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Review article

Striving for excellence in a little red dot: Exploring the evolution of oral and maxillofacial surgery training and practice in Singapore

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Abstract Oral and maxillofacial surgery (OMS) is a field that straddles knowledge and clinical experience from both medical and dental specialties. In the small island nation of Singapore, the rapidly and constantly changing needs of its diverse and aging population, as well as changes in the mindsets of both students and educators have led to many developments in the local OMS program. Tied to the only dental school in the country, the curriculum of the training program has kept up with the changes in the demographics and attitudes of the local patient pool, which comprises a multicultural population with both traditional and modern mindsets. Since its inception, the training program has also shifted away from the traditional apprenticeship model of surgical specialties to include more integrated and modular learning with a heavy emphasis on evidence-based medicine, simulation training workshops, and more focus on digital planning and other technological advancements. This review explores the current scope of training and practice in the Singapore landscape, and how it has evolved and been tailored to meet the needs of its patients and future clinicians.

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Introduction

Singapore is the smallest country in Southeast Asia, with an area of just 734.4 square kilometers. As of 2023, the country houses a multi-ethnic population of just 5.92 million people, of which 4.1 million are citizens or permanent residents.¹ Healthcare services in Singapore are provided using a blend of public healthcare institutions and a substantial private healthcare system.² In dentistry, a total of 245 public and 1079 private dental clinics were reported by the Ministry of Health.³ There are three healthcare clusters in the public sector: the National Healthcare Group (NHG), Singapore Health Services (SingHealth), and National University Health System (NUHS), which primarily serve the central, eastern, and western regions of Singapore respectively.⁴ Consistent expansion and development has cemented Singapore's healthcare system as a superb one;⁵ Singapore ranked first globally in the Health component of the Legatum Prosperity Index in 2023,⁶ and Singaporeans reported the country's healthcare system as the greatest source of national pride.⁷

Although relatively small, the patient pool in Singapore is distinct. In addition to a multicultural and increasingly aging population with a unique blend of modern and traditional mindsets, its high accessibility and quality of healthcare have made Singapore a prime destination for medical tourism.⁸ The need to tailor healthcare services to match the different needs of this patient population translates to a unique scope and training in the field of Oral and Maxillofacial Surgery (OMS) in this small island nation. This review aims to discuss the scope of OMS training and practice in Singapore, and how it has evolved to match the needs of its population and clinicians.

The path to accreditation in Singapore

OMS is one of seven dental specialties recognized by the Dental Specialists Accreditation Board of Singapore (DSAB), the rest being Endodontics, Orthodontics, Pediatric Dentistry, Periodontics, Prosthodontics, and Dental Public Health. The Singapore Dental Council (SDC) annual report in 2022 reported a total of 76 OMS specialists, of which 35 (46.1 %) were employed in the public sector, and 41 (53.9 %) worked in the private sector.⁹ Dentoalveolar surgeries make up the majority of cases in public hospitals (~64 %), followed by the management of dentofacial deformities (8 %), maxillofacial trauma (7 %), cysts and benign tumors (5 %), orofacial infections (4 %), oral mucosal lesions (4 %), implant and pre-prosthetic surgeries (4 %), head and neck oncology and reconstruction (2 %), temporomandibular joint surgeries (1.5 %), and cleft lip and palate surgeries

(0.5 %). In the private sector, surgeons typically see a higher proportion of dentoalveolar and implant surgeries.

Similar to most East and Southeast Asian countries, OMS is a dental specialty, and unlike countries like the United Kingdom and Australia, a medical degree is not required to complete training in OMS.¹⁰ To register as a specialist in OMS, the practitioner must complete two phases of training: Basic Surgical Training (BST) and Advanced Surgical Training (AST) (Fig. 1).

The BST (also known as the Residency Training Program) is a three-year (36 months) postgraduate training program in OMS that is provided by the sole dental school in Singapore at the Faculty of Dentistry, National University of Singapore (FOD, NUS). Successful completion leads to the Master of Dental Surgery (MDS) degree. Prospective applicants are required to have practiced general dentistry for at least two years to ensure that they have obtained sufficient clinical experience and have a grasp of how other dental specialties operate. Furthermore, candidates are required to pass an entry examination on basic medical sciences (e.g. anatomy, physiology) to qualify for the admissions interview, necessitating a sufficient degree of understanding of these topics before commencing their career in OMS.

