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Maxillofacial Surgery Education: Where Is It Heading?

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Abstract

Oral and maxillofacial surgery have a long history dating back to ancient civilizations such as the Egyptians. Since then, surgeons have treated craniofacial trauma and alveolodental fractures. In 1846, Hullihen performed a mandibular body osteotomy to correct prognathism, marking a significant milestone in the field. Over time, the specialty has evolved significantly. The field of craniofacial surgery has undergone several phases, including its involvement in conflicts during world wars and the treatment of craniofacial fractures and discrepancies. The process of learning and teaching specialties has evolved differently in various countries throughout the 20th century. Currently, there is no uniformity in the training and registration of specialized professionals, resulting in distinct scenarios. Considering the accessibility of scientific knowledge through technology and globalization, it is crucial to provide an objective overview of the current state of education in the field. This paper focuses on effective professional training as the primary subject of residency courses in this specialty. A proposal is presented for education, emphasizing the significance of providing quality professional training that is tailored to the specific legislation of each country.

Keywords

Maxillofacial Surgery, Medical Residency, OMS Education, OMS Specialization

1. Introduction

The appropriate education and training required to practice oral and maxillofacial surgery, from Oral and Maxillofacial Surgery specialty (OMS), has been a topic of ongoing debate since the recognition of this specialty. Despite several attempts to address this issue, it remains unresolved. As any future changes in

the educational system can have significant socioeconomic and clinical implications, it is important to review how we arrived at the current circumstances and determine the necessary modifications to resolve this situation [1] [2] [3] [4] [5].

Out of the 99 accredited United States of America (USA) OMS programs, only 17 are not directly sponsored by USA universities [6]. Currently, American universities are facing a crisis, with almost every aspect of their programs open for revision. They are now considered "too expensive, ineffective, and impractical" for today's students [7].

The medical school remains the most crucial of all university units for OMS, and it is undergoing changes that require structural modifications in both 4-year and 6-year programs. The primary concerns pertain to the reduction in qualitative fundamental medical science education and the lack of specific OMS clinical exposure during the first two years of the program [8].

A 2008 study identified four basic systems of education and training in OMS worldwide: those requiring only a dental degree, those requiring both a dental and medical degree, those requiring a medical degree and minimal or no dental training, and those requiring a combination of dental and medical education but not degree-based (stomatology) [5].

Regions that Require Only a Dental Degree are USA, Canada, Denmark, Sweden, Norway, Finland and Iceland, Japan, India, Pakistan, Bangladesh, Sri Lanka, Malaysia, Hong Kong (China), Türkiye, Russia, Africa [9]. Also, in South and Central America, as well as Middle Eastern countries, a dental license is sufficient to practice oral surgery [10]. However, there is significant variation in the length of clinical training and the scope of practice among different nations [11].

To be eligible for OMS training, applicants must have completed both a Dental and Medical degree and be fully registered as dental and medical practitioners in Australia or New Zealand [12].

In the UK, most OMS consultants qualify in dentistry before qualifying in medicine [9]. In Germany, only medical and dental graduates are eligible to apply for the OMS program [13].

In France, OMS (stomatology and maxillofacial surgery) is a medical specialty separate from dentistry (odontology) and is based solely on a medical degree [13]. In Spain, oral and maxillofacial surgeons undergo five years of specialty training after completing six years of medical studies [14].

In China, the higher education system of stomatology consists of three levels of undergraduate programs: 5-year, 7-year, and 8-year. The 5-year program focuses on general oral medicine lessons, and students are awarded a bachelor's degree in oral medicine upon graduation. The 7-year program aims to train students as specialists in areas such as OMS. The duration of the education system is either 7 or 8 years, depending on the program. Upon graduation, students receive either a Master of Stomatological Medicine (S.M.M.) or a Doctor of Stomatological Medicine (S.M.D.), depending on the program they have completed [15].

There is a debate regarding the necessity of having dual medical and dental qualifications to practice the full scope of OMS. Training in OMS begins after dentistry, medicine, or both qualifications, depending on the location. The length, depth, and quality of the curriculum followed by different countries in their training programs vary, resulting in significant differences in professional standards worldwide [16].

Oral Surgery was first recognized as a specialty in the United States of America, and its dental roots are particularly strong. Before World War I, Oral Surgery professors in American dental schools were largely dually qualified. However, after the war, those with medical or dual qualifications dissociated themselves from singly qualified surgeons. In 1921, the American Society of Oral Surgeons and Exodontists was formed by individuals with only a dental degree.

This society later became the American Association of Oral and Maxillofacial Surgeons (AAOMS). The AAOMS has been primarily responsible for maintaining the training pathway for OMS through dentistry. However, it has been recognized that adequate medical training must be incorporated. As a result, the duration of residency programs has been increased to either 4 or 6 years [17].

It is important to note that "Oral Surgery" is recognized as a specialty of dentistry by European Union directives. This field deals with the diagnosis, surgery, and co-adjuvant treatment of diseases, trauma, and defects of the maxilla/mandible and adjacent areas. In 1985, the Dental Education Consultative Committee approved the teaching programs in Oral Surgery offered by many dental schools throughout Europe and the UK. These programs typically last 1 - 2 years [18].

According to the International Guidelines for Training and Education in OMS in 2001, surgical training in the oral and maxillofacial region is the qualifying factor for becoming an oral and maxillofacial surgeon in each country or region, regardless of whether the individual holds dental and/or medical qualifications [19] [20].

Before discussing the teaching and learning of OMS, it is necessary to understand the technical surgical principles that govern the specialty and the physiological and anatomical knowledge that is essential for its practice.

In addition to the specific knowledge described above, the practitioner must be able to assess the general condition of a polytraumatized patient and diagnose systemic changes relevant to the proposed treatment [8].

Practice leads to perfection, theory guides the way more effectively and science advances knowledge through assistance, research, and university extension. These pillars are fundamental to education in any field of knowledge [21].

From a didactic point of view, we can divide the teaching of OMS into two different scenarios: that of a specific residency and that of a broad residency. The main difference is that in the specific residency, the graduate surgeon begins an intensive hospital residency in the specialty, experiencing together all the other specialties related to trauma, mainly neurosurgery and general surgery [22].

