Maxillofacial and Craniofacial Surgery: Our Family Tree

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I. INTRODUCTION

A generation of man—the time from birth to adulthood, and production of the next generation—is generally taken to be 25 years.

The formation of a plastic surgeon takes longer. If one finishes medical school at 25 and takes eight additional years of training, the generation for a plastic surgeon would be 33 years, or three generations per century.

II. EARLY DEVELOPMENTS

Maxillofacial surgery in 1900 did not differ greatly from what surgeons were doing during the American Civil War, except that anesthesia was now available, although it had to be administered by open-drop-ether masks. This limited drastically what surgeons were able to do. Some improved dental splints were available for the treatment of jaw fractures, and one notable individual, Edward H. Angle, M.D., D.D.S., in his publication that was the seminal work in the development of the field of orthodontics, stated bluntly that interosseous wiring of a mandibular fracture should never be done (1). Some pioneering work in the treatment of facial malignancy was performed by David Cheever (2) in the United States and Bernhard von Langenbeck (3) in Germany, who performed

a variety of access osteotomies to permit tumor removal. Aside from the precocious and unappreciated mandibular osteotomy performed by Simon P. Hullihen in 1848 in Wheeling, West Virginia, orthognathic surgery was not considered possible (4).

The first generation of the twentieth century, who were active between 1900 and 1933, were responsible for a tremendous flowering in the field of maxillofacial surgery. George Crile (5) developed the radical neck dissection for cervical cancer, Edward Angle and Vilray Blair (6) took pioneering steps in orthognathic surgery with first a body osteotome and then a ramus osteotomy for manibular deformities. Harvery Cushing (7) and Walter Dandy (8) were creating the new subspecialty of neurosurgery. Medical education underwent restructuring after the Flexner report (9), and the Board system for examination and certification of surgeons began.

In England, Sir Harold Gillies made enormous advances in facial reconstruction with soft-tissue flaps, tube pedicles, and autogenous bone grafting (10,11). The use of these methods in the treatment of those with facial injuries sustained in the trench warfare of World War I is considered to be the beginning of the specialty of reconstructive plastic surgery.

In France, Victor Veau (12) focused on the problems of cleft lip and palate, and the Curies investigated radioactivity (13). In Germany, Roentgen (14) developed the x-ray, and Axhausen (15), Joseph (16), Cohn-Stock (17), and Esser (18) made major contributions to maxillofacial surgery.

III. THE MID-TWENTIETH CENTURY

The generation that came after this one spanned the period from 1933 to 1966. The injured of World War II received better treatment than those of the previous war owing to advances in blood transfusion and anesthesia. However, surgical methods had changed little, with head caps and tube pedicles similar to those of the previous generations being widely used. In 1942, Milton Adams (19) brought forward the principle of fixation of facial fractures to the nearest higher intact structure, but facial fractures were still treated by interosseous wires placed through small incisions directly over the fractures. Ralph Millard (20) began his seminal contributions to cleft lip and palate in the late 1950s, and Paul Tessier (21–28) about the same time began his work with the Le Fort 3 type osteotomy, although he did not present the work for another decade [1967, Rome].

IV. THE LATE TWENTIETH CENTURY

From the mid 1960s to the end of the twentieth century—our generation—a number of elements coalesced to make this a period of extraordinary productivity. Some of these areas of progress include:

1. Anesthesia. Endotracheal anesthesia became safe and commonplace, respirators became reliable, monitoring devices much more sophisticated, and intensive care units developed that were run by full-time, on-the-spot intensivists. Storage and testing of transfused blood became better.
2. Imaging devices. CT and MRI have allowed us to see with precision and in fine detail in three dimensions, with much better understanding of the anatomy of the face, making planning and the ability to evaluate our results much better.
3. Surgical equipment. Collaboration between surgeons and manufacturers of medical equipment became closer, with the development of plating systems specifically developed for use on the facial bones, including biodegradable systems, better electrocauteries, and suture material with swagged-on needles.
4. Surgery itself. Development of new surgical principles, tactics, and techniques—in short, how surgeons conceptualize and go about their craft—have taken of all of the above.

