Int. J. Curr. Res. Med. Sci. (2017). 3(4): 129-138

International Journal of Current Research in Medical Sciences

ISSN: 2454-5716

P-ISJN: A4372-3064, E -ISJN: A4372-3061

www.ijcrims.com

Original Research Article

Volume 3, Issue 4 -2017

DOI: http://dx.doi.org/10.22192/ijcrms.2017.03.04.018

Diversity of Modalities for Correction of Craniofacial Contour

Ahmed Taha Sayed, MD*.

Plastic and Burn Surgery Department, AL-AZHAR University.

Abdelaziz Kamal Saad, MD.

ENT Department, AL-AZHAR University

Abdel-Fattah Elshiekh, MD.

Surgical Oncology Unit, AL-AZHAR University.

*Corresponding Author

Abstract

Introduction: Craniofacial skeleton deformities or defects can be corrected and managed by different methods and techniques for aiming of aesthetics and functional contour correction. Skeleton contour hypoplasia or defects are better corrected by using similar tissues; bones, cartilage, or bone substitutes, also can be using alloplastic materials(Medpore), Titanium mesh, reconstructive plates. This has an advantage over using soft tissues to contour these deformities and donner site morbidities. This article aims to evaluate correction of craniofacial skeleton contour defects using different types of autogenous and allografts.

Methods: Twenty-seven patients were included this study. They complained of different types of craniofacial acquired (17 patients) and congenital deformities (10 patients). Ten patients (6 congenital and 4 acquired defects) operated by using of alloplastic materials group A and 17 patients (3 congenital and 14 acquired)operated by using autogenous grafts group B. all grafts were applied sub-periosteal and fixed in place for all patients. Required contour was achieved in all patients.

Results: All procedures were performed successfully and yielded highly satisfactory results producing the desired harmony cranial and facial contours. The application of these concepts has been effective, with low morbidity, in both groups. No implants extruded or migrated was detected in group (A). Partial exposure of alloplastic martial had detected in one patient (10 percent), early postoperative infections in one patient (10 percent) and contoured irregularity was detected in one patient (10 percent). There were no late infections. In group (B), partial grafts resorption was noticed in 4 patients (23.5 percent), donner site morbidity was detected in 3 patients (17.6 percent) and no infection or graft exposures were detected in this group.

Conclusion: Alloplastic and autogenous augmentation of the craniofacial skeleton can be a useful adjunct or an alternative to osteotomies and orthognathic surgical procedures in situations when the occlusion is normal or has been corrected. Implants can improve contour irregularities left after skeletal movements or defects after trauma or tumor excision and can simulate the visual effect of skeletal movements. One surgical procedure is may not suitable for the improvement of craniofacial contour in all cases of asymmetry. Different procedures and combinations should be integrated to attain an optimal outcome. When patients are both skeletal and soft-tissue deficient, the use of both modalities can optimize the result.

Keywords: Craniofacial skeleton, autogenous and allografts, contour.

Introduction

The craniofacial skeleton deformities may be congenital, traumatic, post inflammatory, post-surgical or post tumour resection. Apart from major skeletal deformities which necessitate advancement osteotomies, distraction osteogenesis or bone grafting, minor skeletal deformities like contour defects need simple procedures [1]. Many articles described how such simple procedures could contour the craniofacial skeleton [1-12]. The aim of craniofacioplasty is not only a cosmetic issue; also, the repair of cranial and facial bones defects gives relief to psychological drawbacks and increases the social performances. There are different types of materials can be used throughout the history of correction of the defects. Alloplastic implants can be adjunctive to orthognathic and craniofacial surgery by correcting contour irregularities or disharmonies after skeletal movements. Implant and graft augmentation can also simulate the visual effect of osteotomies in patients with skeletal deficiencies whose occlusion is normal or has been corrected. Although sometimes it is an adjunct or an alternative to facial skeletal rearrangements, facial skeleton augmentation is not a substitute for orthognathic surgery when used with paranasal and malar implants, they can simulate the visual effect of the Le Fort III osteotomy with advancement. Mandible and extended chin implants can correct skeletal irregularities and deficiencies safer than sagittal and horizontal osteotomies. There is still no consensus about the best material, and ongoing researches on both biologic and nonbiologic substitutions continue aiming to develop the ideal reconstruction materials [2]. Autologous bone grafts and the evolving biomedical technology and different materials are available to be used by the surgeons [3].

