



## COMPARATIVE STUDY: INTER-MAXILLARY FIXATION SCREWS AND ERICH ARCH BAR IN MAXILLO-MANDIBULAR FIXATION IN MANDIBULAR FRACTURES

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### Abstract-

**Aim-** To compare the inter-maxillary fixation screws and erich arch bar in maxilla-mandibular fixation in mandibular fractures. **Materials and Method-** A total number of 60 patients were selected for evaluation of statistically relevant data.

Mandibular fracture patients were randomly divided into two groups after clinical examination and radiographic evaluation- Group I: Maxillo mandibular fixation using erich's arch bar in 30patients; Group II: Maxillo-mandibular fixation using MMF screws in 30patients. Erich's arch bar-All the procedure in placing the dental arch bar was performed under local anaesthesia with their respective nerve blocks. IMF screws-Placement of inter maxillary screws was done under Local infiltration. Maxillo-mandibular fixation will be achieved by using titanium maxillo-mandibular fixation screws. Total number of screws used were 4 in each patient of Group 2. After achieving appropriate Anaesthesia stab incision was given on required site and holes **were drilled**.

**Placement of the screw:** Between canines and premolars; Between 2<sup>nd</sup> premolars and molars. The oral hygiene and glove perforation was calculated using indices and scoring criteria. The results were analyzed using descriptive statistics and making Comparisons between two treatment procedures, with respect to various parameters. Discrete (categorical) data were summarized as in proportions and percentages (%) and Mean  $\pm$ SD (standard deviation).

**Results-** According to unpaired t-test the mean Time taken in placement of Inter-Maxillary fixation screws in group I was significantly less than the time Taken in placement of Erich's arch bar in group I ( $p < 0.001$ ). Intra-operative Gingival score in group I was significantly more than the group II ( $p = 0.007$ ).

**Conclusion-** Inter-maxillary fixation with inter-maxillary fixation screws is more superior as compared to Erich arch bar in the treatment of mandibular fractures. Inter-maxillary fixation screws require less operating time in placement and removal as compared to erich arch bar. Inter-maxillary fixation screws are associated with good maintenance of oral hygiene better gingival health, less trauma to the periodontium and good patient acceptance as compared to arch bars.

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## Introduction-

Facial injuries are increasingly common in modern society. There is an increase risk in incidence of maxillofacial injuries with a change in the life style and mode of transport over the past few years which has resulted in a change of type, mechanism and severity of injury. There has been an improvement in management techniques with better understanding of material and biomechanics. A fracture is a disruption in the continuity of a bone stressed beyond its elastic modulus, with the formation of two or more fragments. The type of fracture produced by an injury depends partly on the magnitude, direction of the force, the age of the patient and the presence of pathology if any. Traditionally fractures are classified by<sup>2</sup>:

The relation of fracture to the site of impact: Direct or indirect fracture

- Completeness: Complete or incomplete
- Mechanism: Bending fracture, torsion fracture, shear fracture, countercoup fracture, Avulsion fracture, burst fracture
- Displacement
- Number of fragments: Single, multiple, or comminuted fracture

Traditionally, closed reduction and open reduction internal fixation with wire osteosynthesis have required an average of 6 weeks of immobilization by maxillo-mandibular fixation (MMF) for satisfactory healing. Difficulties associated with this extended period of immobilization include airway problems, poor nutrition, weight loss, poor hygiene, phonation difficulties, insomnia, social inconvenience, patient discomfort, work loss, and difficulty in recovering normal range of jaw function. Open reduction and internal fixation using rigid and semi-rigid devices is a definite advancement over closed reduction with inter-maxillary fixation, however achieving and holding the occlusion during internal fixation is still done using indirect techniques. Inter-maxillary fixation screws provide an alternative to tooth-borne indirect fixation using direct wires or arch bars.

## Materials And Method-

Patients who reported to Department of Oral and Maxillofacial Surgery, Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow with mandibular fracture were included in the study. A total number of 60 patients were selected for evaluation of statistically relevant data.

Mandibular fracture patients were randomly divided into two groups after clinical examination

and radiographic evaluation.

- Group I: Maxillo-mandibular fixation using erich's arch bar in 30 patients
- Group II: Maxillo-mandibular fixation using MMF screws in 30 patients

## Inclusion Criteria

- Mandibular fracture which requires primary stabilization followed by closed or open reduction internal fixation.

## Exclusion Criteria

- Alveolar Process fracture in maxilla and mandible
- Presence of mixed dentition and unerupted permanent teeth
- Severe displaced fracture
- Patient having respiratory problem
- Patient with maxillary fractures along with mandibular fractures

Thorough clinical and radiological and lab evaluation of the patients were done to identify any criteria which would exclude the patients from the study and additionally the fitness of the patient to undergo the procedure.

## Radiographic Techniques

- Conventional Radiography Digital OPG
- Specialized Radiography CT-Scan

## Method Anaesthesia

Erich's arch bar- All the procedure in placing the dental arch bar was performed under local anaesthesia with their respective nerve blocks.

