OPEN

PRS GLOBAL OPEN

SPECIAL TOPIC

Plastic Surgery Fellowship at Nippon Medical School Hospital: An Integrative Approach to Modern Plastic Surgery Education

Mohamed Abdelhakim, MD*
Carolina Soto Diez, MD†
Chenyu Huang, MD, PhD‡
Ioannis Goutos, FRCSEd§
Dennis P. Orgill, MD, PhD¶
Rei Ogawa, MD, PhD, FACS*

Summary: Plastic surgery requires extensive wide-ranging surgical knowledge, special technical dexterity, and personal skills in order to achieve improved quality of life and satisfying outcomes for patients. For decades, international plastic surgery fellowship programs have offered opportunities to enhance the subspecialty training of young plastic surgeons abroad and promote international exchange of information in the field of plastic surgery. However, concerns around enrolling in a nontraditional educational strategy at the postgraduate level have restricted young plastic surgery residents from pursuing comprehensive training opportunities overseas. Therefore, we present a personal experience of a distinct established international fellowship program in plastic, reconstructive, and aesthetic surgery at Nippon Medical School Hospital, Japan, as an example. This institution has adopted the use of highly skilled surgical techniques, providing basic research education along with the teaching of essential personal skills needed in modern plastic surgery. As a mean to promote international educational collaboration in plastic surgery, we discussed the modern plastic surgery educational strategies worldwide that participate in developing a successful plastic surgeon's career. *(Plast Reconstr Surg Glob Open 2021;9:e3367; doi: 10.1097/GOX.0000000000003367; Published online 26 January 2021.)*

INTRODUCTION

The importance of providing high-quality exposure and effective training in plastic, reconstructive, and aesthetic surgery during residency and at the postgraduate level has become crucial in plastic surgery education. Traditional plastic surgery training has followed a limited path, including postgraduate education and residency training programs. However, with almost yearly advances in the various subspecialties of plastic surgery in addition to innovative techniques for providing best outcomes, it has become necessary to provide specialized training that offers in-depth learning of the various aspects of subjects of interest within the field.[1] Plastic and reconstructive surgery techniques have been demonstrated since 2500 BC.[2] Influences that have shaped modern plastic surgery can be attributed to the European pioneers Morestin, Gillies, McIndoe, and Esser in the 20th century.[3] Consequently, formal plastic surgery training programs were initiated worldwide. In the United States, plastic surgery training programs have been in existence since 1937, with the subsequent advent of plastic surgery training programs in Europe several years later.[4] This history has compelled young plastic surgeons to seek experience in clinical training and research mainly in the United States and some European countries.

In today's highly connected world, it is possible to find comprehensive fellowship programs in East Asia from other parts of the world, with coexisting high-quality medical systems and updated surgical techniques influenced by western medical education. For instance, Japan has followed a German-style educational model for many years; the US model was then adopted after World War II,[5] which resulted in an improved medical education system with globalized standards while preserving local cultural values and technical characteristics. We describe herein an innovative effective plastic surgery program at Nippon Medical School Hospital (NMSH), Japan, established over 2 decades ago

*From the *Department of Plastic, Reconstructive and Aesthetic Surgery, Nippon Medical School, Tokyo, Japan; †National Reference Center for Adult Major Burn, Hospital de Urgencia Asistencia Publica "Dr. Alejandro de Río," Santiago, Chile; ‡Department of Dermatology, Beijing Tsinghua Changgung Hospital, School of Clinical Medicine, Tsinghua University, Beijing, China; §Centre for Cutaneous Research, Blizard Institute, Barts and The London School of Medicine and Dentistry, Queen Mary University of London, London, The United Kingdom; and ¶Division of Plastic Surgery, Department of Surgery, Brigham and Women's Hospital, Harvard Medical School, Boston, Mass.*

Received for publication October 15, 2020; accepted November 23, 2020.

DOI: 10.1097/GOX.0000000000003367

Disclosure: *The authors have no financial interest to declare in relation to the content of this article.*

and has imparted effective improvement reflected in the achievements of participating international fellows and postgraduate students in the field of plastic surgery. To promote international educational collaboration in plastic surgery, we discussed the modern plastic surgery educational strategies worldwide that participate in developing a successful plastic surgeon's career.