Patients and Methods

Twenty-seven patients (15 males and 12 females), aged between 9 – 64 years old included in this study are randomly divided into 2 groups. Group (A), included 10 patients (5 females and 5 males) treated by alloplastic grafts and group (B), included 17 patients (7 females and 10 males) treated by autogenous bone/or and cartilage grafts. Data of all patients are shown in Table (1, 2). All patients were operated on Al-Azhar University and Al-Haram hospitals, between 2011 up to 2015. Physical examinations together with standardized photographs are paramount in analysis and surgical planning. Plain radiographs, panoramic views and, particularly, computed tomographic scans with three-dimensional reconstruction can be useful adjuncts. Reconstruction of craniofacial skeleton defects with autologous grafts or alloplastic implants was to normalize skeletal contours and thus improve facial appearance. [4, 5]. Although useful for patients with certain skeletal disharmonies, facial skeletal augmentation is not a substitute for orthognathic surgery, but for reconstruction of the skeletal contour defects. The aesthetic concerns of the patient determine skeletal augmentation (figure 1).

Table (1), Group (A): ten patients managed by alloplastic grafts.

Patient No.	Age(Y) /sex	Cause	Deformities	Surgery
1	19 /F	Congenital	Midface and nasal bone hypoplasia	Paranasal and nasal dorsum Medpor augmentation
2	24 /F	Congenital	Midface hypoplasia (Treacher Collins syndrome)	Medpor midface contour implant + lipofat injection
3	25 /F	Congenital	Midface hypoplasia	Medpor midface contour implant
4	26 /M	Congenital	Mandibular chin hypoplasia	AugmentationGenioplasty by Medpor
5	28 /F	Congenital	Mandibular chin hypoplasia	AugmentationGenioplasty by Medpor
6	30 /M	Congenital	Suborbital paranasal	Paranasal augmentation by Medpor
7	42 /M	Posttraumatic	Cranial bone defects	Reconstructive Titanium Mesh
8	23 /M	Posttraumatic	Fronto-nasal defects	Reconstructive Titanium Mesh
9	48 / M	Post tumour excision	Hemi mandibulectomy	Reconstruction Mandibular Plates and Screws
10	52 /F	Post tumour excision	Cranial bone defect	Reconstructive Titanium Mesh

Abbreviations; M = male, F = female, Y = years

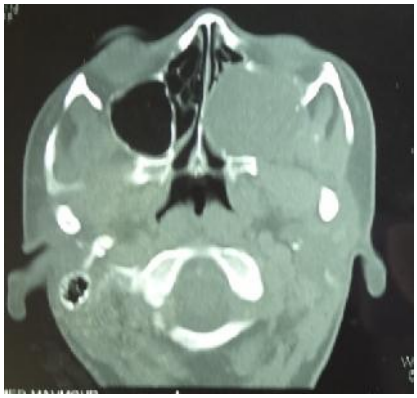
Table (2), Group (B): seventeen patients managed by autologous grafts.