IMF screws- Placement of inter-maxillary screws was done under Local infiltration. Maxillo-mandibular fixation will be achieved by using titanium maxillo-mandibular fixation screws. Total numbers of screws used were 4 in each patient of Group 2. After achieving appropriate anaesthesia stab incision was given on required site and holes were drilled.

Placement of the screw:

- Between canines and premolars.
- Between 2<sup>nd</sup> premolars and molars.

## Oral hygiene Calculation

Oral hygiene was calculated in this study on basis of Green and Vermillion (1964) Simplified Oral Hygiene Index.

In this study, we evaluated oral hygiene pre-operatively and postoperatively i.e. after removal of arch bar and IMF screws.

- Six surfaces were examined for the OHI-S is selected from four posterior and two anterior teeth.
- In the posterior portion of the dentition, the first fully erupted tooth distal to the second bicuspid (15), usually first molar (16) but sometimes the second molar (17) or third molar (18), is examined. The buccal surfaces of the selected upper molars and the lingual surfaces of the selected lower molars were inspected.
- In the anterior portion of the mouth, the labial surfaces of the upper right (11) and the lower left central incisors (31) are scored. In the absence of either of these anterior teeth, the central incisor (21 or 41 respectively) on the opposite side of the midline is titted.

### Criteria for classifying Debris

Scores	Criteria
0	No debris or stains present
1	Soft debris covering not more than one third of the tooth surface, or presence of the extrinsic stains without other debris regardless of surface area covered.
2	Soft debris covering more than one- third, but not more than two- thirds of the exposed tooth surfaces
3	Soft debris covering more than two thirds of the exposed tooth surface

**Debris Index = (The total of the upper and lower buccal- scores) + (The total of the upper and lower lingual-scores)/(The number of segments scored).**

### Criteria for classifying Calculus

Scores	Criteria
0	No calculus present
1	Supra gingival calculus covering not more than third of the exposed tooth surface.
2	Supragingival calculus covering more than one third but not more than two thirds of the exposed tooth surface or the presence of individual flecks of sub-gingival calculus around the cervical portion of the tooth or both.
3	Supragingival calculus covering more than two third of the exposed tooth surface or a continuous heavy band of subgingival calculus around the cervical portion of the tooth or both.

**Calculus Index = (The total of the upper and lower buccal- scores) + (The total of the upper and lower lingual-scores) / (The number of segments scored).**

The average individual or group debris and calculus scores are combined to obtain Oral Hygiene Index, as follows.

*Oral Hygiene Index= Debris Index+ Plaque Index*

### • Calculation of glove perforation technique

All the gloves were collected postoperatively and tested for perforation using water insufflation. Subjective testing of the outer and inner gloves was performed by insufflating the gloves with approximately 500 ml of lukewarm tap water. Each glove had the cuff end twisted close and gentle pressure applied to the palm and individual fingers. All evaluations for punctures were done by one examiner.

The results were analyzed using descriptive statistics and making comparisons between two treatment procedures, with respect to various parameters. Discrete (categorical) data were summarized as in proportions and percentages (%) and Mean  $\pm$  SD (standard deviation).

### Results-

**Table 1:** Distribution of Patients according to Treatment Groups

Group	Description	No.	%
Group I	Maxillo-mandibular fixation using erich's arch bar	30	50.0%
Group II	Maxillo-mandibular fixation using MMF screws	30	50.0%

The Fracture patients were randomly divided into two groups of 30 each after clinical examination and radiographic evaluation. The groups were: Group1: Maxillo-mandibular fixation using erich's arch bar Group2: Maxillo-mandibular fixation using MMF screws.

**Table 2:** Age Distribution of Patients

Parameter	Group	Mean	SD	t-value	p-value
Age	Group I	24.87	9.00	-1.833	0.072
	Group II	29.10	8.88		

The mean age of patients in group I was 24.87 $\pm$ 9.00 years. While the mean age of patients in group II was 29.10 $\pm$ 8.88 years. According to unpaired student's t-test no significant difference (p=0.072) in mean ages was found between the patients under the two groups. So the two groups were comparable in relation to the age of patients.

### Distribution of Patients

The male/female ratio of patients under the group I was 96.7: 3.3. While the male/female ratio of patients under the group II was 90.0: 10.0.

According to Chi square test no significant difference (p=0.301) in male/female ratio was found between the patients under the two techniques. So the two techniques were comparable in relation to the sex of patients.

