0094–1298/97 $0.00 + .20

SECONDARY MANAGEMENT OF CONGENITAL AND ACQUIRED CRANIOMAXILLOFACIAL DEFORMITIES

Individualized Treatment Planning

Steven R. Cohen, MD, and Fernando D. Burstein, MD

Late treatment of craniofacial disorders with concomitant abnormalities of the jaws are among the most challenging cases a craniofacial surgeon faces. This article details the principles of preoperative, individualized treatment planning, using anthropometric guidelines and a simple, but systematic scheme for facial analysis.[2, 5, 6, 8, 12] Functional assessment of neuro-ophthalmologic status, occlusion, and the temporomandibular joint as well as the patency of the upper airway is mandatory.[10] Unfortunately, traditional treatment planning with well-defined cephalometric treatment objectives, face-bow transfer, double-jaw model surgery on articulated dental molds, and fabrication of intermediate and final occlusal splints has many limitations when applied to complex jaw deformities with co-existent craniofacial abnormalities.[8] Even simulated surgery on three-dimensional CT images, although theoretically appealing, does not yet reproduce the soft-tissue changes seen after the knife falls and the operation begins. In spite of the limitations of standard treatment planning, utilization of a consistent and basic clinical approach as outlined in this report permits the surgeon to develop a flexible, but accurate treatment plan and proceed with confidence in the management of any patient with widespread craniomaxillofacial deformity.

MATERIALS AND METHODS

Seventeen skeletally mature patients without cleft lip and palate or hemifacial microsomia ages 15 to 65 years underwent simultaneous orthognathic and craniofacial surgery for a variety of complex craniofacial disorders (Table 1). Diagnoses included both congenital and acquired craniofacial deformities. Four patients had craniosynostosis; five had posttraumatic facial deformities; and one each had Nager's syndrome, Sturge Weber syndrome, velo-cardio-facial syndrome, juvenile rheumatoid arthritis, untreated right coronal synostosis with facial scoliosis, Noonan's syndrome, and neurofibromatosis. Each of the patients had widespread craniomaxillofacial disorders, requiring simultaneous treatment of orthognathic and craniofacial concerns.

From the Center for Craniofacial Disorders, Scottish Rite Children's Medical Center (SRC, FDB); and the Department of Plastic and Reconstructive Surgery, Emory University School of Medicine (SRC), Atlanta, Georgia

Table 1. CLINICAL DIAGNOSES

Patient	Diagnosis	Age (Years)	OSA
DP	Pfeiffers	15	0
RR	Sturge-Weber	15	0
MC	Velo-cardio-facial	15	0
SH	Right coronal synostosis, facial scoliosis	15	0
EH	Nager's	15	+
AR	Juvenile rheumatoid athritis	14	+
WC	Post-traumatic	16	0
DC	Crouzon's	35	0
FS	Post-traumatic	52	0
PR	Post-traumatic	65	0
MN	Post-traumatic	17	0
BW	Crouzon's	15	0
MS	Noonan's	15	0
NB	Crouzon's	17	0
MM	Post-traumatic	31	0
CC	Down	16	+
JJ	Neurofibromatosis	16	0

OSA = obstructive sleep apnea; 0 = OSA absent; + = OSA present.

Indications for surgery were both functional and aesthetic. Functional problems encountered preoperatively included eye muscle abnormalities in three patients with syndromic craniosynostosis, frontal nerve palsy in the patient with right coronal synostosis, and obstructive sleep apnea in two patients, one with Nager's and the other with juvenile rheumatoid arthritis. A neurosurgeon was consulted on all patients with craniosynostosis and those patients in whom an intracranial/extracranial procedure was planned. All patients were seen and definitively managed by an orthodontist except for two patients with post-traumatic malocclusion in whom dental models indicated that pre-injury occlusal status could be achieved easily with refracture and repositioning techniques.

All patients underwent preoperative cephalograms, panoramic radiographs, and conventional and three-dimensional CT scanning. Formal sleep studies with 12-channel polysomography and airway fluoroscopy were obtained in the two patients with a history of obstructive sleep apnea. Ophthalmology consultation was carried out in those patients with preoperative eye muscle findings and when indicated in patients undergoing simultaneous orbital surgery.

The patient's operative and clinical records were scrutinized, and the frequency and type of intraoperative modifications of preoperative treatment plans were analyzed. Complications were tabulated, and attempt was made to record the incidence of residual deformities.

PREOPERATIVE TREATMENT PLANNING: ANATOMIC ASSESSMENT OF FACIAL AESTHETICS

It is beyond the scope of this article to present an in-depth assessment of facial aesthetics. The reader is referred to a variety of reference sources.[2, 5, 6, 10, 12] In brief, full facial evaluation proceeds from a general assessment of balance among various facial features to an analysis of the specific relationships among the parts.

Frontal Analysis

To avoid missing abnormalities, it is best to divide the face into three different zones—the upper, middle, and lower (Fig. 1). The upper zone extends from the hairline to the eyebrows, the middle from the eyebrows to the subnasale, and the lower from the subnasale to the menton. In the frontal view, critical relationships to note are the arch of the eyebrows, the peak being located above the lateral limbus. The lateral brows are cephalad to the medial aspect, and reversal of this disturbs facial balance, giving the patient a sad appearance.

When examining the middle division from the frontal view, the eyes are checked for symmetry in terms of size and position in the cephalocaudal, medial, and lateral direction. The lateral canthus should be situated no higher than 3 mm and no lower than 1 to 2 mm from a horizontal line drawn through the medial canthi. Caudal displacement of the lateral canthus is seen in Treacher Collins and Nager's syndromes. The normal intercanthal distance is approximately 28 to 32 mm, which is equal to the palpebral fissure length.[2] The nose then is checked. Each nasal unit is examined; for example, the nasal bridge is checked for width and the nasal tip for highlights.

In the lower division, upper lip length is noted. This is usually one half the length of the nose and approximately one half the distance from the stomion to the menton. The oral commissure is examined, any tilt is usually an indication of underlying skeletal asymmetry. The chin is checked for position, symmetry, and shape. The submental area is