Case Report

Journal of Otorhinolaryngology and Facial Plastic Surgery 2020;6(1):1-6.

https://doi.org/10.22037/orlfps.v6i1.30441

Utility of Coronoid Bone Graft in Residual Deformity of Zygomaticomaxillary Complex and Associated Orbital Fractures: In Central India Population

Chandrashekhar R. Bande[1*], Manu Goel[1], Akshay Mishra[1], Supriya Dombre[1], Krishna Kurawar[1], Ashish Maheshkar[1]

1. Department of oral and maxillofacial surgery, Swargiya Dadasaheb Kalmegh Smruti dental college and hospital, Nagpur.

Article Info

Article Note:
Received: May, 2020
Accepted: September, 2020
Publish Online: December, 2020

***Corresponding Author:**
Dr. Chandrashekhar R. Bande

Email:
drcrbande@yahoo.co.in

Keywords:
Coronoid bone graft;
Zygomaticomaxillary fracture;
Orbital floor fractures;
Reconstruction.

Abstract

This article reports 20 cases elaborating the role of mandibular coronoid process as a graft in reconstruction of small continuity defects of residual or old zygomaticomaxillary complex (ZMC) fractures or the orbital floor fractures associated ZMC fractures. Though different other various autogenous and alloplastic materials are available, coronoid has its own advantages. The most important advantage of using coronoid graft is autogenous bone of intramembranous origin harvested through the same surgical site.

Various authors for small continuity defects have documented its use as a graft. All the cases in this report showed acceptable results. Thus, we recommend the use of coronoid process of the mandible as a source for autogenous bone graft as it can provide sufficient bone in quantity and quality for selected maxillofacial reconstructions.

Conflicts of Interest: The Authors declare no conflicts of interest.

Please cite this article as: Bande CR, Goel M, Mishra A, Dombre S, Kurawar K, Maheshkar A. Utility of Coronoid Bone Graft in Residual Deformity of Zygomaticomaxillary Complex and Associated Orbital Fractures: In Central India Population. J Otorhinolaryngol Facial Plast Surg 2020;6(1):1-6. https://doi.org/10.22037/orlfps.v6i1.30441

Introduction

Surgeries followed by trauma involving the maxillofacial skeleton, with bone or soft tissue loss often require grafting to correct existing deformities to achieve an ideal functional result (1), especially management of Zygomaticomaxillary complex (ZMC) fractures and associated orbital floor fractures, which are more concerned esthetically.

It is a challenging problem for surgeons as it requires precise surgical techniques for reconstruction and to avoid the post-operative complications; hence, restoring the physiologic function (2).

Various Grafting materials are available like autogenous, alloplastic materials. Characteristics of autogenous bone grafting have unique quantity, quality, and contour of bone for the reconstruction. Many donor sites are available for obtaining small to moderate volumes of bone for this purpose. These include the calvarium, iliac crest, coronoid process, and so on (3).

The ideal bone graft should have sufficient volume, minimal donor-site morbidity, obtaining intramembranous bone with high cortical component, proximity to the recipient site, ease of harvesting and achieving of reproducible and good results and minimal resorption rate (1).

The aim of this article is to highlight the use of excised coronoid process as a graft for reconstruction.

Journal of Otorhinolaryngology and Facial Plastic Surgery 2020;6(1):1-6.
https://doi.org/10.22037/orlfps.v6i1.30441

Methods

Twenty patients aged 18 to 50 years included in the study reported in the Department of Oral and Maxillofacial Surgery. After approval from institutional ethical committee patients were treated with coronoid process graft for reconstruction of fractured Zygomaticomaxillary complex fractures and associated orbital floor fractures to restore esthetics, were included in the study.

Surgical Technique

All the surgical procedures were carried out with standard surgical protocols under general anesthesia. An informed written consent was taken from each participant explaining the detail surgical procedure prior to surgery. Same surgeon and team performed all the surgeries. All the patients were followed up for 6 months with regular intervals.

Patients with trauma mainly old ZMC fractures and associated orbital floor fractures were included in this study, while the patients having head injury and the patients with severe ophthalmic injury or isolated orbital complex fractures were excluded from the study.