**Table 3: Pre-Operative Assessment of Patients Attributes**

Variable	Status		Group I	Group II	Total	Chi sq	p-value
Swelling	Absent	No.	11	9	20	0.300	0.584
		%	36.7%	30.0%	33.3%		
	Present	No.	19	21	40		
		%	63.3%	70.0%	66.7%		
Soft Tissue Injury	Absent	No.	16	22	38	2.584	0.108
		%	53.3%	73.3%	63.3%		
	Present	No.	14	8	22		
		%	46.7%	26.7%	36.7%		
Parasthesia	Absent	No.	30	30	60	NA	NA
		%	100.0%	100.0%	100.0%		
Infection	Absent	No.	30	30	60	NA	NA
		%	100.0%	100.0%	100.0%		
Fracture Mobility	Absent	No.	14	10	24	1.111	0.292
		%	46.7%	33.3%	40.0%		
	Present	No.	16	20	36		
		%	53.3%	66.7%	60.0%		
Fracture	Absent	No.	16	26	42	7.937	0.005
Displacement	Present	No.	14	4	18		
		%	46.7%	13.3%	30.0%		
		%	53.3%	66.7%	60.0%		
Teeth in Line of Fracture	Absent	No.	24	22	46	0.373	0.542
		%	80.0%	73.3%	76.7%		
	Present	No.	6	8	14		
		%	20.0%	26.7%	23.3%		
Total		No.	30	30	60		
		%	100.0%	100.0%	100.0%		

On Pre-Operative Assessment of Patients Attributes it was found that the swelling was present in 63.3% of patients in group I and 70.0% of patients in group II. There was no significant difference in swelling proportion between the groups (p=0.584).

Soft Tissue Injury was present in 46.7% of patients in group I and 26.7% of patients in group II. There was no significant difference in Soft Tissue Injury proportion between the groups (p=0.108).

No parasthesia was present in any patient of any group in this study. No infection was present in any patient of any group in this study.

Fracture Mobility was present in 53.3% of patients in group I and 66.7% of patients in group II. There was no significant difference in Fracture mobility proportion between the groups (p=0.292).

Fracture Displacement was present in 46.7% of patients in group I and 13.3% of patients in group II. So there was significant difference in Fracture Displacement proportion between the groups (p=0.005).

Teeth in Line of Fracture were present in 20.0% of patients in group I and 26.7% of patients in group II. There was no significant difference in Teeth in Line of Fracture proportion between the groups (p=0.542).

**Table 4: Intergroup Comparison of No. of Fractures between the Two Groups**

Parameter	Group	Mean	SD	t-value	p-value
No. of fracture	Group I	1.97	0.76	2.397	0.020
	Group II	1.53	0.63		

On comparing the No. of Fractures between the Two groups, it was seen that the mean No. of fractures in patients of group I was  $1.97 \pm 0.76$  and the mean no. of fractures in patients of group II was  $1.53 \pm 0.63$ . According to unpaired t-test the mean no. of fractures in group I was significantly more than the group II (p=0.020)

**Table 5: Intergroup Comparison of Mouth Opening between the Two Groups**

Parameter	Group	Mean	SD	t-value	p-value
Mouth Opening (mm)	Group I	19.83	4.35	1.894	0.063
	Group II	17.87	3.66		

On comparing the Mouth opening between the Two groups, it was seen that the mean Mouth opening in patients of group I was  $19.83 \pm 4.35$  mm and the mean Mouth opening in patients of group II was  $17.87 \pm 3.66$  mm. According to unpaired t-test the difference in mean Mouth opening between the two groups was not significant (p=0.063)

**Table 6: Intergroup Comparison of Duration of placement of Erich's Arch Bar between the Two Groups**

Parameter	Group	Mean	SD	t-value	p-value
Duration of placement of Erich's Arch Bar (Min)	Group I	73.20	10.40	27.260	<0.001
	Group II	18.07	3.80		

On comparing the duration of placement of Erich's Arch Bars and Inter-maxillary fixation screws between the two groups, it was seen that the mean time taken in placement of Erich's Arch Bar in

patients of group I was  $73.20 \pm 10.40$  mins and the mean Time taken in placement of Inter-maxillary fixation screws in patients of group II was  $18.07 \pm 3.80$  mins.

According to unpaired t-test the mean Time taken in placement of Inter-maxillary fixation screws in group II was significantly less than the time taken in placement of Erich's arch bar in group I ( $p < 0.001$ ).

**Table 7:** Intergroup Comparison of Intra-operative Gingival Health between the Two Groups

Parameter	Group	Mean	SD	t-value	p-value
Gingival Score	Group I	2.17	0.99	2.801	0.007
	Group II	1.53	0.78		

On comparing the Intra-operative Gingival score between the two groups, it was seen that the mean Intra-operative Gingival score in patients of group I was  $2.17 \pm 0.99$  and the mean Intra-operative Gingival score in patients of group II was  $1.53 \pm 0.78$ .

