Treatment of infants with facial palsy

Douglas H Harrison

A facial palsy developing at birth may be developmental or acquired. The developmental facial palsies are rare but are associated with Möbius's syndrome, hemifacial microsomia, microtia, and weakness of the depressor anguli oris. The acquired palsies mostly result from birth trauma. In a large series in the United States congenital VIIth nerve palsy had the incidence of 2:1 per 1000.1 Obstetric forceps, although used rarely, were found to have accounted for most of these facial palsies. Nevertheless, when forceps were applied, 90% recovered, leaving only 10% that did not resolve.

In our series of 52 children with established facial palsy, 14% of mothers gave a history of obstetric difficulties in respect of use of forceps, large birth weight, or prolonged labour. A similar number of the obstetric population experienced these problems in delivery without complication.

It is the treatment of permanent unilateral facial palsy that I will consider in this article.

At birth the weakness of the hemiface becomes evident on crying with inability to close the eye and the angle of the mouth pulling towards the unaffected side. Considerable parental distress is engendered and a scapegoat sought. Clearly a great deal of parental support should be provided with the reassurance that most of these palsies settle spontaneously within a few months but if it is one of the rarer cases of permanent palsy, surgical treatment can be provided.

Eye

Inability to close the eye clearly should never be taken lightly as there is concern with regard to exposure keratitis and development of an opaque cornea. In an adult with facial palsy these dangers are real and means of providing moisture to the cornea, such as creams, closing the eyelids with sticky tape, lateral tarsorrhaphies and the insertion of a gold weight into the upper eyelid, are essential. Strangely, the child born with or developing a facial palsy early in life rarely requires such treatment. Epiphora may not be present in normal circumstances but can develop in windy weather. Enhancing eye closure by the insertion of a gold weight is not often required and the child finds the lagophthalmos, which can develop even with the lightest weights, either irritating or aesthetically displeasing. Long-standing congenital facial palsy does tend to produce a rather atrophic lower eyelid which may pull down with scleral show and therefore asymmetry between the two sides. Correction is best achieved with a palmaris sling inserted between the fixed points of the medial canthal ligament and the supraorbital margin laterally.

Face

It is the immobility of the lower face and the inability to reflect emotion without distortion that causes the greatest concern to both child and parent. The constant worry expressed by the parents is that at school between the ages of 6 and 13. The ridicule can take quite an unpleasant nature, making the child introspective and very reluctant to attend school. Because the act of smiling produces distortion the child compensates by becoming reluctant to smile at all and if caught unawares, will either cover the paralysed side with a hand or tip the head down in order to conceal it. In the unilateral facial palsy, some recovery may well occur, probably by muscular neurotisation across the orbicularis, sometimes even as far as the zygomaticus. For example, raising the eyebrow on the non-paralysed side can produce a smile on the paralysed side. In cases where muscular neurotisation has occurred, on request the child can produce a smile. Unfortunately not many manage to convert this to emotional use and when laughter is uninhibited the control is lost and the face swings across to the unparalysed side.

The aetiology of permanent facial palsy remains obscure. Dissections of the facial nerve in the past have suggested small size but this has not been our experience and indeed standard light microscopy and indeed electron microscopy of the facial nerve appear to show little histopathological difference between the paralysed and the unparalysed side. The muscles of the face may be congenitally absent but similarly if they have no functioning neurological stimulus they will atrophy. Further studies on this condition are required.

