Soft Tissue Correction of Craniofacial Microsomia and Progressive Hemifacial Atrophy

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Background: Moderate to severe soft tissue deficits can exist with craniofacial microsomia or progressive hemifacial atrophy. The authors reviewed the surgical correction of these defects, including serial autologous fat grafting and parascapular free tissue transfer.
Methods: Recently treated patients at the Institute of Reconstructive Plastic Surgery at NYU Medical Center were identified. Patients with microvascular free flap underwent reconstruction with parascapular flaps. These flaps have been modified from previously reported inframammary extended circumflex scapular flaps. Demographic information, operative interventions, complications, and outcomes were reviewed and analyzed. The clinical outcomes of these patients were compared with previously reported patients who underwent serial autologous fat grafting.
Results: Five patients were recently treated with 7 parascapular flaps. The mean age of the patients at the time of parascapular flap reconstruction was 13.1 years. These were compared to those previously reported who have undergone serial autologous fat grafting. The mean number of procedures was less for the free tissue transfer cohort. There were no microvascular complications because all free flaps survived. One patient had wound dehiscence of the donor site managed with local wound care and healing by secondary intention.
Conclusions: For patients undergoing multiple-stage reconstruction of craniofacial microsomia, serial fat grafting is a useful tool for soft tissue reconstruction. Alternatively, in those patients with isolated soft tissue hypoplasia, such as progressive hemifacial atrophy, microvascular free tissue transfer is a safe and efficient option.

Key Words: Soft tissue correction, progressive hemifacial atrophy, craniofacial microsomia, hypoplasia

(*J Craniofac Surg* 2012;23: 2024–2027)

Craniofacial microsomia and progressive hemifacial atrophy are known to affect the soft tissues of the face.[1–3] Soft tissue hypoplasia of the involved region is multidimensional, with the skin, subcutaneous tissue of the cheek region, muscles of mastication, and parotid gland showing varying degrees of deficiency. Serial examinations and retrospective reviews of untreated patients demonstrate that there is little growth on the affected side.[4–6]

Microsurgical free tissue transfer has been offered as a treatment strategy to restore facial contour in craniofacial microsomia and progressive hemifacial atrophy patients.[7–16] Parascapular flaps have shown success in soft tissue correction in as little as 1 or 2 stages. A variation of the parascapular flap, the inframammary extended circumflex scapular (IMECS) flap, has provided good results.[7,8]

Serial autologous fat grafting has also shown promise for soft tissue correction in patients with craniofacial microsomia and progressive hemifacial atrophy.[1] It is a relatively low-risk procedure that can often be concomitantly performed with other procedures. Staged operative interventions for mandibular distraction, ear reconstruction, and orthognathic surgery provide many opportunities for serial fat transfer.[1]

This report highlights the surgical correction of soft tissue hypoplasia in patients with craniofacial microsomia and progressive hemifacial atrophy. It reviews microsurgical and nonmicrosurgical methods of correction, including serial autologous fat grafting and microvascular free flaps (MVFFs).

METHODS

Patients with craniofacial microsomia or progressive hemifacial atrophy treated at the Institute of Reconstructive Plastic Surgery at New York University were identified. From these patients, those with moderate to severe soft tissue hypoplasia corrected by MVFF were selected. The study period extended from 2008 to 2011 and represented the most recently treated patients at the Institute of Reconstructive Plastic Surgery.

Demographic characteristics were noted for each patient. Sex, age, severity of deformity, number of procedures, indications, and operative times for all interventions were recorded. Complications and any adverse events were also identified. Each patient was assessed preoperatively, postoperatively, and during follow-up by the multidisciplinary craniofacial team. Excluded from the study were patients with incomplete records (examinations, photographs, or documentation) and inadequate follow-up.

The clinical outcomes of these patients were compared with previously reported patients who had serial autologous fat grafting.[1] Unlike the previous report, which compared those patients to those

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Received April 15, 2012.
Accepted for publication April 28, 2012.
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The authors report no conflicts of interest.

