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Heads, Hands and Jaws: The Role of the Hand Specialist in the Craniofacial Clinic

Joseph Upton III, MD, * *and Kevin Cheung, MD* †

The association of craniofacial and limb anomalies is well known. The inclusion of the upper limb hand specialist in a multidisciplinary team creates a unique opportunity for patient and surgeon. The experience reported in this article is not what one would initially expect. Within our children's hospital, Dr Joseph Murray created a single division within the department of pediatric surgery and recruited 3 surgeons—a plastic pediatric and cleft specialist, an oral and maxillofacial surgeon, and a plastic and orthopedic hand and microvascular specialist—to meet as many of the surgical needs of these patients as possible, most of whom had multisystem syndrome diagnoses. These 3 young surgeons, with disparate specialized training, needs, personalities, ambitions, and technical skills, were joined by a single secretary, the craniofacial clinic, and their ward rounds. In reality, the perfect environment for collaboration and cross-fertilization had been created. After 10 years of effort, the outcome was much greater than Dr Murray would have predicted and certainly validated the sign on his desk: "The sum is greater than the whole of the parts."[1] The learning cross-fertilization has never stopped.

The role of the hand surgeon has become much greater than anticipated. It is greatly enhanced by previous training in plastic surgery, which traditionally included some experience with maxillofacial, orthopedic, and vascular surgery, and now microsurgery. The practical applications for the hand surgeon extend well beyond the correction of limb deformities. The hand surgeon can learn volumes from craniofacial colleagues in the collective treatment of heads, hands, and jaws.

Planning

The craniofacial clinic and planning sessions, held 1 evening each week, was a place to observe, listen, and learn. The treatment and discussions were more comprehensive than any preoperative planning for upper limb surgery. Clinical photographs and composites; radiographs, including panoramic views, computerized tomograms, and later magnetic resonance images; cephalometric plots; dental models; and clinical summaries and social histories were presented before the surgical options were ever discussed. Recommendations of the dental colleagues and maxillofacial surgeon were pivotal in overall planning, which often involved preliminary tooth extractions, palatal expansion, months, and in some cases, years of orthodontic tooth movement in preparation for craniofacial surgery. I had never seen anything like this in general or plastic surgical evaluation sessions. Such preparation was almost an anathema in orthopedics, in which most decisions were made in front of a view box during rounds.

To obtain the required occlusion, precise measurements and adjustments of upper and lower jaw positions were made on dental models mounted on an articulator. In essence, the maxillofacial surgeon had visualized and actually performed planned osteotomies before entering the operating room to perform the operation. This "dress rehearsal" could be applied to solving problems of complicated hand operations. The dental laboratory was one floor up. Alginate, water, suture boxes, and dental stone were plentiful. We began to make alginate molds of congenital hand and upper limb deformities. Models were created by pouring dental stone into a mold. To date, we have accumulated more than 3,000 models of approximately 1,600 hands with every known congenital hand malformation. These models of deformity have become important in planning, outcome measurement, and education. The pre- and postoperative

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*Clinical Professor of Surgery, Harvard Medical School.

†Fellow in Hand and Microsurgery, Division of Plastic Surgery, Department of Surgery, Beth Israel Deaconess Hospital.

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Address correspondence and reprint requests to Dr Upton: Harvard Medical School, 830 Boylston Street, Chestnut Hill, MA 02167; e-mail: jupton3@gmail.com

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replicas of a given hand are more instructive than an isolated patient examination (Fig 1). There have been drawbacks with the process, including *1)* the difficulty in mixing large amounts of alginate in the operating room, *2)* avoiding the mess, *3)* labeling and archiving, and *4)* the display and storage of large numbers of models.