Patients No.	Age /Sex	Cause	Deformities	Surgery
1	9 /F	Post traumatic	Lt. orbital floor and maxillary alveolus defect	Hip bone graft
2	12 /M	Post traumatic	Frontonasal defects	Costochondral graft
3	16 /F	Congenital	Maxillary alveolus hypoplasia	Costochondral graft and orthognathic surgery
4	18/ F	Congenital	Post cleft lip and palate nose deformities	Costochondral and concha cartilage graft
5	19/ F	Congenital	Saddle nose and paranasal hypoplasia	Costochondral graft and lipofat injection
6	21 /M	Congenital	Saddle nose	Costochondral graft
7	22/ F	Post tumor excision	Lt. Maxilla and inferior orbital wall defects	Hip bone graft
8	23 /M	Post traumatic	Rt. Zygomatic body	Chondral graft
9	25/ M	Post traumatic	Cranial bone defect	Calverian bone graft
10	29 /M	Post traumatic	Rt. Maxilla and orbital floor defects	Costochondral graft
11	33 /M	Post traumatic	Cranial bone defect	Calverian bone graft
12	35/ M	Post tumor excision	Rt. Body of the mandible	Hip bone graft
13	38/ F	Post tumor excision	Lt.body of the mandible	Costochondral
14	43/ M	Post tumor excision	Cranial bone defect	Hip bone graft + Titanium mesh
15	45/ M	Post traumatic	Lt.Zygomatico-orbital defect	Costochondral graft
16	55/ F	Post traumatic	Lt. Superior orbital bone defect	Calverian bone graft
17	64/ M	Post tumor excision	Rt. Paranasal and dorsal nasal bones and alar defects	Hip bone and conchal cartilage grafts

Abbreviations; M = male, F = female, Y = years

Overview of Operative Technique;

Fig. 1: (A) CT. scan, showing lt. maxillary odontogenic myxoma tumour (B) intraoperative view after excision of the tumour.



(A)

(B)

A general anaesthetic is preferred. This approach protects the airway during the operation and allows optimal intraoral preparation and surgical access to the cranium, midface, and mandible. To optimizehaemostasis, a dilute epinephrine solution is infiltrated in the operative site. Bicoronal approached were optimum for cranial and supraorbital regions (figure 2). Intraoral sulcus incisions are used to access the midface for placement of paranasal, maxillary alveolus, and malarregions. Infraorbital rim augmentation requires periorbital (lower blepharoplasty) incisions. The posterior mandible is accessed through intraoral sulcus incisions or external approach according to oncosurgeon preference, particularly in cases of tumours excisions, and we preference to access the chin from external submental approach. Thearea to be augmented or reconstructed is widely exposed in the sub-periosteal plane. Implants or grafts are modified as necessary to meet the specific needs of the patient. In cases of using alloplastic implant, we preference to use porous polyethylene implants (Medpor) fixed into the bed with titanium screws (figure 3). Although with using autogenous grafts screw or plates and screws or non-absorbable sutures fixation are preventing graft movement, allows to be contoured in place, and obliterates gaps between the posterior surface of the graft and the anterior surface of the skeleton. Gaps result in unanticipated increases in implant projection and thus skeletal contour [4,6,7,8]. The sizes of the autogenous grafts used ranged from 2 - 4cm.Chlorhexidine gluconate mouthwashes are prescribed for use 3days postoperatively for intraoral approaches. Intravenous antibiotics are administered perioperatively. Oral antibiotics are prescribed for one week after surgery.

Fig. 2: (A) Bicornal approach for reconstructionand correction of cranial countor defect(B) Countor correction by Titanium mesh and hip bone graft.

(A)

(B)

Fig. 3 (A) Medpo midface contour implant (B) Intraoral approach for midface augmentation by medpor and fixed by screws.