The Plastic, Reconstructive, and Aesthetic Surgery Fellowship at NMSH

This distinctive fellowship program in plastic, reconstructive, and aesthetic surgery was established at NMSH in Tokyo, Japan, the oldest private medical school in Japan with a history spanning over 130 years. This year marks the 50th anniversary of the clinical department of plastic surgery at NMSH.

Collaborative efforts by professors at the Department of Plastic, Reconstructive, and Aesthetic Surgery have led to a close network between NMSH and principal educational plastic surgery departments in North America such as Brigham and Women's Hospital, Harvard Medical School, Boston, and the Division of Plastic Surgery and Reconstructive Surgery, Stanford University, California. This consistent collaborative effort has contributed to establishing cutting-edge plastic and reconstructive surgery education, which integrates the most updated knowledge in plastic surgery worldwide with sophisticated surgical techniques and advanced research studies, and thus contributes to improving quality of life for patients. NMSH was established in 1876; being recognized for high-quality educational and training level, it has expanded into 4 affiliated hospitals in Japan. With an overall capacity of over 2250 beds, NMSH has been recognized for providing the highest quality of patient care among all hospitals in Japan.

The main plastic, reconstructive, and aesthetic surgery department is located in Bunkyo ward, a district well known for its academic culture and historic spots, and a destination for plastic surgeons the world over. This is with respect to surgeons seeking highly specialized training in reconstructive surgery, particularly in scar management including burn reconstruction, and treatment of keloids and hypertrophic scar. The department is also renowned for having one of the leading research laboratories in the area of mechanobiology and mechanotherapy for wound healing and scarring. The Department of Plastic, Reconstructive, and Aesthetic Surgery of the main hospital performs on average about 1500 surgeries annually and receives a total of approximately 20,000 outpatients at the clinic from various regions yearly including an increasing number of foreign patients.

In general, overall success in academic medicine and surgery has been evaluated based on the number of publications, citations, and the level of funding in terms of research grants awarded to individuals or departments.[6,7] The department has strictly adhered to the following 5 main principles within this framework from its early beginnings: medical credibility, academic leadership, originality of research, internationality of education, and diversity of faculty members. As a result, it has rapidly grown to gain international repute in the field of mechanobiology research and scar management.

A total of 100 plastic surgeons distributed on 4 branch hospitals of the university and 10 affiliated hospitals, including 40 plastic surgery trainees and PhD students. At the main branch hospital, there are 10 board-certified plastic surgeons, 16 trainees, and 4 general residents, which allows accommodating 1–2 international fellows in each clinical group per course period according to their subspecialty of interest under supervision of a senior plastic surgeon and direct guidance from the head of the department.

The department is subdivided into 7 discrete subspecialties:

1. Burn reconstruction and pathological scar (keloid) management,
2. Hand surgery,
3. Head and neck reconstruction,
4. Breast reconstruction,
5. Chronic wound treatment,
6. Craniofacial surgery, and
7. Aesthetic surgery.

The Fellowship Program

The fellowship program in plastic, reconstructive, and aesthetic surgery at NMSH has a history of receiving foreign surgeons and plastic surgery trainees spanning over 2 decades, seeking to gain experience in reconstructive surgery from the former head of department, Professor Hiko Hyakusoku, a pioneer in developing unique techniques for burn reconstruction including "propeller flaps" and "super-thin flaps."[8] Also, the current head of department, Professor Rei Ogawa, has extensive research experience in scarring and has established algorithms of multimodal therapy including surgery and postoperative management for burn scars, keloids, and hypertrophic scars.[9] The department receives approximately 2000 scar patients from all over Japan yearly, and a total of about 400 scar and scar contractures surgeries are performed. The scar/keloid specialist clinic in the department has since become one of the largest high-volume centers for scar management worldwide.

The department offers 4 learning courses for international fellows as follows:

1. Short-term observership program (1–3 months),
2. Clinical fellowship including attendance at surgeries and outpatient clinics (over 1 year),
3. Research fellowship at the mechanobiology laboratory of plastic surgery (over 1 year), and
4. Doctoral (PhD) program in plastic, reconstructive, and aesthetic surgery (at least 4 years).

In addition, in non–English-speaking countries, such programs could be hampered by the language barrier. However, in this department, while foreign fellows are encouraged to learn Japanese, most staff can teach and communicate in English language. This acts as further incentive to attracting foreign trainees.

