



Procedural dermatology and its unmet need

Nikhil Mehta, Ananya Sharma, Tekumalla Sindhuja, Pankhuri Dudani, Kanika Sahni, Neena Khanna, Somesh Gupta

Department of Dermatology and Venereology, All India Institute of Medical Sciences, New Delhi, Delhi, India.

Abstract

Procedural dermatology includes invasive conventional dermatologic surgeries which involve significant use of knife and suture, minimally invasive procedures and device-based procedures. Device-based procedures are the easiest to learn and are less prone to human errors due to automation but can lead to monotony, while conventional surgeries require significant skill, craftsmanship and interest. There has been a recent shift in the approach to procedural dermatology as a therapeutic option with complementary and combination models replacing the conventional hierarchical model in which procedures were last in the step-ladder approach. The demand for both conventional dermatologic surgeries and minimally invasive cosmetic procedures is increasing. Unfortunately, this demand has not been met with adequate supply. Consequently, the number of trained professionals with expertise in these procedures is very limited; they are far outnumbered by unqualified practitioners. A limited number of dermatologic surgeons practicing conventional surgeries has resulted in huge waiting lists for vitiligo surgeries, inappropriate excisions for skin cancers and poor cosmetic outcomes of excisions without proper knowledge of flaps and grafts. Increasingly procedures are being performed by inadequately trained personnel, resulting in complications. There is also an absence of good quality research on the subject of procedural dermatology, which has resulted in a lack of standardisation of various procedures and knowledge about the efficacy of various drug-procedure and procedure-procedure combinations. An increasing variety of gimmicky but costly procedures are being offered to the public without much evidence of efficacy. Individual institutional and broad policy directives are needed to address these issues. Special emphasis is required on formal hands-on procedural dermatology training during residency and beyond it.

Key words: Procedural dermatology, dermatologic surgery, dermatosurgery resident training, dermatology curriculum, cosmetic surgery

Introduction

Procedural dermatology has become an integral and essential component of dermatology practice. The American Society for Dermatologic Surgery refers to dermatologic surgery as “*a specialty dealing with the diagnosis and treatment of medically necessary and cosmetic conditions of the skin, hair, nails, veins, mucous membranes and adjacent tissues by various surgical, reconstructive, cosmetic, and non-surgical methods.*”¹ They propose that dermatologic surgery aims to repair and/or improve the function and cosmetic appearance of skin tissue. The University of North Carolina School of Medicine defines procedural dermatology as “*the subspecialty within dermatology that is concerned with the study, diagnosis, and surgical treatment of diseases of the skin and adjacent*

mucous membranes, cutaneous appendages, hair, nails, and subcutaneous tissue.”² ‘Procedural dermatology’ is a broader and perhaps better term which also includes the usage of energy-based devices, simple and less invasive cosmetic procedures like botulinum toxin and filler injections and other ‘non-surgical’ and ‘semi-surgical’ techniques, in addition to the core ‘scalpel and blade’ procedures which come to mind when the conventional term ‘dermatologic surgery’ is used.

Classification

Procedural dermatology can be divided into three categories, based on the invasiveness and complexity of procedures, the skills required to learn them and their technological dependence.

How to cite this article: Mehta N, Sharma A, Sindhuja T, Dudani P, Sahni K, Khanna N, et al. Procedural dermatology and its unmet need. Indian J Dermatol Venereol Leprol 2023;89:807-18.

Corresponding author: Dr. Somesh Gupta, Professor, Department of Dermatology and Venereology, All India Institute of Medical Sciences, New Delhi, Delhi, India. someshgupta@aiims.edu

Received: March, 2022 **Accepted:** June, 2022 **EPub Ahead of Print:** December, 2022 **Published:** October, 2023

DOI: 10.25259/IJDVL_322_2022 **PMID:** 36688880

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- Conventional dermatologic surgeries include invasive techniques involving significant tissue cutting and suturing. These reasonably complex interventions are aimed at alleviating symptoms and/or enhancing cosmesis.
- Minimally invasive procedures (excluding device-based procedures) include ‘non-surgical’ less invasive techniques such as botulinum toxin injections and fillers. Many, but not all of them, are aesthetically enhancing and relatively newer than conventional dermatologic surgeries.
- Laser, light and energy device-based procedures primarily involve using these devices and require less skill than conventional dermatologic surgeries. Apart from their primary use in cosmetic procedures, these devices can also be used to aid conventional dermatologic surgery; an example is laser-assisted recipient epidermis removal during grafting procedures in vitiligo.

