

EFFICACY OF EXTERNAL TEMPORARY STABILIZING ACRYLIC SPLINT IN INDIRECTLY REDUCED ZYGOMATIC ARCH FRACTURE – A PROSPECTIVE STUDY

EFFICACY OF EXTERNAL TEMPORARY STABILIZING ACRYLIC SPLINT IN INDIRECTLY REDUCED ZYGOMATIC ARCH FRACTURE – A PROSPECTIVE STUDY

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ABSTRACT

Aim: To study the efficacy of external temporary stabilizing acrylic splint in indirectly reduced zygomatic arch fracture.

Methods: a total of six patients, four of them were diagnosed with isolated zygomatic arch fracture and two of them were diagnosed with zygomatico- maxillary complex fracture, were admitted in our hospital. Indirect zygomatic arch reduction was done through Gillie's temporal approach for isolated zygomatic arch fracture cases and an external temporary stabilization was done using acrylic splint. Two-point fixation was done and indirect arch reduction was done using keen's approach for the other two cases. The acrylic splint was removed in one week uneventfully.

Results: The zygomatic arch fracture was well reduced and the function was restored. All the patients regained normal opening and mandibular range of movements. None of the patients experienced facial weakness or skin necrosis. Of the six patients only one patient had scarring which was acceptable.

Conclusion: External temporary stabilization using acrylic splint is proved to be better and can be used as an adjuvant in indirect zygomatic arch reduction.

Key words: Zygomatic arch fracture, Temporary stabilization, External acrylic splint.

Keywords: WHO Classification, Odontogenic Keratocyst, Orthokeratinized Variant, CBCT, Recurrence.

INTRODUCTION

Zygoma, a paired bone of the face, which is also called as "cheek bone or malar bone", contributes to the midfacial contour. This bone articulates with temporal bone, frontal bone, maxilla and sphenoid bone. The zygomatic arch is formed by the zygomatic process of temporal bone and the temporal process

of the zygomatic bone, united by an oblique suture – zygomaticotemporal suture¹.

The ZygomaticoMaxillary complex plays an indispensable role in the structure, function and esthetic appearance of the facial skeleton. Being second common, next to nasal bone fracture, the ZMC (Zygomatico Maxillary Complex)

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fracture accounts for approximately 40% of midface fractures. Isolated zygomatic arch fractures (IZAF) round about 4.5% to 10% of all fractures of the midface⁴. Road traffic accidents, assaults, falls⁶, sports and missile injuries are the causes and road traffic accidents are the most common etiology⁷. But it varies from region to region.

Duverney¹⁰, in 1751, was the first surgeon to describe an operative technique for treatment of a fractured zygomatic arch where he used intra oral finger pressure to elevate the depressed arch. The mechanism is that the patient is asked to bite on wooden block which results in temporalis muscle and tendon tension, along with the finger pressure, the fracture is reduced. **Keen**¹¹, in 1909 described the intra oral approach for reduction of zygomatic arch.

The standard technique for management of zygomatic arch fracture is the Gillies's temporal approach described by Gillies' in 1927¹⁵. Most of the cases are stable after the reduction of the zygomatic arch because of the interdigitation of the bone ends¹⁸. But in some cases, fractures are unstable which even required re-reduction of the fracture segment and additional support. The instability of the reduced zygomatic arch fracture because of the fragment movements due to pull of the masseter muscle²¹. Thus it needs a temporary stabilization as an adjuvant.

Zygomatic arch fracture segments are stabilized with either external or internal stabilization.

