

Original Research Article**An Overview of Correction of Contour Deformity of Frontal Bone Using Autologous Tissues**Arunesh Gupta¹, Pooja Mistry², Aravind Hosamani³¹Additional Professor, Department of Plastic Surgery, TNMC BYL Nair Ch Hospital^{2,3}Senior Resident, Department of Plastic Surgery, TNMC BYL Nair Ch Hospital

Received: 25-07-2023 / Revised: 28-08-2023 / Accepted: 30-09-2023

Corresponding author: Dr. Aravind Hosamani

Conflict of interest: Nil

Abstract:

Background: Frontal bone fractures are relatively rare, comprising just around 5% of all maxillofacial injuries. These fractures cause bone deformity which hampers facial aesthetics significantly. These are caused by high velocity, high energy impacts. Wide variety of materials is being used for reconstructing the contour deformities such as porous polyethylene implants, titanium mesh, various autologous materials. Not many studies are available in the literature regarding use of autologous material in frontal bone contouring.

This study emphasises the importance of the same.

Aims and Objectives: To study various autologous options used for contour deformity correction.

Materials and Methods: The study was conducted in the Department of Plastic Surgery at TNMC BYL Nair Ch. Hospital. The clinical series comprises 14 consecutive patients selected by inclusion and exclusion criteria. All patients underwent reconstruction using autologous tissue. Evaluation of the same has been done in this study.

Results: All the patients were males with an average age of 30.5 years. 28.5 % of the deformities were caused due to accidental fall, and rest 71.5% were due to road traffic accidents. In 4 patients immediate correction was done and in 10 patients delayed correction was done. Average time duration was 7 months. In six (42.85%) patients a coronal incision was used to explore the defect whereas in eight (57.14%) patients old scars were used to approach the defect. In 50% cases cartilage was used, 28.57% cases bone was used and fat 14.28% and fascia 7.14%. Out of the 14 cases, 1 patient developed cartilage resorption and 1 patient had fat necrosis. Both these complications were managed with minor procedures on OPD basis. Rest of the patients had acceptable contour with good patient satisfaction.

Conclusion: With various treatment options available autologous tissue gave results which were simple, durable, cost effective and have low risk.

Keywords: Frontal Bone, Contour Deformity, Autologous Tissue, Cartilage Graft, Fat Graft, Tensor Fascia Lata.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Frontal bone fractures are relatively rare, comprising just around 5% of all maxillofacial injuries.[1] However unaddressed frontal bone fractures with residual defects can leave a patient with disfiguring forehead deformities and prominent contour irregularities.[2]

The “Anterior” or “Outer” table of the frontal bone, which forms the brow, forehead, and glabella, is strong and sturdy, with an average thickness of 4 mm, but can reach even up to 12 mm. [3]

This together with the buttressing effect of its pneumatisation confers some degree of protection during trauma and allows it to resist facial fractures more than any other bone in the maxillofacial region. The force needed to fracture the frontal bone is between 800 and 1600 pounds,[4] which is

double the force needed to fracture the mandible and five times that needed to fracture the maxilla. The “Posterior” or “Inner” table is much thinner, just 0.1–4.8 mm in thickness, and it forms part of the anterior cranial fossa. [5]

High-velocity and high-energy impacts to the upper third of the face as seen in motor vehicular accidents are the leading cause of frontal bone fractures. Other important causes are high impact sports injuries, interpersonal violence, falls from heights, and penetrating trauma from industrial accidents.[6]

Wide variety of materials is being used for reconstructing the contour deformities such as porous polyethylene implants [7], titanium mesh, various autologous materials. There is still no ideal

implant material for the reconstruction of facial contours. Not many studies are available in the literature regarding use of autologous material in frontal bone contouring. In our study we emphasise on the use of autologous materials for contour deformity correction.