ISSN: 1049-2275
DOI: 10.1097/SCS.0b013e31825d0594

FIGURE 1. A 15-year-old adolescent boy with right-sided craniofacial microsomia presented for soft tissue correction of soft tissue hypoplasia on the right side of his face.

FIGURE 2. Intraoperative markings demonstrating areas of soft tissue hypoplasia requiring surgical correction have been marked before surgery.

who underwent an IMECS, this study highlights those who have had a traditional parascapular flap.

Operative Technique

Microvascular Free Flap Reconstruction

Preoperatively, in the upright position, areas of soft tissue hypoplasia are marked (Figs. 1 and 2). The patient is placed in a lateral decubitus position with the flap side up (Fig. 3). A pencil Doppler is used to find a perforator over the triangular space. An ellipse is drawn around this point (Fig. 3). Depending on pedicle length, the flap can be placed centrally or eccentrically over the Doppler signal. The arm is prepared in the operative field so that full range of motion can occur and assist during proximal pedicle dissection. All patients undergo general anesthesia. The areas of skin incision are infiltrated with 1% xylocaine with 1:100,000 epinephrine.

All the skin incisions are made, and dissection is beveled away to recruit additional subcutaneous tissue. The dissection is carried down to the fascia. After an island of skin and subcutaneous tissue is created, the flap is elevated from inferior to superior. Dissection can be in a subfascial or suprafascial plane, as long as the teres major muscle is identified. The vascular pedicle appears immediately superior to the superior border of this muscle.

Once the source vessels are identified, flap elevation can proceed from superior to inferior. With this dissection, the teres minor muscle is exposed, and the vessel is observed at the inferior border of this muscle. At the point, the flap is an island of tissue, sandwiched between the teres minor and major muscles. Retraction of these muscles will allow for visualization of the vascular pedicle (Fig. 4).

With appropriate retraction and mobility of the ipsilateral arm, dissection of the circumflex scapular artery is carried proximally through the triangular space (Fig. 5). Several muscular branches and one to the lateral scapular bone will need to be identified and ligated. The flap can be deepithelialized in situ and harvested once the recipient site is prepared (Fig. 6). The flaps are designed so

FIGURE 3. The patient is placed in a lateral decubitus position with the flap side up.

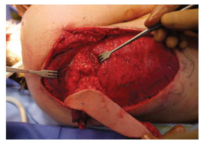

FIGURE 4. Retraction of the teres minor and major muscles will allow for visualization of the vascular pedicle.

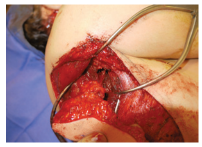

FIGURE 5. Dissection of the circumflex scapular artery is carried out proximally through the triangular space.

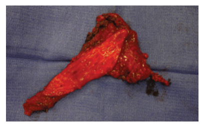

FIGURE 6. The deepithelialized side of the flap.

FIGURE 7. The superficial temporal artery is dissected, and the facial vein is exposed because the superficial vein is inadequate for microvascular anastomosis.

FIGURE 8. The deepithelialized flap is inset, and the flap will be oriented to fill in the soft tissue defects as marked before surgery.

FIGURE 9. The skin is closed similar to a rhytidectomy.

that primary closure is possible after harvest. Donor-site closure is performed in layers over a closed suction drain.

The recipient site can be prepared concomitant with flap harvest. A preauricular rhytidectomy incision is performed. A subcutaneous pocket is created, which extends just beyond the preoperative markings. Superficial temporal vessels were exposed and prepared. In the event that the superficial temporal vein and/or artery are not suitable recipient vessels, the facial vessels can be used and rotated superiorly (Fig. 7). Microvascular anastomosis is performed with an implantable Doppler for postoperative monitoring. The deepithelialized flap is inset (Fig. 8). The flap's pedicle and deep surface are oriented away from the skin. Suture fixation of the flap's fascia is performed to multiple sites. Bolsters were placed from the flap through the skin to ensure that the flap was properly positioned in the pocket (Fig. 9). The skin is closed similar to a rhytidectomy. Patients were typically discharged on day 5, and soft tissue bolsters were removed in the office at 10 days (Fig. 10).

