Craniofacial Microsomia Soft-Tissue Reconstruction Comparison: Inframammary Extended Circumflex Scapular Flap versus Serial Fat Grafting

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Background: The authors investigated the use of serial autologous fat grafting to restore soft-tissue contour in craniofacial microsomia patients.

Methods: Patients with moderate to severe craniofacial microsomia were divided into two groups. Microvascular free flap patients had reconstruction with inframammary extended circumflex scapular flaps at skeletal maturity ($n = 10$). Alternatively, patients had fat grafting during multiple staged operations for mandible and ear reconstruction ($n = 21$). Sex, age, severity of deformity [determined by OMENS (orbital deformity, mandibular hypoplasia, ear deformity, nerve involvement, and soft-tissue deficiency) classification], number of procedures, operative times, and augmentation volumes were recorded. A digital three-dimensional photogrammetry system was used to determine "final fat take" and symmetry (affected side versus unaffected side). Physician and patient satisfaction were elicited.

Results: Microvascular free flap and fat grafting groups had similar OMENS scores, 2.4 and 2.3, and similar mean prereconstruction symmetry scores, 74 percent and 75 percent, respectively. Although the mean number of procedures was less for the microvascular free flap group versus the fat grafting group (2.2 versus 4.3), the combined surgical time was greater for the microvascular free flap group. The complication rate for the microvascular free flap group was 12 percent and that for the fat grafting group was 5 percent. The mean microvascular free flap volume implanted was 131 cc, with a final measured volume of 106 cc. Mean fat grafting volume injected per case was 33 cc, with total fat injections of 146 cc and a final measured volume of 121 cc. There was a mean fat loss of 25 cc and 83 percent fat take. Symmetry score was 121 percent for the microvascular free flap group and 99 percent for the fat grafting group. No statistically significant difference in patient or physician satisfaction was noted.

Conclusion: Serial fat grafting provided a useful alternative to microvascular free tissue transfer after skeletal reconstruction. (*Plast. Reconstr. Surg.* 127: 802, 2011.)

Craniofacial microsomia, or otomandibular dysostosis, is a spectrum of soft- and hard-tissue hypoplasia typically affecting the regions of Tessier no. 6, 7, and 8 facial clefts on one side.[1,2] Serial examinations and retrospective reviews of untreated patients demonstrate that there is little growth on the affected side.[3–5] Given the widespread spectrum of facial deformities, these patients often require multiple operations to address the hard- and soft-tissue defects (Table 1).

The bony hypoplasia is corrected surgically at various time points and has been shown to improve secondary deformity and enhance body image development.[5] For the treatment of mandibular hypoplasia, distraction has become the

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Table 1. Potential Staged Corrective Procedures for Patients with Craniofacial Microsomia during Childhood*

Early childhood
Macrostomia correction
Removal of preauricular skin tag
Repair of cleft lip/palate (if present)
Mandibular distraction osteogenesis for tracheal decannulation or delayed onset/recurrent OSA
Orthodontic procedures
Late childhood
Mandibular distraction osteogenesis for Pruzansky type IIA to IIB (distraction device placement and removal)
Rib graft for Pruzansky type III
Staged microtia repair (framework fabrication, elevation, canal reconstruction)
Orthodontic procedures
Adolescence/adulthood
Double-jaw surgery (Le Fort I osteotomy and bilateral sagittal split osteotomy) for malocclusion
Osseous genioplasty
Orbital box osteotomy/facial bipartition

OSA, obstructive sleep apnea.
*Potential staged corrective procedures for patients with craniofacial microsomia during childhood present multiple opportunities for serial autologous fat grafting. Procedures may vary depending on the involvement and severity of the deformity.

mainstay of treatment in the growing patient, and orthognathic advancement is used in the skeletally mature patient.[6–8] However, these modalities rarely correct the soft-tissue contour deformity.[9–11]

With craniofacial microsomia, the soft-tissue cover of the involved region is deficient. It is multidimensional, with the skin, subcutaneous tissue of the cheek region, muscles of mastication, and parotid gland showing varying degrees of hypoplasia. Microsurgical free tissue transfer has been offered as a treatment strategy to restore facial contour in craniofacial microsomia patients.[12–21] A variation of the parascapular flap, the inframammary extended circumflex scapular flap, has proved to give good results.[12,13] Free flap reconstruction is not, however, without morbidity or risk. In addition, patient satisfaction and aesthetic outcome is not always optimal.[17]

Many authors advocate that management of soft-tissue hypoplasia can be undertaken only after the underlying facial skeleton has been addressed.[12–15] After skeletal correction, microsurgical free-tissue transfer of soft tissue may be used as a "finishing touch."[15] This paradigm is likened to laying the foundation of a house before construction of the walls and roof. The authors present a different model for consideration of soft-tissue reconstruction.

