al.⁵⁹ in 2009. One year later, a randomized controlled trial by Macrene Alexiades-Armenakas et al. proved the concept to be effective for the treatment of facial skin laxity.⁵⁹

An important improvement of the laser technology, called fractional photothermolysis, was introduced in 2004 by Dieter

Manstein.⁶⁰ Unlike conventional lasers, fractional photothermolysis treats only a fraction of the skin, leaving up to a maximum of 95% of the skin uninvolved. Compared to conventional non-fractional laser procedures, the undamaged surrounding tissue permits a rapid repair of the affected skin resulting in an optimized ratio of efficacy, down-time and side effects.^{61,62} These first generation of fractional systems was based on Er:diode lasers with 1535 to 1550 nm wavelengths and worked non-ablative with virtually no damaging of the epidermis. In 2007, a second generation of fractional lasers was introduced by Basil M. Hantash et al.⁶³ These new devices combined powerful 10,600 nm CO₂ lasers with the fractional approach, resulting in ablative fractional photothermolysis with high efficacy and a good safety profile.

Another improvement of light based modalities was the combination of IPL with the topical applied photosensitizer 5-aminolevulinic acid. This procedure, well known for the treatment of actinic keratosis, was the first time described to be also effective for rejuvenation by Javier Ruiz-Esparza et al in 2002.⁶⁴ In 2006, it was the same author who enhanced the use of IPL to the infrared spectrum including wavelengths from 1100 to 1800 µm for the treatment of wrinkles and skin laxity.⁶⁵

In parallel to the technical improvements, a new dermal volume filler found its way into aesthetic medicine. The formulation consists of particles of synthetic calcium hydroxylapatite (CaHA), which is identical in chemical composition to the inorganic constituent of teeth and bone, blended in a gel. The microspheres were surrounded with thin connective tissue after injection and slowly degraded into calcium and phosphate ions over years. Its efficacy and safety for aesthetic treatments was described first by Thomas L. Tzikas⁶⁶ and Patrick Flaharty⁶⁷ in 2004.

The Future of Aesthetic Medicine

The rejuvenation of the aging face and body will stay a high priority for the future of aesthetic medicine and promote the development of new techniques and devices. To be successful in the fiercely competitive market, these new developments need to be superior in efficacy, safety or comfort without having any disadvantages to established technologies.

One of the new technologies that have the potential to set new milestones in aesthetic medicine is a botulinum toxin gel for the topical treatment of facial wrinkles. This gel, consisting of a purified 150kD BoNTA molecule and a peptide absorption enhancer, is applied topically to the treatment area under medical control and with an exposure time of 30 minutes. The first controlled study by Fredric Brandt et al. investigating the treatment of lateral canthal lines showed promising results.⁶⁸ In the near future treatments with topical BoNTA might become an innovative noninvasive alternative, providing a smoother effect with no risk of injection-related side effects.

Another innovation that could become a milestone for aesthetic medicine is the use of autologous platelet-rich plasma (PRP) for skin improvement and rejuvenation. PRP is known to contain various growth factors like platelet-derived growth factor (PDGF), transforming growth factor (TGF) or vascular endothelial growth factor (VEGF), which are effective in stimulating dermal healing processes.⁶⁹ First study results by Alessio Redaelli et al. generally showed that PRP can improve skin wrinkling, elasticity and texture.⁷⁰ Furthermore, PRP seems to be beneficial in hair transplantation and in the treatment of hair loss.^{71,72} However, the efficacy is controversially discussed as randomized double-blind studies for aesthetic indications are still rare.

Another approach using autologous cells is the use of multipotent adipose-derived stem cells (ADSC) obtained from liposuction fat aspirates for the treatment of aged skin. As ADSC have the ability to differentiate into various cell types including adipocytes and keratinocytes, they may hold promise to be effective for skin rejuvenation.^{73,74} However, while first studies show the beneficial effect of ADSC in wound healing,⁷⁵ their usability as anti-aging treatment is controversial.

A new technique for non-invasive treatment of primary hyperhidrosis axillaris was introduced in 2011. The device causes irreversible thermolysis of apocrine and eccrine sweat glands by focused microwave energy at the interface between dermal and subcutaneous tissue. Continuous cooling prevents thermal conduction of heat superficially, and creates a heat zone at the level of the sweat glands. Studies by Glaser et al. and Hang et al. demonstrate a significant reduction of sweating with only minimal side effects and long lasting results.^{76,77} This technology has a good chance to become the new gold-standard for the treatment of primary hyperhidrosis axillaris, as it fills the gap between non-permanent treatments with BoNTA and the permanent but invasive sweat gland excision or curettage.