In a broad residency, which lasts between four and six years, the doctor and/or

dentist, depending on the country and institutional requirements, go through different specialties such as anesthesia, plastic surgery, and general surgery, before being actively responsible for surgery in the sixth year. This long residency is usually followed by a fellowship of at least 2 years [23].

It is important to note that in several countries, including the United States of America and countries within the European Union, OMS residency students are limited from performing procedures as primary surgeons during their training due to legal and health insurance concerns [24] [25].

In Brazil, responsibility for procedures is not associated with the specialty itself, but with registration with regional and federal councils for dentistry or medicine practice. These councils are prerequisites for entry into OMS or craniofacial surgery residency, respectively [26].

Assessing the quality of a student's learning is fundamentally linked to the amount of time they spend practicing surgical procedures under the guidance of a responsible teacher or preceptor. This practice helps them acquire the practical knowledge and confidence necessary to practice the specialty after completing the course [27] [28].

Therefore, it is important to consider the quality and specificity of the training, as well as the guidance received, when evaluating the length of training in a specialty.

Additionally, motivation plays a crucial role in the learning and development of the student, who may not directly experience the program's objectives [29] [30].

In 2024, there are ninety-nine Oral and Maxillofacial Surgery (OMS) Residency Training Programs accredited by the American Association of Oral and Maxillofacial Surgeons (AAOMS). There are 55 single degree OMS programs and 44 dual degree OMS programs. Additionally, 2 programs offer both single and dual degree tracks [1] [29].

The six-year residency program in oral and maxillofacial surgery at Harvard is designed to provide advanced graduate education and leads to certification by the American Board of Oral and Maxillofacial Surgery. The program also requires completion of the MD degree at Harvard Medical School and 16 months of residency in general surgery at Mass General [31].

2. Education Methodology

2.1. OMS Residency Development by Professor Gino E. Lasco

In the 1940s, the specialty of OMS did not exist in Brazil, and the few practitioners were those who could complete fellowships outside the country, mainly in the United States.

Professor Gino Emilio Lasco graduated in dentistry from the University of Sao Paulo (USP), Brazil in 1948. He revolutionized the specialty and its teaching in the country [32].

After finishing dental school, Professor Lasco pursued internships in various

clinics to gain experience and become an OMS. He completed a two-year internship in the Otorhinolaryngology (ENT) department, followed by another two-year internship in plastic surgery.

Due to his dedication to his studies, research, and patient care, he was invited by ENT full professor (cathedratica) Raphael da Nova to join the department as a maxillofacial prosthetist. Da Nova retained both his official and unofficial assistants, which contributed to the high standard of scientific research. In response to the evolving needs of the field, the sections of plastics, dentistry, and speech therapy were introduced.

For four years, he assisted in facial repair and trauma surgeries, reconstructing facial structures lost to trauma and/or tumors using methyl methacrylate associated with dyes to produce prostheses for the nose, eye, and zygoma. This was the birth of the maxillofacial prosthesis department in USP [33].

During the weekly meeting of the specialties department, a case was presented. The case involved a 7-year-old child with gingival synechia, which caused an inability to open her mouth (**Figure 1**).

Following a comprehensive discussion on surgical treatment options, Professor Lasco revised the diagnosis to account for bilateral ankylosis of the temporomandibular joint (TMJ) resulting from birth trauma. It was determined that the gingival synechia was a result of the limited mouth opening and the transition from deciduous to permanent teeth at this age.

After providing an explanation and references, the author suggests a surgical plan that involves bilateral horizontal osteotomy of the ramus in the anterior segment, including the condyle and coronoid process, and a complementary osteotomy in the posterior segment involving the mandibular dental arch. The plan includes the removal of two triangles to form a bone contact apex (**Figure 2**).

Figure 1. Gingival synechia due to bilateral TMJ ankylosis operated by Professor Lasco in 1961.

Figure 2. Post operative results after 21 days of bilateral ankylosis treatment developed by Professor Lasco.

The surgery aimed to create a bilateral mandibular pseudoarthrosis, which would provide an innovative joint without the need for any biomaterial for TMJ reconstruction.

Physiotherapy for mouth opening was carried out three times a day for three months in the immediate post-operative period.

The outcome was impressive (**Figure 2**), and this led to the establishment of the Oral and Maxillofacial Surgery (OMS) specialty at the ENT department of the University of São Paulo (USP) in the early 1960s. Professor Lasco was awarded a scholarship to travel to the United States and Europe. During his travels, he visited the main centers of the OMS specialty to analyze his work [34] [35] [36].

Convinced of the quality of his work, in the early 1970s he began to train OMS specialists with an intensive two-year residency course. He trained more than 200 specialists through medical residency at OMS until 2004, when he retired at the age of 84.

The methodology employed by Professor Lasco to train OMS specialists through an intensive residency course proved highly effective. Almost all specialists in Brazil from 1970 to 2004 were trained directly or indirectly by him, through fellowships, master's degrees, doctorates, and specializations in OMS [37] [38] [39].

In 1981, Professor Lasco was awarded the title of Livre Docente (Free Full Professor). This title represents the ability and expertise gained through professional qualifications, enabling the holder to carry out the independent roles of teaching and professional training, as recognized by the national education body in certain countries, such as Brazil. Lasco's thesis for obtaining the title presented an innovative surgical technique for bilateral correction of benign hypertrophy of the masseter muscle [40].

The main aspect of the intensive medical residency, as established by Profes-

sor Lasco and attended by both physicians and dentists, was the need for the hospital or specialized center to have a substantial caseload, while also receiving expert guidance from qualified specialists [37].

To demonstrate the applicability of this method, the author, a direct disciple of Professor Lasco, has analyzed it for over 25 years. This work will describe various care scenarios observed in the specialty urgency and emergency center and how they are used for teaching, research, and patient care.

Didactically, the types of patients attended include polytrauma, facial trauma, facial fractures, tumors, TMJ dysfunctions, facial discrepancies, dental emergencies, stomatology, and diagnostics [37] [38].

It is important to note that the treatment of cleft lip and palate, and syndromes requires a multidisciplinary approach. These procedures are typically performed at specialized centers. The treatment of cleft lip and palate and syndromes often necessitates a multidisciplinary team and laboratory infrastructure, involving orthodontics, plastic surgery, neonatology, psychology, and other specialties.

Students in the OMS specialty, usually trained dental surgeons, are exposed to the following teaching, and learning methods proposed and applied by Professor Lasco for over 35 years.