Material and Methods

The study was conducted in the Department of Plastic Surgery at TNMC BYL Nair Ch. Hospital. The clinical series comprises 14 consecutive patients admitted during the period of 2021- 2023. The following criteria were used for selection of patients-

Inclusion criteria: Patients with frontal bone contour deformity secondary to fracture, Patient who are fit for tolerating general anaesthesia (ASA-1).

Exclusion criteria: Patients with associated injury to the surrounding structures such as orbit, Dural tear, brain injury, Patient with comorbidities (such as uncontrolled diabetes, Hypertension, Asthama), with Bleeding disorders, with seizure, Active tobacco consumption

Operative technique: Informed written consent was taken. All cases were operated on under general anaesthesia. After exploring the defect either via scar approach (fig.1) or bicornal approach (fig. 2), all non-viable mucosa and debris removed, thorough saline irrigation was done.

Autologous tissue harvested from different sites as shown in table-1 with standard techniques as described in literature. Fat and fascia were used in small defect(less than 2cm) and cartilage and bone grafts were used in larger defects (more than 2cm).

Table 1:

Tissue	Harvest site
Cartilage	Costal cartilage(5,6 th)
Bone	Fracture bone piece
Fat	Lower abdomen, thigh
Fascia	Tensor Fascia Lata

Fractured bone pieces aligned with 3-0 polypropylene suture (fig.3). As per requirement in individual case, cartilage contouring done according to the defect size and shape(fig.4). Fascia and fat are harvested as per the requirement of the defect. After tailoring the cartilage and bone, the edges were feathered, so that continuity between implant and bone was achieved and the edges were not palpable or visible any more. Anchorage of the cartilage and bone to the native

frontal bone was done with sutures and miniplates & screws. The fat and fascia filled in, overcorrecting the defect. Both operative and the donor sites were closed in layers. Protective dressing was given. First check dress was done after 48hours and discharged after that. Oral medications were given and patients were followed up on OPD basis after 1week, 1month, 3months and 6 months.

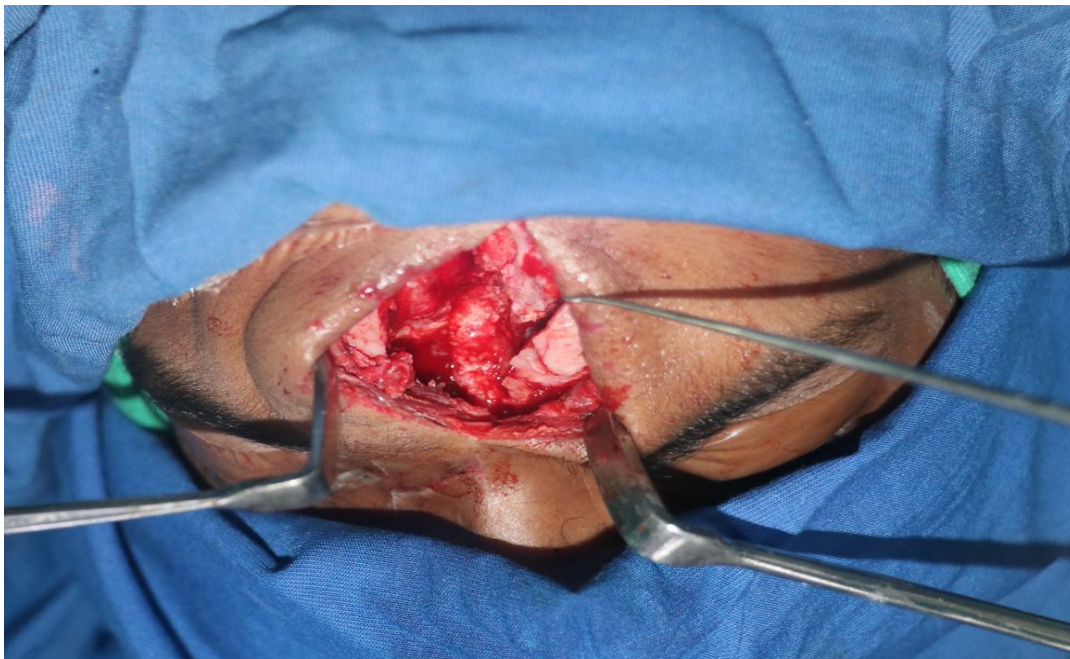


Figure 1: (Scar approach)



