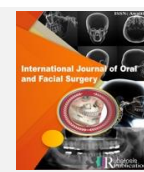




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### Evaluation of the complications associated with ORIF in the management of mandibular fractures- A 7 years retrospective study

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#### ABSTRACT



**Aim:** This study is intended to evaluate the incidence of post-operative complications associated with ORIF in the management of mandibular fractures

**Materials and Method:** A total of 224 patients who were diagnosed clinically and radiographically to have sustained mandibular fractures and were managed with ORIF between the period of June 2012 to May 2019 were included. Patient's records were analysed to evaluate the incidence of post-operative complications that are associated with ORIF in the management of mandibular fractures.

**Results:** It was observed that patients who underwent ORIF for the management of condylar fractures reported with relatively higher number of complications when compared to mandibular angle / body / parasymphysis fractures. Wound dehiscence, occlusal disturbance, paresthesia and infection leading to the removal of miniplates in general are the notable complications following ORIF.

**Conclusion:** It can be concluded that the most common complications associated with ORIF in the management of mandibular fractures were majorly due to the surgical approach used than the type of fixation devices/techniques.

**Keywords:** open reduction; mandibular fractures; complications.

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#### INTRODUCTION

In spite of the mandible being the largest and the strongest bone of the facial skeleton, it is the second most commonly fractured bone after the nasal bones.<sup>[1]</sup> The magnitude and the direction of force delivered in addition to the anatomical area to which it is delivered determine the pattern of fracture. They can be treated by closed reduction methods in the form of intermaxillary fixation (IMF) or by open reduction and internal fixation (ORIF). ORIF has numer-

ous advantages over closed reduction in the management of mandibular fractures amongst which facilitating anatomical reduction of the fracture fragments and early return to normal function are considered to be the forerunners. <sup>[2,3,4]</sup>

With the advent of new biomaterials, fixation devices and fixation techniques, ORIF has become the mainstay in the management of mandibular fractures. Despite the advances, ORIF has its own share of complications.<sup>[5,6,7]</sup> Even though the outcomes are generally promising, postoperative complications associated with ORIF in mandibular fractures are not unusual. When postoperative complications are encountered they significantly impact the postoperative morbidity, quality of life, and health care costs. Literature lacks strong evidence pertaining to the overall complication rates associated with ORIF in the management of mandibular fractures. Hence, this study is intended to evaluate the incidence of post-operative complications associated with ORIF in the management of mandibular fractures

#### MATERIALS & METHOD

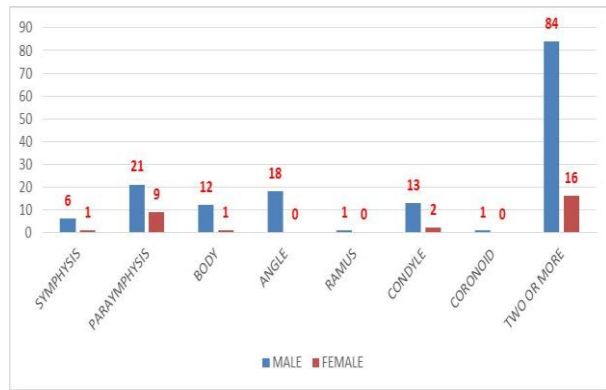
A retrospective study was conducted based on the records of patients treated for mandibular fractures in our unit during the period June 2012-May 2019. A total of 224 patients who sustained a mandibular fracture and were treated for open reduction and internal fixation under GA in our unit were included.

Patients who sustained a hairline fracture and did not require intervention, pediatric patients, geriatric patients with complete edentulous mouth and patients with diabetes, hypertension, and other systemic illnesses that cause immunodepression are excluded from the study. Only those patients who were managed surgically and subsequently followed up for at least one year to see their after effects were included.