This includes a 4-hour theory class every week as part of a program of 24 lectures presented each semester over two or three years, depending on the number of cases seen daily at the hospital center where the specialty course is held.

In these classes, the student discusses, learns and observes with documented real clinical cases, neurological assessment and the general condition of polytraumatized and elective patients; radiology; oral and maxillofacial prosthetics; surgical principles; diagnosis and treatment of tumors; diagnosis and treatment of fractures; diagnosis and treatment of facial discrepancies; conservative and surgical treatment; photographic documentation and research; craniofacial anatomy; general and head and neck pathophysiology; specialty legislation; surgical complications and their treatment; TMJ dysfunctions and their conservative and surgical treatment; history of the OMS.

The lectures present the same theoretical content every six months to students with varying real clinical-surgical cases throughout the two-year intensive course.

The students are responsible for duty every weekday for 12 hours and twice a week for 24 hours. A new preceptor, who has already graduated from the same residency course, is responsible for the students' work and orientation every 12 hours. There are typically four R1 students and four R2 students.

The R2s are authorized to perform surgical procedures after consulting with their preceptors, assistant professors, or course coordinator. The R1s assist in surgical procedures and gain experience by assisting in several cases. They begin to gain surgical autonomy during the first year of residency.

A general rule of thumb is that a surgical assistant must observe 20 specific cases before they can become the first surgeon under the supervision of the pre-

ceptor. This can only happen after a minimum of six months of theory and practice in the residency.

Students discuss clinical and surgical cases based on real problems every day, which are recorded in a specialty notebook. They are encouraged to take personal notes.

The hospital center has an OMS room for clinical and emergency care, as well as a clinic care room.

Every week, students practice minor oral surgeries, such as extracting retained and impacted teeth, removing cysts, and treating intraoral tumors. TMJ dysfunctions are commonly treated and diagnosed through oral rehabilitation, and in some cases, surgery may be necessary after the failure of oral rehabilitation alone (see Figure 3).

Students participate in the multidisciplinary care of patients across various specialties, including orthopedics, ophthalmology, otorhinolaryngology, general surgery, and neurosurgery, among others, that involve the care of patients with oral and maxillofacial conditions.

Upon completion of the intensive residency regime, students are required to submit a final dissertation and pass a final evaluation test with a minimum grade of 80% to obtain the title. Exceptional students may be offered preceptorship positions and, in some cases, assistant professor roles following the conclusion of their residency (see Figure 4).

A didactic case report will be used to demonstrate the advantages and importance of a specialized center with a sufficient number and quality of specific cases to efficiently optimize OMS care, teaching, and research.).

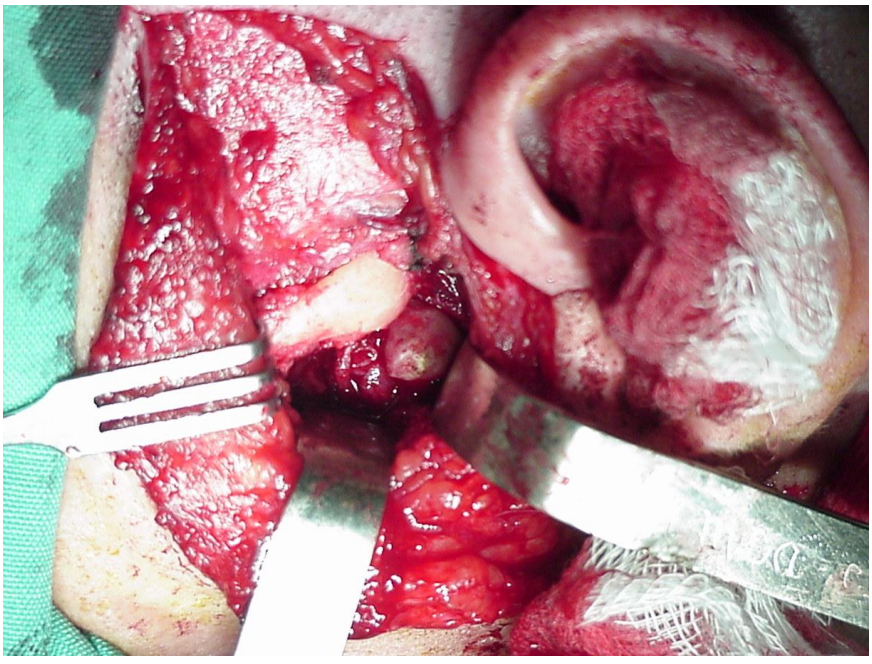
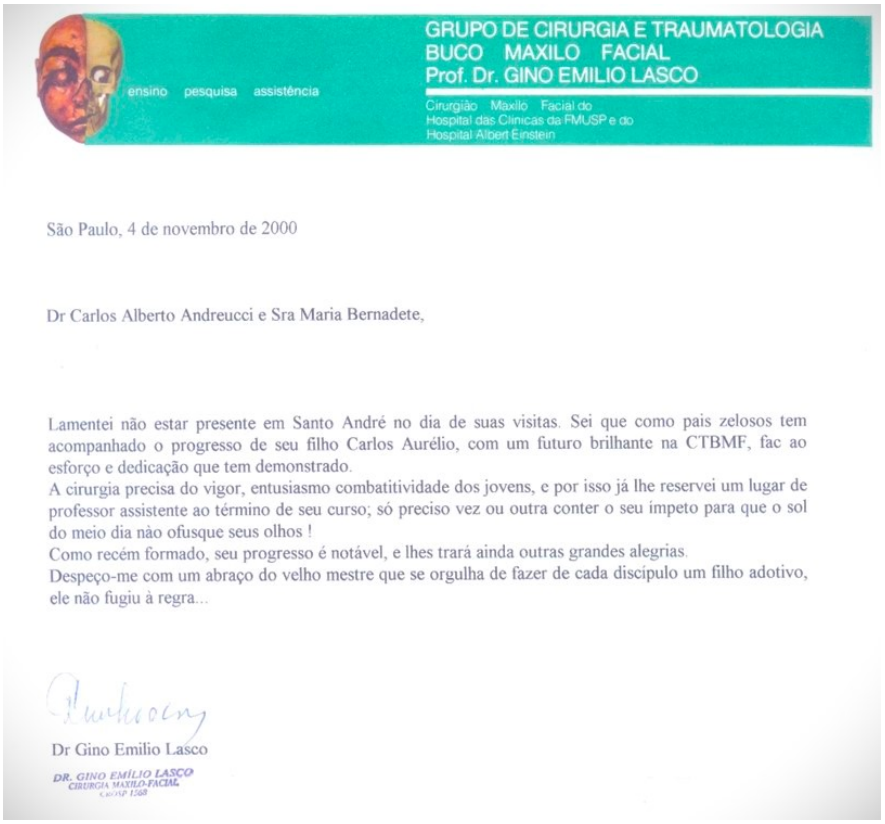


Figure 3. Conservative TMJ arthroplasty was developed by Professor Lasco and performed by the author.