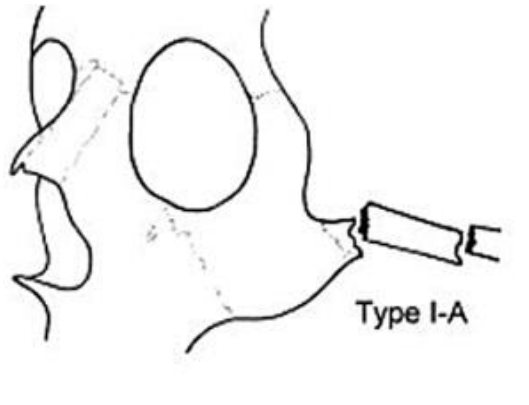
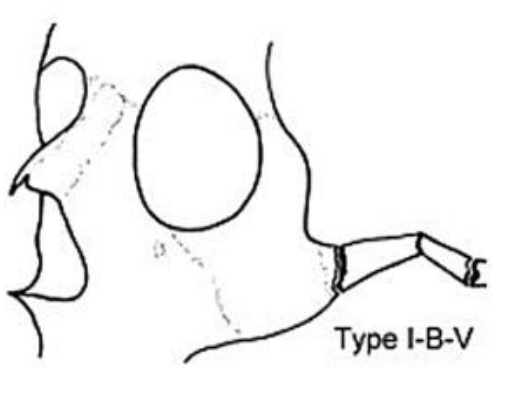
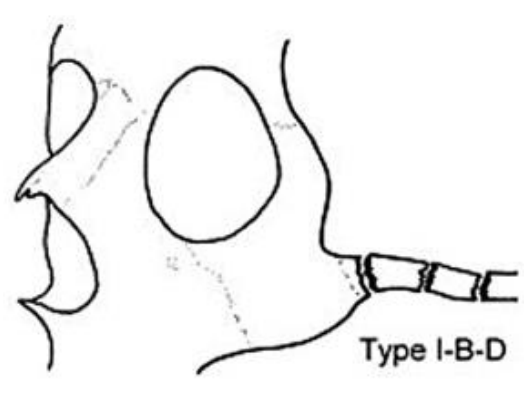
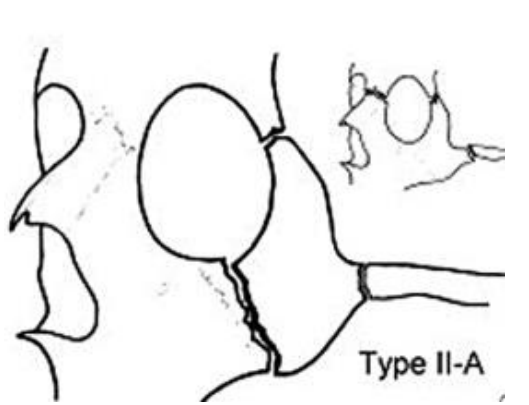
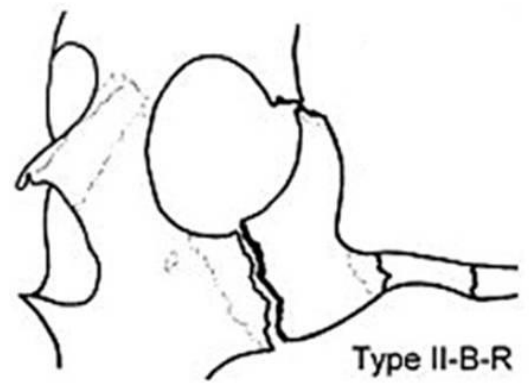
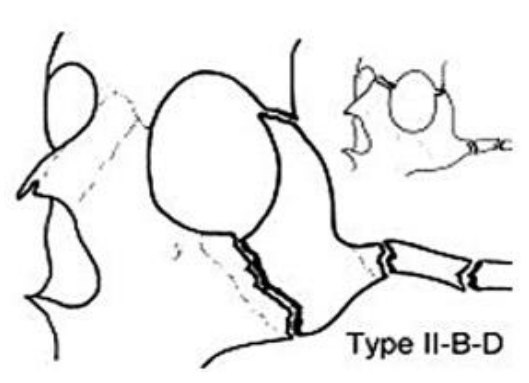
The use of temporary stabilization after reduction of zygomatic arch fractures minimizes the need for open approach which has potential complications and hence a debatable topic and as its efficacy is not reviewed. Hence this study was done to analyze the efficacy of external temporary stabilizing acrylic splint in indirectly reduced zygomatic arch fracture.

MATERIALS AND METHODS:

This prospective study was done on six cases which were clinically and radiographically diagnosed as fractures involving zygomatic arch. Among those cases, four of them were isolated zygomatic arch fractures and two of them were zygomatico maxillary complex(ZMC) fractures. All the patients were male. Restricted mouth opening and facial asymmetry due to depressed zygomatic arch were distinguishly seen in all the patients. Radiographical confirmation was done by using conventional radiograph in submentovertex view. The study was based on Ozyazgan classification of zygomatic arch and the patients were assorted accordingly.