During the 1970s and 1980s, photographs were taken of all radiographs, affected faces and limbs, and associated anomalies. Processing and managing these images was a burdensome process involving slide development and mounting, sorting, labeling, and archiving. Digital imaging has eliminated the boredom and simplified the process. Today, composites of all facial and limb anomalies are part of the patient's intake record (Fig 2). This archive has become indispensable for patient and family education and preoperative planning. The recent publication of *Congenital Hand Anomalies and Associated Syndromes* would not have been possible without this documentation.[2]

The comprehensive immediate and long-term planning for the correction of facial malformations has been mimicked and adapted for the reconstruction of limb anomalies. Careful documentation has enabled the process. For example, we have been able to classify the myriad of problems within the Apert hand, design a protocol, and inform the parents shortly after birth what and when the corrections will be through skeletal maturity. Molds are available to supplement the parents' understanding of what to expect after each correction. With time and growth, many Apert hand deformities will reoccur, because their surgical correction is a dynamic problem and is not complete until these patients have progressed through skeletal maturity (Fig 3). Another common example of the application of planning principles in the craniofacial and hand patient population is the complicated treatment for the various types of radial dysplasias, including thumb hypoplasia and the radial clubbed hand (Figs 4, 5).

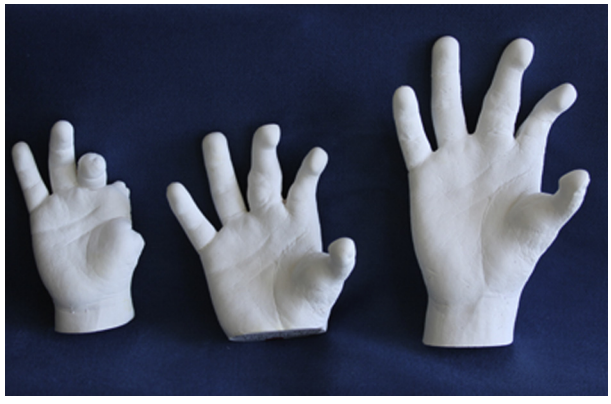

FIGURE 1. Hand molds. A neonatal vascular catastrophe in a patient with a craniofacial malformation resulted in the subtotal loss of the thumb, index, and the distal half of the long digit. The plaster molds show the appearance at 7 years of age after 3 microvascular toe-to-hand transfers (*center*) and the same hand at 14 years after minor soft tissue revisions. Precise details of skin creases and fingerprint patterns are visible.

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Heads

A surgical resident's initial impression of the multidisciplinary craniofacial clinic and conference was of a place where the heads of these children appeared to be quite large, misshapen, and often more conspicuous than their distorted facial features. What relevance did this have to the hand surgeon? The craniofacial clinic and planning sessions were a place to listen and learn. As a hand surgeon, I (J.U.) did not have much to contribute. With regular attendance, however, the distinction between the various types of craniosynostoses and plagiocephaly became meaningful. Management of these skull deformities has been a moving target during the past 40 years, and it became important to understand the various options available or in vogue. The hand specialist often has the opportunity to see and evaluate the syndromic patients first and is often in a position to recognize a deformational plagiocephaly or torticollis, which can be corrected nonoperatively with a helmet and exercises at a very young age. Thirty-five years ago, these problems were undiagnosed and amenable only to surgical correction in later childhood. A second example is a group of small dysmorphic children resembling "house elves" with bilateral hypoplastic thumbs or other types of radial dysplasias. They might have Fanconi pancytopenia syndrome. Early diagnosis by the hand surgeon before the hematologic problems became apparent was quite beneficial to 11 of these patients and their families.[3]

Often in an operating room adjacent to the craniofacial team (Drs Joesph E. Murray, Leonard B. Kaban, John B. Mulliken, and often Paul Tessier), I (J.U.) frequently watched their procedures and was most impressed by their coronal incisions, which provided a panoramic view of the upper two thirds of the face. This approach occasionally became a sanguine affair after injury to the superficial temporal vein in its preauricular location, which often needed to be clamped and tied. As a microsurgeon, I visualized great potential in the pliable layers of the scalp tissue supplied by large axial vessels. After several months in the autopsy room, the temperoparietal fascial flap was born and, with the help of other colleagues, the anatomy was described.[4-7] We were able to transfer this unique tissue as an axial pedicled flap within the