GRUPO DE CIRURGIA E TRAUMATOLOGIA
BUCO MAXILO FACIAL
Prof. Dr. GINO EMILIO LASCO

ensino pesquisa assistência

Cirurgião Maxilo Facial do
Hospital das Clínicas da FMUSP e do
Hospital Albert Einstein

São Paulo, 4 de novembro de 2000

Dr Carlos Alberto Andreucci e Sra Maria Bernadete,

Lamentei não estar presente em Santo André no dia de suas visitas. Sei que como pais zelosos tem acompanhado o progresso de seu filho Carlos Aurélio, com um futuro brilhante na CTBMF, fac ao esforço e dedicação que tem demonstrado.
A cirurgia precisa do vigor, entusiasmo combatitividade dos jovens, e por isso já lhe reservei um lugar de professor assistente ao término de seu curso; só preciso vez ou outra conter o seu ímpeto para que o sol do meio dia não ofusque seus olhos !
Como recém formado, seu progresso é notável, e lhes trará ainda outras grandes alegrias.
Despeço-me com um abraço do velho mestre que se orgulha de fazer de cada discípulo um filho adotivo, ele não fugiu à regra...

Dr Gino Emilio Lasco

DR. GINO EMÍLIO LASCO
CIRURGIA MAXILO-FACIAL

Figure 4. Letter of invitation from Professor Lasco to the author to become an Assistant Professor of the OMS specialty.

2.2. Didactic Case Report

A 25-year-old female patient was admitted to the hospital's emergency department after a motor vehicle accident at 02:35 am. The patient was stable hemodynamically, with no neurological alterations (Glasgow Coma Scale score of 15). She presented with a fracture of the tibia and fibula, blunt chest trauma, concussion, blunt trauma to the face, and suspected facial fractures. Following initial assessment and diagnosis by the general surgeon, orthopedic surgeon, and neurologist, a maxillofacial surgeon was consulted.

The assessment by the OMS was conducted 25 minutes following the emergency treatment described previously. At the beginning of the assessment, the patient's verbal, motor, and ocular responses were re-evaluated. Her pupils were now unequal. The right pupil measured 5 mm and was nonreactive to direct light, whereas her left pupil measured 2 mm, and the neurosurgeon was immediately contacted. Upon reassessment, the patient was diagnosed with traumatic brain injury, which required emergency surgery by the neurosurgeon. The maxillofacial assessment was postponed prioritizing life preservation.

One hour after the neurosurgical procedure to remove an epidural hematoma, the patient remained hemodynamically stable and showed no neurological deficits. The maxillofacial surgeon assessed the patient in the intensive care unit, which optimized diagnostic time.

Upon physical examination, a transfixion wound was found on the right side of the face, and emergency facial sutures were performed previously by the general surgeon.

The patient was diagnosed with a lesion in the left parotid salivary duct, which had been mistakenly sutured. The suture was removed, and the duct was sutured again in the region of the buccal mucosa (buccinator muscle and mucosa) to restore its normal function. The external region was sutured with nylon 5.0 to preserve function and aesthetics.

The patient also experienced partial avulsion of the upper incisor teeth, which were repositioned and temporarily immobilized with 4.0 surgical steel wire ties.

Crepitus and mobility were observed in the left mandibular body, between the molar and premolar teeth, leading to a clinical diagnosis of mandibular fracture. The fractured mandibular segments were provisionally restored by tying them with surgical steel wires and Erich bars under regional anesthesia of the left inferior alveolar nerve and local infiltration. The occlusion was tested and adjusted, and no intermaxillary block was performed due to the patient's general condition.

When adjusting the occlusion, it was noted that the patient has a prognathic jaw with mandibular growth discrepancy. Therefore, the adjustment was made based on establishing the previous functional occlusion rather than parameters of aesthetic normality.

Continuing the physical examination, crepitus, and mobility of the zygomatic bone on the left side were observed, palpating, and moving the bone with the thumb and index fingers, intra and extra-buccally, respectively. Using a malar hook (Ginestet), the fracture was repositioned favorably, with no mobility (Figure 5).

The patient was observed in the ICU for 24 hours and then transferred to the

Figure 5. Example of a conservative treatment of a zygomatic bone fracture with an extraoral malar hook.

surgical clinic for further hospitalization. Following discharge from neurosurgery and confirmation of the initial diagnoses through radiography, a general physical examination was conducted.

The orthopedist has already treated the leg fractures with surgery and internal fixation using plates and screws. The patient is in good general condition, without any neurological deficits, and has stable hemodynamics.

The left parotid duct's normal functioning was observed through milking, and the stability of the zygomatic bone and mandibular fracture was assessed. Radiographic examination showed a favorable fracture of the mandibular body and satisfactory repositioning of the left zygomatic bone.

During secondary diagnostic care, the patient exhibited signs of respiratory distress without airway obstruction, as well as hematoma and edema in the left thorax (hemothorax). The general surgeon was consulted to confirm and diagnose the extra pleural hematoma, and the chest was promptly drained.

During the third evaluation to determine the final diagnosis and case planning, it was observed that rigid internal fixation of the mandibular body on the left side was necessary. Despite the initial stability and reestablishment of the occlusion with emergency tie-up care, it was not sufficient to achieve the desired stability.

The surgical indication was primarily due to the patient's crossbite (prognathism) and the need to maintain patent airways without intermaxillary block, given the complexity of the case.

Mini plates and screws were used for rigid fixation, with a submandibular approach employed to preserve the normal function of the parotid duct, which was still healing.

During the surgical procedure, it was observed that obtaining torque of the screws and stability of the mini plates was difficult in an unusual way, requiring a greater number of screws and plates.