Diversity of the International Fellows

Over the past 2 decades, fellows from various parts of the world have participated in the Plastic, Reconstructive,

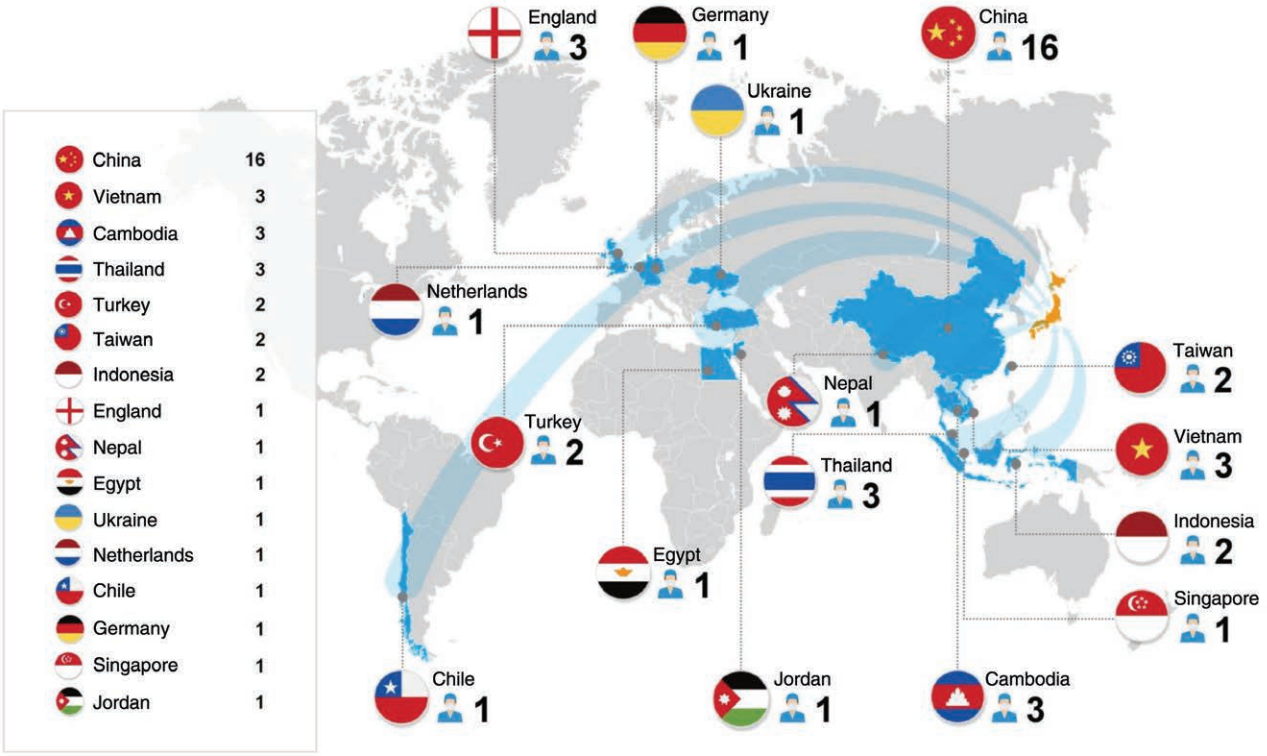

Fig. 1. Distribution of international surgeons who have participated in the fellowship program at the Department of Plastic, Reconstructive, and Aesthetic Surgery at NMSH in the last 2 decades.

and Aesthetic Surgery fellowship program at NMSH. Many have completed the training with notable accomplishments including gaining new surgical skills in a particular technique, carrying out a research study, coauthoring a research paper, and earning a PhD degree.

Statistical data from the international office of NMSH show the varied regions of origin of international fellows from all over the world (Fig. 1). Not only do these data indicate the strong network, collaborative efforts, and the department's reputation within Asia, it also depicts the reach to various parts of the world including Europe, South America, the Middle East, and Africa. In these world regions, fellows have recognized the value of acquiring subjective skills in plastic surgery and have improved in a range of integrated personal roles as communicator, collaborator, manager, health advocate, scholar, and professional, which are key skills in this new era of plastic surgery.[10]

The Culture of NMSH, Plastic, Reconstructive, and Aesthetic Surgery Department

Professor Rei Ogawa, the current head of the department, has created a deeply rooted culture among the departmental staff based on teamwork, selflessness, and accountability also promoting a sense of psychological safety and collegiality within the educational environment of the department. As a result, trainees, fellows, residents, and medical students on rotation are given the opportunity to speak up and seek advice. Such environments have been proven to be effective in fostering the development of self-motivated young surgeons in plastic surgery.[11,12]