(A) (B)

Group A: Allografts

Results

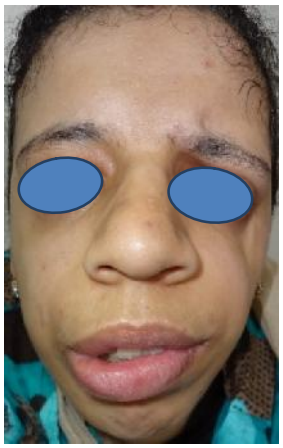
All patients recovered from anaesthesia uneventfully. All procedures were performed successfully and yielded highly satisfactory results producing the desired harmony cranial and facial contours. The follow up periods was ranged from 6 months up to 2 years. All patients were photographed just postoperatively, two weeks, 6 months and one year later. All patients were followed up radiologically (CT Scan, 3D, and panoramic views) 6 months and one year postoperatively. In group A, partial intraoral exposure of alloplastic martial (Mandibular reconstructive plates and screws) were noticed in one patients after few days from the operation and treated surgically by local Bucco-mucosal flap after one week from the exposure. Contoured irregularity was detected in one patient with titanium mesh for cranial bone defect after three weeks from the operation time and treated with free fat graft injection. Infection was detected in one patient and recovered completely after intravenous antibiotics with care of mouth hygiene (fig.4,5,6). In group B, partial grafts resorption was noticed in 4 cases (2 costochondral and 2 hip bone grafts) and re-operated 9 months later by autogenous grafts. No infection nor graft exposures were detected in this group (fig. 7,8). Donner site morbidity was detected in 3 patients in forms of wound infection and hypertrophic scars. The contouring was maintained and all patients were satisfied.

Fig.(4): Chin Augmentation by medpoimplant for female patient 28 years old, with normal occlusion.

A. Preoperative front view B. Implant in placevia C. Postoperative front view submental approach

D. Preoperative side view E. Postoperative side view

Fig. (5):Medpo midface contour implant for augmentation of the midface hypoplasia (Treacher Collins syndrome)of female patients 24 years old.

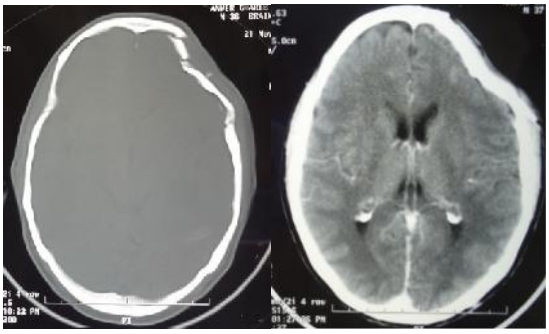


A. Preoperative view C. Postoperative view

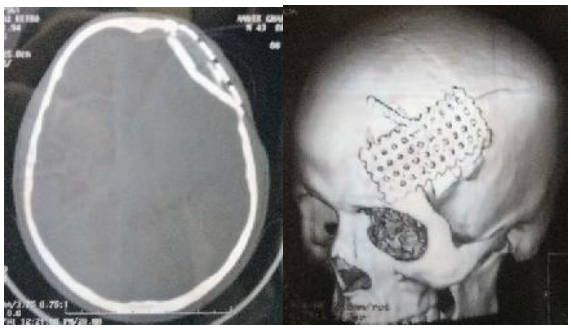
Fig. (6): Hip bone graft and Titanium mesh for reconstruction and correction of cranial bone defect in male patient, 43 years old presented.

A. Preopratine view

B. Postoperative view



C. Preoperative CT Scan showing post depressed cranial bone



D. Postoperative CT Scan and 3D showing traumatic cranial bone contour correction by Titanium fracture mesh and hip bone graft

Group B: Autologous grafts.

Fig. (7): Female patients 16 years old presented with maxillary alveolus hypoplasia and class III malocclusion treated by orthognathic surgery and augmentation by costochondral graft.