In Table 1, we summarise the skills required, the monetary investment needed and the perceived return on investment for common procedures in dermatology, based on an online survey using Google Forms from 53 procedural dermatologists (authors' unpublished data). Neither is this list exhaustive, nor are the categories watertight. In general, conventional dermatologic surgeries are skill-intensive, have a longer learning curve, involve significant craftsmanship and require low-to-moderate monetary investment. They are not automated and are thereby more prone to human errors and complications. Currently, they are performed by limited well-trained experts in dermatologic surgery. Minimally invasive procedures are relatively easily mastered, require low initial monetary investment but have a moderate-to-high return. As evident from Table 1, even the seemingly ‘simple’ and quick minimally invasive procedures like botulinum toxin and filler injections are considered to require significant skills, because they necessitate a comprehensive knowledge of complex facial anatomy and carry the risk

Table 1: Skill level, monetary investment needed and its expected return for various procedures in dermatology (unpublished data, survey of 53 experts in dermatosurgery)

Procedure	Skill level, on a Likert scale of 1–5*	Monetary investment, on a Likert scale of 1–5*	Return on investment, on a Likert scale of low-moderate-high*
	Median (range)	Median (range)	(Mode)
Conventional dermatologic surgery			
Reconstructive flaps and grafts	5 (1–5)	4 (1–5)	Moderate
Scar revision	4 (1–5)	3 (1–5)	Moderate
Autologous fat transfer	4 (1–5)	4 (1–5)	Moderate
Hair restoration surgery	4 (1–5)	4 (1–5)	High
Vitiligo surgeries	4 (2–5)	3 (1–5)	Moderate
Nail surgeries	4 (2–5)	2 (1–5)	Moderate
Serial excision	4 (1–5)	3 (1–5)	Moderate
Simple excision and punch excision	3 (1–5)	2 (1–5)	Low
Minimally invasive procedures			
Dermabrasion	3 (1–5)	2 (1–4)	Moderate
Microdermabrasion	2 (1–5)	2 (1–4)	Moderate
Injectable fillers	4 (1–5)	4 (1–5)	High
Botulinum toxin	4 (1–5)	3 (1–5)	High
Chemical peels	3 (1–5)	3 (1–5)	Moderate
Microneedling	2 (1–5)	2 (1–4)	Moderate
Thread lift	4 (2–5)	3 (1–5)	Moderate
Intralesional injections	2 (1–5)	2 (1–5)	Moderate
Subcision	3 (1–5)	2 (1–5)	Moderate
Laser, light and energy-based devices			
Vascular lasers	4 (2–5)	5 (2–5)	Moderate
Pigment lasers	4 (2–5)	4 (2–5)	Moderate
Phototherapy	3 (1–5)	3 (1–5)	Moderate
Hair removal lasers	3 (1–5)	4 (2–5)	High
Non-ablative fractional lasers	3 (1–5)	4 (2–5)	Moderate
Electrosurgery and radiofrequency	3 (1–5)	3 (1–5)	High
Microneedling radiofrequency	3 (1–5)	3 (1–5)	Moderate
Skin tightening and body contouring devices	3 (1–5)	4 (1–5)	Moderate
Fat reduction devices	3 (1–5)	4 (1–5)	Moderate

*Unpublished data obtained from survey of 53 experts in dermatologic surgery by circulating an online form

of complications. They are among the most common procedures done by procedural dermatologists. Though they are often initiated early in their careers by most beginners, significant experience is required to master them. The device-based procedures tend to suffer from the drawback of a high ratio of investment: initial return. They are generally automated with few predetermined selected parameters; thus they are safer, less prone to human errors and are easy to deliver by minimally-trained professionals. Automation and overdependence on technology can bring boredom and monotony to practice that could possibly even outweigh the monetary returns. One needs to balance both skill-intensive and technology-intensive procedures in practice.

History and current status

Milestones

The beginning of procedural dermatology perhaps predates recorded history.³ Skilled dermatologic surgeons extensively use flaps and reconstructions, and this use dates back to the time of Sushruta, an Indian pioneer in dermatologic and plastic surgery.⁴ Modern “procedural dermatology” formally started around half a century ago when various like-minded dermatologists practicing different procedural interventions collaborated and started a separate publication focusing on this sub-division of dermatology.⁵ Prof. Lawrence Field is

considered the father of modern dermatologic surgery.⁶ In India, two organisations dedicated to the field of dermatologic surgery, namely, the Association of Dermatological Surgeons of India and the Indian Academy of Cutaneous Surgeons, were launched in 1993 in Manipal and Kolkata, respectively. They were later merged to form the Association of Cutaneous Surgeons of India.⁷

Dermatologists have been pioneers in chemical peeling,⁸ cryosurgery,⁹ vitiligo surgeries,¹⁰ hair transplantation surgeries,¹¹ soft tissue augmentation and rejuvenation procedures. A large number of aesthetic or cosmetic procedures, like hair transplantation, were started first by dermatologists and later adopted by others.⁶ Although not primarily discovered by dermatologists, dermatologists perform the maximum number of botulinum toxin injections,¹² skin cancer excisions including Mohs’ surgery,¹³ liposuction¹⁴ and electrosurgery¹⁵ [Table 2]. In the USA, the volume of reconstructive surgical procedures by dermatologists exceeds that of any other specialty, including plastic surgery.¹⁶ Not only do dermatologists perform more excisions for skin cancers, but they also do so better and more adequately than other practitioners.¹⁷ Dermatology probably utilises the highest numbers of lasers, light sources and energy-based devices amongst the various medical specialties.