A DEXA exam was performed to evaluate the patient's bone density, revealing atypical osteoporosis at a young age. The patient was referred for specialized treatment and reevaluation.

After seven days, the patient was discharged from the hospital and followed up on an outpatient basis every week for one month. Subsequently, quarterly follow-up appointments were scheduled until the completion of one year.

The patient received instruction on the benefits of correcting prognathism through orthognathic surgery, which was performed after a year and a half of surgical orthodontic treatment.

The case was documented and photographed at every step.

3. Efficient Ratios of Hours and Cases for Problem-Based Learning

In 1999, a survey was conducted on the number, type, and procedure of consultations carried out during the residency course before Professor Lasco's retire-

ment. This survey was the basis of the author's final residency dissertation in 2000 [37].

Over one year, 9880 patients received treatment for craniofacial urgencies and emergencies, with 2210 (22.4%) of them having facial trauma (18% female and 82% male). Facial fractures accounted for 917 cases (41.5%) within this group, comprising 112 Le Fort fractures (12.2%), 309 mandible fractures (33.7%), 70 alveolar fractures (7.6%), 248 nasal fractures (27%), 163 zygomatic bone fractures (17.8%), and 15 fractures of the inferior wall of the orbit (1.6%) [38].

The fractures were evenly distributed throughout the studied months ($p > 0.05$). A significant association was observed between etiology and fracture types ($p < 0.001$), with facial fractures being the most common type resulting from traffic accidents (55.1%), followed by physical aggression (33.5%) and other causes (11.5%) [38].

It is evident that an intensive residency program carried out in a specialized center with a high volume of cases (averaging nine thousand patients per year) and comprehensive guidance, along with integrated hospital experience, has proven to be an effective method for training OMS specialists in Brazil for over 35 years.

Naturally, each country has its legislation with specific conditions. It is important to note that not all specialty centers cater to a population of over 20 million inhabitants, such as the São Paulo area.

Therefore, it is advisable to evaluate mainly the number of cases attended, types of occurrences, and hours dedicated to practical and theoretical training, rather than just the number of years spent in learning.

Another crucial aspect of training the OMS is the short- to medium-term follow-up of treated patients. While the immediate surgical outcome may appear satisfactory, it can lead to post-operative problems and complications for the patient. In some cases, the risk of complications outweighs the surgical benefits.

The specialty of OMS encompasses a range of surgical treatments and procedures. Each of these must be practiced by the student first as a surgical assistant and then as the primary surgeon to acquire the necessary experience and skills.

Throughout history, the best way to learn any surgical specialty has been through study, research, practice, and trauma care. Trauma can cause alterations or compromise normal functions in humans, which can facilitate the learning of both normal and pathological functions.

Wilder Penfield surgically treated epilepsy to map the human brain before drugs were available for this purpose. In 1861, Pierre Paul Broca, a French surgeon, described two patients who had lost their ability to speak after sustaining injuries to the posterior inferior frontal gyrus of the brain [41].

The methodology described here aims to provide a new perspective on the subject, which can be considered in future discussions on professional training in the specialty. This has already been done distinctively by the International Association of Oral and Maxillofacial Surgeons (IAOMS) in the year 2011 [6] [8].

4. Discussion

Due to historical reasons, there are many different training pathways across countries that lead to a degree in OMS. Although it is generally accepted as a specialty of dentistry, the complex nature of procedures performed by OMF surgeons today has necessitated extensive general surgical training [1] [8].

Therefore, many countries have made dual qualification mandatory, while others have extended training programs in OMS with integrated medical teaching [2] [3].

A survey was conducted to assess the opinions of current surgical residents regarding their training. The survey focused on perceptions of early entry into a subspecialty and the adequacy of training.

The data shows that 80% of trainees choose fellowship training, which may be due in part to the fact that 38% of them lack confidence in their skills despite completing 5 years of training. This figure includes 23% of graduating chief residents [23].

Training and certifying groups should update and strengthen the current curriculum for categorical residents in general surgery. They should also continue their efforts to offer shortened independent or integrated residency training for those who will enter surgical specialties. Innovative solutions are required to solve the logistical and financial problems involved.

There is concern within the surgical community that a crisis in confidence at the end of training is leading general surgery residents to choose subspecialty training in large numbers. Recent studies have attempted to quantify and measure confidence in graduating general surgery residents, despite the challenges of defining and measuring this quality [42].

Survey studies, while limited, are often used to shape discourse and influence policies. Considering social and cultural factors that can influence self-efficacy is important. It is not enough to focus only on operative volume and autonomy as these may not address all the reasons why some residents express concerns about their readiness to practice.

Laskin [5] proposed that oral and maxillofacial surgery can be categorized into areas of expertise, such as oral pathology, oral medicine, dentoalveolar surgery, preprosthetic surgery, and maxillofacial traumatology; areas of competence, including orthognathic surgery, temporomandibular joint surgery, and local reconstructive surgery; and areas of familiarity that include cleft lip and palate surgery, craniofacial surgery, regional reconstructive surgery, oncologic surgery, and cosmetic surgery.

A cross sectional study assessed the level of confidence that residents have in performing the full spectrum of OMS, as well as to identify any gaps in their training. No significant difference was found between orthognathic surgery and any other area in the expertise category [43].

In some cases, orthognathic surgery was perceived to have a higher level of ability ($P < 0.05$). However, there was a significantly lower perception of training

in oral medicine compared to each area in the expertise category ($P < 0.05$), indicating a deficiency in oral medicine training.

OMS residents generally consider research experience during residency to be beneficial. However, they report facing significant barriers, particularly a lack of time. Although most OMS training programs in the US require research for completion, many do not allocate sufficient time to facilitate this process [44].

Despite literature from over a decade ago highlighting these issues, little progress has been made in addressing them. Addressing this issue could enhance the quantity and quality of research, advancing the profession.

The evolution of clinical education is being adapted to changes in technology and the American higher education environment. These changes are being incorporated into OMS residency education, which is adapting to a changing workforce and practice model, as well as the technological revolution of today [8].

Most studies on technological advances in surgical education have demonstrated a positive impact on patient care and medical knowledge. However, there has been no evaluation of the impact of simulation-based surgical training and simulation-based non-technical skills (NTS) training on American Board of Surgery In-Training Examination (ABSITE) scores and American Board of Surgery(ABS) certification [45].