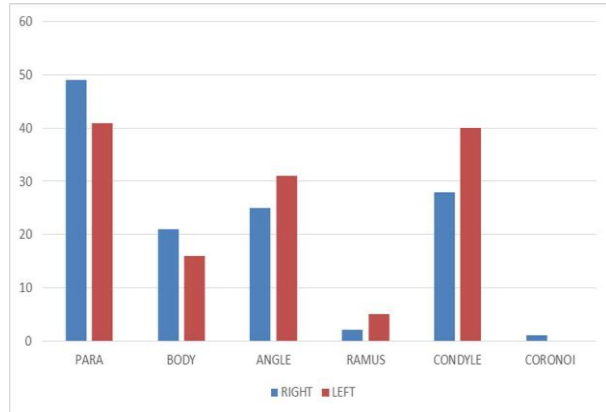
The surgery was done under GA with nasotracheal intubation. Postoperatively, the patients were not put on IMF; standard antibiotics and oral nutrition were administered. In order to obtain the data, inpatient record of the patients, their plain radiographs, computed tomography data and clinical photographs were reviewed. Details pertaining to the patient’s age, sex, etiology, surgical approach, type of fixation device and its associated complications were noted. The entire data was tabulated and analyzed for the complications associated with ORIF in the management of mandibular fractures based on the anatomical location.

**RESULTS**

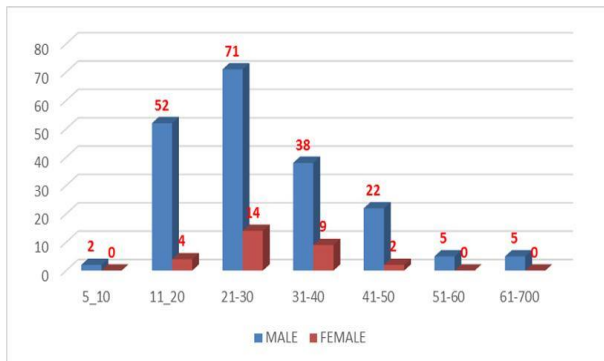
A total of 224 patients who sustained mandibular fracture and were treated for open reduction and internal fixation in our unit were included in this study. The recorded data were analyzed using the Statistical Package for the Social Sciences (SPSS; SPSS Inc., Chicago, IL, USA) software, version 21. Descriptive statistics which included computation of frequency and percentages and chi square tests were performed. Confidence interval was set at 95%. P value < 0.05 was considered statistically significant.



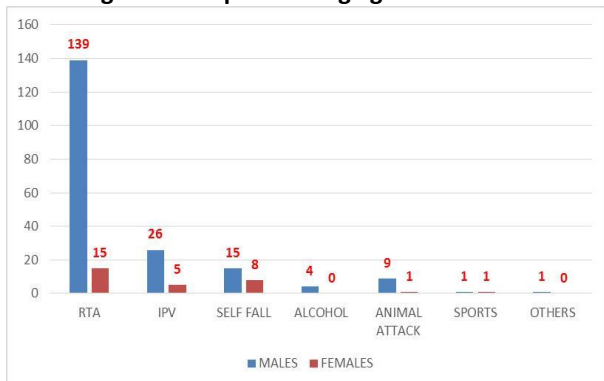
**Figure 3: Graph showing isolated mandibular fractures based on anatomical distribution**



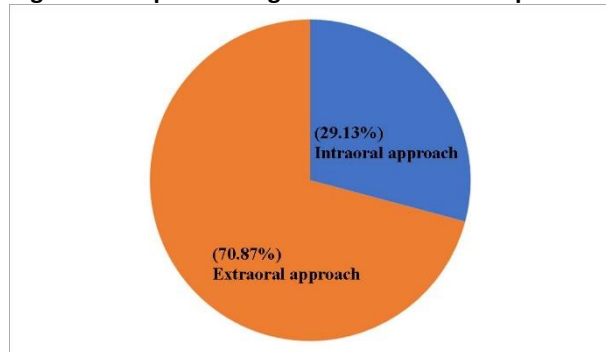
**Figure 4: Graph showing mandibular fracture patterns**