As many patients with moderate or severe deformity require multiple operations, serial autologous fat grafting can be concomitantly performed simultaneously at the time of many of these procedures. Staged operative interventions for mandibular distraction, ear reconstruction, and orthognathic surgery provide many opportunities for serial fat transfer (Table 1). Instead of undertaking soft-tissue reconstruction after skeletal correction, small gains in improving facial contour can be made earlier. To study this alternative soft-tissue treatment strategy, we performed volumetric outcome comparison of patients who underwent serial autologous fat grafting and/or microvascular free flap surgery.

PATIENTS AND METHODS

Craniofacial microsomia patients who underwent soft-tissue reconstruction with serial autologous fat grafting or free flap reconstruction with an inframammary extended circumflex scapular flap at the University of California, Los Angeles were included in this study ($n = 31$). Children included in the study were diagnosed by our multidisciplinary craniofacial team between 1990 and 2009. With institutional review board approval, the charts and records of all these patients were reviewed. Excluded from the study were patients with incomplete records (examinations, photographs, or documentation) and inadequate follow-up. All patients had at least 1-year follow-up. Sex, age, severity of deformity [as determined by the OMENS (orbital asymmetry, mandibular hypoplasia, ear deformity, nerve involvement, and soft-tissue deficiency) classification], number of procedures, indications, and operative times for all interventions were recorded.[22] Each patient was assessed preoperatively, postoperatively, and in follow-up by the University of California, Los Angeles multidisciplinary craniofacial team.

Operative Technique

All operations were carried out under general anesthesia. Before incision, intravenous Ancef (GlaxoSmithKline, Research Triangle Park, N.C.) was administered.

Group 1: Microvascular Free Flap

For patients who underwent microvascular free flap surgery, an inframammary extended circumflex scapular flap or modified parascapular flap was performed as described by Siebert et al.[13] Soft-tissue deficiency was marked preoperatively with the patient in the upright position. The patient was placed in lateral oblique position and the flap was designed on a longitudinal axis of rotation, designed curvilinearly from the ipsilateral inframammary fold to the origin of the circumflex scapular artery. The degree of facial deformity guided the width of the flap and inclusion of fascial extensions of the dorsal thoracic fascia. Flap width varied from 4 to 10 cm. Flaps were contoured grossly after harvest, but final sculpting was performed after inset into the deficient soft-tissue bed. The donor site was closed in layers over a drain.

A limited preauricular rhytidectomy incision was performed and a subcutaneous pocket was made to just beyond the preoperative markings. Superficial temporal vessels were exposed and prepared. The flap's pedicle and deep surface were oriented away from the skin. Permanent suture fixation of the flap's fascia was performed to multiple sites around the infraorbital rim and zygoma periosteum. Soft-tissue bolsters were placed from the flap through the skin to ensure that the flap was positioned properly in the pocket. Skin was closed over a drain. Routine postoperative flap monitoring was performed by serial Doppler and clinical examination. Patients were typically discharged on day 5 and soft-tissue bolsters were removed in the office at 10 days.

Group 2: Serial Fat Grafting

The specific details of our fat harvest, preparation, and grafting are documented in a previous article.[23] The methodology used at our institution is very similar to that described by Coleman.[24] Fat was typically harvested from the abdomen or flank. If a sufficient amount of fat could not be obtained from these depots, as in some of our young patients, other sites including the medial thigh and buttock were used. After fat was harvested using manual suction with a 10-cc syringe and a 3-mm blunt cannula, the aspirated fat was centrifuged for 3 minutes at 3000 rpm. After the supernatant was removed, fat was transferred into 1-cc syringes and injected immediately into the affected regions of the face. Multiple access sites and a "fanning-out" technique were used to transfer small aliquots of fat into various depths of the soft tissue.

