

Fracture Mandible Treated with Mini-Plate Fixation with & Without IMF: A Retrospective Comparison

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1. Abstract

1.1. Introduction: Malocclusion is a frequent complication of management of fracture mandible. We adopted two different protocols for treatment of fracture mandible spread over different time period, one with semi-rigid (mini plate) fixation only and other with semi-rigid fixation plus 2 weeks of supplemental IMF and compared the outcome.

1.2. Material and Method: From January 2013 to June 2015 we treated 31 patients having fracture mandible with mini-plates plus 2 weeks of Inter maxillary fixation immediately after surgery. In the subsequent group (July 2015 to December 2017), 30 patients with fracture mandible were treated with same technique but without supplemental IMF. The medical records were analyzed to compare the outcome primarily in terms of occlusion. Implant site infection and mouth opening was also evaluated in order to assess overall complication.

1.3. Result: Most of our patients were male in 3rd decades of life. 75.67 % in first group and 57.5% in second group were anterior fractures (symphyseal and parasymphyseal). The mean follow-up was 11 and 8 weeks in both the groups respectively. Malocclusion was found in 3.2% in first and none in second group. None in first group and 3.33 % in second had significant restriction of mouth opening. Implant site infection was found in 9.6 % in first group and 10% in second.

1.4. Conclusion: We observed no statistically significant differ-

ence in outcome between two groups.

2. Introduction

Historically, bandages of various nature and design were the treatment for fractures of mandible. In late nineteenth century Gilmer introduced Inter Maxillary Fixation (IMF) as a better treatment option for these ailments [1]. Disadvantages like poor oral hygiene, weight loss, temporomandibular joint ankyloses and difficult life style lead to evolution of semi-rigid and rigid fixation as treatment of choice jaw fractures. Plethora of implants are available now for use in Open Reduction and Internal Fixation (ORIF). With the obvious advantages of recent fixation techniques, IMF is still believed to play an important role in treatment of mandibular fractures even today. Some authors are of opinion that supplemental IMF following ORIF yields better occlusal outcome whereas many others do not recommend it [2-8]. In our earlier practice we were using two weeks of IMF after semi-rigid fixation of fracture mandible as a routine protocol in order to achieve favorable outcome. But we observed comparable result in some of our cases where IMF was contraindicated. This led us to exclude the supplemental IMF from our routine protocol of fracture mandible treatment. After two and half years we analyzed our medical records to evaluate the outcome of treatment in both the groups and compare. Published English literature is scant in studies comparing treatment outcome of mandibular fractures with and without supplemental IMF following mini-plates fixation. We did that in order to reach a conclusion in this regard.

3. Materials and Methods

We analyzed the medical records to assess the outcome of treatment in patients with fracture mandible managed with mini plate fixation without supplemental IMF and those treated by mini plate fixation plus supplemental two weeks of IMF. The first group of patients (Group – A) included those having mandibular fractures treated with ORIF (using 2 mm titanium mini-plates) followed by two weeks of supplemental inter maxillary fixation. They received treatment in between January 2013 to June 2015. In the second group (Group – B) from July 2015 to December 2017 the patients were treated by ORIF (using 2 mm titanium mini-plates) only, without supplemental IMF. Patients of pediatric age group, edentulous patients, those having comminuted fractures of mandible and with condylar fractures were excluded. Similarly, unconscious patients and patients with a history of convulsive disorders are also excluded.

We followed a standard protocol for management of all patients having fracture mandible diagnosed clinically, except the supplemental use of IMF for 2 weeks following surgery in one subset. All of them were subjected to 3D CT scan of skull and mandible for confirmation of diagnosis. Then they underwent ORIF under general anaesthesia with naso-tracheal intubation as early as they became fit for the same. Fracture segments were reduced manually and Erich's arch bars tied to both maxillary and mandibular arches. Secondary tie wires were used to achieve IMF in occlusion. Intra-oral approach was preferred except for those having external lacerations over the fracture. Semi rigid fixation performed using titanium mini-plates (2.0 mm system) and screws of various lengths. Fixation of fractures was performed following Champy's principles of osteosynthesis [9, 10]. Two mini-plates were used for anterior fractures and single plate for mandibular angle fractures

along the oblique line. 2x10 millimeter screws were used for the plates of inferior margins and 2x6 millimeter screws for plates of superior location overlying the tooth roots. After the fixation, occlusion was verified once again and the wound sutured. In group – A patients IMF was retained for a period of 2 weeks after surgery. Whereas in group – B patients, the secondary tie wires were removed after completion of surgery and the mouth left open.