A model potential educational strategy that has been used to teach trainees is the outcome-based teaching strategy, which simply demonstrates the results of surgical techniques based on a large database of records and images of cases after undergoing surgery at NMSH. This offers an effective learning approach where trainees learn by seeing actual results and comparing various other approaches and their outcomes.[13,14]

Introduction to the Fellowship

Upon arrival in Tokyo, the new fellow meets with the host professor on the first day of the fellowship and then receives orientation about the program, which includes attending surgery and the outpatient clinic where they receive firsthand experience of the Japanese medical system and the daily flow of patients at the department.

The experience of the attending plastic surgeons covers a range of subspecialties including head and neck reconstruction, hand surgery, breast reconstruction, and lymphedema surgery, which provides a broad spectrum of varying expertise providing guidance to the visiting fellow in their field of interest.

Mechanobiology Research Laboratory

Besides the clinical course, fellows are encouraged to carry out research in the plastic, reconstructive, and aesthetic surgery laboratories. There are 4 laboratories in the department: mechanobiology and mechanotherapy, scar/keloid, wound healing and molecular interaction research, and wound healing and electron microscopic analysis laboratories. The Mechanobiology and Mechanotherapy

Laboratory in particular has received huge national grants of up to 4,000,000 USD. This laboratory has focused on research studies on mechanical forces and their role in the pathophysiology of keloids and hypertrophic scars, wound healing, tissue regeneration, and aesthetic/antiaging medicine.[15] Professor Rei Ogawa is the principal investigator of the laboratory and has conducted extensive studies in mechanobiology while working with Dr. Dennis Orgill at the Tissue Engineering and Wound Healing Laboratory within the Division of Plastic Surgery at Brigham and Women's Hospital between 2007 and 2009. Professor Ogawa has continued to conduct further research studies in this field along with laboratory members of NMSH and collaborative international institutions in the following areas:

1. Mechanical forces and wound healing and scarring,
2. Mechanical forces and angiogenesis and lymphangiogenesis on flap and skin graft,
3. Mechanical forces and hair growth and regeneration, and
4. Mechanical forces and aesthetic and antiaging medicine.

Microsurgery Training and Mentoring in Plastic Surgery

Young plastic surgeons and residents have the opportunity to participate during surgery and to improve their microsurgical skills by attending microsurgery simulation workshops hosted by NMSH. These workshops have been reported to improve surgical techniques, reduce risk of errors, enhance patient safety, improve surgeon-patient relationship, and maximize hospital resources.[16] Fellows have unlimited access to the facility throughout the 1 year of their fellowship with guidance and supervision from senior Japanese plastic surgeons, receiving opportunities to improve motor dexterity, enhance visuospatial ability, and obtain quality microsurgical skills in a pressure-free environment before actually operating on patients.[17] Moreover, foreign fellows who intend to stay for a period of more than 6 months can obtain a Japanese government permit and temporary license to participate in hands-on clinical responsibilities in the operating theater.

The ideal mentorship model in surgical teaching in the operative theater has been best described to involve one-on-one mentoring, with the possibility of including up to 3 trainees at a time. The mentor is expected to not only teach and train but also act as an advisor and role model to younger trainees.[18] One-to-one mentoring at NMSH allows fellows to acquire sophisticated surgical skills and boost their confidence to participate in surgeries under the guidance and valuable step-by-step commentary by Professor Ogawa (Fig. 2) and associate professors.

A previous study assessing intraoperative teaching has reported that the majority of attending surgeons often tend to be concerned about teaching surgical skills without teaching the equally relevant and important aspect of decision making.[19] One of the educational outcomes international fellows appreciate about attending operations at NMSH has been the teaching of decision-making skills, such as choosing the correct flap, designing the flap, managing graft failure, and planning multimodal therapies beyond the sole ability to create a vascular anastomosis. Such skills are now being considered fundamental in the development of microsurgery.[20]

Recently, virtual reality–based virtual trainings have been extensively investigated, and many commercial products have become available for educational purposes; however, virtual reality is still lacking realism and efficient interactive learning methods that address the surgeons' personal skills; current advances in technology are expected to make it possible in the near future.[21]

Conferences and Interactive Education

Several conferences and academic meetings are held throughout the year allowing interactive learning, debate, and continuous sharing of updated therapies and recent research studies.