A. Preoperative front vie

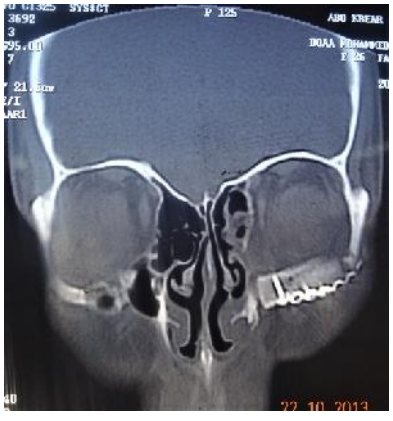
B. Orthognathic surgery and premaxillaa

B. Postoperative front view augmentation of bycostochondral graft

C. preoperative side view D. Postoperative side view

Fig. (8): Hip bone graft for reconstruction of orbital floor and rim after excision of odontogenic myxoma of the left maxilla in female patients 22 years old.

A. Preoperative view B. intraoperative view, reconstruction C. Postoperative viewofAthe inferior orbital bone byhip bone graftafter tumour excision.



D. Preoperative CT. Scan showing the eroding the lt. inferior orbital bone

E. Postoperative CT. Scan showing the tumour graft fixed by miniplates and screws

F. Preoperative intraoral view

G. Postoperative intraoral view

Discussion

For different types of facial and cranial contour deformities, different procedures and combinations should be integrated to attain an optimal outcome. In the formulation of craniofacial contour surgery plan, in addition to anatomic structures, proportion of each component, patient requirements, esthetic views, cultural background, and other factors of the patients should also be considered. One surgical procedure is not suitable for the improvement of facial contour in all cases of asymmetric lower face [9]. In the current study, we used combination of procedures in most of our cases. Both the soft tissues and the skeleton contribute to midface contour and convexity. Thus, both soft-tissue and skeletal augmentation can be appropriate for creating midface convexity. However, these modalities are not equivalent in their impact on the appearance of the midface. Free fat grafting and the injection of various fillers is intuitive and appropriate for the restoration of soft tissue volume loss. It has a limited role in simulating the effect of an increase in skeletal projection. Whereas augmenting the facial skeleton results in an increase in the projection of the skeleton, augmenting the soft tissue volume results in an inflation of the soft tissue envelope and blunting of the contours of the skeleton. Over augmentation of either component brings home the point [2].Soft-tissue volume augmentation has been complementary [10,11] to both the adjunctive and alternative use of alloplastic implants to orthognathic procedures. Rosen, in multiple writings was one of the first to point out aesthetic inadequacies that may accompany adherence to classic skeletal movements based on cephalometric data. He emphasized that when given alternatives to satisfy occlusal inadequacies, it is usually better to expand rather than to reduce the facial skeleton [12]. This skeletal expansion provides support for, and allows better drape of, the soft-tissue mask with, as he demonstrated, a more youthful and attractive appearance. Because soft tissues change over time and implants do not, soft-tissue augmentation can mask implant visibility in patients with senescence-attenuated soft-tissue envelopes. When patients are both skeletal and soft-tissue deficient, the use of both modalities can optimize the result. The donner site morbidities, graft resorption and longtime operative procedures are the most common complications of the autologous graft, but the allografts and synthetic materials have advantages at this point of views. Although, exposures and possibilities of infection are still existing.

Conclusion

Alloplastic and autogenous augmentation of the craniofacial skeleton can be a useful adjunct or an alternative to osteotomies and orthognathic surgical procedures in situations when the occlusion is normal or has been corrected. Implants can improve contour irregularities left after skeletal movements or defects after trauma or tumor excision and can simulate the visual effect of skeletal movements. One surgical procedure is may not suitable for the improvement of craniofacial contour in all cases of asymmetry. Different procedures and

combinations should be integrated to attain an optimal outcome. When patients are both skeletal and soft-tissue deficient, the use of both modalities can optimize the result.

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How to cite this article:
Ahmed Taha Sayed, Abdelaziz Kamal Saad, Abdel-Fattah Elshiekh. (2017). Diversity of Modalities for Correction of Craniofacial Contour. Int. J. Curr. Res. Med. Sci. 3(4): 129-138.
DOI: http://dx.doi.org/10.22192/ijcrms.2017.03.04.018