Autologous Serial Fat Grafting

The specific details of our fat harvest, preparation, and grafting are those of Dr Kawamoto and documented in a previous article.[1] The methodology is very similar to that described by Coleman,[17] with nontraumatic harvest, centrifugation, and meticulous implantation. Fat was typically harvested from the abdomen or flank. If not enough fat could be obtained from these depots, as in some of our young patients, then others sites including the medial thigh and buttock were used. Fat was harvested using manual suction to a 10-mL syringe with a 3-mm blunt cannula. The aspirated fat was centrifuged for 3 minutes at 3000 rpm. After the supernatant was discarded, fat was transferred into 1-mL syringes and immediately injected into the affected regions of the face. No growth factors were added. Exposure to room air was avoided as much as possible by minimizing the time between harvest and injection. Multiple access sites and a "fanning-out" technique were used to transfer small aliquots of fat into various depths of the soft tissue.

RESULTS

Five patients were identified for inclusion in this study. Seven flaps (n = 7) were performed in these 5 patients because 2 patients required bilateral reconstructions. All patients had moderate to severe soft tissue hypoplasia secondary to progressive hemifacial atrophy or craniofacial microsomia. The mean age of the patient at the time of parascapular flap reconstruction was 13.1 years. All patients required only 1 revision surgery (flap contouring) after the parascapular flap(s). The mean number of surgical interventions was

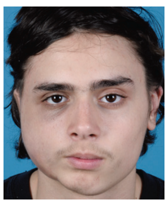

FIGURE 10. The patient is shown only 2 weeks after surgery, as swelling is evident.

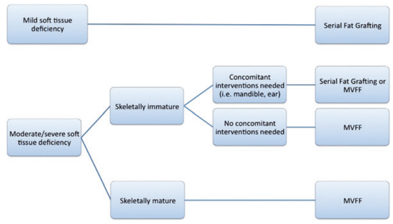

FIGURE 11. Treatment algorithm for surgical correction of soft tissue hypoplasia.

1 per patient or 1.7 per flap. Therefore, unilateral soft tissue corrections were completed in 2 stages, whereas bilateral reconstructions finished in 3 stages.

Microvascular anastomosis was performed in the superficial temporal or facial vessels in all cases. There were no microvascular complications because all free flaps survived. There were no cases of partial flap loss, fat necrosis, infection, or hematoma. One patient had wound dehiscence of the donor site managed with local wound care and healing by secondary intention.

These cases were compared with our previously reported cohort of patients who underwent serial autologous fat grafting (n = 21).[1] In this study, the mean (SD) number of autologous fat grafting procedures performed was 4.3 (1.0).

DISCUSSION

Moderate to severe soft tissue deficits can occur in patients with craniofacial microsomia and progressive hemifacial atrophy. The hypoplasia of the involved region can involve various tissues and locations, including the skin, subcutaneous tissue of the cheek region, muscles of mastication, and parotid gland showing varying degrees of deficiency. Options for soft tissue correction include serial autologous fat grafting and microvascular free tissue transfer.

Serial autologous fat grafting is a relatively low-risk procedure that can often be concomitantly performed with other procedures. The variable survival rate of fat is the most concerning issue with this modality of treatment. Otherwise, the risk profile is limited, with isolated reports of complications secondary to fat emboli.

Microsurgical free tissue transfer is another great option to restore facial contour in patients with craniofacial microsomia and progressive hemifacial atrophy.[7,8] As this report highlights, parascapular flaps can many times correct soft tissue deficiency in fewer stages than those required for serial fat grafting. The aesthetic outcome of the donor site is good because the final scar is a linear one after primary closure. The relative disadvantage is that the procedure requires a higher level of skill because microsurgical techniques are used.