1. Weekly Academic Conference

Held every Monday, the conference allows plastic surgeons share the most recent published studies, case reports, and updated treatment strategies. These journal club meetings consist of small groups of young surgeons, residents, and medical students and are a proven effective learning tool that serves in transferring knowledge of key articles and valuable research findings as well as critical appraisal of each study discussed and the quality of the literature.[22]

2. Monthly Research Progress Meeting

At this monthly meeting, each plastic surgeon, researcher, and fellow are given an opportunity to share the progress of their ongoing research and receive feedback through comments from experienced colleagues in the department resulting in easier and more efficient progress.

3. Yanesen Conference

Yanesen is an acronym derived from the names of the 3 areas within which the university is situated, namely Yanaka, Nezu, and Sendagi. This annual conference organized by the Department of Plastic, Reconstructive, and Aesthetic Surgery has been held for over 18 years. It brings together all plastic surgeons at NMSH in a festive yet competitive atmosphere with discussions of interesting cases and research studies among junior residents, PhD students, and international fellows.

4. Conferences in Asia

A. Annual Meeting of the Japan Society of Plastic and Reconstructive Surgery

In addition to the previously mentioned conferences, overseas fellows are opportune to attend the annual conference of the Japan Society of Plastic and Reconstructive Surgery. Held in a different prefecture in Japan each year, this meeting offers a great opportunity to experience the Japanese plastic surgery system, learn about hot topics, and enjoy the fascinating Japanese culture as well.

B. Scar-related conferences

As a leader in the field of scar management, the department aspires to ultimately provide scarless wound healing under the auspices of Professor Rei Ogawa who is

Fig. 2. Photograph of Professor Rei Ogawa with a plastic surgery fellow from Chile, demonstrating one-on-one mentoring in the operating theater during microsurgery at NMSH.

also the current president of The Japan Scar Workshop. The Japan Scar Workshop has joint collaborative efforts with the Global Scar Society and the Asia-Pacific Society for Scar Medicine. The last Asia-Pacific Society for Scar Medicine congress was held in Tokyo in 2019, and the World Congress of Global Scar Society will be held in Tokyo in 2021. These conferences serve to expand clinical and basic research knowledge on scars, keloids, hypertrophic scars, scar contracture, and fibrosis and contribute to helping patients overcome challenges associated with pathological scarring.[23] This laser-focused conference allows exposure of overseas fellows to the severe pathologic scars in the Asian population as well as a wealth of accumulated Japanese knowledge base providing important insights into the underlying mechanisms and appropriate cutting-edge management strategies.

5. International Conferences

The attending fellows are continuously encouraged to submit abstracts of their accomplished work during the fellowship to high-quality international conferences including Plastic Surgery Research Council, American Association of Plastic Surgery, European Association of Plastic Surgeons, etc., thus, allowing them to comprehend current global trends and issues in plastic surgery and expand their network.

Connecting with Visiting Professors

Reputable plastic surgery professors from America, Europe, Middle East, Africa, and Asia have known the department through international conferences, published research papers, or research collaboration and have considered it as special landmark in Asia where they earn an opportunity to share their recent works, receive feedbacks from senior plastic surgeons, and discuss future collaborative ideas.

Fellowship Completion and Institutional Collaboration

As the international fellowship program comes to a close, several benefits are obtained, set goals are realized, and new opportunities arise to boost the trainee's career prospects. These include published research, transfer of clinical skills and plastic surgery treatment strategies learned, new research collaborations.[24–26] Such acquired benefits lay the foundations for facilitating networking between researchers, encouraging international institutional collaboration, and connecting investigators in multiple disciplines leading to increased communication, interdisciplinary citation, and research productivity which is recently considered essential in improving modern academic plastic surgery especially when local governmental funding constraints interfere with maximizing the research productivity.[27]