To harvest coronoid process of mandible intraoral incision is made along the external oblique ridge to expose the process. It was then cut at the first base with bur and separated by gentle tapping with an osteotome. The attachments of the temporalis muscle were cut and coronoid was removed. After removal, reshaping of coronoid done to fit over the repaired fractured segments.

In residual ZMC fractures, the malaligned segments were exposed and reduced with three point fixation. Here the continuity defects were sealed with coronoid graft. This gave high esthetic results.

For associated orbital floor fractures, the incision preferred is infra orbital incision for reduction of fractured segments. The incision was placed, followed by dissection of orbicularis oculi muscle. Careful dissection was performed for preservation of the infraorbital nerves and vessels. The inferior orbital rim was then uncovered by dissecting the orbital septum and the orbicularis oculi muscle to expose the fractures. The fracture site of the floor of orbit was reduced. After the reduction of the fractured segments, fixation was performed using miniplate osteosynthesis or titanium mesh. In cases of minimally displaced fractures of orbital floor, small continuity defects can easily be restored with coronoid graft. The surgical procedure is shown in figure 1-5 and follow-up of patient after 6 month shown in Figure 6.

Figure 1. Pre-operative

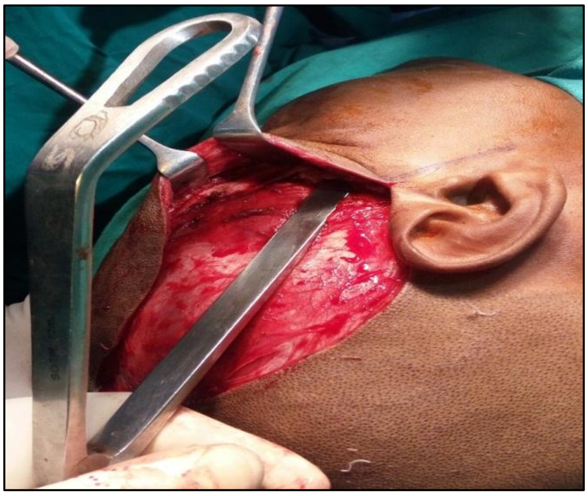

Figure 2. Exposure and reduction of ZMC fracture with hemicoronal incision.

Journal of Otorhinolaryngology and Facial Plastic Surgery 2020;6(1):1-6.

https://doi.org/10.22037/orlfps.v6i1.30441

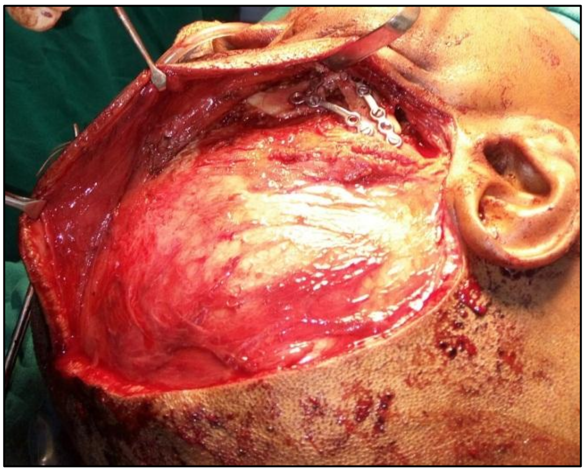

Figure 3. Reduction of fractured segments with three point fixation at ZMC site

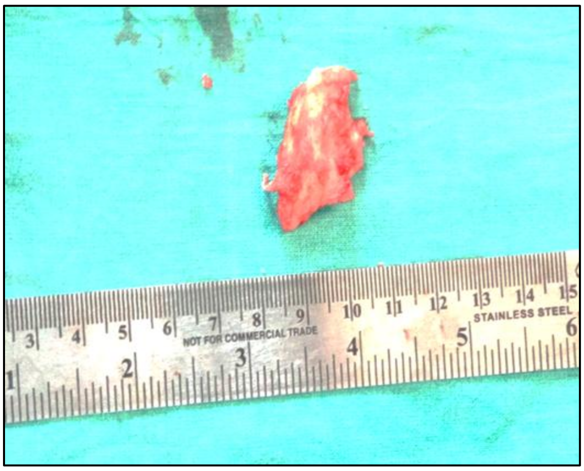

Figure 4. Coronoid harvested for reconstruction of fracture of ZMC associated with orbital floor defect

Figure 5. Placement of coronoid graft to orbital floor.