Table 2: Historical milestones in procedural dermatology

Procedure	First described in modern history by?	Year of first description	Currently predominant practitioners
Chemical peeling	Ferdinand von Hebra, Austrian dermatologist William Tilbury Fox, British dermatologist	1860 1871	Dermatologists
Vitiligo surgeries	Pran Nath Behl, Indian dermatologist, thin Thiersch skin grafts Rafael Falabella, Italian dermatologist, suction blister grafting and mini-punch grafting	1964 1971 1978	Dermatologists
Cryosurgery and cryosurgery using refrigerants	James Arnott, English physician, for various tumours and some skin conditions Archibald Campbell White, American physician, for skin conditions	1845–1851 1899	Dermatologists
Electrosurgery	Joseph Riviere, French physician Harvey Cushing, American neurosurgeon, along with William T Bovie, biophysicist	1900 1926	All surgical fields for hemostasis, dermatologists for most indications including resurfacing
Botulinum injections	Alan Brown Scott, American ophthalmologist, for strabismus Jean Carruthers and Alastair Carruthers, Canadian ophthalmologist and dermatologist, respectively, for glabellar frown lines	1980 Procedure in 1987, article published in 1992	Many surgical specialties, but most commonly performed by dermatologists for cosmetic reasons
Mohs’ surgery	Frederic Mohs, American surgeon	Procedure in 1936, article published in 1941	Mostly by dermatologists, also by plastic surgeons and general surgeons
Liposuction	Arpad Fischer and Giorgio Fischer, Italian gynaecologists, blunt cannula liposuction Jeffrey Klein, American dermatologist, tumescent liposuction without requirement of general anaesthesia	1975 1987	Plastic surgeons and dermatologists
Hair transplant for patterned baldness	Norman Orentreich, American dermatologist	1959	Dermatologists and plastic surgeons

Shift in models

Earlier, a conservative mindset was supported by limited availability and experience of procedural modalities, hence the general hierarchical approach of dermatologists was to first try medical interventions while procedures played a supplementary role and often required referral to surgical disciplines [Figure 1a]. Many diseases were considered untreatable as they were not amenable to any medical therapy, and patients were counselled without attempting any procedure in line with the ‘first do no harm’ principle. For diseases like early-stage androgenetic alopecia, melasma and other pigmentary disorders, a hierarchical model is still valid, that is, they are generally treated first with medical treatment and if medical treatment fails, procedures can be tried.^{18,19}

However, with the established efficacy, safety and wide availability of a variety of procedures, the hierarchical model has given way to complementary [Figure 1b] and combination models [Figure 1c]. Many diseases previously considered untreatable are now offered procedures as the first-line modality for management (e.g., acrochordons, vascular malformations, tattoos, epidermal, pigmented and vascular nevi, mucoceles, cysts and malignant tumours).^{20–22} Procedures are also indicated to tackle residual changes following successful medical management of certain conditions (e.g., leprosy, panniculitis, linear morphea and infantile haemangiomas).^{23–25} Certain conditions involve utilising a combination of medical and physical modalities initially itself (e.g., keloids, acne scars and chromoblastomycosis).^{26,27}