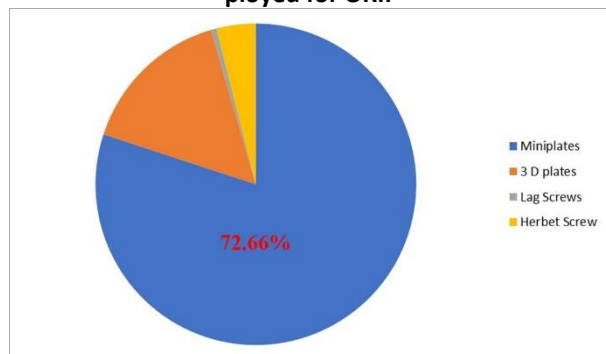
**Figure 1: Graph showing age distribution**



**Figure 2: Graph showing etiological factors for mandibular fractures**



**Figure 5: Graph showing the surgical approaches employed for ORIF**



**Figure 6: Graph showing various fixation devices employed for ORIF**

Among the 224 patients, 195 were male and 29 were female. The age ranged from 7 years to 70 years with a mean age of 28 years. Mandibular fractures were most commonly noticed in the age group of 21-30

**Table 1: Age and sex distribution of mandibular fractures**

Age	Male	Female	Total (%)	Chi square value	df	P value
0-10	2	0	2(1)	6.452	6	0.374 (NS)
11-20	52	4	56(28)			
21-30	71	14	85(38)			
31-40	38	9	47(21)			
41-50	22	2	24(11)			
51-60	5	0	5(2)			
>61	5	0	5(2)			
	195(87)	29(13)	224			

*Inference: There was no statistically significant association between gender and age during fracture (p value 0.374)*

**Table 2: Etiology of maxillofacial fractures according to sex**

Etiology	Male	Female	Total (%)	Chi square value	Df	P value
Rta	139	15	154(69)	12.383	6	0.053 (ns)
lvp	26	5	31(14)			
Self fall	15	8	23(10)			
Alcohol	4	0	4(2)			
Animal attack	9	1	10(4)			
Sports	1	0	1(0.5)			
Others	1	0	1(0.5)			
Total	195	29	224			

*Inference: There was no statistically significant association between gender and etiology of fracture (p value 0.053)*

**Table 3: Table showing isolated mandibular fractures and mandibular fractures associated with other facial bone fractures**

Anatomical area	Male	Female	Total (%)	Chi square value	Df	P value
Mandible	137	25	188(83)	6.358	3	0.095
Mandible + zmc	31	0	31(14)			
Mandible + nasal	3	0	3(2)			
Mandible + lefort-i	2	0	2(1)			
			224			

*Inference : There was no statistically significant association between gender and site of fracture (p value 0.095)*

**Table 4: Table showing mandibular fractures based on anatomical distribution**

Site	Male	Female	Total (%)	Chi square value	Df	P value
Symphysis	6	1	7(4)	9.082	7	0.246 (ns)
Para Symphysis	21	9	30(16)			
Body	12	1	13(7)			
Angle	18	0	21(11)			
Ramus	1	0	1(0.6)			
Condyle	13	2	15(8)			
Coronoid	1	0	1(0.6)			
Two or more	84	16	100(53)			
	156	29	185			

*Inference: There was no statistically significant association between gender and site of fracture (p value 0.246)*

years comprising of 85 patients (38%) followed by 11- 20 years age group comprising of 56 patients (28%) as shown in (Figure 1) and Table 1. Most common etiological factor accountable for mandibular fracture was road traffic accident accounting to 154 patients (69%) followed by interpersonal violence in 31 patients (14%) as shown in Figure 2 and Table 2. In 224 patients, 278 mandibular fractures were noted. Amongst the 224 patients, 188 patients (83.9%) sustained only a mandibular fracture. The

remaining 36 patients (16.1%) sustained a mandibular fracture which was associated with other facial bone fractures with ZMC being the most commonly involved as shown in Table 3. Amongst the 188 patients who sustained pure mandibular fracture, 100 patients (53%) sustained a mandibular fracture at more than one anatomical region as shown in Figure 3 & Figure 4.