Outcome Analysis

The number of soft-tissue reconstruction procedures performed for patients undergoing serial fat grafting was compared with that for patients undergoing microvascular free flap surgery. These included any flap revisions. For serial fat grafting, the amount of fat injected (in cubic centimeters) was recorded for each procedure. In addition, the mean for all procedures and the final volume were calculated. For the microvascular free flap group, the volume of fat/fascia grafted based on water displacement in the operating room was recorded. During revision surgery, the volume of fat removed was recorded so that the final volume could be determined. All complications or adverse events for each group of patients were noted. The operating surgeon documented perioperative complications, including but not limited to wound dehiscence, bleeding, infection, hypertrophic scarring, contour irregularities, flap failure, and donor-site complications.

In both groups of patients, volume determinations were made with a digital three-dimensional photogrammetry system (MU-4 imaging system; 3dMD, Atlanta, Ga.). This high-resolution, digital, three-dimensional photography system has been used by our institution and other authors for reliable volumetric analysis.[25–29] The distance from the patient to the camera was consistent and standardized throughout the duration of the study. We cross-referenced two methods of volumetric analysis: (1) radial region and (2) surface landmarks. Three independent users selected the center of the radius or surface landmarks and recorded volumetric measurements based on the system software.

Volumetric augmentation was noted for each patient by comparing the preoperative, postoperative (6 weeks), and follow-up (1 year) reconstruction volumes of the affected side. Fat take was considered the difference between postoperative volume and preoperative volume. Final fat take was considered the fat preservation at 1 year or the difference between the follow-up volume and preoperative volume. Fat loss over time was the fat take minus the final fat take.

Volume symmetry was evaluated by comparing the affected side to the unaffected side. Each independent evaluator attempted to match radial and landmark surface points between the sides. Symmetry score was determined both preoperatively and at follow-up and calculated as follows: symmetry percent = (affected side volume/contralateral unaffected side volume) $\times$ 100.

To assess satisfaction, physician and patient surveys were used that have been validated for intrarater and interrater reliability in previous studies.[6] Physician satisfaction with the outcome based on symmetry, volume, and overall appearance was recorded in both the perioperative and follow-up periods using a five-point scale (0, dissatisfied or no improvement; 1, only partially satisfied or 25 percent improvement; 2, half satisfied or 50 percent improvement; 3, mostly satisfied or 75 percent improvement; and 4, totally satisfied or 100 percent improvement). A patient satisfaction assessment (0, dissatisfied or no improvement; 1, only partially satisfied or 25 percent improvement; 2, half satisfied or 50 percent improvement; 3, mostly satisfied or 75 percent improvement; and 4, totally satisfied or 100 percent improvement) was also collected in both the perioperative and follow-up periods.

Statistical Analysis

An unpaired t test was used to determine any significant differences between the two groups of patients. To compare patient and physician satisfaction scores between the two groups, a Mann-Whitney-Wilcoxon test was performed. A value of $p < 0.05$ was considered statistically significant.

RESULTS

During the study period, 31 patients with craniofacial microsomia underwent correction of soft-tissue hypoplasia and had complete records and imaging necessary for comparative analyses. Ten patients in group 1 (Fig. 1) underwent microvascular free flap surgery with an inframammary extended circumflex scapular flap (Table 2). Serial autologous fat grafting was performed in 21 patients (Figs. 2 and 3) in group 2 (Table 3). Preoperatively, both groups had similar soft-tissue deficiencies, as determined by the OMENS classification, with a mean soft-tissue deficiency score of 2.4 ± 0.5 for group 1 (microvascular free flap) and 2.3 ± 0.7 for group 2 (serial fat grafting) (Table 4). In addition, the mean prereconstruction symmetry score for groups 1 and 2 was 74 ± 7.1 percent and 75 ± 5.0 percent, respectively. Neither difference was statistically significant.

Patients who underwent soft-tissue reconstruction with microvascular free flaps (group 1) had a statistically significantly lower number of procedures than those children who received serial fat grafting ($p < 0.05$). The average number of procedures for the patients who underwent inframammary extended circumflex scapular flap surgery (group 1) including take-backs or flap recontouring revisions was 2.2 ± 0.6. The mean number of autologous fat grafting procedures (group 2) performed was 4.3 ± 1.0. A mean number of only 0.3 cases of fat grafting was performed without a simultaneous procedure such as staged ear reconstruction. The total surgical time or net surgical time was 490 minutes for group 1 and 228 minutes for group 2. However, the average operative time per case was 232 minutes for group 1 and 48 minutes for group 2.