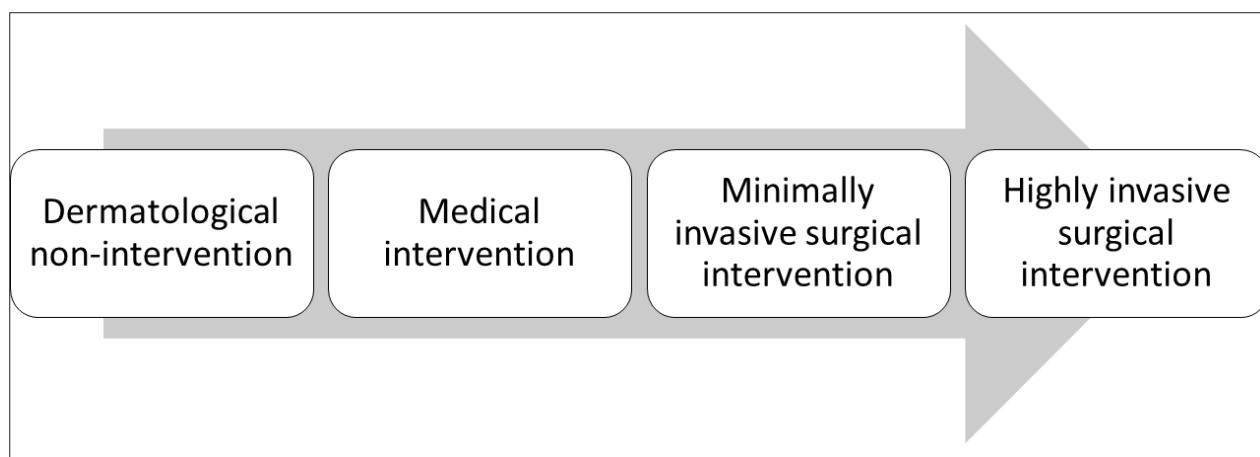


Figure 1a: Models of dermato-therapeutics: (a) Conventional hierarchical model

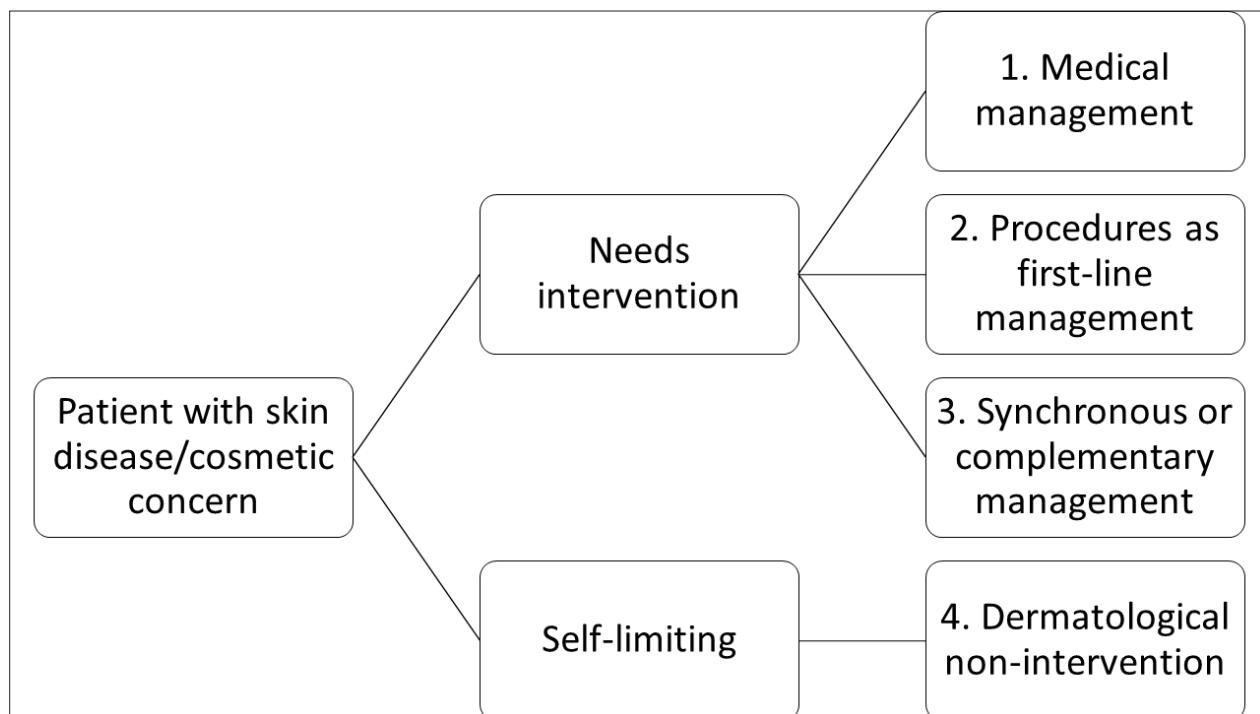


Figure 1b: Models of dermato-therapeutics: (b) Complementary model

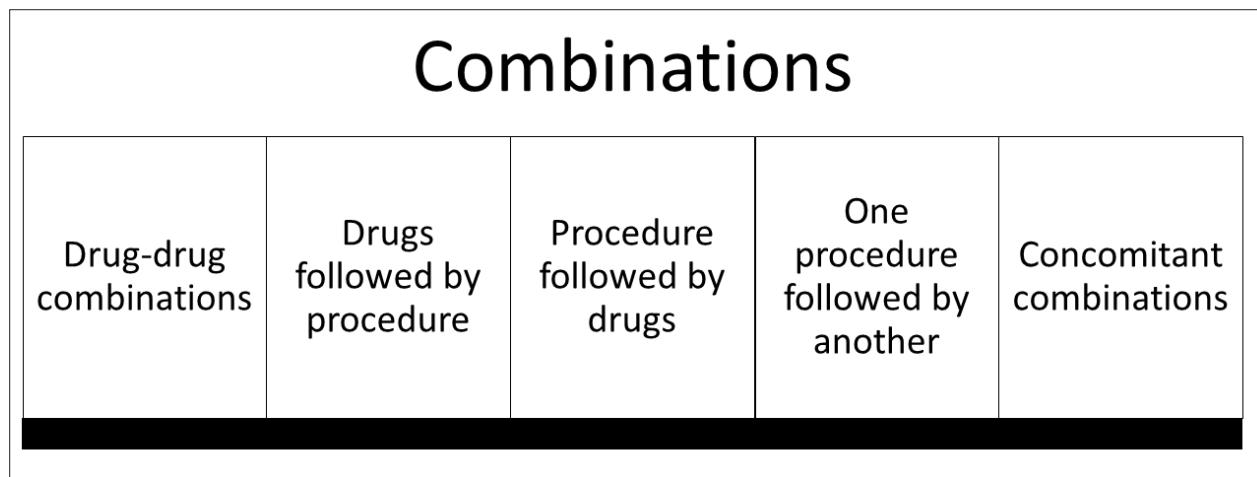


Figure 1c: Models of dermato-therapeutics: (c) Combination model

Hence, medical and procedural dermatology should now be considered complementary to each other.