During follow up patients were evaluated for occlusion, mouth opening, implant infection and neurological complications. We documented occlusion grouped into three categories - (a) normal (b) minimally deranged - which required minimal occlusal treatment to achieve normal occlusion and (c) grossly deranged – those who would necessitate a surgical correction to get back the normal occlusion. Mouth opening was recorded by measuring inter-incisor distance and grouped into three categories (< 3.0 cm, 3.0 – 4.5 cm and > 4.5 cm). Inter incisor distance of less than 3 cm was considered as significant restriction of mouth opening, 3.0 to 4.5 cm average and greater than 4.5 cm as good.

We compared the outcome between both the groups using Pearson's Chi square test considering probability value of less than 0.05 to be statistically significant.

4. Result

After using the exclusion criteria, a total of 61 patients with total 77 fractures, were included in this study. Group - A had 31 patients and 30 patients in Group - B. The details of our observations (Table 1 & Table 2) are summarized below.

Out of 31 patients in group – A 29 were male and 2 females. Similarly, in group – B out of 30 patients 28 were male and 2 being female. In group – A age of the patients ranged from 17 to 56 years with a mean of 29.35 years and in group – B the range was 16 to 57 years with a mean of 30 years (Table 3).

Table 1: Patient details – group A

Patient Sl no.	Age (Yrs)	Sex	Fracture site	Trauma - ORIF Interval (Days)	Immediate post op occlusion	Follow up (Wks)	Final occlusion	Mouth opening (cm)	Implant site infection
1	25	M	PS (Lt)	5	N	8	N	5	
2	18	M	A (Lt)	7	N	8	N	4.5	
3	24	M	A (Lt)	4	N	10	MD	4.8	
4	27	M	S	6	N	9	N	4.8	
5	20	M	R (RT)+ PS (Lt)	3	N	7	MD	4	Yes
6	17	M	S	1	N	8	N	5	
7	46	M	S	8	N	6	N	4.8	
8	32	M	A (Rt)	4	N	9	N	4.7	
9	27	M	PS (Lt.)	10	N	10	N	4.9	
10	56	M	PS (Rt)	7	N	8	N	4.8	Yes
11	27	M	A (Lt) + PS (Rt)	8	N	8	MD	4	
12	18	F	S	5	N	8	N	4.2	
13	28	M	R (Rt)	2	N	10	N	3.2	

14	55	M	S	4	N	9	N	4.7	
15	30	M	S	7	N	10	N	4.5	
16	29	M	B (Rt)+PS (Lt)	42	MD	78	GD	3.5	Yes
17	31	M	PS (Rt)	6	N	12	N	5	
18	21	M	PS (B/L)	8	N	11	MD	4	
19	28	M	A (Lt)	4	N	7	N	5.2	
20	32	M	S	7	N	8	N	4.6	
21	52	M	PS (Rt)	5	N	8	N	4.2	
22	19	M	PS (B/L)	8	N	6	N	3.8	
23	31	M	PS (LT.)	6	N	10	N	4.5	
24	27	M	S	6	N	10	N	4.8	
25	19	M	PS (Rt)	5	N	9	N	4.2	
26	25	M	A (Rt) + S	8	N	8	MD	3	
27	21	M	S	7	N	11	N	3.5	
28	30	M	PS (Rt)	6	N	10	N	4	
29	46	M	PS (Rt)	3	N	10	MD	4.2	
30	24	F	PS (Lt.)	7	N	9	N	4.5	
31	35	M	S	2	N	8	N	4.9	