The program accepts an average of three applicants per year, with the number of applications ranging from five to 10 annually, adding up to an acceptance rate of approximately 30–60 %. In the past 10 years, the residents were aged 25–30 at the time of BSTS commencement, with 60 % of residents being male. Most residents were Chinese in ethnicity (96.7 %), and the remaining 3.3 % were Indian. Four residents (11.8 %) who commenced their BST dropped out, mostly due to personal reasons. 60 % of residents received scholarships from the SingHealth cluster, 20 % from the NUHS cluster, 13.3 % from the NHG cluster, and 3.3 % from the Singapore Armed Forces (SAF). 3.3 % did not take up any scholarship. Residents who received scholarships are required to serve a bond of minimum three years duration with their sponsoring cluster, and will practice there for the duration of their AST.

During these three years, the OMS resident is exposed to practitioners from 10 different institutions across two healthcare clusters. While the scope of practice varies across centers, the core scope to which residents are exposed includes medically complex dental patients, dentoalveolar surgery, dental implantology, oral medicine, orofacial pain and temporomandibular joint disorders, orofacial infections, maxillofacial pathology, maxillofacial trauma, and dentofacial deformities. Training in oncologic surgery and microvascular reconstruction is provided by subspecialty clinics in the National Dental Centre and National University Centre for Oral Health.

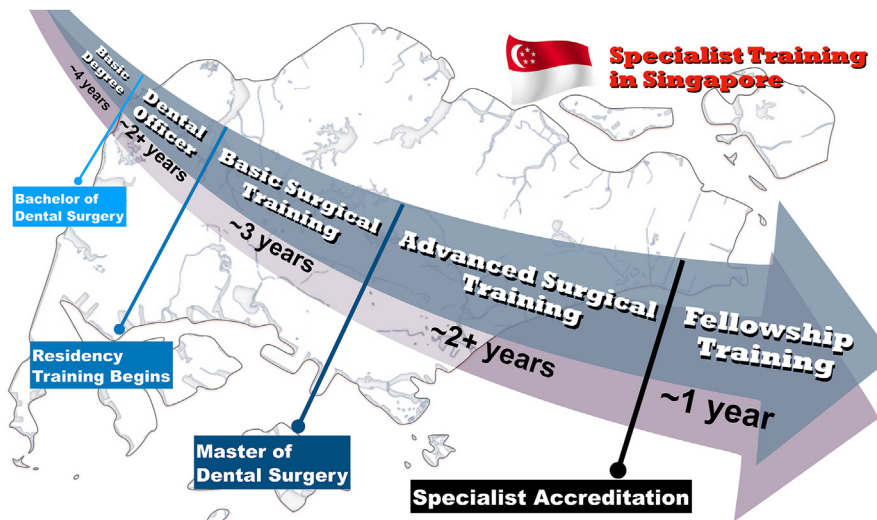


Figure 1 Overview of the pathway for oral and maxillofacial surgical training in Singapore.

In the first year, residents rotate between OMS units to gain experience in hospital dentistry, clerking of surgical patients, diagnostic sciences, dentoalveolar surgery, management of oral mucosal diseases and infections, temporomandibular disorders, and dentofacial deformities. This is achieved by didactics, journal clubs, multi-disciplinary conferences and hands-on training, both with simulations and on patients. First-year residents also attend modular training on dental implantology and clinical photography with residents from other dental specialties. The resident needs to pass a dentoalveolar surgery practical competency and an oral viva exam before proceeding to their second year.

In addition to their OMS postings, second and third-year residents are rotated to medical postings outside of OMS units. Out of the 36 months of the BST, nine months are dedicated to these postings in General Surgery (Head and Neck Surgery) (four months), Anesthesia (three months), Otolaryngology (one month), and Plastic Surgery (one month). These postings expose residents to the practices of their medical counterparts. From the second year, residents also commence advanced procedural training in orthognathic surgery, complex bone harvesting and grafting, mandible fractures, and ablation of benign tumors. The second year culminates with an oral viva exam.