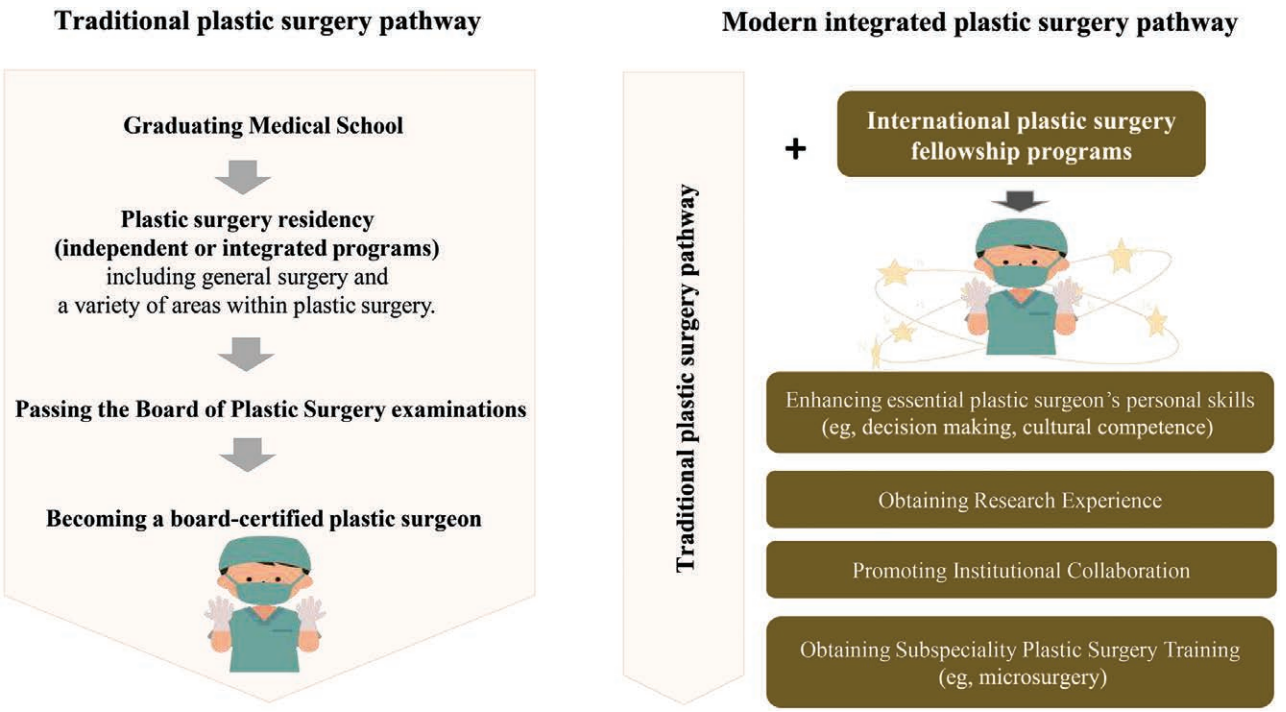

Fig. 3. An illustrative diagram showing the difference between traditional plastic surgery pathway and the proposed modern integrated plastic surgery pathway demonstrating the benefits of pursuing international fellowship programs in plastic surgeon's career.

Fellowship programs have been offered in departments worldwide for decades; however, plastic surgeons and young trainees are hesitant to risk studying in a different environment that might retard their career goals. Modern plastic surgery education requires additional skills not taught in traditional residency programs, as illustrated in Figure 3. The fellowship program at NMSH integrates these additional skills with modern teaching strategies in plastic surgery, thus representing a crucial point in the career of many international plastic surgery fellows who have remarkably enhanced their career by transfer of knowledge and skills gained as fellows to their home hospitals.

CONCLUSIONS

International fellows who have completed their fellowship programs have found the positive environment and commitment of the staff a major motivating factor allowing them to engage, speak up, and proactively seek guidance and feedback in the course of their research studies. In addition to a robust surgical experience gaining knowledge of cutting-edge treatment strategies and exposure to recent research in the field of plastic surgery, other benefits were obtained. These include high-level collaborative efforts toward achieving progress, profound care for the quality of life of the patient, personal supervision, and taking responsibility to accomplish assigned tasks. Encouraging similar models of plastic surgery training programs may contribute to promoting international educational collaboration in plastic surgery, and preventing psychological exhaustion, developing professional autonomy, as well as achieving personal control, which are essential qualities to avoid burnout in the busy field of plastic surgery and may participate in establishing a successful career as a plastic surgeon.