Figure6. Post-operative 6 months follow up.

Results

All cases of maxillofacial reconstructions in this series were successful. Patients were listed with type of fractures and the reconstruction done by coronoid bone graft (Table 1).

There were no complications such as the extrusion of grafts, infection, excessive resorption, or functional disturbance in any of the patients. All patients showed good acceptance of the graft. After treatment, patient showed good and acceptable and esthetic malar prominence after treatment.

Discussion

Midfacial trauma is relatively common due to prominence of this region. Inadequate reduction and reconstruction can result in significant disturbances in function and appearance.

For the reconstruction of continuity defects due to trauma, it is well accepted that autogenous bone grafting is superior to alloplastic and homologous sources, because it is the most physiologic of all the materials. Autogenous bone grafts from ilium, calvarium, and rib. Although an iliac graft is rich in cortical and medullary bone, this harvest can result in a number of complications, such as dysesthesia of peripheral sensory nerves and also scarring. Calvarial donor sites may be associated with potential intracranial injuries and a temporary non- cosmetic appearance on

Journal of Otorhinolaryngology and Facial Plastic Surgery 2020;6(1):1-6.
https://doi.org/10.22037/orlfps.v6i1.30441

face. The complications of rib donor sites include unsightly chest scars and possible pneumothorax v (2).

Coronoid process is a membranous bone and has a thick cortical portion. It was introduced first by Russell EA (1969) for the repair of small discontinuity defects of the mandible (4). The merits of using the coronoid process can be harvested more safely and easily, with minimal donor site morbidity. Also the size, shape, and thickness of graft is ideal for small defect reconstruction. As a membranous bone it has slower resorption rate, when compared to the costochondral graft, the coronoid process is much stiffer, which facilitates the use of rigid internal fixation (3).

Axhausen (1907) coined the term ‘‘creeping substitution’’, a widely accepted theory describing the physiology of cortical bone graft incorporation into its new recipient site. According to this theory first, the new secured bone graft is engulfed in a hematoma from the surrounding disrupted tissues. Only the most peripheral cells at this point remain viable and osteogenic. As the inflammatory process continues and organizes, the dense fibrous stroma becomes highly vascular, and the graft begins its revascularization process at approximately day 10. This vascular ingrowth is responsible for the osteogenic potential of the graft. Autogenous grafts of intramembranous lineage offer faster revascularization and healing and undergo resorption at a slower rate than bone from endochondral origin3. An additional advantage of cortical block grafts is that even if the bone graft is exposed to the oral environment, it is more resistant to failure than grafts from mostly cancellous origin (ilium, rib, tibia, etc) (1).

Pill-Hoon Choung (2001) carried a study on dry skull study found that the coronoid process can yield a triangular shaped piece of bone measuring approximately 19×18×26 mm and 6 mm in thickness. This is similar in thickness to the outer table of calvarial bone thus it can be easily used to reconstruct the floor of orbit (5).

Treatment of ZMC fractures associated with orbital floor fractures aims to prevent long-term sequelae, especially enophthalmos, persistent diplopia by reconstructing large defects and preventing herniation of orbital contents into the maxillary sinus. A clinically significant orbital floor defect will be defined as a gap remaining after reduction or elevation of orbital floor fracture fragments. Therefore, this definition excludes small defects (<5 mm in width) (6).

Saar Amrani (2010) proposed the graft combination for reconstruction with coronoid process grafts with the external oblique ridge grafts that are harvested in continuity could provide sufficient bone volume for more extensive reconstructions. Advantages of this surgical site include convenient surgical access and proximity of the donor and recipient sites. The graft is of the adequate size and contour for moderate size maxillofacial defects. Patient acceptance of the procedure is high as thee is lack of cutaneous scarring and minimal discomfort (1).