Further research is required to provide quantitative evidence that surgical residency program objectives are met through technological advances in surgical education and simulation based NTS training.

In the United States, an estimated 40,000 patients are injured each day due to preventable medical errors. Although many studies have examined the causes of medical trainee errors and efforts to reduce patient injuries in this population, little research has been conducted on adverse events experienced by OMS residents or strategies to improve patient safety awareness in OMS residency programs [46].

The literature suggests that OMS residents face similar risks to medical trainees in medical, surgical, and anesthesia residency programs. Therefore, integrating competency-based safety training into the OMS residency curriculum may be beneficial [47].

OMS educators should ensure that residents acquire the necessary skills to understand and apply patient safety principles and system improvement strategies during the training period.

The significance of training quality and content in dentistry or medicine prior to undertaking the OMS specialty has not been extensively discussed in the literature.

However, Brazil provides comprehensive training in dentistry as a medical specialty. Their curriculum covers a broad range of topics, including maxillofacial local and regional anesthesia, radiology, stomatology (tumors and diagnostics), oral and maxillofacial surgery and traumatology, implants, and basic life

support. Proficiency in occlusion theory, temporomandibular joint function, and orofacial rehabilitation are essential components of the skillset required for a successful OMS specialist [26] [37].

Another important aspect of training OMS specialists is the hospital where the specialty is taught and the specific caseload in terms of the number and types of diseases [48].

For instance, a center that specializes in maxillofacial trauma in Santo Andre, Sao Paulo, Brazil, saw an average of 9000 patients per year. This illustrates that the quality and quantity of patients seen over a short time can be more beneficial than a longer period with fewer cases overall [37].

To maintain objectivity, it is important to describe the number of patients attending, being diagnosed, treated, and followed up for the minimum period required for each disease until a cure or minimum estimated results are obtained, given the available technology.

The association of years of study with the quality of training is a simplistic way of assessing the quality of professional training and is outdated, given the technological tools available today.

The IAOMS provides a platform for cross-cultural exchange of experiences among countries with diverse backgrounds [5] [8] [9] [19].

The quality of professors in OMS is a crucial factor in shortening the training period for OMS. This can be achieved by having a training center with adequate infrastructure and residencies in various medical areas, including general surgery, orthopedics, neurosurgery, clinical medicine, and plastic surgery. Living together in a common environment with these specialties' benefits everyone, especially the patients [37] [38].

OMS programs should cover both surgical and non-surgical treatments, emphasizing their differences.

Medical residencies often prioritize surgical techniques and protocolized procedures over fundamental life-saving skills and urgent care. Therefore, it is crucial to provide a comprehensive theoretical and practical grounding in all aspects of patient care [48] [49] [50].

Continuous assessment of trauma patients is essential throughout their care, and all professionals, regardless of their training, must monitor their hemodynamic and neurological status.

The ongoing debate about the education and training requirements for oral and maxillofacial surgery (OMS) practitioners is influenced by a number of key factors. One such factor is the time efficiency of the practical and theoretical learning process, which is dependent on the ratio of OMS patients to effective training hours.

The educational structures and training pathways for OMS vary considerably across different countries and regions. This raises the question of the implications of these differences on professional standards. The most reliable method for assessing the quality of results is to access the long-term follow-up of patients

(one to 10 years). This is the gold standard for evidence-based medicine.

The evolution of surgical techniques and technologies has influenced the development of OMS education, with the objective of optimizing training through the use of digital and experimental models based on real digital images of specific patients. These models enable students to undertake surgical procedures in a simulated environment, prior to assisting or performing the procedure itself.

The historical developments that have shaped the current landscape of OMS education, particularly in countries such as Brazil and the United States, were strongly influenced by the practical experience of pioneers and periods of war. In Brazil, the number of gunfire wounds is similar to that of periods of war [33] [37].

The objective of OMS residency programs is to achieve an optimal balance between theoretical learning and practical surgical experience. In order to ensure comprehensive training, it is essential to employ appropriate strategies based on problem-based learning.

It is recommended that an international committee be established to address the difficulties and implications of integrating medical and dental qualifications within OMS training programs. This committee should analyze the quality of results on an annual basis using an international database.

The prospective trajectories and prospective reforms that are being contemplated for the education of OMS students, particularly in response to the evolving healthcare landscape and the evolving needs of patients, should address the integration of diagnostics, treatment and results under an international database, with universal terms and basic protocols adapted for each individual need and country characteristics.

The most effective approach for both practice and teaching are multidisciplinary work. It is important to avoid overloading the workload.

5. Conclusions

When considering the needs of the public, it is evident that single-degree oral and maxillofacial surgeons have a crucial role to play, while double-degree oral and maxillofacial surgeons may also be required in some countries. This is supported by changing ratios, even in nations that have traditionally required medical and dental degrees or only a medical degree to be considered an oral and maxillofacial surgeon.

It is not realistic to expect everyone to conform to a single standard. To benefit the public and the field, it is crucial to foster a sense of collaboration and harmony between the two groups, rather than promoting hostility and rivalry.

The specialty in OMS should be completed during a medical intensive residency, either by dentists or physicians. This residency program provides exposure to a wide range of cases in maxillofacial surgery under appropriate supervision, with particular attention paid to monitoring the results for the required period.

Specialized trauma care is fundamental for students to acquire the necessary skills, knowledge, and experience in all subspecialties of OMS. In some training or residency centers, fellowships may be necessary to supplement the number of cases seen per hour if it is insufficient to complete the proposed program.

The proposed and practiced ideal ratio of cases seen in 30 days is satisfactory, with an average of 800 cases. Out of the 184 traumas recorded per month, 76 were fractures, including 9 Le Fort fractures, 25 mandibular fractures, 6 dento-alveolar fractures, 20 nasal fractures, 13 zygomatic bone fractures, and 2 orbital floor fractures on average.

Using the number of consultations during a given period proved to be an effective method for qualifying specialist training courses. Insufficient case numbers during lengthy training periods can hinder excellence in training and render courses impractical, expensive, and unsustainable for both students and teaching institutions.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Koch, C.R.E. (1909) History of Dental Surgery (Vol. 1). National Art Publishing Company, Washington DC.