The facial nerve mediates the emotion of smiling, and for the reconstructive surgeon he must use what he knows is functioning; in this circumstance, it is the facial nerve on the contralateral side. Muscle transfers of the Vth cranial nerve will produce movement of the angle of the mouth but not to humour without positive cortical control.
Historical perspective

Fascial slings in children are largely contra-indicated as their static position is usually acceptable. Crossed facial nerve grafts, as advocated by Anderl,2 have a place in the acquired facial palsy where the proximal end of the nerve may have been divided but in congenital cases muscular atrophy is probable and therefore the crossed facial nerve graft would be insufficient. The transfer of a free muscle was largely unsatisfactory3 until the advent of microvascular surgery. Even so, experimental work employing microneurovascular transfers of the rectus femoris muscle of rabbits has yielded maximal tetanic tensions of up to 55% of normal.4,5 These studies expose the considerable loss of muscle power that must be expected when a muscle is transferred and relate to not only division of the pedicle but also the change in the muscle tendon length. Early work in the human transfer of the extensor digitorum brevis of the foot, a muscle with a relatively short excursion and small volume, yielded the occasional excellent result but in a series, was relatively disappointing.6

The gracilis muscle transfers originally championed by Harii et al7 and then refined by O’Brien et al,8 have become, and still are, popular having the advantages of ease of access and large vessels in the neurovascular bundle. The disadvantages, however, are the muscle’s excessive length and bulk, which necessitates trimming, and very unidirectional muscle fibres.

In 1980 we therefore looked for a muscle with a more triangular shape such that it would provide elevation to the upper lip and depression to the lower, thus exposing the teeth on smiling.9 The muscle on removal should cause minimal functional disability and we therefore turned to the pectoralis minor transfer.

Procedure (fig 1)
The pectoralis minor muscle transfer is divided into two stages. In the first stage, functioning VIIth nerve motor fibres are introduced into the paralysed side of the face by extending the buccal branch of the VIIth nerve on the unparalysed side. Via a preauricular incision on the unparalysed side, the buccal branch is found at the level of the parotid duct. Electrostimulation of this nerve will confirm its action. Division of the branch has not produced a demonstrable weakness. A 20 cm sural nerve graft is harvested from the leg, inserted across the face via an incision in the nasal vestibule and the distal end fixed to the pre-auricular region in the paralysed side. The nerve graft is then sutured to the buccal branch of the facial under magnification.

Six months is permitted to elapse before the second stage. The Tinel can be percussed as it travels across the nerve graft to its termination in the preauricular region. A parotidectomy incision is then employed on the paralysed side and the distal end of the sural nerve graft found and dissected out. The facial artery and vein are similarly prepared for a suitable length. The pectoralis minor muscle is harvested from the chest. It originates from the third, fourth, and fifth ribs and inserts via a flat tendon into the coracoid process of the scapula. Its vascular supply usually comes directly from the axillary artery or from a branch of the acromiothoracic, and venous drainage is directly into the axillary vein. The medial and lateral pectoral arteries from their respective cords of the brachial plexus penetrate the pectoralis minor before entering the major. After removal of the muscle from the chest, it is inserted into the paralysed side of the face in such a way that the insertion is distributed around the mouth and the nasal base and the origin is fixed to the temporalis fascia, preauricular region and into the sternomastoid fascia. The muscle is then revascularised on the facial artery and vein using microvascular techniques and the distal end of the sural nerve graft is inserted into the medial and lateral pectoral nerves. Post-operatively the circulation in the muscle is monitored by impedance plethysmography employing a flat array of four wires. A wave pattern is produced on an oscilloscope, the loss of which may indicate re-exploration and reassessment of the vascular supply.

Movement in the muscle graft should not be expected under six months, although in very young children this has been seen at three months. The face is commonly swollen on the involved side for two to three months before it spontaneously involutes.

Surgery for congenital facial palsies is usually commenced at the age of 5 years as in my view the child is sufficiently mature to understand the reasons for the surgery and the various discomforts.

Results
Assessment of the results of this type of surgery is inevitably rather inaccurate and liable to bias. However energetically one tries to be scientific in compiling the results, it in the end depends on the degree of movement, symmetry, and response to emotion. Over complex measurements tend merely to confuse (figs 2–4).

Clinically we have graded the results according to ++++. A 0 relates to no movement...
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Figure 2 A 12 year old boy showing congenital facial palsy preoperatively.

whatsoever; +++ relates to good movement on smiling both with the lips open and lips closed, a symmetrical static position and good response to emotion; ++ relates to good movement of the angle of the mouth on smiling but poor exposure of the teeth; and + relates to movement, perhaps with poor static position and asymmetry on smiling.