At least one month in the final year is reserved for attachment to an overseas OMS unit, with attachments averaging four to six weeks in hospitals in Taiwan, China, South Korea, Switzerland, and the United States of America. To qualify for the final MDS examination, residents must complete and defend a research thesis and submit a logbook showing the adequacy of hands-on training. The final examination comprises two essay and two oral viva examinations, with an established surgeon from an overseas OMS unit invited annually to be an external examiner. A typical graduate is competent in oral and dentoalveolar surgeries, and familiarity in orthognathic surgery and maxillofacial trauma surgery.

While the BST equips the resident with the principles of maxillofacial surgery, three years is too short to achieve

mastery in performing these surgeries. The AST serves to ensure that surgeons are competent in both oral surgery and maxillofacial surgery. The graduated OMS resident, now an OMS registrar (senior resident), typically seeks a public hospital to continue their AST. The AST is a minimum of two years (24 months), and allows a higher level of autonomy for the registrar to lead surgical cases. During this period, the registrar logs their cases to show not just case numbers, but also a wide case variety and complexity. By the end of the AST, the registrar submits this logbook to the Dental Specialist Accreditation Committee (DSAC), and is examined by an OMS expert panel before they are eligible to be registered as a specialist in OMS.¹¹

Harmonizing population and training needs

The rapidly changing landscape necessitates consistent review and revision of the scope of practice and training by healthcare professionals to suit the needs of Singapore's patient population. To match the expectations of modern-day patients and keep up with new trends, developments and technological advancements, the surgical training curriculum has morphed into one that is vastly different from what it started off to be.

Tailoring treatment to an aging population

The Population in Brief 2023 by the National Population and Talent Division reported a median age of 43.0 years, with 19.1 % of citizens being at least 65 years old. This percentage is expected to increase to 24.1 % by 2030.¹ The scope of training and practice in OMS has reacted to this increasingly geriatric patient pool by revisiting the content taught within and across the subspecialties of OMS.

An epidemiological study in Singapore reported a prevalence of moderate-to-severe obstructive sleep apnea (OSA) of 30.5 % among adults.¹² Furthermore, 91 % of people with at least moderate OSA were previously

undiagnosed. As a result of a rising prevalence, awareness and interest in OSA, the orthognathic surgery curriculum now includes teaching sessions dedicated to sleep medicine, with didactics provided by sleep specialists and collaborative sleep surgeries with otolaryngologists. More time within the curriculum is also dedicated to exposing residents to conditions more commonly seen in older patients, such as the surgical management of medically complex patients, oral and maxillofacial pathology, oral mucosal diseases, and head and neck tumors. Similarly, in maxillofacial trauma, specific injury patterns (e.g. falls and zygomatic fractures) occur more often in the elderly;^{13,14} the training program has hence included didactics on injury patterns, indications and contraindications and complications of surgery in these patients.

Managing varying patient demands and expectations

The Census of Population by the Department of Statistics Singapore published in 2020 showed increasing literacy rates and improving educational attainment levels.¹⁵ This has translated to a patient population that is more knowledgeable and aware of their healthcare needs and expectations. A survey from a local surgical unit reported that 56.9 % of patients wanted to know every possible risk of surgery, compared to 28.3 % who wanted to know just the common and serious risks.¹⁶ With rapidly evolving technological advancements and novel diagnostic and therapeutic options, surgeons must keep up with the latest developments in OMS. A robust didactic program ensures that clinicians remain relevant, with the inclusion of regular sessions to dissect both the classic and newly published literature and discuss traditional and novel treatment options.

Furthermore, the healthcare industry has increasingly redirected some of its focus from “hard skills” to value-based healthcare that seeks to enhance patient quality of life.¹⁷ There has also been a rising degree of awareness of mental health in recent years.¹⁸ The changing focus towards patient wellness has resulted in the modification of clinical practices. Prior to orthognathic surgery, for example, all patients go through a thorough medical history and discussion of expectations, as well as screening questionnaires for body dysmorphic disorder (BDD), a mental disorder of significant prevalence in patients undergoing procedures that alter the face.^{19–21} Collaborations with psychologists are in place for referrals as necessary, and experts in BDD are part of the lecture series of the curriculum.

Moving beyond traditional apprenticeship

Surgical specialties have historically employed the apprenticeship model of education, where the student learns required skills simply by observing and following in the footsteps of a senior surgeon in the clinic and operating theatre.²² Medical education has since shifted from a teacher-centered approach to a student-centered one that allows students to play a bigger role in their learning journey.²³ A combination of modular structuring of the

training program, prioritizing evidence-based healthcare, and the integration of technology have led to the program evolving into what it is today.