Table 2: Patient details - Group B

Patient Sl no.	Age (Yrs)	Sex	Fracture site	Trauma – ORIF Interval (Days)	Immediate post op occlusion	Follow up (Wks)	Final occlusion	Mouth opening (cm)	Implant site infection
1	33	M	PS (Rt)	2	N	8	N	4.7	
2	22	M	A (Rt)	5	N	6	N	5	
3	24	M	PS (Rt)+A (Lt)	24	N	8	MD	5.2	
4	27	M	PS (Lt)+A (Rt)	3	N	8	N	4.8	Yes
5	48	M	B (Rt)	2	N	7	N	4.8	
6	21	M	S	1	N	6	N	4.6	
7	34	M	PS (Rt) + R (Lt)	7	N	7	N	4.6	
8	24	M	A (Lt)	2	N	8	N	4.7	
9	44	M	PS (B/L)	4	N	8	N	3.8	
10	19	M	S	1	N	30	MD	4.6	
11	41	F	A (Lt)	5	N	7	N	4.8	
12	23	M	B(Rt)	3	N	8	N	4.7	
13	57	M	PS (Lt)+A (Rt)	2	N	6	N	2	
14	23	M	R (Lt)	7	N	6	N	5	
15	28	M	S	6	N	8	N	4.8	
16	19	M	B (Lt)	6	N	6	N	5.2	
17	24	M	PS (Rt)+ R (Lt)	8	N	7	N	4.9	
18	43	M	PS (Lt)	7	N	8	N	4.7	
19	42	M	A (Rt)	5	N	7	N	4.6	

20	35	M	S	3	N	7	N	4	
21	18	M	PS (Rt)	8	N	8	MD	5	
22	20	M	PS (Lt)+A (Rt)	2	N	8		5.8	
23	28	F	PS (Lt)	3	N	8	N	4.8	Yes
24	25	M	PS(Rt)+A (Lt)	5	N	7	N	4.6	
25	30	M	PS (Lt)	13	N	6	N	5	
26	45	M	PS (Lt)	3	N	7	N	4.5	
27	16	M	R (Rt)	2	N	8	N	4.6	
28	23	M	S	10	N	7	N	4.8	
29	25	M	PS (Lt)+A (Rt)	5	N	7	N	4.7	Yes
30	29	M	PS (B/L)	6	N	8	N	4.2	

Table 3: Age group

Age group	Group – A	Group – B
< 10	0	0
11 – 20	6 (19.35 %)	5 (16.67 %)
21 – 30	15 (48.38 %)	15 (50 %)
31 – 40	5 (16.12 %)	3 (10 %)
41 – 50	2 (6.45 %)	6 (20 %)
51 – 60	3 (9.67 %)	1 (3.33 %)
>61	0	0
Total	31	30

Interval between trauma and the surgery (ORIF) in group – A varied from 24 hours to 6 weeks, with a mean of 6.87 days. In group – B, it ranged from 24 hours to 24 days with a mean of 5.3 days. One patient in each group were taken up for surgery after an interval of more than three weeks because of delay in their recovery from neuro trauma. As per the anatomical distribution of fractures, anterior fractures (symphyseal and parasymphyseal) constituted the majority with 75.67 % in group – A and 57.5 % in group – B (Chart - 1). 6 patients in group – A and 10 in group – B had double fractures. By the end of the procedure occlusion of all the patients were maintained.

The occlusion was normal in 77.5 % and 90 % of patients in group – A and B respectively (Chart - 2). Occlusion was grossly deranged in one patient (3.2 %) in group –A and none in group – B. Occlusion was minimally deranged in 6 (19.3 %) of the group – A and 3 (10 %) in group – B. Their occlusion could be rectified by minimal occlusal treatment.

No one in group – A and one (3.33 %) in group – B had inter-incisor

opening less than 3.0cm (Chart - 3). 45.2 % of patients in group – A and 83.33% of patients in group – B got back their mouth opening more than 4.5 centimeters. Amongst the other complications implant site infection was found in 9.6 % of cases in group – A and 10 % of cases in group – B. Neurological complications were noticed in one (3.2 %) of group – A patients and none in group – B. Overall malocclusion, restricted mouth opening (< 3.0 cm), and neurological complication were found in 1.64 % each and implant infection in 9.84 % of patients. The total complication rate was found to be 14.76 % in entire series.

The mean follow-up period was 11 weeks in group – A and 8 weeks in group – B. Follow up period varied from 6 weeks to 18 months in group – A and 6 weeks to 30 weeks in group – B.

Using Pearson’s Chi square test in order to analyze the most important complication (grossly deranged occlusion), we found no statistically significant difference between the two groups (p = 0.98).