The complication rate in group 1 was 12 percent, including a hematoma and partial flap loss with fat necrosis. In group 2, there was a 5 percent

Fig. 1. Craniofacial microsomia microvascular free flap (group 1) patient. (*Left*) Preoperative frontal image shows facial asymmetry with right hypoplasia before skeletal or soft-tissue correction. (*Center*) After double-jaw (Le Fort I/bilateral sagittal split osteotomy) surgery but before soft-tissue correction of skeletal midline was seen. (*Right*) Postoperative frontal image following soft-tissue reconstruction with an inframammary extended circumflex scapular flap shows improved facial symmetry (note that the patient also had orbital dystopia correction with right orbital box osteotomy/downward movement and septorhinoplasty).

Table 2. Characteristics of Craniofacial Microsomia Patients Who Underwent Microvascular Free Flap or an Inframammary Extended Circumflex Scapular Flap

Patient	OMENS	No. of Procedures	Volume of Initial Flap (cc)	Final Volume (cc)	Prereconstruction Symmetry (%)	Postreconstruction Symmetry (%)	Physician Satisfaction	Patient Satisfaction
1	$O_0M_2AE_2N^7{}_2S_3$	2	129	104	74	122	3.6	3.4
2	$O_0M_2AE_2N^7{}_2S_3$	3	145	110	76	124	3.3	3.4
3	$O_0M_2AE_2N^7{}_2S_2$	2	137	124	84	110	3.2	3.3
4	$O_0M_2AE_2N^7{}_2S_2$	3	138	98	71	117	3.7	3.6
5	$O_0M_2AE_2N^7{}_2S_3$	1	95	95	88	139	2.8	3.6
6	$O_1M_2AE_2N^7{}_2S_2$	3	144	115	68	114	3.3	3.0
7	$O_0M_2AE_2N^7{}_2S_3$	2	150	131	71	122	3.8	3.6
8	$O_0M_2AE_2N^7{}_2S_2$	2	115	95	73	120	3.6	3.3
9	$O_0M_2AE_2N^7{}_2S_2$	2	122	90	64	116	3.3	3.5
10	$O_0M_2AE_2N^7{}_2S_2$	2	135	102	73	126	3.9	3.8
Mean	$O_0M_2AE_2N^7{}_2S_2$	2.2	131	106	74	121	3.5	3.5

Fig. 2. Craniofacial microsomia fat grafting (group 2) patient. (*Left*) Preoperative frontal image shows facial asymmetry with right hypoplasia before skeletal or soft-tissue correction. (*Center*) After right mandibular distraction and staged ear reconstruction surgery with serial fat grafting (two times). (*Right*) Postoperative frontal image following soft-tissue reconstruction with serial fat grafting (four times) showed improved facial symmetry.

complication rate, with infection and surface irregularities. One patient from the microvascular free flap group had a prolonged seroma, but there was no donor-site morbidity in the serial fat grafting group.

Volume Augmentation

Volume augmentation for group 1 patients, based on volume at the time of inset of the inframammary extended circumflex scapular flap, was a mean of 131 ± 16.5 cc; after revisions, which included soft-tissue debulking, the mean final volume was 106 ± 13.4 cc. The three-dimensional imaging using radial recording and surface landmarks showed an initial mean fat take in the postoperative period of 124 ± 10.4 cc. The mean final fat take using three-dimensional imaging after 1-year follow-up and revision procedures was 101 ± 9.3 cc.