Figure 2: (Bicoronal approach)

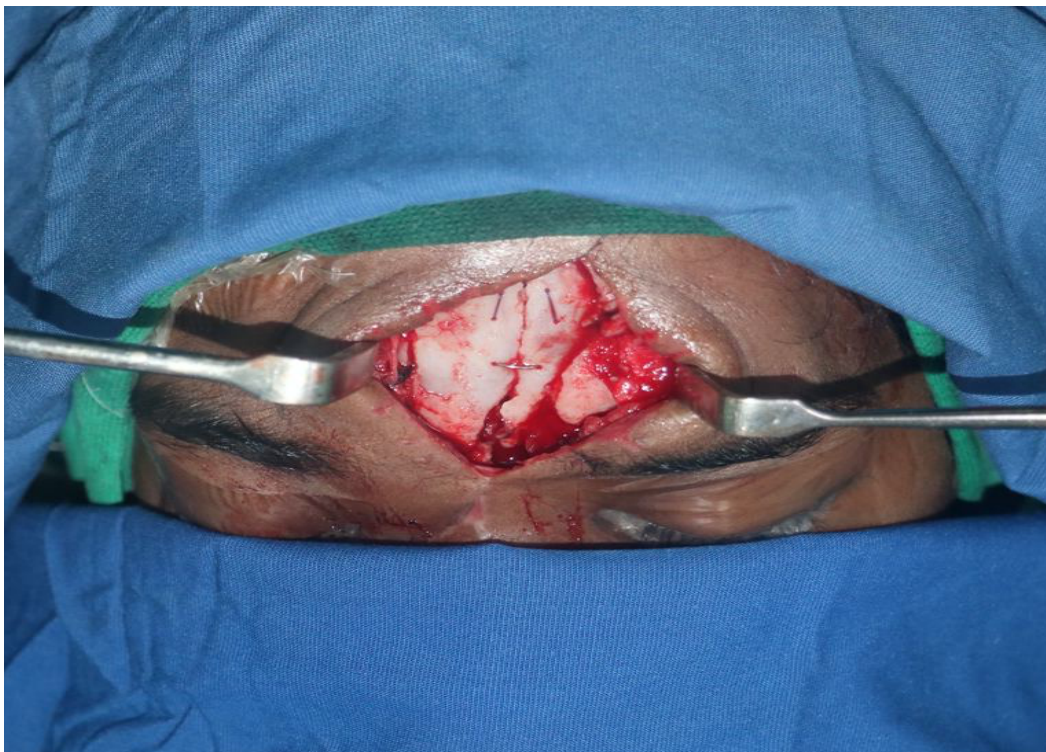


Figure 3: (Bone fixation)