According to unpaired t-test the mean Intra-operative Gingival score in group I was significantly more than the group II ( $p = 0.007$ )

**Table 8:** Intergroup Comparison of Patient Comfort During Placement between the Two Groups

Parameter	Group	Mean	SD	t-value	p-value
Pt Comfort During Placement	Group I	60.93%	25.07%	-4.037	<0.001
	Group II	81.80%	13.14%		

On comparing the Patient comfort between the two groups, it was seen that the mean Patient comfort in patients of group I was  $60.93 \pm 25.07\%$  and the mean Patient comfort in patients of group II was  $81.80 \pm 13.14\%$ . According to unpaired t-test the mean Patient comfort in group II was significantly more than the group I ( $p < 0.001$ )

**Table 9:** Intergroup Comparison of No. of Puncture in Gloves between the Two Groups

Parameter	Group	Mean	SD	t-value	p-value
No. of Puncture in Gloves	Group I	1.97	1.59	5.204	<0.001
	Group II	0.32	0.55		

On comparing the No. of Puncture in Gloves between the Two groups, it was seen that the mean No. of Puncture in Gloves of group I was  $1.97 \pm 1.59$  and the mean No. of Puncture in Gloves of group II was  $0.32 \pm 0.55$ .

According to unpaired t-test the mean No. of Puncture in Gloves in group I was significantly more than the group II ( $p < 0.001$ )

**Table 10:** Intergroup Comparison of Time taken in removal of Erich's Arch Bar between the Two Groups

Parameter	Group	Mean	SD	t-value	p-value
Time taken in removal of arch bar (minutes)	Group I	22.42	4.46	18.595	<0.001
	Group II	6.48	1.48		

On comparing the Time taken in removal of Erich's Arch Bars and Inter-maxillary fixation screws between the two groups, it was seen that the mean time taken in removal of Erich's Arch Bar in group I was  $22.42 \pm 4.46$  mins and the mean Time taken in removal of Inter-maxillary fixation screws in group II was  $6.48 \pm 1.48$  mins.

According to unpaired t-test the mean Time taken in removal of Inter-maxillary fixation screws in group II was significantly less than the time taken in removal of Erich's arch bar in group I ( $p < 0.001$ ).

**Table 11:** Intergroup Comparison of Post-operative Gingival Health between the Two Groups

Parameter	Group	Mean	SD	t-value	p-value
Gingival Health Score	Group I	2.86	1.07	3.781	<0.001
	Group II	1.95	0.77		

On comparing the Post-operative Gingival score between the Two groups, it was seen that the mean Post-operative Gingival score in patients of group I was  $2.86 \pm 1.07$  and the mean Post-operative Gingival score in patients of group II was  $1.95 \pm 0.77$ .

According to unpaired t-test the mean Post-operative Gingival score in group I was significantly more than the group II ( $p < 0.001$ )

**Table 12:** Intergroup Comparison of Patient Comfort During Removal between the Two Groups

Parameter	Group	Mean	SD	t-value	p-value
Pt Comfort During Removal	Group I	71.60%	12.36%	-3.583	0.001
	Group II	82.00%	10.01%		

On comparing the Patient comfort during removal between the two groups, it was seen that the mean Patient comfort during removal in patients of group I was  $71.60 \pm 12.36\%$  and the mean Patient comfort during removal in patients of group II was  $82.00 \pm 10.01\%$ . According to unpaired t-test the mean Patient comfort during removal in group II was significantly more than the group I ( $p = 0.001$ )

**Table 13: Intergroup Comparison of Occlusion Status between the Two Groups**

Time	Occlusion		Group I	Group II	Total	Chi sq	p-value
Pre Op.	Absent	No.	1	0	1	4.286	0.232
		%	3.3%	.0%	1.7%		
	Deranged	No.	28	30	58		
		%	93.3%	100.0%	96.7%		
Not Present	No.	1	0	1			
	%	3.3%	.0%	1.7%			
Post Op.	Achieved	No.	30	30	60	NA	NA
		%	100.0%	100.0%	100.0%		
Total		No.	30	30	60		
		%	100.0%	100.0%	100.0%		

On comparing Occlusion Status between the groups, it was found that the pre operatively occlusion was deranged in 93.3% cases of group I and 100% cases of group II. No significant

difference in Occlusion Status proportion was seen between the groups (p=0.232). Post operatively occlusion achieved in all the cases.

**Table 14: Intergroup Comparison of Oral Hygiene between the Two Groups**

Time	Oral Hygiene		Group I	Group II	Total	Chi sq	p- value
Pre. Op	Poor	No.	10	6	16	1.800	0.407
		%	33.3%	20.0%	26.7%		
	Fair	No.	12	12	24		
		%	40.0%	40.0%	40.0%		
Intra Op.	Good	No.	8	12	20	1.800	0.407
		%	26.7%	40.0%	33.3%		
	Poor	No.	10	6	16		
		%	33.3%	20.0%	26.7%		
Post Op.	Fair	No.	12	12	24	13.325	0.001
		%	40.0%	40.0%	40.0%		
	Good	No.	8	12	20		
		%	26.7%	40.0%	33.3%		
Total	Poor	No.	18	6	24		
		%	60.0%	20.0%	40.0%		
	Fair	No.	10	12	22		
		%	33.3%	40.0%	36.7%		
		No.	2	12	14		
		%	6.7%	40.0%	23.3%		
		No.	30	30	60		
		%	100.0%	100.0%	100.0%		

On comparing Oral Hygiene Status between the groups, it was found that the pre operatively Oral Hygiene was good in 26.7% cases of group I and 40% cases of group II. No significant difference in Oral Hygiene proportion status was seen between the groups (p=0.407).