The mandibular parasymphysis area is the most commonly fractured anatomical area in the mandible accounting for 90 fractures (32.3%) followed by the condyle of the mandible accounting for 68 fractures (24.4%) as shown in Table 4. Out of the 278 mandibular fractures, 81 fractures (29.13%) were managed through an extraoral approach whereas 197 fractures (70.87%) were managed through an intraoral approach as shown in Figure 5. Straight stainless steel miniplates were used in the management of 202 fractures (72.66%) whereas the rest were treated using 3D plates, lag screws, and Herberts screws as shown in Figure 6.

Most common complication associated with ORIF in this study was neurological disturbances in the form of transient facial nerve and mental nerve paresthesia which resolved within 3–6-month postoperatively. The complications were noted in all kinds of age groups. The mandibular condyle region showed the highest incidence of postoperative complications when compared to another anatomical region in the mandible. Various other complications in the form of infection/plate removal, paresthesia, wound dehiscence, malocclusion, and injury to the tooth, etc. following ORIF procedure in mandible are given in Table 5.

## DISCUSSION

The etiology for maxillofacial fracture varies from one geographical area to another and the age group of the victim. Literature reveals that road traffic accidents are the main reasons for mandibular fractures in developing countries while interpersonal violence is the most common cause in developed countries.<sup>[8,9,10]</sup> Our results are in accordance with previous studies.

Generally, mandibular fractures are seen more commonly in younger males. Majority of the patients in this study were in the age group of 21–30 years accounting for 85 patients accounting for 38%. This is in accordance with previous studies.<sup>[11,12,13,14,15]</sup> A recent study showed the maximum incidence of mandibular fractures in the third and fourth decades of life attributing to more social interactions and reckless driving.<sup>[16]</sup>

Pertaining to the anatomical area involved, the most frequent anatomical area of the mandible that sustained a fracture was the parasymphysis region with 90 fractures accounting for 23.3%, including five bilateral fractures followed by 68 in the mandibular condylar region with 11 bilateral involvements. There were 56 mandibular angle fractures. 37 fractures were noted in the mandibular body region.

Literature in the past have shown that the mandibular condylar region is the most commonly fractured anatomical region in the mandible.<sup>[16,17,18]</sup> In contrary, few studies have shown the mandibular body to be

the most vulnerable region for fracture in the mandible.<sup>[19,20]</sup> However, the results of this study show that the parasymphysis region is the most commonly fractured anatomical region in the mandible. This is in accordance with few studies.<sup>[8,13,21]</sup>

ORIF allows direct visualization of the fracture site and facilitates an operator to ensure achieve necessary anatomic reduction thereby promoting primary bone healing without the need for intermaxillary fixation for immobilization.<sup>[6]</sup> Initial studies in the laboratory showed that the application of rigid internal fixation devices for mandibular fractures resulted in a high rate of iatrogenic complications.<sup>[22]</sup> They attributed it to the more complex anatomy in these sites and the limited dental education of the majority of participants. The presence of teeth makes treatment planning options more limited and their successful execution more complex.

Initial studies have demonstrated no significant reduction in complication rates when comparing ORIF with standard treatment.<sup>[23,24]</sup> It has been hypothesized that complication rates with ORIF are inversely related to operator experience because of the demanding nature of the technique.<sup>[25,26]</sup> However, recent studies showed a downward trend in complications associated with ORIF with increase in the experience of the operator. Hence it can be advocated that the chances of complication following ORIF would be minimal in the hands of an experience operator.

