FACE VALUE

Professor James A McCaul looks at the development through the ages of oral and maxillofacial surgery

Oral and maxillofacial surgery (OMFS) incorporates all facets of facial surgery and reconstruction from congenital deformity, through acquired intraoral and craniofacial pathology to trauma and cancer. Many benign and malignant facial conditions require intervention affecting facial function, leaving patients with difficulty eating, speaking and swallowing, as well as compromised aesthetics. The surgeon's task is to design surgical intervention to meet the demands of facial function without compromising treatment of the pathology.

Historically, surgeons recognised that two-thirds of the facial skeleton is the jaws, and some then acquired a dental degree to augment their understanding of the functioning anatomy and physiology of the human face, head and neck. Dentists, meanwhile, have long reconstructed teeth to improve patients' aesthetics, eating and speech. As surgical techniques developed, facial reconstruction expanded from the oral cavity to the rest of the head and neck. This is when many dentists chose to pursue a formal qualification in medicine.

Of course, the face has many important functions, some of which are more obvious than others. It houses four of the five senses: vision, hearing, smell and taste. Humans have always been obsessed with beauty and facial form. The personal identity of the face has been obvious throughout recorded history, with the current selfie trend the modern equivalent of the historic portrait. Alexander the Great put his face on coins to emphasise dominance over his empire.

More recently, the inextricable relationship between the face and human identity was emphasised by the case of Carmen Blandin Tarleton, who described having had three faces: the original one, a terribly disfigured one and her new one. She says she had dreams three weeks after her face transplant, with her new face in the dream – emphasising the role of her face in her identity.

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Early reconstruction

The value of surgically restoring the face can be seen throughout history. Records of facial reconstruction date back to ancient India in the Sushruta Samhita texts. Here, we find descriptions of nose reconstruction with the forehead flap, which is still a core part of nasal reconstruction in 2017. Surgeons continued to experiment with tissue transfer for reconstruction. In the late 1500s, Gaspare Tagliacozzi in Italy first described the famous arm pedicle flap. Skin and soft tissue from the arm is attached to the face to reconstruct the defect until new local blood supply is established that allows separation from the donor site.

Fast-forward to the world wars and the demands for facial reconstruction led to rapid development of surgical techniques. The introduction of front-line artillery and explosive shells in the First World War led to unprecedented numbers of facial wounds. After collaboration with Sir Charles Valadier (a dentally qualified French–American), ENT surgeon Harold Gillies encouraged the army chief surgeon to set up a facial injury ward at the Cambridge Military Hospital in Aldershot. Valadier had set up the first facial trauma hospital in France in the war and, among other achievements, performed the first distraction osteogenesis on wounded soldiers. Soon expanding across to other hospitals, Gillies performed a catalogue of skin-flap transfer techniques to treat more than 5,000 servicemen.

By the Second World War, the UK had facial surgery units across the country. These early maxillofacial surgeons worked on tens of thousands of soldiers to help them return to society. East Grinstead was one such unit where Archibald McIndoe treated patients with serious facial disfigurement. He pushed the boundaries of reconstruction with techniques such as the tube pedicle, first widely used in modern times by his cousin, Harold Gillies, where skin from the donor site is tubed to reduce the risk of infection. His patients formed the 'Guinea Pig Club', which continued to meet long after the war.

Flap advancements

The days of attaching the patient's arm to the face are past. Facial reconstruction following cancer surgery routinely uses free flap transfer, which enables surgeons to use donor sites away from the face. A wide variety of bone from the scapula, hip or fibula can be used to reconstruct the mandible or maxilla. Similarly, skin and soft tissue from the arm or thigh can be used to create a new tongue or seal the floor of the mouth. This type of autogenous tissue transfer enables rapid healing of the cancer resection site and gives great postoperative functional outcomes. All of this prepares the patient to receive adjuvant chemotherapy or radiotherapy sooner and in turn improves survival outcome.

There have been great strides in resection and reconstruction technologies over the last few decades.

"As techniques developed, facial reconstruction also expanded from the oral cavity to the rest of the head and neck"

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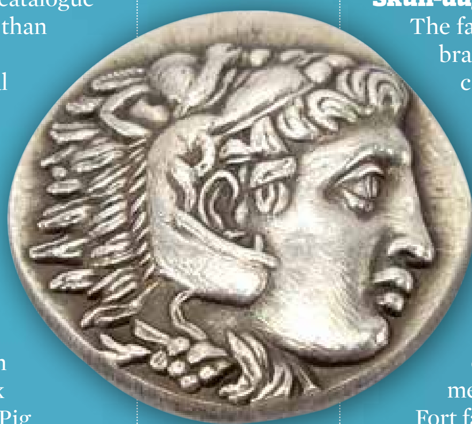
Right: The breadth of practice of maxillofacial surgery is vast



Below: Alexander the Great put his face on coins to signify his dominance

The introduction of chemical agents for vital staining such as Lugol's iodine, long used in the cervix, enables surgeons to visualise oral dysplastic tissue for the first time. This, along with improved access using robotic and laser surgery, has meant increased precision of cancer resection. Intraoperative navigation guidance is being trialled to meet the challenges of accurate resection in hard-to-access areas, leading to smaller safe-margin resection and smaller defects for reconstruction.

Skull-duggery

The facial skeleton forms a cage to protect the brain. Similar to the grilles at the front of an SUV car, it creates a crumple zone. The specially designed spaces within the sinus, thin sections of bone and weak joins are perfect for force absorption.

René Le Fort was a great pathologist in the early 1900s who, through observational experiments dropping cannonballs on cadaver skulls from a great height, was able to replicate various force applications and study facial fracture patterns. His contemporaries may have been baffled by his methods, but his work is renowned and the Le Fort facial fracture patterns are referenced across the world. Experienced maxillofacial surgeons know these patterns as a guide and now accurately refer to 'complex middle third injuries' when describing patients where trauma to the face has absorbed energy transfer, often sparing the intracranial contents.

Using high-resolution CT imaging to produce 3D printed models of the skull means surgeons can better visualise and conceptualise the patient's anatomy and operative planning. The use of CAD/CAM in industry to manufacture accurate components has also been extended to develop patient-specific medical implants. Using materials such as titanium and PEEK, we can replicate the patient's original facial features.

More recently, the same technology has been applied to make cutting guides to enable autogenous tissue to be harvested and moulded to better replace the reconstructed anatomy. For example, the human fibula can be harvested with a fasciocutaneous paddle and even as a chimeric flap with muscle also, and sectioned *in situ* in the leg to provide a complex 3D scaffold. This allows reconstruction of facial hard and soft tissues, and enables osseointegrated titanium implants to provide a stable dental prosthesis, restoring facial form and function.

All this achieves the ultimate aim of a better quality of life for patients, with improved appearance, and the ability to speak, masticate and swallow.