Volume augmentation for group 2 patients was based on the amount of fat injected (measured in cubic centimeters) during each procedure. The mean for all fat grafting procedures was 33 ± 3.2 cc. The final mean volume of fat injected based on the total of fat injected during all procedures was 146 ± 9.2 cc. Three-dimensional imaging using radial recording and surface land-

Fig. 3. Craniofacial microsomia fat grafting (group 2) patient. (*Left*) Preoperative frontal image shows left facial hypoplasia and right torticollis before ear, mandibular, or soft-tissue correction. (*Center*) After right sternocleidomastoid release for torticollis, left costal cartilage graft for Pruzansky type III mandibular deformity, subsequent rib graft distraction, and fat grafting (two times). (*Right*) Postoperative frontal image following staged ear reconstruction and soft-tissue reconstruction with serial fat grafting (four times) shows improved facial symmetry.

marks showed an initial mean fat take for each procedure in the postoperative period of 35 ± 3.5 cc. The mean final fat take using three-dimensional imaging measurements after 1-year follow-up was 121 ± 8.1 cc (83 percent). The mean fat loss was 25 ± 3.0 cc.

There was a higher amount of volume augmentation achieved with less fat loss in the microvascular free flap group compared with the serial fat grafting group ($p < 0.05$). For three-dimensional imaging, radial recording volumes differed from surface landmark volumes by less than 3 percent, and interrater error was less that 2 percent.

Volume Symmetry

After soft-tissue reconstruction, group 1 patients had a symmetry score of 121 ± 7.9 percent and patients in group 2 had a symmetry score of 99 ± 5.4 percent. When comparing final volumes of the affected to the unaffected sides, a value of 100 percent is ideal. Patients in group 2 had a postreconstruction symmetry score significantly closer to 100 percent ($p < 0.05$).

Satisfaction

When considering patient and physician satisfaction, no statistically significant difference was noted betweens groups 1 and 2 ($p < 0.05$). On a five-point scale, the mean physician satisfaction score for groups 1 and 2 was noted to be 3.5 ± 0.3 and 3.6 ± 0.2, respectively. The average score for patient satisfaction was 3.5 ± 0.2 for group 1 and 3.7 ± 0.5 for group 2.

DISCUSSION

Craniofacial microsomia represents a wide spectrum of bony and soft-tissue hypoplasia. To correct these deformities, patients often undergo multiple operations. These are staged and performed at various time points, beginning as early as the neonatal period and extending into adulthood (Table 1). This presents a unique opportunity for early soft-tissue reconstruction with serial autologous fat grafting.

With craniofacial microsomia, mandibular abnormality is most evident and occurs to some degree in 89 to 100 percent of patients.[1,2] The mandible can be operated on at all stages of the child's life, depending on the necessity of the operation. Mandibular distraction is considered in the neonatal period only to treat significant airway obstruction.[7] Mandibular distraction may then be reconsidered during midchildhood (between the ages of 6 and 12 years) for delayed onset/recurrent obstructive sleep apnea, to facilitate trache-

Table 3. Characteristics of Craniofacial Microsomia Patients Undergoing Serial Fat Grafting

Patient	OMENS	No. of Procedures	Total Volume per Fat Injection Procedure (cc)						Total Fat Injected per Case (cc)	Prereconstruction Symmetry (%)	Postreconstruction Symmetry (%)	Physician Satisfaction	Patient Satisfaction
			First	Second	Third	Fourth	Fifth	Sixth					
1	$O_0M_{2A}E_2N^7{}_0S_2$	4	30	35	42	34			144/35	76	105	3.7	4
2	$O_0M_{2B}E_2N^7{}_2S_3$	4	35	38	40	25			138/35	72	95	3.5	4
3	$O_1M_{2A}E_3N^7{}_2S_2$	6	34	35	33	38	30	28	198/33	81	97	3.7	3
4	$O_0M_1E_0N^7{}_0S_1$	3	35	25	28				88/29	74	107	3.6	4
5	$O_0M_3E_1N^7{}_1S_3$	5	42	34	36	30	35		177/35	66	103	3.4	4
6	$O_0M_{2B}E_2N^7{}_0S_2$	4	40	36	33	25			134/34	77	96	3.4	3
7	$O_0M_1E_0N^7{}_2S_1$	3	35	32	25				92/31	69	101	3.7	3
8	$O_0M_{2A}E_2N^7{}_2S_3$	6	30	38	26	35	38	30	197/33	78	92	3.7	4
9	$O_0M_{2A}E_2N^7{}_3S_3$	4	27	36	30	35			128/32	82	109	3.5	4
10	$O_0M_{2B}E_3N^7{}_3S_3$	5	40	28	35	30	22	28	183/31	73	102	3.8	4
11	$O_0M_{2B}E_2N^7{}_2S_2$	5	38	40	35	33	37		183/37	65	94	3.7	4
12	$O_0M_1E_2N^7{}_1S_2$	3	38	35	30				103/34	71	96	3.8	3
13	$O_0M_{2A}E_2N^7{}_2S_2$	5	33	27	35	28	30		153/31	79	103	3.6	4
14	$O_0M_1E_3N^7{}_0S_2$	4	45	38	35	38			156/39	76	92	3.4	3
15	$O_0M_{2B}E_2N^7{}_3S_3$	4	35	32	28	30			125/31	76	98	3.7	4
16	$O_0M_3E_3N^7{}_2S_3$	6	36	34	35	28	39	30	202/34	73	89	3.4	4
17	$O_0M_1E_2N^7{}_0S_1$	3	37	35	35				107/36	84	103	3.6	4
18	$O_0M_{2A}E_2N^7{}_2S_3$	4	44	35	37	35			151/38	74	107	3.2	3
19	$O_0M_1E_0N^7{}_0S_2$	4	30	25	30	35			120/30	71	99	3.8	4
20	$O_0M_{2B}E_2N^7{}_3S_3$	5	38	35	35	32	25		165/31	75	100	3.4	4
21	$O_0M_1E_0N^7{}_0S_2$	4	30	34	35	33			132/33	82	98	3.9	4
Mean	$O_0M_{2A}E_2N^7{}_2S_2$	4.3							146/33	75	99	3.6	3.7