Literature reveals that ORIF is associated with numerous complications in the form of wound dehiscence, occlusal disturbance, paresthesia and infection leading to the removal of miniplates, injury to tooth root, etc. Studies have shown that infection of maxillofacial fractures is the most commonly encountered postoperative complication following ORIF and particularly the mandibular fractures are considered to be associated with the highest rate of infections when compared to other maxillofacial structures.<sup>[27]</sup> Another study reported wound dehiscence to be the most common complication associated with ORIF.<sup>[28]</sup>

However, the results of this study reveal that paresthesia of the nerve is the most commonly encountered complication following ORIF which was observed in 42 patients (18.75%). Out of the 42 patients, 26 patients encountered paresthesia of the lower lip due to mental nerve damage while 16 patients encountered paresthesia of the terminal branches of the facial nerve particularly the marginal mandibular nerve. With regards to mental nerve injury, it was observed in majority of the patients who were treated for parasymphysis fracture. This could be attributed to the fact that in most instances the fracture line runs obliquely very close to the mental foramen and an attempt to dissect the mental nerve or excessive stretching of the tissues in order to facilitate ORIF could have resulted in the nerve injury. The same could be attributed to the facial nerve injury in

subcondylar fractures due to greater soft tissue retraction to permit placement of bone plates. However, all the patients completely recovered in 3-6 months times.

The results of this study reveal that the long-term fracture stability and occlusion were found to be stable and satisfactory irrespective of the kind of fixation device. Out of the 224 patients, 07 patients (03.12%) showed occlusal instability. In the immediate postoperative period, 03 patients treated with miniplate fixation in the anterior mandible showed minor interfragmentary movement which was managed with IMF and did not have any long-term complication. This could be attributed to the poor oral hygiene maintenance of the patients as well as comminuted nature of the fracture in these patients. However, 04 patients treated for mandibular angle fracture showed occlusal instability in the immediate postoperative period. These patients were treated for a concomitant subcondylar fracture on the contralateral side. They were managed with IMF and did not have any long-term complication.

In addition, we have found that the use of lingual acrylic splints assists in alignment of the fracture site in the symphysis, parasymphysis, and anterior body of the mandible prior to open reduction particularly in patients with missing anterior teeth which makes accurate repositioning of the fractured segments difficult.

Injury to the tooth root was noticed in 02 patients (0.89%). This can be attributed to the use of 3 D plates in the parasymphysis fractures where the unmodifiable vertical dimension of these plates makes it challenging in clinical scenarios where the bone height available inferior to the mandibular anterior teeth is less and may result in a damaged tooth root or a plate palpable at the lower border due to its prominence or exposure in the labial sulcus. This is predominantly noted in female patients.<sup>[29]</sup>

Two patients treated for subcondylar fracture developed sialocele which was managed by pressure dressings. Postoperative infection is potentially the most serious complication following ORIF. This study observed postoperative infections following ORIF for mandibular fractures only in 06 patients (2.67%), which could be attributed to the poor oral hygiene maintenance of the patients in addition to the habits like smoking and alcohol consumption in the immediate postoperative period. The use of pressure dressing / suction drains to reduce hematoma and dead space in addition to performing the surgical intervention in the most aseptic conditions possible resulted in the fewer incidences of postoperative infections. Majority of the cases that encountered postoperative infection were in the mandibular angle region leading to hardware failure. The hardware's were removed under local anesthesia following sufficient period of bone consolidation using IMF. Extraoral surgical approaches resulted in fewer complications when

compared to the intraoral surgical approaches in addition to the fact that the extraoral surgical sites healed faster.

Based on the results of this study, it can be concluded that the most common complications associated with ORIF in the management of mandibular fractures were majorly due to the surgical approach employed rather than the type of fixation devices/techniques. ORIF still continues to be the mainstay in the management of mandibular fractures even in the hands of an inexperienced operator.

## CONCLUSION

Mandible is one of the most prominent bones of the facial skeleton. This predisposes the mandible to sustain a higher degree of injury. The management of mandibular fractures has evolved over the years. ORIF has numerous advantages and has proved to deliver better outcome when compared with closed reduction. Despite the evolution in techniques, open reduction and internal fixation (ORIF) has its own share of complications particularly in the hands of an inexperienced operator.

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