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OZYAZGAN¹⁷ CLASSIFICATION OF ZYGOMATIC ARCH FRACTURES

 <p style="text-align: right;">Type I-A</p>	 <p style="text-align: right;">Type I-B-V</p>
<p style="text-align: center;">CASE NO: 03 CASE NO: 02</p>	<p style="text-align: center;">CASE NO: 04 CASE NO: 01</p>
 <p style="text-align: right;">Type I-B-D</p>	 <p style="text-align: right;">Type II-A</p>
	<p style="text-align: center;">CASE NO: 06</p>
 <p style="text-align: right;">Type II-B-R</p>	 <p style="text-align: right;">Type II-B-D</p>
	<p style="text-align: center;">CASE NO: 05</p>

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The surgical procedure was done under general anesthesia either by direct or blind nasal intubation. Surgical site preparation was done using betadine. The method of approach used were Gillie's temporal approach and Keen's intraoral approach. Amongst the six patients, four of the patients were operated using the former approach and two of them were operated using the latter approach. The armamentarium encompasses local anesthesia, Bard Parker blade size no. 15, medium artery forceps, Molt's periosteal elevator, zygomatic awl big and small, acrylic splint, 26-gauge wire, 3-0 vicryl and 3-0 ethilon.

Briefly describing, making of the acrylic splint involves wax adaptation to the shape of zygomatic arch on a dried skull and self-cure acrylic was used with either sprinkle technique or dough technique. After curing, the acrylic splint was smoothed and polished to avoid any injury to the patient. To ensure the stability of the splint in position, two grooves were made on the upper surface of the splint to engroove the wires.

Out of six cases, four cases were isolated zygomatic arch fracture. Incision marking for Gillies' temporal approach was done (image 1). Local anesthesia was administered. Skin incision was placed using no. 15 blade. Layer by layer dissection done. Temporalis fascia identified. A small incision placed and Rowe's zygomatic arch elevator was passed through it (image 2).



Figure 1: Adaptation of wax over the zygomatic arch in a dried skull



Figure 2: self cured acrylic splint

The elevator was directed towards and beneath the zygomatic arch. Reduction was done by upward lifting of the zygomatic arch and fanning out along the zygomatic arch was done confirming the reduction of zygomatic arch fracture.

A 26-gauge wire was passed transcutaneously surrounding the zygomatic arch using a zygomatic awl (image 3). Acrylic splint framed to the contour of the zygomatic arch was adapted to the external surface of the zygomatic

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arch (image 4). A betadine soaked gauze was placed under the splint in order avoid pressure over the skin. The acrylic splint was positioned and fixed (image 5). Closure was done using 3-0 vicryl and 3-0 ethilon.

Two cases zygomatico maxillary complex fracture. In one case, three-point fixation in frontozygomatic suture, infra orbital rim and zygomatic buttress region was done. Zygomatic arch reduction was done by the same intra oral approach made for zygomatic buttress plating. Reduction of the arch was done and the external acrylic splint fixation was done as described above. In another case, two-point fixation was done in frontozygomatic suture and infraorbital margin and indirect zygomatic arch reduction was done through Keen's approach and external acrylic splinting was done. Closure was done using 3-0 vicryl and 3-0 ethilon in both patients. Both of them were extubated uneventfully. Proper antibiotics and analgesics were given to control the post-operative infection and pain.



Image 1



Image 2



Image 3



Image 4



Image 5

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Image 1: Incision marking for Gillies' temporal approach.

Image 2: Reduction of zygomatic arch using Rowe's zygomatic elevator.