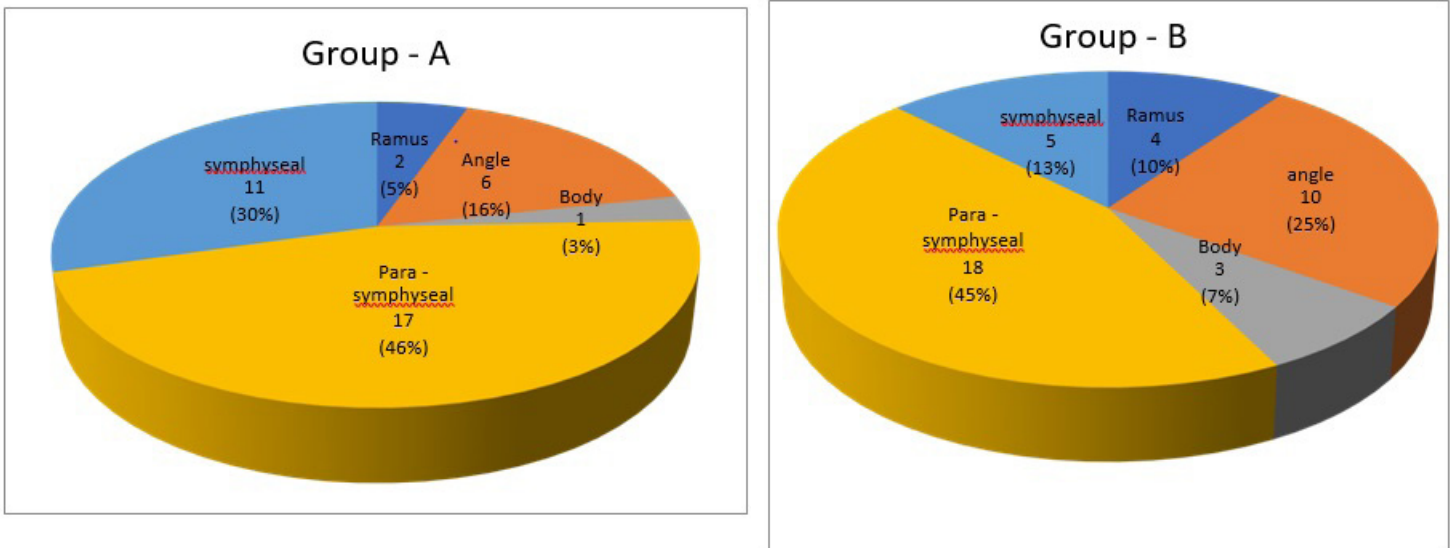


Chart 1: Anatomical distribution of fractures

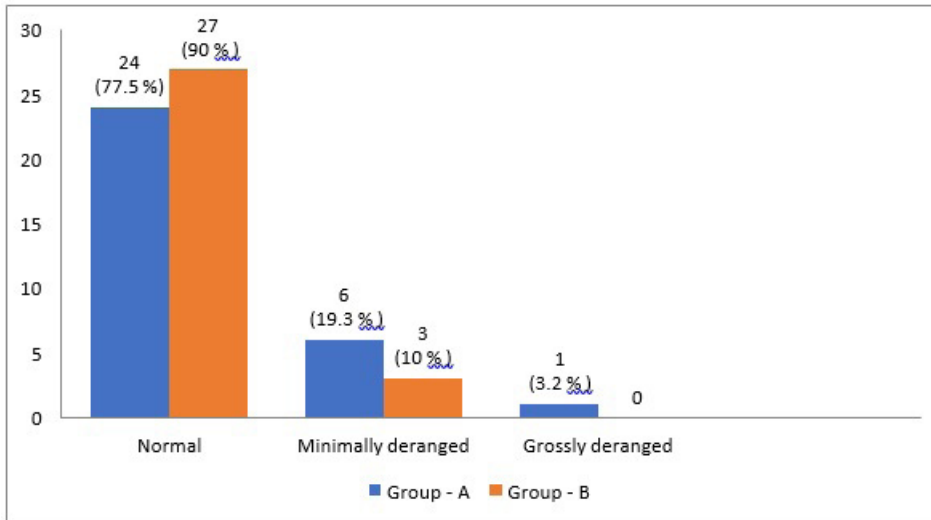


Chart 2: Post – op Occlusion

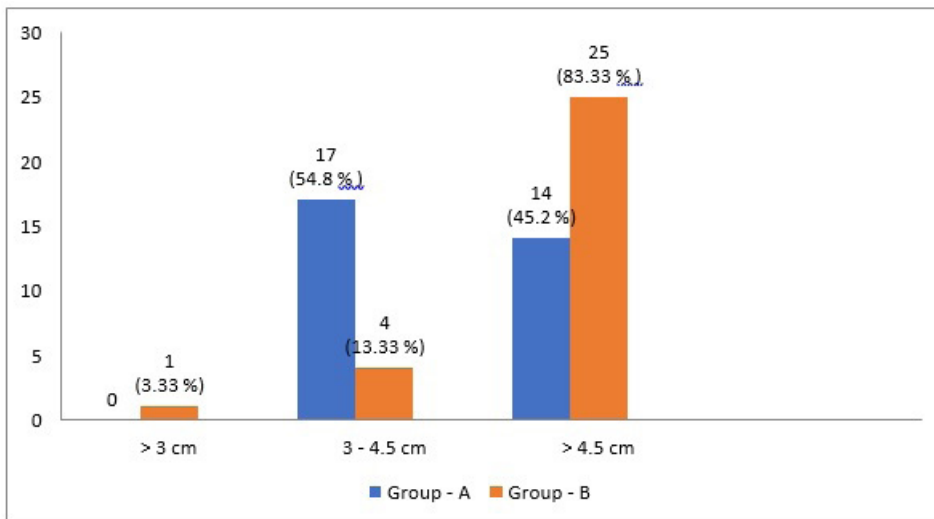


Chart 3: Post – op Mouth opening

5. Discussion

In this study we evaluated usefulness of 2 weeks supplementary Inter maxillary fixation following mini plate fixation of mandibular fractures. The reasons for adopting this semi-conservative approach (using IMF which is outdated and known for its obvious complications) when we are subjecting our fractures to internal fixation are many. Firstly, we experienced the occlusion to be disturbed after restoring it to normalcy during surgery (semi rigid fixation) in a significant number of patients during the early part of our practice. Secondly, we compromised on the duration of IMF from complete conservative recommendation of 6 weeks to only 2 weeks expecting the complications to be negligible. Finally, there are few studies reported in published literature which established satisfactory outcome with post-operative IMF for a shorter period [4-6]. Later on, our observation of negligible complications in some of our patients whose co-morbid conditions did not permit post-operative IMF, led us to modify our protocol for this kind of fracture treatment, ruling out the supplemental IMF. The modification of our protocol (mini plate fixation without supplemental IMF) was based on our own experience and the analysis of published literature some of which favored this approach [2, 7, 18].