Table 4. Mean Outcome Values for Microvascular Free Flaps and Serial Fat Grafting

	MVFF (group 1)	Serial Fat Grafting (group 2)
No.	10	21
OMENS soft-tissue deficiency score	2.4 ± 0.5	2.3 ± 0.7
No. of procedures†	2.2 ± 0.6	4.3 ± 1.0
Operative time, min		
Per case	232	48
Total	490	228
Complications, %	12	5
Volumetric augmentation, cc		
Case	131 ± 16.5	33 ± 4.1
Total†	106 ± 13.4*	146 ± 24.8
Prereconstruction symmetry, %	74 ± 7.1	75 ± 5.0
Postreconstruction symmetry,† %	121 ± 7.9	99 ± 5.4
Physician satisfaction		
Mean ± SD	3.5 ± 0.3	3.6 ± 0.2
Range	2.8–3.9	3.2–3.9
Patient satisfaction		
Mean ± SD	3.5 ± 0.2	3.7 ± 0.5
Range	3.0–3.8	3–4

MVFF, microvascular free flap.
*For MVFF flaps, volumetric case fill represents flap volume at inset and total represents initial volume minus the fat removed at revision.
†$p < 0.05$.

ostomy decannulation, or to treat significant and severe mandibular ramal asymmetry.[8] In addition to lengthening the mandibular bone, distraction also lengthens the regional muscles of mastication, nerves, and soft tissue.[9] However, it rarely resolves the soft-tissue deficiencies.[10,11] For Pruzansky type III mandibles, a costal cartilage or rib graft may be required (between 5 and 8 years of age).

Throughout childhood, patients may undergo dental rehabilitation and orthodontic procedures to improve occlusion.[30] Often, at skeletal maturity, an orthognathic procedure is required. A double-jaw procedure or Le Fort I osteotomy with simultaneous bilateral sagittal split osteotomy of the mandible is used to correct the dental midline and an occlusal cant. Osseous genioplasty may be used simultaneously or on its own for final chin point correction. In addition, vertical orbital dystopia can be addressed with orbital box osteotomy or facial bipartition. With craniofacial microsomia, microtia is present in 66 to 99 percent of patients.[1] These children benefit from staged total ear reconstruction between 5 and 10 years of age.