[2] Punjabi, A.P. and Haug, R.H. (1990) The Development of the Dual-Degree Controversy in Oral and Maxillofacial Surgery. *Journal of Oral and Maxillofacial Surgery*. **48**, 612-616. https://doi.org/10.1016/S0278-2391(10)80476-8

[3] Stoelinga, P.J. (1992) International Guidelines for Specialty Training in Oral and Maxillofacial Surgery. *International Journal of Oral and Maxillofacial Surgery*, **21**, 130-132. https://doi.org/10.1016/S0901-5027(05)80777-5

[4] (2003) European Guidelines for Specialty Training in Oral and Maxillo-Facial Surgery. *Revue de Stomatologie, de Chirurgie Maxillo-faciale*, **104**, 186.

[5] Laskin, D.M. (2008) The Past, Present, and Future of Oral and Maxillofacial Surgery. *Journal of Oral and Maxillofacial Surgery*, **66**, 1037-1040. https://doi.org/10.1016/j.joms.2007.11.037

[6] American Dental Association at Ada (2024) Advanced Dental Education Programs in Oral and Maxillofacial Surgery.

[7] Kosslyn, S. and Nelson, B. (2017) Building the Intentional University: Minerva and the Future of Higher Education. MIT Press, Cambridge. https://doi.org/10.7551/mitpress/9780262037150.001.0001

[8] Assael, L.A. (2022) Residency Education in Oral and Maxillofacial Surgery: A New Curriculum Framework. *Oral and Maxillofacial Surgery Clinics of North America*, **34**, 537-544. https://doi.org/10.1016/j.coms.2022.03.009

[9] Kumar, S. (2017) Training Pathways in Oral and Maxillofacial Surgery across the Globe-A Mini Review. *Journal of Maxillofacial and Oral Surgery*, **16**, 269-276. https://doi.org/10.1007/s12663-017-1020-0

[10] Herlin, C., Goudot, P., Jammet, P., Delaval, C. and Yachouh, J. (2011) Oral and Maxillofacial Surgery: What Are the French Specificities? *Journal of Oral and Max-*

illofacial Surgery, **69**, 1525-1530. https://doi.org/10.1016/j.joms.2010.12.009

[11] Yuce, E. and Komerik, N. (2015) Oral Maxillofacial Training: Opinions of Trainees and Specialists in Turkey. *Journal of Contemporary Medical Education*, **3**, 25-30. https://doi.org/10.5455/jcme.20150504014834

[12] Ricciardo, P., Bobinskas, A., Vujcich, N., Nastri, A. and Goss, A. (2015) Survey of Australasian Oral and Maxillofacial Surgeons 2011—Scope and Workforce Issues. *International Journal of Oral & Maxillofacial Surgery*, **44**, 1569-1573. https://doi.org/10.1016/j.ijom.2015.03.007

[13] Pitak-Arnnop, P., Bauer, U., Chaine, A., Hemprich, A. and Bertolus, C. (2010) The Past, Present, and Future of Oral and Maxillofacial Surgery—Some Details in Europe. *International Journal of Oral & Maxillofacial Surgery*, **68**, 491-494. https://doi.org/10.1016/j.joms.2009.06.023

[14] EACMFS (2016) White Book. http://beta.jointogethergroup.com/society/members/whitebook/export.asp?wb=35

[15] Zheng, J., Fang, B., Zhang, S., Yang, C., Shen, G. and Qiu, W. (2013) Oral and Maxillofacial Surgery in China: Past, Present and Future. *Open Journal of Stomatology*, **3**, 354-358. https://doi.org/10.4236/ojst.2013.37060

[16] Samman, N. (2009) The Modern Specialty of Oral and Maxillofacial Surgery. *Hong Kong Medical Diary*, **14**, 3.

[17] Lew, D. (2017) A Historical Overview of the AAOMS. http://www.aaoms.org/images/uploads/pdfs/historical_overview_aaoms.pdf

[18] Rodriguez-Perez, M., Romero-Olid, M.N. and Vallecillo-Capilla, M. (2005) Post Graduate Training in Oral Surgery in Spain. *Medicina Oral, Patología Oral y Cirugía Bucal*, **10**, 323-330.

[19] Nayak, K. (2011) Oral and Maxillofacial Surgery: It's Future as a Specialty. *Journal of Maxillofacial and Oral Surgery*, **10**, 281-282. https://doi.org/10.1007/s12663-011-0332-8

[20] Reddy, S.G. and Pandey, A. (2022) Fellowships Post Maxillofacial Residency—Is It Necessary? *National Journal of Maxillofacial Surgery*, **13**, 1-4. https://doi.org/10.4103/njms.njms_28_22

[21] Scatolini, S.A., Jan, V.M. and Bartholomé, M.A. (2010) Developing a Curriculum for 'Learning to Live Together': Building Peace in the Minds of People. *Semantic Scholar*, **1**, 133-158.

[22] Carlson, E.R. and Tannyhill, R.J. (2019) A Foundational Framework for Andragogy in Oral and Maxillofacial Surgery II: Interactive Andragogies. *Journal of Oral and Maxillofacial Surgery*, **77**, 1101-1102. https://doi.org/10.1016/j.joms.2019.01.054

[23] Coleman, J.J., Esposito, T.J., Rozycki, G.S. and Feliciano, D.V. (2013) Early Subspecialization and Perceived Competence in Surgical Training: Are Residents Ready? *Journal of the American College of Surgeons*, **216**, 764-773. https://doi.org/10.1016/j.jamcollsurg.2012.12.045

[24] (1965) Professional Liability Insurance for the Intern and Resident. *JAMA*, **193**, 55-60. https://doi.org/10.1001/jama.1965.03090010061017

[25] (2024) What Is a Surgical Resident? https://www.facs.org/media/0kph3p0n/what_is_a_surgical_resident.pdf

[26] (1966) Presidência da República Casa Civil. Law Nº 5.081. https://www.planalto.gov.br/ccivil_03/leis/l5081.htm

[27] Donoff, B. and Troulis, M.J. (2018) The Development of Dual-Degree Programs in Oral and Maxillofacial Surgery: Celebrating the 75th Anniversary of the Journal of

Oral and Maxillofacial Surgery and the 100th Anniversary of Our Specialty. *Journal of Oral and Maxillofacial Surgery*, **76**, 1147-1149. https://doi.org/10.1016/j.joms.2018.01.028