Electromyographic studies were carried out early on in the study but we were hoping to see a trend towards increase in speed of conduction across the nerve graft with the proceeding myelination and perhaps increased amplitude in the muscle relating to strength, but in fact these trends were not really forthcoming.

Of the 52 cases who were born with congenital facial palsies 47 were completed: 37 were graded +++ (80%), seven ++ (14%), three + (6%), and none failed. Compared with the older age group of acoustic neuromas and temporal bone fractures, making a total of 110, there is no doubt that the children do particularly well.

Discussion

The pectoralis minor muscle has proved relatively easy to transfer in that although the blood vessels have a small diameter, they are comparable with the distal end of the facial artery and vein. Suitable magnification, fine instrumentation and excellent needles, make small vessel anastomosis entirely possible. The muscle itself is triangular in shape such that on contraction it raises the upper lip and depresses the lower. The scars in the axilla, face, and legs are relatively inconspicuous and power loss does not appear to occur in the shoulder.

The first operation takes approximately two hours to perform and requires 48 hours’ hospitalisation. The second operation six months later usually takes four to six hours and requires hospitalisation of three to four days. The timing of the operation should not be less than six months but we have carried out one of these cases nine years after the insertion of the nerve graft with a satisfactory outcome.

The insertion of the muscle is carried out under no tension and indeed we have found one of the complications of this surgery is that although the result may be excellent at six months after the second operation, sometimes the muscle tends to tighten up. It is, however, not the muscle itself but rather the scar tissue present around the muscle which contracts. Trying to free this scar contracture is usually rather ineffective and VY advancement of the angle of the mouth is more valuable. If the surgery is carried out within the first decade of life the results are usually outstanding, probably because of good axonal passage across the nerve graft and secondly across the second nerve repair into the neuromuscular graft.

There are obviously limitations to trying to replace the eight muscles of facial expression with one large muscle. For example, it is not always easy to emulate the buccinator muscle such that if the muscle is placed a little too superficially, then on smiling there is excess mucosa covering the teeth and if placed too deeply the lips appear unnaturally thin compared with the contralateral side. The facial nerve activates the orbicularis to purse the lips and also elevates the angle of the mouth. The muscle graft procedure is not that subtle and in consequence on trying to purse the lips, the muscle tends to pull up on the reconstructed side. These limitations are usually cheerfully accepted by the patients as they are much
happier to produce a smile in response to emotion.

The Möbius’ syndrome constitutes a bilateral facial palsy and is therefore very much more difficult to correct. It is not possible to use the facial nerve to power a muscle graft as it is non-functional. Transfers therefore powered by the Vth or the XIIth cranial nerve are usually employed. The temporalis muscle can be turned down and suitably lengthened to attach to the angle of the mouth. In consequence, on clenching the teeth, there is movement of the angle of the mouth in an outward and upward direction and these patients do adapt quite well to this transfer.

The temporalis transfer produces a relatively small excursion of the angle of the mouth and hollowing of the temporal area. A rather more sophisticated operation has been pioneered in Canada in which half the hypoglossal nerve on each side is extended via a nerve graft and six months later a free vascularised muscle graft is inserted into each side of the face and reinnervated by these nerve grafts.10 Weakness of the depressor anguli oris (asymmetric crying facies) can be corrected by transferring the anterior belly of the digastric muscle as a neurovascular unit to the involved lower lip.11

In conclusion, a facial palsy, whether unilateral or bilateral, should never be underestimated by the observer. It causes deep distress and embarrassment to the sufferer and severely inhibits their social interaction. Man is the only member of the animal kingdom who uses the subleties of facial expression to enhance communication and express emotion. The foregoing operative procedures offer a smile responsive to emotion which is the primary request. The fact that function is achieved is surprising and a particular kindness that it works so well in children.

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