Integrated and modular learning

Although the apprenticeship model remains useful in the clinic and operating theatre, OMS education in Singapore now involves a heavy didactic component to ensure that future OMS specialists practice with a high level of clinical knowledge. Following the accreditation standards set by the Commission on Dental Accreditation (CODA),²⁴ residents get at least half a day of protected time per week for didactics in addition to their clinical postings. These teaching sessions are organized by modules, with each module comprising an overarching core topic (e.g. Maxillofacial Trauma, Implantology) that is discussed in great depth over one or two months. Lessons within each module vary from lectures by subject matter experts to case discussions and problem-based learning seminars, where residents direct their own learning by preparing cases for discussion beforehand with guidance from senior residents and specialists.

Facilitation of good interdisciplinary collaboration has also become an essential part of teaching.²⁵ The specialty of OMS has always held a unique position in that it combines part of the scope of work of both medicine and dentistry, hence necessitating good interdisciplinary relationships with both medical and dental specialties. The OMS residency training program in Singapore includes structured modules held in conjunction with other dental specialty residency training programs. Residents follow a lecture and tutorial series and treatment seminars on dental implantology with their future colleagues from the Prosthodontics, Periodontics and Graduate Diploma in Dental Implantology programs. Monthly seminars are held with Orthodontics residents to discuss relevant complex or interesting topics. In addition, first-year residents from all dental specialties attend foundation courses together, such as a Clinical Photography program and a Basic Medical Sciences program in their first few months of residency.

The program has also evolved to include more and more experts from medical specialties to share their insights on relevant topics (e.g. sleep medicine specialists share on OSA). During their postings to other medical specialties, residents also have the opportunity to attend the didactics provided by these specialties to gain a new perspective on familiar topics. The time spent in these postings also allows for the fostering of good working relationships that can last the years of the resident’s career; the OMS units in major hospitals have had a consistent flow of combined surgeries with Otolaryngology and Plastic Surgery colleagues to share clinical skills over a range of topics, including trauma, sleep surgery, and oncological resective and reconstructive surgery.

Prioritizing evidence-based medicine

As the training lies within the domain of NUS, great emphasis has been placed on the proper conduct and interpretation of research. NUS has been ranked eighth in

the world in the QS World University Rankings 2024 and 2025.²⁶ This is in part due to high scores in academic reputation, which the university has invested a great amount of time to maintain. In the residency training program, all students attend a compulsory Graduate Research Methodology Module to learn the basics of biostatistics and running a good research project, before commencing a thesis project that spans the three years of their BST. This thesis project is one of the resident's first experiences with research, and is guided by a research thesis committee comprising senior clinicians and even scientists and data analysts who impart their knowledge throughout the project. Journal clubs, literature reviews and evidence-based seminars have also become mainstay within the training program and even across the many hospitals as the trainee advances to AST and more.

Simulation training as an adjunct

The relatively small land area and population size in Singapore translates to the fact that complex cases or unique situations may not be sufficient to ensure that all residents are equally trained. In addition, there is a huge focus on patient safety, and thus certain procedures may be deemed unsafe if performed for the first time on a real clinical patient. To enhance the competence of trainees, the BST hence includes a wide range of simulation training that also extends into AST.²⁷

Basic medical clinical skills, including medical examination of patients, medical emergencies in a dental setting, head and neck ultrasonography, computed tomography, and cone-beam computed tomography workshops are introduced early in the resident's career and refreshed yearly, with general surgeons, radiographers, and simulated patients playing a role in these workshops. Basic anesthesiology skills are also a key part of the curriculum, with annual workshops on conscious sedation and airway management conducted in conjunction with anesthesiologists.