Building on the contributions of the prior generation of German-speaking maxillofacial surgeons, Hugo Obwegeser (29) showed the versatility of the sagittal split, and Jacques Dautrey (30) and Bernd Speissl (31) made further improvements in technique and instrumentation. Obwegeser and Karl Hogeman (32) of Sweden made the Le Fort 1 osteotomy commonplace, and Obwegeser was the first to do a simultaneous two-jaw movement (33). With collaboration in preoperative planning and preparation by a new generation of orthodontists accustomed to working with surgeons, orthognathic surgery now could move the tooth-bearing structures predictably and with stability in all directions. Besides his contributions to maxillofacial surgery, Hugo Obwegeser also became a leader in educating a new generation of maxillofacial surgeons, both at the Zahnartliches Institut in Zurich and through his involvement with the European Society of Maxillofacial Surgeons.

Obwegeser added substantially to the existing specialty of maxillofacial surgery; Paul Tessier created an entirely new specialty de novo. After showing the success of the subcranial Le Fort 3–type osteotomy (a subcranial craniofacial procedure that was a higher facial advancement than had been previously performed, but still nevertheless a maxillofacial procedure),

Tessier went on with Gerard Guiot and other neurosurgeons at Hôpital Foch in Paris to show the safety and many possibilities of the transcranial approach to the face. The entire face could be dissected subperiosteally through coronal, intraoral, and lower-eyelid incisions. Segments of facial bones could be displaced and rigidly fixed in any new position desired, and the success of all of the procedures rested on the liberal use of autogenous bone grafts. The demonstrated success of these procedures used for congenital anomalies led to the same methods being used for simultaneous tumor removal and reconstruction, and primary bone grafting in major facial fractures. At the end of the twentieth century, experienced craniofacial teams in a number of centers around the world regularly applied Tessier's methods with rates of morbidity and mortality that became lower and lower.

Other contributions were made in plastic surgery that could be applied to maxillofacial and craniofacial surgery. These included myocutaneous flaps, microsurgical free-tissue transfer, and tissue expanders. Joe McCarthy (34) and Fernando Molina (35) showed how to make small mandibles larger by applying Ilizarov's method of distraction osteogenesis (36), and John Polley (37) and others developed equipment that could distract the maxilla. However, contrary to some initial predictions, distraction osteogenesis does not seem to have supplanted orthognathic surgery in most cases. Rather, it has made it possible to provide earlier treatment for conditions that were not well suited to traditional orthognathic techniques.

Although numerous new antibiotics have been developed, the tremendous ability of microorganisms to reprogram their biochemical structure and rapidly develop resistant strains has been a great disappointment and relative failure. Hopes are high that newer types of antibiotics can be developed, based on having the complete DNA map of the human being available from the Human Genome Project.

Endoscopic surgery, originally developed by gynecologists and then adopted by general surgeons, was tried by plastic surgeons on a number of conditions. The most common use by far is for the endoscopic forehead lift. The technology has been applied to the harvest of certain types of free flaps, and less often in breast augmentation and abdominoplasty. In maxillofacial surgery, the best application so far seems to be in the fixation of condylar fractures and the visualization of hard-to-see areas such as the medial orbital wall through the lower eyelid, where it is in reality not being used for much more than a convenient light source. Each new technology needs to have its proper applications established, and discussion still continues as to whether, for instance, it is better to approach an orbital floor fracture through a Caldwell Luc approach with an endoscope or through a more direct and simpler conjunctival incision. Similarly, it may seem convoluted to some to perform an endoscopic release of a unilateral coronal synostosis

simply to avoid a slightly longer incision in the scalp when the tradeoff requires wearing a cranial-molding band for a year after the surgery. New technology will eventually find its appropriate applications.

V. THE FUTURE

What will come for the generation that will extend to 2033? We can expect that biochemical and genetic advances will be made that will help with spontaneous tissue generation, so that instead of a bone graft we will be able to add a material that will lead to bone formation where it is added. Mundane but frustrating problems, such as keloid formation, will hopefully find a cure, as will more and more forms of cancer.

The greatest advances may come, perhaps, if we develop systems of providing medical care that will simply make it possible to apply what we are able to do at the highest level in a regular basis to all comers. Just as designated burn centers have greatly improved the outlook for burn patients, facial fractures, cancer, and congenital anomalies should be treated in designated centers by surgeons with the highest level of expertise. The hideous, convoluted, grotesque, and nightmarish system of medical care currently operating in the United States, wherein bureaucrats who call themselves "medical directors," but have no real expertise in medicine, are rewarded financially for denying as much care as possible, must be dismantled and replaced with a viable system. A certain basic level of care could best be provided by a national health service, but a nightmare in the other direction should be avoided by allowing patients considerable choice in their own medical decisions, and perhaps expecting them to pay for some of it out of their own pocket.

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