No significant difference in Oral Hygiene proportion status was seen between the groups (p=0.407).

Intra operatively again Oral Hygiene was good in 26.7% cases of group I and 40% cases of group II.

Post operatively Oral Hygiene was good in 6.7% cases of group I and 40% cases of group II. A significant difference in Oral Hygiene proportion status was seen between the groups (p=0.001).

**Table 15: Intergroup Comparison of Fate of Adjacent teeth/bone surroundings between the Two Groups**

Variable			Group I	Group II	Total	Chi sq	p-value
Fate of adjacent teeth	Absent	No.	29	23	52	5.192	0.023
		%	96.7%	76.7%	86.7%		
	Present	No.	1	7	8		
		%	3.3%	23.3%	13.3%		
Fate of bone surrounding the screw (bone loss, infection)	Absent	No.	30	29	59	1.017	0.313
		%	100.0%	96.7%	98.3%		
	Present	No.	0	1	1		
		%	.0%	3.3%	1.7%		
Total		No.	30	30	60		
		%	100.0%	100.0%	100.0%		

On comparing Fate of Adjacent teeth/bone surroundings between the Two Groups, it was found that the Fate of adjacent teeth was present in 3.3% cases of group I and 23.3% cases of group II. A significant difference in proportion of fate of adjacent teeth was seen between the groups (p=0.023).

It was found that the fate of bone surrounding the screw (bone loss, infection) was present in none of cases of group I but 3.3% cases of group II.

However no significant difference in proportion of fate of bone surrounding the screw was seen between the groups (p=0.313).

**Table 16:** Intergroup Comparison of Instrumental Problems between the Two Groups

Variable		Group I	Group II	Total	Chi sq	p- value	
Needle Stick Injury	Absent	No.	12	22	6.787	0.009	
		%	40.0%	73.3%			56.7%
	Present	No.	18	8			26
		%	60.0%	26.7%			43.3%
Ease of Operator	Poor	No.	1	3	1.167	0.558	
		%	3.3%	10.0%			6.7%
	Fair	No.	13	11			24
		%	43.3%	36.7%			40.0%
	Good	No.	16	16			32
		%	53.3%	53.3%			53.3%
Hardware failure	Absent	No.	30	20	12.000	0.001	
		%	100.0%	66.7%			83.3%
	Present	No.	0	10			10
		%	.0%	33.3%			16.7%
Double gloving	Absent	No.	0	0			
		%	0%	0%			50.0%
	Present	No.	30	30			60
		%	100.0%	100%			100.0%
Total	No.	30	30	60			
	%	100.0%	100.0%	100.0%			

On comparing the instrumental problems between the Two Groups, it was found that the: Needle stick injury was present in 60.0% cases of group I and 26.7% cases of group II. A significant difference in proportion of needle stick injury was found between the groups (p=0.009). Ease of operator was good in 53.3% of cases of group I & II both. A significant difference in proportion of ease of operator was found between

the groups (p=0.558). Hardware failure was seen in nil cases of group I but 33.3% cases of group II. A significant difference in proportion of hardware failure was found between the groups (p=0.001). Double gloving in arch bar was present in 100% in both the groups. There is no significant difference in double gloving.

**Table 17:** Intergroup Comparison of Patient Acceptance between the Two Groups

Patient Acceptance		Group I	Group II	Total	Chi sq	p-value
Poor	No.	9	0	9	13.994	0.001
	%	30.0%	.0%	15.0%		
Fair	No.	14	12	26		
	%	46.7%	40.0%	43.3%		
Good	No.	7	18	25		
	%	23.3%	60.0%	41.7%		
Total	No.	30	30	60		
	%	100.0%	100.0%	100.0%		

On comparing Patient acceptance between the groups, it was found that the good response was seen in 23.3% cases of group I and 60.0% cases of group II. A significant difference in Patient acceptance was seen between the groups (p=0.001).

**Discussion-**  
In this study hardware used for the patients in Group I was Erich's Arch bar and for Group II was Inter-maxillary Fixation screw. In this study, it was found that male female ratio of patient under the group I was 96.7: 3.3(Male 29,

Female 1) and group II ratio was 90:10 (Male 27, Female 3). The percentage of male is higher than that of female. This increase in prevalence in male can be attributed to men having more outdoor activities and are prone to road traffic accidents, sport injury, assaults etc. resulting in trauma. There is no statistically significant difference in both the group. Our study concurred with findings of **Vartanian et al (2002)** who in their study found that male are more prone to injuries than females (male=20, female=3)<sup>11</sup>.

**Hashemi Mahmood et al (2011)** also reported that male ratio is greater than females<sup>21</sup>.

In our study it was found that mean age in Group I was  $24.87 \pm 9.00$  years. While in Group II the mean age was  $29.10 \pm 8.88$  years. The difference is not statistically significant. Incidence of fracture mandible is highest in third decade of life. Our study concurs with the findings of **B. Van der Bergh (2015)** who in his study stated that there were no significant differences between these groups regarding age<sup>43</sup>. Mean age in their study was 31.8 years. And hence the two group are matched for the age of the patient.