Image 3: Zygomatic awl placement below the zygomatic arch for wire insertion

Image 4: Acrylic splint adapted and stabilization via 26-gauge wire

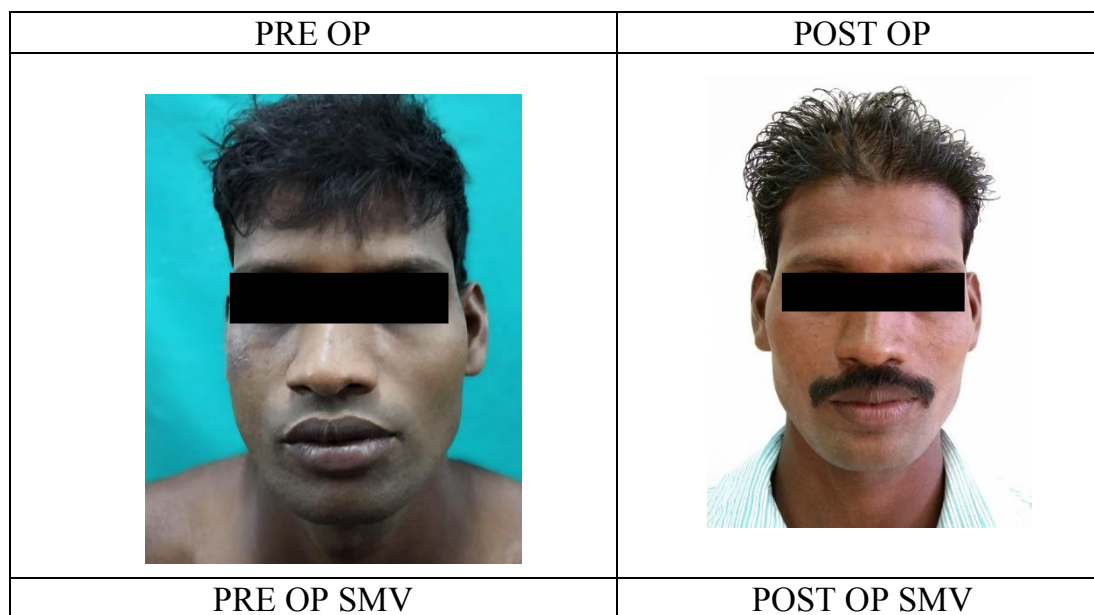
Image 5: External acrylic splint after stabilization.

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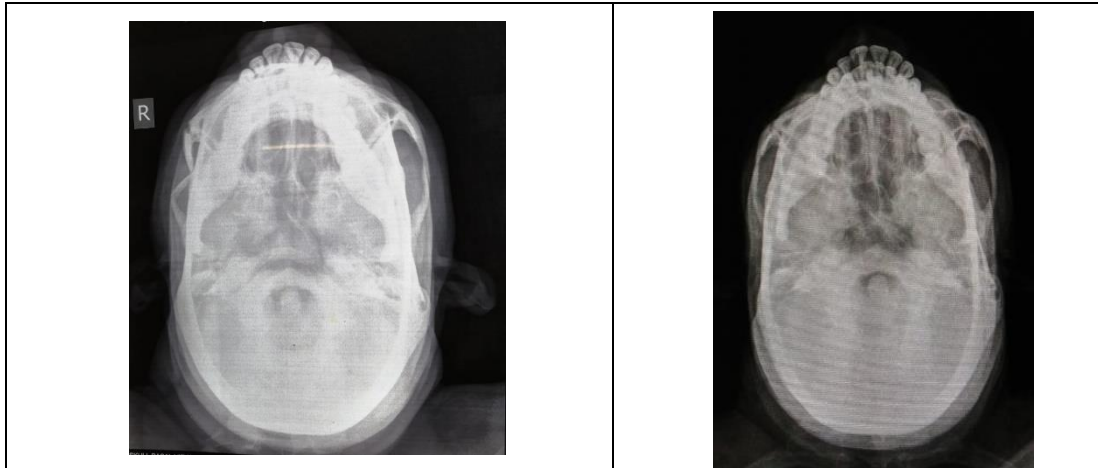
CASE REPORTS:

Table 1:

S.No	Criteria	Case no 1	Case no 2	Case no 3	Case no 4	Case no 5	Case no 6
1.	Age/ Sex	35 /M	25/M	22/M	32/M	28/M	35/M
2.	Etiology	RTA	RTA	RTA	RTA	RTA	RTA
3.	Classification	Type I B V	Type I A	Type II B	Type I B V	Type II B D	Type II A
4.	Pain	3	3	2	3	4	3
5.	Mouth opening	15 mm	26 mm	15 mm	23 mm	20 mm	27 mm
6.	Mandibular range of movements	Restricted	painful	Restricted	Restricted	Restricted	Restricted
7.	Facial asymmetry	Present	Present	Present	Present	Present	Present



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RESULTS:

In this study, all the patients were male and the age group was between 22 - 35 years. Road traffic accident was the cause in all the cases. No remarkable medical history in all the patients. They were all operated under general anesthesia and it was uneventful. The pain was greatly reduced post operatively. One patient had restricted medial movement in the right eye and it was self-corrected by doing eye movement exercises. Paresthesia was present in two of the patients which was restored.