[28] Hendler, B.H. and Quinn, P.D. (2009) University of Pennsylvania Oral and Maxillofacial Surgery Training Program. *Journal of Oral and Maxillofacial Surgery*, **67**, 937-942. https://doi.org/10.1016/j.joms.2007.03.035

[29] AAOMS (2024) OMS Residency Training Programs. https://www.aaoms.org/docs/education_research/edu_training/aaomresidency_omsprogram.pdf

[30] Felsenfeld, A.L. and Casagrande, A. (2004) Oral and Maxillofacial Surgery Residency Education. *Journal of the California Dental Association*, **32**, 817-822. https://doi.org/10.1080/19424396.2004.12224029

[31] (2024) Harvard OMS Residency Program. https://hsdm.harvard.edu/oral-and-maxillofacial-surgery-program

[32] Andreucci, C.A. (2024) Sixty Years of Innovation in Biomechanical Orthognathic Surgery: The State of the Art and Future Directions. *Osteology*, **4**, 11-32. https://doi.org/10.3390/osteology4010002

[33] Lasco, G.E. (1984) 20 Years of Maxillofacial Surgery (20 anos de cirurgia maxilo-facial). In: Marco Antonio, B. and Christa, F., Eds., *Atualização clínica em odontologia*, Artes Médicas, São Paulo, 219-230.

[34] Lasco, G.E. and Mello, J.B. (1984) Contribution to Surgical Treatment of Temporomandibular Joint Recidivant Dislocation (Contribuição ao tratamento cirúrgico das luxações recidivantes da atm). In: Marco Antonio, B. and Christa, F., Eds., *Atualização clínica em odontologia*, Artes Médicas, São Paulo, 231-236.

[35] Lasco, G.E. and Mello, J.B. (1984) TMJ Pain Dysfunctions (Disfunções dolorosas da ATM). In: Marco Antonio, B. and Christa, F., Eds., *Atualização clínica em odontologia*, Artes Médicas, São Paulo, 237-242.

[36] Lasco, G.E. (1967) Contribution to the Study of the Pathology and Therapy of the Temporomandibular Joint (Contribuição ao Estudo da Patologia e Terapêutica da Articulação Temporomandibular). *Revista da APCD*, **2**, 264.

[37] Andreucci, C.A. (2000) Primum Non Nocere. Diagnosis and Treatment of Facial Fractures (Diagnostico e Tratamento das Fraturas Faciais). Medical Residency Dissertation, Universidade Brasil, São Paulo.

[38] Andreucci, C.A. (2009) Epidemiology of Craniofacial Trauma in the Hospital Centre of Santo André (Brazil) in 1999, Under the New Traffic Code. (Epidemiologia dos Traumatismos Craniofaciais no Centro Hospitalar de Santo André (Brasil) No ano de 1999, Na Vigência do Novo Código de Trânsito). Master's Thesis, Centro Universitário Faculdade de Medicina do ABC (FMABC), Santo André.

[39] (2024) Gino Emilio Lasco Academic Genealogy. http://plataforma-acacia.org/profile/gino-emilio-lasco/

[40] Lasco, G.E. (1980) Benign Hypertrophy of the Masseter Muscle: Standardisation of Surgical Technique and Comparative Cytometric Study between Normal and Hypertrophied Muscle [Hipertrofia Benigna do Musculo Masseter: Padronizacao de Tecnica Cirurgica e Estudo Citometrico Comparativo Entre Musculo Normal e Hipertrofiado (Livre Docência)]. Post Doctoral PhD Thesis, Universidade De São Paulo, Ribeirao Preto.

[41] Dronkers, N.F., Plaisant, O., Iba-Zizen, M.T. and Cabanis, E.A. (2007) Paul Broca's Historic Cases: High Resolution MR Imaging of the Brains of Leborgne and Lelong. *Brain*, **130**, 1432-1441. https://doi.org/10.1093/brain/awm042

[42] Elfenbein, D.M. (2016) Confidence Crisis among General Surgery Residents: A Systematic Review and Qualitative Discourse Analysis. *JAMA Surgery*, **151**, 1166-1175. https://doi.org/10.1001/jamasurg.2016.2792

[43] Tannyhill III, R.J., Baron, M. and Troulis, M.J. (20121) Do Graduating Oral-Maxillofacial Surgery Residents Feel Confident in Practicing the Full Scope of the Specialty? *Journal of Oral and Maxillofacial Surgery*, **79**, 286-294. https://doi.org/10.1016/j.joms.2020.09.035

[44] Ho, A.H., Sansevere, M.J. and Chou, J.C. (2024) Barriers to Research among Residents in Oral and Maxillofacial Surgery. *Journal of Dental Education*. https://doi.org/10.1002/jdd.13484

[45] Dietl, C.A. and Russell, J.C. (2016) Effects of Technological Advances in Surgical Education on Quantitative Outcomes from Residency Programs. *Journal of Surgical Education*, **73**, 819-830. https://doi.org/10.1016/j.jsurg.2016.03.016

[46] Buhrow, S.M. and Buhrow, J.A. (2013) Reducing Oral and Maxillofacial Surgery Resident Risk Exposure: Lessons from Graduate Medical Education Reform. *Journal of Dental Education*, **77**, 1670-1676. https://doi.org/10.1002/j.0022-0337.2013.77.12.tb05646.x

[47] Buhrow, S.M. and Buhrow, J.A. (2016) Integrating Patient Safety in the OMFS Curriculum: Survey of 4-Year Residency Programs. *Journal of Patient Safety*, **12**, 197-203. https://doi.org/10.1097/PTS.0000000000000094

[48] Meyer, R.A. (2016) Historical Milestones in Oral and Maxillofacial Surgery. *Journal of Oral and Maxillofacial Surgery*, **74**, 2336-2337. https://doi.org/10.1016/j.joms.2016.08.034

[49] Strother, E.A. (2003) Maxillofacial Surgery in World War I: The Role of the Dentists and Surgeons. *Journal of Oral and Maxillofacial Surgery*, **61**, 943-950. https://doi.org/10.1016/S0278-2391(03)00290-8

[50] Brue, E. and Salf, E. (1995) Gustave Ginestet (1897-1966), Doctor General. Life and Work of a Pioneer of Cosmetic and Reconstructive Maxillofacial Surgery. *Histoire des sciences médicales*, **29**, 307-315.