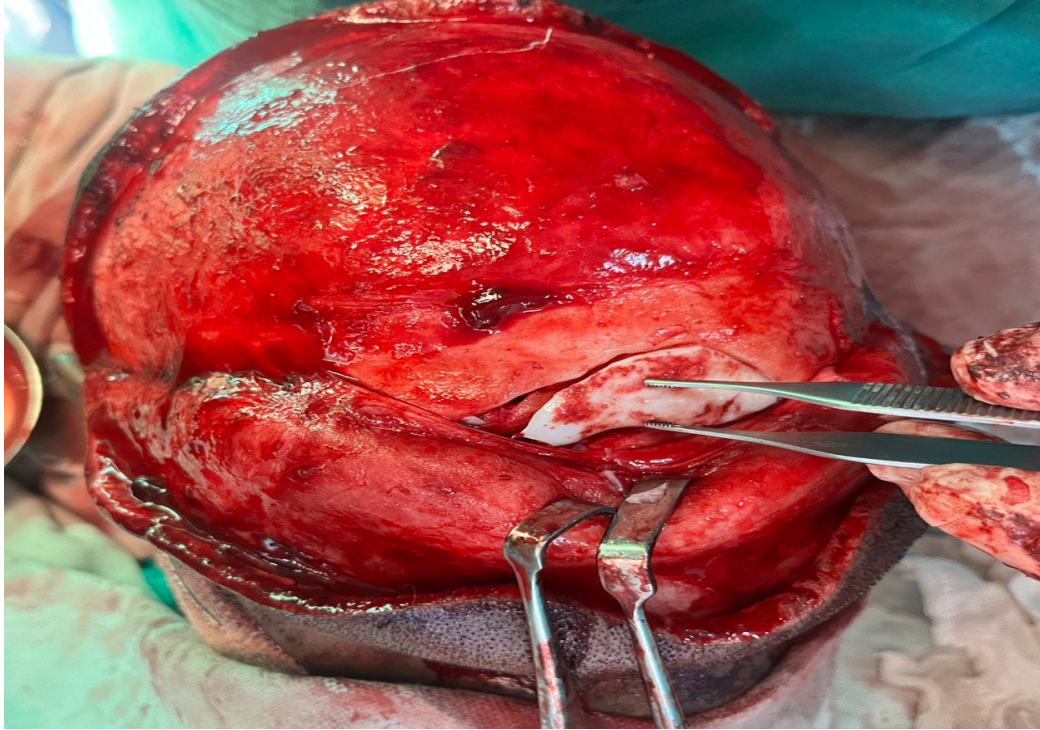


Figure 4: (Contoured cartilage graft)

Results: The results obtained in our study are tabulated in table-2.

Table 2:

Age(years)	Aetiology	Presentation time	Approach	Tissue used	complication
26	Road Traffic Accident	8months	Coronal	Cartilage	-
28	Road Traffic Accident	12months	Scar	Cartilage	-
33	Road Traffic Accident	10months	Scar	Cartilage	-
26	Road Traffic Accident	6months	Coronal	Cartilage	Cartilage resorption
29	Accidental Fall	Immediate	Scar	Bone	-
35	Road Traffic Accident	4months	Scar	Cartilage	-
33	Road Traffic Accident	10months	Coronal	Cartilage	-
36	Accidental Fall	5 months	Scar	Fat	-
28	Road Traffic Accident	Immediate	Scar	Fascia	-
27	Accidental Fall	5 months	Coronal	Bone	-
26	Accidental Fall	9 months	Coronal	Bone	-
40	Road Traffic Accident	Immediate	Scar	Fat	Fat necrosis
31	Road Traffic Accident	7 months	Coronal	Cartilage	-
29	Road Traffic Accident	Immediate	Scar	Bone	-

All the patients were males with an average age of 30.5 years. 28.5 % of the deformities were caused due to accidental fall, and rest 71.5% were due to

road traffic accidents. In 4 patients, immediate correction was done and in 10 patients delayed

correction was done. Average presentation time duration being 5.42 months.

In six (42.85%) patients a coronal incision (Fig. 1) was used to explore the defect whereas in eight (57.14%) patients old scars (Fig. 2) were used to approach the defect. In 50% cases cartilage was used, 28.57% cases bone was used, fat in 14.28% and fascia in 14% of the cases. Out of the 14 cases, 1 patient developed cartilage resorption and 1 patient had fat necrosis.

Both these complications were managed with minor procedures on OPD basis. Rest of the patients had acceptable contour with good patient satisfaction score being 90%.