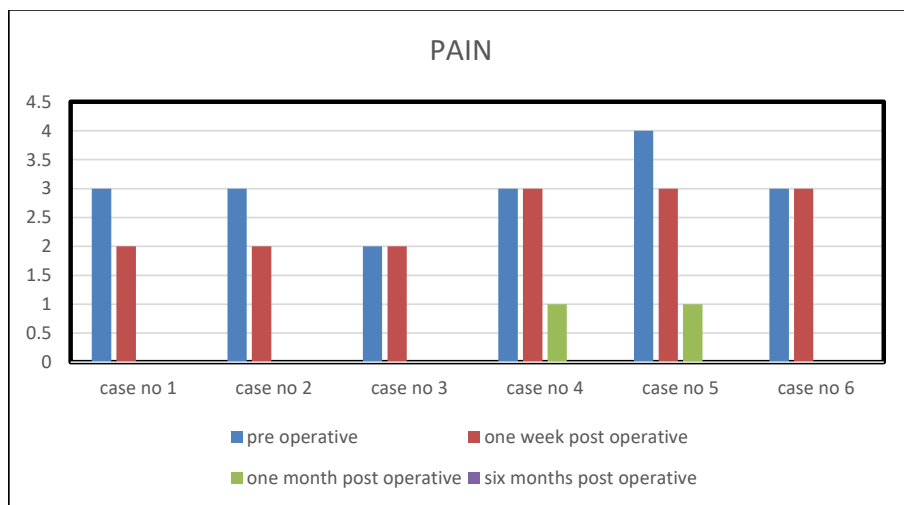


Chart no: 01

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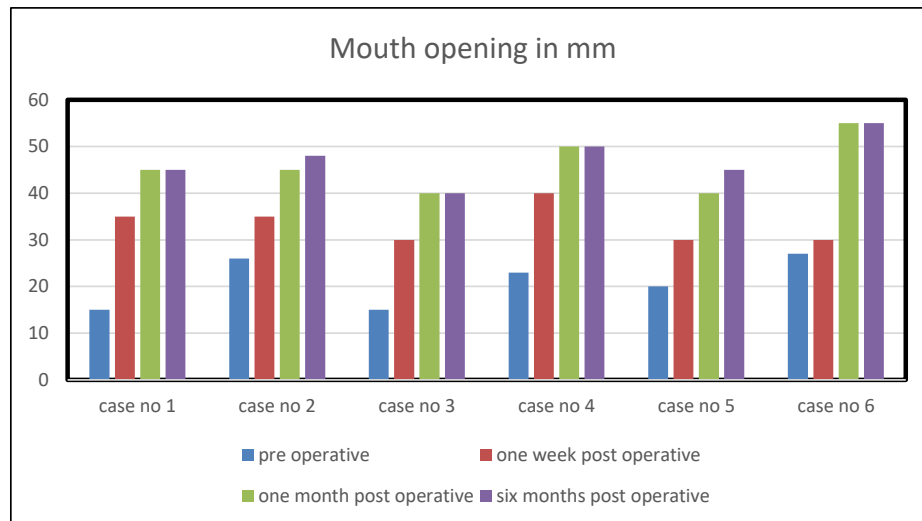


Chart no:02

Table 2: Facial asymmetry:

s.no	Pre operatively	One month post operatively	Six months post operatively
Case no 1	Present	No depression	No depression
Case no 2	Present	No depression	No depression
Case no 3	Present	No depression	No depression
Case no 4	Present	No depression	No depression
Case no 5	Present	No depression	No depression
Case no 6	Present	No depression	No depression

