Pediatric Facial Nerve Rehabilitation

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KEYWORDS

• Facial paralysis • Facial nerve palsy • Pediatric • Gracilis • Synkinesis • Bell palsy

KEY POINTS

- The main goals of facial reanimation are to restore symmetry, balance, resting tone, and movement to the face, and to decrease hyperfunction from aberrant regeneration.
- Special considerations in the pediatric population include the ability to understand and participate in rehabilitation, small-caliber vessels and nerves, and concerns about long-term outcomes with continued craniofacial growth.
- An individualized treatment plan is developed for each patient. The paralyzed face is assessed and treated by zone.
- Free muscle transfer for smile reanimation in children is safe and has superior results compared with adults. It should be considered as first-line therapy for children with lack of meaningful smile.
- Treatments directed at decreasing synkinesis, including botulinum toxin, physical therapy, and surgery, are critical in the overall treatment of children with facial paralysis.

HISTORICAL PERSPECTIVE

Harii and colleagues[1] first described gracilis free muscle transfer with microvascular anastomosis for facial rehabilitation in 1976. Free muscle transfer has since become the gold standard for dynamic smile restoration in the adult population. The treatment of impaired facial movement in children is less defined. Investigators including Ueda and colleagues,[2] Terzis and colleagues,[3–7] Zuker and colleagues,[8,9] and Hadlock and colleagues[10] have focused specifically on the pediatric population to provide treatment algorithms for children. Advances in facial reanimation over the past 4 decades have given rise to new treatments designed to restore balance and function in pediatric patients with facial paralysis.

INTRODUCTION

Facial palsy in the pediatric population is a rare condition, with an incidence of 21.1 per 100,000 per year for children less than 15 years old.[11] Facial paralysis has variable presentations, ranging from complete hypofunction to hyperfunction and mixed presentations. Injury to the facial nerve can have severe consequences, including physical deformity, ocular complications, nasal valve collapse, inability to express emotion, oral incompetence, and speech difficulty. The treatment of pediatric facial paralysis is especially challenging because of additional psychosocial concerns, the impact of future growth and potential disfigurement, anatomic considerations, and complex parent decision making.

Pediatric facial paralysis is classified as congenital or acquired. Congenital facial paralysis is uncommon and has multiple causes including birth trauma, Moebius syndrome, unilateral lower lip paralysis, hemifacial microsomia, Goldenhar-Gorlin syndrome, CHARGE (Coloboma, Heart defects, Atresia choanae, Retardation of growth and/or development, Genital and/or urinary

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abnormalities, and Ear abnormalities and/or hearing loss) association, Arnold-Chiari malformation, and syringobulbia.[12,13] Physical examination and the presence of synkinesis can help distinguish between traumatic and developmental deficits. Acquired facial paralysis in the pediatric population may be caused by infection, Bell's palsy, neoplasm, or trauma. The most common cause of pediatric facial paralysis is debated in the literature. Although Bell's palsy occurs less frequently in children compared with adults, multiple studies have found that Bell's palsy accounts for most pediatric facial paralysis, occurring in 40% to 50% of cases.[14–17] Other studies have found an identifiable cause in most patients, citing that fewer than 20% of children were diagnosed with Bell's palsy.[18,19] Both Grundfast and colleagues[18] and Evans and colleagues[19] found that infectious causes, most frequently otitis media, and trauma were the most common causes of facial nerve paralysis in children.

TREATMENT GOALS

When facial nerve injury occurs, the primary goal is to reestablish continuity of the facial nerve via direct neurorrhaphy or cable graft. Facial reanimation procedures are performed when reestablishing the nerve is not possible or when reestablishment of the nerve leads to unacceptable results. The main goals of facial reanimation procedures and adjuvant therapies are to restore symmetry, balance, resting tone, and movement to the face, and to decrease hyperfunction from aberrant regeneration. The specific treatment goals vary with each patient.

PREOPERATIVE PLANNING AND PREPARATION

Preoperative planning begins with a thorough history to determine the cause of facial paralysis and the likelihood of spontaneous recovery. Cognitive evaluation is also important in children, because physical therapy and muscle training are often components of facial reanimation. All patients undergo zonal facial assessment, including documentation of resting position and movement on eFACE (**Fig. 1**), photography of 7 standard facial expressions, videography, and spontaneous smile assay. The clinician then develops an individualized treatment plan. If the treatment algorithm includes surgery, medical clearance is required.

There are special considerations in the pediatric population. Although children as young as 2 years old have successfully undergone free tissue transfer for smile restoration,[6] waiting until at least 5 or 6 years of age, around the time the child is school aged and becomes self-aware, is preferred.[6,20] Delaying major procedures until this age provides time for growth of nerves and vessels, whose small caliber may lead to free flap failure, and allows children to be mature enough to understand and participate in their own care. There is a theoretic concern that surgery may disrupt continued craniofacial growth and lead to disfigurement; however, this has not been established in human studies.[6] In addition, some investigators have found poorer results after long-term follow-up of free flaps for facial reanimation,[21] raising the concern that free flaps in childhood might not function adequately into adulthood. Multiple investigators have refuted these results, reporting excellent aesthetic and functional long-term outcomes following free flap smile reanimation.[2,6,20,22,23]

PROCEDURAL APPROACH TO ZONE-BASED FACIAL REANIMATION SURGERY

Ocular Rehabilitation

After facial nerve injury, ocular protection to prevent dryness, corneal abrasion, and irreversible blindness is paramount.[24] In all children with incomplete eye closure, an aggressive eye care regimen, including artificial tears during the day and ophthalmic ointment with eyelid patching at night, should be established immediately.

Static procedures

Ocular reanimation may involve static and/or dynamic techniques. Pediatric patients with lagophthalmos are candidates for static eyelid procedures to passively assist in upper eyelid closure, including eyelid weights or palpebral springs. Platinum weights are preferred in adults and children because of their thinner profile, decreased tendency for capsule formation, and lower rates of extrusion.[25] In cooperative children, the procedure may be performed under local anesthesia. For younger children or those who require multiple procedures for facial reanimation, the eyelid weight is placed under general anesthesia. The supratarsal crease is marked before surgery. The patient is placed in a supine position. An incision is made in the crease, and dissection is performed through the orbicularis oculi to the tarsal plate. The implant is centered between the midpupillary line and the medial limbus and sutured in 3 places to the tarsal plate with 6-0 clear nylon sutures (**Fig. 2**). Eyelid weights can easily be removed during a brief office procedure if facial paralysis resolves.

Lower lid malposition occurs less commonly in the pediatric population. In children with lower lid