On pre-operative assessment of the patients it was found that the swelling was present in both the groups (Group A -63.3% and Group B- 70%) and there was no statistical significance difference in swelling proportion between the groups.

No pre-operative paraesthesia in facial region and infection was present in any patient of any group in this study. As there was no injury to the nerve reported in the study.

Fracture Displacement was present in 46.7% of patients in group I and 13.3% in patient group II. There was a significant difference in fracture displacement proportion between the groups. Use of erich arch bar provides better reduction as well as better occlusion stability in case erich arch bar than in Inter-maxillary fixation screws.

The mean time required for placement of erich arch bar was  $73.20 \pm$

$10.40$  mins (Group I) while time required for placement of IMF screws (Group II) was  $18.07 \pm 3.80$  mins. The difference in mean time for placement is statistically significant. Making it obvious that the placement of erich arch bar is significantly more time consuming than placement of IMF screws. Inter-maxillary fixation screws is a secure and fast method along with its better handling than arch bar. These findings concur with **Nandini.G et al (2011)** in their study found that time taken for placement of IMF screw was  $8.27 \pm 2.7$  mins compared to Erich's arch bar which was 100 mins<sup>22</sup>. **Sahoo et al (2010)** observed that the IMF screws took an average 5 mins for fixation<sup>20</sup>.

**Quraishi et al (2016)** also reported in their study that arch bar took more time for placement in mandibular fracture than IMF screws; mean time taken was 94.67 mins for arch bar and 15.56 min in IMF screws<sup>46</sup>. **Satish et al (2014)** also concluded that the time taken in placing the IMF screws for achieving Intermaxillary fixation was 16.3 mins<sup>36</sup>.

Comfort scale proposed by **Chhabra et al (2013)** was used to evaluate patients comfort during placement of erich arch bar and IMF screws<sup>6</sup>. On conversion to numerical values we found that in our study that the mean patient comfort in group I was  $60.93 \pm 25.07\%$  and in group II was  $81.80 \pm 13.14\%$ . The difference in these two comfort score was found to be statistically significant. **H.G. West (2013)** reported that pain and patient comfort during inter-maxillary fixation was good in patients which underwent for IMF screws<sup>32</sup>. **M. Alves Jr et al (2012)** also stated that IMF screws were well tolerated by his patients in their study<sup>27</sup>. Our study also concurred with study of **Qureshi et al (2016)** in which patient acceptance was good in 21 cases of Inter-maxillary fixation screws compared to patients of second group who received arch bar placement<sup>46</sup>. **Chandan et al (2010)** also reported in their study that patient who received Erich's arch bar had more discomfort than resin bonded arch bar<sup>5</sup>. **Mehta et al (2014)** evaluated the comfort level in 10 patients who underwent inter-maxillary fixation using inter-maxillary fixation and found that patient comfort was in between good and moderate; no patients were classified under 'difficult' category.<sup>37</sup> Hence the findings of study suggests, under L.A. process of placement of IMF-screws is faster and more comfortable to the patient as against in the placement of erich arch bar which is more time consuming and uncomfortable to the patient. To ascertain the incidence of glove punctures and hence the possibility of potential needle sticks injury to the operators. The gloves used during procedure in both the groups were evaluated with water suffrance for puncture. Since double gloving technique was used in both the groups so two pairs of gloves were used by the operators in each patient. The number of punctured glove in group I was found to be 59 out of which 36 punctures were in outer gloves and 13 in inner gloves where as in group II total no. of glove puncture was 9 and all these 9 perforations were in outer gloves whereas inner glove perforations was found to be negative. Total gloves perforations was 68 in which 19 perforations were reported in dominant hand and 49 in non-dominant hand. Hence, the incidences of glove perforations were mostly in non-dominant hand. **Cornelius Peter- Carl (2010) et al** found



lower incidence of glove perforation using IMF screw with a ratio of 9:1 compared to arch bars<sup>4</sup>. **Lone.P.A (2015) et al** also reported glove perforation during placement of Erich's arch bar, they also specified that most common site of glove for perforation of glove was is the non-dominant hand<sup>45</sup>. In spite of above mentioned literature our study also concur with **Chhabra et al (2013)** who reported that a normal wire twister have a greater chance of glove perforation i.e  $7.6\pm 1.70$  than a pencil wire twister which was  $4.01\pm 1.08$ .<sup>6</sup> Needle stick injury was present in 60% cases of group I and 26.7% cases of group II. A significant difference was found between the both groups. **Lone et al (2015)** reported that needle stick injuries were present in their study while placing arch bar<sup>45</sup>. Our study concurred with **Van den Bergh et al (2015)** who reported that only eight needle stick injuries occurred in arch bar group (30.7%) whereas 0% in IMF screws group<sup>43</sup>. **Rai et al (2014)** their study mentioned to overcome this complication they used dynaplast adhesive tape over all the finger tips, before wearing the gloves while performing IMF<sup>38</sup>. **Kumaresan et al (2014)** used custom made finger which are made up of thermoplastic material of 1mm thickness to avoid needle stick injury during inter-maxillary fixation<sup>39</sup>. **Bhut et al (2015)** did not find any needle stick injuries in their study<sup>44</sup>. Inter-maxillary screws are associated with several advantages one of the advantages is that it minimizes the risk of needle stick injury to the operator.