For final correction of soft-tissue deficiency, a microvascular free tissue transfer has been used widely.[14,15] Many flaps have been described for the microsurgical restoration of facial contour, including groin, parascapular, rectus abdominis, superficial inferior epigastric artery, latissimus dorsi, deltopectoral, radial forearm, and anterolateral thigh flaps.[12–21] Although free tissue transfer is effective, it is not without increased risk and morbidity in this patient population. A majority of these patients have had multiple previous reconstructive procedures, making microvascular flap reconstruction arduous. Scarring and tethered tissue from previous dissection is common. The superficial temporal vasculature is not always available as recipient vessels because of previous temporal incisions and the harvesting of temporoparietal fascia for ear reconstruction.[31] In addition, flap revision is routinely advocated 6 months postoperatively for flap debulking, reevaluation, recontouring, and resuspension. Patients who received the inframammary extended circumflex scapular flap (group 1) had overcorrection, as evidenced by their 121 percent postreconstruction symmetry score. These patients underwent an average of 2.2 procedures. Scarring, proximity to critical structures, and flap contracture made it difficult to contour the flaps to match the contralateral unaffected side.

With microsurgical reconstruction, it has been reported that patient satisfaction is not always optimal.[17] Iñigo et al. reported that 23 percent of 118 conventional free flap cases for severe deformity indicated a poor result.[17] However, in our study, patient satisfaction was high, with a score of 3.6 of 4.0. Finally, despite the flap delivering volume to the affected area, the aesthetic result is not always ideal. The flap can sag because of its weight, affecting nearby structures such as the lower eyelid. At times, flap contracture can cause irregularity of the skin and a hard texture with palpation of the surface.

Considering the multiple staged operative interventions craniofacial microsomia patients undergo and recognizing the morbidity of free tissue transfer, we performed serial fat grafting for soft-tissue correction of craniofacial microsomia patients and undertook a comparative study. Our data showed that serial fat grafting throughout childhood was a viable alternative to free tissue transfer after skeletal correction for addressing craniofacial microsomia soft-tissue deformities.

With our comparative study, before intervention, both groups of patients had similar degrees of soft-tissue deficit based on the mean OMENS soft-tissue score and prereconstruction symmetry scores. As expected, group 2 (fat grafting) patients had a statistically greater number of procedures than those in group 1 (microvascular free flap); however, the total time in the operating room for fat grafting patients (228 minutes) was less than for microvascular free flap patients (490 minutes). Microvascular free flap patients were overcorrected, with postreconstruction symmetry scores of 121 percent (>100 percent, which is ideal). By contrast, patients undergoing serial fat grafting achieved a symmetry score closer to 100 percent and were found to have 82 percent fat retention at follow-up. There was no statistically significant difference in patient or physician satisfaction noted in either group. In short, groups 1 and 2 achieved similar results, with the latter foregoing a free flap transfer procedure with increased donor-site morbidity and benefiting from earlier soft-tissue improvement.

For the craniofacial microsomia patient who presents in adolescence with significant soft-tissue hypoplasia, an inframammary extended circumflex scapular flap is still considered by us to be the appropriate management. This procedure has the advantage of large volume correction with one or two procedures. For the growing child who will require multiple reconstructive procedures in the future, we plan serial fat grafting throughout their reconstructions.

Fat transfer is generally regarded as a safe procedure, with isolated reports of severe morbidity.[23] Although rare, aphasia, hemiparesis, hemiplegia, and blindness have occurred secondary to fat embolism.[32–37] No patients in this series developed signs or symptoms consistent with fat embolism. The authors believe that retrograde injection of fat can minimize the risk of intravascular transfer. More common complications include hematoma, cellulitis, and contour irregularities.

Survival rates of fat grafts vary tremendously in the literature.[23] In addition, these clinical assessments fail to objectively assess outcomes. Instead, the results of these studies are based on subjective evaluations, such as preoperative and postoperative photographs. Although initially patients who received fat injections (group 2) had a postsymmetry score of 99 percent, the mean fat take in our study group measured by three-dimensional photographic imaging was 82 percent. These data confirm that overcorrection may be necessary when correcting soft-tissue deficiency with fat grafting. As survival and retention of fat varies among individuals, it is difficult to ascertain exactly how much overcorrection is appropriate. The use of autologous fat grafting to improve craniofacial contour will become increasingly important as advancements in tissue engineering improve survival of cells and predictability.[38,39]

CONCLUSIONS

Patients with craniofacial microsomia require multiple operations and procedures for the correction of hypoplasia. By combining serial autologous fat grafting at the time of these operative interventions, the craniofacial contour can be improved markedly. Fat grafting is safe and effective, and often alleviates the necessity and added morbidity of microvascular free tissue transfer.

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PATIENT CONSENT

Parents or guardians provided written consent for the use of patient images.

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