Surgical skills are enhanced using a combination of models and cadaveric training. Residents start with suturing workshops on artificial skin models and OMS procedural training on three-dimensionally (3D)-printed models,²⁸ before proceeding to workshops on local flaps and microvascular anastomosis on animal cadavers. Finally, human cadaveric dissection workshops are held annually, and are a vital part of surgical training in improving the understanding of surgical anatomy for surgeons of all levels of experience.^{29,30}

The advantage of technology

Lastly, Singapore has openly embraced the many global technological advancements in the recent decade, and has invested heavily in the Smart Nation initiative to integrate technology in all parts of daily life, including healthcare.³¹ Medical and dental education is no exception to this rule; both students and educators have stated that the integration of new technologies into education is both beneficial and necessary to avoid becoming obsolete.^{32,33}

The field of OMS has already been moving towards virtual surgical planning (VSP).^{34,35} As improvements in

planning technology have led to increasingly high levels of accuracy and reduced surgical time,^{36–39} the vast majority of OMS units in Singapore have similarly hopped on the technology train to utilize VSP in all subspecialties of surgery. In orthognathic surgery, most surgeons have stepped away from cast models, model surgery and lab-created splints in favor of intraoral scans, digital planning workflows and 3D-printed splints. For dental implant planning, more clinicians opt for guided implant surgeries over conventional surgery. In the field of reconstructive surgery, VSP has allowed for highly accurate reconstructive plans that have allowed for better long-term reconstructive outcomes, such as better aesthetics and the ability to plan simultaneous dental implants for future dental rehabilitation.³⁶ Because of its multitude of benefits, VSP has become a vital part of maxillofacial reconstruction in OMS in Singapore.

Education in OMS has followed clinical practice in its shift towards the use of technology. Residents are taught to utilize intraoral scanners and various planning software early in their residency. They now perform fewer model surgeries and are instead equipped with more knowledge and experience in understanding VSP and patient-specific implants. Mixed reality has also made its way into both the curriculum and clinical practice, with both junior and senior surgeons donning mixed reality headsets intraoperatively to aid in anatomical and pathological visualization. Simulation training has also turned towards using mixed reality to replace models in the past few years.⁴⁰

Continuing surgical training

OMS training in Singapore does not just stop once a clinician obtains their specialist title. The Ministry of Health launched the Social and Health Manpower Development Programme (SHMDP) in 2002 to encourage continued upgrading of skills and healthcare services, and is still active today. This program provides funding support not only for young OMS specialists to seek fellowships for subspecialty training both locally and abroad, but also to invite visiting experts from around the globe to impart their skills and knowledge in local hospitals.⁴¹ Furthermore, as with all other countries, certain conditions have a lower prevalence and are hence seen and managed less frequently locally (e.g. cleft lip and palate). Memoranda of Understanding in place between NUS and other overseas university hospitals bridge this gap and have allowed surgeons of all levels from both institutions to experience managing patients with these less common conditions.

As part of its aim to collaborate globally and train surgeons from all walks of life, the National University Hospital (NUH) is currently also one of the 34 international training centers selected by the International Association of Oral and Maxillofacial Surgeons (IAOMS) for their "Red Book" scholarships.⁴² These local and international fellowship collaborations help not just to better the specialty as a whole, but also allow young surgeons to form ties with their counterparts from abroad, to gain new insights and perspectives on optimizing treatment for their patients.

Future evolutions

As trends change, diseases evolve and people continue to innovate with time, the wants and needs of patients and technology will continue to change as well. Singapore has always been eager to adapt to changes and progress accordingly,⁴³ and so will its healthcare system and training.

Technology has been developing rapidly, especially with the recent influx in the popularity of artificial intelligence (AI). The National AI Strategy was launched in 2019 to support the development of innovative AI systems and products to enhance quality and efficiency.⁴⁴ As AI continues to develop, plans are already underway to develop and integrate AI systems into clinical practice and training. In the coming years, residents and senior surgeons are preparing to welcome virtual patients, AI-powered chatbots for patients, AI systems for radiographic and histologic interpretation, and AI as an adjunct for diagnosis and planning.

As part of a student-centric learning process, NUS has made student feedback processes an important part of all curricula.⁴⁵ In OMS, resident feedback is done twice a year across healthcare clusters, and the feedback provided is taken seriously to maintain quality assurance and optimize student welfare. With changes in the attitudes of both students and patients inevitable, the residency training program in OMS will continue to evolve to suit the needs of all parties involved.

In conclusion, Singapore's OMS training program has undergone many changes since its inception to achieve a robust and adaptive structure to its curriculum. Through its integration of technological advancements, interdisciplinary collaboration, and a focus on evidence-based practice, the program is well-equipped to meet the evolving needs of its diverse and aging population. As the field continues to grow, the specialty's commitment to innovation and excellence ensures that its surgeons remain at the forefront of global practices and deliver high-quality care to their patients.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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