Similarly time taken in removal of erich arch bar (Group I) was  $22.42\pm 4.46$  mins and for removal of IMF screws (Group II) was  $6.48\pm 1.48$ mins which was statistically significant. Our studies concurred with the studies of **Vartanian et al (2002)** who reported that average time taken for IMF screws removal was 15 mins and for arch bar was 45-60 mins<sup>11</sup>, **Mehta et al(2014)** also mentioned in their study that time taken in removing IMF screws was 15.5 mins with a range of 10-20 mins<sup>37</sup>. **Rai et al (2011)** also concluded that for IMF screws required less time in removal of IMF screws compared to arch bars<sup>23</sup>. In the study it can be concluded that removal of arch bar is more time consuming than IMF screws.

On comparing occlusion status between both the groups it was found that the pre-operatively occlusion was deranged in 93.3% cases of group A and 100% cases of group B which shows no significant difference between both the groups pre-operatively, and post-operatively occlusion was achieved in all the cases and there was no discrepancy in both the groups in our study after removal of arch bars and IMF screws. Use of Inter-

maxillary fixation screws provides good occlusal results in cases of un-displaced or simple fractures. For comminuted or displaced fractures arch bar provides better anchorage and gives more occlusal stability than inter-maxillary fixation screws. **Qureshi et al (2016)** reported that there were no such differences in post-operative occlusion status in both the groups<sup>46</sup>. **Falci et al (2015)** mentioned in their study that IFS showed no differences regarding inter-maxillary stability and the occlusion index after inter-maxillary device installation<sup>40</sup>. **West et al (2013)** in his study found that guiding elastics were rarely required in the post-operative period to control occlusion in ORIF groups, but in most cases there was accepted occlusion post-operatively<sup>32</sup>. **Gordon et al (1995)** rated that 96.6% had normal post-operative occlusion<sup>10</sup>. **Anwar et al (2013)** analysed in their study that in 90% of the patients, functional occlusion was restored<sup>33</sup>. **Satish et al (2014)** reported 1 week post-operative malocclusion rate of 0%, but 1 patient(8.3%) had to change to arch bars at 3<sup>rd</sup> day because of a moderately deranged occlusion.<sup>36</sup>

Post-operative gingival health was assessed for both the groups using Green Vermillion OHI-s index and it was seen that in gingival score in patients of Group I was  $2.86\pm 1.07$  where as in Group II was  $1.95\pm 0.77$  which shows that gingival score in Group I was more statistically significant than Group II. Oral hygiene status between the groups was also compared and it was found that the pre-operatively and intra operatively there were no significant differences between both the groups but post-operative oral hygiene status was good in 6.7% cases of group I and 40% cases of group II which showed a significant difference in oral hygiene proportion. During the period of inter-maxillary fixation, there was difficulty in maintaining the oral hygiene, which resulted in coated tongue, fetid odour, calculus and debris deposition which has detrimental effect on periodontium. Advancement in inter-maxillary fixation in mandibular fracture by the use of inter-maxillary fixation screws helps to improve gingival health along with oral hygiene and **West et al (2013)** reported in their study that gingival health was not an issue with IMF screws for most part and experienced that short term gingival health associated with IMF screws is better than arch bars. They graded gingival inflammation using 3-point Likert scale.<sup>32</sup> **Rai et al (2011)** found that oral hygiene which was measured by plaque index was better in patients with IMF than with arch bars<sup>23</sup>. **Falci.G.S(2015) et al's** result showed that gingival and plaque index and oral hygiene status in arch bar group was worst<sup>40</sup>.

**Lone.P.A.(2015)** that in arch bar group there was collection of food debris and gingival inflammation and there was difficulty in maintaining oral hygiene which results in fetid breath and coated tongue<sup>45</sup>. **Adeyemi et al (2012)** showed that 100% of patients in the study group had a good oral hygiene compared to control group i.e. 68.2%<sup>28</sup>. Our study also concurred with **Nandini et al (2011)** who found statistically better oral hygiene index by Greene and Vermillion, in an IMFS group compared with an arch bar control group<sup>22</sup>.