Mohamed Abdelhakim, MD
Department of Plastic, Reconstructive and Aesthetic Surgery
Nippon Medical School
1-1-5 Sendagi, Bunkyo-ku
Tokyo 113-8603, Japan
E-mail: mohamed-abdelhakim@nms.ac.jp

REFERENCES

1. Papas A, Montemurro P, Hedén P. Aesthetic training for plastic surgeons: are residents getting enough? *Aesthetic Plast Surg.* 2018;42:327–330.
2. Mazzola RFM, Isabella C. *Plastic Surgery: Principles.* Philadelphia, Pa.: Elsevier Health Sciences; 2012: 11–12.
3. Santoni-Rugio P, Sykes PJ. *A History of Plastic Surgery.* Berlin, Heidelberg, New York: Springer; 2007.
4. Wallace AB. The history and evolution of plastic surgery. *Res Medica.* 1965;4:7–10.
5. Stevens GA. Medical education in East Asia: past and future. *J Med Libr Assoc.* 2019;107:270–271.
6. Mann M, Tendulkar A, Birger N, et al. National Institutes of Health funding for surgical research. *Ann Surg.* 2008;247:217–221.
7. Jacob BA, Lefgren L. The impact of research grant funding on scientific productivity. *J Public Econ.* 2011;95:1168–1177.
8. Hyakusoku H, Gao JH. The "super-thin" flap. *Br J Plast Surg.* 1994;47:457–464.
9. Ogawa R. The most current algorithms for the treatment and prevention of hypertrophic scars and keloids. *Plast Reconstr Surg.* 2010;125:557–68.
10. Societal Needs Working Group CanMEDS Project. Skills for the new millennium. *Ann Physicians Surg Can.* 1996;29:206.
11. Behmand RA, Tang DH, Smith DJ Jr. Outcomes in breast reduction surgery. *Ann Plast Surg.* 2000;45:575–580.

12. Shakespeare V, Postle K. A qualitative study of patients' views on the effects of breast-reduction surgery: a 2-year follow-up survey. *Br J Plast Surg.* 1999;52:198–204.
13. Papadopulos NA, Kovacs L, Krammer S, et al. Quality of life following aesthetic plastic surgery: a prospective study. *J Plast Reconstr Aesthet Surg.* 2007;60:915–921.
14. Kerrigan CL, Collins ED, Kneeland TS, et al. Measuring health state preferences in women with breast hypertrophy. *Plast Reconstr Surg.* 2000;106:280–288.
15. Ogawa R. Mechanobiology of scarring. *Wound Repair Regen.* 2011;19(suppl 1):s2–s9.
16. Masud D, Haram N, Moustaki M, et al. Microsurgery simulation training system and set up: an essential system to complement every training programme. *J Plast Reconstr Aesthet Surg.* 2017;70:893–900.
17. Rosen JM, Long SA, McGrath DM, et al. Simulation in plastic surgery training and education: the path forward. *Plast Reconstr Surg.* 2009;123:729–738; discussion 739.
18. Sweeney WB. Teaching surgery to medical students. *Clin Colon Rectal Surg.* 2012;25:127–133.
19. Pernar LI, Peyre SE, Hasson RM, et al. Exploring the content of intraoperative teaching. *J Surg Educ.* 2016;73:79–84.
20. Rostom M, Lam WL. Microsurgery fellowships-development of a clinical curriculum. *J Reconstr Microsurg.* 2018;34:145–150.
21. Kim Y, Kim H, Kim YO. Virtual reality and augmented reality in plastic surgery: a review. *Arch Plast Surg.* 2017;44:179–187.
22. Bhattacharya S. Journal club and post-graduate medical education. *Indian J Plast Surg.* 2017;50:302–305.
23. Congress Organizing Service Inc. The 2nd Congress of the Asian Pacific Society for Scar Medicine with the 14th Japan Scar Workshop. 2018. Available at http://gakkai.co.jp/scar2019/index.html.
24. Huang C, Liu L, You Z, et al. Keloid progression: a stiffness gap hypothesis. *Int Wound J.* 2017;14:764–771.
25. Hsu CK, Lin HH, Harn HI, et al. Caveolin-1 controls hyperresponsiveness to mechanical stimuli and fibrogenesis-associated RUNX2 activation in keloid fibroblasts. *J Invest Dermatol.* 2018;138:208–218.
26. Harn HI, Ogawa R, Hsu CK, et al. The tension biology of wound healing. *Exp Dermatol.* 2019;28:464–471.
27. Chi D, Curiel D, Bucknor A, et al. Institutional collaboration in plastic surgery research: a solution to resource limitations. *Plast Reconstr Surg Glob Open.* 2018;6:e1822.