Table 3: Mandibular range of movements

s.no	Pre operatively	One week post operatively	One month post operatively	Six months post operatively
Case no 1	Restricted	Painful	Normal	Normal
Case no 2	Painful	Painful	Normal	Normal
Case no 3	Restricted	Painful	Normal	Normal
Case no 4	Restricted	Painful	Normal	Normal
Case no 5	Restricted	Painful	Normal	Normal
Case no 6	Restricted	Painful	Normal	Normal

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Table 4:

Criteria	Facial nerve weakness	Infection control	Skin necrosis	Scar	Patient acceptance
Case no 1	Absent	Good	Absent	No scar	Good
Case no 2	Absent	Good	Absent	No scar	Good
Case no 3	Absent	Good	Absent	No scar	Good
Case no 4	Absent	Good	Absent	acceptable	Good
Case no 5	Absent	Good	Absent	No scar	Good
Case no 6	Absent	Good	Absent	No scar	Good

DISCUSSION:

Zygomatic bone is the prominent part of the face which makes it more prone for injuries. Zygomatic arch is significant for the facial contour and helps in determining the facial width. Zygomatic bone fractures are second common facial injuries next to nasal bone fractures. It has a peak incidence in the second and third decade of life¹. The etiology of zygomatic bone fractures includes road traffic accidents, assaults, falls, sports injury.

Clinical features include restricted mouth opening, asymmetry due to depression of the zygomatic arch, malar flattening, diplopia, enophthalmos, subconjunctival hemorrhage^{2,5}. There are various classification of zygomatic arch fracture^{11,12,14}. This study was based on ozyazgan¹⁷ classification of zygomatic arch fracture. This classification is exclusively for zygomatic arch which is kind of interesting and the study suit into this classification.

Management of zygoma fractures, based on the severity of the fracture, can vary from conservative management to 5-point fixation as a

latest technique³. On historical evolution, various methods have been postulated for the approach of zygomatic arch. But still, Gillies' approach has been the standard approach for zygomatic arch fracture, as it is easy to perform and rare chances of facial nerve injury, minimal scar within the hairline. Keen's method, intra oral approach has been used to avoid external scar. In case of zygomatic fractures, it can also be used to explore and examine the anterior wall of maxillary antrum, zygomatic buttress region. We have used Gilles' approach in four cases which were isolated zygomatic arch fractures. Two cases were zygomatic complex fractures and the same intra oral incision was used for reducing the zygomatic arch fracture.

The anatomical relationship of zygomatic arch and the facial nerve makes the surgeon to think regarding open approach. Open approach to zygomatic arch has potential complications like facial nerve weakness, scarring, alopecia, temporal hollowing⁸. That is why, either Gillies' or Keen's approach has been always the choice of approach. Despite of potential risk, communitied arch fracture needs

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open reduction and internal fixation. In order to avoid such complications, temporary stabilization can be used as an adjuvant procedure.

Temporary stabilization of zygomatic arch can be either internal or external. External devices include orthopedic splint (Zimmer splint), foam padded aluminium splint, custom-made acrylic splint, wooden tongue blade, Steinmann pin, tampons, Kirschner wires, metal eye shield, aqua splint and even mandibular reconstruction plate. Internal stabilization includes Foley's catheter, epistaxis balloon catheter, silicone nasoendogastric tube, alloderm.

Richard M Graham¹⁹ propounded the risk of perforation of the balloon from instrumentation or sharp bony edges and it may serve no purpose. Wooden tongue blade cannot be manipulated to the shape of the arch. Use of internal stabilizers might have potential risk for retrograde infection¹⁸. Of the above mentioned materials, custom made acrylic splints are universally accepted. It is architecturally prepared. As described earlier, it is prepared in dried skull in the contour of the zygomatic arch (figure 1 and 2). In the circumstances, where the fracture segments are not reduced properly, reduction can be done post-operatively by outward traction of the wire under local anesthesia. The wire is then tightened and the splint is stabilized.

In order to prevent infection, strict asepsis and sterilization protocol was followed. Post operatively pain was well managed. The following regimens were given (table 5).