On comparing fate of adjacent teeth/bone surrounding the screw between two groups, it was found that the fate of adjacent teeth was present in 3.3% cases of group I and 23.3 % cases of group II which shows a significant difference in proportion to fate of adjacent teeth between both the groups. **Nandini et al (2011)** reported that tooth morbidity was seen in 30% patient who received arch bar fixation whereas 0% who received IMF screw fixation<sup>22</sup>. Our study also concurred with **Quershi et al (2016)** also mentioned in his study that post-operative non-vitality characteristics were more significant in Group that have IMF screws(6 teeth) compared to Arch bar group(2 teeth).<sup>46</sup>

A total of 120 screws were placed out of which 1 screw had infection. Pus discharge was seen in right lower mandibular premolar region. It was found that the bone surrounding the screw (bone loss, infection) was in Group II was 3.3%. However there was no significant difference in proportion to fate of bone surrounding the screw was seen between the groups ( $p=0.313$ ). Infection may be due to improper sterilization techniques or due to thermal necrosis(caused due to overheating of drill). Our study also concurred with **Vartanian et al (2002) et al** which showed no incidence of post-operative bleeding or infection in relation to cortical bone screw placement and removal<sup>11</sup>. **Coburn et al (2002)** reported that out of their 5 case report 1 case showed a interproximal bone resorption, the place where IMF screw was positioned also mentioned that, this complication was because of poor operating technique<sup>12</sup>. **Satish et al (2014)** in their study found that there was no incidence of any infection or bone loss<sup>36</sup>. **Nandini et al (2010)** reported that there was no infection related to IMF screws<sup>22</sup>.

Ease of operator was good in 53.3% of cases of both the group. Ease of operator was described in terms of how comfortable the patient while performing the procedure. **Mehta et al (2014)** graded 'easy' in 8 patients and 'moderate' in 2 patients while applying IMF screws.<sup>37</sup>

Hardware failure was seen in 0% cases of group I

but 33.3% cases (total no. of screw loosening= 10 out of

120) in group II. Screw loosening can be because of continued force exerted on the head screw heads during post-operative period. Improper direction of the screw placement leads to the loosening of screw. **Bai Zhenxi et al (2015)** reported that 11 screws were loosened out of 768 screws<sup>42</sup>. **Rai et al (2011)** study mentioned that screw loosening was 16.67%<sup>23</sup>. The reason was due to force of musculature, which is exerted while the patient is in maxillo-mandibular fixation or the patients where the direction of screw is not perpendicular to the occlusion plane. The percentage of screw loosening in the study by **Coletti et al (2007)** was 29%<sup>2</sup>. **Quershi et al (2016)** recorded screw loosening in 3 cases<sup>46</sup>.

Overall patient acceptance was better from the time of placement till the time of removal of inter-maxillary fixation screws than erich arch bars which underwent inter-maxillary fixation. Patient acceptance in respect of inter-maxillary fixation screws and erich arch bars during treatment was graded as "Good", "Fair" and "Poor" in this study. On comparing patient acceptance between the groups, it was found that only 23.3% of cases ( $n=7$ ) and 60% of cases ( $n=18$ ) in group II showed good response in accepting the hardware during treatment. No patient was categorised as "poor" in group II while in group I 30% of cases ( $n=9$ ) showed poor acceptance. Quality of life which includes ability to carry out daily activities was better who underwent for inter-maxillary fixation using inter-maxillary fixation screws. Our study concurred with study of **West et al (2013)** reported that inter-maxillary fixations screws were well accepted by the patients<sup>32</sup>. **Alves Jr et al (2012)** also reported in their systemic review that inter-maxillary fixation screws were well tolerated by the patents<sup>27</sup>.

### Conclusion-

- The ultimate goal of treating mandibular fractures is to restore mandibular form and function to its pre-traumatic state.
- Inter-maxillary fixation is an indispensable requirement to achieve temporary dental occlusion during the pre-operative & post-operative phase of treatments.
- Inter-maxillary fixation with inter-maxillary fixation screws is more superior as compared to Erich arch bar in the treatment of mandibular fractures.
- Inter-maxillary fixation screws require less operating time in placement and removal as compared to erich arch bar.

- Inter-maxillary fixation screws are associated with good maintenance of oral hygiene better gingival health, less trauma to the periodontium and good patient acceptance as compared to arch bars.
- Inter-maxillary fixation provides better occlusal result in simple mandibular fracture than in multiple or comminuted fracture as in these fractures it provides limited anchorage.
- Patient as well as operator comfort level is always better in placing inter-maxillary fixation screws than in erich arch bar.
- Inter-maxillary fixation screws are more cost effective than erich arch bar as it reduces the operating time and minimizes operation theatre charges.
- One of the disadvantages of inter-maxillary fixation screws are that they are not indicated where the function of tension bands and post-operatively directional tractions are required as in comminuted mandibular fractures.
- Incidence of glove perforation and needle stick injuries is significantly less during Inter-maxillary fixation while using inter-maxillary screws.
- Disadvantages of inter-maxillary screws include in suitability for long term fixations as mucosal coverage over the screw, during the fixation necessitates its perforation for removal and screw loosening is a feature of long term usage.
- After this study conclusion can be made that inter-maxillary fixation screws are more proven useful technique of inter-maxillary fixation. This study has a limitation of small sample size and hence further study with larger sample size is required to further substantiate results.

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