The division of management of diseases into these models is not clear-cut or uniformly accepted. The choice of order of utilising these modalities is also subjective and based on physician preference. Often clear guidelines do not exist and even if they do, patient preference is also a determining factor, examples being the choice of utilising medical treatment versus a surgical modality as the first-line treatment for segmental vitiligo. Similarly, for many conditions, the levels of the traditional hierarchical approach are also in the process of rearrangement, the classic example being the utility of early surgical intervention versus prolonged antibiotic therapy in moderate-to-severe hidradenitis suppurativa.^{28,29} The decision of whether to use a procedure as the first-line or medical treatment or combination should be need-, cost- and evidence-based.

Current demand

The demand for procedural dermatology is growing exponentially. A total of 11.3 million surgical and 13.6 million non-surgical procedures were performed worldwide in 2019, 3.8% and 1.6% of which respectively were done in India. India ranked fourth amongst all included countries in liposuction, sixth in hair removal and eighth in facial rejuvenation.³⁰ Hair transplantation,^{31,32} botulinum toxin injections³³ and medical aesthetic device-based procedures³⁴ have either shown or are predicted to show, a double-digit annual growth rate in India and the world. In the USA, there has been an exponential increase in body sculpting procedures, laser/light and energy-based treatments, fillers, wrinkle-relaxing procedures and procedures to remove non-melanoma skin lesions.³⁵

This rise in demand has been consistent despite the global financial crisis of 2007–2008 and the COVID-19 pandemic.^{36,37} The USA had a 54% increase in botulinum toxin injections and a 75% increase in filler treatments in 2020 compared to 2019.³⁸ In 2020, while conventional surgical procedures

dropped by 10%, there was a 5% rise in minimally invasive cosmetic procedures worldwide. India accounted for 5% of these procedures, with hair removal and facial rejuvenation being the most common.³⁹

The social factors contributing to this rapid rise in the patient pool include an enhanced consciousness about looks, a direct perceived correlation between attractiveness and ‘success’ at work and in relationships, minimal downtime of the newer procedures, social-media-driven goals of appearance, the background lack of regulatory controls over such procedures and increasing disposable incomes in contrast to earlier economic frugality.^{40–42}

Training and research opportunities

There are many fellowships in procedural dermatology in India and the rest of the world, including the USA, UK, Europe, Australia, Middle East and South-East Asia. These range from six months to two years in duration. The American Society for Dermatologic Surgery has certified fellowship programmes in cosmetic dermatologic surgery and procedural dermatology. The latter has 47 participating programmes offering 55 positions annually, which are highly contested.⁴³ The American Society for Dermatologic Surgery has four other internationally recognised procedural dermatology training programmes in South Africa, Romania, Pakistan and the Netherlands,⁴⁴ and programmes for international graduates. The International Traveling Mentorship Program was established in 2010 through the Lawrence Field, MD, International Dermatologic Surgery Education Exchange Fund to enhance the surgical skills of dermatologists and to facilitate the exchange knowledge between international counterparts.⁴⁵ Through the International Traveling Mentorship Program, the American Society for Dermatologic Surgery and Dermatologic and Aesthetic Surgery International League assist dermatologic surgeons to visit a host institution in another country or host a dermatologic surgeon from another country for a defined period of training. The list of approved mentors/hosts under

Table 3: Some of the international and national centres/organisations offering dermatologic surgery/aesthetics fellowships

S. no	Sponsoring organisation	Country	Centres/Doctors	Programme and duration	Eligibility
1.	ASDS and DASIL	USA	Variable. Established through the Lawrence M. Field, MD, International Dermatologic Surgery Educational Exchange Fund ⁷³	International Preceptorship Program, 1–3 weeks	International dermatologic surgeons (i.e., not American or Canadian and not residents-in-training) practicing full-time in an academic institution or private practice Current member of the ASDS or another internationally recognised dermatologic surgery organisation
		Saudi Arabia	Salman AlSaad, MD	International Traveling Mentorship Program, ⁴⁵ up to 4 weeks	Considered hosts must be an ASDS or other member. Be in an authoritative position in dermatologic surgery at a hosting institution
		USA	Brett Coldiron, MD Terrence Cronin, MD Roberto L. Davila-DePedro, MD Daniel Eisen, MD Michael Gold, MD Patrick Lillis, MD Peter J. Panagotacos, MD Thomas Rohrer, MD Christine H. Weinberger, MD		
		Indonesia	Khairuddin Djawad, MD Moerbono Mochtar, MD Chadijah Rifai, MD Indah Julianto, MD, PhD		
		Canada	Sahar Ghannam, MD		
		India	Somesh Gupta, MD Nilesh N. Goyal, MD		
		Germany	Michael Haeberle, MD Eckart Haneke, MD, PhD Mark Tanner, MD		
		Hungary	Istvan Juhász, MD		
		Netherlands	Gertruud Kreckels, MD		
		Israel	Marina Landau, MD Isaac Zilinsky, MD		
		Romania	Mihaela Leventer, MD		
		Dubai	Mahaveer Mehta, MD Syed A.A. Shah, FRCP (UK), CCST (UK)		
		UK	Richard J. Motley, FRCP		
		Greece	Constantine Noutsis, MD, PhD		
		South Africa	Derek Odendaal, MD Marc B. Roscher, MD		
		Brazil	Ramos-e-Silva, MD, PhD		
		Philippines	Manalo-Manuel Remedios, MD		
		South Korea	Ki Hoon Song, MD		
		Thailand	C. Treewittayapoom, MD		
2.	NYU Langone's Health	USA	Skin and cancer unit of the Ronald O. Perelman, Department of Dermatology at NYU Langone ambulatory care center, and faculty practice of Jerry Shapiro, MD ⁷⁴	International Observership Program in Dermatology, 1 month*	Completed documented formal training in dermatology at least equivalent to a residency or in another subspecialty or area of interest relevant to the practice of dermatology, such as public health or infectious disease

(Contd...)