Discussion

There is still no ideal implant material for the reconstruction of facial contours. Not much study are available in the literature regarding use of autologous material in frontal bone contouring. The available literature is discussed as follows;

A study by Haluk Duman, Mustafa Deveci, Fatih Uygur et al. in 1999 states Medpor implant is easy to use, readily carved, time saving and does not lead to any donor site morbidity [7]. The results obtained here were aesthetically excellent. However these implants are associated with high infection rates around 7.2%, higher implant failure as concluded by Ridwan-Pramana A, Wolff J, Raziei A, Ashton-James CE et al. [8]. A study by Chattopadhyay C, out of 35 cases, all titanium implants was well tolerated without any case of rejection. Success rate for a period up to 18 months was 100%. [9] Recent studies have pointed out complications associated with titanium such as infection, exposure, collection and loosening, ultimately requiring implant removal. However, it is more related to the timing of procedure related to late repair (> 18 months). [10,11] With our patient's affordability (of implants) was one of the limiting factors due to which use of autologous tissues was considered. They are inexpensive, easy to obtain, exhibits good fit and contour, presents no risk of disease transmission, and is viable. [12] However, there were complications noted with our patients, they were minor and managed on OPD basis. Patients had good cosmetic appearance with 90% patient satisfaction rate.

Conclusion

Our study gave satisfactory aesthetic results in all patients treated for contour deformity with autologous tissue. Though use of autografts, conventional alloplastic materials such as PMMA, porous polyethylene and titanium have been giving satisfactory results, search for better and

biodegradable material for frontal bone reconstruction is still under evaluation.

References

1. Erdmann D, Follmar KE, Debruijn M, Bruno AD, Jung SH, Edelman D, et al. A retrospective analysis of facial fracture etiologies. *Ann Plast Surg* 2008;60:398-403
2. Jeyaraj P. Frontal bone fractures and frontal sinus injuries: Treatment paradigms. *Ann Maxillofac Surg* 2019;9:261-82.
3. Doonquah L, Brown P, Mullings W. Management of frontal sinus fractures. *Oral Maxillofac Surg Clin North Am* 2012; 24:265-74, ix.
4. Strong EB, Pahlavan N, Saito D. Frontal sinus fractures: A 28-year retrospective review. *Otolaryngol Head Neck Surg* 2006;135:774-9
5. SalentijnEG, Peerdeman SM, Boffano P, van den BerghB, ForouzanfarT. A ten-year analysis of the traumatic maxillofacial and brain injury patient in Amsterdam: Incidence and aetiology. *J Craniomaxillofac Surg* 2014;42:705-10.
6. Maladière E, Bado F, Meningaud JP, Guilbert F, Bertrand JC. Aetiology and incidence of facial fractures sustained during sports: A prospective study of 140 patients. *Int J Oral Maxillofac Surg* 2001;30:291-5
7. HalukDuman, Mustafa Deveci, Fatih Uygur et al. Reconstruction of contour and anterior wall defects of frontal bone with a porous polyethylene implant: *Journal of Cranio-Maxillofacial Surgery* 1999; 27: 298-301.
8. Ridwan-Pramana A, Wolff J, Raziei A, Ashton-James CE, Forouzanfar T. Porous polyethylene implants in facial reconstruction: Outcome and complications. *J Craniomaxillofac Surg*. 2015 Oct;43(8):1330-4
9. Chattopadhyay C. Reconstruction of Acquired Frontal Bone Defects Using Titanium Mesh Implants: A Retrospective Study. *J Maxillofac Oral Surg*. 2019 Mar;18(1):34-39.
10. Mukherjee S, Thakur B, Haq I, Hettige S, Martin AJ. Complications of titanium cranioplasty—a retrospective analysis of 174 patients. *Acta Neurochir (Wien)* 2014;156(5):989–998.
11. Hill CS, Luoma AM, Wilson SR, Kitchen N. Titanium cranioplasty and the prediction of complications. *Br J Neurosurg*. 2012;26(6):832–837.
12. Iwama, T., Yamada, J., Imai, S., Shinoda, J., Funakoshi, T., & Sakai, N. (2003). The use of frozen autogenous bone flaps in delayed cranioplasty revisited. *Neurosurgery*, 52(3), 591-596.