- | |
|---|
| 1. Injection Cefotaxim 1g/IV/BD |
| 2. Injection Diclofenac Sodium 75mg/IM/BD |
| 3. Injection Ranitidine 50mg/IV/BD |
| 4. Injection Dexamethasone 8mg/IV/STAT dose intra operatively and 8mg/IV/BD for 2 days followed by 4mg/IV/BD for one day. |

Table 5

Pain was evaluated using visual analog scale(VAS). In cases no 05 and 06, they experienced severe pain which was further controlled by administering injection Paracetamol 100 mg on the day of surgery followed by Diclofenac injection from the first post-operative day. Injection metronidazole was added in cases no. 05 and 06, as intraoral approach was done. With the above mentioned regimen, studied by Shridhar et al²⁰, post-operative pain and infection was greatly controlled (table 5).

Edema was present in cases no 05 and 06 as both the cases were zygomatic complex fracture. Perhaps, the soft tissue retraction and the time taken for the surgery could have been the reason for the post-operative edema. Inj. Dexamethasone 8mg was given intra operatively as STAT and 8mg/IV/BD was given post operatively (table 5). The swelling was diminished on the post-operative 4th day and case no. 5 took another couple of days for the swelling to get reduced and it settled then.

As four cases were isolated zygomatic arch fractures and two were

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zygomatoco complex fractures, paraesthesia was present in the malar region and upper philtrum region in those two cases which were improved by the release of infra orbital nerve. Paraesthesia was not present in the six months follow up which denotes the recovery of the infra orbital nerve. The sensory disturbance of infra orbital nerve is the most common finding in orbitozygomatic fractures as stated by Erik Neovius¹⁶ et al in his study.

Restoration of the function (restricted mouth opening, restricted mandibular range of movements) and esthetics (facial asymmetry due to depressed zygomatic arch) will be the foremost aim of the surgical management of the zygomatic arch. Average pre-operative mouth opening was between 15-27mm, whereas post-operatively it was 40-55mm (chart no:2). This improvement shows good reduction of the zygomatic arch. Long term trismus was experienced by B. Veale²² due to the scarring of the temporalis muscle where circumferential wires have accidentally penetrated the muscle. We did not experience such a long term trismus. All the patients in our study had good range of mandibular movements and esthetics was well restored.

It is of prime importance to monitor eye signs in zygomatoco maxillary complex fractures. In one of our cases (case no.06), there was a restricted medial movement in the right eye post operatively. This could be due to the edema of the soft tissues or muscle entrapment during fixation in the frontozygomatic suture region. Measures were taken to reduce the edema. Patient was educated to do eye

movement exercises and it was self-corrected in the late post-operative follow ups. All the other patients had no significant eye signs.

Facial nerve weakness and scarring are the suspected complications of external splinting and the expected complications of open approach. Facial nerve weakness can occur due to the compression of the acrylic splint over the facial nerve. None of the patients in our study had facial nerve weakness.

Skin necrosis is due to pressure necrosis of the skin as the splint will be in place for one or two weeks. Betadine soaked gauze was placed to avoid the skin necrosis as done by Puneet Wadhvani¹⁸. Our patients had no skin necrosis.

Orhan guven⁹ and Khaja Atheruthin¹³ removed the splint in two weeks. We removed the splint in one week which was more than enough. None of the patients had any relapse of the fractured fragments.

The transcutaneous insertion via zygomatic awl creates an acceptable scar in the face. All the patients except one patient (case no: 04) had no scar, although it was an acceptable scar. Patient acceptance was good when compared to the use of traction-pin.

Conclusion:

Zygomatic arch plays an important role in facial esthetics as it gives contour to the face. Restoring both the functional and esthetic problem should be the aim of the surgeon. From this study, following conclusion remarks were made.

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Ozyazgan Classification can be considered as it is exclusively for zygomatic arch. Temporary stabilization is proved to be better but proper reduction of the zygomatic arch is much more important. Although, the author could not come to a definitive conclusion on the efficacy of the temporary stabilizing acrylic splint in zygomatic arch fracture. But from the experience, in certain situations of zygoma fracture, where stabilization of post reduced fragments should be considered, these type of temporary stabilizing splints made in acrylic with considerable stability is helpful in esthetic and functional outcome. As a young oral maxillofacial surgeon who handle a lot of simple fracture should consider a custom made acrylic splint as one of the armamentarium in management of zygomatic arch fracture.

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