Soft tissue correction is possible with either parascapular free flaps or serial fat transfer. However, our experience suggests that patients with isolated soft tissue hypoplasia may benefit from microvascular free tissue transfer. In those with progressive hemifacial atrophy, soft tissue correction can be completed in as few as 1 or 2 operative settings. Alternatively, for patients undergoing multiple staged reconstructions for craniofacial microsomia, serial fat grafting may be considered a useful tool for soft tissue correction. Unlike progressive hemifacial atrophy, craniofacial microsomia represents a wider spectrum of bony and soft tissue hypoplasia. These patients often present with varying degrees of microtia, mandibular hypoplasia, and macrostomia. To correct these deformities, patients often require multiple operations. These are performed at various time points, beginning as early as the neonatal period and extending into adulthood. Staged operative interventions for mandibular distraction, ear reconstruction, and orthognathic surgery provide many opportunities for fat transfer. This presents a unique opportunity for early soft tissue reconstruction with serial autologous fat grafting. Figure 11 summarizes the authors' treatment algorithm.

REFERENCES

1. Tanna N, Wan DC, Kawamoto HK, et al. Craniofacial microsomia soft-tissue reconstruction comparison: inframammary extended circumflex scapular flap versus serial fat grafting. *Plast Reconstr Surg* 2011;127:802–811
2. Bradley JP, Hurwitz DJ, Carstens MH. Embryology, classification, and descriptions of craniofacial clefts. In: Mathes SJ, ed. *Plastic Surgery.* 2nd ed. Pennsylvania, PA: Elsevier, 2006:15–43. *Pediatric Plastic Surgery.* Vol. 4
3. Gorlin R, Cohen M, Levin L. *Syndromes of the Head and Neck.* 3rd ed. New York, NY: Oxford University Press, 1990:649–652
4. Murray JE, Kaban LB, Mulliken JB. Analysis and treatment of hemifacial microsomia. *Plast Reconstr Surg* 1984;74:186
5. Mulliken JB, Kaban LB. Analysis and treatment of hemifacial microsomia in childhood. *Clin Plast Surg* 1987;14:91
6. Kaban LB, Moses ML, Mulliken JB. Surgical correction of hemifacial microsomia in the growing child. *Plast Reconstr Surg* 1988;82:9
7. Siebert JW, Anson G, Longaker MT. Microsurgical correction of facial asymmetry in 60 consecutive cases. *Plast Reconstr Surg* 1996;97:354
8. Siebert J, Longaker M, Angrigiani C. The inframammary extended circumflex scapular flap: an aesthetic improvement of the parascapular flap. *Plast Reconstr Surg* 1997;99:70
9. Longaker MT, Siebert JW. Microvascular free-flap correction of severe hemifacial atrophy. *Plast Reconstr Surg* 1995;96:800
10. Longaker M, Siebert J. Microsurgical correction of facial contour in congenital craniofacial malformations: the marriage of hard and soft tissue. *Plast Reconstr Surg* 1996;98:942
11. Shintomi Y, Ohura T, Honda K, et al. The reconstruction of progressive facial hemi-atrophy by free vascularized dermis-fat flaps. *Br J Plast Surg* 1981;34:398
12. Inigo F, Jimenez-Murat Y, Arroyo O, et al. Restoration of facial contour in Romberg's disease and hemifacial microsomia: experience with 118 cases. *Microsurgery* 2000;20:167
13. Govila A, Chhajer PK. Extracorporeal fascia-fat flap for restoration of facial contour in progressive hemifacial atrophy. *Br J Plast Surg* 1994;47:54
14. Williams HB, Crepeau RJ. Free dermal fat flaps to the face. *Ann Plast Surg* 1979;3:1
15. Koshima I. Short pedicle superficial inferior epigastric artery adiposal flap: new anatomical findings and the use of this flap for reconstruction of facial contour. *Plast Reconstr Surg* 2005;116:1091
16. Naugh M, Fenn C, Kay S. The use of free groin flaps in children. *Plast Reconstr Surg* 2004;113:1161
17. Coleman SR. Facial recontouring with lipostructure. *Clin Plast Surg* 1997;24:347