CONCLUSION

The history of the aesthetic surgery is probably as old as medicine's itself. In the beginning often driven by single individuals and their personal interests and experience, the aesthetic medicine developed into an independent scientific discipline, involving physicians and scientists from many fields. Over time, a plethora of developments and innovations have made aesthetic medicine one of the most diversified disciplines in medicine. Currently, a distinct trend can be seen towards minimal or non-invasive treatments, with minimal risk for the patient, no downtime and highly satisfactory results. The ongoing development of innovative technologies includes novel laser or radiofrequency systems devices, topically applied BoNTA and the use of microwaves for the non-invasive treatment of hyperhidrosis. These innovations are just examples for the steady progress of the field and hold promise for the future of cosmetic surgery and aesthetic medicine.

TABLE 1.

Historical overview over the development of the aesthetic medicine

Year	Surgeon	Core specialty
1829	Dieffenbach, Johann F.	Nasal reconstruction / cosmetic rhinoplastic
1854	Velpeau, Alfred	Aesthetic breast surgery
1867	Lister, Josef	Development of the antiseptic surgery
1871	Fox, Tilbury	Phenol peeling
1881	Ely, Robert T.	Otoplasty for protruding ears
1882	Unna, Paul G.	Peeling with salicylic acid, resorcinol, phenol and trichloroacetic acid (TCA)
1887	Roe, John O.	Subcutaneous rhinoplastic
1893	Neuber, Franz	Autologous fat injections for facial augmentation
1895	Czerny, Vincent	Augmentation mammoplasty
1899	Gersuny, Robert	Paraffin injections for cosmetic purposes.
1906	Miller, Charles C.	Cosmetic eyelid surgery, face lifts, double chin correction
1911	Kolle, Frederick S.	Correction of protruding ears, eyelid correction
1912	Holländer, Eugen	Face lifting by removing skin pieces at the margins of the hairline
1955	Pangman, John W.	Breast implants made of polyvinyl alcohol
1959	Orentreich, Norman	"Donor dominance" as groundwork for hair transplantation
1962	Baker, Thomas / Gordon, Howard	Baker and Gordon phenol peeling
1963	Cronin, Thomas / Gerow, Frank	Breast implants made of silicone
1965	Rees, Thomas	Silicone for soft-tissue augmentation
1965	Goldman, Leon	(Ruby)Laser for tattoo removal
1968	Demsey WC / Latham WD	Submuscular-retropectoral placement of breast implants
1972	Schrudde, Joseph	Lipidexheresis (curettage of subcutaneous fat)
1977	Knapp, Terry R.	Injectable collagen for soft tissue augmentation
1977	Fisher, Arpad / Fisher, George	Liposuction (sharp tip)
1980	Illouz, Yves-Gerard	Use of blunt instruments for liposuction
1981	Anderson Rox R., Parrish John A.	Theory of selective photothermolysis

1983	Reid, Walter H.	Q-switched ruby laser for tattoo removal
1987	Klein, Jeffrey A.	Tumescent technique in Liposuction
1989	David, Laurence M.	Pulsed CO2 laser for ablative resurfacing
1992	Zocchi, Micheal	Ultrasound-assisted liposuction
1992	Carruthers, Alistair/ Carruthers, Jean	Botulinum toxin for wrinkle reduction
1992	Apfelberg, David	Laser assisted Liposuction
1996	Grossman, Melanie	Ruby laser for hair removal
1997	Little, Curt M. / Goldberg, David J.	Q-switched Nd:YAG laser for hair removal
1997	Gold, Michael H.	IPL for hair removal
1998	Olenius, Michael	Hyaluronic acid as filler
1999	Menaker, Gregg M.	Treatment of facial rhytides with non-ablative Nd:YAG laser
1999	McDaniel, David H.	Long pulsed alexandrite laser for treatment of leg veins
2000	Hetter, Gregory P.	Croton oil-phenol peel
2001	Rittes, Patricia	Injection of phosphatidylcholine for fat reduction
2003	Ruiz-Esparza, Javier	Photodynamic therapy
2003	Ruiz-Esparza, Javier	Radiofrequency technology for skin tightening
2004	Thomas L. Tzikas/ Patrick Flaharty	Injection of calcium hydroxylapatite for soft-tissue augmentation
2004	Rotunda Adam	Sodium deoxycholate for fat reduction
2004	Manstein, Dieter	Non-ablative fractional photothermolysis
2005	Doshi, Seema	Combination of radiofrequency and optical energy
2007	Hantash, Basil	Ablative fractional photothermolysis
2009	Hantash, Basil	Sublative fractional radiofrequency
2009	Coleman, Sydney	Cryolipolysis
2010	Brandt, Frederic	Topical use of botulinum toxin
2010	Redaelli, Alessio	Injection of platelet-rich plasma for skin rejuvenation
2012	Lee, Young Bok	Combination of radiofrequency and pulsed electromagnetic fields
2012	Glaser, Dee Anna / Hong, H. CHIH-HO	Use of microwaves for treatment of focal hyperhidrosis

DISCLOSURE

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AUTHOR CORRESPONDENCE

Nils Krueger PhD

E-mail:.....nils.krueger@chemie.uni-hamburg.de