In our entire series males dominated the patient population (93.4 %), majority being in their 3rd decade of life (49.2 %). This observation corroborates with those of Kar & Mahavoi and Mehra & Murad who had similar findings in their respective series [12, 13]. Fractures in our series were mostly situated in anterior mandibular region (parasymphiseal and symphyseal making up 66.2 %) with parasymphiseal region of mandible being the commonest after excluding fractures of condylar region. The reason of anterior part of mandible being involved more commonly in trauma may be attributed to frequent use of motorcycles for commutation in this part of world precipitated further by non-use of helmets by teenagers. The finding is similar to those of Kar & Mahavoi and Yildiran et al and Prabhakar C et al [12, 14, 15].

We had complications in 14.76 % of our cases with grossly deranged occlusion, restricted mouth opening (< 3.0 cm), and neurological complication in 1.64 % each. Implant infection was found in 9.84 % of our cases. Occlusion was grossly deranged in only one of our group – A patient. This patient had fracture of left angle as well as right parasymphiseal region of mandible along with diffuse axonal injury of brain. He was unconscious and put on ventilator for a significant length of time. It was four weeks after injury when he became fit to undergo mandibular fixation. Proper reduction of fracture fragments could not be achieved during surgery (semi – rigid fixation) and even two weeks of post-operative IMF did not help restoring normal occlusion. Rest others achieved normal or minimally deranged occlusion. The only patient in our entire series which belongs to group – B having severe restriction of mouth opening, was found to have oral sub mucus fibrosis and