Table 3: Continued...

S. no	Sponsoring organisation	Country	Centres/Doctors	Programme and duration	Eligibility
3.	Cleveland Clinic	USA	Dermatology and Plastic Surgery Institute, Center for International Medical Education ⁷⁵	International Physician Observership Program, 1 month	Fully trained international practicing physicians and specialists International residents, fellows and medical students currently enrolled in a residency/fellowship programme at a foreign institution and who are expected to graduate from that same school/institution
4.	MD2B Connect	USA	St. Louis, Missouri ⁷⁶	Outpatient externship in dermatology**	International medical graduates and students seeking hands-on patient care experience in dermatology
5.	Wake Forest School of Medicine	USA	Rita Pichardo-Geisinger, MD, Department of Dermatology ⁷⁷	International Dermatology Fellowship Program, 6 months–1 year	International dermatology residents or dermatology graduates
6.	National Skin Centre	Singapore	National Skin Centre ⁷⁸	Clinical Hands-On Fellowship, 3–12 months**	A recognised basic degree in medicine and traineeship or specialist degree in dermatology
7.	Seoul National University Hospital	Korea	Dong Hun Lee, Department of Dermatology ⁷⁹	Short-term visiting fellowship programme, 2–4 weeks***	Dermatologists
8.	Mahidol University	Thailand	Department of Dermatology at Faculty of Medicine Siriraj Hospital ⁸⁰	Clinical fellowship in dermatologic surgery, 1 year	Dermatologist, MSc in dermatology
9.	Rajiv Gandhi University of Health Sciences (Bengaluru)	India	Bangalore Medical College and Research Institute ⁸¹ CUTIS Academy of Cutaneous Sciences ⁸² Kempegowda Institute of Medical Sciences ⁸³ St. John's Medical College ⁸⁴ Venkat Charmalaya ⁸⁵	Dermatosurgery, Aesthetic Dermatology, Lasers (6 months–1 year); hair Transplantation (1–2 weeks)	MD/DVD/DNB in dermatology Three years' experience DM/MCH/DNB in concerned specialty Plastic surgeons (preferably with 2 years of professional experience after post-graduation)
10.	Maharashtra University of Health Sciences	India	Institute of Skin Cosmetology and Lasers, Solapur ⁸⁶	Basic phototherapy and lasers, 1 year	MD, DNB or DVD in dermatology, venereology and leprosy
11.	DY Patil University	India	Shrilata Suresh Trasi, Pradeep Sethi, Mumbai ⁸⁷	Fellowship in cosmetology (6 months), hair transplant (1 year)	MD or diploma in dermatology
12.	Datta Meghe Institute of Medical Sciences	India	Jawaharlal Nehru Medical College & AVBRH ⁸⁸	Fellowship in dermatosurgery	MD/DNB in dermatology
13.	JIPMER	India	JIPMER ⁸⁹	Lasers and dermatosurgery, 1 year	MD/DNB in dermatology
14.	Christian Medical College	India	Department of Dermatology ⁹⁰	Post-Doctoral Fellowship in Dermatosurgery, 1 year	MD/DNB in dermatology
15.	IADVL (https://www.iadvl.org/)	India	Chiranjiv Chhabra and Kavish Chouhan, New Delhi Dasika Subba Rao, Eluru Sachin Varma, Kolkata Sumit Sharma, Panipat	Training course in procedural dermatology, 3 months ⁹¹	Candidates who have obtained their MD or diploma or DNB in dermatology

(Contd...)

Table 3: Continued...

S. no	Sponsoring organisation	Country	Centres/Doctors	Programme and duration	Eligibility
16.	IADVL (https://www.indiadavl.org/)		Yogesh M Bhingradia, Surat Suruchi Garg, Chandigarh Parmjit Singh Walia, Mohali Muhammed Razmi, Calicut Debjit Kar, Odisha Mahendra Deora, Pune Sumit Gupta, Lucknow Koushik Lahiri, Kolkata Vishalakshi Viswanath, Thane Subrata Malakar, Kolkata Rohit Bansal, Chandigarh Madhavi Pudi, Hyderabad J K Sadana, Patiala Sachin Varma, Kolkata Sumit Sharma, Panipat Imran Majid, Srinagar	Dermatosurgery, aesthetic dermatology, lasers, phototherapy, phlebology, hair transplant; 2–4 weeks ⁹²	Candidates who have obtained their MD or diploma or DNB in dermatology
17.	ACS(I)	India	Dhanashree Bhide, Pradyumna Vaidhya, Pune Imran Majid, Srinagar Jaishree Sharad, Mumbai Koushik Lahiri, Kolkata Niteen Dhepe, Pune Niti Khunger, New Delhi Raj Kirit, Rajyalakshmi, Hyderabad Venkataram Mysore, Bengaluru	Training observerships in dermatosurgery, laser surgery and cosmetic dermatology; 2–4 weeks ⁴⁹	Life members of the ACS(I) who are not working in the same institution and who have completed their degree or diploma.