Sheldon M. Mintz (1998) have done the clinical study and stated that an individual’s right or left coronoid process can be used interchangeably as an autogenous graft for an ipsilateral or a contralateral orbital floor fracture, the contralateral process was used in their study to avoid the possibility of an infection contiguous to the graft site2. The coronoid process also can be used for the infraorbital or zygomatic augmentation to restore prominence of face (5).

In conclusion, it is clear that the coronoid process bone graft offers advantages over other sources of autogenous bone for orbital floor reconstruction and restoration of malar prominences after treatment of residual deformities of zygomaticomaxillary complex fractures. There is no facial scarring or no alteration or trauma to the dentition.

https://doi.org/10.22037/orlfps.v6i1.30441

Conclusions

Coronoid process provides good medullary bone and has superiority of membranous bone over endochondral bone with adequate amount of graft for repair of small continuity defects. There is ease of assessment for graft harvesting with minimal donor site morbidity.

Table 1. type of fractures and the reconstruction done by coronoid bone graft

Patients	Age/ Sex	Recipient Site
1.	34/M	ZMC Fracture with associated orbital floor fracture
2.	28/M	ZMC Fracture
3.	38/F	ZMC Fracture
4.	26/M	ZMC Fracture with associated orbital floor fracture
5.	40/M	ZMC Fracture
6.	18/M	ZMC Fracture
7.	33/F	ZMC Fracture with associated orbital floor fracture
8.	29/M	ZMC Fracture
9.	30/M	ZMC Fracture with associated orbital floor fracture
10.	45/M	ZMC Fracture
11.	42/M	ZMC Fracture with associated orbital floor fracture
12.	37/M	ZMC Fracture
13.	29/F	ZMC Fracture with associated orbital floor fracture
14.	25/M	ZMC Fracture
15.	36/M	ZMC Fracture
16.	40/M	ZMC Fracture with associated orbital floor fracture
17.	41/M	ZMC Fracture with associated orbital floor fracture
18.	50/F	ZMC Fracture with associated orbital floor fracture
19.	37/M	ZMC Fracture
20.	43/F	ZMC Fracture with associated orbital floor fracture

Acknowledgments

Not declared.

Conflicts of Interest

The authors declare no conflicts of interest.

Financial Support

Not declared.

Authors' ORCIDs

Chandrashekhar R. Bande
https://orcid.org/0000-0002-8259-8135
Manu Goel
https://orcid.org/0000-0002-3247-3078
Supriya Dombre
https://orcid.org/0000-0001-6595-8058
Krishna Kurawar
https://orcid.org/0000-0001-9404-7026
Ashish Maheshkar
https://orcid.org/0000-0003-3055-6926

References

1. Amrani S, Anastassov GE. - Mandibular Ramus / Coronoid Process Grafts in Maxillofacial Reconstructive Surgery. YJOMS [Internet]. 2010;68(3):641–6. Available from: http://dx.doi.org/10.1016/j.joms.2009.09.100

2. Mintz SM, Ettinger A. Contralateral Coronoid Process Bone Grafts for Orbital Floor Reconstruction : An Anatomic and Clinical Study. J Oral Maxillofac Surg, 1998;1140–4.

3. Sabhlok S, Waknis PP, Gadre KS.- Applications of Coronoid Process as a Bone Graft in Maxillofacial Surgery. The Journal of Craniofacial Surgery, 2014;25(2):577–80.

4. Robert D. Youmans, Russell EA. The coronoid process: A new donor source for autogenous bone grafts. Jou. OS,OM,OP, Vol. 27, Number 3, March 1955.

5. Choung P, Kim S. The coronoid process for paranasal augmentation in the correction of midfacial concavity. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2001;91:28-33.

Journal of Otorhinolaryngology and Facial Plastic Surgery 2020;6(1):1-6.

https://doi.org/10.22037/orlfps.v6i1.30441

6. Chowdhury K, Krause GE. Selection of Materials for Orbital Floor Reconstruction. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2001;91:28-33.