hence restriction of mouth opening prior to his trauma. Hence it was not considered as a complication attributable to his trauma or surgery. The overall complication rate is high in comparison to that of Prabhakar et al who had overall postoperative complications in 6.25% of their cases (15). But this is much lower to that of Daif & Emad who had malocclusion in 32%, infection with an extra oral fistula in 21%, wound dehiscence with intraoral exposure of the mini-plates in 17%, and combination of these in 13% [16]. The total rate of complications was 17% and 20% with and without supplemental maxilla mandibular fixation respectively in the series of Valentino and Marentette [2]. Complication rate was also remarkably high in the report of Yajdani [17]. Our complication rate was very close to Goyal et al who had post-operative infection and wound dehiscence in 3 of their 30 patients (10 %) and marginally lower than that of Khiabani and Mehmandoost who observed it to be 12.5% [18, 19]. Complication rate was also significantly lower than that of Bhatnagar et al who had local wound infection in 8 (30%) of their 30 patients [20]. Akhiwu B et al had miniplates infection in 13.8 % of their cases which is higher than that of our implant infection rate [21].

Bolourian et al used supplemental maxillomandibular fixation for a period of 2 weeks after mini-plates fixation of fracture mandible and found negligible complications in their series (4). They used single mini plate and mono cortical screws. Chritah, Lazow & Berger noted 6% complication rate with single locking mini-plates fixation and 1 week of supplemental IMF [5]. Prabhakar C et al observed 2-mm locking mini-plates to be reliable and effective in management of mandibular fractures without postoperative inter maxillary fixation [15]. But these authors did not compare the outcome with and without supplemental IMF.

There are several studies in which authors compared the outcome with different techniques or protocols in cases of fracture mandible. Daif & Emad compared 2 mini-plates with more than 2 mini-plates for patients with single-compound symphyseal and parasymphiseal fractures osteosynthesis and found, 2 mini-plates to yield better outcome [16]. Yazdani J et al compared mandibular angle fractures treated with one and two mini-plates and observed no significant difference between the groups in terms of overall complication rate [17]. Comparing efficacy of lag screws verses two mini-plates in ORIF of mandibular fractures, Goyal M et al and Bhatnagar A et al found the former to be more effective and inexpensive [18, 20]. Similarly comparing the utility of three dimensional mini-plates and standard miniplates Al-Moraissi EA et al in their study and Liu Y et al in their meta-analysis concluded 3D mini-plates were superior in fixation quality and reduction of complications [21, 22]. Whereas some of the studies shown to have no significant difference in terms of occlusal outcome, of locking mini-plates and screws over conventional mini-plates for mandibular fracture fixation [23, 24].

As mentioned earlier, there are few reports available in published literature on comparison between mini plate fixation with and without supplemental post-operative IMF in treatment of mandibular fractures. We compared these two protocols and found no significant difference between them in terms of complications in this study. Our finding was same as observed by Valentino & Marentette, Kumar I et al and Khiabani & Mehmandoost all of whom had similar comparison in their studies with short periods of post-operative supplemental IMF [2, 7, 19].

IMF still has its role in the mini plate osteosynthesis of fracture mandible. In some of the occasion occlusion was achieved with great difficulty after adopting all possible measures to reduce the fracture fragments anatomically, even under anesthesia just before mini plate fixation. Use of locking mini-plates and screws also has not been seen to make significant difference in terms of occlusal outcome in cases of mandibular fractures, though it helped reducing overall complication rate. Even if the fixation is done meticulously, occlusion get disturbed in some of these patients on long term follow up. In such cases 2 weeks of supplemental IMF after mini plate fixation provides better stability and maintains occlusion during the early phase of bone healing. Though supplemental IMF does not add to the cost of treatment, operative time or other morbidity, it is often an unnecessary inconvenience to the patients. Hence instead of making it a routine practice, supplemental IMF can be used judiciously in order to achieve better outcome after mini plate fixation of fracture mandible.

6. Conclusion

Comparing both groups of patients one with 2 weeks of supplemental IMF and the other without; we found no significant difference in outcome between them. Hence supplemental IMF has no definite role in achieving good result in fractures of mandible not involving condyle. Meticulously performed, mini plate fixation can bring the anatomy and function of the fractured mandible back to its pre – injury state without increase in complication rate. Supplemental IMF for a shorter period may be used in cases where occlusion is achieved with difficulty and any suspicion about maintenance of occlusion during the bone healing period. Younger surgeons may use IMF as a routine adjunct during the early part of their clinical practice with adequate precaution for inadvertent vomiting and possible aspiration during early post-operative period.

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