ASDS: American Society for Dermatologic Surgery; DASIL: Dermatologic and Aesthetic Surgery International League; USA: United States of America; JIPMER: Jawaharlal Institute of Postgraduate Medical Education and Research; IADVL: Indian Association of Dermatologists, Venereologists and Leprologists; ACS(I): Association of Cutaneous Surgeons of India; *general hair disorders observership, also focuses on procedures to treat alopecia; **general dermatology observership with significant focus on dermatosurgery; ***general dermatology observership with significant focus on dermatosurgery, but no hands-on experience

the International Traveling Mentorship Program is mentioned in Table 3. The UK's British Society for Dermatological Surgery offers post-residency fellowships in Mohs and advanced dermatological surgery at eight centres.⁴⁶ The Netherlands also has a fellowship training programme,⁴⁷ and Australia offers multiple 1–2 years of procedural dermatology training programmes.⁴⁸

Not many formal training opportunities in this sub-division of dermatology are available in India and dermatologists depend on short-term training programmes and observerships, and live and cadaveric workshops in conferences, which cannot be considered as adequate training for a specialty involving invasive procedures. Under the Indian Association of Dermatologists, Venereologists and Leprologists, fellowship programmes in procedural or cosmetic dermatology for 1–3 months are offered every year and receive a large number of applications. The Association of Cutaneous Surgeons of India offers observerships in dermatologic surgery and aesthetics for 2–4 weeks in eight cities biannually for its members.⁴⁹ The universities/institutes offering fellowships/observerships in dermatologic surgery or aesthetics are also summarised in Table 3.^{45,49,73–93} Qualified dermatologists from India and other countries are eligible for the international fellowships and training programmes mentioned in Table 3.

The unmet need

The extent of the unmet need

There is a great unmet need for procedural dermatologists globally. The extent of unmet need for conventional dermatologic surgery can be gauged by the data from the waiting list of a tertiary centre that performs these procedures frequently and at a low cost. Five minor procedural dermatology operation theatres run five days a week at All India Institute of Medical Sciences, New Delhi, India, with an average of 86 conventional dermatological surgeries, 372 minimally invasive procedures, 402 device-based interventions and 287 skin biopsies carried out per month in the year 2019. In a retrospective analysis of records (authors' unpublished data), the waiting period was 8.5 months for various lasers, 3.5 months for vitiligo surgeries, five months for fat grafting, three months for scar revisions and 1.75 months for radiofrequency ablation or sclerotherapy for vascular malformations. Even excision of skin cancers had a waiting period of 1.25 months despite trying to accommodate patients at the earliest possible date.

Many conventional dermatologic surgeries require specialised skills that are frequently not available even in dermatology departments of tertiary care hospitals. Procedural dermatologists or plastic surgeons are best suited

to perform them, but they are frequently done by general surgeons and other specialists entailing inappropriate, incomplete or excessive revisions with poor cosmetic outcomes. In the authors' experience, many patients with stable vitiligo and volume defects who are suitable candidates for phototherapy/cellular grafting and volume restoration surgeries respectively, are never offered these modalities despite many years of treatment in many government hospitals due to lack of availability. In developing nations where the majority of the population depends on socialised medicine and welfare systems, patients with these conditions stand virtually abandoned.

The unmet need for cosmetic procedures

The World Health Organization defines Health as "*a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity.*"⁵⁰ This implies that ideally, to be healthy, patients must be free of mental and social distress which results from diseases leading to disfigurement. The lack of beauty and attractiveness is associated with a significant social disadvantage and a 'beauty premium'.^{51,52} Skin aging is also considered a disease by many experts.⁵³ Cosmetic manifestations of aging like androgenetic alopecia lead to significant distress and loss of social advantage.⁵⁴ Conventional surgeries for androgenetic alopecia, minimally invasive cosmetic procedures for reversing skin aging, and liposuction for various indications can improve quality of life and body image and reduce psychological distress and anxiety.^{55–57}

Despite the huge demand and benefits, the so-called 'cosmetic' minimally invasive procedures are frowned upon in academic settings. In the authors' experience, Indian tertiary government hospitals have limited expertise in cosmetic procedures for aging and rejuvenation, and only a few minimally invasive procedures to treat benign growths or symptomatic diseases are carried out. The alleviation of impact on quality of life due to aging is not considered a priority in resource-limited settings. The majority of these procedures are uninsured and are done in private set-ups for the affording segment of the population. Even if people with limited economic means have a high willingness to pay for these procedures, their aesthetic and perceived social concerns are paternalistically disregarded by many dermatologists. This perpetuates social disparities due to economic disparities. Aesthetic socialism dictates that everyone should have the opportunity to enhance or restore beauty where it is lacking or when it is lost due to disease, trauma or aging.⁵¹

Limited training

Due to the limited number of specialists and centres providing training in various conventional surgeries and procedures, there is a large unmet need for training opportunities.

Some medical institutions in India do train residents in procedural dermatology, but the training needs to be standardised, formalised and modularised, and research be included as a component of the training. In an online survey of 103 dermatologists trained in India and practicing across the world, 59% felt that greater exposure to cosmetic and procedural dermatology was required to improve the training programme (authors' unpublished data).

There are significant differences between the dermatology residency training programmes in India and internationally. The Indian residency programme is three years long, akin to other specialties, whereas, the length of dermatology residency is 3–4 years in the USA,⁵⁸ four years in the UK⁵⁹ and Australia⁶⁰ and five years in Ireland.⁶¹ Procedural dermatology training in the US incorporates dedicated hours in the first, second and third years of residency.⁶² The residents need to maintain a detailed logbook or portfolio for supervised and independently done procedures in these countries.^{59,61} A minimum number for each procedure is required to be eligible for the final qualification.⁶¹ Third-year dermatology residents in the US are expected to perform procedures independently and also train other trainee doctors in these techniques.⁶² In India, this level of autonomy and independence is hard to achieve due to limited training, but efforts are underway. Recently All India Institute of Medical Sciences, New Delhi incorporated live supervised procedures on patients by the examinees as part of the final MD (Dermatology and Venereology) practical exam. This can be replicated in other institutions in a phased manner as the training level improves. Most large institutions in the USA have about one-third of their 25–30 board-certified faculty focusing nearly entirely on procedural dermatology,⁶³ with dermatologic surgery sessions happening both pre-noon and afternoon five days a week.

The unmet need for research

There is a significant lack of evidence-based guidelines and consensus for the procedural treatment of various dermatological diseases. For example, while surgical excision is the definitive and potentially curative treatment for hidradenitis suppurativa, there is no definite recommendation on surgical modalities in the Cochrane review of its treatment, as good-quality controlled studies are lacking.⁶⁴ The same is the case for procedural management of post-acne scars.⁶⁵ It is difficult to perform controlled studies in surgical procedures, and even well-conducted studies are downgraded when compiling evidence due to the lack of a sham surgery control. Individuals and centres treat patients based on individual preference, training and availability.⁶⁶ Similarly, there is a lack of standardisation of platelet-rich plasma protocols for various indications. Many procedures have different risk-benefit ratios or procedural parameters in the skin of

colour, while most published research originates in fairer skin types.⁶⁵ Amongst the public as well as in academic circles, there is a perception that aesthetic procedures are more commerce-driven than based on sound scientific research and principles. This is because high-quality research is lacking for many cosmetic procedures and devices.

Pioneer tertiary research centres must encourage research studies in procedural dermatology to generate more evidence about the benefit of various procedures and combinations, their adaptability to low resource settings and the standardisation of various techniques. This will encourage more dermatologists to practice procedures and more medical institutions and national boards to add them to their residency training curriculum.

Unqualified practitioners and complications

The rapid rise in demand for procedural dermatology has not been paralleled with a proportionate increase in trained personnel or the establishment of treatment guidelines or quality control methods. There are no National Medical Commission of India guidelines on minimal qualifications required to perform these procedures, unlike in some other countries, like Singapore.⁴² This has resulted in unsupervised procedures done by untrained and unqualified practitioners often resulting in serious potential consequences. Many of these procedures warrant the application of sound scientific principles on a background of detailed knowledge of the anatomy and physiology of the skin; they also require standard operating protocols with emphasis on asepsis.

The majority of practitioners of medical aesthetics in China are illegal.⁶⁷ There were 28 lawsuits of severe injuries due to elective cosmetic procedures by untrained individuals from the USA in a single year (2013). Out of these 28 cases, 25% had resulted in death and a further 50% required hospitalisation.⁶⁸ The majority of laser surgery lawsuits involved non-physician operators.⁶⁹ Exhaustive data are lacking, and these figures likely represent the tip of the iceberg.⁷⁰

The Centers for Disease Control and Prevention, USA released a warning in 2008 regarding unlicensed cosmetic procedures when three women suffered acute renal failure after being injected with unlicensed liquid silicone products.⁷¹ The Singapore Medical Council subsequently introduced guidelines on the practice of aesthetic procedures for Singapore medical practitioners,⁴² and England's Department of Health also launched a similar campaign to tackle 'botched' cosmetic procedures in 2019.⁷²

Conclusion

There is a rising unmet need for various dermatologic procedures, and consequently, a growing demand for more procedural dermatologists, hands-on training programmes as well as research in procedural dermatology. The residency

programme in dermatology needs to incorporate formal training in procedures, and maintenance of logbook records of procedures assisted and performed independently by trainees during residency. Organisations and associations such as the Indian Association of Dermatologists, Venereologists and Leprologists, Dermatologic and Aesthetic Surgery International League, Association of Cutaneous Surgeons of India and American Society for Dermatologic Surgery should facilitate actual hands-on training opportunities to dermatologists, rather than just observership programmes. The practice of cosmetic procedures should be based on sound scientific principles and unbiased evidence. Individual institutional and broad policy directives must be undertaken to address this gap.

Declaration of patient consent

Patient's consent is not required as there are no patients in this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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